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Environment Group

Wilson Bowden Developments Ltd
Plot L Kingsway Business Park
Rochdale

Phase 1 and Phase 2 Geo-Environmental
Assessment

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Environment Group

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Rochdale
Phase 1 and Phase 2 Geo-
Environmental Assessment

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EXECUTIVE SUMMARY	
Site Address	The site is located at Plot L Kingsway Business Park Rochdale in Greater Manchester, at National Grid coordinates 391359, 411650.
Site Setting and History	The site is irregular in shape, occupying approximately 4.33 hectares. The site lies between the town of Rochdale and the M62 motorway and exists as part of the development land of Kingsway Business Park. The site lies at approximately 150m AOD and is generally flat, sloping gently from the south to the north. The site has historically existed as agricultural fields, with an abattoir present in the south of the site and occupying the site grounds from the mid- to late-20th Century. The abattoir has since been demolished in the early 21st Century. The site is now being sought for commercial development as part of the larger development area of Kingsway Business Park.
Published Geology, hydrogeology and hydrology	Information published by the BGS indicates the site is underlain by superficial deposits comprising Head, Peat and Hummocky Glacial Deposits. The BGS indicates the site is underlain by bedrock deposits of the Milnrow Sandstone and Pennine Middle Coal Measures Formation. The superficial and bedrock deposits are classified as Secondary A Aquifers by the Environment Agency. A tertiary river (drainage ditch) intersects the site running south to north, confluenting with a secondary river running along the northern site boundary.
Scope of investigation works	A ground investigation was completed between the 8th of May and 5th June 2017 and comprised the following: •Non-intrusive survey of excavation locations for underground utilities; •Seventeen machine excavated trial pits to a maximum depth of ~4m bgl; •Three cable percussive boreholes to a maximum depth of 10.45m bgl; •Four subsequent gas and groundwater monitoring visits; •Chemical analysis of soils; and •Geotechnical testing of soil.
Ground Conditions Encountered	Topsoil was encountered in 15 of 17 exploratory locations, ranging between 0.3m and 1.0m in thickness. Underlying the Topsoil was variable strata of the Hummocky Glacial Deposits (depth to base unproven) found at all locations, comprising multiple layers of variable strength, variable density clay, sand and gravel. Sections of the Hummocky Glacial Deposits were recovered as very organic in nature towards alluvial channels in the north east and west of the site. Bedrock was not encountered during this investigation. Shallow Made Ground deposits were encountered in the vicinity of the former abattoir in the south of the site. Made Ground was also encountered on site at the stub of the adjacent highway.
Geotechnical Appraisal	For lightly loaded steel portal framed buildings, trench fill foundations founding in the granular glacial deposits may be the most suitable solution. Following a site strip to remove soft organic clay topsoil and subsoil layers of up to around 1.0m thick (typically ~0.6m), with replacement with an imported granular fill material, a ground bearing floor slab could be adopted with loads of no more than 30kPa. Should greater loadings be proposed then an alternative foundation and floor slab solution may need to be considered. Design Sulphate Class DS-1 and ACEC Class AC-1 should be adopted when considering the most appropriate type of concrete to be used at the site.

EXECUTIVE SUMMARY	
Contamination Sources	Ground gas monitoring followed by a ground gas assessment has indicated that the site is a CS-2 site whereby any development should include the installation of ground gas protection measures.
Pollutant Linkages	Given the ground conditions including Made Ground and organic glacial deposits, there is a risk that Carbon Dioxide concentrations could accumulate within enclosed spaces within the proposed development and present a risk to future site users through asphyxiation.
Waste Classification	Natural arisings at the site are likely to go to tip at the lower rate of landfill tax, if off-site disposal is required. It is possible the small quantities of Made Ground would attract a higher rate although it is likely to be possible to avoid these materials going to landfill. Should soils require disposal off site an assessment of waste classification of the soils for disposal should be made by a competent person. Further chemical analysis may be required to fully characterise waste soils for disposal to landfill or re-use off site. WAC analysis may be required for disposal of soils as inert or hazardous.
Recommendations	Ground gas protections measures appropriate to a CS2 as detailed within BS8485: 2015 must be included within the design of new properties at the Site. The geotechnical solutions should be confirmed once final loadings are known. Further ground investigation will be required if higher loads are proposed to inform pile design. Allowance should be made for temporary shoring of excavations due to likely stability issues associated with running sands. Contingency for groundwater control should be considered especially if development is undertaken during the winter months.
This summary should be read in conjunction with BWB's full report (ref. HLK-BWB-ZZ-XX-EN-RP-YE-0001_CombinedPh1Ph2_P1) and reflects an assessment of the site based on information received by BWB at the time of production.	

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1 INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Wilson Bowden Developments Ltd (the Client) to carry out a Phase 1 and Phase 2 Geo-environmental Assessment for the site at Plot L Kingsway Business Park, Rochdale. Details of the project brief are included in BWB proposal reference KS/RPD/NTT2589/03/R1 dated March 2017.
- 1.2 The site comprises Plot L of the larger Kingsway Business park development area. The Client is seeking to develop the site for a commercial/light industrial end use.
- 1.3 The site currently comprises undulating grassland with soft ground, patches of denser vegetation and seasonally boggy areas. Based on the known and anticipated geology at the site, which include peat and running sands, ground conditions are likely to present a geotechnical constraint.

Objectives

- 1.4 This report comprises a combined geo-environmental desk study (Phase 1), followed by an intrusive geo-environmental assessment (Phase 2). Individual objectives of each section contained within the report are detailed below:

Phase 1 (Sections 2 to 6)

- Site visit to inspect the current condition of the site at ground surface (photographs presented as **Appendix 1**);
- Review of the following information:
 - Groundsure Reports ref. HMD-214-3887194 and HMD-214-3887195 (see **Appendix 2**);
 - Historical Ordnance Survey Mapping ref. HMD-214-3887196 (**Appendix 3**);
 - British Geological Survey (BGS) exploratory hole records (www.bgs.co.uk);
 - British Geological Survey (2008) 1:50 000 Scale Manchester Sheet 85 Bedrock and Superficial;
 - Zetica – regional unexploded bomb risk maps (**Appendix 4**);
 - Environment Agency website (www.environment-agency.gov.uk).
- Provide a summary of key ground risks that require further ground investigation in order to control the identified risks; and
- Produce a geo-environmental desk study in the first sections of this report, providing qualitative contamination risk assessment and ground-related constraints to the proposed development.

Phase 2 (Sections 7 to 16)

- The prevailing ground and groundwater conditions across the site;
- The potential presence and extent of contamination in shallow soil and groundwater beneath the site;

- The significance and magnitude of the observed contamination through comparison of analytical data to appropriate published environmental screening criteria;
 - The strength properties of the soil beneath the site to enable foundation design; and
 - The ground gas regime beneath the site.
- 1.5 The above objectives will allow the preliminary Conceptual Site Model presented in the Phase 1 report to be verified and updated. The report has been completed in accordance with BS10175:2011(+A1:2013) 'Investigation of Potentially Contaminated Sites, Code of Practice' and CLR11 'Model Procedures for the Management of Land Contamination'.
- 1.6 This report presents the information obtained from a desk study and the subsequent ground investigations and contains relevant factual information from the previous investigations undertaken in the surrounding area. Sections 2 to 6 of the report, together with the associated Figures and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007
- 1.7 The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and recommendations are presented in Sections 7 to 16 of the report, together with the associated Figures and Appendices.

Scope of Intrusive Works

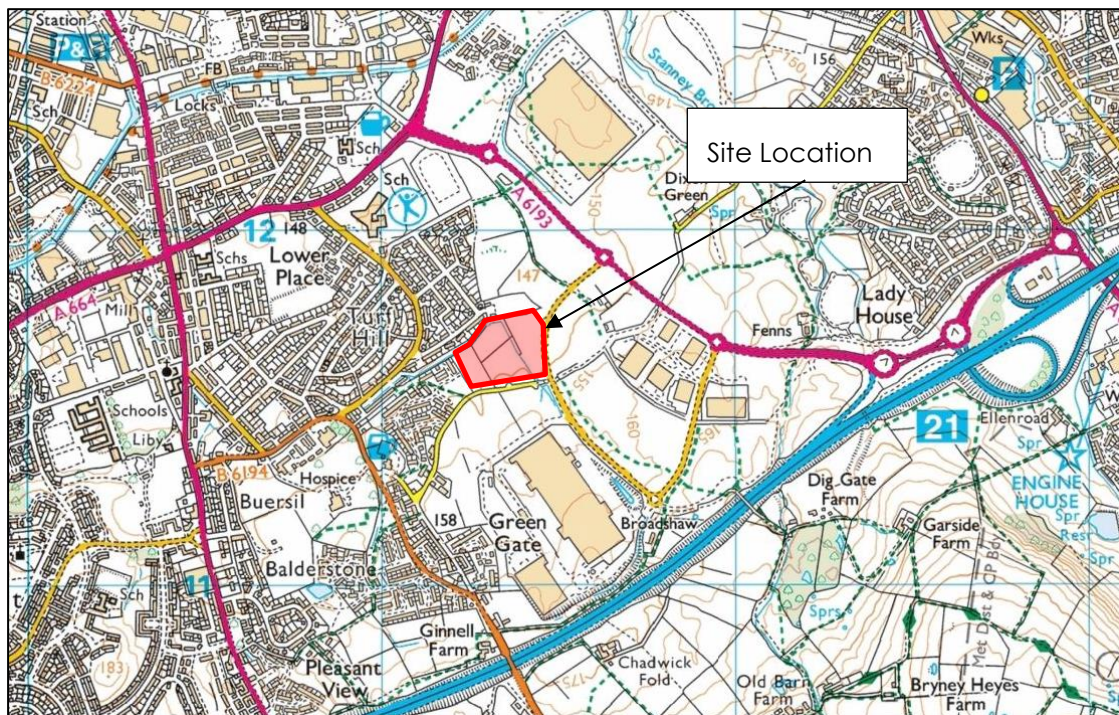
- 1.8 The ground investigation scope of works was completed between the 8th May and 5th of June 2017 and comprised the following:
- Non-intrusive survey of excavation locations for underground utilities;
 - Seventeen machine excavated trial pits to a maximum depth of ~4m bgl;
 - Three cable percussive boreholes to a maximum depth of 10.45m bgl;
 - Four subsequent gas and groundwater monitoring visits;
 - Chemical analysis of soils; and
 - Geotechnical testing of soil.
- 1.9 Findings of the intrusive works are included in the Phase 2 geo-environmental assessment detailed in Section 7 to Section 16.

2 THE SITE

Site Location

- 2.1 The site is located at Plot L Kingsway Business Park Rochdale in Greater Manchester, at National Grid coordinates/reference 391359, 411650 (SD913116, approximate site centre). The approximate location of the site is shown in **Figure 1**.

Figure 1 Site Location Plan



Reproduced from the Ordnance Survey Open Map - Local with the permission of the controller of Her Majesty's Stationery Office Crown Copyright Reserved.

Site Description

- 2.2 A site walkover of the site was completed on 4th May 2017 by a representative of BWB. Photographs from the initial site walkover are presented in **Appendix 1**.
- 2.3 The site is irregular in shape, occupying approximately 4.33 hectares. The site lies between the town of Rochdale and the M62 motorway and exists as part of the development land of Kingsway Business Park.
- 2.4 The site lies at approximately 150m AOD and is generally flat, sloping gently from the south to the north. The site is bound to the north and the west by residential housing and to the south and east by light industrial warehouse units of the larger development site.
- 2.5 The northern, southern and western boundaries are occupied by semi-mature and mature trees. A small area of mature woodland also exists in the south east corner of

the site. A bund (~3m tall) is also present along the northern site boundary. The internal areas of the site is occupied by grassland (90%), semi mature trees (5%) and hedgerows/fences (5%).

- 2.6 A drainage ditch (Tertiary River) intersects the site south to north and drains away to the west running along the northern site boundary (Secondary River). At the time of the site walkover and ground investigation the site was relatively dry. However during inclement weather over the winter months it is expected the site is boggy in nature.

No visual or olfactory sources of contamination were noted during the site walkover.

3 GEO-ENVIRONMENTAL SETTING

3.1 Based on the Groundsure Report (**Appendix 2**), the anticipated ground conditions for the site and controlled waters vulnerability is discussed within **Table 1** below.

Table 1 Published Ground Conditions

Geology	The Groundsure report indicates that the site is directly underlain by superficial deposits comprising Hummocky Glacial Deposits (Diamicton), Head (Clay, Silt, Sand and Gravel) and Peat. The BGS Lexicon describes Hummocky Glacial Deposits as lithologically diverse and complex glacial deposits, composed of rock debris, clayey till and poorly- to well-stratified sand and gravel. Head is described as poorly sorted and poorly stratified deposits comprising sand and gravel, locally with lenses of silt, clay, peat and organic material. Peat is described as humic deposits, an accumulation of wet, dark-brown, partially decomposed vegetation; may be an organic rich clay. The Groundsure report indicates that the site is directly underlain by bedrock strata of the Pennine Middle Coal Measures Formation (PMCM, north east corner of the site) and the Milnrow Sandstone (rest of the site). No Made Ground or other Artificial Ground is indicated to be present on site in the Groundsure Report. However, Made Ground is anticipated to be present due to the recent and historic occupation of the site. BGS borehole logs located to the west of the site largely confirm the anticipated geological sequence.
Hydrogeology	The Environment Agency (EA) lists the superficial deposits as a Secondary A Aquifer and the Bedrock geology as a Secondary A Aquifer. These are 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. Three historical Groundwater Abstraction Licenses are attributed to the site, relating to general farming and domestic, with a maximum annual abstraction volume of 5123.34m³. The closest active license is located 1846m to the east (United Utilities Water Ltd). The site is not within an EA Groundwater Source Protection Zone (SPZ). There is a high potential for soil leaching to impact groundwater on site related to the deep, permeable, coarse textured soils. These will readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
Hydrology	No standing water is indicated to be present on site. A tertiary river exists on site running from the south of the site to the north where it confluences with a secondary river running along the northern boundary of the site east to west. Due to the local nature of these rivers they are likely to be subject to significant seasonal variations. There are no active or historic Surface Water Abstraction Licenses within 1000m of the site.

	Sudden Beck (1132m SW) achieved biological grade D quality in 2009.
Ground Gas & Radon	Although no Made Ground is indicated on site, Made Ground deposits are anticipated due to previous on-site developments. Made Ground has the potential to emit elevated concentrations of hazardous ground gases. The site is not within a Radon Affected Area, as less than 1% of properties are above the action level.
Mining and Mineral Extraction	The site is located within the specified search distance of an identified coal mining area. No other mining or mineral extraction is indicated within 1000m of the site boundary.
Ground Stability	The Groundsure Report (Appendix 2) has indicated the following Natural Ground Subsidence hazards for the site: • Low hazard potential for shrink-swell clays; • Very Low hazard potential for landslides; • Negligible hazard potential for ground dissolution; • High hazard potential for compressible deposits; • Very Low hazard potential for collapsible deposits; and • Very Low hazard potential for running sands.
Landfill/Waste Sites	No landfills or waste sites located within 500m of the site.
UXO	A review of the Zetica Regional Unexploded Ordnance Map for Greater Manchester (Appendix 4) has indicated the site is of low risk from Unexploded Ordnance.

4 SITE HISTORY

- 1.1 Historical Ordnance Survey (OS) mapping for the site area has been reviewed. These maps and plans date from the 1851 OS County Series to the current 2014 OS Plans. The historical plans reviewed have been reproduced in **Appendix 3**. The key points of the historical development of the site and surrounding area are summarised below in **Tables 2** and **3**.

Table 2 Key Points of Site Development History

Dates	On Site	Significance
1851	Site appears to largely exist as AGRICULTURAL fields. A small house exists in the south of the site. A stream is intersecting the site north to south, and traverses the site east to west along the northern boundary.	Use of the site as cropland may have given rise to elevated concentrations of agricultural contaminants such as herbicides and pesticides. Made Ground will exist on site in the footprint of the house. The stream represents a potential receptor.
1891	No significant changes.	
1910	A rectangular area in the north of the site now appears to be paddocked/fenced.	
1930	The rectangular area is now labelled SHEEPWASH . A spring is also mapped centrally on-Site.	Occupation of the site has likely introduced areas of Made Ground in building footprints.
1955	Marsh listed in the north-east corner of the site.	Any animal remains/waste disposed of on-site has the potential to present risk of anthrax or other pathogens.
1992	House in the south of the site is now listed as a SLAUGHTERHOUSE . Pond also listed in the south-east of the site.	Marshland and pond could act as a sensitive receptor.
2002	No significant changes.	
2010	SLAUGHTERHOUSE is no longer shown as present on site.	
2014	No significant changes.	
No further on-site changes indicated by mapping.		

Table 3 Key Points of Surrounding Area Development History

Dates	Off Site	Significance
1851	A number of MILLS (woollen/cotton) listed 750m+ to the north-west. Stanney Brook is located 700m to the north-east and beyond lies a RAILWAY LINE . Rochdale Canal runs 750m to the north of the site.	Industry of the mills and iron works has the potential to introduce contamination of heavy metals, inorganic compounds, asbestos and organic contaminants.
1891	Surrounding land exists dominantly as agricultural land. A Castle and well is bordering the site to the south, with houses approximately 120m to the east	Railway land may introduce contamination of PAHs, ethylene glycol, creosote, ash, sulphate and asbestos.

Dates	Off Site	Significance
	and a farm approximately 150m to the south-west. Extensive development to the north-west of the site (Rochdale), including MILLS and IRON WORKS . Three Reservoirs are also shown 1km to the south-west of the site.	Surface reservoirs, marshes, and canal represent potential receptors. Residential housing and community centre also present potential receptors.
1910	An IRON WORKS and TANK is listed approximately 120m to the east of the site.	
1928	Large residential development bordering the north-west of the site.	
1938	No significant changes.	
1955	Iron works is converted to MILL (Cotton Spinning). Marshland indicated to border the site to the north-east.	
1967	No significant changes.	
1976	Construction of the M62 motorway 600m south of the site indicated on mapping.	
1992	COMMUNITY CENTRE now present bordering the north of the site.	
2010	Works to the east of the site are no longer present. Implemented new road infrastructure east of the site and the development of BUSINESS PARK .	

Aerial Photographs

1.2 Google Earth aerial photography has been reviewed below in **Table 4**.

Table 4 Key Points from Historic Aerial Photographs

Dates	On Site & Off Site Changes	Significance
Dec. 2000	Slaughterhouse present on-site with paddocked livestock appearing in photography. Industrial unit is present to the east of the site.	Potential for contaminants and pathogens associated with the recent occupation of the site as an abattoir.
Dec. 2005	As above. Photography appears to show large scale re-profiling of the land to the east of the site in the area of the business park.	Redevelopment of nearby land may have introduced widespread Made Ground.
April 2013	Site is vacant. New road infrastructure has been implemented to the east of the site in addition to large scale light industry/distribution units to the north and south of the site.	On-site structures have been demolished. Made Ground deposits likely to be present within the building footprint.
Sept. 2016	Additional light industrial units constructed to the east of the site.	Potential for contamination associated with the recent development of warehouse units nearby to impact the site.

Operational / Company Records

- 1.3 No operational / company records have been reviewed as part of this assessment.

BWB Information

- 1.4 BWB has completed a number of intrusive investigations on nearby plots within Kingsway Business Park.
- 1.5 Extensive areas of peat have been identified on Plot K directly east of the site, and Plot M directly north of the site. Although significant extents of peat are not expected on site, bands of soft highly organic layers are present close to the valley brook. A significant thickness of organic topsoil and subsoil is also present across the site.
- 1.6 The Hummocky Glacial Deposits comprise clayey till and poorly- to well-stratified sand and gravel. Nearby investigations have encountered thick bands of silty sands and have arisen in excavations as running sands.

5 REGULATORY SETTING

Permits Consents and Authorisations

- 1.8 A full listing of permits, consents and authorisations including discharge consents, pollution incidences and other environmental information included in the Groundsure® Report, is presented in **Appendix 4**.
- 1.9 The factors that could influence the environmental status of the site are described below in **Table 5**.

Table 5 *Notable Environmental Information*

Feature	No. Within 500m of the site boundary	Closest to the site	Comments
Records of Planning Hazardous Consents and Enforcements	One, 118m to the east of the site. Approved application dating to 1992 from British Vita Plc.		No entries have been attributed to the site.
Dangerous or hazardous sites	One, 58m to the east of the site. Historical NIHHS Site related to British Vita Plc.		No entries have been attributed to the site.
Environment Agency Recorded Pollution Incidents	Two, one on site and one 181m to the east of the site.	On-site entry relates to the pollution to water (Category 3, Minor) from Blood and Offal.	The entries are attributed to the former on-site slaughterhouse with the pollution incident dated to August 2003. This could present a potential source of contamination.

Landfilling and Waste Management

- 1.10 A full listing of EA, BGS and Local Authority recorded landfills are provided in the Groundsure® Report presented in **Appendix 2**.
- 1.11 No landfills or other waste sites have been listed to be within 500m of the sites boundary.

6 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

- 6.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 6.2 The following sections discuss all the identified potential on and off site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.
- 6.3 Three impact potentials exist for any given site, these are:
- The site impacting upon itself;
 - The site impacting on its surroundings; and
 - The surroundings impacting on the site.
- 6.4 All three impacts need to be considered in a risk assessment.
- 6.5 A Source, Pathway, Receptor analysis has been undertaken for the site based on the information provided in the preceding sections. This is presented as **Table 6**. A Preliminary Conceptual Site Model sketch for the site is included as **Drawing 2**.
- 6.6 **Sources (S);** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 6.7 **Pathways (P);** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 6.8 **Receptors (R);** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Table 6 Preliminary Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-site Sources S1a: Buried animal remains and other contaminants associated with the former abattoir. Contaminants of potential concern are spores of anthrax or other pathogens. S1b: Made Ground and/or topsoil present across the site. Contaminants of potential concern may include heavy metals, PHCs, PAHs, phenols, chlorinated solvents and sulphates, asbestos and ACMs, ground	P1: Dermal contact, incidental ingestion and/or inhalation of contaminated soil particulates.	R1: Ground and construction workers.	Sv	UI	M/L	The recommendations of CIRIA Report 132 – 'A Guide for Safe Working on Contaminated Sites' and CIRIA Report C741 – 'Environmental Good Practice On Site' should be considered during ground works at the site to ensure the appropriate PPE is worn and correct procedures are adopted. Full Tyvek suit with appropriate eye protection, gloves and shoe covers should be worn during the initial digging of pits in the footprint of the former abattoir. Samples from these pits should be sent off for anthrax analysis at an appropriately licensed laboratory. The use of specialist, licenced contractors during future works would help to mitigate the risks for future site users.
		R2: Potential future site users.	Md	UI	L	It is anticipated that hard standing will be present across most of the site (roads and buildings) and in areas of soft landscaping, a layer of topsoil or 'clean' capping material is likely to be required. This will limit the potential for direct contact with the soils and minimise dust generation from potentially contaminated soils at the site.
		R3: Buried concrete structures and water utility pipes.	Mi	Li	M/L	Soil testing for sulphate as part of future ground investigation works should be undertaken to assess the appropriate concrete class for on-site use. Laboratory testing results from future ground investigation works may be required by the water utilities providers to confirm the most suitable pipe materials. Barrier pipes may be required.

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
gases and soil-derived vapours.	P2: Outdoor inhalation of soil-derived vapours and ground gases in ambient air post-construction and via migration into excavations during construction phase.	R1: Ground and construction workers.	Mi	Li	M/L	In the event that elevated concentrations of hazardous ground gases/vapours are identified during ground investigation works and/or where entry into confined spaces/excavations is required by construction workers, a combination of appropriate PPE and/or Respiratory Protective Equipment (RPE), monitoring equipment (such as explosive level meters) and safe entry procedures would be required to mitigate the potential risk of exposure to hazardous gases/vapours by workers.
		R2: Potential future site users.	Mi	Lw	L	In the event that elevated concentrations of hazardous ground gases/vapours are identified during ground investigation works, the installation of ground gas protection measures may be required during construction to mitigate ground gases/vapours.
	P3: Indoor inhalation of soil-derived vapours and ground gases.	R2: Potential future site users.	Mi	Lw	L	Potential sources of ground gases and vapours such as Made Ground, highly organic soils and contaminated soils could potentially be mitigated through removal or treatment prior to construction.
	P4: Leaching and permeation through soil profile followed by groundwater migration and surface run-off into drainage systems.	R4: Underlying Secondary A Aquifers.	Mi	Li	M/L	Leachate analysis of soils should be undertaken to determine the potential for leaching contaminants to impact surface and groundwater.
		R5: On-site surface water drainage ditch.	Mi	Li	M/L	The recommendations of EA document <i>PPG6: Construction and Demolition Sites: Prevent Pollution</i> should be considered during construction.

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
Off-Site Sources S2: Contamination from off-site development and associated Made Ground. CoPC include heavy metals, PHCs, PAHs, phenols, chlorinated solvents, sulphates, asbestos and ACMs, ground gases and soil-derived vapours.	P1: Dermal contact, incidental ingestion and/or inhalation of contaminated soil particulate.	R1: Ground and construction workers.	Mi	Lw	L	The land in the surrounding area is generally well developed. It is considered unlikely that on-site receptors will be exposed to off-site soils. The recommendations of CIRIA Report 132 – ‘A Guide for Safe Working on Contaminated Sites’ and CIRIA Report C741 – ‘Environmental Good Practice On Site’ should be considered during ground works at the site to ensure the appropriate PPE is worn and correct procedures are adopted.
		R2: Potential future site users.	Mi	UI	VL	It is anticipated that hard standing will be present across some of the site (roads and buildings) and in areas of soft landscaping and gardens a layer of topsoil or ‘clean’ capping material is anticipated to be present at the surface. This will limit the potential for direct contact with the soils and minimise dust generation from potentially contaminated soils at the site.
		R3: Buried concrete structures and water utility pipes.	Mi	UI	VL	Soil testing for sulphate as part of future ground investigation works should be undertaken to assess the appropriate concrete class for on-site use. Laboratory testing results from future ground investigation works may be required by the water utilities providers to confirm the most suitable pipe materials. Barrier pipes may be required.
	P2: Outdoor inhalation of soil-derived vapours and ground gases in ambient air post-construction and via migration into excavations during construction phase.	R1: Ground and construction workers.	Mi	UI	VL	In the event that elevated concentrations of hazardous ground gases are identified during ground investigation; where entry into confined spaces and/or excavations is required by construction workers, a combination of appropriate PPE and/or RPE, monitoring equipment and safe entry procedures would be required to mitigate the potential risk of exposure to hazardous gases/vapours by construction workers. Ground investigation for general coverage purposes should include exploratory hole locations adjacent to the site boundaries, where possible.
		R2: Potential future site users.	Mi	UI	VL	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
	P3: Indoor inhalation of soil-derived vapours and ground gases.	P3: Indoor inhalation of soil-derived vapours and ground gases.	Mi	UI	VL	In the event that elevated concentrations of hazardous ground gases/vapours are identified during ground investigation works the installation of protection measures may be required during construction to mitigate ground gases/vapours. Ground investigation for general coverage purposes should include exploratory hole locations adjacent to the site boundaries where possible.
	P4: Leaching and permeation through soil profile followed by groundwater migration and surface run-off into drainage systems.	R4: Underlying Secondary A Aquifers	Mi	Lw	L	No groundwater testing data or information of standing water levels is currently available for the site and further investigation would confirm whether potentially unacceptable risks are present. Ground investigation for general coverage purposes should include exploratory hole locations adjacent to the site boundaries where possible.
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely						

7 PHASE II ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

Scope of Works

- 7.1 Intrusive ground investigation works were undertaken between Monday 8th May and Monday 5th June 2017 and comprised the following works:
- Clearance of investigation locations by a specialist buried services tracing company;
 - Collection of coordinates and elevations of exploratory hole locations;
 - The advancement of 3 cable percussive boreholes (BH01 to BH03 inclusive) to a maximum depth of 10.45m bgl with completion of SPTs and installations of gas and groundwater monitoring wells;
 - The advancement of seventeen machine excavated trial pits (TP01 to TP16 inclusive and TP01A) to a maximum depth of ~4.0m bgl;
 - TRL dynamic probe penetration (TRL DCP) testing at selected locations in order to infer CBR values;
 - Collection of soil samples within the former abattoir grounds for anthrax analysis;
 - Collection of environmental soil and groundwater water samples for chemical analysis at a UKAS and MCERTS accredited laboratory;
 - Collection of bulk and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory; and
 - Four post investigation ground gas and groundwater level monitoring visits.
- 7.2 An exploratory hole location plan is presented as **Drawing 1**. BWB exploratory hole records are presented as **Appendix 5**, Drillers' Logs are presented as **Appendix 6**, the SPT calibration certificate is presented in **Appendix 7**, and the post investigation gas and groundwater monitoring data is presented as **Appendix 8**.
- 7.3 The site investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011 'Investigation of Potentially Contaminated Sites'.

Exploratory Location Strategy

- 7.4 Six trial pits were located within the area of the former on-site abattoir, where Made Ground was expected and where former animal remains may have been buried. The exploratory location strategy is detailed below in **Table 7**.

Table 7 Exploratory Location Strategy

Location	Reason
TP01A, TP05 - TP09	• Sampling of general Made Ground within former on-site building footprint to assess potential contamination. • To identify potential evidence of <i>Bacillus anthracis</i> (causative agent of anthrax) within the former abattoir grounds in shallow soils (<1.0m bgl).
TP01, TP10 – TP16, BH01 – BH03	Spatial coverage within the site of general ground conditions.

Biological and Chemical Analytical Strategy

Soil Strategy

- 7.5 Selected soil samples collected from potential locations of anthrax were sent to the Health and Safety Laboratory for microbiological analysis. Six soil samples were subject to microbiological analysis of *Bacillus anthracis*, the causative agent of anthrax.
- 7.6 In addition to the above, selected soil samples collected from exploratory hole locations were sent to i2 Analytical Services (UKAS and MCERTS accredited) for chemical analysis. The following chemical analytical testing was undertaken:
- Thirteen soil samples tested for a soil suite (BWB Standard Suite) comprising arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), total phenols, total cyanide, free cyanide, complex cyanide, fraction of organic carbon, pH, Polycyclic Aromatic Hydrocarbons (PAHs) (United States Environment Protection Agency priority 16 compounds) and Total Petroleum Hydrocarbons (TPH) C6-C40;
 - Five soil samples tested for TPH speciated to the UK Criteria Working Group (TPHCWG) aliphatic and aromatic compounds;
 - Five soil samples for asbestos screening; and
 - Five soil samples tested for a suite of common leachable contaminants, namely arsenic, barium, beryllium, water soluble boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), sulphate, total cyanide and pH.
- 7.7 The results of the microbiological testing are presented as **Appendix 9** and soil chemical testing are presented as **Appendix 10**.
- 7.8 The above soil chemical testing was targeted based on the following rationale presented within **Table 8**.

Table 8 Analytical Strategy

Location	Depth (m bgl)	Stratum	Analysis	Reason
TP06	0.3-0.4	Made Ground	BWB Standard suite BWB Leachate Suite TPH-CWG with BTEX Asbestos Screen	General Made Ground Screen
TP07	0.2-0.3	Made Ground	BWB Standard suite BWB Leachate Suite TPH-CWG with BTEX Asbestos Screen	General Made Ground Screen
TP08	0.2-0.3	Made Ground	BWB Standard suite BWB Leachate Suite TPH-CWG with BTEX Asbestos Screen	General Made Ground Screen
TP16	0.7-0.8	Made Ground	BWB Standard suite BWB Leachate Suite TPH-CWG with BTEX Asbestos Screen	General Made Ground Screen

Location	Depth (m bgl)	Stratum	Analysis	Reason
<i>All other locations have been analysed to provide spatial coverage for the site.</i>				

Geotechnical Strategy

- 7.9 The cable percussive borehole locations were positioned to 'triangulate' across the site to assess underlying ground conditions for geotechnical purposes and to allow for the groundwater flow to be determined (if possible). The trial pits were positioned to assess ground conditions, strength properties and characteristics across the wider site, with the CBR tests undertaken at selected locations to allow for pavement design.
- 7.10 In-situ soil strength testing comprising SPTs were undertaken with the cable percussive. SPT 'N' values are included on the exploratory hole logs presented as **Appendix 5**.
- 7.11 Selected disturbed and bulk samples were collected from the investigation locations and sent to the i2 Analytical Services which is UKAS accredited. The following geotechnical testing was undertaken;
- Nineteen samples tested for moisture content;
 - Seven samples tested for Atterberg (liquid and plastic) limits;
 - Eight samples tested for particle size distribution by sieving;
 - Eight samples tested for particle size distribution by sedimentation;
 - Ten samples tested for BRE Suite comprising aqueous sulphate and pH;
 - Four CBR (2.5kg) compaction testing; and
 - Three samples tested for organic matter content.
- 7.12 The results of the geotechnical testing are included as **Appendix 11**.

