Environmental Statement

Appendix 10.1: Phase I Geoenvironmental Site Assessment

Land at Lower Berse Farm, Wrexham

On behalf of Redrow Homes Ltd

July 2024



Phase I Geoenvironmental Site Assessment
Ruthin Road, Wrexham

Reference:14-854-R3-Rev E
Date: June 2024

PHASE I GEOENVIRONMENTAL SITE ASSESSMENT

Ruthin Road
Wrexham
LL14 4HP

Prepared for:
Redrow Homes

Report Ref: 14-854-R3-Rev E
Date Issued: June 2024

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EXECUTIVE SUMMARY

Site Address	Land off Ruthin Road, Offa, Wrexham, LL14 4HP	
Grid Reference	E 331553, N 349878.	
Site Area	72.85ha	
Proposed Development	Redrow Homes are currently in a master planning phase with a view to constructing a residential development of up to 1450 homes, plus associated roads, open space, community facilities, a site for a primary school and safe-guarding of an area for major highways infrastructure (should this continue).	
Current Site Use	The site is predominantly agricultural land with limited structures present on site. The structures are associated with the farm in the north-western corner, a residential dwelling towards the west of the site, and electrical features towards the south of the site. There is no evidence to suggest the land has been used for any other purpose outside of agriculture to date. A stream/drain is present in the north of the site. The field boundaries are mature hedgerows with sporadic mature/semi mature trees and tracks/ bridleways. The site is slightly variable in topography with the site at a higher elevation in the west, falling in an easterly direction. Generally, the land falls 20 m from the west to the east.	
Site History	A review of the pertinent Ordnance Survey mapping suggests that the site has comprised agricultural land with two farm buildings from circa 1872 until the present day with a number of field boundaries and ponds. A wireless electricity station was constructed next to Bryn-Moel in 1992. No significant changes occur on-site from 1992 onwards.	
Environmental Setting	**Drift Geology**	Glacial Till – CLAY, SAND, GRAVEL (West) Glaciofluvial Sheet Deposits – SAND & GRAVEL (East) Alluvium – SAND, SILT, CLAY and GRAVEL (North)
	Bedrock Geology	Pennine Lower Coal Measures Formation and Pennine Middle Coal Measures Formation – MUDSTONE, SILTSTONE, SANDSTONE (Southwest, East, Centre) Etruria Formation – MUDSTONE (West, Centre)
	Faults	A number of geological faults are recorded on site as shown in the snapshot below:

Environmental Setting	**Hydrogeology**	Secondary A bedrock aquifer (Etruria, Pennine Lower and Pennine Middle Coal Measures Formations). Secondary Undifferentiated superficial aquifer (Glacial Till) and Secondary A superficial aquifer (Glaciofluvial deposits, Alluvium). Three historical groundwater abstraction wells are recorded 796–869 m northeast at Carlsberg Tetley Brewing Ltd for process water. There are no potable abstractions within 1 km
	Hydrology	Two drainage ditches are recorded on site. The nearest off-site surface water feature is Afon Clywedog located 81 m south. Due to the local topography, it is likely that any shallow groundwater if present will flow in a southerly direction towards Afon Clywedog
	Flood Risk	The Groundsure Report identifies a high risk of flooding from rivers and the sea in northeast and northwest of the site which are classified as a Flood Zone 2 and Flood Zone 3, therefore a flood risk assessment will be required.
Utility Locations	A CCTV drainage survey has been completed recently at the site with the detail added to the constraints plan which shows Welsh water sewer, HV and LV cables, overhead lines, BT/Virgin and a gas main present within the site boundary. Furthermore, two drainage ditches are noted in the northern portion of the site. Following a review of utility plans obtained by E3P, street lighting is present along the northern boundary. Two high voltage electricity cables intersect the site. One runs from the farm in the northwest corner down towards the southern boundary. The second runs east along the northern section of the site, to the eastern boundary. A low voltage cable runs along the southern boundary and accesses where site where the buildings are situated in the southwest. BT connections are present in the northwest at Lower Berse Farm. Clean water pipes run along the eastern and southern site boundary. Two mains intersect the middle of the site in a northeast to southwest direction. A medium pressure gas main is present through the eastern section of the site, in a northwest to southeast direction.	
Landfill Sites and Ground Gases	A recent landfill is located 235 m southeast at Esless Farm which is now recorded to be closed. The landfill type is noted as other wastes. Esless Farm was also a licensed waste treatment site from February 1993. There are no historic landfills within 500 m. Localised Made Ground, alluvium and any organic deposits in the location of infilled ponds are potential sources of ground gas.	

Radon	Between 10% and 30% of homes are above the "Action Level" – full radon protective measures are necessary in the development of new structures in these areas.
Coal Mining/Land Stability	The site is located in a coal mining reporting area but not within a development high-risk area. There are recorded underground workings across much of the site, however, there are no past shallow mine workings or probable shallow workings. BGS mapping shows inferred coal seams on site. No mine entries are recorded in the vicinity of the site. An area of open-cast mining is present to the west of the site. A low risk of unrecorded shallow coal mining has been identified. The proposed development is located within both a tertiary shallow coal, brick clay and other sandstone and SAND and GRAVEL mineral safeguarding area. A Mineral Safeguarding Assessment has been completed for the site (Ref: 14-854-R4-Rev D, dated June 2024). The report concludes that given the size of the site, there is not considered likely to be a viable quantity of quality minable mineral and based on the regional extent of the minerals in the safeguarding zones, development of the site would not lead to a strategic sterilisation of the minerals in future. In addition, the nuisance/impacts to residents, listed buildings within the site and other receptors would be too great to consider a viable extraction facility in this position.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.
Initial Conceptual Site Model	The following potential on-site sources of contamination have been identified: • Infilled ponds/infilled field boundaries/tracks (Made Ground) – Heavy metals and inorganic compounds, PAHs, hydrocarbon compounds, asbestos, hazardous ground gas. • Lower Berse Farm and tanks – Heavy metals and inorganic compounds, PAHs, hydrocarbon compounds, asbestos. • Arable farming – Pesticides, herbicides. • Wireless electrical station – PCBs.(though considered unlikely given the age) Made Ground may underly localised areas of the site, associated with the farm buildings and infilled features within the site boundary, which may contain contaminants such as heavy metals, non-volatile PAH and asbestos.

Initial Conceptual Site Model	Arable farming is also a potential source of pesticides and herbicides. There is the potential for localised small fuel leaks or spillages from agricultural use and tanks in the location of the farm which are a potential source of PAHs and hydrocarbon compounds. Controlled waters receptors are identified as the underlying secondary undifferentiated and secondary A drift aquifers and secondary A bedrock aquifers, together with the on-site stream/drain. The sensitivity of underlying aquifers is reduced given there are no potable groundwater abstractions within 1 km. Significant sources of mobile contamination have not been identified on the site. Additionally, the presence of low permeability clay soils will reduce the migration of any mobile contaminants. Made Ground, infilled field boundaries, infilled ponds and possible organic deposits are all potential sources of ground gas.
Recommendations	A detailed Phase II intrusive geoenvironmental ground investigation should be undertaken in order to confirm the findings of the initial conceptual site model and value engineer a development solution.

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DRAWING LIST

14-854-001 - Site Location Plan
14-854-002 - Proposed Development Plan
14-854-003 - Historical Features Plan
14-854-004 - Site Features Plan

1. INTRODUCTION

1.1. BACKGROUND

E3P Ltd has been commissioned by Redrow Homes North West to undertake a Phase I Geoenvironmental Site Assessment at land to the south of Ruthin Road, Wrexham

This report is required to determine potential contaminated land liabilities and geotechnical constraints as part of a proposed residential development.

1.2. PROPOSED DEVELOPMENT

Redrow Homes are currently in a master planning phase with a view to constructing a residential development of up to 1450 homes, plus associated roads, open space, community facilities, a site for a primary school and an area safe-guarded for future major highways construction.

Drawing 14-854-002 (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the geoenvironmental investigation are as follows:

- Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document Land Contamination: Risk Management (LC:RM) (2023)
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- Assess the desk-study information and, where possible, provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- Provide recommendations regarding future works required and undertake a preliminary pre-construction cost appraisal.

1.4. SOURCES OF INFORMATION

Background information was sought from the following sources:

- Groundsure Report;
- Historical mapping dated 1872 to 2022. A selection of historical maps are reproduced in Appendix V;
- On-line planning records held by Wrexham County Borough Council;
- Consultations with representatives of Wrexham County Borough Council;
- Magic Map Groundwater Vulnerability Map;
- Radon: Guidance on protective measures for new buildings (BRE Document BR 211, 2007);
- British Geological Survey Map;
- Groundsure IO database;
- https://zeticauxo.com/downloads-and-resources/risk-maps/; and,
- https://flood-map-for-planning.service.gov.uk.

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.6. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.

1.7. RISK CLASSIFICATION

E3P has utilised the available data to classify the site on the basis of its likely contaminated land liability and potential for geotechnical constraints in relation to the site development. The risk classification definitions are summarised in Table 1.1.

TABLE 1.1 RISK CLASSIFICATION

RISK	DEFINITION
Low	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property.
Low Moderate	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property with regard to the proposed use. However, minor issues may require further consideration in the event of future redevelopment of the site.
Moderate	Some potential contaminated land liabilities/geotechnical constraints are likely to affect the property as a result of historical and/or current activities. The risks identified are unlikely to pose an immediate significant issue but the purchaser/developer may wish to make further enquiries of the vendor or undertake further environmental improvements. Redevelopment of the site will likely require further site investigation.
Moderate High	Some potentially significant contaminated land liabilities/geotechnical constraints have been identified at the property that requires further assessment, including intrusive ground investigations.
High	Significant potential contaminated land liabilities/geotechnical constraints have been identified at the property. Further assessment including intrusive ground investigation will be required to determine to the level of risk and associated liability.

2. SITE SETTING

2.1. SITE DETAILS

Site Address	Land off Ruthin Road, Offa, Wrexham, LL14 4HP
National Grid Reference	E 331553, N 349878.
Site Area	72.85ha

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III as Drawing 14-854-001.

