Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Volume 6

Proposed Ribble Crossing

Appendix 11.1 Geotechnical and Geo-environmental Site Briefing (Desk Study) Report

June 2021

United Utilities

Water for the North West

Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

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Contents

1 INTRODUCTION

1.1 Background to the Project and Development Proposals

This report has been prepared to support the Proposed Ribble Crossing section of the Haweswater Aqueduct Resilience Programme (HARP). For full details on the HARP project, reference should be made to the Environmental Statement and planning submission for the scheme. A summary of proposals related to this site is set out below.

The current development proposals are to construct a temporary two-lane haul road and associated crossing across the River Ribble between Clitheroe and West Bradford to divert construction traffic from the villages of Waddington, Grindleton and Chatburn. The proposed haul road is approximately 1.5 km long and follows a general northwest-southeast alignment. It is proposed that the temporary haul road will be removed, and the land reinstated upon completion of the wider Haweswater Aqueduct Resilience Programme.

1.2 Legal and Planning Context

In order to meet the planning requirements set out in Section 11 of the National Planning Policy Framework (NPPF) 2019), an initial conceptual model has been prepared. This assesses potential risks at the proposed development from ground and water contamination that may have occurred as a result of historical and/or current use of the site and the surroundings.

The site characterisation has been undertaken in general accordance with the procedures identified within the Environment Agency (EA) guidance Land Contamination: Risk Management.

1.3 Report Objective

The aim of this report is to undertake a desk-based review of available information to develop an initial conceptual model of the site in order to establish whether or not there are potentially unacceptable risks posed by contamination resulting from the historical or current uses of the site and surrounding area.

This report utilises publicly available data, along with data sourced from various providers including the Environment Agency, the Local Authority, the British Geological Survey (BGS), the Coal Authority and Ordnance Survey. This has allowed characterisation of the site with respect to its geology, hydrology, hydrogeology, history and environmental setting. Refer to Section 6 for details of the references used.

The scope of this study is as follows.

- Undertake a study of background information to understand the history of the site;
- To carry out an appraisal of the local geological/hydrogeological records;
- To obtain environmental information regarding the site and its local area;
- To identify gaps and provide proposals for additional site investigation works; and
- To develop an initial conceptual model.

1.4 Previous Reports

No previous reports have been made available for review.

1.5 Site Ownership

It is understood that the land is currently tenanted and used for agricultural purposes.

2 DESCRIPTION OF SITE

2.1 Site Description

The Proposed Ribble Crossing ('the site') comprises an irregular shaped parcel of land approximately 30 Ha in extent which is located to the east of Waddington and southwest of West Bradford, Lancashire as shown on Figure 1. The site is accessed via West Bradford Road to the north (E: 373345 N: 443999) and to the southeast (E: 374505 N: 443833) with the purpose of the development to create a new haul road to divert construction traffic away from the existing road network and surrounding villages. The proposed crossing will cross the River Ribble at E: 374397 N: 443873.

Within this report, the study area comprises a 250 m buffer around the red line planning boundary as shown on Figure 1. However, it should be noted that the development of the Proposed Ribble Crossing haul road and bridge across the River Ribble is smaller in extent (approximately 5 Ha.) than the planning boundary (approximately 30 Ha.).

The current land use comprises agricultural land with limited associated farm buildings. There is a slight variation in topography across the site. The elevation is slightly higher in the north at approximately 74 m Above Ordnance Datum (AOD) sloping to approximately 59 m AOD in the centre and to 66 m AOD in the south. It is anticipated that the Proposed Ribble Crossing haul road would be built relatively at grade, and large cut and fill operations are not anticipated.

2.2 Site Walkover Inspection / or Site Access

A site walkover/inspection has not been undertaken as part of this report. The subsequent information has been collated from desk-based sources, such as aerial imagery and maps.

2.3 Vegetation (if any)

From a review of aerial imagery, it is not anticipated that there will be a significant amount of vegetation outside of trees and hedgerows, which are mainly located at field boundaries or the edges of watercourses. It is not possible to assess the potential for encountering potential invasive species (Japanese Knotweed, Giant Hogweed etc.) using these sources.

2.4 Buildings / Structures (if any)

From aerial imagery, the only building/structure within the study area is a small farm building.

2.5 Underground and Above ground Storage Tanks

No underground or above ground storage tanks have been identified within the study area from current mapping or aerial imagery.

Historical tanks have been identified within the study area using data included within the Groundsure report. The locations of historical tanks have been outlined in Section 3.

2.6 Site Surroundings

The study area is set in a mainly agricultural setting with other surrounding land uses including residential housing and some industrial land use to the south and southeast. The site surroundings are detailed in Table 2.1.

Table 2.1 - Surrounding land uses

Direction	Surrounding land use
North	West Bradford Road with agricultural land and residential houses beyond
Northeast	A primary school, residential houses and agricultural land with associated buildings

Direction	Surrounding land use
East	West Bradford village with agricultural land beyond
Southeast	The River Ribble with cement works, an industrial park and quarries beyond
South	The River Ribble with agricultural land beyond
Southwest	Agricultural land with farmhouse/farm buildings beyond
West	Waddington village with agricultural land beyond
Northwest	Waddington village with agricultural land beyond

3 SITE HISTORY

A review of historical maps and historical land uses data obtained as part of the Groundsure report has been undertaken and a summary of pertinent features have been outlined in Table 3.1 and are shown on Figure 2 and Figure 3. Whilst features have been identified within the study area, these are all outside the red line boundary of the Proposed Ribble Crossing planning application area.