Limitations and Uncertainty

- 7.13 Due to a shallow concrete obstruction TP08 could not be progressed below 0.4m bgl and as such no geotechnical samples were obtained from the deeper strata within TP08.

8 GROUND CONDITIONS ENCOUNTERED

Geological Summary

- 8.1 The ground conditions recorded confirmed the published geology discussed in **Section 3** comprising clays, sands and gravels consistent with Hummocky Glacial Deposits with some deposits recovered very organic in nature. No significant thicknesses of peat were encountered during the ground investigation. Depth to the top of the bedrock strata was not proven during the investigation.
- 8.2 The recorded ground conditions are summarised in **Table 9** below and **Drawing 3** presents a geological cross section through the site. Corrected SPT results collected from the borehole locations are presented on the exploratory hole records presented in **Appendix 5**.

Table 9 Summary of Ground Conditions

Stratum	Top Depth (m)		Base Depth (m)		Thickness (m)		SPT N60 Value	
	Min	Max	Min	Max	Min	Max	Min	Max
Topsoil	0.00	0.00	0.25	1.00	0.25	1.00	NR	NR
Made Ground	0.00	0.00	0.25	3.50	0.25	3.50	NR	NR
Hummocky Glacial Deposits (multiple granular and cohesive layers)	0.00	1.00	2.50	10.45	2.10	10.20	3	38

NR: None recorded within the stratum.

Geological Descriptions

Topsoil

- 8.3 Topsoil was encountered consistently across the site with the exception of TP07, with depths recorded between GL and 1.0m bgl. Thicknesses of topsoil were recorded between 0.3m and 1.0m. The composition typically comprised a dark brown sandy loam with frequent rootlets.
- 8.4 The depth of topsoil over the site may vary from that encountered at the locations investigated within the scope of this investigation which may result in inaccurate estimations of topsoil quantities on the site.

Made Ground

- 8.5 Made Ground was encountered within six exploratory holes at the site beneath the Topsoil at depths generally ranging between GL and 0.4m bgl, with a maximum thickness of 0.4m. One exploratory hole (TP16) encountered Made Ground thicknesses to 3.5m bgl, due to localised fill material being deposited in the north east corner of the site at the stub of the adjacent highway to the east of the site.

- 8.6 In the south of the site, Made Ground generally comprised gravelly topsoil, with the gravel fraction recorded as fine to coarse, angular to sub-angular brick and pot.
- 8.7 In the localised fill area in the east of the site, Made Ground generally comprised gravelly clay/gravelly sand with frequent cobble content. The gravel fraction is recorded as fine to coarse angular mudstone, sandstone, clinker, brick and metal with cobbles recorded as angular brick.

Hummocky Glacial Deposits (HGD)

- 8.8 The HGD were recovered as multiple layers of both granular and cohesive deposits. Throughout the site the deposits were very poorly sorted with high variability in their constituents recorded laterally and vertically.
- 8.9 Where cohesive, the HGD generally comprised soft brown sandy gravelly clay. The gravel fraction was recorded as fine to coarse sub-rounded to rounded quartz, mudstone and sandstone. The proportion of cohesive deposits was greater towards the northern, western and north eastern portions of the site likely associated with alluvial channels. However, significant visual or strength properties were not apparent other than greater proportions of organic matter within the cohesive horizons.
- 8.10 Where granular, the HGD generally comprised loose clayey sand/clayey gravel. The gravel fraction was recorded as fine to coarse sub-rounded to rounded quartz, mudstone and sandstone.
- 8.11 Where suitable cohesive deposits were encountered hand shear vane tests were undertaken. The tests comprised three tests with the average taken as the peak results and presented as a graph below as **Figure 2**. However, due to the sand portion in the cohesive horizons, reported shear strength is considered to be lower than actual values. The HSV results obtained at trial pits are presented on the exploratory hole records presented in **Appendix 5**.
- 8.12 Cohesive deposits were typically very variable in strength with averaged hand shear vane values ranging from 4 kPa (extremely low strength) to 83 kPa (very high strength), based on the average of three results. A summary of strength classifications for the site is provided in **Table 10**, based on BS5930 'Code of practice for ground investigations'.
- 8.13 Shear strength values recorded within the cohesive deposits of the HGD were very variable, with no clear relationship between depth and shear strength.

Figure 2 *In Situ Hand Shear Vane Test Results*

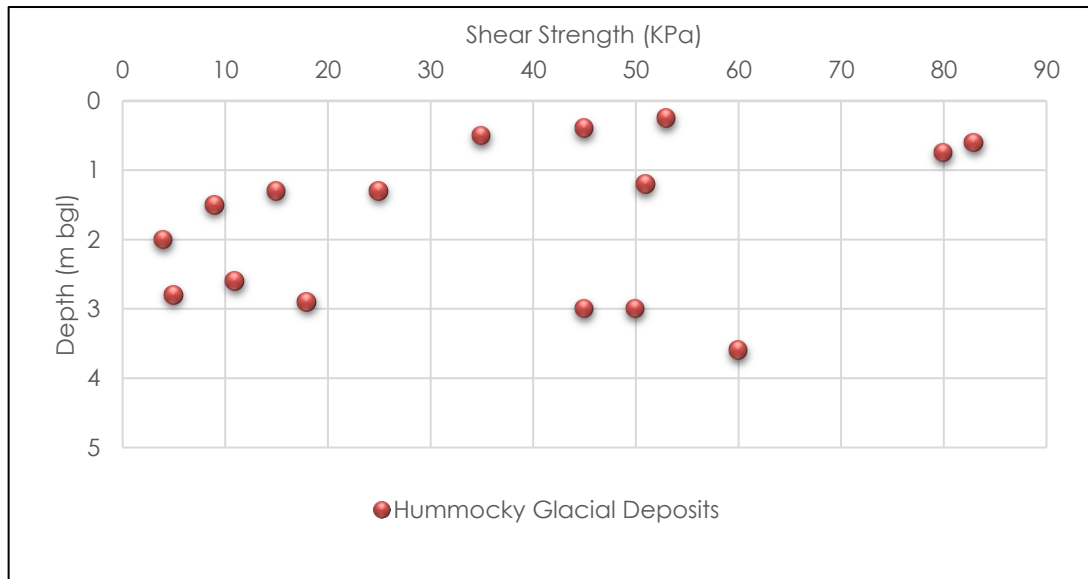
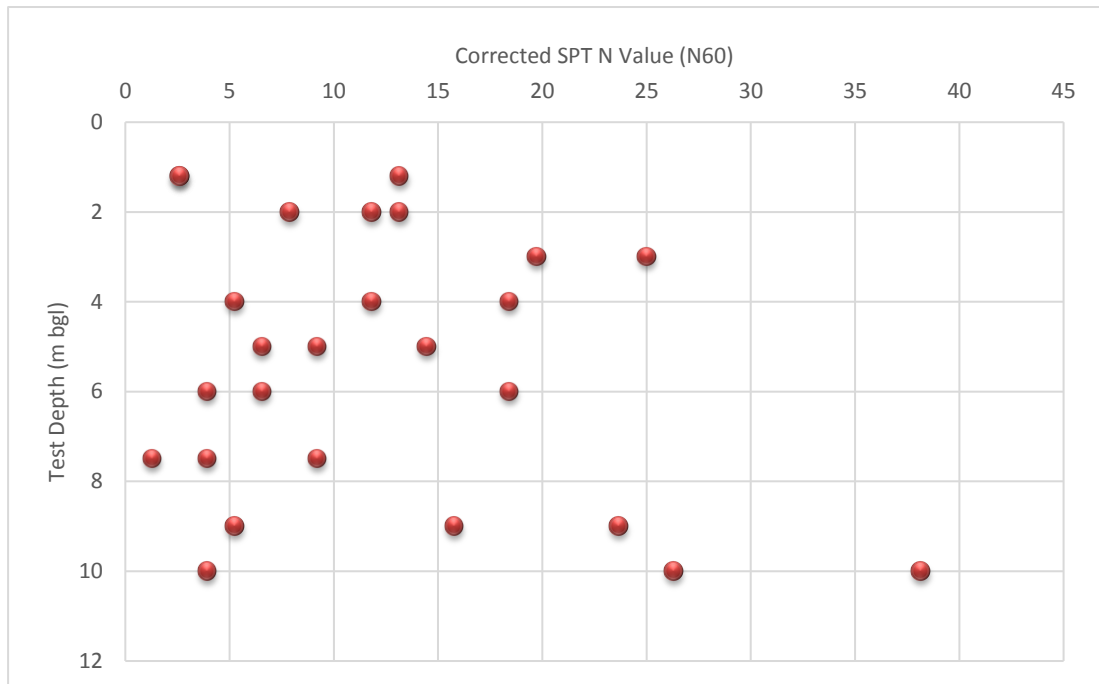


Table 10 *Strength Classifications from HSV*

Strength term	Strength classification (kPa)	Number recorded in HGD
Extremely Low	<10	3
Very Low	10 – 20	3
Low	20 – 40	2
Medium	40 – 75	6
High	75 – 150	2

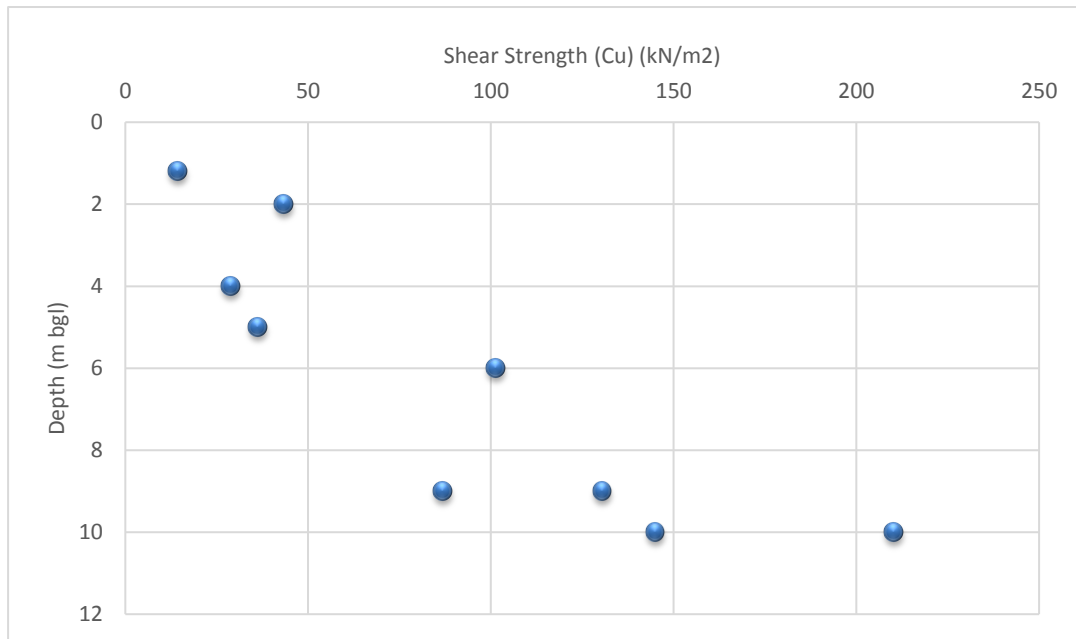
- 8.14 Standard Penetration Testing (SPT) was undertaken within the exploratory boreholes. SPT N values give an indication of soil strength, relative density and other geotechnical parameters.
- 8.15 SPT N_{60} values within the HGD were generally very variable, recorded in the range 1 and 38 blows. Within the HGD, no clear relationship is inferred between the main strata constituent (e.g. dominantly clay/sand/gravel) and the SPT N_{60} value. The lower N_{60} values associated with granular horizons at greater depth are likely associated with blowing sands and so there is uncertainty in this data, with strength properties likely greater than the N_{60} values suggest.
- 8.16 A plot of corrected SPT ' N_{60} ' Value Vs Depth is presented as **Figure 3** overleaf.

Figure 3 Corrected SPT 'N' Value (N_{60}) Versus Depth



- 8.17 Geotechnical laboratory testing reported plasticity indices between 10% and 12% (low plasticity) increasing to 26% at greater depth (6.9m bgl at BH01), with moisture contents of between 14% and 26%. Several samples were reported as none plastic (described by the laboratory as slightly, to very clayey and often gravelly sand).
- 8.18 Shear strength within the HGD was reported to be between 14kPa and 210kPa. A plot of reported and calculated shear strength (correlated with SPT values) is presented overleaf as **Figure 4**.
- 8.19 Optimum moisture contents were reported in the range 8.1% and 14% with as received moisture contents of between 14% and 25%. Maximum dry density values were reported between 1.75Mg/m³ and 2.09Mg/m³.

Figure 4 *Calculated Shear Strength (from SPTs in Cohesive Strata) Versus Depth*



8.20 The results of particle size distribution testing are provided in **Table 11** below.

Table 11 *Particle Size Distribution Results*

Location	Depth	Cobble Content	Gravel Content	Sand Content	Silt Content	Clay Content	Silt/Clay Content	Series 600 Earthworks Class (Table 6/2)
TP11	1.8	0	0	42	39	18		2A&2B
TP12	1.2	0	0	35	43	20		2A&2B
TP15	1.9	0	0	81	14	5		2A&2B
TP13	2.6	6	54	34			6	1A
TP11	1.2	0	0	63	24	13		2A&2B
TP10	3.7	0	2	63			35	2A&2B
TP07	0.5	0	4	61			35	2A&2B
TP06	1.2	0	10	68			21	2A&2B
TP05	1.3	0	61	25			14	1A
TP04	2.7	0	61	24			14	1A
BH01	5	0	2	84			13	1A
BH02	7.5	0	0	96			4	1A
BH03	9	0	16	40			44	2A&2B
TP02	0.9	0	23	74			3	1A
TP03	2.9	0	5	60	20	15		2A&2B
TP01A	3	0	4	44	41	11	52	2A&2B

In Situ Testing

TRL-DCP Testing

- 8.21 Dynamic Cone Penetrometer (DCP) tests were undertaken adjacent to a number of exploratory hole locations (twelve total) in order to infer California Bearing Ratio (CBR) values to inform pavement design. The testing was undertaken in accordance with Transport Research Laboratory (TRL) methodology (see **Appendix 12**). The results of the testing are presented as **Appendix 12** and are summarised in **Table 12** below.

Table 12 DCP TRL Results Summary

Stratum	Min CBR (%)	Max CBR (%)
Topsoil	1.1	5.1
Made Ground	5.1	High (~80 – 120)
Hummocky Glacial Deposits	1.5	22.0

- 8.22 It should be noted that during TRL DCP testing ground conditions were wet and boggy due to inclement weather.

Hydrogeology

- 8.23 Groundwater was encountered in thirteen of the seventeen investigated locations.
- 8.24 Within the trial pits, groundwater was encountered between 1.9m bgl and 3.7m bgl, all groundwater strikes located within the Hummocky Glacial Deposits. **Table 13** below provides a summary of the groundwater encountered.
- 8.25 Groundwater was generally recorded within or close to the boundaries of coarse strata (i.e. sands, gravels) within the Hummocky Glacial Deposits.

Table 13 Water Strikes

Location	Depth (m bgl)	Strata	Description
BH01	3.0	HGD	Strike recorded within sand and gravel.
BH02	2.6	HGD	Strike recorded within sandy gravel.
BH03	7.5	HGD	Strike recorded within gravelly sand.
TP01	3.1	HGD	Slow ingress within clayey gravelly sand.
TP02	3.6	HGD	Medium ingress within clayey sand & gravel.
TP03	1.9 3.1	HGD	Slow ingress within sandy gravelly clay (1.9m). Fast ingress within clayey gravelly sand (3.1m)
TP04	3.15	HGD	Slow ingress within clayey gravelly sand.
TP05	3.3	HGD	Fast ingress within sandy gravelly clay.
TP07	3.3	HGD	Medium ingress within sandy gravel.
TP10	2.3	HGD	Slow ingress within clayey gravelly sand.
TP12	2.1	HGD	Medium ingress within clayey gravelly sand.
TP13	2.5	HGD	Medium ingress within clayey gravelly sand.
TP15	2.0 3.7	HGD	Slow ingress within sandy organic clay (2.0m). Medium ingress within sandy gravelly clay (3.7m).

- 8.26 During the post investigation monitoring period, groundwater was encountered in all three monitoring wells, ranging between 1.61m bgl (BH02 on 19/5/2017) and 4.53m bgl (BH01 on 5/6/2017). The groundwater data has suggested that groundwater is present at shallower depths in the east of the site.

Hydrology

- 8.27 A hydrological assessment did not form part of this assessment.

Contamination Observations

- 8.28 No visual or olfactory evidence of contamination was noted during the ground investigation or gas and groundwater monitoring period.

9 GEOTECHNICAL ASSESSMENT

Introduction

- 9.1 At this stage it is assumed that the development will comprise either a single larger, or several smaller, industrial units with associated infrastructure and are likely to be steel framed portal structures. No current development plans are available. This assessment is therefore considered preliminary at this stage and should be reassessed once the development plans are better known. Depending upon the final load requirements, further ground investigation may also be required to assess deeper ground conditions for pile design.
- 9.2 The generalised ground conditions across the development site consist of soft organic Topsoil over Hummocky Glacial Deposits comprising multiple layers of weak clays, silts and loose sand and gravels. The proportion of cohesive deposits was greater towards the northern, western and north eastern portions of the site likely associated with alluvial channels. However, significant visual or strength properties were not apparent other than greater proportions of organic matter within the cohesive horizons. Areas of organic clays are also present, particularly close to alluvial channels with some areas of Made Ground, associated with the former site usage. Across the central areas of the site away from alluvial channels, the granular horizons appear more prevalent at depth.
- 9.3 Highly variable thicknesses of soft and likely compressible topsoil and subsoil have been recorded at the site with thicknesses varying between 0.25m (location BH01) and 1.0m (location BH02). These materials will need to be stripped prior to development due to the potential for differential settlement of pavements, floor slabs and foundations. These materials will need to be replaced with a suitable granular material imported and placed to a method specification.
- 9.4 Limited thickness of Made Ground have been recorded in the southern area of the site associated with the former Abattoir. Additional Made Ground of up to 3.5m has been recorded at location TP16 in the north east of the site. The greater thickness of Made Ground is considered to be associated with the former construction compound which was located in the area during the construction of the adjacent Plot K site. Made Ground is not considered a suitable founding strata due to the potential for excessive differential and/or total settlement.

Ground Model

- 9.5 For the purpose of foundation appraisal, groundwater is considered to be at 1.0m bgl. While groundwater during this investigation was at a much greater depth, historical data and BWBs experience of the local area indicates that the groundwater flow is very seasonal and is expected to flow in granular layers at shallow depth during winter months.
- 9.6 Based on the ground conditions discussed in **Section 5** a geotechnical ground model, indicating various geotechnical parameters, has been developed. This model provides the basis for geotechnical analysis undertaken within this report. There is principally one geological strata at the site, the Hummocky Glacial Deposits which can

be sub divided into two types; cohesive layers and granular layers present in multiple layers.

- 9.7 Within shallow granular layers (between 1 and 4m) a ϕ angle (friction) of 30 has been adopted based on the relationship between SPT N_{300} values and ϕ angle after Peck, Hanson and Thornburn (1963), with an E' value for settlement of 19 for silty sands below the water table (Burland and Burbridge (1985)). For cohesive horizons, based on a Plasticity Index of 12 and relationship between shear strength and N_{300} values (Stoud (1975)) a C_u value of 40 has been adopted for shallow deposits (between 1 and 4m) and E' value of 4 (note this is based on values for over consolidated clays and is indicative only).

Foundation Solutions

Trench Fill Foundations

- 9.8 Shallow strip footings are not considered as a potential founding option at the site with Trench Fill potentially providing the most economical founding option. Based on founding in the granular Hummocky Glacial Deposits between 2 and 3m bgl the trench fill foundation options that can be accommodated within 25mm settlement are provided in **Table 14** below.

Table 14 *Shallow Spread Foundation Options*

Founding Strata	Pad Size	Bearing Capacity (kPa)	Column Load (kN)
Medium Dense Granular Hummocky Glacial Deposits between 2 and 3m bgl	2.0m x 2.0m	60	240
	2.5m x 2.5m	50	310
	3.0m x 3.0m	45	405

Piles

- 9.9 If greater loads are required then an alternative piled solution could be adopted. Based on the ground conditions, a Continuous Flight Auger (CFA) pile is likely to be the most suitable solution. However, this method would generate significant volumes of spoil, which will need to be considered. It is possible that this material could be reincorporated into the works as general fill, if it meets the method specification, otherwise it may need to be discarded off site.
- 9.10 For a piles design, additional ground investigation would be required to assess the ground conditions to greater depth with Cone Penetrometer Testing (CPT) and cable percussive boreholes both required to obtain the required data. A specialist piling contractor should be consulted to further assess the most economical and suitable piling solution.

Ground Improvement Techniques

- 9.11 A vibro ground improvement option, such as stone columns, could also be a potential alternative foundation solution that could be considered. However, as with a piled

solution, additional ground investigation may be required to assess the deeper ground conditions and a specialist ground improvement contractor should be consulted.

Floor Slabs

Method of Construction (suspended, non-suspended)

- 9.12 Based upon an assessment of the ground model, a ground bearing floor slab may be suitable and could accommodate up to 30kPa. This is following a site strip to remove up to around 1.0m (typically around 0.6m) of shallow soft and compressible topsoil and subsoil deposits as well as variable Made Ground layers and replacement to a method specification with a layer of imported granular fill. These subsoil materials may be useful for placement as topsoil in soft landscaped areas.
- 9.13 If greater floor loads are required then it is possible that an alternative suspended solution may need to be considered.

Treatment of Ground Prior to Casting

- 9.14 The ground gas assessment (Section 10) indicates that ground gas protection measures are required in accordance with a CIRIA C665 CS2 situation.

Roads and Pavements

- 9.15 In-situ TRL DCP testing undertaken on the top 900mm at the site has indicated that the shallow deposits are highly variable and often soft with low corresponding CBR values (<3%). Much of the soft organic shallow topsoil and subsoil deposits will need to be removed and replaced with imported granular fill to accommodate development at the site. Additional CBR Testing will be required following the soil strip to assess the CBR values and identify whether liming will be required to improve the surface to accommodate pavements.

Drainage

- 9.16 No soakaway drainage testing has been undertaken at the site. However, the site is anticipated to be affected by seasonal shallow groundwater and so a soakaway drainage solution is unlikely to be a viable option. Instead an attenuated (tank/pond) solution or a positive drainage solution should be considered instead.

Excavations

Ease of Excavation

- 9.17 Conventional plant equipment is expected to be suitable for excavations at the site although it is anticipated that standard plant breaker equipment will be required for localised areas of buried obstructions in the southern area of the site associated with the former abattoir.

Stability of Excavation

- 9.18 Excavations displayed generally poor stability during the site investigation once granular horizons were encountered with running sands a potential issues that will need to be considered during development. The issues will be significantly reduced if works are undertaken during dryer periods such as summer months. The use of temporary support, such as trench boxes may need to be considered.
- 9.19 Excavation may also become unstable if left open for any significant periods. Where personnel entry is required for inspection; excavations should be sufficiently enlarged and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

Legislation on Personnel Entry to Excavations

- 9.20 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented.

Groundwater

- 9.21 Groundwater is likely to be a seasonal issue at the site with excavations likely to require dewatering during later autumn through to spring. However, this be highly dependent upon precipitation totals in the local areas.
- 9.22 If development, and particularly excavations are required during wetter periods then groundwater level control, such as dewatering at well points or slit trenches may need to be incorporated.
- 9.23 Standard pumping equipment is likely to be suitable for the above although may need to be run for long periods of time. The local water board should be consulted to assess whether a temporary discharge consent is required if discharging to the local drainage network is considered. The groundwater should be desilted prior to discharge but contamination of the groundwater is not considered to be an issue.

Chemical Attack on Buried Concrete

- 9.24 Water soluble sulphate concentrations in soils varied from <1.3mg/l to 219mg/l with soil pH values ranging from 6.0 to 10.1. Total sulphur concentration ranged from 0.0054% to 0.0750%. No groundwater testing has been undertaken.
- 9.25 In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

Earthworks

- 9.26 It is likely that small scale earthworks will be required to develop level development platforms. Based on the materials encountered, the materials are likely to conform to Highway Works earthworks class 1A or 2A/2B.
- 9.27 The suitability of earthworks materials has been assessed on the basis of the testing carried out as part of this investigation. The materials encountered on site may vary from those analysed; furthermore, inclement weather or winter working may result in materials being unsuitable for incorporation within the works without modification by lime, cement or other methods. In particular, cohesive soils are very susceptible to 'wet weather working' and we strongly recommend that consideration should be given to lime and/or cement stabilisation of these materials if the earthworks are undertaken during inclement weather or the winter period.
- 9.28 Stockpiled materials often deteriorate due to water infiltration and they may become unsuitable for incorporation in the works; further testing and re-assessment should be made prior to the finalisation and implementation of the earthworks design.

10 GROUND GAS ASSESSMENT

Introduction

- 10.1 Ground gas assessment has been undertaken to assess the risks associated with ground gases and volatile vapours to new buildings and their occupants. The results obtained have been assessed in line with relevant guidance (notably CIRIA C665 and BS8485: 2015).
- 10.2 CIRIA C665 guidance indicates that for a site with low gas generation potential (based on the Site History, **Section 4**, and the presence of Made Ground on site) and a low sensitivity development (the proposed light industrial land use), a typical monitoring programme comprised four visits over a period of four weeks.
- 10.3 BWB has completed the prescribed monitoring programme as set out in CIRIA C665.

Methodology

- 10.4 All boreholes were installed with ground gas monitoring wells with response zones set within the Hummocky Glacial Deposits (HGD). Exploratory hole records showing monitoring well constructions are presented in **Appendix 5**.
- 10.5 The assessment of potential ground gas generation is based on the observation of trends and changes in gas evolution by the direct measurement of ground gases from gas wells. The works included measurement of methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flows and barometric pressure. A PID survey was undertaken to measure volatile organic compounds within the borehole response zones.

Results

- 10.6 The minimum and maximum steady state concentrations recorded for borehole flow, oxygen, carbon dioxide and methane are summarised below in **Table 15**.

Table 15 Summary of Recorded Ground Gas Results

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
BH01	HGD	<0.1	<0.1	0.1	1.0	<0.1	<0.1
BH02	HGD	<0.1	<0.1	1.2	3.9	<0.1	<0.1
BH03	HGD	<0.1	<0.1	2.9	4.2	<0.1	<0.1

Atmospheric Pressure and Flow

- 10.7 During the monitoring programme completed at the site the atmospheric pressure ranged between 987mb (recorded on 05/06/2017) and 1010mb (recorded on 31/05/2017).

- 10.8 Two monitoring visits were undertaken when atmospheric pressure was recorded below 1000mb, representing a low pressure event. On this basis, the monitoring is considered to have captured the worst case gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure falls and particularly when the pressure drops below 1000mb. The pressure was recorded as steady during all four monitoring visits.
- 10.9 During all monitoring visits, steady flow rates were recorded at <0.1 l/hr for all boreholes.

Hazardous Ground Gas and Volatile Vapours

- 10.10 Steady carbon dioxide concentrations recorded ranged between 0.1% v/v (recorded in BH01 on 31/05/2017) and 4.2% v/v (recorded in BH03 on 05/06/2017) with steady methane concentrations were recorded at <0.1%v/v (recorded in all boreholes on all monitoring occasions).
- 10.11 Hydrogen sulphide and carbon monoxide concentrations were not recorded above the limit of detection of the equipment during the monitoring visits.
- 10.12 PID concentrations were recorded between 1.3ppm (in BH01 on 31/05/2017) and a maximum of 3.6 ppm (in BH02 on 25/05/2017).
- 10.13 Ground gas monitoring results are presented as **Appendix 8**.

Suitability of the Data

- 10.14 The response zones in all three boreholes have been partially or significantly flooded on a proportion of monitoring occasions since installation, in total, twelve discreet monitoring events (total number of discreet monitoring events = number of boreholes x number of monitoring visits) have been affected from the total twelve discreet monitoring events. Such flooding is likely to prevent the migration of ground gas into these boreholes and to affect measured gas flow rates and therefore recorded ground gas monitoring data may not be considered wholly representative of ground conditions.
- 10.15 It should also be noted that monitoring wells were not positioned within Made Ground deposits, which are known to be present in the footprint of the former on-site abattoir. Therefore this ground gas assessment may not captured the worst gas gassing scenario for the site.

Risk Assessment

- 10.16 The monitoring is considered likely to have captured the worst case atmospheric gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure drops below 1000mb.
- 10.17 CIRIA Report 665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" presents current best practice on the assessment of ground gases for commercial and residential buildings (with the exception of low rise traditional housing). The report presents a risk based approach based on gas screening levels which depend on both

the concentration and emission rate of gas from the ground. Gas screening levels are calculated as follows:

$$\text{Gas screening value (l/hr)} = \frac{\text{gas concentration (\%)} \times \text{measured borehole flow rate (l/h)}}{100}$$

- 10.18 Gas screening values should be calculated on a borehole basis in the first instance. Consideration of worst case i.e. highest flow and highest concentrations should only be considered if the CSM warrants it.
- 10.19 Maximum gas screening levels of 0.0036 l/hr were recorded giving a classification of CIRIA Characteristic Situation 1 – no special protective measures required.
- 10.20 However, when considering the fact that the data set may be compromised due to flooding of the wells an assessment has been made using the Fraction of Organic Carbon (FOC). The FOC ranges from 0.24% to 5.9%. With FOC concentrations such as these, the Site should be characterised as a Characteristic Situation 2 (CS2) whereby ground gas protection measures are required to be included in the design of new properties.

11 CONTAMINANT DISTRIBUTION

Soils – Biological

- 11.1 Six samples of material from the upper 1.00 m of soil collected from the area of the former abattoir were tested for the presence of anthrax. All tests were returned negative. The laboratory report is included as **Appendix 9**.

Soils - Chemical

- 11.2 Contamination data have been compared to generic site assessment criteria (GSAC) for a commercial end use, with the assumption that the soil type is a sandy loam with an organic matter content of 1%; this is considered to be representative of shallow Made Ground found on most brownfield sites.
- 11.3 The soil chemical laboratory results are presented as **Appendix 10** and details of the derivation of the GSACs are presented in **Appendix 13**. The criteria includes reference to the LQM/CIEH S4ULs for Human Health Risk Assessment Copyright Land Quality Management Limited reproduced with permission; publication number S4UL3271.
- 11.4 Contamination testing was primarily undertaken within Made Ground deposits, with some testing also undertaken within the natural Hummocky Glacial Deposits. Samples were sent to a MCERTS and UKAS accredited laboratory.
- 11.5 Elevated concentrations of contaminants have not been identified above their screening criteria.
- 11.6 No asbestos containing materials were recorded within targeted samples (Made Ground samples at TP06, TP07, TP08, TP15 and TP16).