2.2. CURRENT SITE USE

E3P has undertaken a site walkover of the entire site and a description of the key findings is summarised in Table 2.1.

TABLE 2.1 SITE DESCRIPTION

Occupancy/Use	The subject site is an irregularly shaped parcel of land located to the southwest of Wrexham and is currently agricultural farmland.	
Surface Cover (%)	**Buildings**	5%
	Hardstand	0%
	Soft Cover	95%
Structures	The site is predominantly agricultural land with the only structures present being a farm in the north-western corner, a residential dwelling towards the west of the site, and some electrical features nearby to the residential dwelling. No further structures have been identified within the site boundary.	
Access	Pedestrian and vehicular access can be gained through the farmyard off Berse Lane to the north of the site.	
Slope	The site is slightly variable in topography with the site at a higher elevation in the west, falling in an easterly direction. Generally, the land falls 20 m from the west to the east.	
Retaining Structures	No retaining structures have been identified on-site.	
Vegetation/Ecology	The field boundaries are mature hedgerows with sporadic mature/semi mature trees and tracks/ bridleways. There is a small water feature crossing the north-western section of the site.	
Hazardous Material Storage	It is likely that hazardous materials storage will have occurred in the location of the farm buildings on site. Tanks have been identified, however the contents have not been confirmed	
Asbestos-Containing Material (ACM)	No evidence of ACM was noted across the majority of the site during the site walkover. Access was not granted to the farm building or the residential dwelling on site; however, due to the age of the building, ACM cannot be discounted within the building fabric. Due to the lack of any further structures on the site, it is unlikely there will be any further asbestos present on the site.	

Asbestos-Containing Material (ACM)	A pre-demolition asbestos survey will be required for all existing buildings within the site boundary.
Polychlorinated Biphenyls (PCBs)	There is no equipment identified that may contain PCBs within the site boundary.
Waste Storage	Potentially hazardous waste streams are unlikely to be generated at the site and none were observed during the preliminary site inspection.
Drainage	A formal drainage survey has not been completed; however, a review of online records held by United Utilities indicates that main water pipes run along the eastern and southern site boundary. Two mains intersect the middle of the site in a northeast to southwest direction.

2.3. SURROUNDING AREA

The surrounding area land uses are summarised in Table 2.2.

TABLE 2.2 SURROUNDING LAND USES

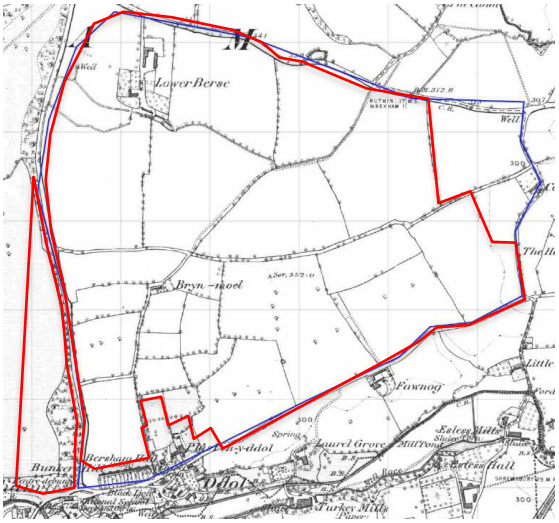
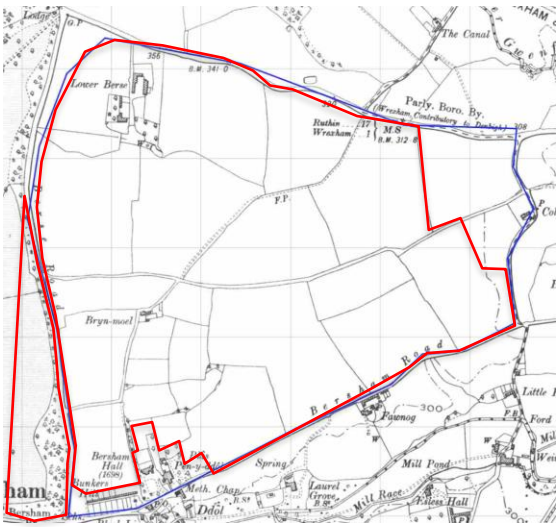
DIRECTION	LAND USE
North	Residential properties, Agricultural land, Moneypenny Telephone Answering Service
East	Residential properties, Clywedog Secondary School
South	Residential properties, Bersham Road, River Clywedog, Bryn Tirion Hall School
West	Agricultural Land, A483

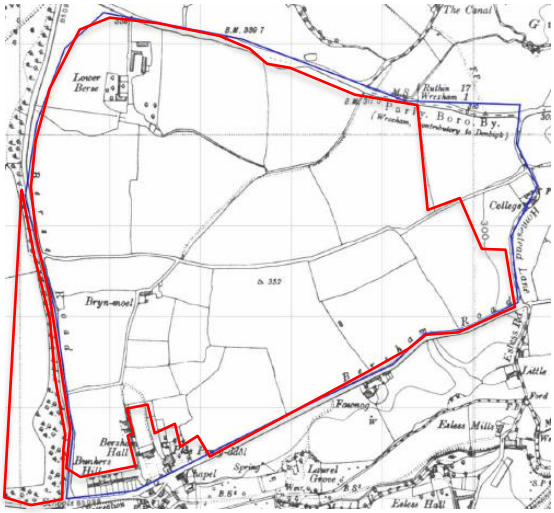
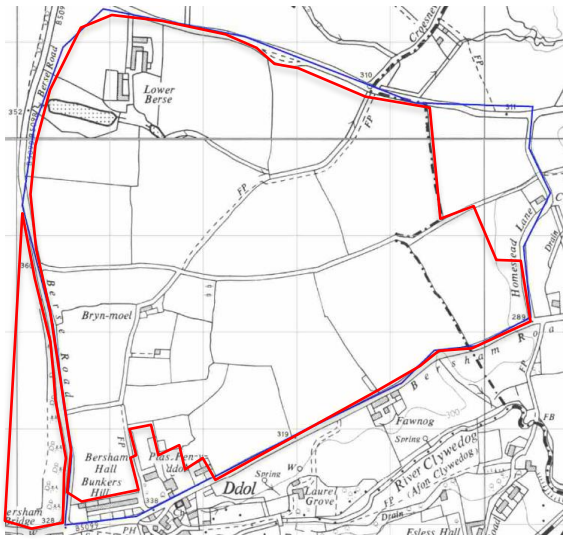
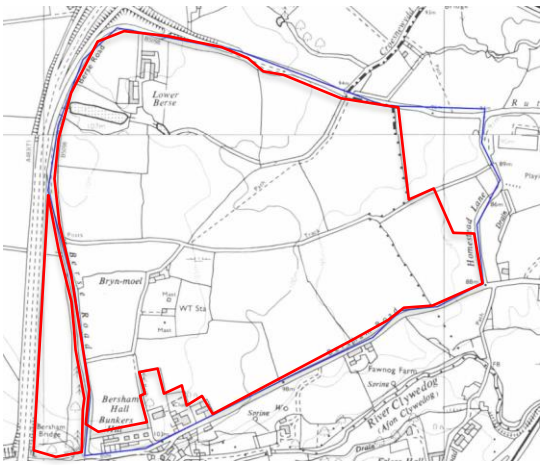
3. SITE HISTORY

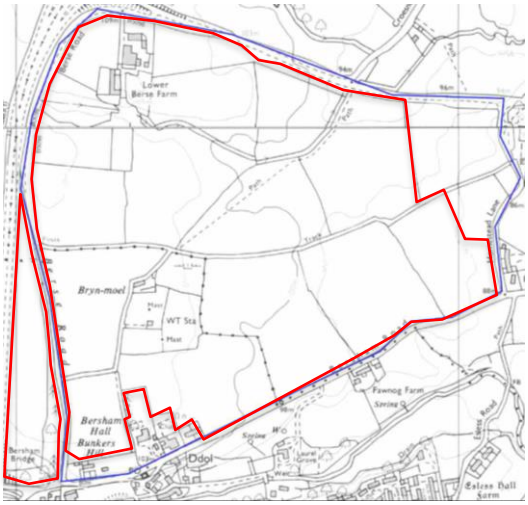
3.1. ON-SITE HISTORICAL DEVELOPMENT

A review of historical mapping and historical aerial imagery pertinent to the site is summarised in Table 3.1. In addition, historical site features are presented on Drawing No 14-854-003 in Appendix III.

TABLE 3.1 HISTORICAL DEVELOPMENT

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1872 **1:10,560**	Lower Berse Farm and Bryn-Moel are both already constructed in the north and centre of the site. The area is split up into agricultural land with numerous field boundaries. A wooded area is shown in the western sector. There is a road running through the centre of the site and a branch leading south that feeds Bryn-Moel. A footpath is marked through the centre of the site. A well is recorded on-site in the northwest. A pond is present to the south of Lower Berse Farm leading to a drain and two further ponds are present in the south of the site.	
1898-1900 **1:10,560**	The well in the northwest is no longer marked and a well is now recorded to the south of Lower Berse Farm. A field boundary in the southwest is no longer present and the small ponds in the south are no longer shown.	

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1938 **1:10,560**	A small pond is shown in the central southern sector. The well is no longer marked. A footpath is present east of Bersham Hall. There are no further changes.	
1964 **1:10,560**	A large pond is shown to the southwest of Lower Berse Farm. The small pond in the central southern sector is no longer shown. A field boundary has been added in the northwest and a field boundary has been removed in the southeast.	
1974-1979 **1:10,560**	A wireless electricity station has been constructed next to Bryn-Moel. Two masts are shown. A field boundary in the southwest has been removed.	

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1992 **1:10,000**	A track leading from the south of Lower Berse farm has been added. The large pond in the north is no longer recorded.	
2020 **Historical Aerial Photography**	There are no significant changes.	

3.2. OFF-SITE HISTORICAL DEVELOPMENT

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 250 m radius of the site is summarised in Table 3.2.