Table 3.1 - Historical features within the study area

Easting/Northing	Historical Feature (Date)	Location
E: 373869 N: 443911	Waddington Works (Brick and Tile) (1884)	In centre of study area – off-site (60m north)
E: 373875 N: 443824	Unspecified Tanks (1884)	In centre of study area – off-site (60m north)
E: 373844 N: 443904	Unspecified Pits (1910)	In centre of study area – off-site (60m north)
E: 373869 N: 443911	Brick and Tile Works (1910)	In centre of study area – off-site (60m north)
E: 373875 N: 443824	Unspecified Tanks (1930)	In centre of study area – off-site (60m north)
E: 373858 N: 444007	Unspecified Ground Workings (1971)	In centre of study area – off-site (60m north)
E: 374719 N: 443631	Unspecified Tanks (1955)	In southeast of study area – off-site (210m southeast)
E: 374740 N: 443688	Railway Sidings (1955)	In southeast of study area – off-site (145m southeast)
E: 374693 N: 443708	Lime Works (1955)	In southeast of study area – off-site (180m southeast)
E: 374644 N: 443702	Unspecified Works (1971)	In southeast of study area – off-site (145m southeast)
E: 374647 N: 443564	Lime Kiln (1846) shown as Old Lime Kiln (1932)	In southeast of study area – off-site (230m southeast)
E: 374666 N: 443562	Unspecified Heap (1910)	In southeast of study area – off-site (230m southeast)
E: 374651 N: 443551	Unspecified Ground Workings (1955)	In southeast of study area – off-site (230m southeast)
E: 374705 N: 443769	Unspecified Tank (1964)	In southeast of study area – off-site (160m southeast)
E: 374740 N: 443621	Tanks (1984)	In southeast of study area – off-site (210m southeast)
E: 374753 N: 443644	Unspecified Tank (1976)	In southeast of study area – off-site (210m southeast)
E: 374740 N: 443621	Tanks (1988)	In southeast of study area – off-site (210m southeast)
E: 374740 N: 443621	Tanks (1997)	In southeast of study area – off-site (210m southeast)
E: 372985 N: 443955	Joiners Yard (1966)	In northwest of study area – off-site (200m west)
E: 374553 N: 444174	Electricity Sub-Station (1967)	In northeast of study area – off-site (90m northeast)
E: 374703 N: 443588	Electricity Sub-Station (1976)	In southeast of study area – off-site (230m southeast)
E: 374437 N: 444357	Gas Governor (1993)	In northeast of study area – off-site (250m northeast)

Aside from the areas noted above which are relatively limited in geographical extent, the study area has been relatively undeveloped and has remained in agricultural use since the first available historical maps.

4 SITE SERVICES

Site service plans have not been obtained for this report.

5 GROUND CONDITIONS

The following section presents the geological setting of the study area based on available published information. The superficial geology is presented in Figure 4 and the bedrock geology is presented in Figure 5.

5.1 Made Ground

BGS 1:50 000 mapping does not record any made ground within the study area. Given the relatively undeveloped nature of the area, any localised made ground deposits are likely to be relatively minor associated with agricultural development and roads.

5.2 Superficial Geology

BGS 1:50 000 mapping records the superficial geology within the study area as:

- Alluvium;
- River Terrace Deposits;
- Hummocky (moundy) glacial deposits
- Glacial Till; and
- Glaciolacustrine deposits.

5.3 Alluvium

Alluvium is recorded running in a channel from north to south, associated with the Coplow Brook watercourse, and in another channel from southwest to northeast, associated with the River Ribble. The alluvium directly underlies the Proposed Ribble Crossing as it crosses the land either side of the River Ribble. The alluvium is anticipated to comprise clay, silt, sand and gravel with varying organic content.

5.4 River Terrace Deposits

River terrace deposits are recorded in the north and northeast of the study area, but not directly underlying the Proposed Ribble Crossing itself. These deposits are anticipated to comprise sand and gravel, locally with lenses of silt, clay or peat.

5.5 Hummocky (moundy) Glacial Deposits

Isolated areas of hummocky (moundy) glacial deposits are recorded in the north and central extents of the study area, but not directly underlying the Proposed Ribble Crossing itself. These deposits are anticipated to be poorly sorted and vary in composition with particle sizes ranging from clay to boulders.

5.6 Glacial Till

Glacial till is recorded in northern and southeast extents of the study area, directly underlying isolated areas in the north and southeast of the Proposed Ribble Crossing. These deposits are anticipated to be poorly sorted and vary in composition with particle sizes ranging from clay to boulders.

5.7 Glaciolacustrine Deposits

Glaciolacustrine deposits are recorded across the study area in the western and central extents, directly underlying the Proposed Ribble Crossing in the west. These deposits are anticipated to comprise clay and silt.

5.8 Bedrock Geology

The bedrock underlying the majority of the study area comprises carboniferous limestone and mudstone of the Clitheroe Limestone Formation and Hodder Mudstone Formation. A small area in the southeast of the study area is underlain by carboniferous limestone bedrock of the Chatburn Limestone Formation. The bedrock within the study area is shown in Figure 5.

5.9 Previous Investigation

There are no historical BGS boreholes within the site to confirm the above. At the time of reporting there were no known previous reports or ground investigation data within the vicinity of the study area.

6 ENVIRONMENTAL SETTING

The following sources have been referred to in order to identify the hydrological, hydrogeological and general environmental setting of the site:

- Groundsure report 151131_20210312, dated February 2021;
- GOV.UK Flood map for planning website [accessed February 2021] https://flood-map-for-planning.service.gov.uk/;
- HSE COMAH 2015 Public Information Search [accessed February 2021] http://www.hse.gov.uk/comah/index.htm;
- MAGIC website [accessed February 2021] http://magic.defra.gov.uk;
- Zetica UXO Unexploded Bomb Risk Map website [accessed February 2021] https://zeticauxo.com/downloads-and-resources/risk-maps/; and
- BGS website and online map viewers [accessed February 2021] https://www.bgs.ac.uk/geoindex/

6.1 Hydrogeology

Aquifer designations from the EA indicate the following are present beneath the site:

- Alluvium – Secondary A;
- River Terrace Deposits – Secondary A;
- Glacial Till – Secondary (Undifferentiated);
- Hummocky (moundy) glacial deposits – Secondary (Undifferentiated);
- Glaciolacustrine deposits – Unproductive Strata;
- Clitheroe Limestone Formation and Hodder Mudstone Formation – Secondary A bedrock aquifer; and
- Chatburn Limestone Formation – Secondary A bedrock aquifer.