12 HUMAN HEALTH RISK ASSESSMENT

- 12.1 Soil contaminant data have been compared against Generic Site Assessment Criteria (GSAC) developed by BWB using the CLEA model 1.071 and the updated CLEA framework (2009) for assessing risk from soil contamination to human health. Details of the derivation of the GSACs are presented in **Appendix 13**. The results of the soil chemical laboratory results are provided within **Appendix 10** with a table summarising the results presented as **Appendix 14** and **Appendix 15**.
- 12.2 The GSACs have been developed with the following assumptions which have been changed from the CLEA default parameter set. Soil type is a sandy loam with an organic matter content of 1%. This is considered to be more representative of shallow Made Ground found on most Brownfield sites than the CLEA default of 6% organic matter.

Pathways

- 12.3 Contamination data have been compared to GSACs for a commercial end use (i.e. using all pathways for that end use) based on an organic matter content of 1%. The key receptor for such a site is considered to be an adult female worker. Details of the derivation of the GSACs are presented in **Appendix 13**.
- 12.4 Exposure pathways considered in this assessment are presented in **Table 16**.

Table 16 Commercial Exposure Pathways

Source	Shallow Soils		Deep Soils
Pathway	Commercial / Industrial with managed landscaped areas	Commercial / Industrial with Hard standing areas	Commercial / Industrial
Ingestion of soil	✓	✗	✗
Ingestion of site derived household dust	✓	✗	✗
Ingestion of contaminated vegetables	✗	✗	✗
Ingestion of soil attached to vegetables	✗	✗	✗
Dermal contact with soil	✓	✗	✗
Dermal contact with site derived household dust	✓	✗	✗
Inhalation of fugitive soil dust	✓	✗	✗
Inhalation of fugitive site derived household dust	✓	✗	✗

Source	Shallow Soils		Deep Soils
Inhalation of vapours outside	✓	✓	✓
Inhalation of vapours inside	✓	✓	✓

Sources

- 12.5 No visual or olfactory source of contamination was noted on site, as such a statistical assessment of the exceedances was not suitable and the recorded contaminant concentrations have been directly compared to the GSACs.
- 12.6 The assessment has not identified any one single determinant to be present at concentrations above its respective assessment criteria.
- 12.7 In the context of a commercial development, the concentrations of determinants are not considered to represent a potential risk to Human Health.
- 12.8 A copy of the CLEA worksheets is presented as **Appendix 13**.

13 CONTROLLED WATERS RISK ASSESSMENT

- 13.1 No groundwater or surface water testing has been undertaken as part of this assessment. However, soil leachability has been undertaken for a number of metals in the Made Ground. The soil leachability results are presented within **Appendix 10**.
- 13.2 The controlled waters assessment considers the potential impact of on-site contamination to pertinent controlled waters receptors identified at the site including:
- Secondary A Aquifer beneath the site within superficial Hummocky Glacial Deposits;
 - Secondary A Aquifer beneath the site within the PMCM Formation and Milnrow Sandstone; and
 - Tertiary River present on site.

Pathways

- 13.3 Controlled water risk assessment has been undertaken through assessment of leachable concentrations of contaminants in soil referring to exposure pathways considered and referencing **Table 17**.

Table 17 *Controlled Water Exposure Pathways*

Controlled Waters Exposure Pathway	Receptor
Leaching of soil contamination into recharge infiltration	✓
Vertical migration of impacted pore water through unsaturated zone into underlying aquifer	✓
Horizontal migration of groundwater through aquifer to off-site receptors	✓

- 13.4 The site is underlain by Hummocky Glacial Deposits (Secondary A Aquifer) and the Milnrow Sandstone and PMCM Formations (Secondary A Aquifers). Therefore, in the absence of a sensitive potable supply it is considered appropriate to adopt environmental quality standards (EQS) for freshwater when assessing groundwater quality and soil leachate concentrations. Where EQS are not available, World Health Organisation Standards (WHO) and UK Drinking Water Standards (DWS) have been adopted as the relevant screening criteria.

Soil Leachability

- 13.5 A summary of the soil leachate concentrations and adopted guideline concentrations are presented within **Appendix 15**.
- 13.6 Following a direct comparison of leachate laboratory results to water quality standards, five exceedances of the lower copper EQS standard (1 µg/l) were noted in exploratory holes TP02 (0.3-0.4m), TP06 (0.3-0.4m), TP07 (0.2-0.3m), TP08 (0.2-0.3m) and TP16 (0.7-0.8m). The recorded concentrations are below the upper screening level of the

applied copper water quality standard (2000 µg/l) and therefore are still considered to be at acceptable concentrations.

- 13.7 Marginal exceedances in the lower lead (1.2 µg/l) and zinc (10.9 µg/l) EQS standards were noted in TP08 (lead and zinc), TP06 (lead), TP07 (zinc) and TP16 (lead).
- 13.8 Other exceedances are recorded, however these are unwarranted as the contaminants were recorded below the laboratory equipment limit of detection.
- 13.9 Based on the concentrations recorded, the soil leachate is not considered to present a potential risk to controlled waters.

14 ENVIRONMENTAL RISK ASSESSMENT

- 14.1 An updated assessment of identified pollutant linkages has been made following completion of a ground investigation. The preliminary risk assessment presented in **Section 6** has been updated in the light of the findings of the ground investigation and the revised conceptual site model developed, as presented in **Table 18**. Details of the CIRIA risk classification scheme are presented as **Appendix 16**.

Sources

- Marginally elevated Carbon Dioxide concentrations.

Pathway

- Accumulation and inhalation of ground gasses within new development.

Receptor

- Future site users; and
- Groundworkers/Future maintenance workers.

Summary of Potentially Significant Pollutant Linkages

Potential Accumulation of Hazardous Ground Gas to Future Site Users

- 14.2 Given the ground conditions including Made Ground and organic glacial deposits, there is a risk that Carbon Dioxide concentrations could accumulate within enclosed spaces within the proposed development and present a risk to future site users through asphyxiation.

The site should be categorised as a CS2 site whereby enhanced ground gas protection measures will need to be included within the design of any future building.

Table 18 **Revised Conceptual Site Model**

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-site Sources S1: Elevated concentrations of Carbon Dioxide.	P1: Indoor inhalation of soil-derived ground gases.	R1: Potential future site users.	Sv	UI	M/L	The potential risk to future Site users can be mitigated via the installation of appropriate ground gas protection measures within the new property. The ground gas protection measures will need to achieve a minimum score of 1.5 points for areas of warehousing and 2.5 points for areas where office and confined spaces are in contact with the ground surface. The risks to construction works and future maintenance workers can be mitigated by the use of appropriate PPE & RPE where entry is required into confined spaces such as man holes. Any entry to a confirmed space will require appropriate risk assessment prior to the works commencing.
		R2: Construction workers and maintenance workers				

Pollutant Linkage Assessment Summary

The risk to human health for construction workers and future Site users is considered to be **Moderate/Low**.

The controlled waters risk assessment has not identified a significant risk to controlled water receptors, the risk is considered to be **Low**.

15 ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT CONSTRAINTS

Statutory Liability

- 15.1 Under statutory guidance for definition of contaminated land site may be classified into 4 categories. Categories 1 and 2 would meet the definition of contaminated land and categories 3 and 4 would not meet the definition.
- 15.2 It is considered that the site would fall within Category 3 based on the presence of Made Ground on-site and the localised TPH and PAH contamination identified at the site.
- 15.3 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated.
- 15.4 Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:
- 'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under land, that:*
- a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
 - b) Pollution of controlled waters is being or is likely to be, caused'.*
- 15.5 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:
- 'Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property'.*
- 15.6 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:
- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.
 - Class B appropriate persons are the owners(s) or occupier(s) of the land.
- 15.7 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.
- 15.8 Based on the information available regarding the site, the potential for Statutory Authority action based on 'pollution of controlled waters' or 'significant harm' as defined by Part IIA of the Environmental Protection Act 1990 is considered to be **LOW**.

Third Party Liability

- 15.9 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be **LOW**.

Public Relations

- 15.10 The likelihood of public relations being tarnished due to contamination issues at the site are considered to be **LOW**.

Development Implications

- 15.11 On the basis of the hazardous ground gas risk assessment, ground gas protection appropriate to a CS2, will need to be included within the design of future properties constructed at the Site.

16 WASTE MANAGEMENT

Waste Classification

- 16.1 Natural arisings at the site are likely to go to tip at the lower rate of landfill tax, if off-site disposal is required. It is possible the small quantities of Made Ground would attract the higher rate although it is likely to be possible to avoid these materials going to landfill.
- 16.2 Asbestos has not been found at the site. The presence of visible asbestos containing materials in waste or at concentrations exceeding 0.1% by weight will classify the waste as mixed and require disposal as hazardous waste irrespective of the chemical properties of the waste.
- 16.3 Should any soils require disposal off site an assessment of waste classification of the soils for disposal should be made by a competent person. Further chemical analysis may be required to fully characterise waste soils for disposal to landfill or re-use off site. WAC analysis may be required for disposal of soils as inert or hazardous.

17 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- 17.1 A preliminary desktop study, followed by an intrusive ground investigation has been undertaken at the site at Plot L, Kingsway Business Park, Rochdale.
- 17.2 The ground investigation comprised the advancement of three cable percussive boreholes and seventeen trial pits with subsequent laboratory analysis of selected soil samples for chemical and geotechnical purposes. Four rounds of gas and groundwater monitoring has also been undertaken. Estimations of CBR values have been made through in-situ DCP testing.
- 17.3 Ground conditions were found to comprise varying depths of Topsoil overlying multiple granular and low plasticity cohesive layers associated with Hummocky Glacial Deposits. Bedrock strata was not encountered during the investigation. Localised areas of Made Ground were also encountered in the area of the former abattoir. Greater frequencies of cohesive deposits were encountered towards the north east and west of the site, likely associated with Alluvial channels, with greater portions of granular horizons in central areas.

Environmental

- 17.4 No visual or olfactory evidence of contamination was identified during the intrusive investigation.
- 17.5 Preliminary screening of hazardous ground gases recorded slightly elevated concentrations of carbon dioxide.
- 17.6 Chemical soil analysis has been undertaken of samples from the site, and has not identified elevated concentrations of contaminants above their respective screening criteria. All samples analysis for Anthrax returned negative.
- 17.7 In the context of a future development the localised contamination may represent a significant risk to human health. The risk to human health is considered to be **Moderate/Low** for future site users.

Geotechnical

- 17.8 For more likely loaded steel portal framed buildings, shallow spreadtrench fill foundations may be the most suitable solution, founding in granular Hummocky Glacial Deposits at depths of between 2.0m and 3.0m bgl. Following a site strip to remove soft organic clay topsoil and subsoil layers of up to around 1.0m thick (typically ~0.6m), and replaced with imported granular fill to an end specification a ground bearing floor slab could be adopted with loads of no more than 30kPa.
- 17.9 Should greater loadings be proposed then an alternative foundation and floor slab solution (suspended slab) may need to be considered, which would require additional ground investigation to confirm ground conditions at greater depth.

- 17.10 Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site.

Recommendations

Environmental

- 17.11 A gas protection verification plan should be completed detailing mitigation measures and validation expectations for the installation of ground gas protection measures.
- 17.12 Ground gas protection measures in accordance with a CS2 must be included within the design of new properties at the Site.

Geotechnical

- 17.13 Due to the variability of the cohesive and granular layers beneath the site, once detailed loadings and site layouts are known, the geotechnical solutions should be reassessed. Further ground investigation will also be required if higher loads are proposed to inform pile design.
- 17.14 Allowance should be made for temporary shoring of excavations due to likely stability issues associated with running sands.
- 17.15 Contingency for groundwater control should be considered especially if development is undertaken during the winter months.

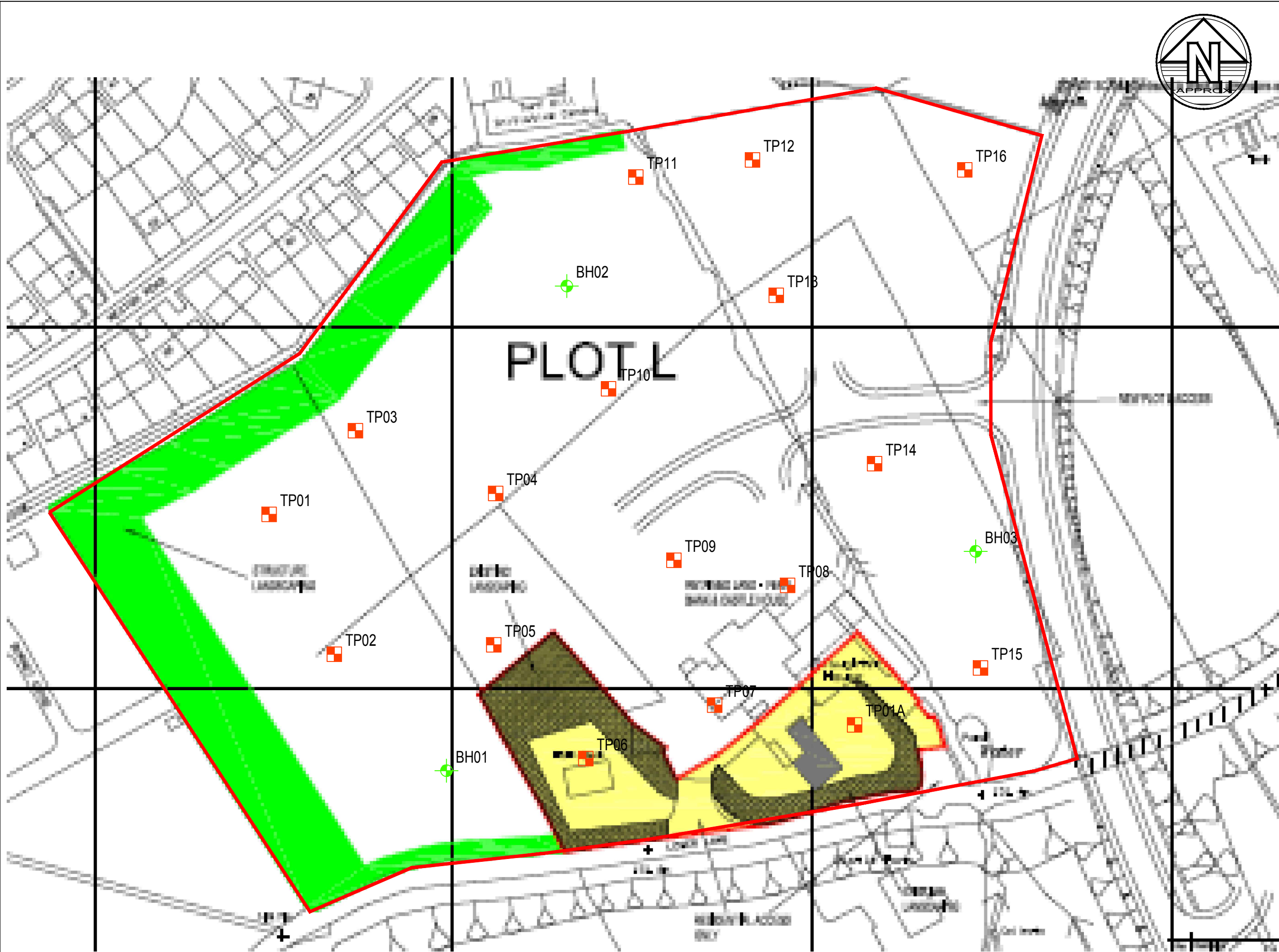
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DRAWINGS

DRAWING 1
EXPLORATORY HOLE LOCATION PLAN



- Notes**
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Site Boundary
Trial Pit Location
Cable Percussion Location

Legend

P1	03.05.17	PRELIMINARY ISSUE	DLJ	DLJ
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client
**WILSON BOWDEN
DEVELOPMENT LTD**

Project Title
PLOT K, ROCHDALE

Drawing Title
**EXPLORATORY HOLE
LOCATION PLAN**

Drawn:	D.Josling	Reviewed:	D.Josling
BWB Ref:	NTT2589	Date:	03.05.17
Scale:	A3	N.S.	

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
XXX-BWB-ZZ-XX-DR-YE-0001	P	1

DRAWING 2
PRELIMINARY CONCEPTUAL SITE MODEL SKETCH

Sources

1. Anthrax and other pathogens located in animal remains disposed of on-site (Pollution incident recorded on-site from Blood & Offal impacting water).
2. Made Ground

Pathways

1. Vertical and lateral migration of pathogen along deep, permeable, coarse Hummocky Glacial Deposits and in Milnrow Sandstone.
2. Ingestion of contaminated groundwater by future/ nearby residents
3. Inhalation of anthrax spores by groundworkers
4. Accumulation of gases in confined spaces.

Receptors

1. Groundworkers.
2. Site end users.
3. Secondary A Aquifers in the Hummocky Glacial Deposits and Milnrow Sandstone.
4. Drainage ditch (Secondary River).
5. Nearby residents.

The Site

SOUTH

FORMER ABATTOIR

Groundworkers

MADE GROUND

DRAINAGE DITCH

RESIDENTIAL
HOUSING

Public

Groundwater Flow

Microbes migrate into groundwater

HUMMOCKY GLACIAL DEPOSITS

MILNROW SANDSTONE

CONCEPTUAL SITE MODEL

NORTH

Client
Wilson Bowden Developments Ltd

Site
Plot L, Kingsway Business Park Rochdale



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DATE
06-Jun-17

FIGURE

PROJECT No.
NTT2589

DRAWN:	LM
CHECKED	

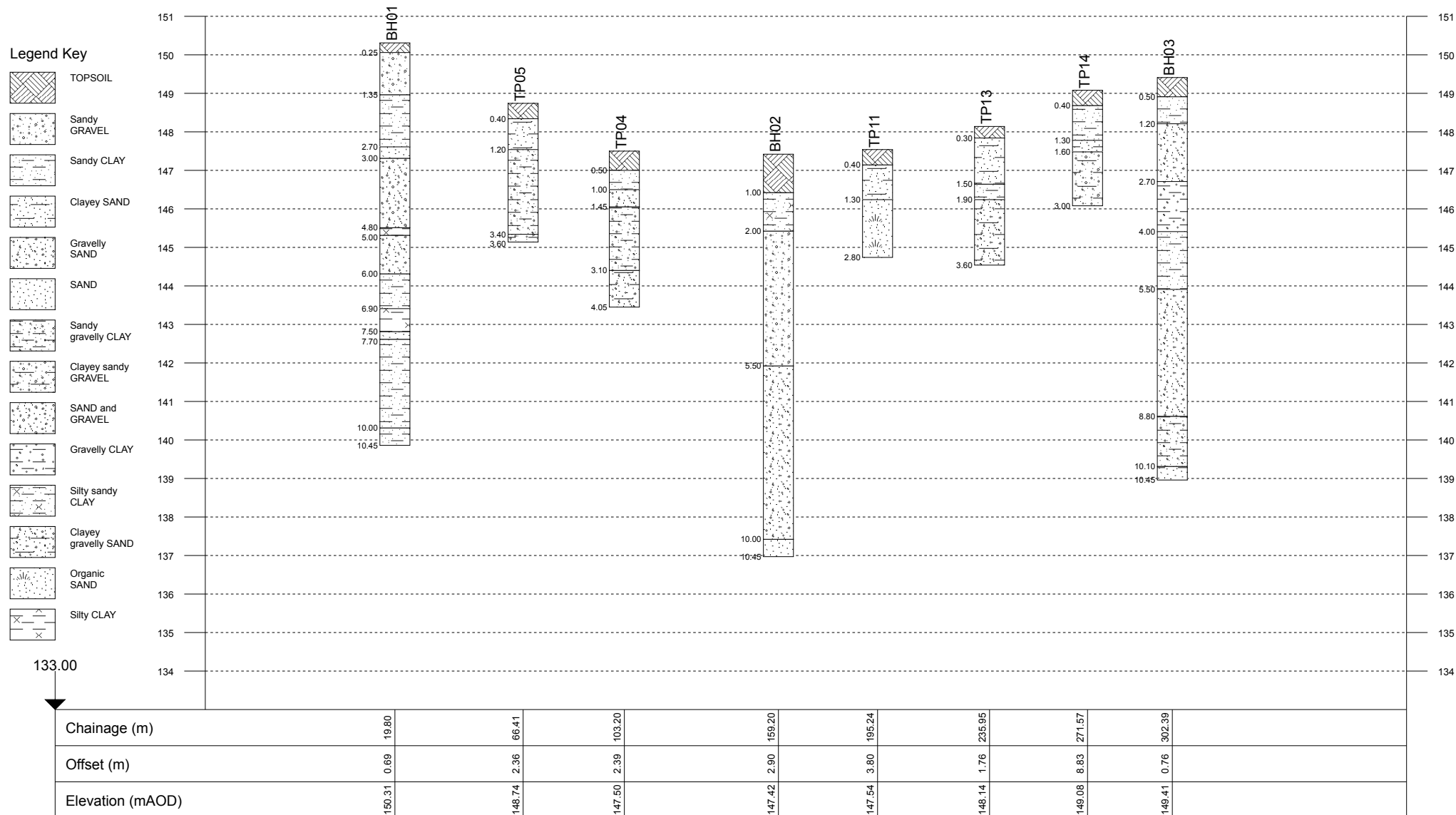
DRAWING 3
GEOLOGICAL CROSS SECTION

Title: Section Line

Vertical Scale: 1:140

Horizontal Scale: 1:1960

Engineer: LM



APPENDICES

APPENDIX 1

SITE VISIT PHOTOGRAPHS

Project Number: NTT2589

Project Name: Plot L, Kingsway Business Park, Rochdale

Site Visit Photographs



Photo 1—View from the eastern site boundary looking west.



Photo 2— View from the north of the site looking south.

APPENDIX 2

GROUNDSURE REPORT



BWB Consulting Limited

5th Floor, Waterfront House, Station Street,
Nottingham, NG2 3DQ

Groundsure
Reference:

HMD-214-3887194

Your Reference: POR010967_Plot_L_Rochdale

Report Date 17 May 2017

Report Delivery Method: Email - pdf

Groundsure Enviro Insight

Address: 391352 411646,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Groundsure Enviro Insight

Address: 391352 411646,
Date: 17 May 2017
Reference: HMD-214-3887194
Client: BWB Consulting Limited

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 26-Mar-2012
Grid Reference: 391397,411707
Site Size: 4.33ha

Report Reference: HMD-214-3887194
Client Reference: POR010967_Plot_L_Rochdale

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Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	0	1	6	10
1.2 Additional Information – Historical Tank Database	0	0	10	2
1.3 Additional Information – Historical Energy Features Database	0	0	2	10
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	0	0
1.6 Potentially Infilled Land	0	0	3	5

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	0	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	1	0
2.2 Records of COMAH and NIHS sites	0	0	1	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	1	0	1	0
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	0	2	3
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	2	1
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	4

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	1	6	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	0
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology	0-500m					
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes					
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes					
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	3	0	2	0	2	4
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	18
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	3
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	2	0	0	1	Not searched	Not searched

Section 6: Hydrogeology and Hydrology	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	Yes
6.10 Detailed River Network entries within 500m of the site	3	3	4	6	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 7: Flooding						
7.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	No					
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No					
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low					
7.4 Are there any Flood Defences within 250m of the study site?	No					
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No					
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No					
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface					
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low					

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	1	4
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	1	4
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	0	0	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	4
8.14 Records of Green Belt land	0	0	0	0	1	7

Section 9: Natural Hazards	
9.1 What is the maximum risk of natural ground subsidence?	High
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	High
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Very Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining	
10.1 Are there any coal mining areas within 75m of the study site?	Yes
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

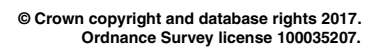
This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.



Legend:

- Site Outline
- Industrial Land Use
- Potentially Infilled Land
- Search Buffers (m)
 - 250
 - 500
- Historical 1:2,500, 1:1,250 and 1:500 scale mapping
- Energy Features
- Petrol Stations
- Tanks
- Garages

1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 17

ID	Distance [m]	Direction	Use	Date
1	40	E	Unspecified Factory	1976
2A	94	E	Unspecified Mill	1967
3A	95	E	Iron Works	1928
4A	95	E	Iron Works	1908
5A	95	E	Iron Works	1938
6A	122	E	Iron Works	1954
7K	186	N	Unspecified Pit	1908
8H	254	N	Electric Substation	1976
9B	368	SW	Unspecified Works	1891
10B	368	SW	Unspecified Works	1908
11B	368	SW	Unspecified Commercial/Industrial	1928
12	376	E	Pump	1851
13C	410	NW	Unspecified Heap	1976
14C	410	NW	Unspecified Heap	1967
15L	430	NW	Refuse Heap	1967
16	452	SW	Pump	1851
17M	485	W	Unspecified Pit	1928

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 12

ID	Distance (m)	Direction	Use	Date
18	51	E	Unspecified Tank	1987
19D	140	SE	Unspecified Tank	1910
20D	140	SE	Unspecified Tank	1930
21D	141	SE	Unspecified Tank	1955
22D	142	SE	Unspecified Tank	1955
23	147	E	Unspecified Tank	1987

24E	232	S	Unspecified Tank	1994
25E	232	S	Unspecified Tank	1993
26E	232	S	Unspecified Tank	1999
27E	232	S	Unspecified Tank	1994
28F	437	NE	Tanks	1955
29F	437	NE	Tanks	1955

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 12

ID	Distance (m)	Direction	Use	Date
30G	124	NW	Electricity Substation	1999
31G	126	NW	Electricity Substation	1987
32H	271	N	Electricity Substation	1955
33H	271	N	Electricity Substation	1988
34H	272	N	Electricity Substation	1955
35I	275	NW	Electricity Substation	1987
36I	275	NW	Electricity Substation	1999
37J	402	W	Electricity Substation	1980
38J	403	W	Electricity Substation	1955
39J	403	W	Electricity Substation	1990
40J	403	W	Electricity Substation	1955
41J	407	W	Electricity Substation	1955

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 0

Database searched and no data found.

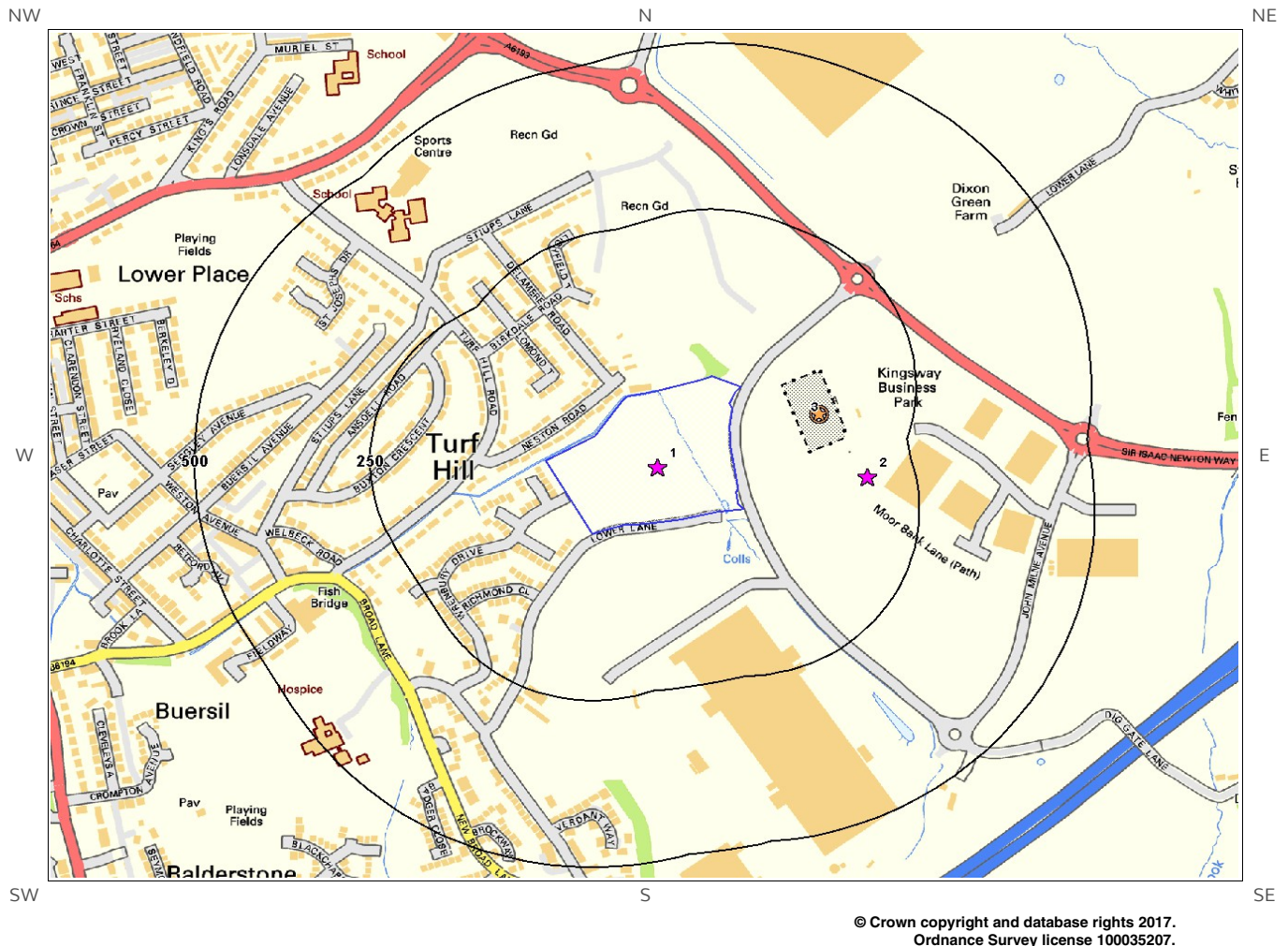
1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 8

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
42K	183	N	Pond	1891
43K	186	N	Unspecified Pit	1908
44	236	SW	Pond	1891
45	376	NW	Pond	1967
46C	410	NW	Unspecified Heap	1976
47C	410	NW	Unspecified Heap	1967
48L	430	NW	Refuse Heap	1967
49M	485	W	Unspecified Pit	1928

2. Environmental Permits, Incidents and Registers Map



- | | | | | | |
|---|-------------------------------|---|--|---|---|
|  | Site Outline |  | Recorded Pollution Incident |  | RAS 3 & 4 Authorisations |
|  | Dangerous Substances (List 1) |  | Part A(1) Authorised Processes and Historic IPC Authorisations |  | Part A(2) and Part B Authorised Processes |
|  | Dangerous Substances (List 2) |  | Water Industry Referrals |  | COMAH / NIHHS Sites |
|  | Search Buffers (m) |  | Licenced Discharge Consents |  | Sites Determined as Contaminated Land |
|  | Red List Discharge Consents |  | Hazardous Substance Consents and Enforcements | | |

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

0

Database searched and no data found.

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

1

The following records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Application Reference Number	NGR	Application Status	Application Date	Address	Details	Details of Enforcement Action
5A	118	E	92/D28756	391579 411719	Approved	20/10/1992	British Vita Plc (Vitaluxan Plc), Lower Lane, Milnrow, Rochdale, Lancashire, OL16 4NG	Application for Hazardous Substances Consent (Deemed Consent).	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site:

1

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Company	Address	Operational Status	Tier
3	58	E	British Vita Plc(vitaluxan)	British Vita Plc(vitaluxan), Lower Lane, Miln Row, Rochdale	Historical NIHHS Site	-

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

2

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
1	0	On Site	391350 411640	Incident Date: 27-Apr-2001 Incident Identification: 3803 Pollutant: General Biodegradable Materials and Wastes Pollutant Description: Blood and Offal Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2	181	E	391648 411625	Incident Date: 08-Aug-2003 Incident Identification: 180279 Pollutant: Oils and Fuel Pollutant Description: Other Oil or Fuel Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

Database searched and no data found.