TABLE 3.2 SURROUNDING HISTORICAL DEVELOPMENT

SURROUNDING FEATURE	DISTANCE	DATES	DIRECTION
Opencast Workings Then: no longer recorded	0 m	Pre 1964 – Pre 1979 Pre 1979 – Present	West
A483	0 m	Pre 1979 – Present	West
Pond Then: no longer recorded	5 m	Pre 1872 – Pre 1964 Pre 1964 – Present	North
Ground Workings Then: Recreation Ground	10 m	Pre 1899 – Pre 1912 Pre 1912 – Present	South
Turkey Mills (Paper) Then: no longer recorded	150 m	Pre 1872 – Pre 1949 Pre 1949 – Present	South
Electricity Substation Then: no longer recorded	150 m	Pre 1992 – Pre 2001	East
Factory	160 m	Pre 1985 – Present	Northeast
Railway Then: dismantled Then: no longer recorded	200 m	Pre 1910 – Pre 1979 Pre 1979 – Pre 2001 Pre 2001 – Present	South
Factory Then: no longer recorded	200 m	Pre 1964 – Pre 1989 Pre 1989 – Present	East
Unspecified Works Then: Engineering Works Then: no longer recorded	200 m	Pre 1964 – Pre 1977 Pre 1977 – Pre 1993 Pre 1993 – Present	South
Gravel Pit Then: no longer recorded	230 m	Pre 1910 – Pre 1980 Pre 1980 – Present	North
Mill Pond Then: no longer recorded	230 m	Pre 1872 – Pre 1964 Pre 1964 – Present	South
Esless Mills Then: no longer recorded	230 m	Pre 1872 – Pre 1949 Pre 1949 – Present	South

3.3. PLANNING HISTORY

E3P has undertaken a review of online planning records held by Wrexham County Borough Council and no environmentally pertinent information has been obtained for the site.

4. ENVIRONMENTAL SETTING

4.1. GEOLOGY AND HYDROGEOLOGY

The British Geological Survey (BGS) map (Sheet 121) for the site, (1:50,000, Solid and Drift editions) and online records indicate the site is underlain by the geological sequence presented in Table 4.1.

TABLE 4.1 SUMMARY OF UNDERLYING GEOLOGY

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Drift	Glacial Till (West)	SAND, SILT, CLAY and GRAVEL	Secondary Undifferentiated
	Glaciofluvial Sheet Deposits (East)	SAND & GRAVEL	Secondary A aquifer
	Alluvium (North)	CLAY, SILT, SAND, GRAVEL	Secondary A aquifer
Solid	Pennine Lower Coal Measures and Pennine Middle Coal Measures Formation (Southwest, East, Centre)	MUDSTONE, SILTSTONE, SANDSTONE	Secondary A aquifer
	Etruria Formation (West, Centre)	MUDSTONE	Secondary A aquifer

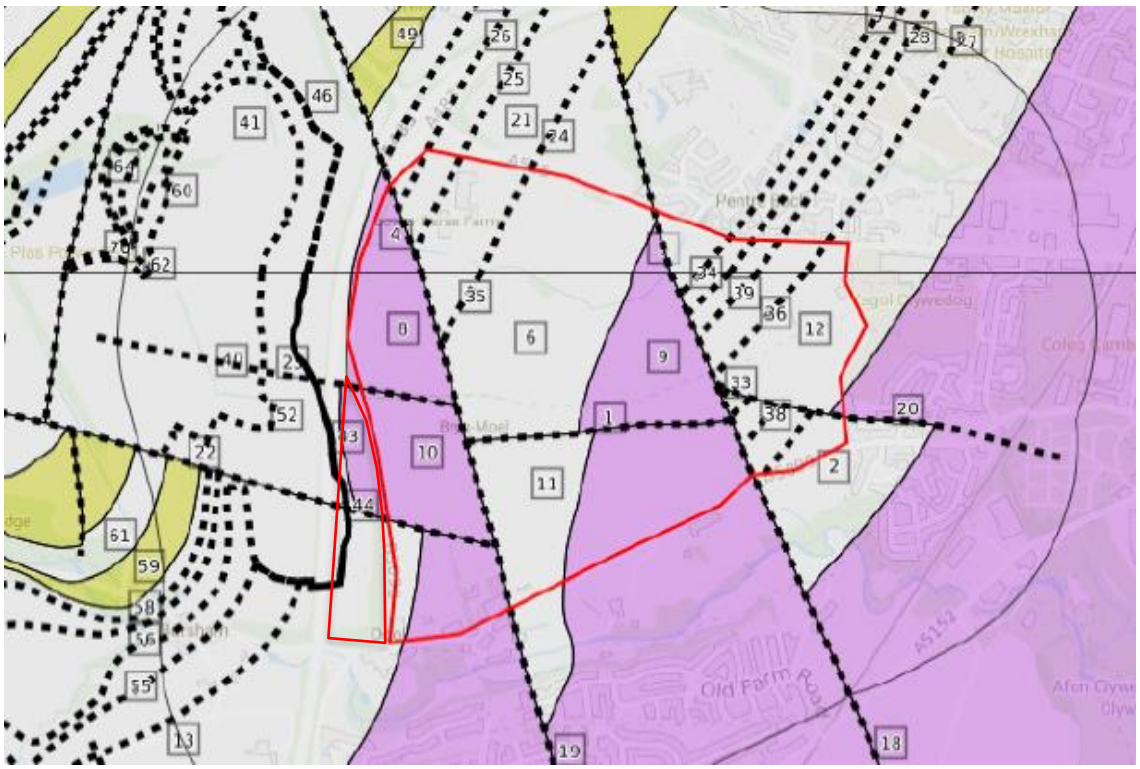
A summary of nearby BGS boreholes is included in Table 4.2.

TABLE 4.2 SUMMARY OF BGS BOREHOLE RECORDS

LOCATION	DEPTH	MADE GROUND	DRIFT	SOLID
On site	3.35 m	0.30 – 0.50 m	CLAY > 3.35 m	Not encountered
On site	2.44 m	Not encountered	SILT and GRAVEL > 2.44 m	Not encountered

The site is heavily faulted as shown in Table 4.3.

TABLE 4.3 FAULTING



LOCATION OF FAULT	DESCRIPTION
Fault 1 – On site	Normal fault, inferred (from Geological sequence)
Fault 16 – On site	Normal fault, inferred (from Geological sequence)
Fault 17 – On site	Normal fault, inferred (from Geological sequence)
Fault 18 – On site	Normal fault, inferred (from Geological sequence)
Fault 19 – On site	Normal fault, inferred (from Geological sequence)
Fault 20 – On site	Normal fault, inferred (from Geological sequence)
Fault 22 – On site	Normal fault, inferred (from Geological sequence)
Fault 23 – On site	Normal fault, inferred (from Geological sequence)

The Envirocheck report indicates that the site is not located within a groundwater source protection zone. Three historical groundwater abstraction wells are recorded 796 – 869 m northeast at Carlsberg Tetley Brewing Ltd for process water. There are no potable abstractions within 1km

4.2. NATURAL LANDFORM AND GEOMORPHOLOGY

Based on the initial geological assessment, a review of available topographic data and pertinent mapping, E3P has undertaken a preliminary geomorphological assessment of the landform and its possible mechanism for formation.

A review of relevant records indicates that the site has not been subject to anthropogenic changes, with the current site topography broadly representing natural landform.

A river flows in an easterly direction to the south of the subject site at a lower elevation to that of the proposed site with a shallow, partially wooded embankment. It would appear that the site has always been level and this river has had little impact on this due to its size.

4.3. GEOTECHNICAL DATA

Geotechnical data presented within a commercially available environmental database is summarised in Table 4.4.

TABLE 4.4 SUMMARY OF GEOTECHNICAL DATA

HAZARD	DESIGNATION
Shrink-Swell Clay	Negligible to very low risk
Landslides	Very low risk
Ground Dissolution	Negligible risk
Compressible Ground	Negligible to moderate risk
Collapsible Deposits	Negligible to very low risk
Running Sand	Very low to moderate risk

4.4. COAL MINING

The Groundsure report states the site is in an area that may be affected by coal mining.

The Coal Authority Online Viewer confirms that the site is not located in a development high risk area, however a high risk area is located circa 150 m to the west of the site where an unlicensed open cast site is recorded.

The CA operates a risk-based approach to the assessment of potential instability issues associated with the future development of land located within the predefined CA consultation areas. This risk-based approach subdivides the potential risk into “low” and “high” risk categories.

The risk categories can be defined as:

Low-Risk Sites – Deemed to be land where coal mining has taken place, however, it was at such depth not to pose a risk to new development and it, therefore, contains no known recorded risks and as such no further assessment is required.

For low-risk sites, the CA categorically states:

> *If your proposed development is within the Development Low Risk Area there is no need for you to submit any coal mining information with your planning application and The Coal Authority will not be consulted by the LPA. The LPA will include our Standing Advice as an informative note within the decision notice.*

High-Risk Sites – Deemed to be landholdings located within an area known to contain legacy risks that include:

- Mine entries (shaft or adit);
- Shallow coal workings (recorded and probable);
- Workable coal seam outcrops;

- Mine gas sites and areas;
- Recorded coal-mining-related hazards;
- Geological features (fissures and break lines); and
- Former surface mining sites (sometimes using historic opencast extraction methods).