No groundwater abstractions have been identified within the study area. Given the semi-rural location, there is the potential that properties could have private water supplies.
The MAGIC website indicates that groundwater vulnerability of the aquifers underlying the study area is medium, medium-low and low, with a ‘soluble rock risk’ being present underlying the entirety of the study area. Medium groundwater vulnerability is classified as areas that offer some groundwater protection. The definitions of these ranking are:

- **Low**: areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low-leaching soils and/or the presence of low-permeability superficial deposits.
- **Medium**: areas that offer some groundwater protection. Intermediate between high and low vulnerability.
- **Soluble rock risk**: areas where solution features that enable rapid movement of a pollutant may be present.

The Proposed Ribble Crossing is not located within a Groundwater Source Protection Zone.

6.2 Hydrology

The following surface water features have been identified within the study area and are shown on Figure 3:

- Coplow Brook – running approximately north-south towards the River Ribble and crossed by the Proposed Ribble Crossing;
- Greg Sike – running approximately north-south towards the River Ribble and crossed by the Proposed Ribble Crossing;

- Moor Roads Sike – running approximately northeast-southwest towards the River Ribble, located in the east of the study area, but not crossed by the Proposed Ribble Crossing;
- River Ribble – runs along the southern boundary of the Proposed Ribble Crossing and crossed by the development in the southeast;
- Waddington Brook – running approximately north-south towards the River Ribble in the west of the study area; and
- West Bradford Brook/Porters Brook – running approximately north-south towards the River Ribble in the east of the study area.

There are an additional three unnamed watercourses located in the east and southeast of the study area.

6.3 Flooding

An area of flooding has been identified which runs approximately southwest to northeast across the study area. This area is identified as Flood Zone 3, with outer areas classified as Flood Zone 2. The risk of flooding within these flood zones from rivers ranges from Low to High, with the areas of High flood risk being prominent in the immediate vicinity of the River Ribble and the watercourses running towards the River Ribble.

6.4 Recent Industrial Land Use

Recent industrial land uses have been identified within the study area and outlined in Table 6.1. The recent industrial land uses are shown on Figure 3.

Table 6.1 - Recent industrial land uses within study area

Easting/Northing	Location	Category	Description
E: 372962 N: 444036	In northwest of study area – off-site (220 m northwest)	Farming	Livestock Farming
E: 374348 N: 444347	In northeast of study area – off-site (250 m north)	Infrastructure and Facilities	Electricity Sub Station
E: 374451 N: 444376	In northeast of study area – off-site (250m northeast)	Infrastructure and Facilities	Gas Governor Station
E: 374522 N: 444179	In east of study area – off-site (80 m northeast)	Industrial Features	Water Pumping Station
E: 374694 N: 443672	In southeast of study area – off-site (170 m southeast)	Industrial Products	Hanson – Concrete Products
E: 374729 N: 443612	In southeast of study area – off-site (230m southeast)	Infrastructure and Facilities	Electricity Sub Station

6.5 Discharge Consents

Four discharge consents have been identified within the study area. Table 6.2 provides a summary of these consents and their locations are shown on Figure 3.

Table 6.2 - Discharge consents within the study area

Easting/Northing	Location within study area	Operator	Discharge Type	Receiving Water
E: 373505 N: 443991	In north of the study area – on-site	Healings Farm	Sewage discharges (final/treated effluent) (historical)	School Brook (River Ribble)

Easting/Northing	Location within study area	Operator	Discharge Type	Receiving Water
E: 374558 N: 444204	In northeast of the study area – off-site (125 m northeast)	Unknown	Sewage discharges – Pumping Station Water Company	West Bradford Brook
E: 374519 N: 443989	In east of study area – off-site (30 m east)	Castle Cement Ltd	Trade discharges – unspecified (revoked and replaced by IPC authorisation)	River Ribble
E: 374491 N: 443929	In east of study area – on-site	Castle Cement Ltd	Trade discharges – process effluent (revoked – unspecified)	River Ribble

6.6 Pollution Incidents

Four recorded pollution incidents to controlled waters and land have been identified within the study area. Table 6.3 details the incidents which are shown on Figure 3.

Table 6.3 - Pollution incidents to controlled waters within the study area

Easting/ Northing	Location within study area	Category	Pollutant/Cause	Receiving Water	Comments
E: 374449 N: 444333	In northeast of study area – off-site (225 m northeast)	Category 2 – Significant	Contaminated Water/Firefighting Run-Off	Porters Brook	Category 3 – Minor to land
E: 374399 N: 444354	In northeast of study area – off-site (250 m northeast)	Category 2 – Significant	Pollutant not identified	Porters Brook	Category 4 – No impact to land
E: 374388 N: 444354	In northeast of study area – off-site (250 m northeast)	Category 2 – Significant	Other pollutant	Porters Brook	Category 4 – No impact to land
E: 374344 N: 444332	In northeast of study area – off-site (245 m northeast)	Category 3 – Minor	Sewage Materials/Crude Sewage	Porters Brook	Category 4 – No impact to land

6.7 Waste and Minerals

The following information relating to waste and minerals is shown across Figure 2 and Figure 3.

There is one recorded historical landfill located within the study area, namely Waddington Brickworks, located approximately 60 m north of the site. It is understood that this landfill accepted household waste, however no further details relating to the site were available at the time of reporting.

There is one Licenced Waste Site within the study area, namely Circle North West Limited, located approximately 250 m northwest of the site. This site is licenced to accept household, commercial and industrial waste.

There are four waste exemptions within the study area, which are summarised in Table 6.4.

Table 6.4 - Waste exemptions within the study area

Easting/Northing	Location within study area	Description
E: 373892 N: 444154	Within north of study area – off-site (170 m northeast)	Use of waste for a specified purpose
E: 374512 N: 443718	Within southeast of study area – off-site (<5 m south)	Storage of sludge; non-agricultural waste only
E: 374516 N: 443723	Within southeast of study area – off-site (<5 m south)	Spreading waste on agricultural land to confer benefit; non-agricultural waste only
E: 374556 N: 443729	Within southeast of study area – off-site (20 m south)	Spreading waste on agricultural land to confer benefit; on a farm

There is one historical quarry identified within the study area, approximately 60 m north of the site, this is listed as Unspecified Ground Workings, and also a Brick and Tile Works. A point within this boundary is also mapped as a surface mineral working, which has ceased to extract minerals and may be considered closed by the operator. This feature is mapped at the same location of the Waddington Brickworks historical landfill.