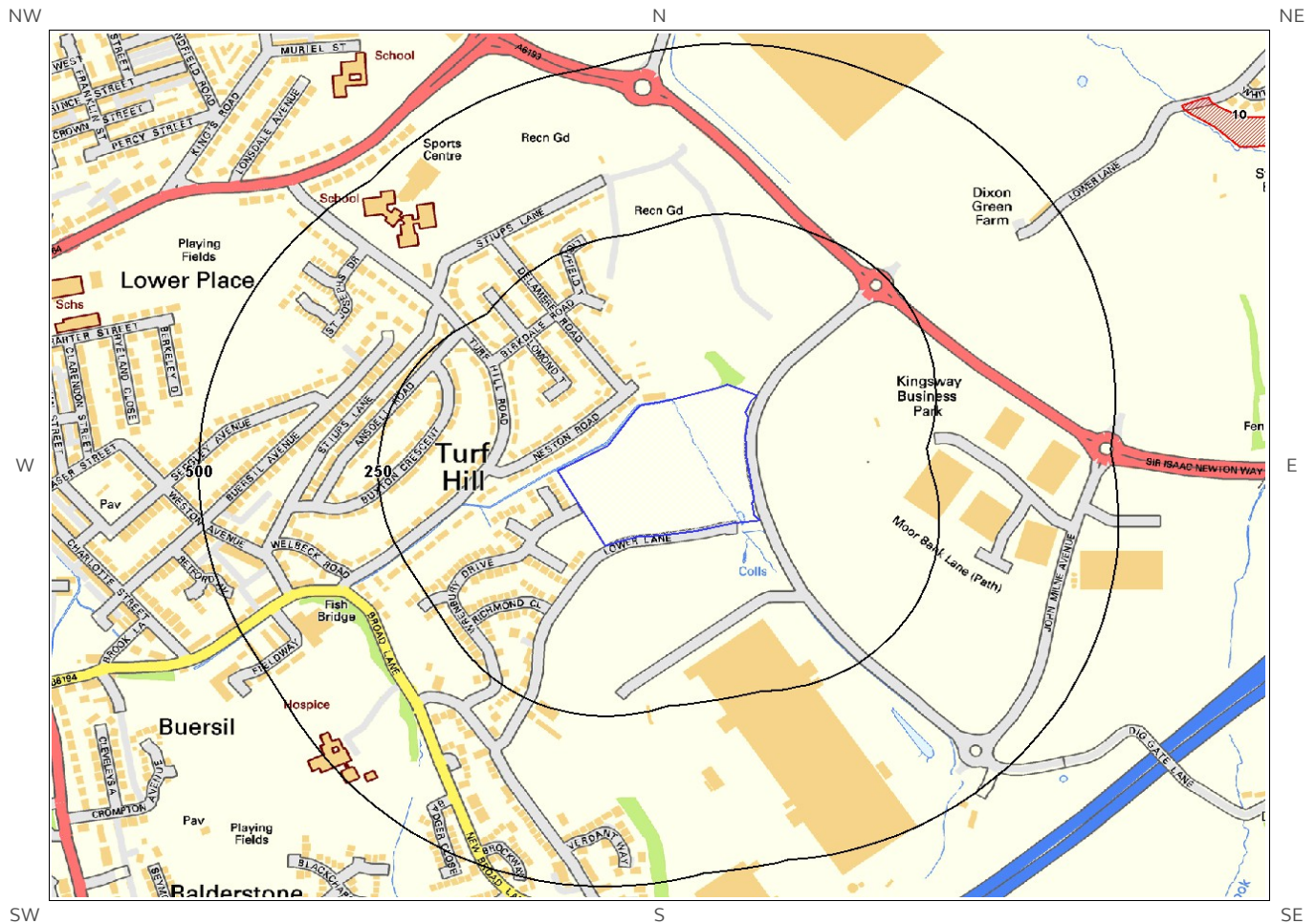
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site?

0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



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- | | | | | | |
|---|---------------------------|---|----------------------------|---|---|
|  | Site Outline |  | EA/NRW Active Landfill |  | Historic and Planned Waste Sites |
|  | EA/NRW Historic Landfill |  | EA/NRW Licensed Waste Site |  | Local Authority/Historical Mapping Landfill Records |
|  | BGS / DoE Survey Landfill | | | | |
- 250 — Search Buffers (m)
— 500 —

3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

5

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
Not shown	799	E	392300 412100	Site Address: Little Lane, Off Harbour Lane, Milnrow, Greater Manchester Waste Licence: - Site Reference: D073 Waste Type: - Environmental Permitting Regulations (Waste) Reference: - Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -
Not shown	892	E	392300 411300	Site Address: Dig Gate Farm, Dig Gate Lane, Milnrow Waste Licence: Yes Site Reference: D028, RD/LIC/449/86 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 10-Sep-1986 Licence Surrendered: Licence Holder Address: Dig Gate Lane, Milnrow, Rochdale Operator: - Licence Holder: Mark Greenwood First Recorded: 01-Oct-1986 Last Recorded: 31-Dec-1987
Not shown	1202	S	391700 410400	Site Address: Burnedge Mill, Rochdale Waste Licence: Yes Site Reference: D050, RD/LIC/303/83 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 05-Apr-1984 Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: Richardson and Carroll First Recorded: 01-May-1984 Last Recorded: 31-Dec-1986
Not shown	1305	NE	392400 412500	Site Address: Ex Universal Laundry Lodge, Buckley Hill Lane, Milnrow, Rochdale Waste Licence: Yes Site Reference: RD/LIC/493/87 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 01-Jul-1988 Licence Surrendered: Licence Holder Address: Lane Bottom, Newhey, Rochdale Operator: - Licence Holder: Lane Bottom Industrial Equitables Pioneers First Recorded: 01-Aug-1988 Last Recorded: 31-Dec-1988

ID	Distance (m)	Direction	NGR	Details	
Not shown	1428	NW	390200 412700	Site Address: Fishwick Street, Rochdale Waste Licence: Yes Site Reference: RD/LIC/477/87 Waste Type: Inert, Industrial, Commercial Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 04-Jun-1987 Licence Surrendered: 10-Oct-1990 Licence Holder Address: Off Fishwick Street, Rochdale Operator: - Licence Holder: Rochdale Timber Company First Recorded: 01-Jul-1987 Last Recorded: 31-Dec-1989

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

3

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Site Address	Source	Data Type
10	729	NE	392299 412145	Little Lane, Off Harbour Lane, Milnrow	Rochdale Council	Polygon
Not shown	803	NE	391991 412552	Buckley hill lane, Rochdale	Rochdale	Polygon
Not shown	1169	NE	392402 412504	Ex Universal Laundry Lodge	Rochdale Council	Point

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

Database searched and no data found.

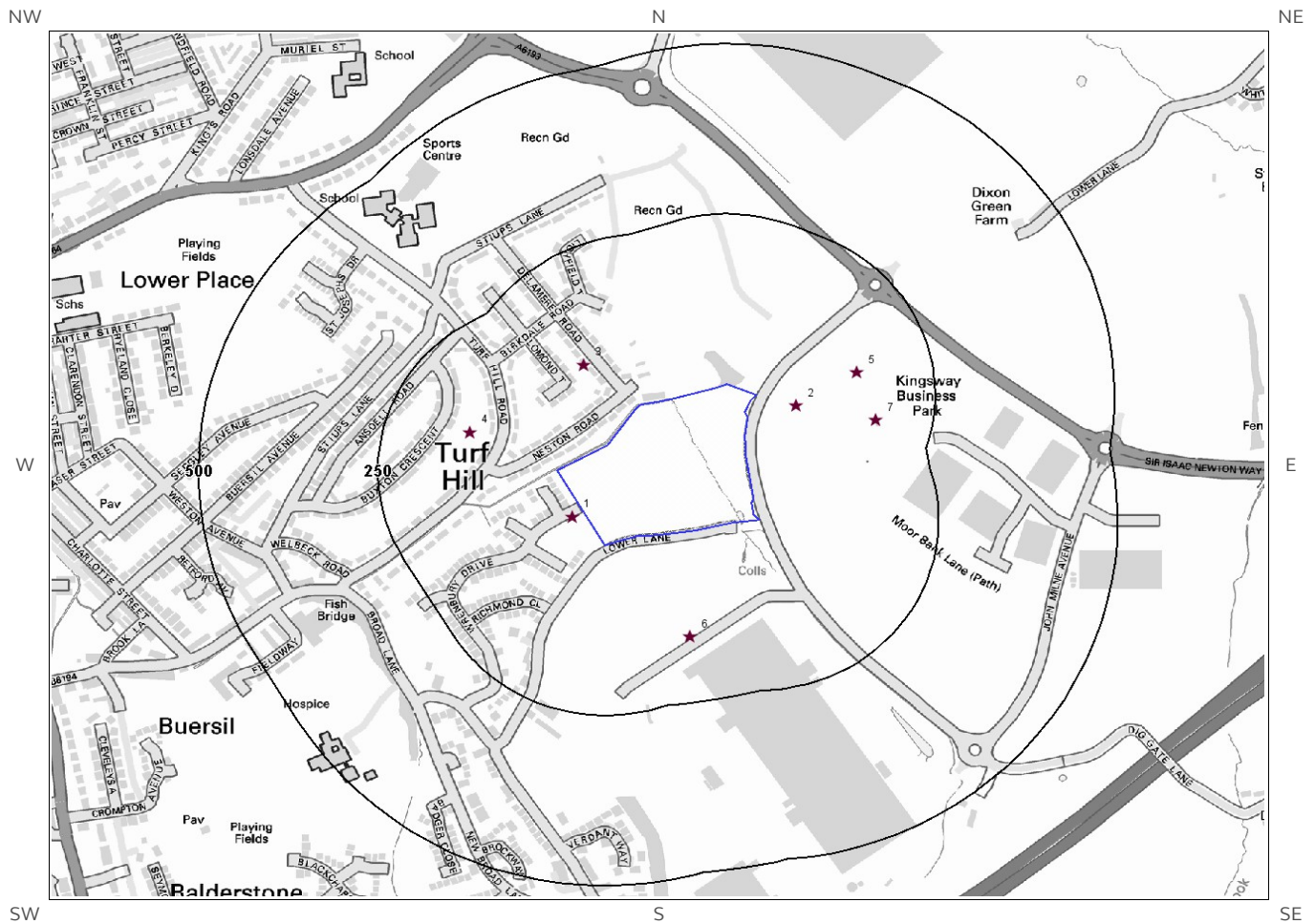
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

4

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
Not shown	1413	NW	390127 412578	Site Address: Cronshaw Industrial Estate, Lincoln Street, Deeplish, Rochdale, Lancashire, OL11 1LR Type: Metal Recycling Site (mixed MRS's) Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: AAL001 EPR reference: - Operator: Mohammed Asam & Habib Ahmed Latif Waste Management licence No: 50378 Annual Tonnage: 0.0 Issue Date: 04/04/2005 Effective Date: 03/10/2006 Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Transferred Site Name: Rochdale Auto Spares Correspondence Address: 4, Harwin Close, Shawclough, Rochdale, Lancashire, OL12 7UY
Not shown	1413	NW	390127 412578	Site Address: Cronshaw Industrial Estate, Lincoln Street, Deeplish, Rochdale, Lancashire, OL11 1LR Type: Metal Recycling Site (Vehicle Dismantler) Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: JAP001 EPR reference: - Operator: Shehzad Suleman And Habib Latif Waste Management licence No: 50378 Annual Tonnage: 0.0 Issue Date: 04/04/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Rochdale Auto Spares Correspondence Address: 81-119, Durham Street, Cronshaw Ind. Estate, Rochdale, Lancs, OL11 1LR
Not shown	1413	NW	390127 412578	Site Address: Cronshaw Industrial Estate, Lincoln Street, Deeplish, Rochdale, Lancashire, OL11 1LR Type: ELV Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: AAL001 EPR reference: EA/EPR/ZP3194CL/T002 Operator: Mohammed Asam & Habib Ahmed Latif Waste Management licence No: 50378 Annual Tonnage: 2500.0 Issue Date: 04/04/2005 Effective Date: 03/10/2006 Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Transferred Site Name: Rochdale Auto Spares Correspondence Address: -
Not shown	1413	NW	390127 412578	Site Address: Cronshaw Industrial Estate, Lincoln Street, Deeplish, Rochdale, Lancashire, OL11 1LR Type: ELV Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: JAP001 EPR reference: - Operator: Shehzad Suleman And Habib Latif Waste Management licence No: 50378 Annual Tonnage: 0.0 Issue Date: 04/04/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Rochdale Auto Spares Correspondence Address: Shehzad Suleman, 81-119, Durham Street, Cronshaw Ind. Estate, Rochdale, Lancs, OL11 1LR

4. Current Land Use Map



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4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site:

7

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	17	SW	Electricity Sub Station	391212 411583	Electricity Sub Station, OL16	Electrical Features	Infrastructure and Facilities
2	57	E	Tank	391524 411746	Tank, OL16	Tanks (Generic)	Industrial Features
3	98	NW	Clark Welding	391228 411806	Clark Welding, 40, Delamere Road, Rochdale, OL16 4XN	Fences, Gates and Railings	Industrial Products
4	134	NW	Electricity Sub Station	391070 411707	Electricity Sub Station, OL16	Electrical Features	Infrastructure and Facilities
5	145	E	Tank	391609 411795	Tank, OL16	Tanks (Generic)	Industrial Features
6	153	S	Electricity Sub Station	391376 411406	Electricity Sub Station, OL16	Electrical Features	Infrastructure and Facilities
7	170	E	Electricity Sub Station	391635 411725	Electricity Sub Station, OL16	Electrical Features	Infrastructure and Facilities

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site:

0

Database searched and no data found.

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site:

0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
HMGDD-DMTN	HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN	DIAMICTON
PEAT-P	PEAT	PEAT

5.3 Bedrock and Solid Geology

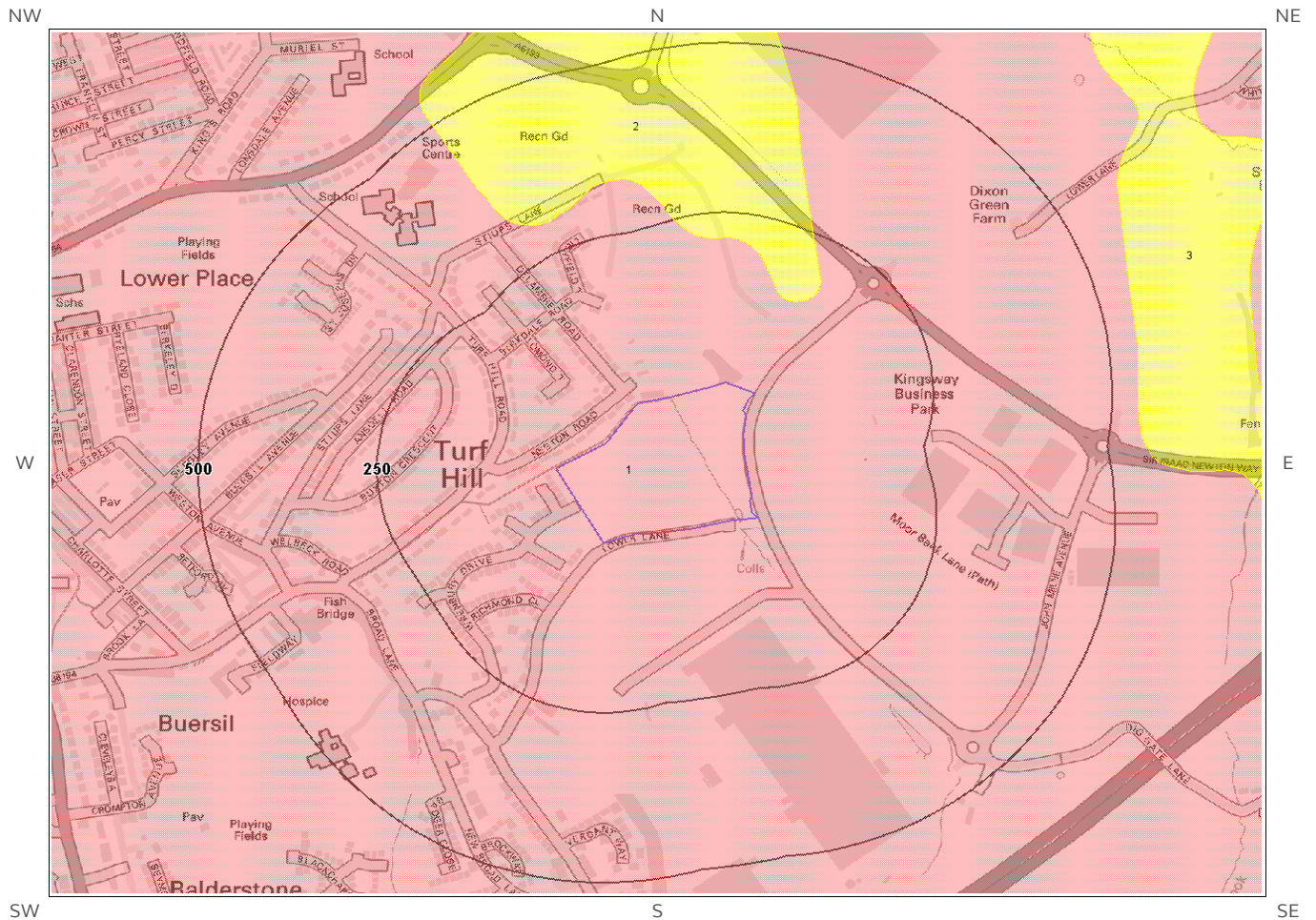
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
MLRS-SDST	MILNROW SANDSTONE	SANDSTONE
PLCM-MDSS	PENNINE LOWER COAL MEASURES FORMATION	MUDSTONE, SILTSTONE AND SANDSTONE

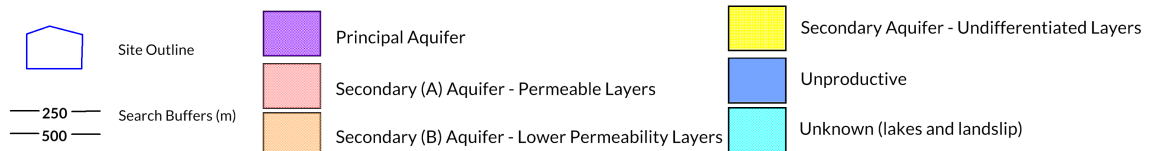
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

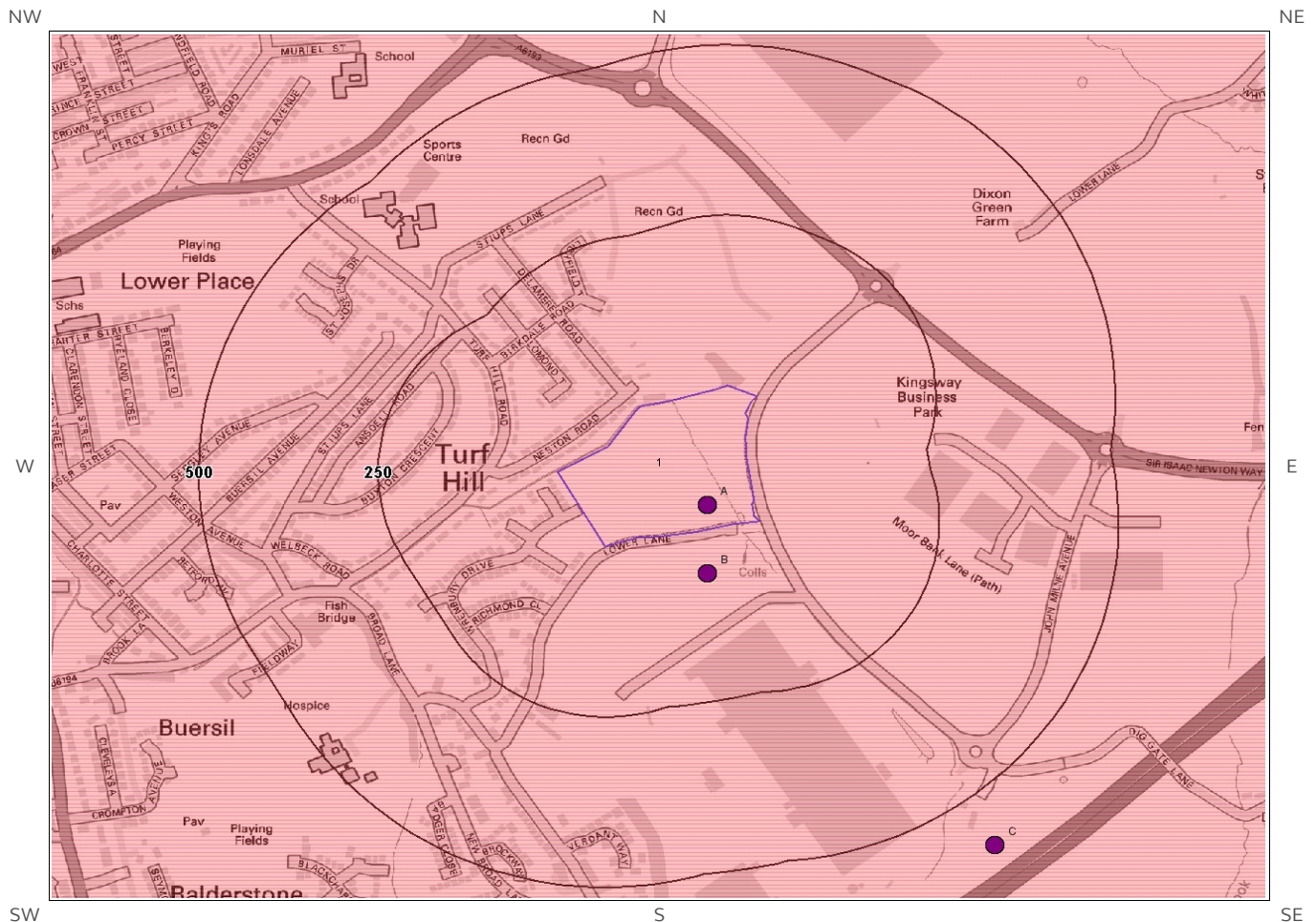
6a. Aquifer Within Superficial Geology



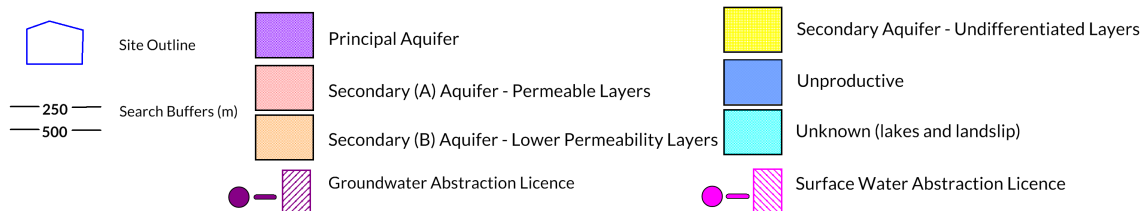
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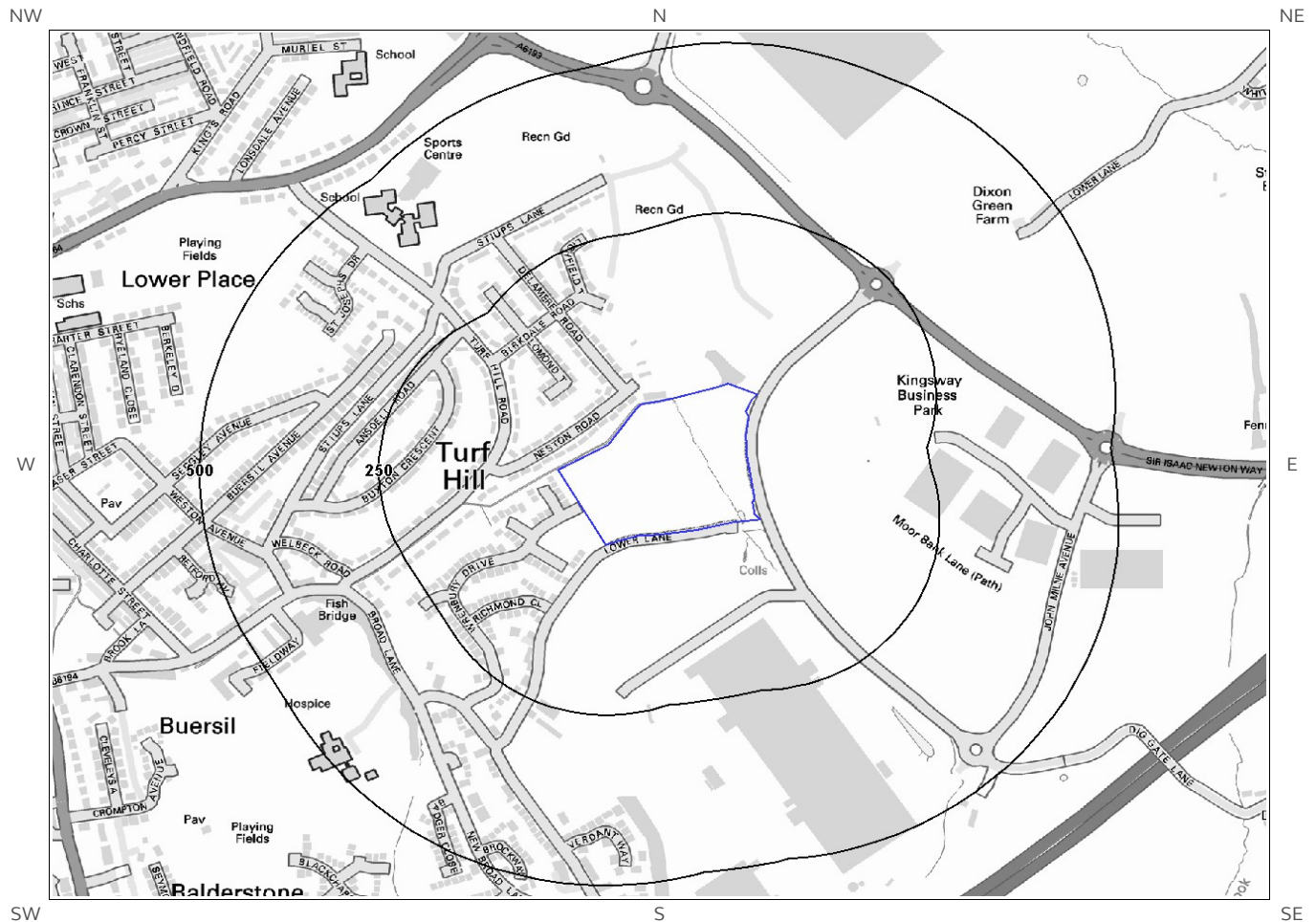
6b. Aquifer Within Bedrock Geology and Abstraction Licenses



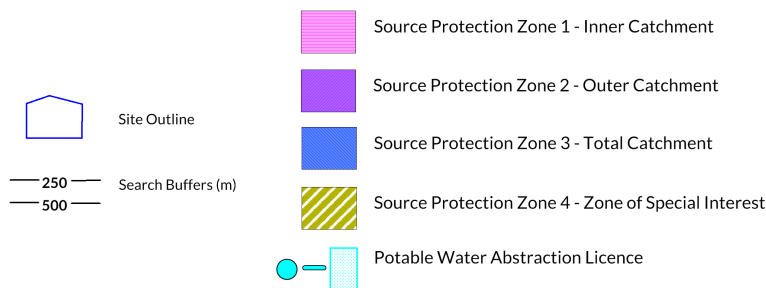
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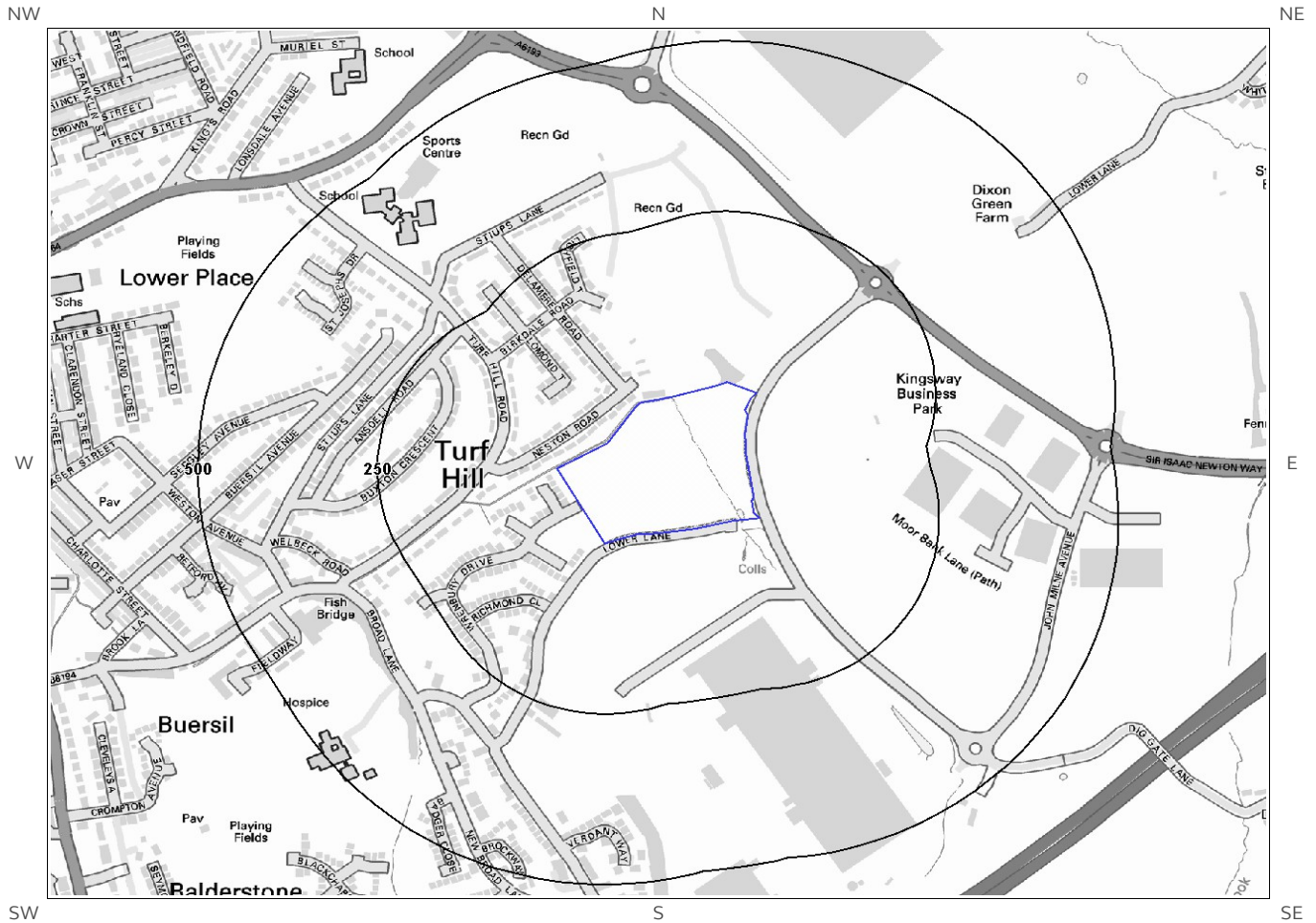
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



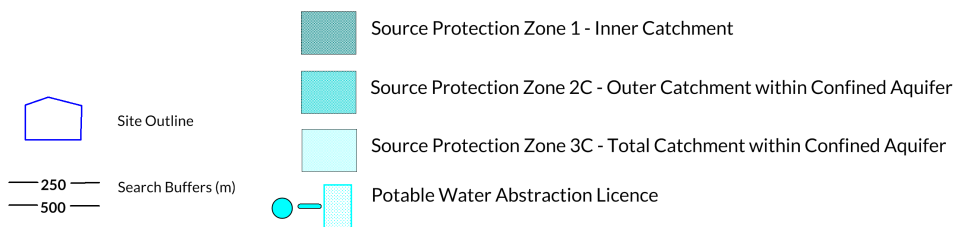
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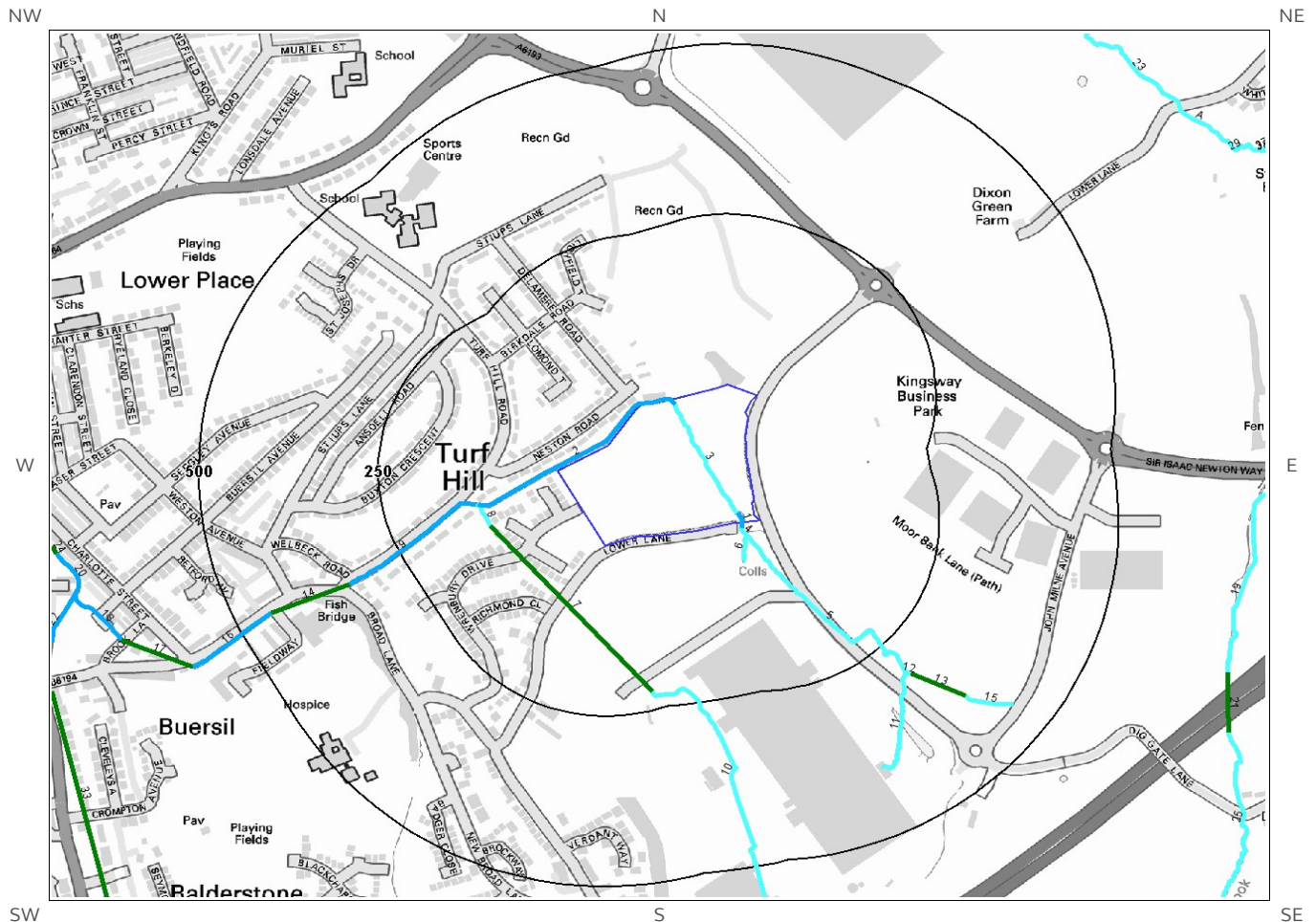
6d. Hydrogeology – Source Protection Zones within confined aquifer



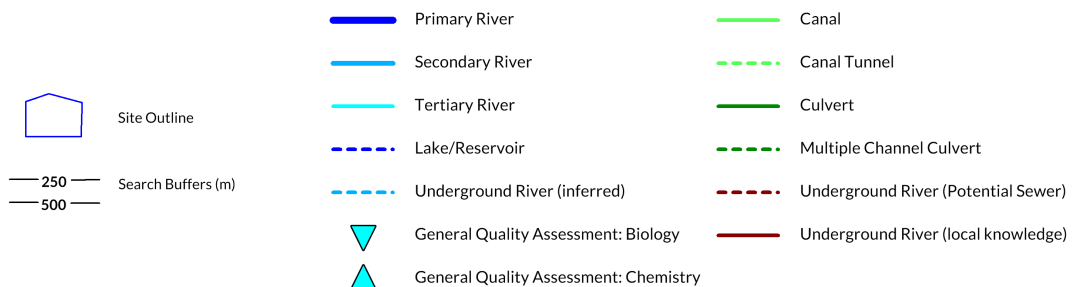
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6e. Hydrology – Detailed River Network and River Quality



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6. Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	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
2	144	N	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	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

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site?

Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
2A	0	On Site	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: "well At Farm, Lower Lane, Milnrow, Rochdale" Data Type: Point Name: HARTLE Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1780 Original Start Date: 1/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/2/1966 Version End Date:
3A	0	On Site	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: Well At Farm, Lower Lane, Milnrow, Rochdale Data Type: Point Name: HARTLE Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1780 Original Start Date: 1/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/2/1966 Version End Date:
4A	0	On Site	391400 411600	Status: Historical Licence No: 2569002159 Details: General Farming & Domestic Direct Source: Ground Water - North West Region Point: Well At Farm Lower Lane Milnrow Rochdale Data Type: Point Name: HARTLE Annual Volume (m³): 5123.34 Max Daily Volume (m³): 31.82 Original Application No: 1780 Original Start Date: 1/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2007 Version End Date:
5B	64	S	391400 411500	Status: Historical Licence No: 2569002060 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: Well At Castle Farm, Lower Lane, Milnrow Data Type: Point Name: SANDERSON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1854 Original Start Date: 11/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 11/2/1966 Version End Date:
6B	64	S	391400 411500	Status: Historical Licence No: 2569002060 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "well At Castle Farm, Lower Lane, Milnrow" Data Type: Point Name: SANDERSON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1854 Original Start Date: 11/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 11/2/1966 Version End Date:

ID	Distance (m)	Direction	NGR	Details
7C	578	SE	391800 411100	Status: Historical Licence No: 2569002086 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "well At Broadshaw Farm, Milnrow, Rochdale" Data Type: Point Name: CROSTON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1842 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 2/2/1966 Version End Date:
8C	578	SE	391800 411100	Status: Historical Licence No: 2569002086 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: Well At Broadshaw Farm, Milnrow, Rochdale Data Type: Point Name: CROSTON Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1842 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 2/2/1966 Version End Date:
Not shown	1217	SE	392200 410600	Status: Historical Licence No: 2569002204 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: Borehole At Premises, Old Barn Farm, burnedge, Rochdale Data Type: Point Name: CRYER Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 2273 Original Start Date: 24/4/1969 Expiry Date: - Issue No: 100 Version Start Date: 24/4/1969 Version End Date:
Not shown	1217	SE	392200 410600	Status: Historical Licence No: 2569002204 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "borehole At Premises, Old Barn Farm, burnedge, Rochdale" Data Type: Point Name: CRYER Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 2273 Original Start Date: 24/4/1969 Expiry Date: - Issue No: 100 Version Start Date: 24/4/1969 Version End Date:
Not shown	1846	E	393200 412400	Status: Historical Licence No: 2569002206 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: "colliery Shaft at Premises, Butterworth Hall, Milnrow" Data Type: Point Name: UNITED UTILITIES WATER PLC Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1567 Original Start Date: 1/4/1969 Expiry Date: - Issue No: 100 Version Start Date: 31/3/1994 Version End Date:
Not shown	1846	E	393200 412400	Status: Active Licence No: 2569002206 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: Colliery Shaft at Premises, Butterworth Hall, Milnrow Data Type: Point Name: UNITED UTILITIES WATER LTD Annual Volume (m³): 3982296 Max Daily Volume (m³): 13638 Original Application No: 1567 Original Start Date: 1/4/1969 Expiry Date: - Issue No: 100 Version Start Date: 31/3/1994 Version End Date:

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site?

Yes

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
Not shown	1003	W	390200 411800	Status: Historical Licence No: 2569002178 Details: Boiler Feed Direct Source: surface, Non-tidal - North West Region Point: catchpit Fed By Surface Drainage At Premises, Rochdale Data Type: Point Name: DUNPHY COMBUSTION LTD. Annual Volume (m³): - Max Daily Volume (m³): - Application No: CW 1093 Original Start Date: 18/2/1966 Expiry Date: - Issue No: 101 Version Start Date: 12/2/1991 Version End Date:
Not shown	1003	W	390200 411800	Status: Active Licence No: 2569002178 Details: Boiler Feed Direct Source: Surface, Non-tidal - North West Region Point: Catchpit Fed By Surface Drainage At Premises, Rochdale Data Type: Point Name: DUNPHY COMBUSTION LTD Annual Volume (m³): 2318.46 Max Daily Volume (m³): 34.09 Application No: CW 1093 Original Start Date: 18/2/1966 Expiry Date: - Issue No: 101 Version Start Date: 12/2/1991 Version End Date:
Not shown	1104	NW	390300 412300	Status: Historical Licence No: 2569002076 Details: Boiler Feed Direct Source: Surface, Non-tidal - North West Region Point: Rochdale Canal At Rochdale, Lancs Data Type: Point Name: J & J MAKIN CONVERTORS LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: 602 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/4/1993 Version End Date:
Not shown	1164	W	390070 411960	Status: Historical Licence No: 2569002107 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-tidal - North West Region Point: Rochdale Canal At Queensway, rochdale Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): 10455.8 Max Daily Volume (m³): 45.46 Application No: 0571 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1164	W	390070 411960	Status: Historical Licence No: 2569002107 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: surface, Non-tidal - North West Region Point: rochdale Canal At Queensway, rochdale Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: 571 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 20/12/1993 Version End Date:
Not shown	1164	W	390070 411960	Status: Historical Licence No: 2569002107 Details: Boiler Feed Direct Source: surface, Non-tidal - North West Region Point: rochdale Canal At Queensway, rochdale Data Type: Point Name: SEALOCRETE PLA LTD Annual Volume (m³): - Max Daily Volume (m³): - Application No: 571 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 20/12/1993 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1164	W	390070 411960	Status: Historical Licence No: 2569002107 Details: Boiler Feed Direct Source: Surface, Non-tidal - North West Region Point: Rochdale Canal At Queensway, rochdale Data Type: Point Name: SEALOCRETE PLA LTD	Annual Volume (m³): 10455.8 Max Daily Volume (m³): 45.46 Application No: 0571 Original Start Date: 2/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2008 Version End Date:
Not shown	1490	NE	392700 412600	Status: Historical Licence No: 2569002175 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Springs At Premisesmilnrow Data Type: Point Name: HOLROYD MACHINES TOOLS & ROTORS	Annual Volume (m³): 16365.6 Max Daily Volume (m³): 54.55 Application No: 0559 Original Start Date: 15/2/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/4/2007 Version End Date:
Not shown	1490	NE	392700 412600	Status: Active Licence No: 2569002175 Details: General Cooling (Existing Licences Only) (High Loss) Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Springs At Premisesmilnrow Data Type: Point Name: Precision Components Limited	Annual Volume (m³): 16365 Max Daily Volume (m³): 54.55 Application No: - Original Start Date: 15/2/1966 Expiry Date: - Issue No: 101 Version Start Date: 30/11/2009 Version End Date:
Not shown	1532	E	393000 411700	Status: Historical Licence No: 2569002064 Details: Boiler Feed Direct Source: surface, Non-tidal - North West Region Point: r Beal At Newhey, Milnrow, Rochdale Data Type: Point Name: THE SECRETARY	Annual Volume (m³): - Max Daily Volume (m³): - Application No: 421 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/6/1993 Version End Date:
Not shown	1532	E	393000 411700	Status: Historical Licence No: 2569002064 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-tidal - North West Region Point: R Beal At Newhey, Milnrow, Rochdale Data Type: Point Name: ELLENROAD TRUST LTD	Annual Volume (m³): 327312 Max Daily Volume (m³): 2954.9 Application No: 0421 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 101 Version Start Date: 11/9/2008 Version End Date:
Not shown	1532	E	393000 411700	Status: Historical Licence No: 2569002064 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: surface, Non-tidal - North West Region Point: r Beal At Newhey, Milnrow, Rochdale Data Type: Point Name: THE SECRETARY	Annual Volume (m³): - Max Daily Volume (m³): - Application No: 421 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/6/1993 Version End Date:
Not shown	1532	E	393000 411700	Status: Historical Licence No: 2569002064 Details: Boiler Feed Direct Source: Surface, Non-tidal - North West Region Point: R Beal At Newhey, Milnrow, Rochdale Data Type: Point Name: THE SECRETARY	Annual Volume (m³): 327312 Max Daily Volume (m³): 2954.9 Application No: 0421 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 100 Version Start Date: 21/6/1993 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1532	E	393000 411700	Status: Active Licence No: 2569002064 Details: Non-Evaporative Cooling Direct Source: Surface, Non-tidal - North West Region Point: R Beal At Newhey, Milnrow, Rochdale Data Type: Point Name: ELLENROAD TRUST LTD	Annual Volume (m³): 3520 Max Daily Volume (m³): 350 Application No: NPS/WR/015275 Original Start Date: 18/1/1966 Expiry Date: - Issue No: 103 Version Start Date: 30/1/2014 Version End Date:
Not shown	1532	E	393000 411700	Status: Active Licence No: 2569002233 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-tidal - North West Region Point: R Beal At Milnrow Data Type: Point Name: SUN CHEMICAL LTD	Annual Volume (m³): 66370 Max Daily Volume (m³): 181.8 Application No: 2725 Original Start Date: 13/8/1986 Expiry Date: - Issue No: 102 Version Start Date: 1/1/2005 Version End Date:
Not shown	1981	E	393400 412200	Status: Historical Licence No: 2569002207 Details: General Cooling (Existing Licences Only) (Low Loss) Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Unnamed Trib Of Butterworth Hall Brk At Data Type: Point Name: SONOCO INDUSTRIAL PACKAGING	Annual Volume (m³): - Max Daily Volume (m³): - Application No: 2305 Original Start Date: 26/6/1970 Expiry Date: - Issue No: 100 Version Start Date: 1/2/1990 Version End Date:
Not shown	1981	E	393400 412200	Status: Historical Licence No: 2569002207 Details: Boiler Feed Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Unnamed Trib Of Butterworth Hall Brk At Data Type: Point Name: SONOCO INDUSTRIAL PACKAGING	Annual Volume (m³): - Max Daily Volume (m³): - Application No: 2305 Original Start Date: 26/6/1970 Expiry Date: - Issue No: 100 Version Start Date: 1/2/1990 Version End Date:
Not shown	1981	E	393400 412200	Status: Historical Licence No: 2569002207 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Unnamed Trib Of Butterworth Hall Brk At Data Type: Point Name: SONOCO INDUSTRIAL PACKAGING	Annual Volume (m³): - Max Daily Volume (m³): - Application No: 2305 Original Start Date: 26/6/1970 Expiry Date: - Issue No: 100 Version Start Date: 1/2/1990 Version End Date:

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site?

Yes

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

ID	Distance (m)	Direction	NGR	Details
Not shown	1846	E	393200 412400	Status: Active Licence No: 2569002206 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: Colliery Shaft @ Premises, Butterworth Hall, Milnrow Data Type: Point Name: UNITED UTILITIES WATER LTD Annual Volume (m³): 3982296 Max Daily Volume (m³): 13638 Original Application No: 1567 Original Start Date: 1/4/1969 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1846	E	393200 412400	Status: Historical Licence No: 2569002206 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: "colliery Shaft @ Premises, Butterworth Hall, Milnrow" Data Type: Point Name: UNITED UTILITIES WATER PLC Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 1567 Original Start Date: 1/4/1969 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:
Not shown	1981	E	393400 412200	Status: Historical Licence No: 2569002207 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Surface, Non-tidal - North West Region Point: Reservoir Fed By Unnamed Trib Of Butterworth Hall Brk At Data Type: Point Name: SONOCO INDUSTRIAL PACKAGING Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 2305 Original Start Date: 26/6/1970 Expiry Date: - Issue No: 100 Version Start Date: Version End Date:

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site?

No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
0	On Site	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
351	SE	Minor Aquifer/Low Leaching Potential	L	Soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? Yes

6.9.1 Biological Quality:

Biological Quality data describes water quality in terms of 83 groups of macroinvertebrates, some of which are pollution sensitive. The results are graded from A ('Very Good') to F ('Bad').

The following Biological Quality records are shown on the Hydrology Map (6e):

ID	Distance (m)	Direction	NGR	River Quality Grade	Biological Quality Grade				
					2005	2006	2007	2008	2009
Not shown	1132	SW	390500 410700	River Name: Sudden Bk Reach: Qsl At Balderstone To Roch End/Start of Stretch: Start of Stretch NGR	E	E	E	D	D

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site?

Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
2	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
3	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
4	10	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
5	22	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	22	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7	98	SW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
8	120	SW	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined

ID	Distance (m)	Direction	Details	
9	122	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
10	223	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
11	299	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
12	299	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
13	307	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
14	333	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
15	386	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
16	450	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

6.11 Surface Water Features

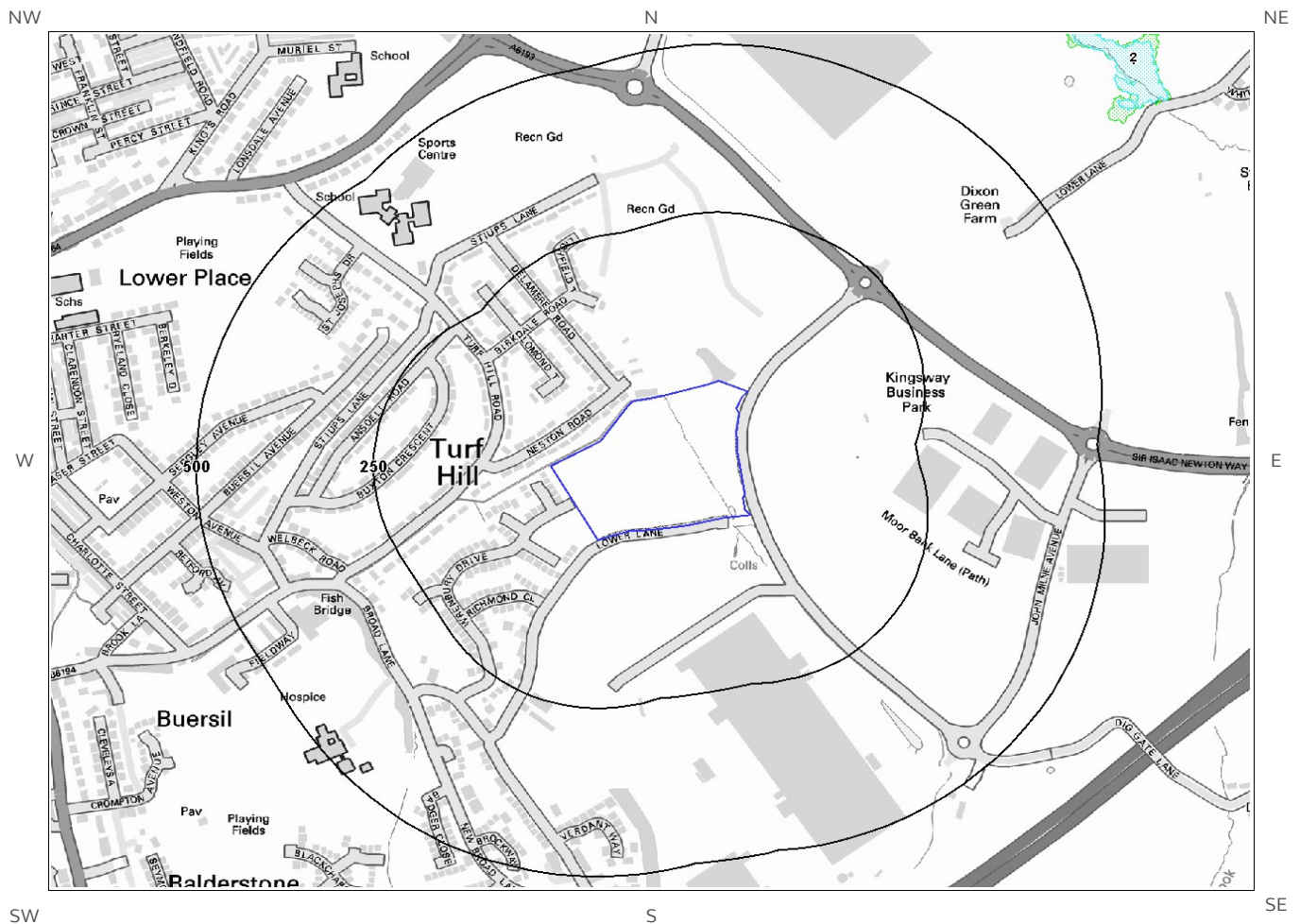
Are there any surface water features within 250m of the study site?

Yes

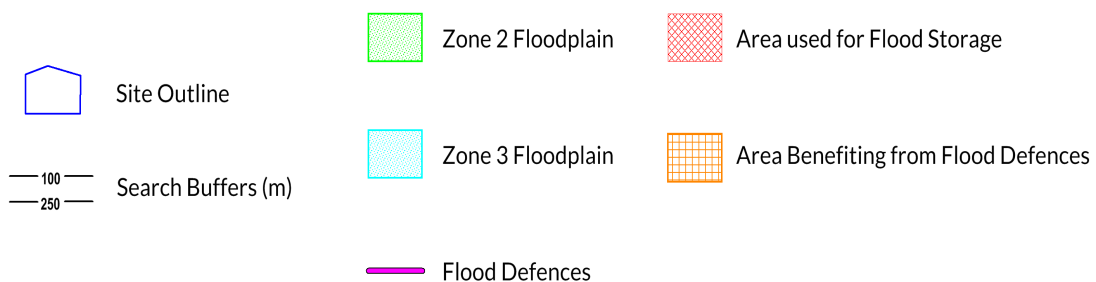
The following surface water records are not represented on mapping:

Distance (m)	Direction
0	On Site
13	S
13	S
22	S
22	S
42	S
42	S
42	S
121	SW
141	SE

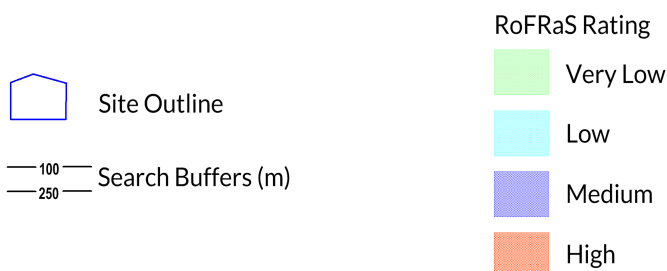
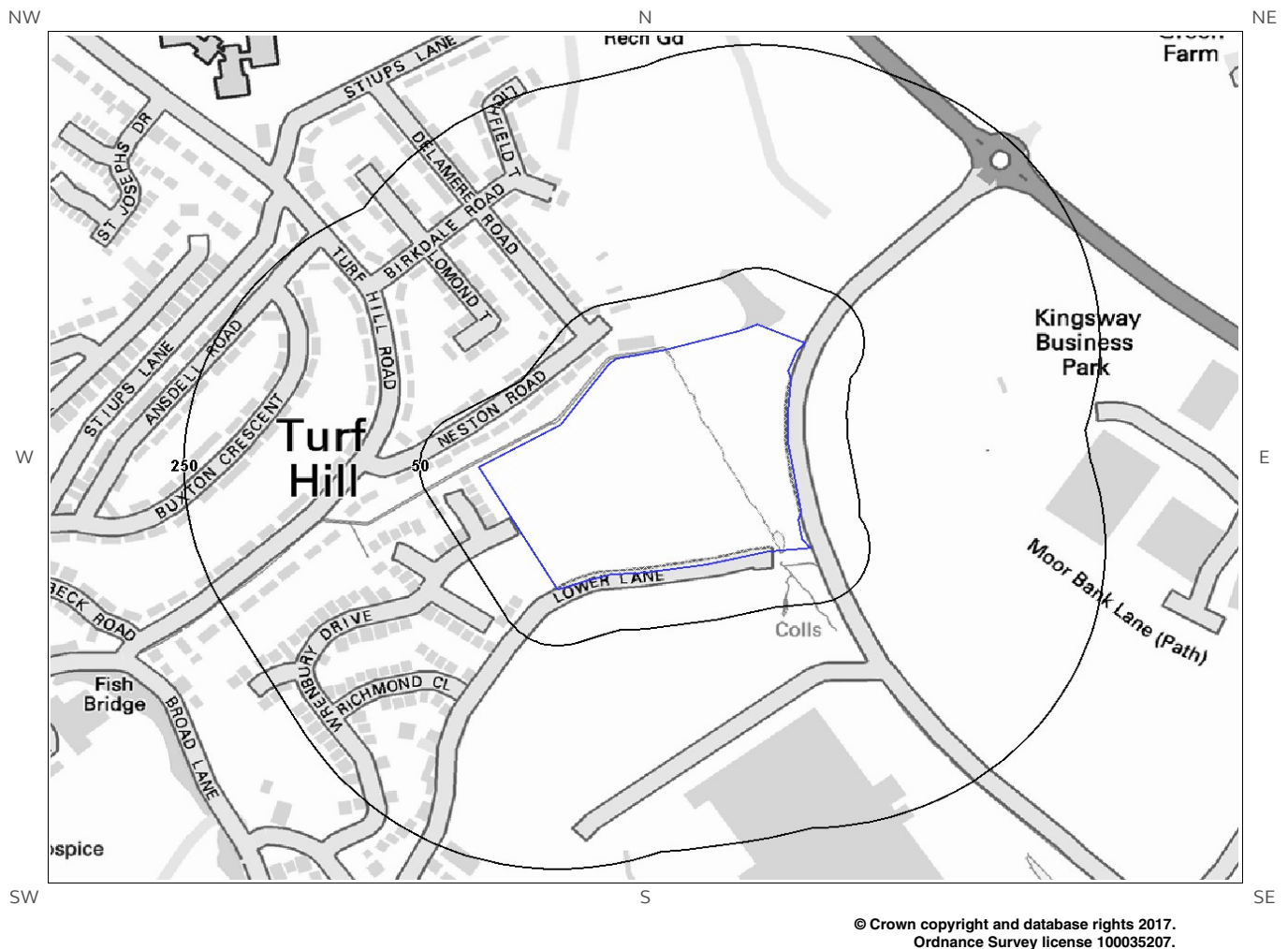
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



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7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No
Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site?

No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

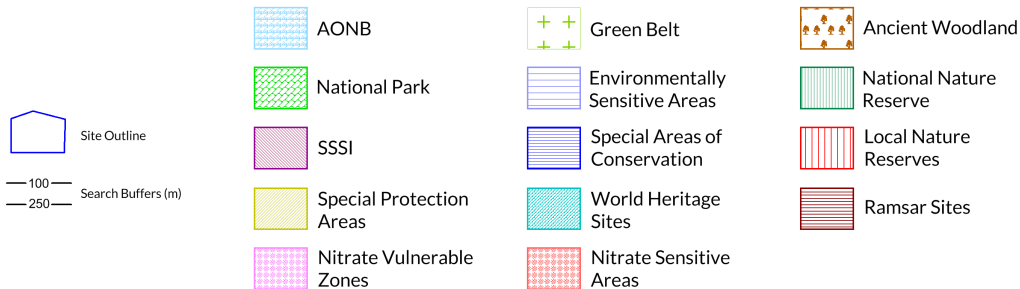
7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result?

Low

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.



8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

5

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
6	746	N	Rochdale Canal	Natural England
7	1225	W	Rochdale Canal	Natural England
Not shown	1557	W	Rochdale Canal	Natural England
Not shown	1567	N	Rochdale Canal	Natural England
Not shown	1838	W	Rochdale Canal	Natural England

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

5

The following Special Area of Conservation (SAC) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SAC Name	Data Source
1	746	N	Rochdale Canal	Natural England
Not shown	1426	W	Rochdale Canal	Natural England
Not shown	1557	W	Rochdale Canal	Natural England

ID	Distance (m)	Direction	SAC Name	Data Source
Not shown	1567	N	Rochdale Canal	Natural England
Not shown	1838	W	Rochdale Canal	Natural England

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

4

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
Not shown	1675	SW	Existing	DEFRA
Not shown	1715	SW	Existing	DEFRA
Not shown	1733	SW	Existing	DEFRA
Not shown	1989	SW	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

8

Green Belt data contains Ordnance Survey data © Crown copyright and database right [2015].

ID	Distance	Direction	Green Belt Name	Local Authority Name
15	664	SE	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)
16	1197	E	Liverpool, Manchester and West Yorks Greenbelt	Oldham District (B)

Not shown	1209	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)
Not shown	1583	S	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)
Not shown	1604	S	Liverpool, Manchester and West Yorks Greenbelt	Oldham District (B)
Not shown	1779	E	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)
Not shown	1828	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)
Not shown	1989	SW	Liverpool, Manchester and West Yorks Greenbelt	Rochdale District (B)

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from our **website**. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? High

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing

ones as described in publication BR211 by the Building Research Establishment?

No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site? Yes

The following coal mining information provided by the Coal Authority is not represented on Mapping:

Distance (m)	Direction	Details
0	On Site	The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No

Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com



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Local Authority
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Phone: 01706 647 474
Web: <http://www.rochdale.gov.uk/>
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<https://www.groundsure.com/terms-and-conditions-sept-2016>

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Groundsure
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Your Reference: POR010967_Plot_L_Rochdale

Report Date 17 May 2017

Report Delivery Method: Email - pdf

Groundsure Geo Insight

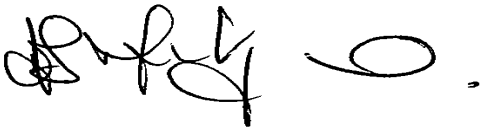
Address: 391352 411646,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight



NW N NE



SW S SE

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Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	Yes
	1.2.2 Are there any records of landslide within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale

2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslide within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults

2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.

2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?

Yes

2.3.3 Are there any records of faults within 500m of the study site boundary?

No

Section 3: Radon

3. Radon

3.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?

The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

No radon protective measures are necessary.