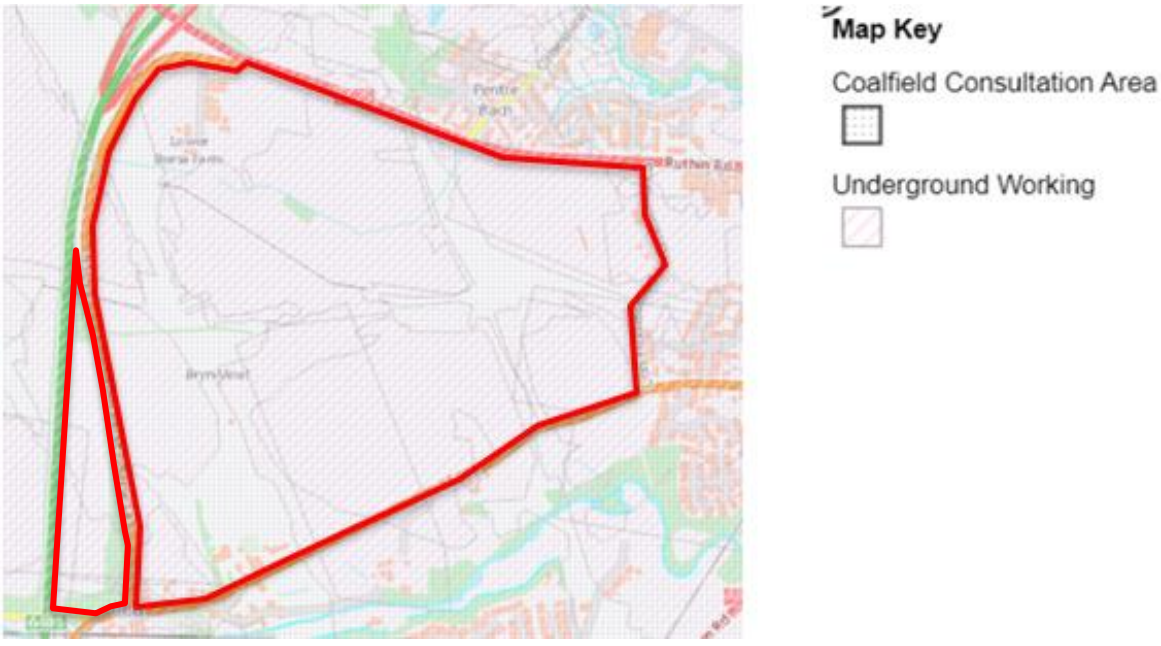
4.5. COAL MINING INFORMATION

Prior to the enactment of the Coal Mines Regulation Act (1872), which came into force on the 1st January 1883, there was no statutory requirement to record the extent of abandoned mine workings and as such the CA has no knowledge of extensive workings throughout the UK Coal Fields where shallow workings are present at a depth that could result in a subsidence event in the future (through successive cavitation) associated with failure of support mechanism.

To determine if a site may have unrecorded or recorded coal mine workings requires the consideration of a wide range of information and E3P has completed a review of relevant information in relation to potential coal mining activities.

In the first instance, E3P has reviewed the Coal Authority Online Viewer and an excerpt of this is presented as Figure 4.1. This map shows recorded underground workings across much of the site, however there are no past shallow mine workings or probable shallow workings. The rate of dip is recorded as between 0.4 – 7.0 degrees. No outcrops are shown, however, BGS mapping shows inferred coal seams on site. No mine entries are recorded in the vicinity of the site.

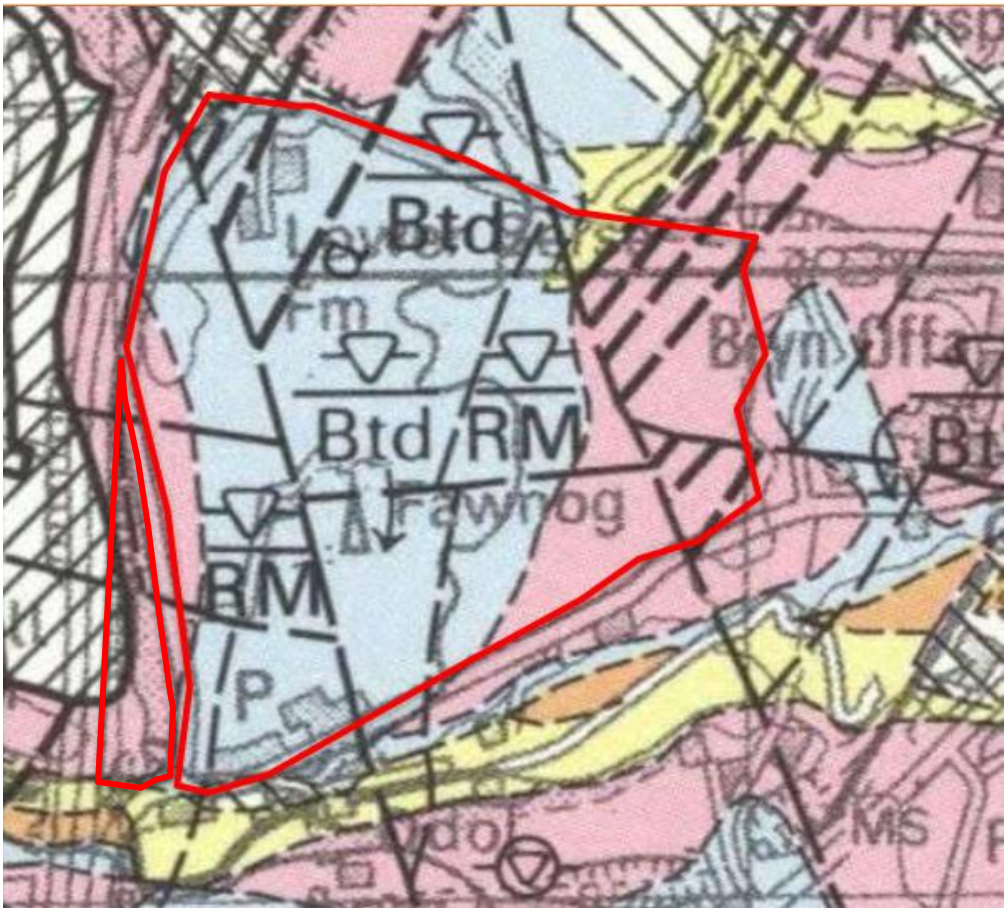
FIGURE 4.1 EXCERPT OF THE COAL AUTHORITY ONLINE VIEWER



4.5.1. COAL MINING GEOLOGY

Figure 4.2 is a photograph of the 1:50,000 plan for the site which shows coal outcrops inferred in the north, northeast and southeast of the site. The site is heavily faulted.

FIGURE 4.2 PHOTOGRAPH OF THE 1:50,000 PLAN FOR THE SITE



4.6. COAL MINING RISK ASSESSMENT

This risk assessment comprises a desk-based review of all available information on coal mining issues that are relevant to the application site deemed to be located within a high-risk area. This includes:

- Interpretation of information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of issues;
- Setting out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development; and
- Demonstrating to the local planning authority that the application site is, or can be made, safe and stable to meet the requirements of national planning policy with regard to development on unstable land.

The coal mining risk assessment is summarised in Table 4.5.

TABLE 4.5 SUMMARY OF COAL MINING RISK ASSESSMENT

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	No	Low
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	Yes	Low
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	No	Low
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	Yes	Moderate
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Low (Opencast to the west of site)

Based on the above, a low risk of unrecorded coal mining at shallow depth has been identified and no further assessment is considered to be required.

The proposed development is located within both a tertiary shallow coal, brick clay and other sandstone and SAND and GRAVEL mineral safeguarding area. A Mineral Safeguarding Assessment has been completed for the site (Ref: 14-854-R4-Rev D, dated June 2024). The report concludes that given the size of the site, there is not considered likely to be a viable quantity of quality minable mineral and based on the regional extent of the minerals in the safeguarding zones, development of the site would not lead to a strategic sterilisation of the minerals in future. In addition, the nuisance/impacts to residents, listed buildings within the site and other receptors would be too great to consider a viable extraction facility in this position.

4.7. BRINE WORKINGS

The site is not situated within the Cheshire Salt Field and is not affected by brine workings.

4.8. RADON RISK POTENTIAL

The Envirocheck report indicates the site is situated in an area where up to 10% and 30% of homes are above the “Action Level” and that the BGS reports that in these areas full radon protective measures are necessary in the construction of new dwellings or extensions.

4.9. PRELIMINARY GEOTECHNICAL ASSESSMENT

Based on the desk-study information, the following geotechnical assessment has been made:

- Given the predominantly undeveloped nature of the site, it is likely there will be limited Made Ground fill deposits and obstructions. Existing buildings will require demolition, with all relict foundations grubbing out, prior to the construction of the proposed development.
- Historically infilled ponds are present within the site boundary, which are potential sources of alluvial deposits, silts and possible organic peat deposits in addition to potential depths of Made Ground. Investigation will be required in order to assess these and undertake in-situ geotechnical testing to determine the likely foundation solution for plots in these areas.

- The site is undulating with topographical variances. In order to construct low-rise residential development, earthworks will be required to create a level development platform and this may generate a significant volume of top-soil and excess soils.
- Clay strata may underly the site and therefore a volume change potential assessment will be required.
- The underlying superficial geology is likely to comprise a cohesive soil matrix and as such is unlikely to offer the required degree of permeability to make soakaway drainage.
- The Mineral Safeguarding Assessment (Ref: 14-854-R4-Rev D) suggests that mining is not likely to be viable.

4.10. HYDROLOGY

Surface water features within 250 m of the subject site are summarised in Table 4.6.