An historical mineral planning area is located within the study area, approximately 230 m east of the site, namely Lane Head, relating to a surface mineral working for limestone and shale. Consultation enquires with local and county officers in respect of waste and minerals have been made and at the time of writing responses have not been received.

6.8 Environmental Permits

There are no recorded environmental permits within the study area.

6.9 Sensitive Land Uses

Cross Hill Quarry in the south of the study area is designated as a Local Nature Reserve.

6.10 Radon

The study area crosses four different radon potential areas. The majority of the study area is within an area whereby the maximum radon potential is 1-3%. Areas in the north of the study area are within an area where the maximum radon potential is 3-5%. An area in the southeast of the study area is within an area where the maximum radon potential is between 5-10%. An area surrounding the River Ribble is within an area of elevated radon potential where the maximum radon potential is 10-30%.

6.11 Unexploded Ordnance (UXO)

The Zetica Unexploded Bomb Map (Zetica, 2021) indicates that site is at low risk, which is defined as having 15 bombs per 1000 acres or less.

6.12 Control of Major Accident Hazards (COMAH)

The Health and Safety Executive website indicates that no COMAH sites are located within the study area. The closest is approximately 330 m south of the study area associated with the Pimlico Industrial Area and is for the manufacturing of chemicals.

7 INITIAL CONCEPTUAL MODEL

7.1 General

Implications of potential contamination are assessed through the development of a conceptual model which uses source-pathway-receptor methodology in accordance with EA Land Contamination: Risk Management.

Historical maps indicate that the site has been relatively undeveloped since the earliest available mapping. There are a number of small-scale features located within the study area, with the most significant being the historical landfill at Waddington Brick and Tile Works. Made ground may exist in localised area associated with the use of the site for agricultural purposes and the local road network.

The land surrounding the study area mainly comprises small villages with residential properties and agricultural use. Land uses to the south and southeast comprise more developed, industrial use with the town of Clitheroe and an industrial estate, cement works and a quarry beyond.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

a) Source, i.e. a substance that is capable of causing pollution or harm to a receptor;
b) Receptor, i.e. something which could be adversely affected by the contaminant; and
c) Pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing there can be no significant risk. If all are present a pollutant linkage exists and the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

7.2 Preliminary Contamination Assessment

The information presented below has been collated and evaluated qualitatively to develop an initial conceptual model for the site. The aim of the conceptual model is to present any plausible contaminant-pathway-receptor linkages (potential pollutant linkages) under the future development scenario which includes the haul road and proposed Ribble Crossing. The model will also identify potential environmental liabilities or constraints on the development associated with possible ground contamination.

7.3 Sources of Contamination

Table 7.1 details historical land uses that have been identified as potential sources of contamination.

Table 7.1 - Potential sources of contamination

Land Use	Potential Contaminants of Concern (PCoC)	Commentary
Historical landfill at Waddington Brick and Tile Works	Metals, inorganic compounds, hydrocarbons Ground gas generation: methane, carbon dioxide, hydrogen sulphide and carbon monoxide	The feature is within the study area, but outside the planning boundary. Therefore, the only relevant PCoC are those associated with migration of contaminated groundwater or gases beneath the site.
Agricultural land use/grazed land	Herbicides, pesticides, animal burials, pathogens and fuel	Maybe present in isolated locations across the site
Geological hazard	Radon	Only relevant within confined spaces

7.4 Receptors

A receptor can be either controlled waters (surface water or ground water), humans, ecological systems or property. Potential receptors at the site and in the study area are detailed in Table 7.2 – Potential Receptors.

Table 7.2 - Potential receptors

Potential Receptors	
Human health	Construction workers involved in excavations, material handling and water management during the works. Nearby residents and users of adjacent sites/land from airborne soil dusts during works. Future site users during the operational phase of the haul road, such as security staff. It is not anticipated that the haul road will be open to the public. Potable water supply to temporary security accommodation.
Controlled waters	Surface water features including the River Ribble. Groundwater in the superficial (Secondary A and Secondary Undifferentiated) and bedrock (Secondary A) aquifers.
Property receptors	Proposed below and above ground infrastructure (foundations, site cabins).

7.5 Pathways

There are a number of potential pathways that may allow the transport of contaminants to receptors. These are set out in Table 7.3 – Potential Pathways.

Table 7.3 - Potential pathways

Potential Pathways	
Human health	Direct contact with soil; Direct contact with indoor dusts backtracked to construction offices and nearby residential properties; Ingestion of soil and indoor dust; Inhalation of outdoor and indoor dust; and Inhalation of outdoor and indoor gases and vapours.
Controlled waters	Surface water run-off to nearby surface water features; Vertical/lateral migration via the unsaturated zone; Lateral migration of groundwater to surface water features; Vertical migration to underlying groundwater in the bedrock geology; and Preferential migration of dissolved phase contaminants along drains, cable ducts, pipes and/or associated bedding materials.
Property receptors	Direct contact with construction materials.

7.6 Potential Pollutant Linkages

Potential pollutant linkages have been identified which are considered to warrant further assessment. Tables 7.4 to 7.6 present the likelihood (in terms of 'likely', 'possible' or 'unlikely') of the various pathways linking the identified sources to the receptors.