Section 4: Ground Workings

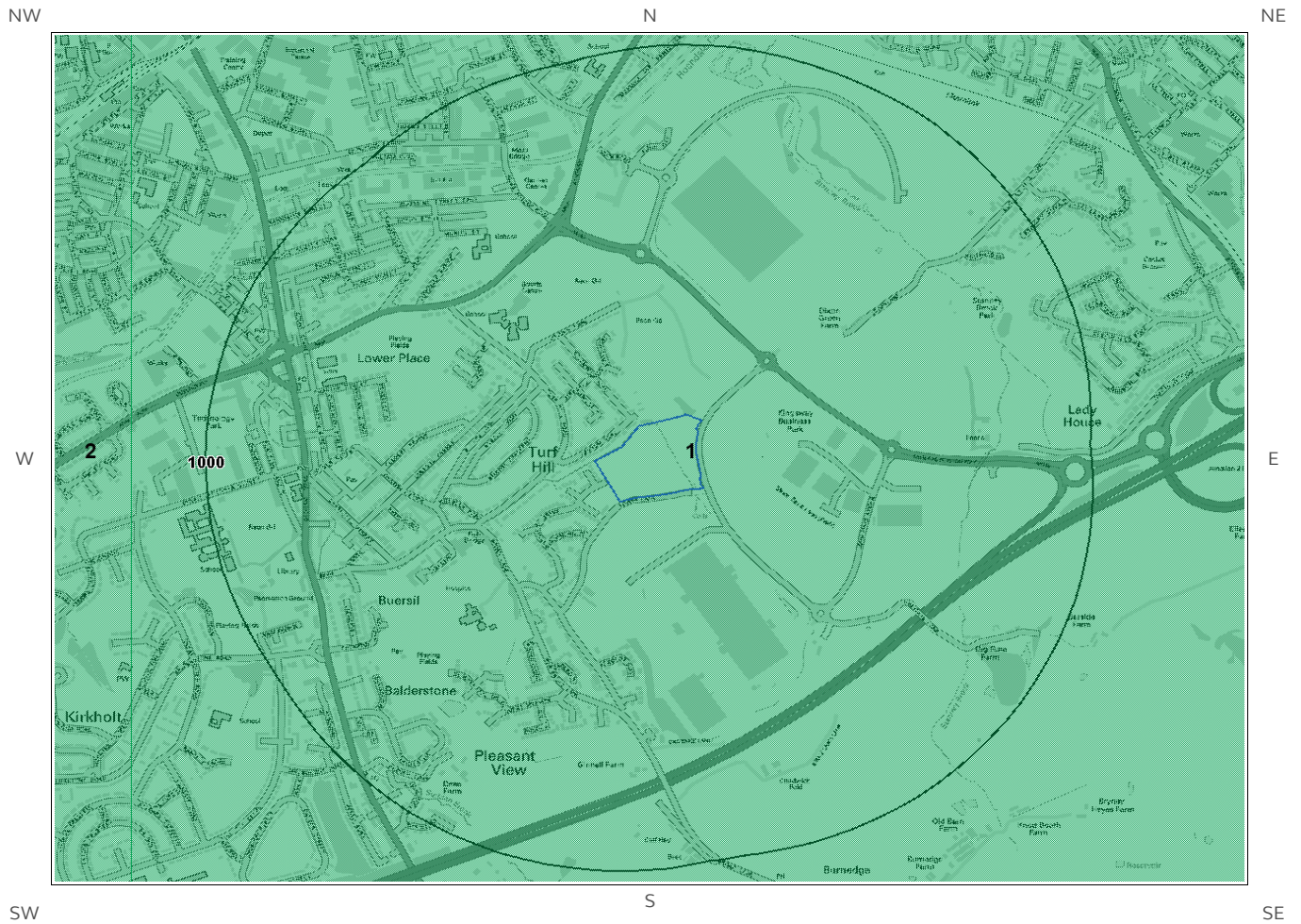
	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	3	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
4.3 Current Ground Workings	0	0	0	0	1

Section 5: Mining, Extraction & Natural Cavities

	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	0
5.2 Coal Mining	1	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	0	0	0	0	0
5.5 Non-Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

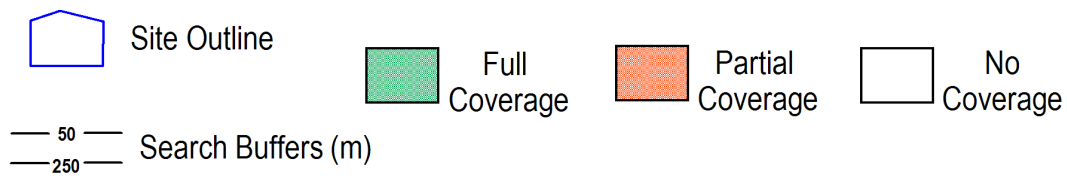
Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-site				
6.1 Shrink-Swell Clay	Low				
6.2 Landslides	Very Low				
6.3 Ground Dissolution of Soluble Rocks	Negligible				
6.4 Compressible Deposits	High				
6.5 Collapsible Deposits	Very Low				
6.5 Running Sand	Very Low				
Section 7: Borehole Records	On-site	0-50m	51-250		
7 BGS Recorded Boreholes	1	1	1		
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250		
8 Records of Background Soil Chemistry	5	6	0		
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searched	
9.2 Historical Railway and Tunnel Features	0	0	0	Not Searched	
9.3 Historical Railways	0	0	0	Not Searched	
9.4 Active Railways	0	0	0	Not Searched	
9.5 Railway Projects	0	0	0	0	

1:10,000 Scale Availability



1_10,000 Availability Legend

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Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	Some deposits are mapped
2	1192.0	Some deposits are mapped	Full	Full	Some deposits are mapped
N3	1539.0	Some deposits are mapped	Full	Full	Some deposits are mapped
N4	1989.0	Some deposits are mapped	Full	Full	Some deposits are mapped

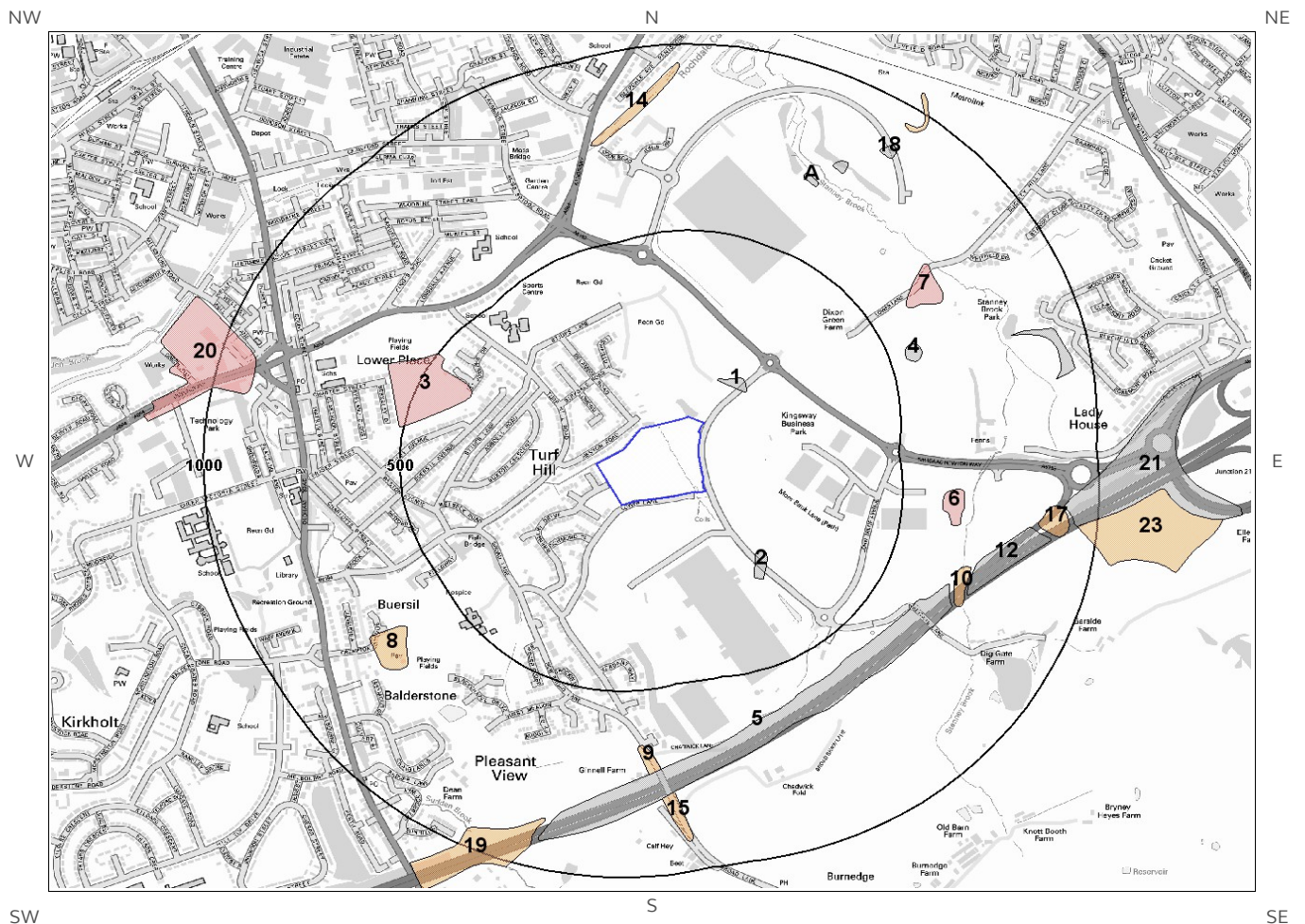
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

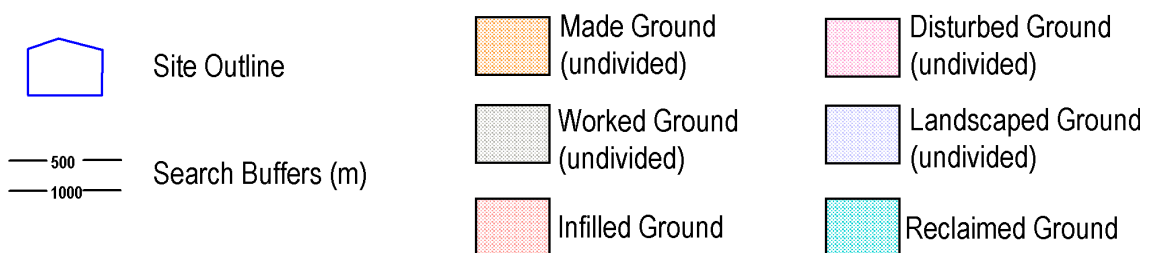
1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

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1. Geology 1:10,000 scale

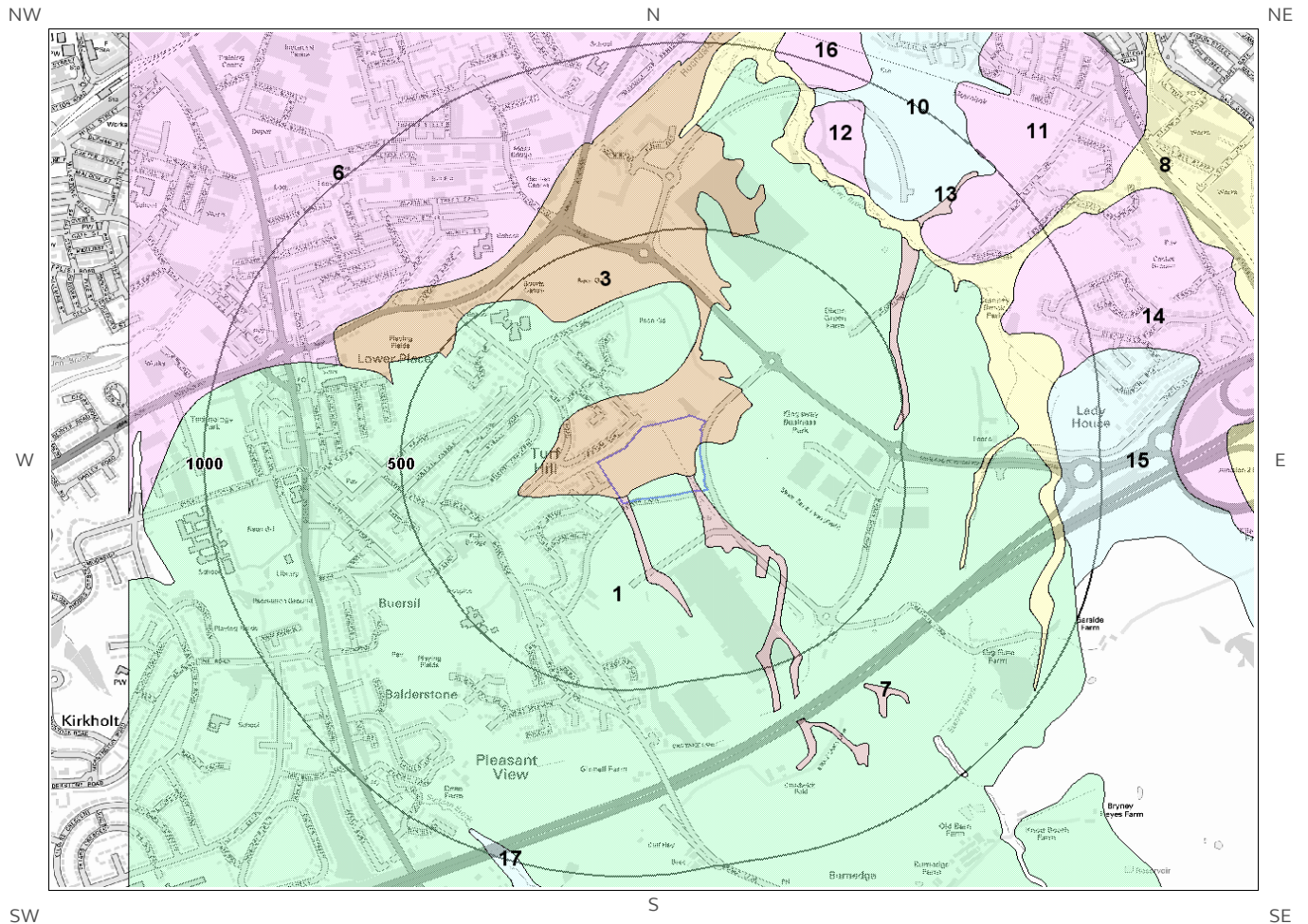
1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

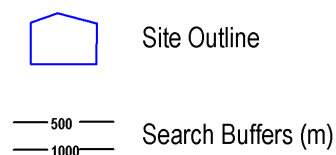
ID	Distance	Direction	LEX Code	Description	Rock Description
1	116.0	NE	WGR-VOID	Worked Ground (Undivided)	Void
2	207.0	SE	WGR-VOID	Worked Ground (Undivided)	Void
3	368.0	NW	WMGR-ARTDP	Infilled Ground	Artificial Deposit

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)



Artificial Ground Legend

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1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	HMGDD-DMTN	Hummocky (moundy) Glacial Deposits, Devensian - Diamicton	Diamicton
2	0.0	On Site	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
3	0.0	On Site	PEAT-P	Peat - Peat	Peat
4	0.0	On Site	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
5	478.0	E	HEAD-XCZSV	Head - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

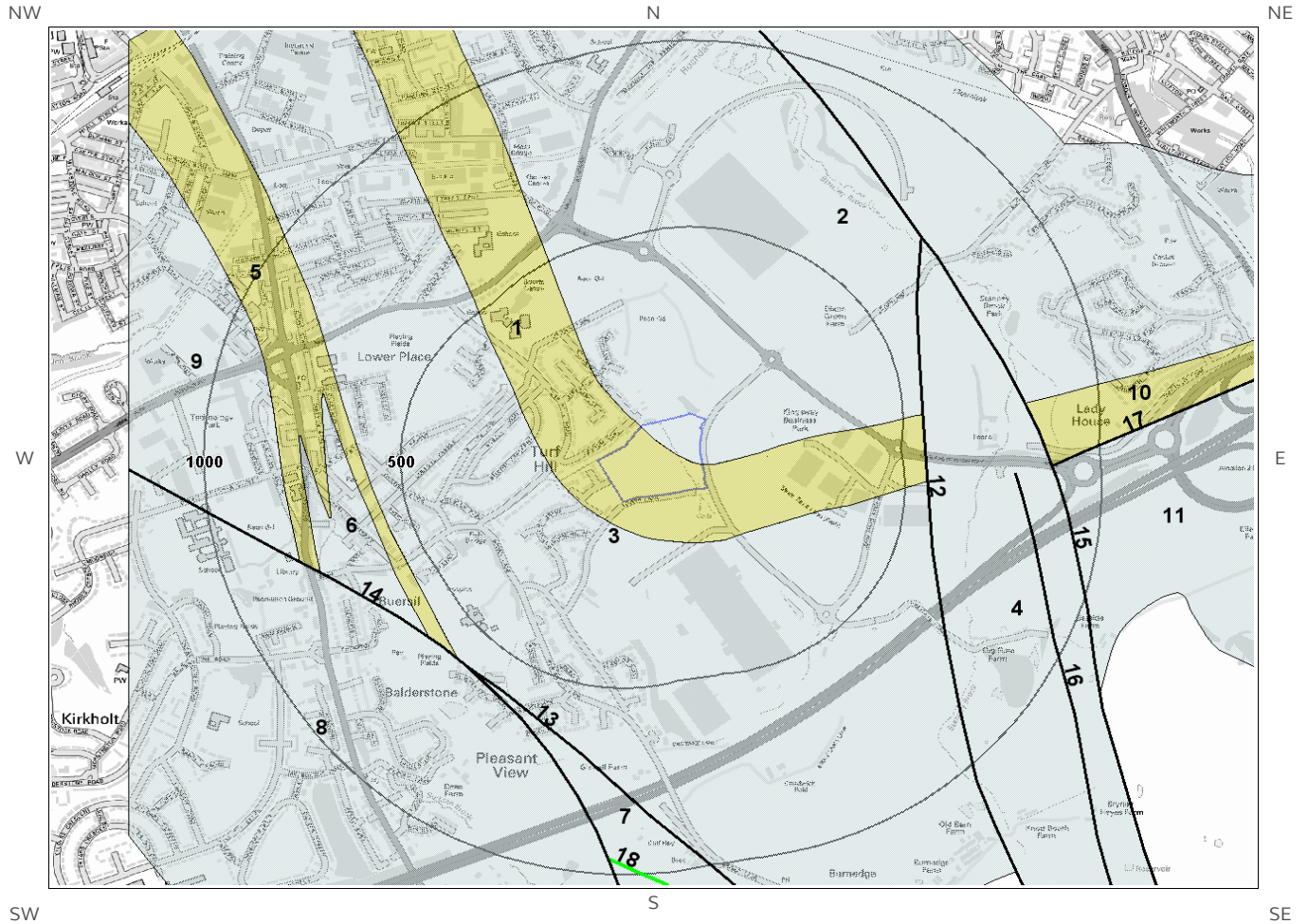
No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and Faults Map (1:10,000 scale)

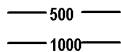


Bedrock and Faults Legend

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Site Outline



Search Buffers (m)

1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	MLRS-SDST	Milnrow Sandstone - Sandstone	Langsettian Sub-age
2	0.0	On Site	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
3	66.0	SW	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

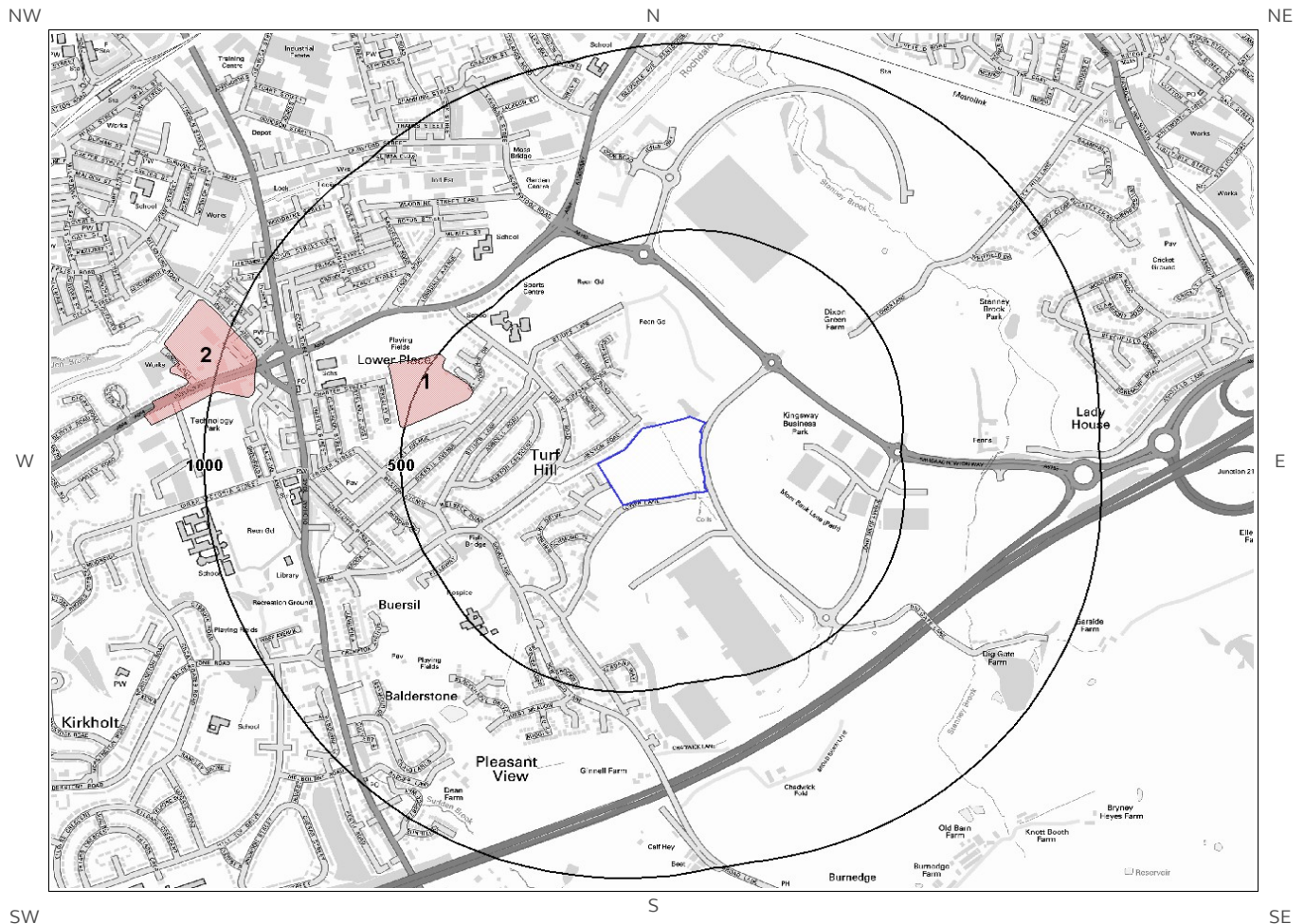
Database searched and no data found at this scale.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

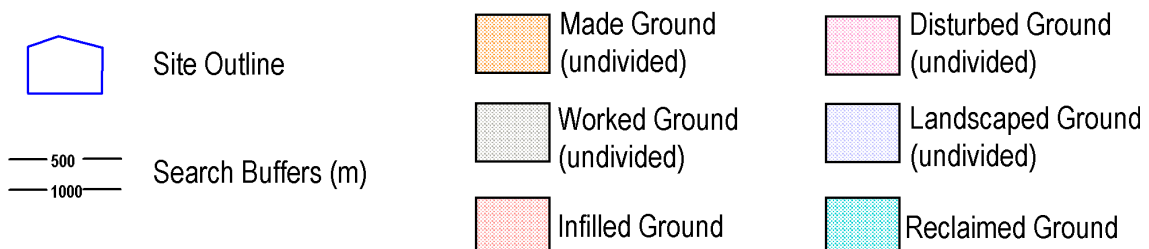
2 Geology 1:50,000 Scale

2.1 Artificial Ground Map



Ground Workings Legend

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2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 085

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

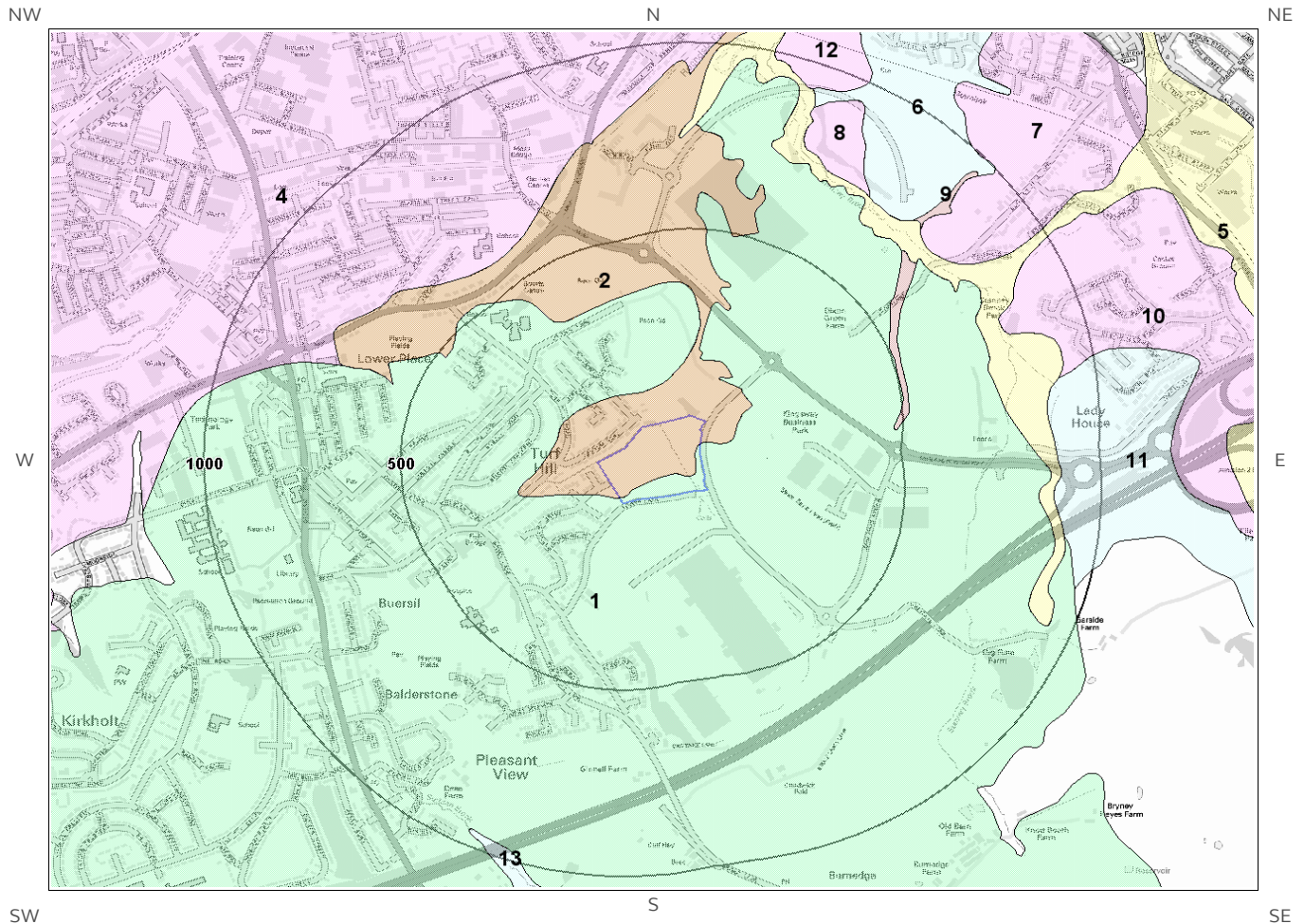
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	369.0	NW	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

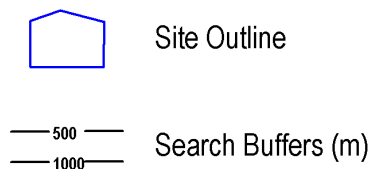
Database searched and no data found.

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

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2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	HMGDD-DMTN	HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN	DIAMICTON
2	0.0	On Site	PEAT-P	PEAT	PEAT
3	478.0	E	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Low	Very Low
0.0	On Site	Mixed	High	Low

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

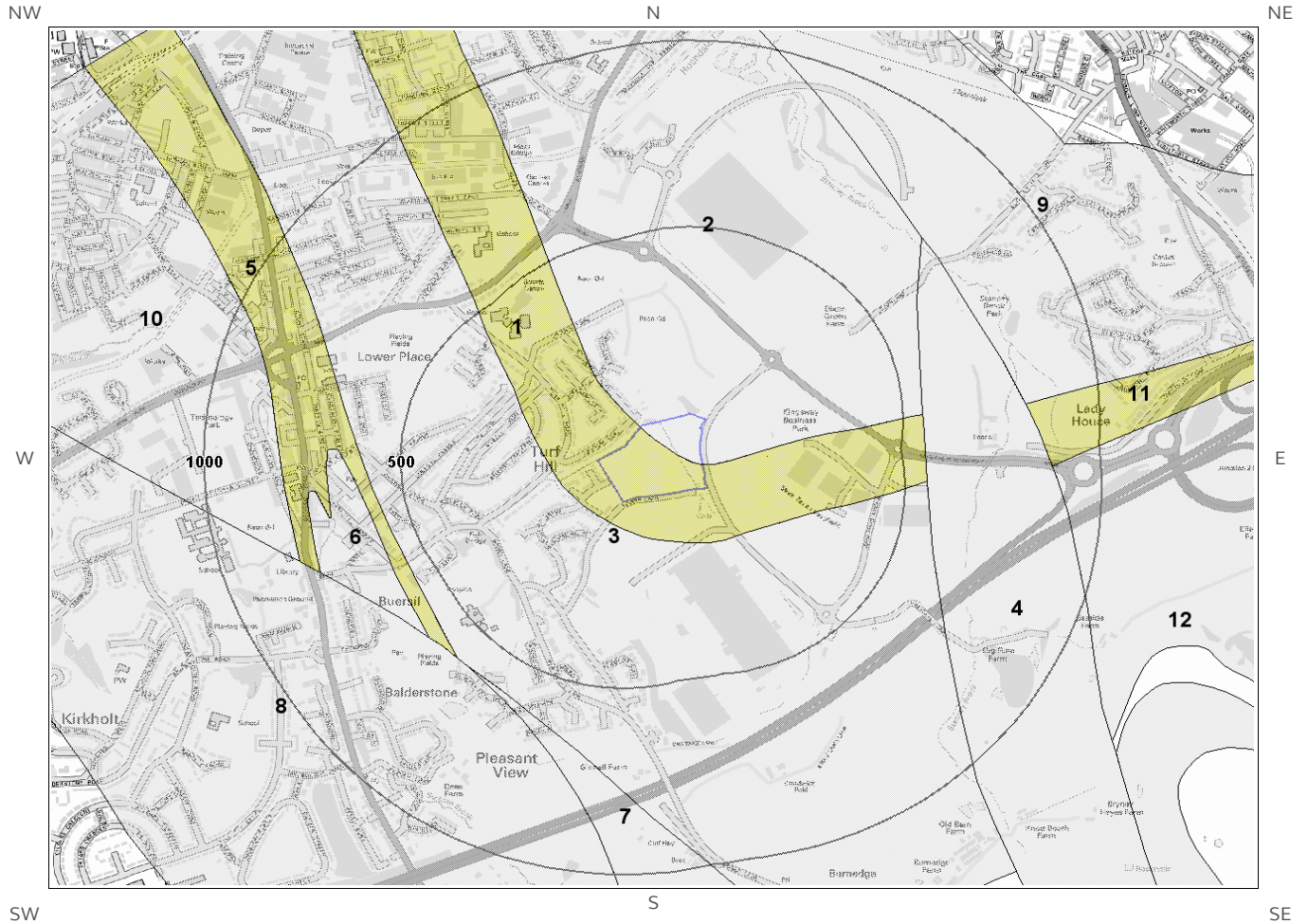
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

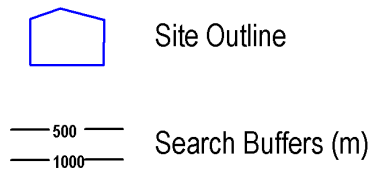
Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

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2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 085

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	MLRS-SDST	MILNROW SANDSTONE - SANDSTONE	WESTPHALIAN
2	0.0	On Site	PLCM-MDSS	PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	WESTPHALIAN
3	66.0	SW	PLCM-MDSS	PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	WESTPHALIAN

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	High	Moderate
0.0	On Site	Fracture	High	Low