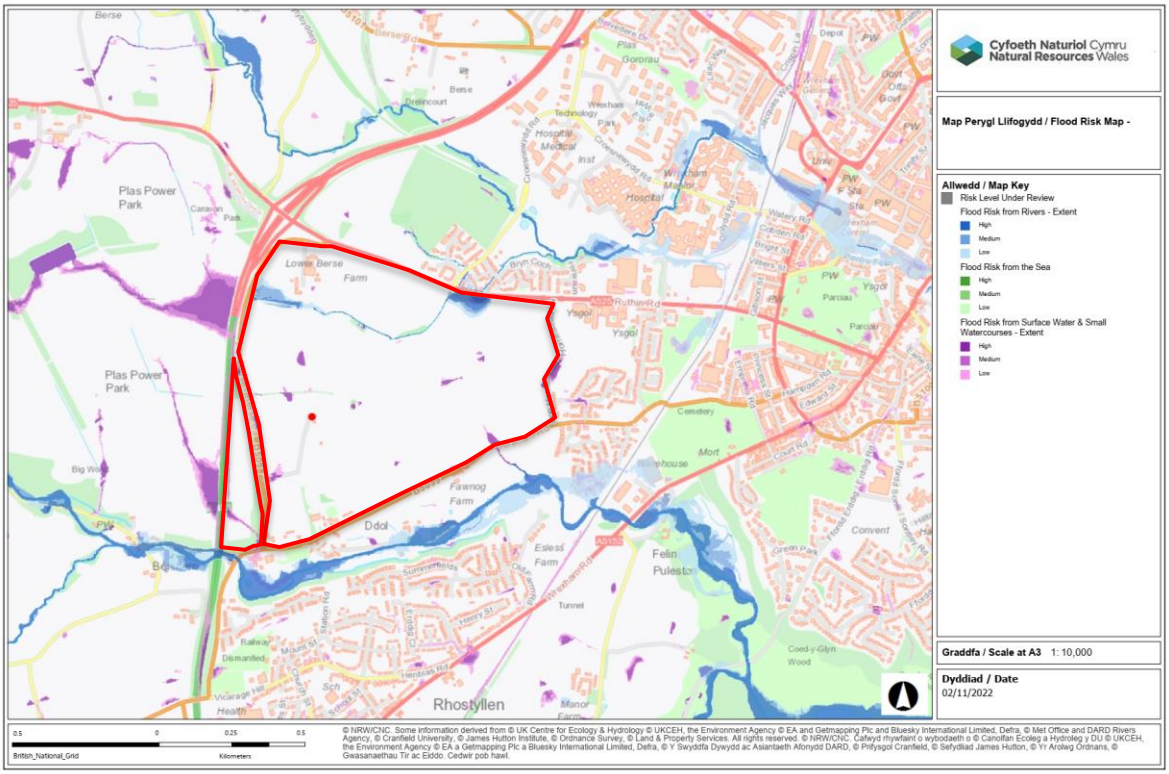
TABLE 4.6 SURFACE WATER FEATURES

SURFACE WATER FEATURE	QUALITY	DISTANCE (m)	DIRECTION
Drainage ditch	Fairly Good	On Site	-
River Clywedog	Fairly Good	81 m	South
River Gwenfro	Fairly Good	140 m	Northeast

The site is predominantly located within a currently defined “Flood Risk Zone 1”; defined as land assessed as having less than 1 in 1,000 annual probability of river or sea flooding (< 0.1%).

The Groundsure Report identifies a high risk of flooding from rivers and the sea in northeast and northwest of the site. Areas in the north of the site are within a Flood Zone 2 and Flood Zone 3, therefore a flood risk assessment will be required. In addition to this, there are multiple small areas where the risk from surface water is also considered to be high. The Natural Resources Wales flood map is shown in Figure 4.3.

FIGURE 4.3 NRW FLOOD RISK MAP



Source - https://maps.cyfoethnaturiolcymru.gov.uk/

Based on the local topography, the location of surface watercourses and the presence of several drainage ditches and streams within the site boundary, it is considered likely that shallow groundwater, if present, will flow in a south-easterly direction, following the topographical gradient towards the River Clywedog in the south.

4.11. INDUSTRIAL LAND USES

The Groundsure report records three telecommunications features and an electricity substation on site. The closest off-site industrial feature is a Gas Governor Station located 3 m north.

4.12. SENSITIVE LAND USES

The closest residential properties are located adjacent to the northern, southern and eastern boundaries of the site, with a school located along the eastern boundary.

Sites of Special Scientific Interest (SSSI) are located 1032 m north and 1910 m south and the site is within a SSSI Impact Risk Zone.

An area in the west of the site is recorded as a designated ancient woodland. No other environmentally sensitive land uses have been identified within close proximity to the site.

4.13. SITE SENSITIVITY ASSESSMENT

The site is assessed to be located within a "Moderate" sensitivity setting as discussed within Table 4.7.

TABLE 4.7 SITE SENSITIVITY ASSESSMENT

SENSITIVITY PROFILE	DISCUSSION	RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not located within a groundwater abstraction zone or drinking water safeguard zone.	Low
Distance to the Closest Groundwater Abstraction Point	Three historical groundwater abstraction wells are recorded 796–869 m northeast at Carlsberg Tetley Brewing Ltd for process water. There are no potable abstractions within 1km	Low
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated superficial aquifer (Glacial Till) and Secondary A superficial aquifer (Glaciofluvial Deposits, Alluvium).	Moderate
Aquifer Classification in Bedrock	Secondary A bedrock aquifer (Etruria, Pennine Lower and Pennine Middle Coal Measures Formations).	Moderate
Is the Site Underlain by Low-Permeability Drift to Depths in Excess of 10 m?	The underlying superficial deposits are likely to comprise gravelly sands interbedded with low-permeability silty clay soils to depths in excess of 5 m which may reduce the potential for mobile phase contaminants to migrate towards the bedrock aquifer or adjacent watercourses.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	A surface water drain is located in the north of the site.	Moderate
Sensitive Land Uses	The site is surrounded by residential dwellings on the northern, eastern and southern boundaries, with a school located along the eastern boundary. An area in the west of the site is recorded as a designated ancient woodland. The SSSI Impact Risk Zone is noted at 1032m and 1910m from site.	High
OVERALL SITE ENVIRONMENTAL SENSITIVITY		Moderate

5. CONSULTATIONS

5.1. LANDFILL SITES AND WASTE TREATMENT SITES

A recent landfill is located 235 m southeast at Esless Farm which is now noted to be closed. The landfill type is noted as other wastes. Esless Farm was also a licensed waste treatment site from February 1993. There are no historic landfills within 500 m.

5.2. REGULATORY DATABASE

The information summarised in Table 5.1 has been obtained from a commercially available environmental database. The summary table only includes records from within 250 m of the subject site and not otherwise detailed in the report.

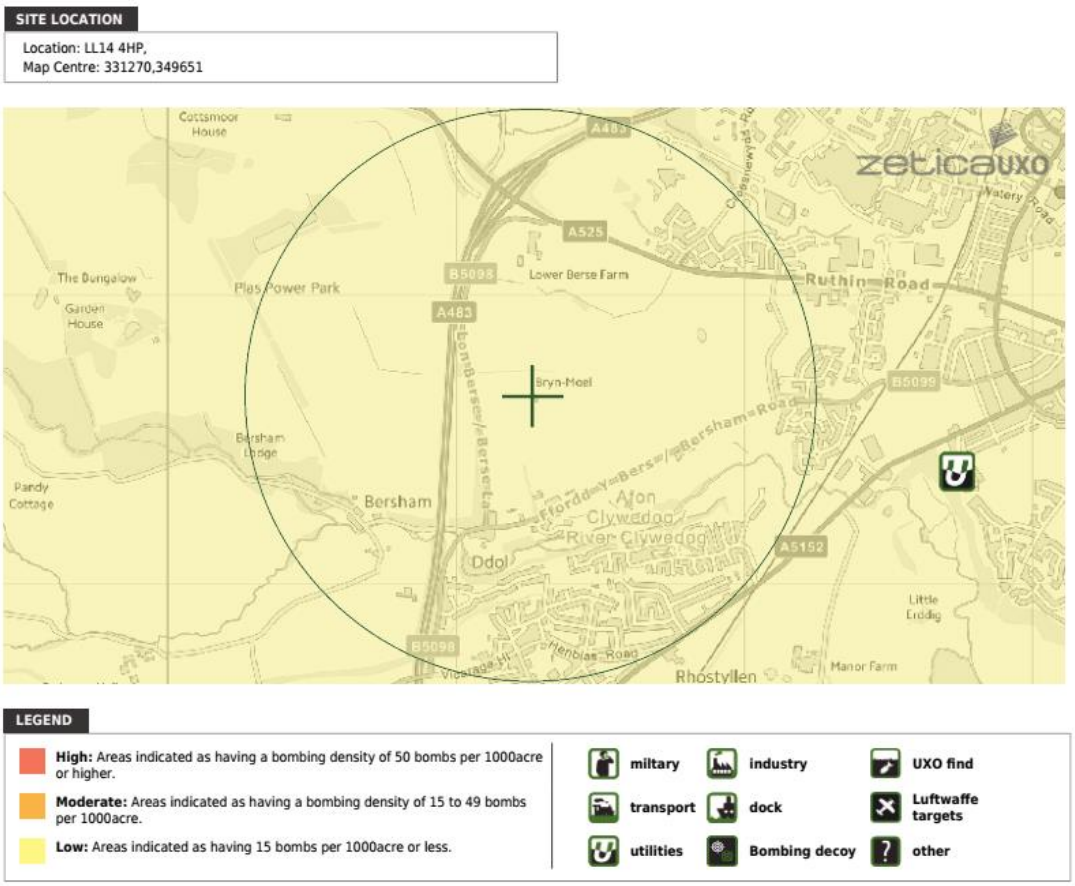
TABLE 5.1 SUMMARY OF ENVIRONMENTAL DATA

RECORD	ENTRIES WITHIN 250 m	DETAILS
Contaminated Land Register Entries and Notices	0	None Identified
Authorised Industrial Processes (IPC/IPPC/LAPPC)	0	None Identified
Fuel Stations Entries	0	None Identified
Licensed Radioactive Substances	0	None Identified
Enforcements, Prohibitions or Prosecutions	0	None Identified
Discharge Consents	4	39 m E – Unspecified effluent to an open ditch entering River Clywedog 50 m E – Unspecified effluent to an open ditch entering River Clywedog. 88 m SE - 39 m E – Unspecified effluent entering River Clywedog. 165 m SE - 39 m E – Unspecified effluent to entering River Clywedog.
Pollution Incidents	2	85 m SE – Crude sewage impacting River Clywedog (category 3 minor water impact). 180 m SE – Crude sewage impacting River Clywedog (category 3 minor air impact).
Consents Issued Under the Planning (Hazardous Substances) Act 1990	0	None Identified
Control of Major Accident Hazard (COMAH) Sites	0	None Identified

5.1. UNEXPLODED ORDNANCE

The regional unexploded bomb risk map from Zetica (2014) indicates that the site is in an area at low risk from possible unexploded ordnance (UXO) resulting from the Second World War. The Zetica UXO Risk Map is presented as Figure 5.1. No further assessment is required.