Table 7.4 - Summary of potential pollutant linkages for human health

Potential Pollution Linkages	Metals	Organics	Inorganics	Pathogens	Asbestos	Ground Gases
Ingestion/inhalation of contaminated soils/dust	X	P	P	P	X	-
Direct contact with contaminated soil or groundwater	X	P	P	P	X	-
Inhalation of volatile compounds in soil or groundwater	-	X	-	-	-	-
Exposure to ground gases	-	-	-	-	-	P
Potable water supply	-	X	X	-	-	-

Table key: X = pollutant linkage unlikely, √ = pollutant linkage likely, P = pollutant linkage possible, - = not applicable

Table 7.5 - Summary of potential pollutant linkages for controlled waters

Potential Pollution Linkages	Metals	Organics	Inorganics
Leaching of soluble contaminants from soil and groundwater within the unsaturated and saturated zone	P	P	P
Lateral and vertical migration of soluble contaminants within groundwater to surface water bodies	P	P	P
Vertical migration to underlying groundwater in the bedrock geology	P	P	P
Preferential migration of dissolved phase contaminants along drains, cable ducts, pipes and/or associated bedding materials	P	P	P

Table key: X = pollutant linkage unlikely, √ = pollutant linkage likely, P = pollutant linkage possible, - = not applicable

Table 7.6 - Summary of potential pollutant linkages for property receptors

Potential Pollution Linkages	Inorganics	Organics	Ground Gases
Direct contact with construction materials (foundations, site cabins)	P	P	P

Table key: X = pollutant linkage unlikely, √ = pollutant linkage likely, P = pollutant linkage possible, - = not applicable

8 CONCLUSION / RECOMMENDATIONS

The initial conceptual site model demonstrates that there are potential pollutant linkages that may pose a risk to human health and the environment. In order to gain a better understanding of these potential risks it is recommended that an intrusive ground investigation be undertaken.

Any intrusive ground investigation would aim to further characterise the geological and hydrogeological regime within the footprint of the proposed works. This would include sampling of soil and groundwater for subsequent geoenvironmental testing, targeting any potential contaminants of concern.

Please note that due to location of the historical landfill at Waddington Brick and Tile Works, outside the planning boundary, no intrusive works are proposed to be undertaken in this area because there will be no direct disturbance of this site by the proposed works. Sampling of groundwater and ground gases from within the footprint of the works are recommended to identify whether migration of contamination has occurred from the former landfill site.

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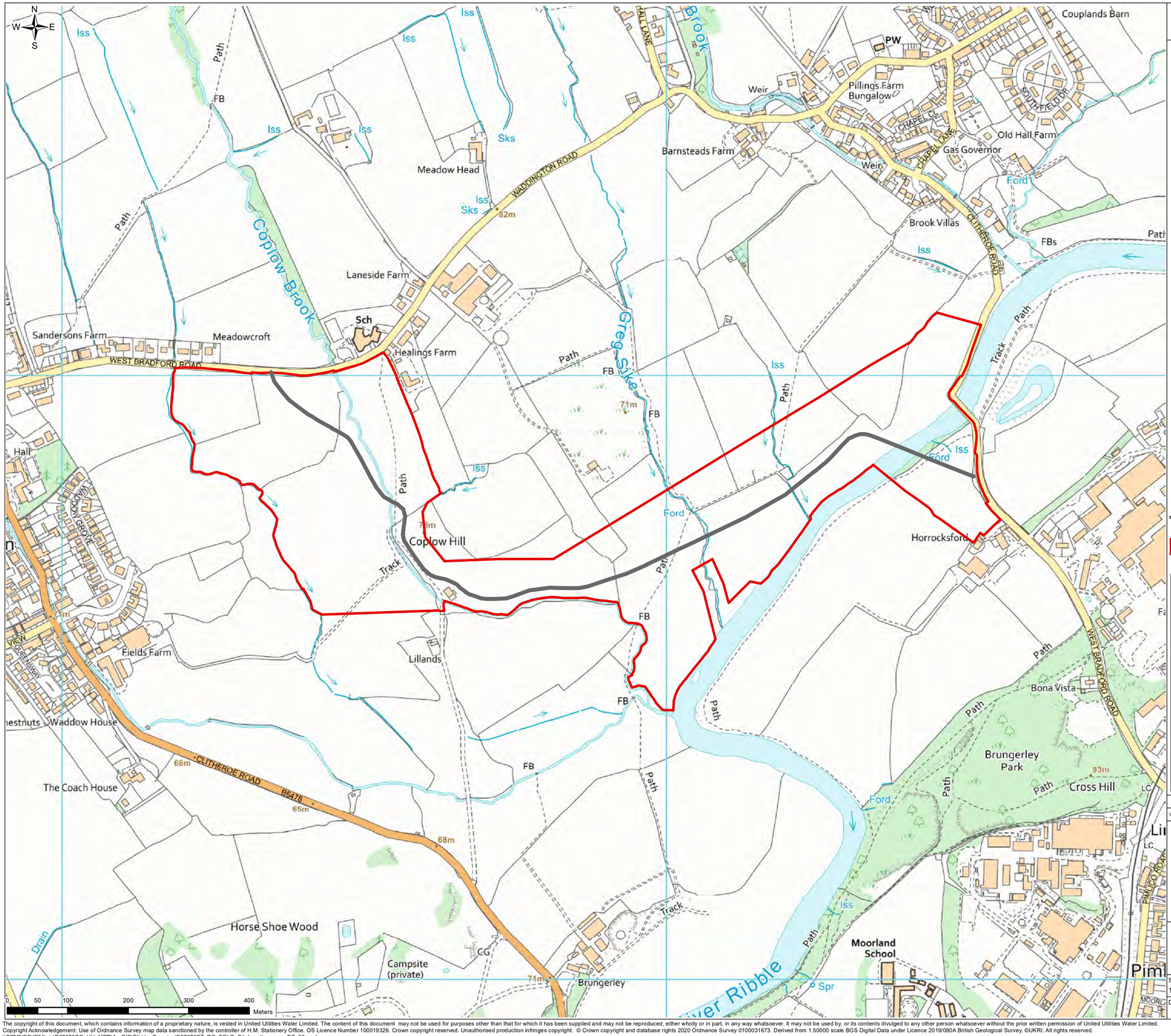
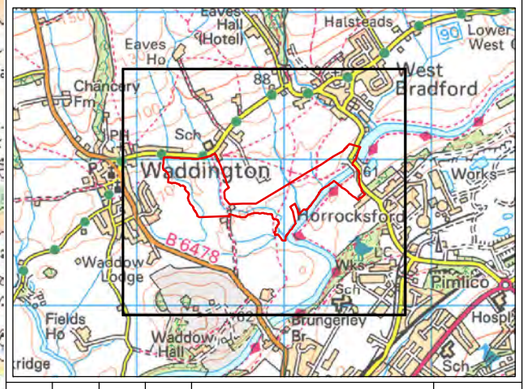
FIGURES