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

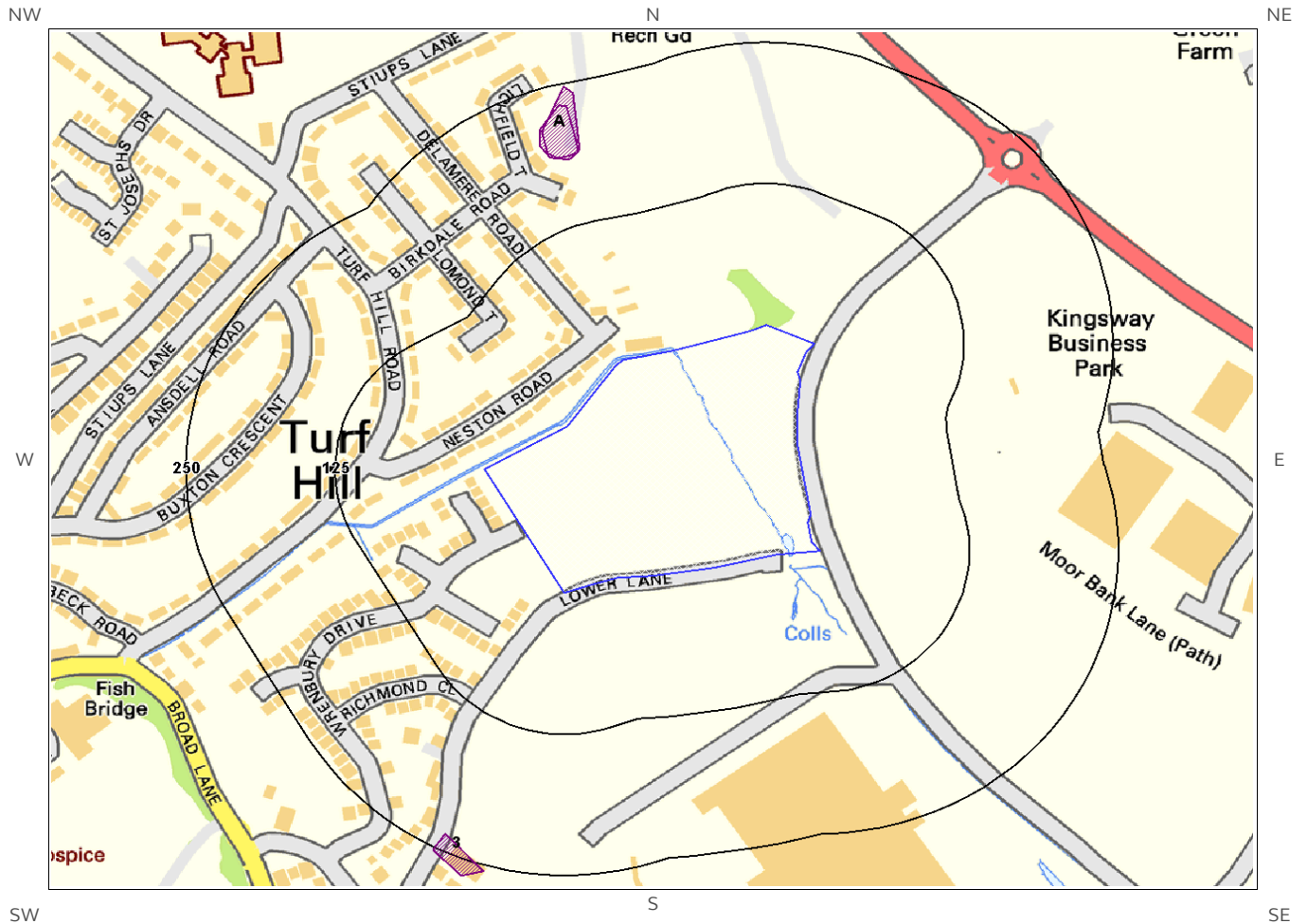
3.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

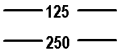
Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

4 Ground Workings Map



Ground Workings Legend

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- | | | | |
|---|--------------------|---|----------------------------------|
|  | Site Outline |  | Historic Surface Ground Workings |
|  | Search Buffers (m) |  | Historic Underground Workings |
| | |  | Current Ground Workings |

4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1A	183.0	N	391254 411948	Pond	1891
2A	186.0	N	391256 411956	Unspecified Pit	1908
3	236.0	SW	391170 411308	Pond	1891

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

4.3 Current Ground Workings

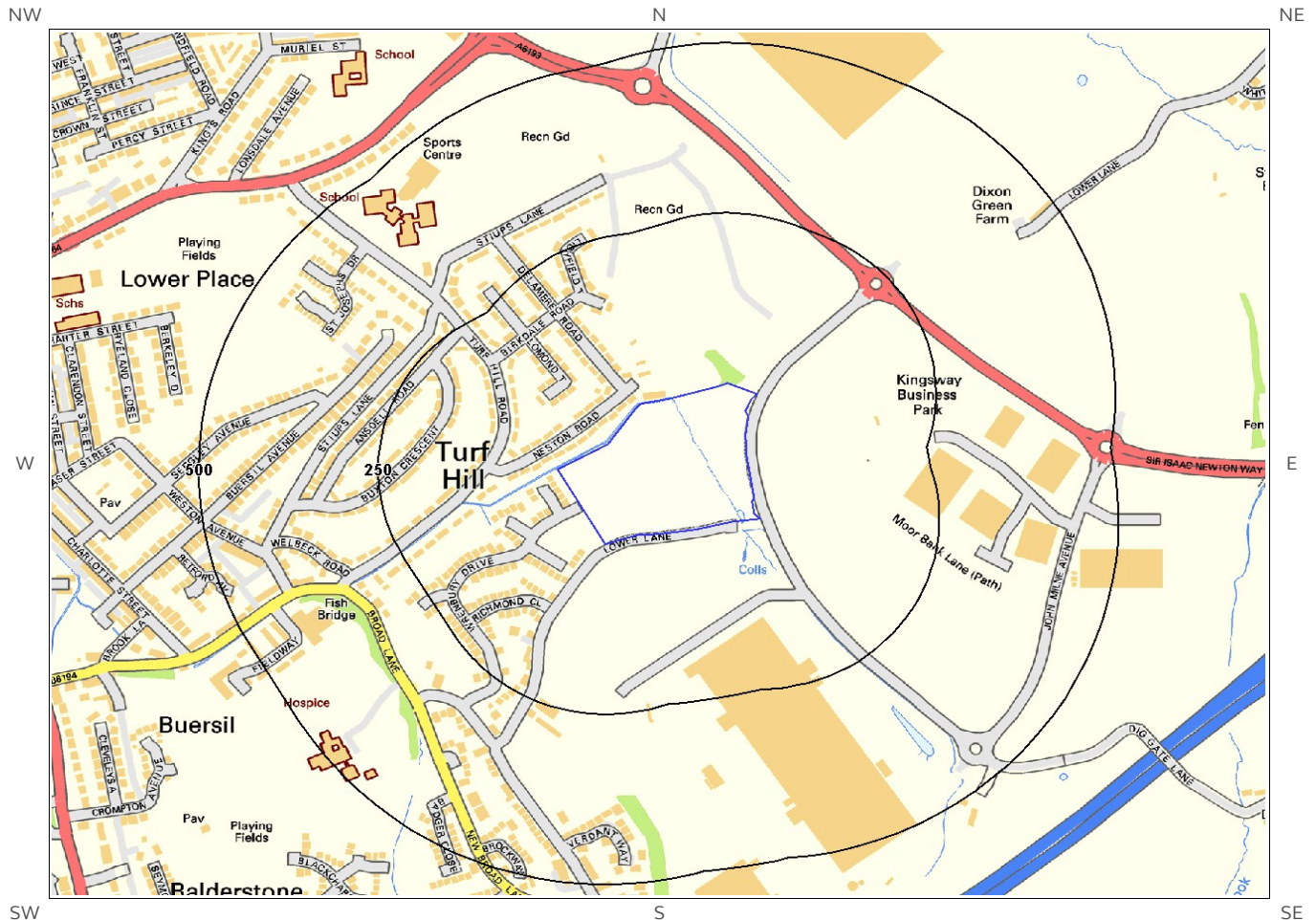
This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
Not shown	660.0	E	392127 411486	Sand	Near Moor Bank Sand Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

5 Mining, Extraction & Natural Cavities Map



Mining, Extraction and Natural Cavities Legend

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5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? Yes

The following Coal Mining information provided by the Coal Authority is not represented on Mapping:

Distance (m)	Direction	Details
0.0	On Site	The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled “Review of mining instability in Great Britain, 1990” PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

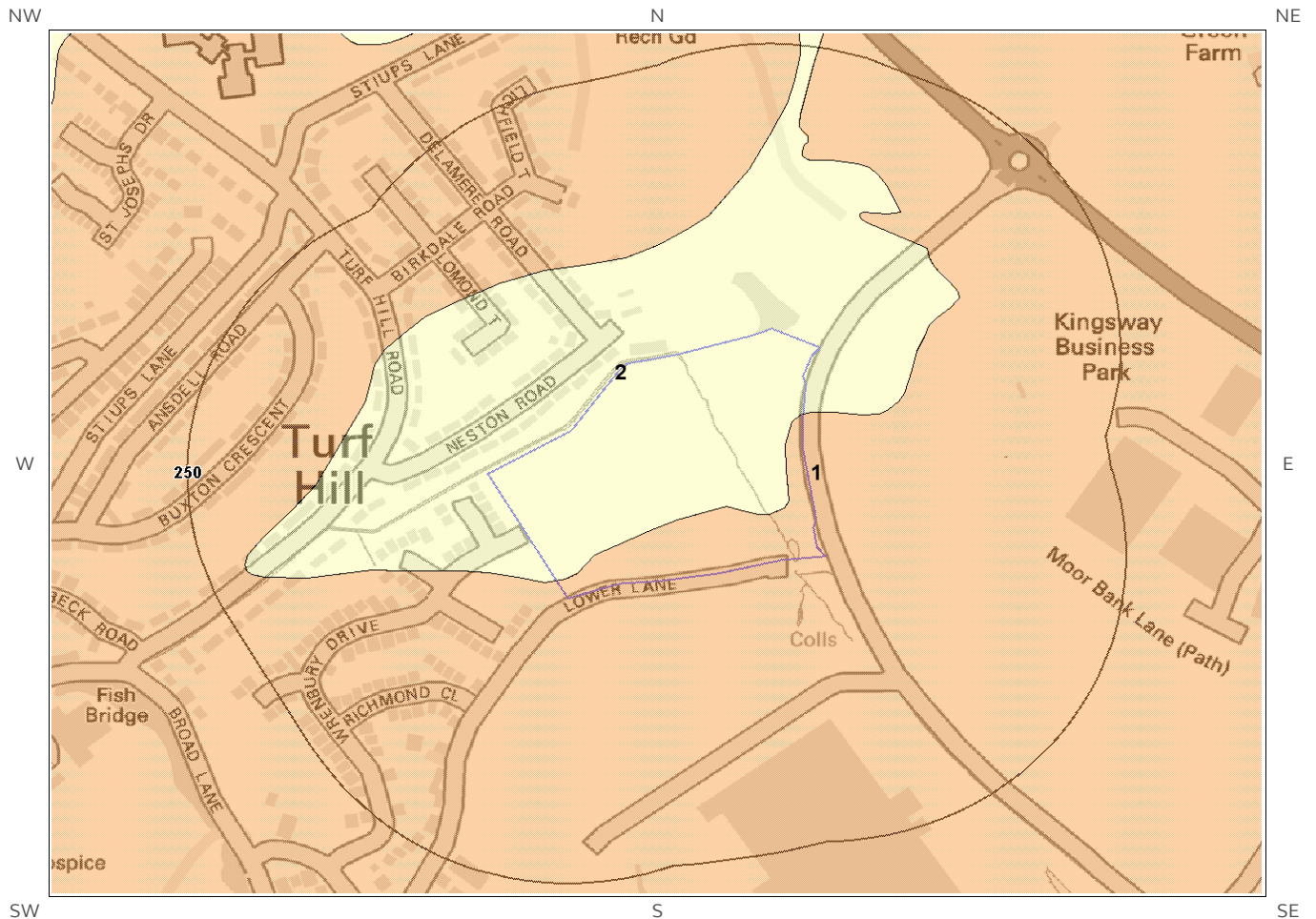
Are there any Clay Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

6 Natural Ground Subsidence

6.1 Shrink-Swell Clay Map

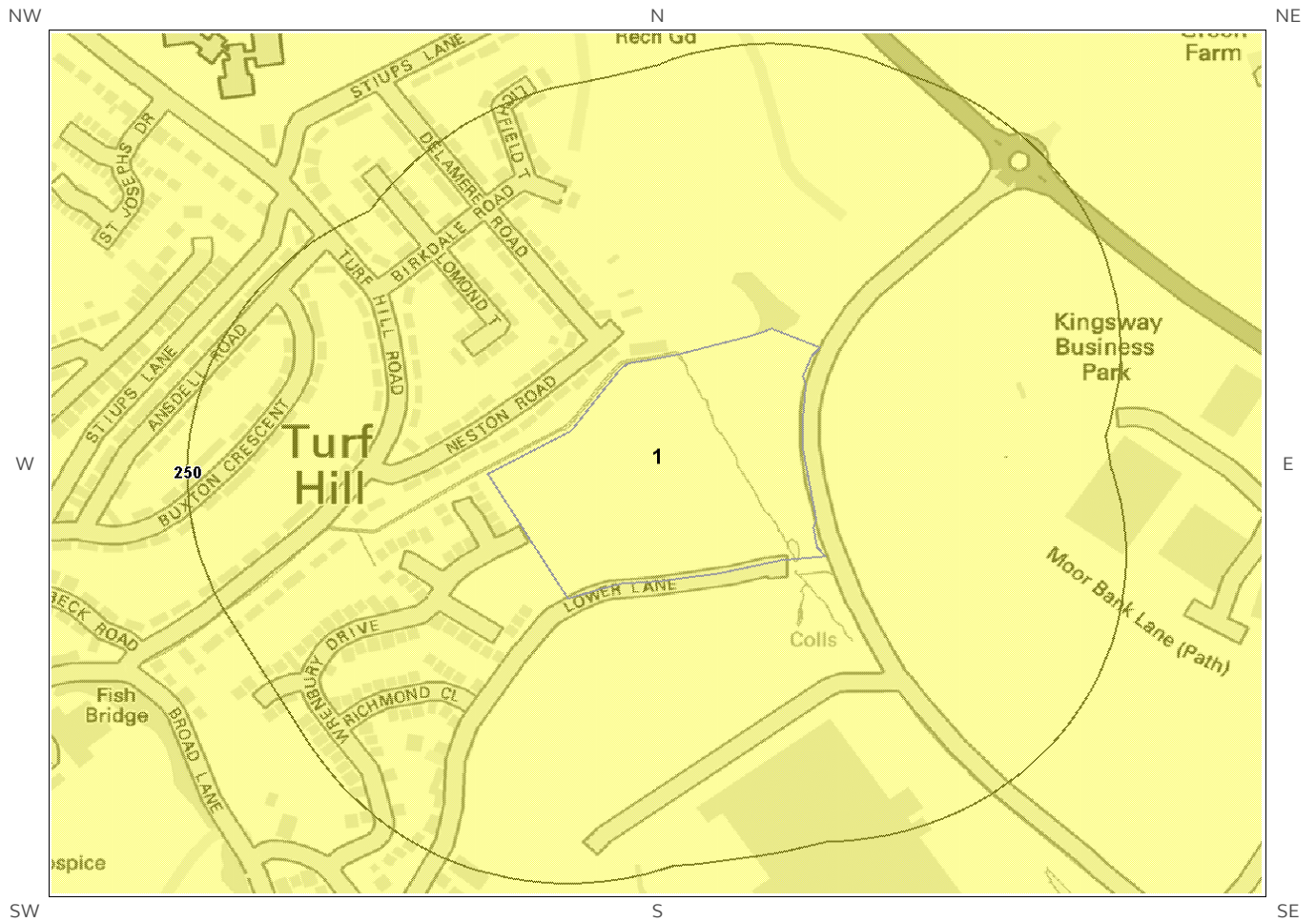


Shrink Swell Clay Legend

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6.2 Landslides Map

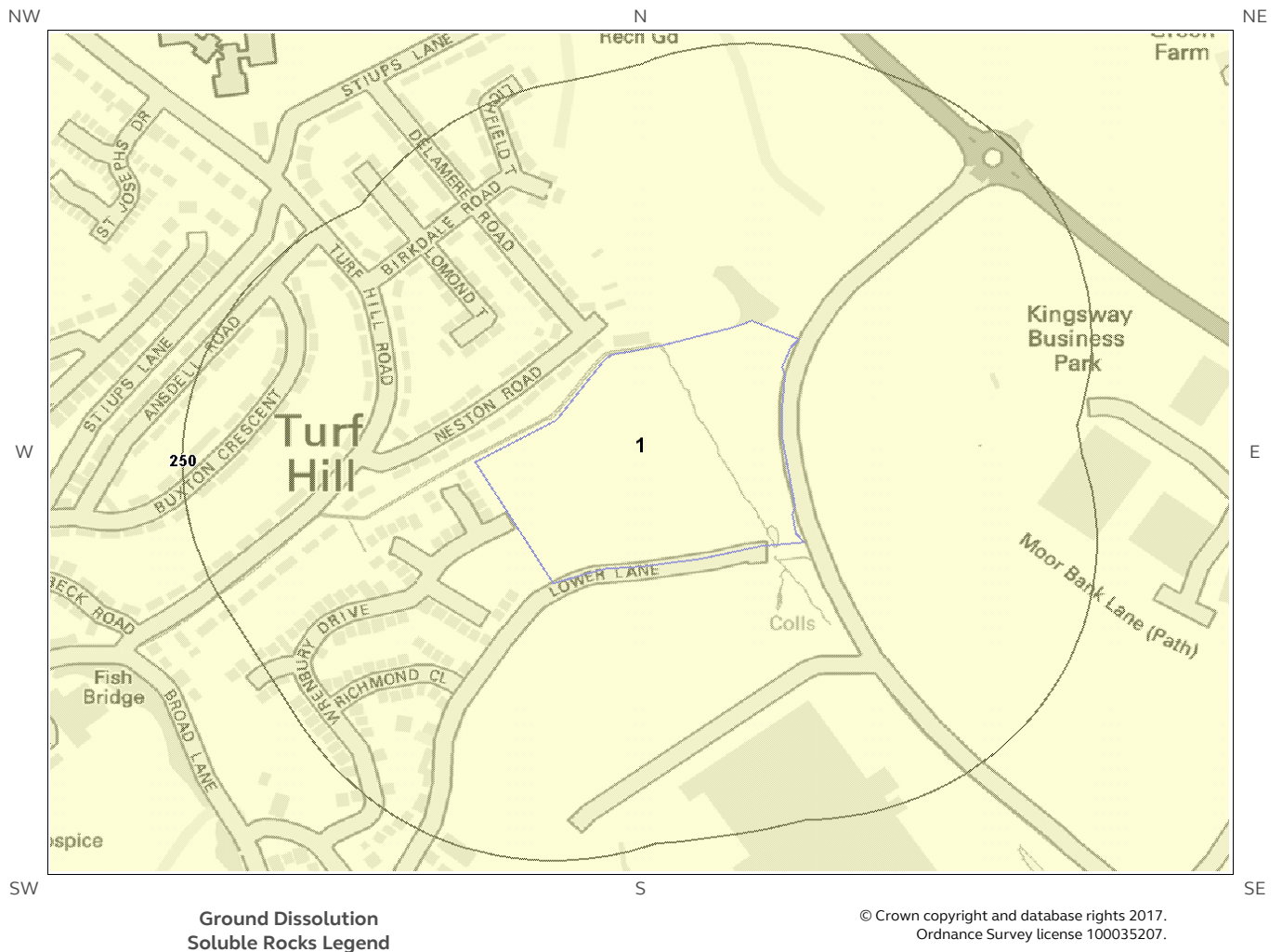


Landslides Legend

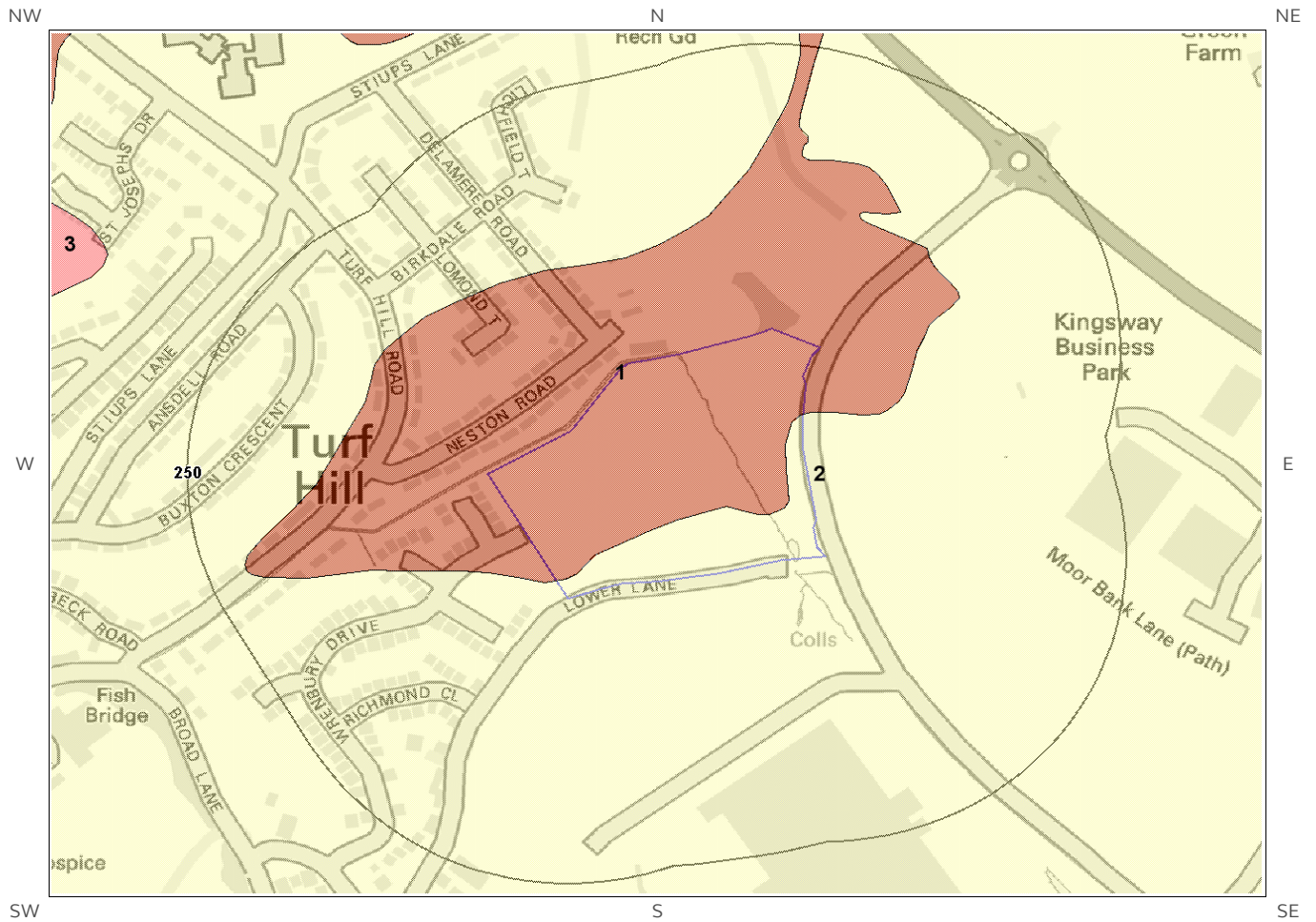
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6.3 Ground Dissolution of Soluble Rocks Map



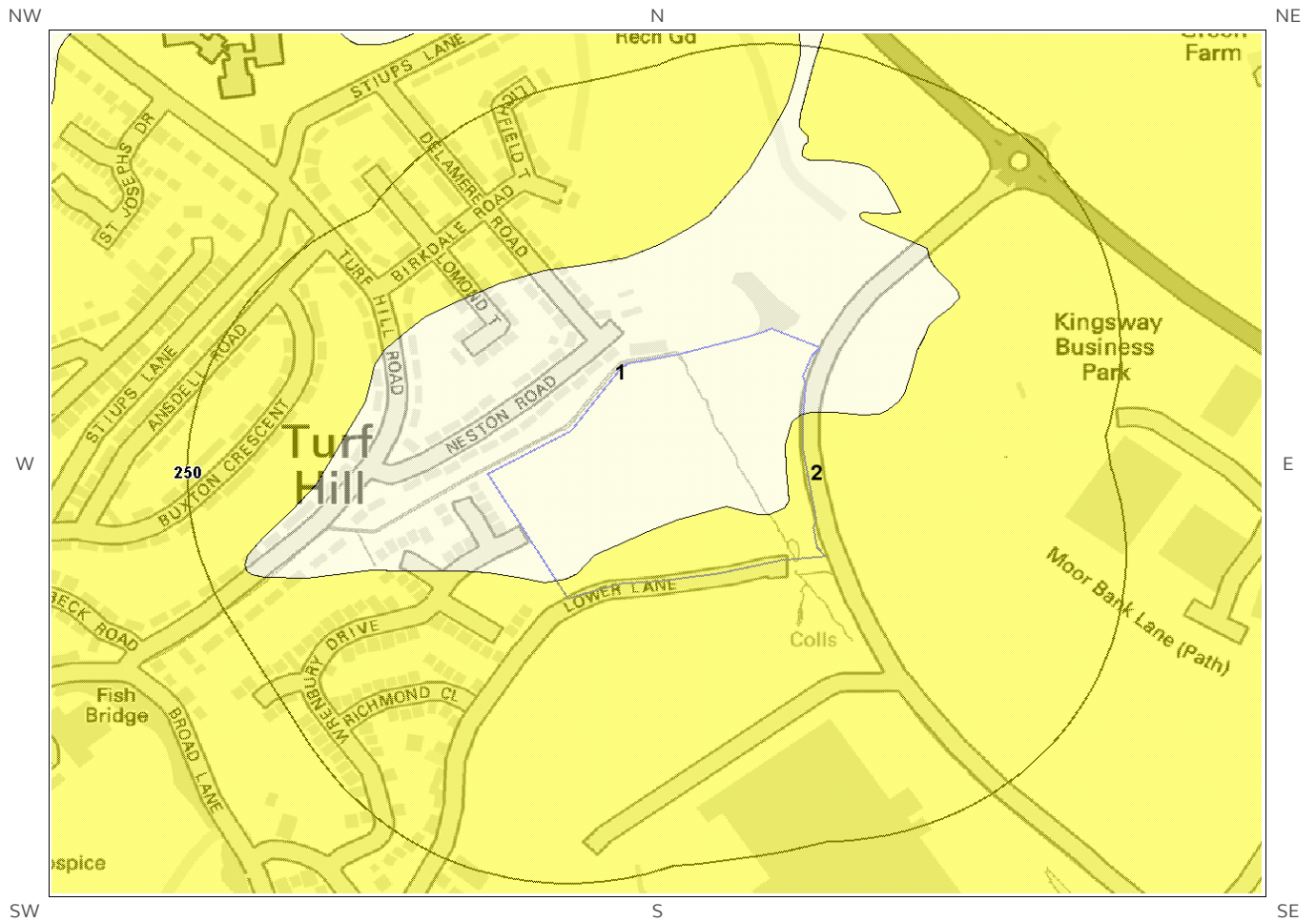
6.4 Compressible Deposits Map



Compressible Deposits Legend

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6.5 Collapsible Deposits Map

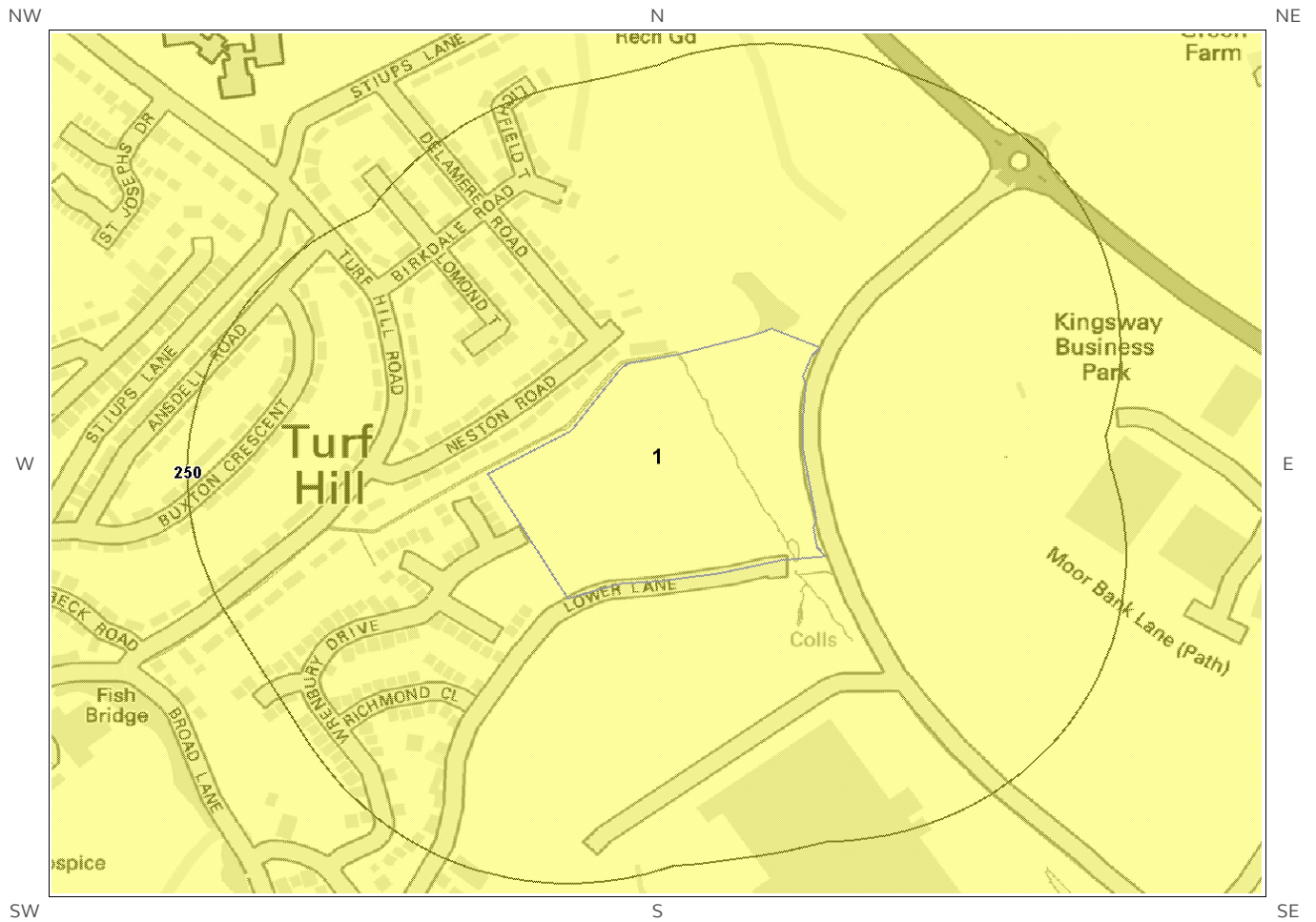


Collapsible Deposits Legend

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6.6 Running Sand Map



Running Sand Legend

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6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site* boundary? High

6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
2	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with landslides.