FIGURE 5.1 ZETICA UXO RISK MAP



Source - https://zeticauxo.com/downloads-and-resources/risk-maps/

6. INITIAL CONCEPTUAL SITE MODEL

In accordance with EA LC:RM (2019) guidance and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), E3P has developed an initial conceptual site model (CSM) to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 6.1.

ON-SITE SOURCES OF CONTAMINATION

The following potential on-site sources of contamination have been identified:

- Infilled ponds/infilled field boundaries/tracks (Made Ground) – Heavy metals and inorganic compounds, PAHs, hydrocarbon compounds, asbestos, hazardous ground gas
- Lower Berse Farm and tanks – Heavy metals and inorganic compounds, PAHs, hydrocarbon compounds, asbestos
- Arable farming – Pesticides, herbicides

OFF-SITE SOURCES OF CONTAMINATION

The following potential off-site source of contamination have been identified:

- Opencast workings (0 m W) – Hazardous ground gas
- Infilled pond (5 m N) – Hazardous ground gas
- Ground workings (10 m S) – Hazardous ground gas
- Turkey Paper Mills (150 m S), Esless Mills (230 m S) – Heavy metals, PAHs, hydrocarbon compounds
- Railway (200 m S) – Heavy Metals, PAHs, hydrocarbon compounds
- Gravel Pit (230 m N) – Hazardous ground gas
- Mill Pond (230 m S) – Hazardous ground gas

TABLE 6.1 INITIAL CONCEPTUAL SITE MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH, PCBs (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Low Likelihood	High	LOW

Discussion:
Made Ground, derived from the former infilling of ponds and infilling of field boundaries is likely to be present in localised areas of the site. The farm and structures in the south and west of the site are also a potential source of Made Ground. Made Ground is likely to be impacted by heavy metals, hydrocarbons and polycyclic aromatic hydrocarbons (PAHs).

If present, heavy metals and non-volatile PAHs may pose a short-term risk to construction workers who may come into contact with impacted soils during earthworks.

Should residential plots be located within the area of any Made Ground deposits, these should be mitigated through careful removal, validation and placement of potentially impacted materials at appropriate depths in order to break potential exposure pathways.

An electricity substation has been identified in the southern sector of the site. The substation is recorded post 1992, therefore the presence of PCBs is unlikely.

At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered.

Recommendation:
Site investigation recommended through the remainder of the site and within the farm buildings area to assess the presence of soil contamination.

Cover system to garden and landscaped areas will prevent exposure to future site users (if required). Construction works completed with PPE and provision of welfare.

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
Assessment: Asbestos may be present in any localised Made Ground associated with historic infilling. Asbestos is likely to be present in the building fabric of the farm buildings. ACM poses a risk through fibre and dust inhalation and if present may pose a risk to construction workers during any future earthworks/ demolition and to adjacent third-party property should dust be generated during those works. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no asbestos fibres have been encountered. **Recommendation:** Site investigation is required in areas not currently assessed. Cover system to garden and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare. A pre-demolition asbestos survey will be required for all existing buildings within the site boundary.						
PL4	Volatile contaminants such as hydrocarbons, (Made Ground, Farm (tanks)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Low Likelihood	Moderate	To be determined
Assessment: There is the potential for localised small fuel leaks or spillages from agricultural use and tanks in the location of the farm which is a potential source of PAHs and hydrocarbon compounds. Hydrocarbon compounds and PAHs may pose a risk to construction workers if they come into contact with impacted soils during further earthworks, however appropriate PPE/Respiratory Protective Equipment (RPE) will ensure they are at no unacceptable risk.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Future end users may come into contact with impacted soils in garden and landscaped areas, though the main pathway of volatile compounds is considered to be vapour inhalation indoors. If identified, additional remediation of impacted soils and/or perched groundwater will likely be required to mitigate the risk to future residential end-users. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered. **Recommendation:** An intrusive investigation is required in areas not currently assessed.						
PL4	Methane, carbon dioxide (coal measures, organic deposits and potentially infilled features on and within 250 m of the site)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Low likelihood	Moderate	**LOW**
Assessment: Made Ground, infilled ponds, infilled field boundaries and possible organic deposits may be sources of hazardous ground gases such as carbon dioxide and methane which have associated asphyxiation and explosive risks. Ground gas can accumulate within confined spaces such as excavations, sub-structures or deep excavations. Inhalation of these gases could result in asphyxiation, while accumulation of these gases can be explosive. Therefore, if a gas risk is identified, construction workers should carefully manage entry within deep excavations or confined spaces and allow for adequate monitoring. At the time of writing, E3P has completed an initial investigation which included a phase of gas monitoring within the northern parcels at the site. To date no elevated readings have been encountered and the addendum report concluded that no mitigation measures will be required in the pertinent areas of the site.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Recommendation: Assessment will be required in areas not currently investigated to confirm the ground gas classification through the remainder of the site.						
PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground, Farm (tanks)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Secondary Undifferentiated and Secondary A aquifers). Surface water (Drainage ditches).	Low likelihood	Moderate	**LOW**
Assessment: Low Likelihood considered as limited sources of mobile contamination identified in the form of fuel storage within the farm area. Leakages/spillages of mobile contamination are considered possible however cohesive deposits across the site may reduce downward migration into the underlying aquifers and vertical migration to the on-site stream/drain. The sensitivity of the underlying aquifers is reduced given there are no potable abstractions within 1 km. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered. **Recommendation:** Sampling of groundwater and surface water is required throughout the site.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Low Likelihood	Moderate/Low	LOW
Assessment: Elevated pH and sulphate within Made Ground deposits may result in the corrosion of buried concrete within the proposed development. Assessment must be undertaken to confirm the levels of pH and sulphate within the underlying strata and in particular any Made Ground deposits so that a concrete classification can be determined. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated sulphates have been encountered that would require specialist concrete classification. **Recommendation:** Site investigation is recommended in areas not currently assessed.						
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground, Farm (tanks))	Ingestion of tainted water supply.	Future site users. Water pipes.	Low Likelihood	Moderate	LOW
Assessment: Elevated concentrations of hydrocarbons may be present in localised Made Ground anticipated beneath the site, which can degrade polyethylene (PE) pipelines over time. The degradation of PE pipework can lead to the tainting of drinking water supplies when installed in impacted soils. Any tainted drinking water may act as an exposure pathway to site end-users. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered that would suggest barrier pipeline materials will be required. **Recommendation:** An intrusive investigation is required to confirm the requirements throughout the site. A UKWIR Risk Assessment will be required to determine the ultimate potable water pipe material choice.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Low Likelihood	Low	**LOW**

Assessment:
Localised Made Ground on-site may contain levels of contamination which may be taken up by plants and trees.

At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered.

Recommendation:
If impacted soils are identified then an appropriate cover system, designed in accordance with an agreed remediation strategy will mitigate the risk in any proposed gardens or landscaped areas.

Main exposure pathways:
PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants;

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. SITE SUMMARY

Current Site Use	The site is predominantly agricultural land with limited structures present on site. The structures are associated with the farm in the north-western corner, a residential dwelling towards the west of the site, and electrical features towards the south of the site. There is no evidence to suggest the land has been used for any other purpose outside of agriculture to date. A stream/drain is present in the north of the site. The field boundaries are mature hedgerows with sporadic mature/semi mature trees and tracks/bridleways.
Historical Site Use	A review of the pertinent Ordnance Survey mapping suggests that the site has comprised agricultural land with two farm buildings from circa 1872 until the present day with a number of field boundaries and ponds. A wireless electricity station was constructed next to Bryn-Moel in 1992. No significant changes occur on-site from 1992 onwards.
Site Sensitivity	The site is surrounded by residential dwellings on the northern, eastern and southern boundaries, with a school located along the eastern boundary. An area in the west of the site is recorded as a designated ancient woodland. A SSSI Impact Risk Zone is present at both 1032m and 1910m from site.

7.2. CONTAMINATED LAND ASSESSMENT

Human Health	Made Ground may underly localised areas of the site, associated with the farm buildings and infilled features within the site boundary, which may contain contaminants such as heavy metals, non-volatile PAH and asbestos. Arable farming is also a potential source of pesticides and herbicides. There is the potential for localised small fuel leaks or spillages from agricultural use and tanks in the location of the farm which are a potential source of PAHs and hydrocarbon compounds. At the time of writing, E3P has completed an initial investigation which included chemical sampling within the northern parcels at the site. To date no elevated contaminants have been encountered. Further assessment is required through the remaining areas of the site.
Controlled Waters	Controlled waters receptors are identified as the underlying secondary undifferentiated and secondary A drift aquifers and secondary A bedrock aquifers, together with the on-site stream/drain. The sensitivity of underlying aquifers is reduced given there are no potable groundwater abstractions within 1km.

Controlled Waters	Significant sources of mobile contamination have not been identified on the site which may present a direct risk to controlled waters. Additionally, the presence of low permeability clay soils will reduce the migration of any mobile contaminants. At the time of writing, E3P has completed an initial phase of investigation which included chemical analysis within the northern parcels at the site. To date no elevated contaminants have been encountered.
Ground Gas	Made Ground, infilled field boundaries, infilled ponds and possible organic deposits are all potential sources of ground gas. Carbon dioxide and methane have associated asphyxiation and explosive risks, respectively. If present, the risks can be appropriately mitigated through the careful design of building structures. At the time of writing, E3P has completed an initial phase of ground gas monitoring which included positions within the northern parcels at the site. To date no elevated contaminants have been encountered and the E3P report concluded that mitigation measures would not be required for structures in that area. A programme of ground gas monitoring is required to confirm the ground gas regime across the full site area.
Potable Water	Elevated concentrations of hydrocarbons may be present in localised areas of Made Ground which can degrade polyethylene (PE) pipelines over time. Chemical analysis completed in the northern parcels to date has not identified any elevated contaminants of concern that would otherwise require the use of barrier pipeline materials. A UKWIR Risk Assessment will be required on completion of assessment throughout the site.