SITE LOCATION MAP



Legend

- Centreline
- Environment Assessment Area



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SCALE	SHEET SIZE
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DRAWING NUMBER: DESK STUDY - FIGURE 1	REVISION: 0

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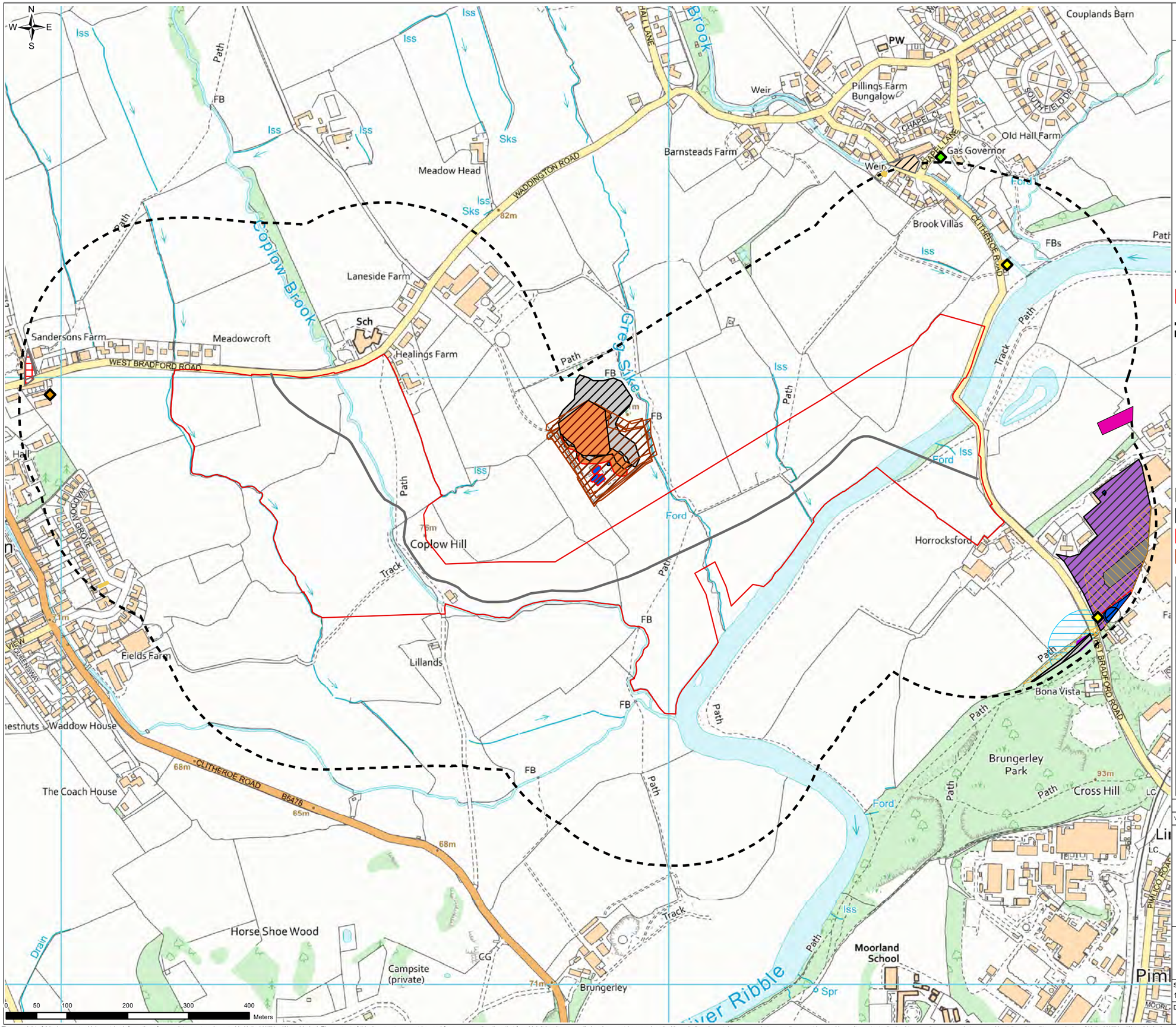
HISTORICAL FEATURES



Legend

- Centreline
- Environment Assessment Area
- Environmental Assessment Area (250m Buffer)

Historic Map Analysis Data

Type

- Electricity Substation
- Gas Governor
- Joiners Yard

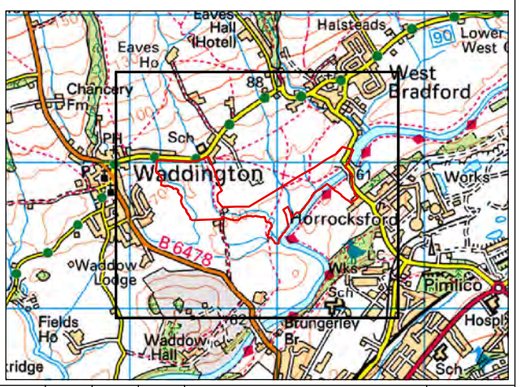
Historic Landuse

Land Use type

- Tanks
- Unspecified Tank
- Unspecified Tanks
- Brick and Tile Works
- Hospital
- Cotton Mill
- Lime Kiln
- Lime Works
- Old Lime Kiln
- Railway Sidings
- Unspecified Ground Workings
- Unspecified Heap
- Unspecified Mill
- Unspecified Pit
- Unspecified Pits
- Unspecified Works