* This includes an automatically generated 50m buffer zone around the site

6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	High	Very significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Construction may not be possible at economic cost. For existing property - probable increase in insurance risk from compressibility especially if water conditions or loading of the ground change significantly.
2	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

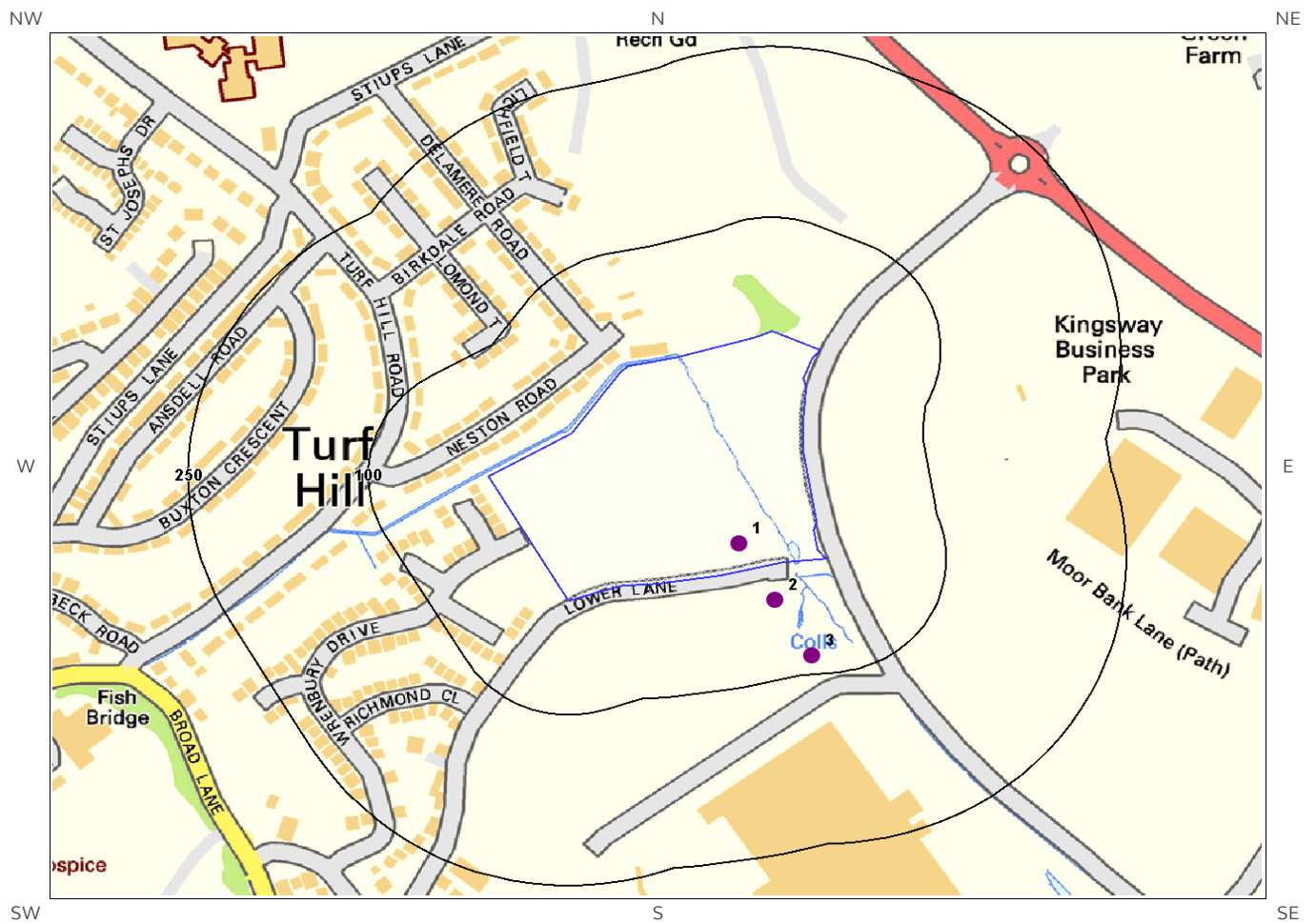
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
2	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

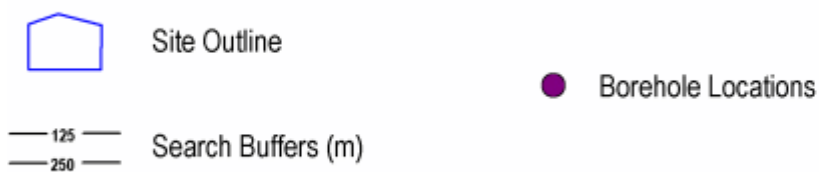
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

7 Borehole Records Map



Borehole Records Legend

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7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary:

3

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	0.0	On Site	391400 411590	SD91SW227	-1.0	JOHN HARTLE
2	31.0	S	391430 411540	SD91SW228	-1.0	HARRY SANDERSON
3	84.0	S	391461 411491	SD91SW5	240.46	BROAD LANE CASTLE BORING

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#1: scans.bgs.ac.uk/sobi_scans/boreholes/35350

#2: scans.bgs.ac.uk/sobi_scans/boreholes/35351

#3: scans.bgs.ac.uk/sobi_scans/boreholes/35125

8 Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary:

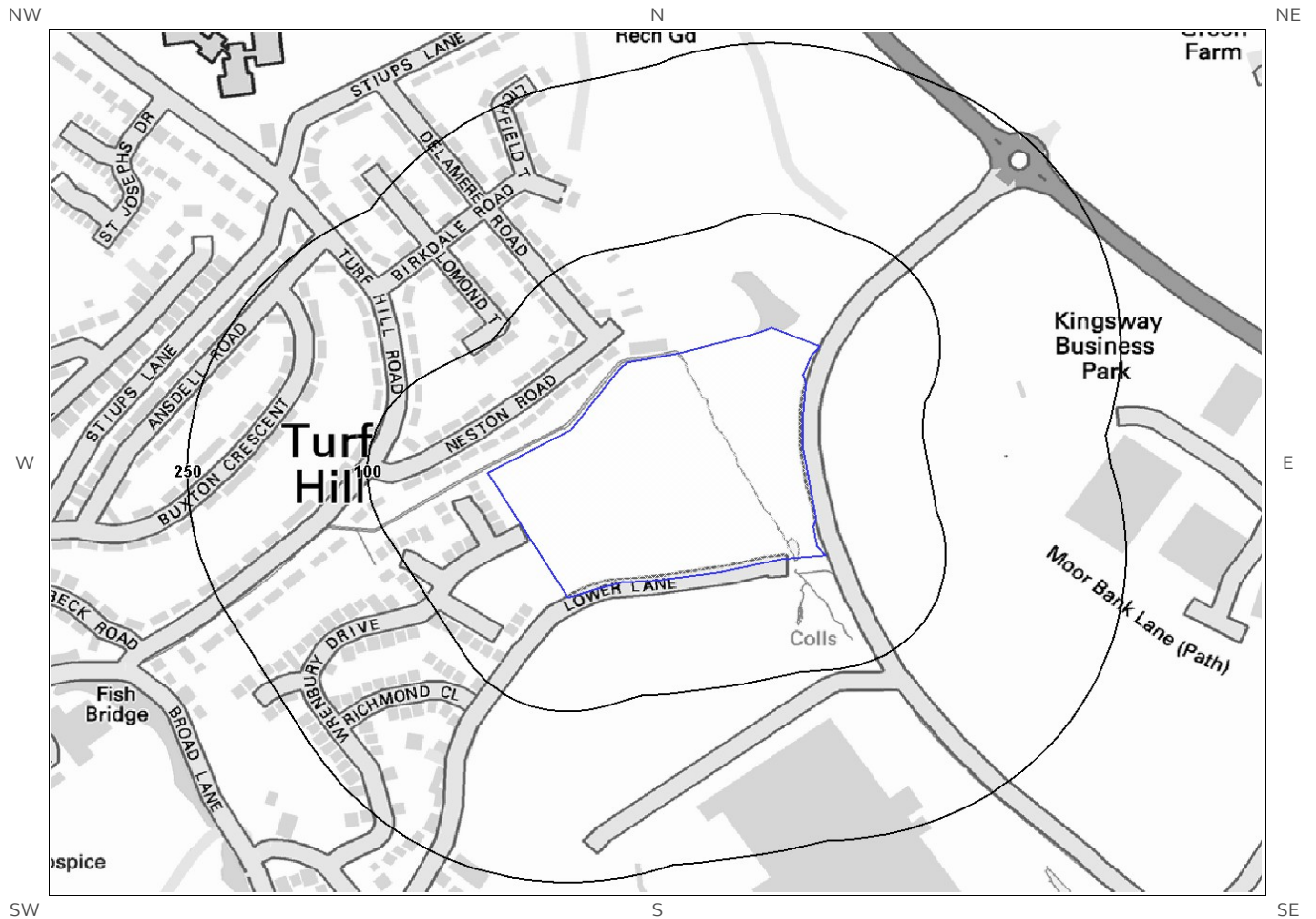
11

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	15 - 30 mg/kg	100 - 200 mg/kg
0.0	On Site	Sediment	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	100 - 200 mg/kg
0.0	On Site	Sediment	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	100 - 200 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	100 - 200 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	100 - 200 mg/kg
27.0	E	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
31.0	E	Sediment	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
35.0	E	Sediment	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
38.0	SW	Sediment	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	100 - 200 mg/kg
39.0	S	Sediment	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	100 - 200 mg/kg
40.0	S	Sediment	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	100 - 200 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

9 Railways and Tunnels Map



Railways and Tunnels Legend

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	Site Outline		Underground or Partially Underground Railway / Subway System		Railway Track (OpenStreetMap)
	Search Buffers (m)		Railway Tunnel (OS Mapping)		High Speed 2
	250		Abandoned or Dismantled Railway (OpenStreetMap)		High Speed 2 Revised Proposed Route
	500		Railway Track (OS Mapping)		Crossrail 1
					Railway and/or Tunnel Feature from Historical Mapping

9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? No

Have any historical railway or tunnel features been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project? No

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

Contact Details

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info@groundsure.com



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Fax: 0115 936 3276.
Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk



BGS Geological Hazards Reports and general geological enquiries

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British Gypsum Ltd
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The Coal Authority

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Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk



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<https://www.gov.uk/government/organisations/public-health-england>
Email: enquiries@phe.gov.uk
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<https://www.groundsure.com/terms-and-conditions-sept-2016/>

APPENDIX 3

HISTORICAL ORDNANCE SURVEY MAPPING

Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: County Series

Map date: 1851

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1848
Revised N/A
Edition 1851
Copyright N/A
Levelled N/A

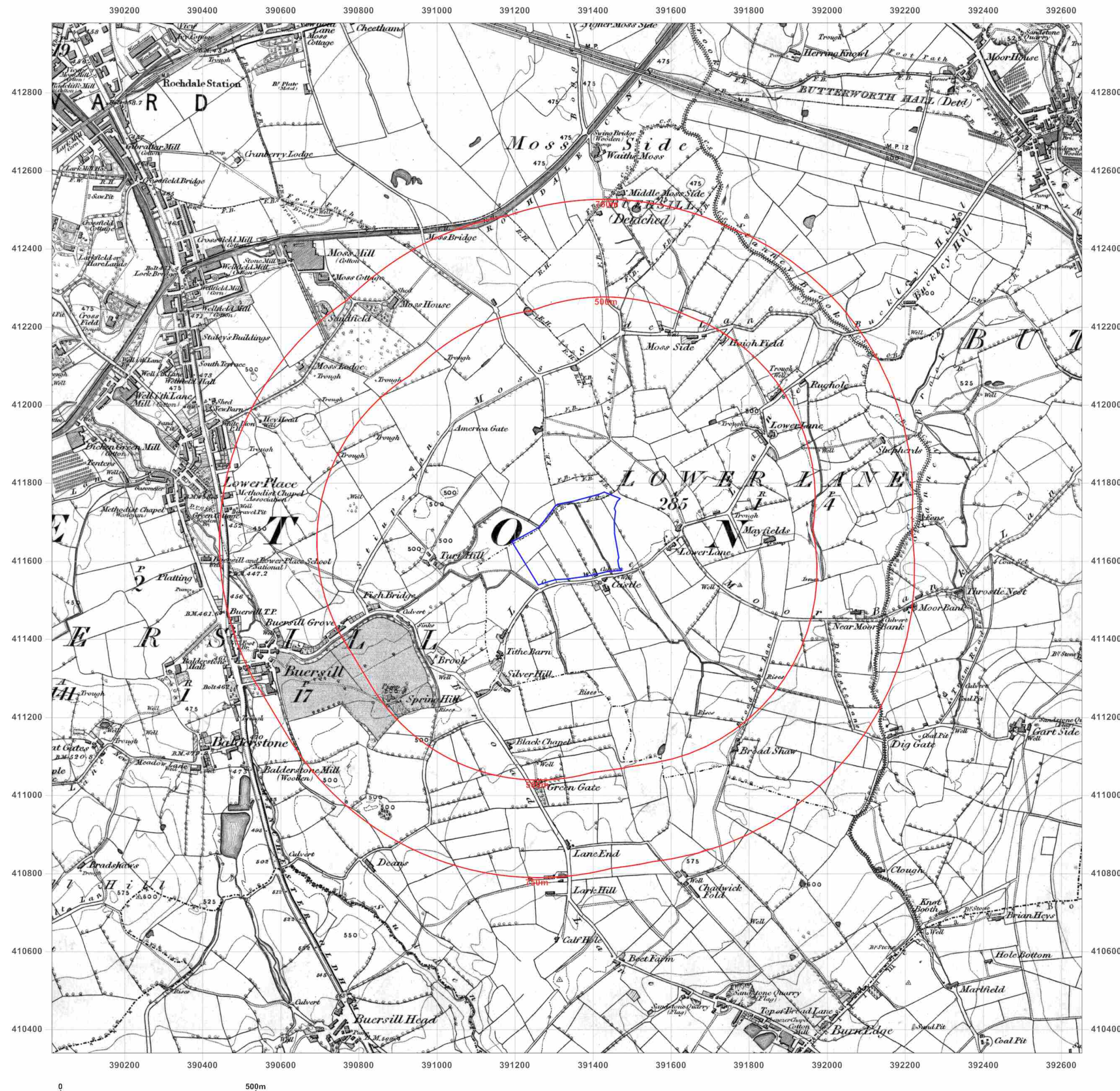


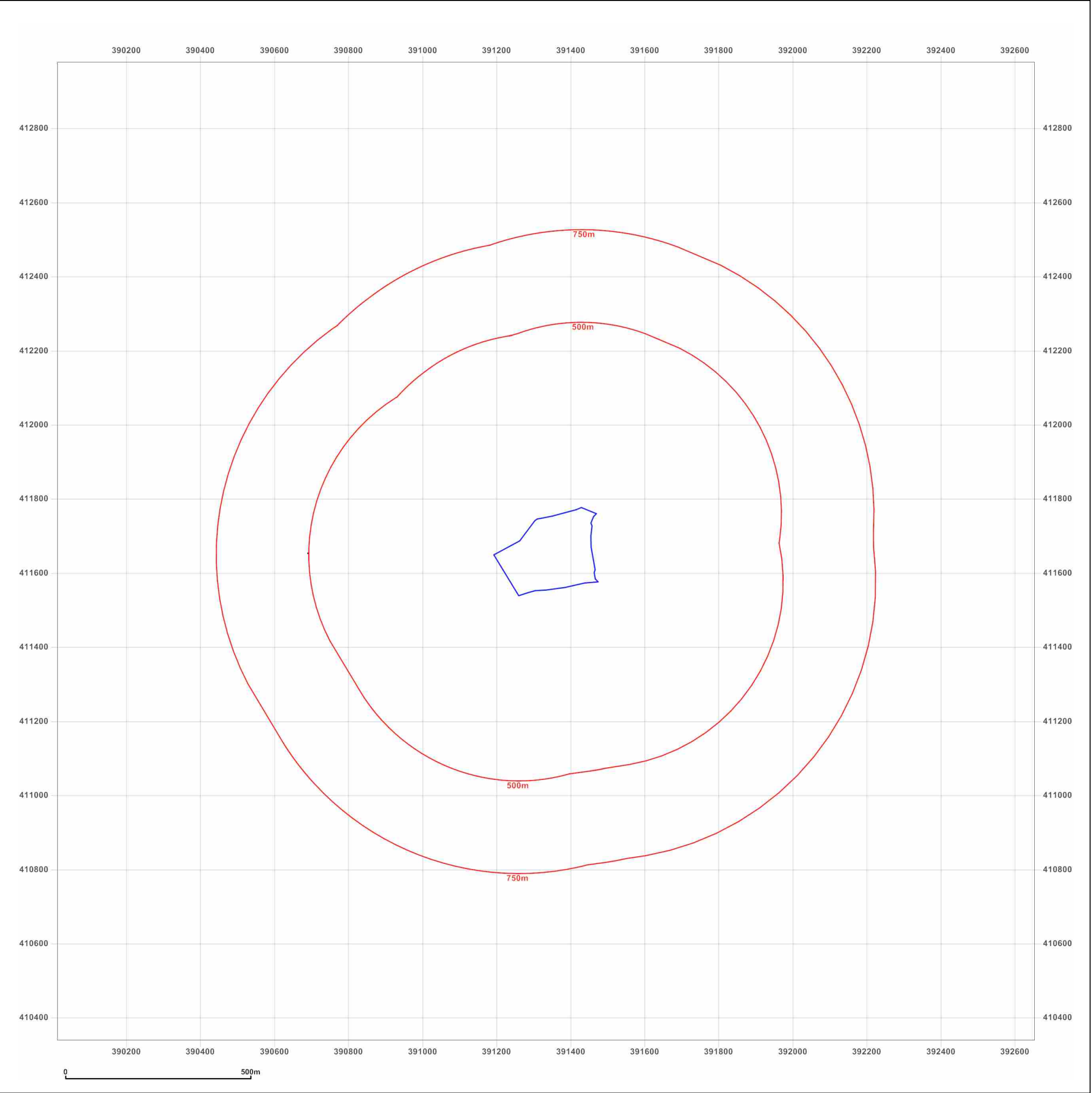
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W: www.groundsure.com

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Production date: 17 May 2017

To view map legend click here [Legend](#)





Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: County Series
Map date: 1854
Scale: 1:10,560
Printed at: 1:10,560



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: County Series

Map date: 1907-1908

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1848
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1907
Edition N/A
Copyright N/A
Levelled N/A

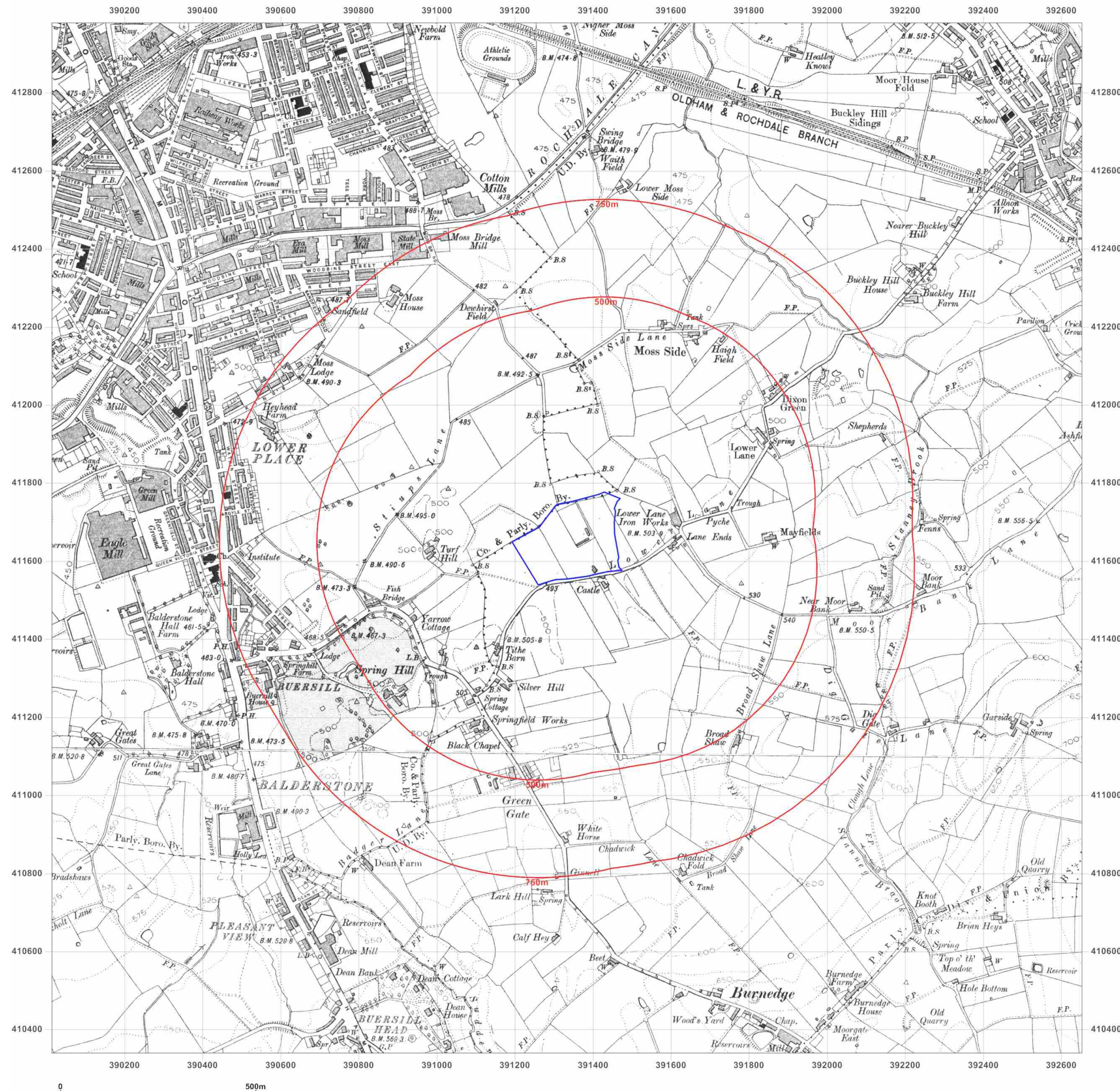


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Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: County Series

Map date: 1928

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1848
 Revised 1928
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1848
 Revised 1928
 Edition N/A
 Copyright N/A
 Levelled N/A

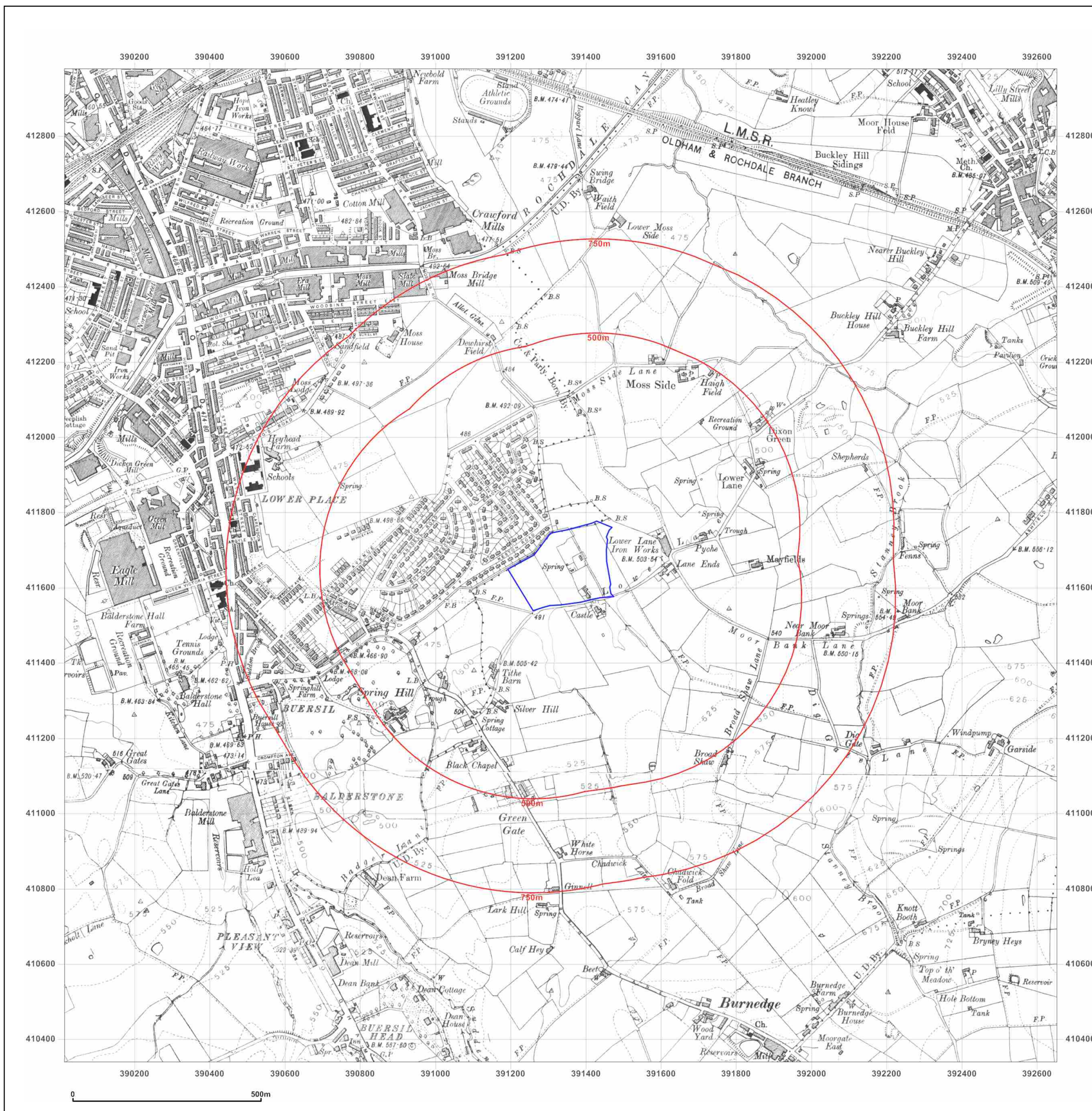


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Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



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Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

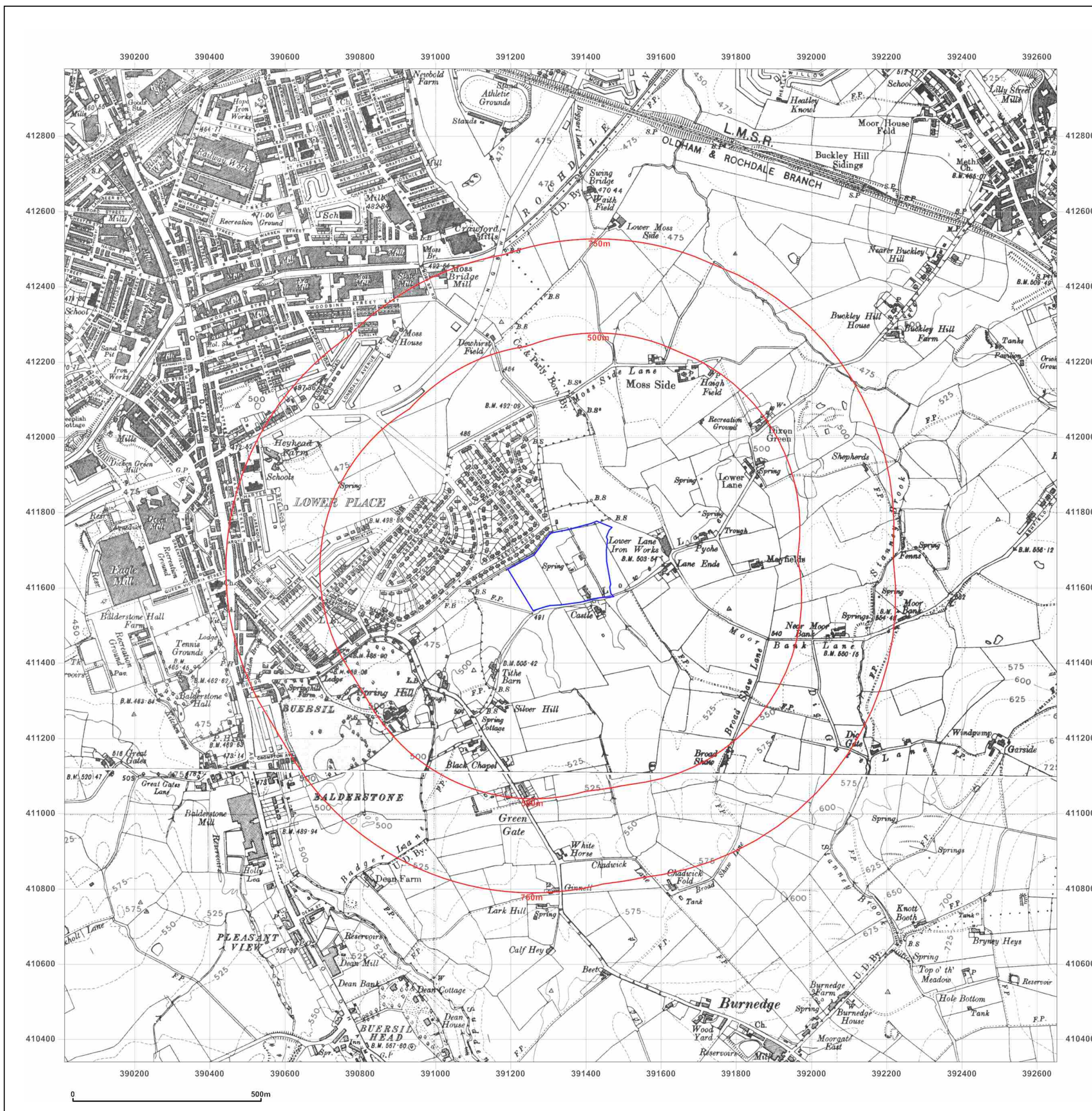


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Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: Provisional

Map date: 1954

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1954
Revised 1954
Edition N/A
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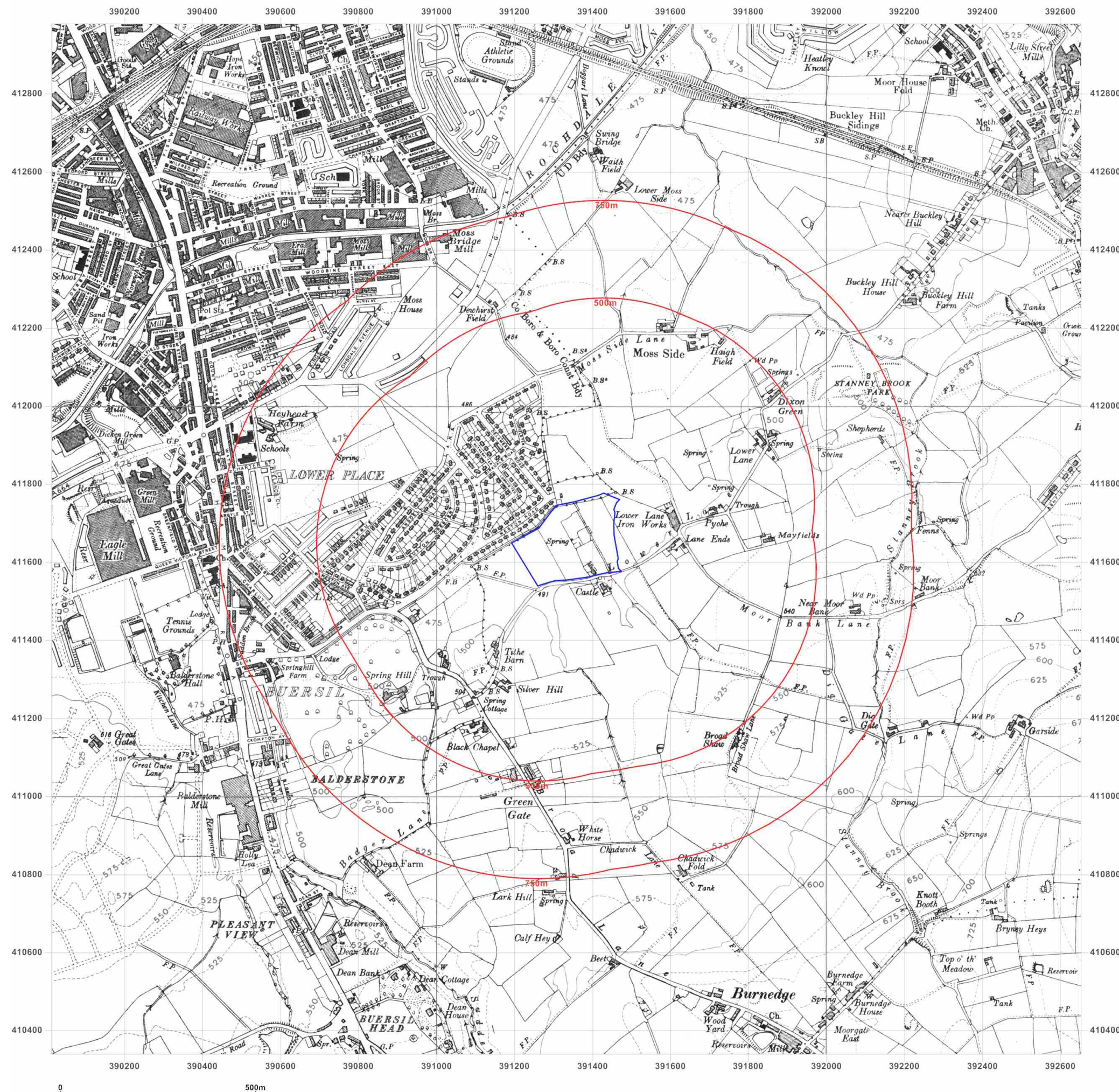


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Production date: 17 May 2017

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Site Details:

391352 411646

Client Ref: POR010967_Plot_L_Rochdale
Report Ref: HMD-214-3887196
Grid Ref: 391332, 411658

Map Name: Provisional

Map date: 1967

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1967
 Revised 1967
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