Mineral Planning Type

- Surface mineral working, Limestone and shale



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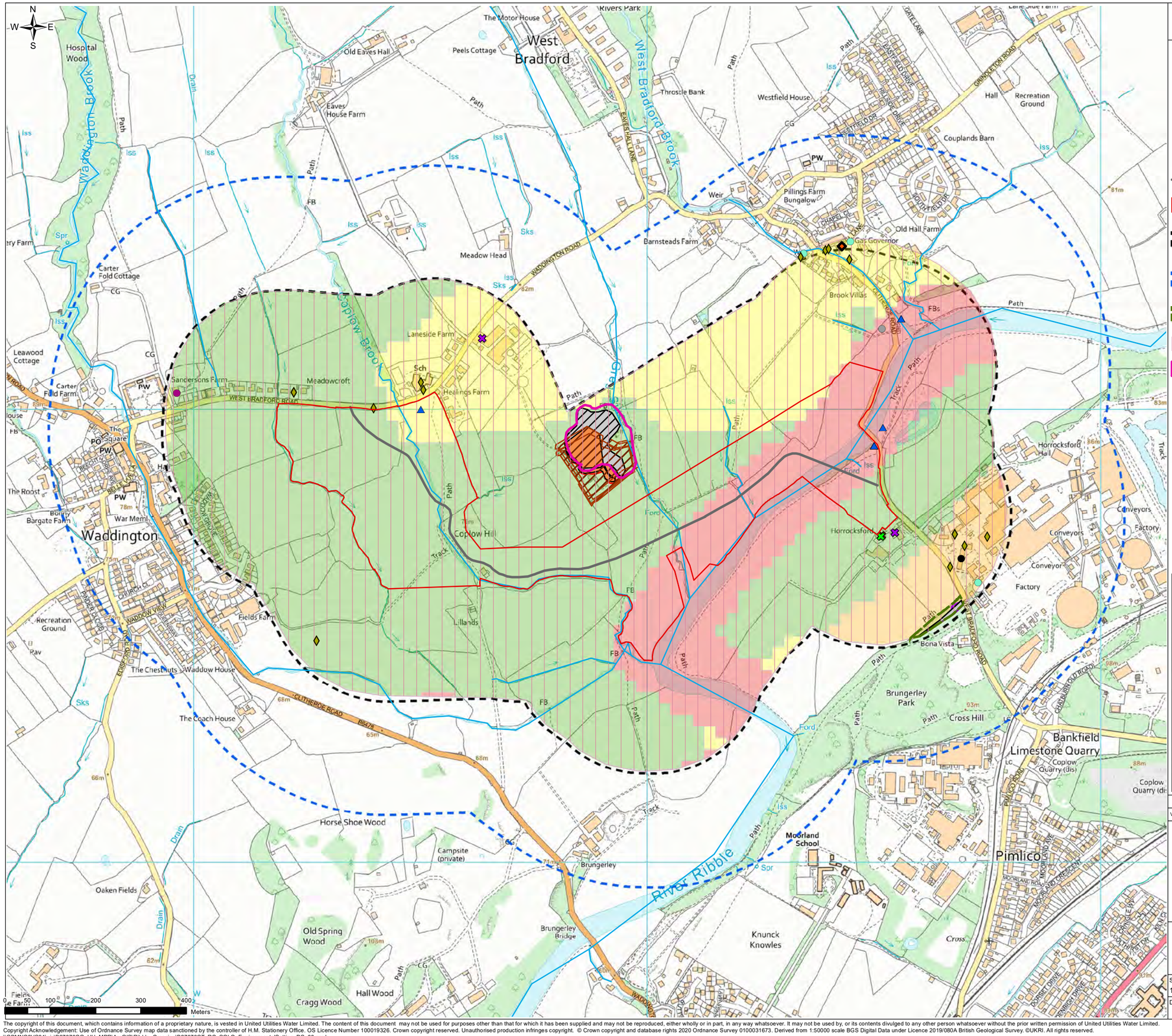
ENVIRONMENTAL SETTING



Legend

- Centreline
- Environment Assessment Area
- Environmental Assessment Area (250m Buffer)
- Environmental Assessment Area (500m Buffer)
- Local Nature Reserves (LNR)
- Site of Special Scientific Interest (SSSI)
- Historic Landfill
- Licensed Discharge To Controlled Waters
- Pollution Incidents
- Licensed Waste Sites

Recent Industrial Land Uses

- Farming
- Industrial Features
- Industrial Products
- Infrastructure and Facilities

Waste Exemptions

- Agricultural Waste Only
- Both agricultural and non-agricultural waste
- Non-Agricultural Waste Only
- On a Farm
- Existing Watercourses

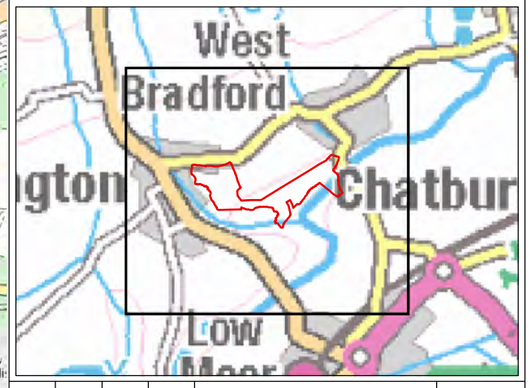
Surface Ground Workings

- Brick and Tile Works
- Unspecified Ground Workings
- Unspecified Heap
- Unspecified Pit
- Unspecified Pits

BGS Radon PHE

Radon % Band

- 1-3
- 3-5
- 5-10
- 10-30



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ENVIRONMENTAL SETTING
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SCALE	SHEET SIZE
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DRAWING NUMBER: DESK STUDY - FIGURE 3	REVISION: 0

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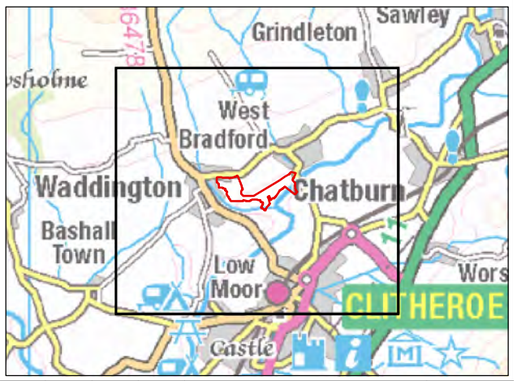
SUPERFICIAL GEOLOGY

Legend

- Centreline
- Environment Assessment Area
- Environmental Assessment Area (250m Buffer)
- Environmental Assessment Area (500m Buffer)

Superficial Deposits

- Alluvium - Clay, silt, sand and gravel
- Glaciolacustrine Deposits, Devensian - Clay and silt
- Hummocky (Moundy) Glacial Deposits, Devensian - Diamicton
- Till, Devensian - Diamicton
- River Terrace Deposits, 1 - Sand and gravel
- River Terrace Deposits, 2 - Sand and gravel
- River Terrace Deposits, 2 To 3 - Sand and gravel



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SCALE	SHEET SIZE
1:15,000	A3
DRAWING NUMBER: DESK STUDY - FIGURE 4	REVISION: 0

0 0.25 0.5 1 Km

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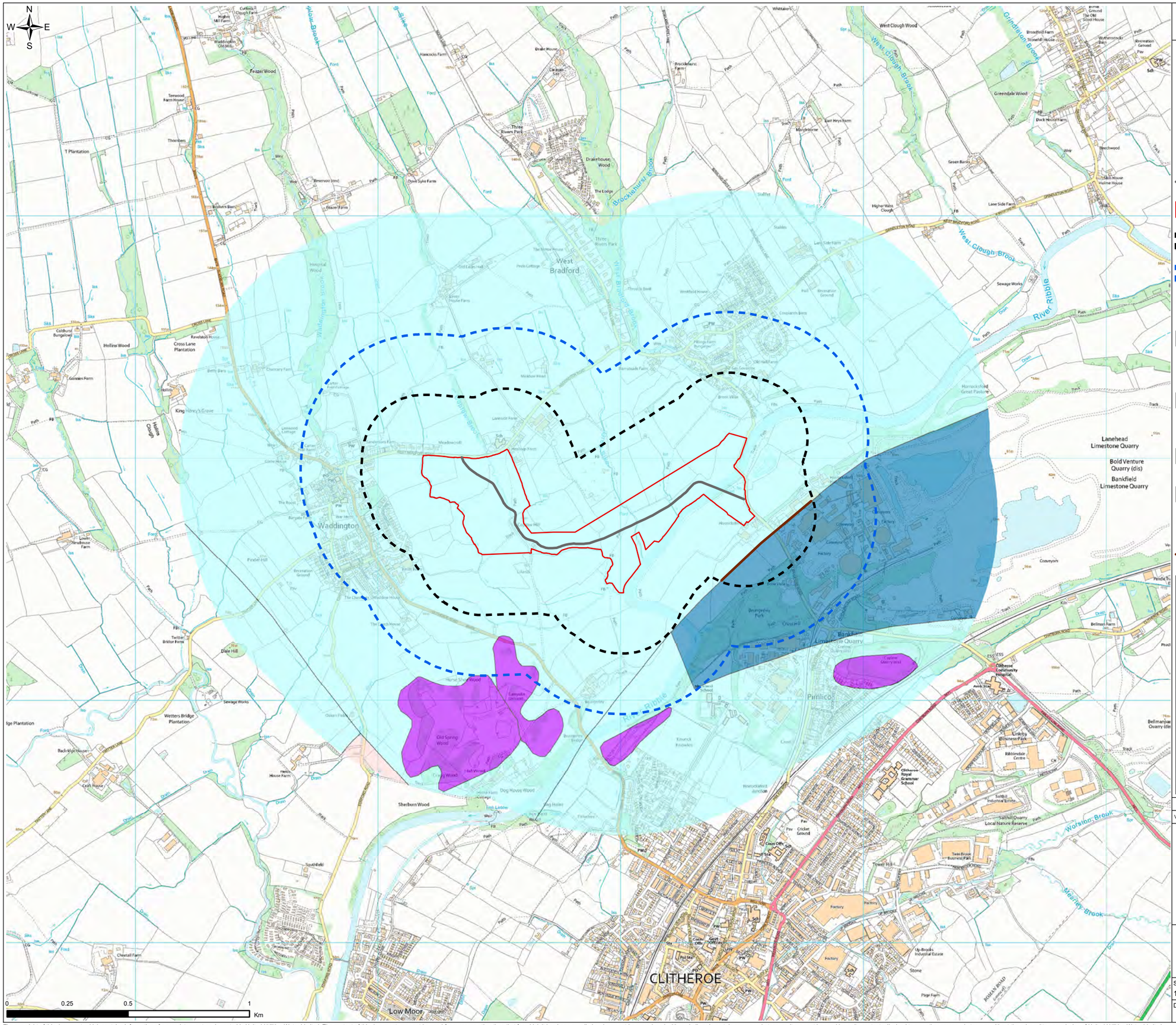
BEDROCK GEOLOGY



Legend

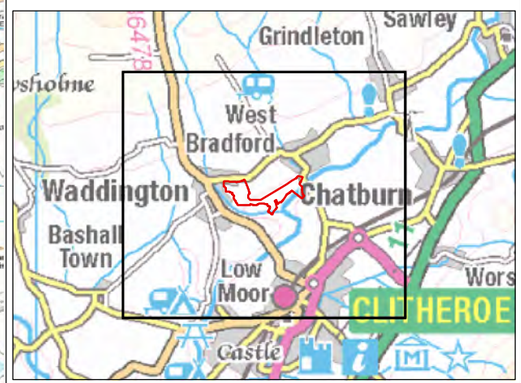
- Centreline
- Environment Assessment Area
- Environmental Assessment Area (250m Buffer)
- Environmental Assessment Area (500m Buffer)

Bedrock Geology

- Permian Rocks And Triassic Rocks (Undifferentiated) - Sandstone and mudstone
- Clitheroe Limestone Formation And Hodder Mudstone Formation (Undifferentiated) - Mudstone
- Clitheroe Limestone Formation (Knoll-Reef) - Limestone
- Chatburn Limestone Formation - Limestone

Bedrock Faults and Linear Features

- Fault, inferred



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BEDROCK GEOLOGY
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