7.3. COAL MINING

Coal Mining/Mineral Safeguarding	The site is located in a coal mining reporting area but not within a development high-risk area. There are recorded underground workings across much of the site, however, there are no past shallow mine workings, probable shallow workings or mine entries identified in Coal Authority data. BGS mapping shows inferred coal seams on site. An area of open-cast mining is present to the west of the site. A low risk of unrecorded shallow coal mining has been identified. The proposed development is located within both a tertiary shallow coal, brick clay and other sandstone and SAND and GRAVEL mineral safeguarding area. A Mineral Safeguarding Assessment has been completed for the site (Ref: 14-854-R4-Rev D, dated June 2024). The report concludes that given the size of the site, there is not considered likely to be a viable quantity of quality minable mineral and based on the regional extent of the minerals in the safeguarding zones, development of the site would not lead to a strategic sterilisation of the minerals in future. In addition, the nuisance/impacts to residents, listed buildings within the site and other receptors would be too great to consider a viable extraction facility in this position.

7.4. GEOTECHNICAL ASSESSMENT

Geological	Clay strata may underly the site and therefore a volume change potential assessment will be required given that the site is lined by mature and semimature trees and hedges. Consideration of the potential water demand of trees affecting foundations should also be considered. Localised organic deposits may be present in the location of the infilled field boundaries and surface water drains. The Mineral Safeguarding Assessment (Ref: 14-854-R4-Rev D) suggests that mining is not likely to be viable.
Civil and Structural	Relict substructures and obstructions are unlikely to be present and no retaining structures are present within the site boundary.
Abnormal Foundations	Foundation solutions will be largely dependent on the proposed development levels and the requirement to cut and fill to achieve the development platform levels. It is likely that shallow strip/trench foundations will be suitable for the proposed plots. An abnormal engineering solution may be required where there is significant thickness of Made Ground, tree influence, loose granular soils or soft cohesive and organic deposits.

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

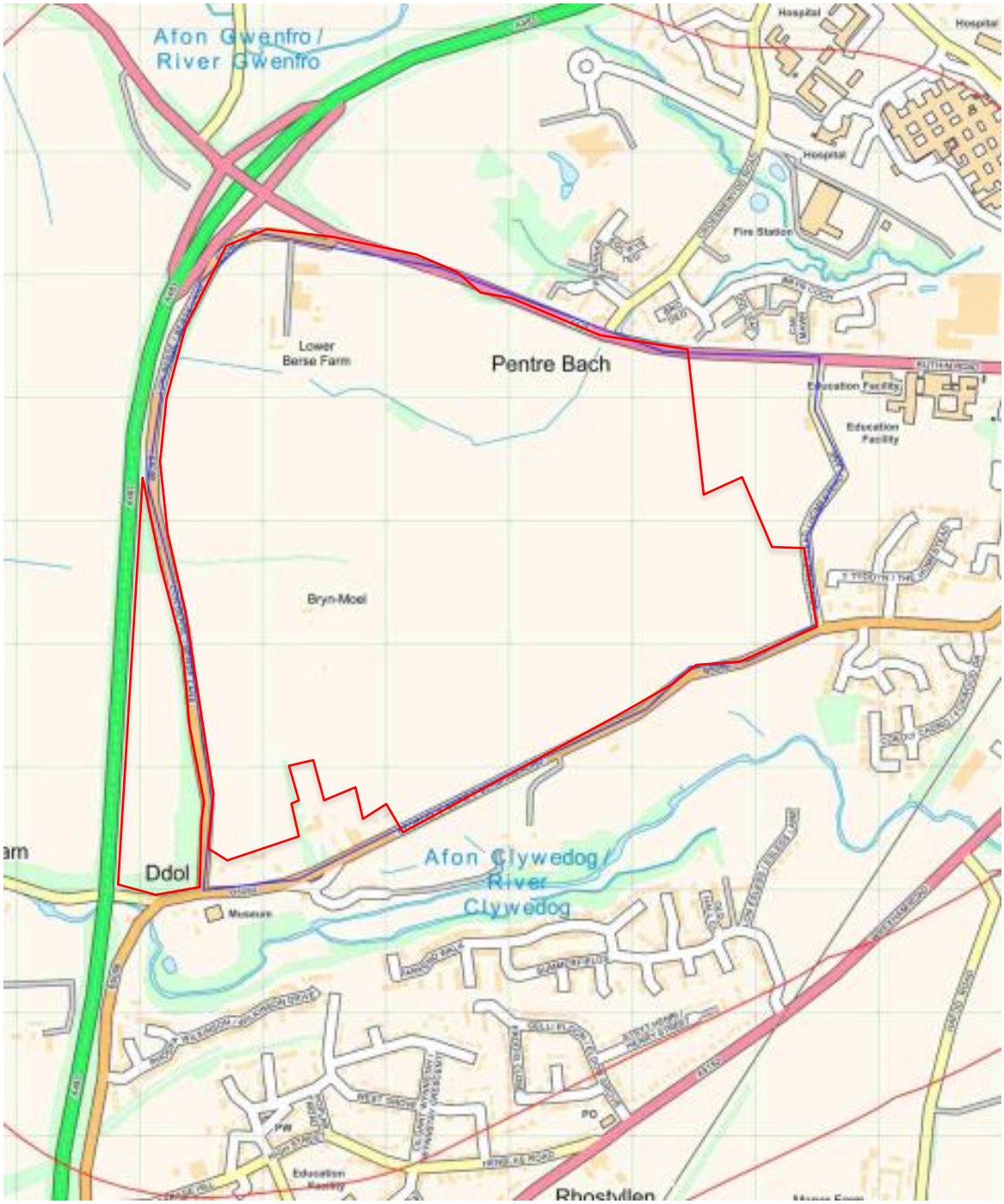
TERMS

ACM	Asbestos-containing material	**MMP**	Materials management plan
ADS	Acoustic design statement	**ND**	Not detected
AST	Above-ground storage tank	**NDP**	Nuclear density probe
BGS	British Geological Survey	**NMP**	Noise management plan
BSI	British Standards Institute	**NPSE**	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	**NR**	Not recorded
CA	Coal Authority	**PAH**	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	**PCB**	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	**PI**	Plasticity index
CIRIA	Construction Industry Research Association	**PID**	Photo ionisation detector
CLEA	Contaminated land exposure assessment	**POS**	Public open space
CML	Council of Mortgage Lenders	**PPE**	Personnel protective equipment
CoC	Contaminants of concern	**ProPG**	Professional practice guidance
CSM	Conceptual site model	**QA**	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	**SGV**	Soil guideline value
DWS	Drinking water standard	**SPH**	Separate-phase hydrocarbon
EA	Environment Agency	**SPT**	Standard penetration test
EQS	Environmental quality standard	**SVOC**	Semi-volatile organic compound
FFL	Finished floor level	**TPH**	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	**TPH CWG**	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	**UKWIR**	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	**UST**	Underground storage tank
HCV	Health criteria value	**VCC**	Vibro-concrete column
ICSM	Initial conceptual site model	**VOC**	Volatile organic compound
LEL	Lower explosive limit	**VRSC**	Vibro-replacement stone columns
LMRL	Lower method reporting limit	**VSC**	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	**WHO**	World Health Organisation
MCV	Moisture condition value	**WRAP**	Waste and Resources Action Programme
MIBK	Methyl isobutyl ketone	**WTE**	Water table elevation

m	Metres	**ppm**	Parts per million
km	Kilometres	**mg/m^3**	Milligram per metre cubed
% v/v	Percent volume in air	**m bgl bgl**	Metres below ground level
mb	Millibars (atmospheric pressure)	**m bcl**	Metre below cover level
l/hr	Litres per hour	**mAOD**	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	**kN/m^2**	Kilonewtons per metre squared
ppb	Parts per billion	**µm**	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	**SSRT**	Site Specific Remediation Target
PSD	Particle Size Distribution	**DD**	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	**Mc**	Moisture Content
ρ	Bulk Density	**GPR**	Ground Penetrating Radar
NDP	Nuclear Density Probe	**FFL**	Finished Floor Level
LEL	Lower Explosive Limit	**UKWIR**	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	**LOD**	Limit of Detection

APPENDIX III
DRAWINGS

DRAWING 14-854-001 – SITE LOCATION PLAN





P1	REVE	26.06.2024	OW	RJW
P1	REVD	17.08.2023	OW	RJW
P1	REVC	31.05.2023	OW	RJW
P1	REVB	14.12.2022	HM	RJW
P1	REVA	02.09.2021	LM	AR
Phase	Issue	Date	Drawn	Checked

Notes:

Client: Redrow

Job No: 14-854

Date: 26.06.2023

Drawing No: 002

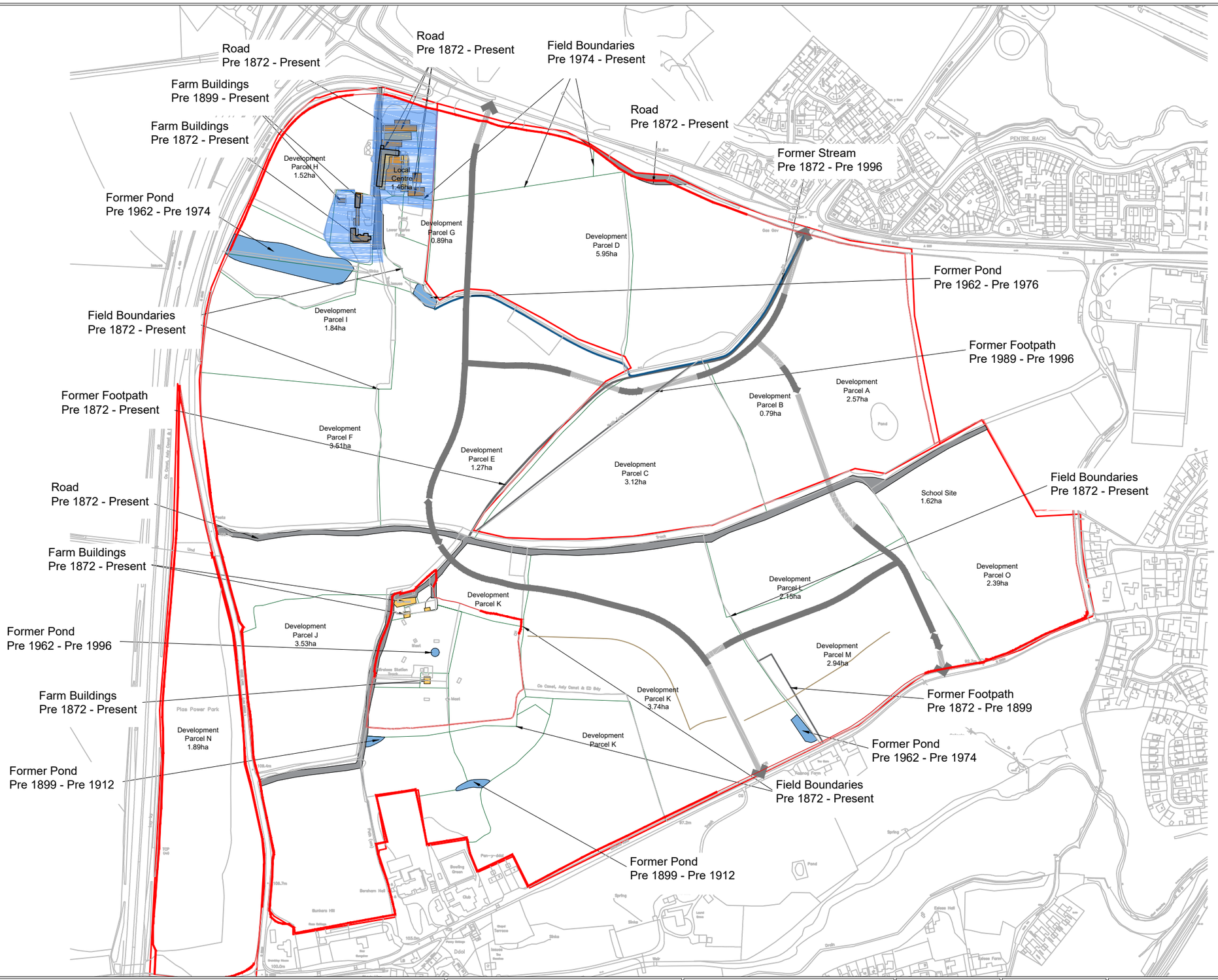
Scale: NTS @ A3

Job Title: Ruthin Road, Wrexham

Drawing Title: Proposed Development Plan

e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Historical Features

- Road
- Former Buildings
- Buildings
- Field Boundaries
- Stream

Notes:

Client: Redrow

Job No: 14-854

Date: 26.06.2024

Drawing No: 003

Scale: NTS @ A3

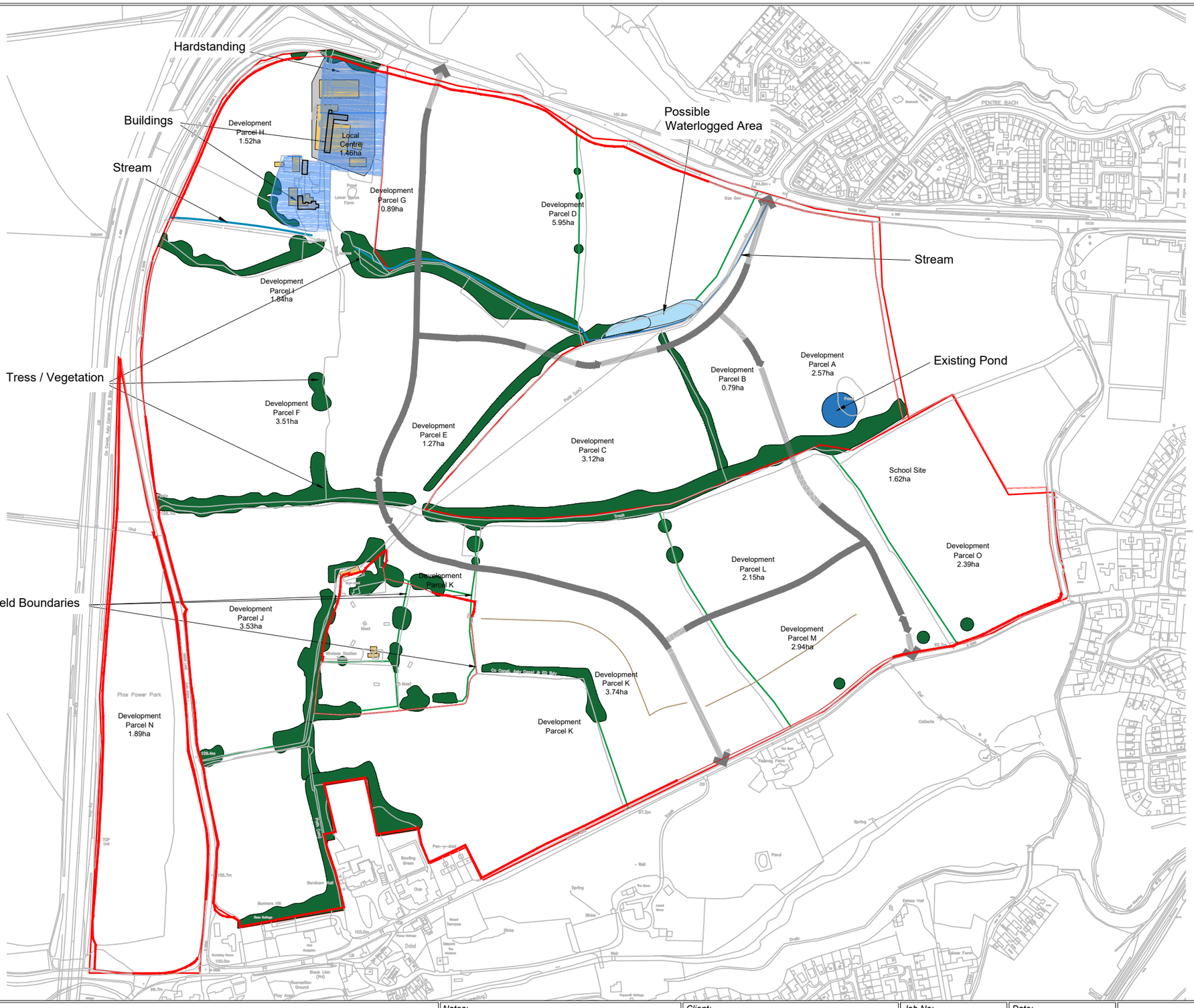
Phase	Issue	Date	Drawn	Checked
P1	REVC	26.06.2024	OW	RJW
P1	REVB	31.05.2023	OW	RJW
P1	REVA	03.09.2021	LM	AR

Job Title: Ruthin Road, Wrexham

Drawing Title: Historical Features Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Site Features

- Buildings
- Hardstanding
- Field Boundaries
- Trees / Vegetation
- Pond
- Possible Waterlogged Area
- Stream

Notes:

Client: Redrow

Job No: 14-854

Date: 26.06.2024

Drawing No: 004

Scale: NTS @ A3

Phase	Issue	Date	Drawn	Checked
P1	REVC	26.06.2024	OW	RJW
P1	REVB	31.05.2023	OW	RJW
P1	REVA	03.09.2021	LM	AR

Job Title: Ruthin Road, Wrexham

Drawing Title: Site Features Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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APPENDIX IV
PHOTOGRAPHS

PLATE 1 – GENERAL SURFACE CONDITIONS THROUGH NORTHERN FIELDS



PLATE 2 – GENERAL SITE COVERAGE



PLATE 3 – GENERAL SURFACE CONDITIONS IN THE SOUTH OF THE SITE AND MAST IN BACKGROUND

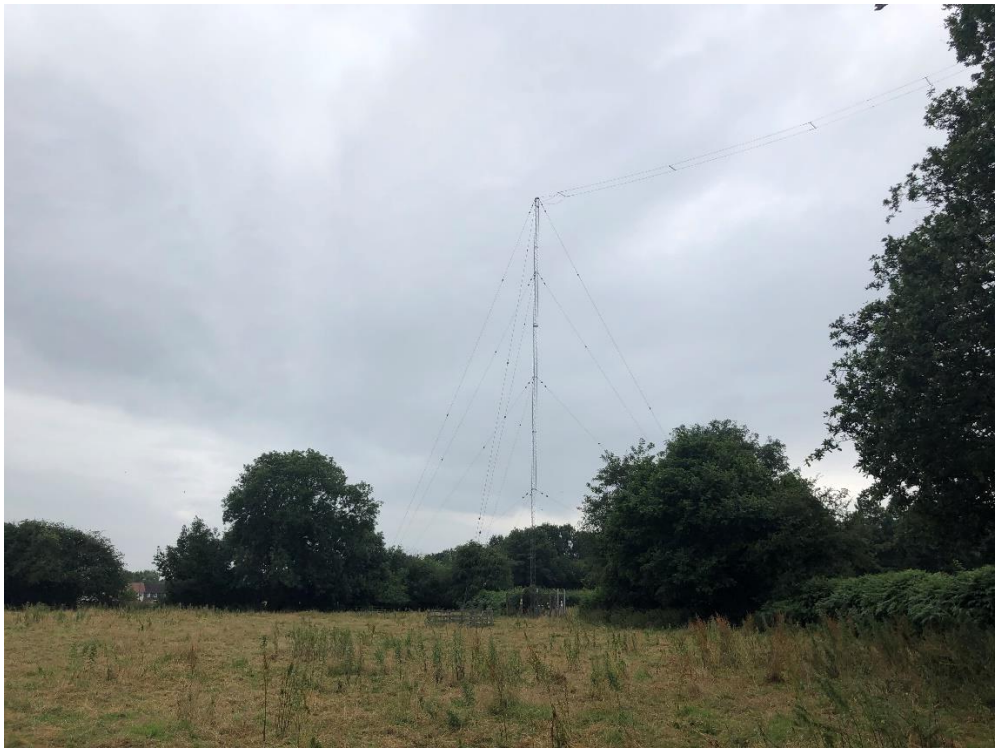


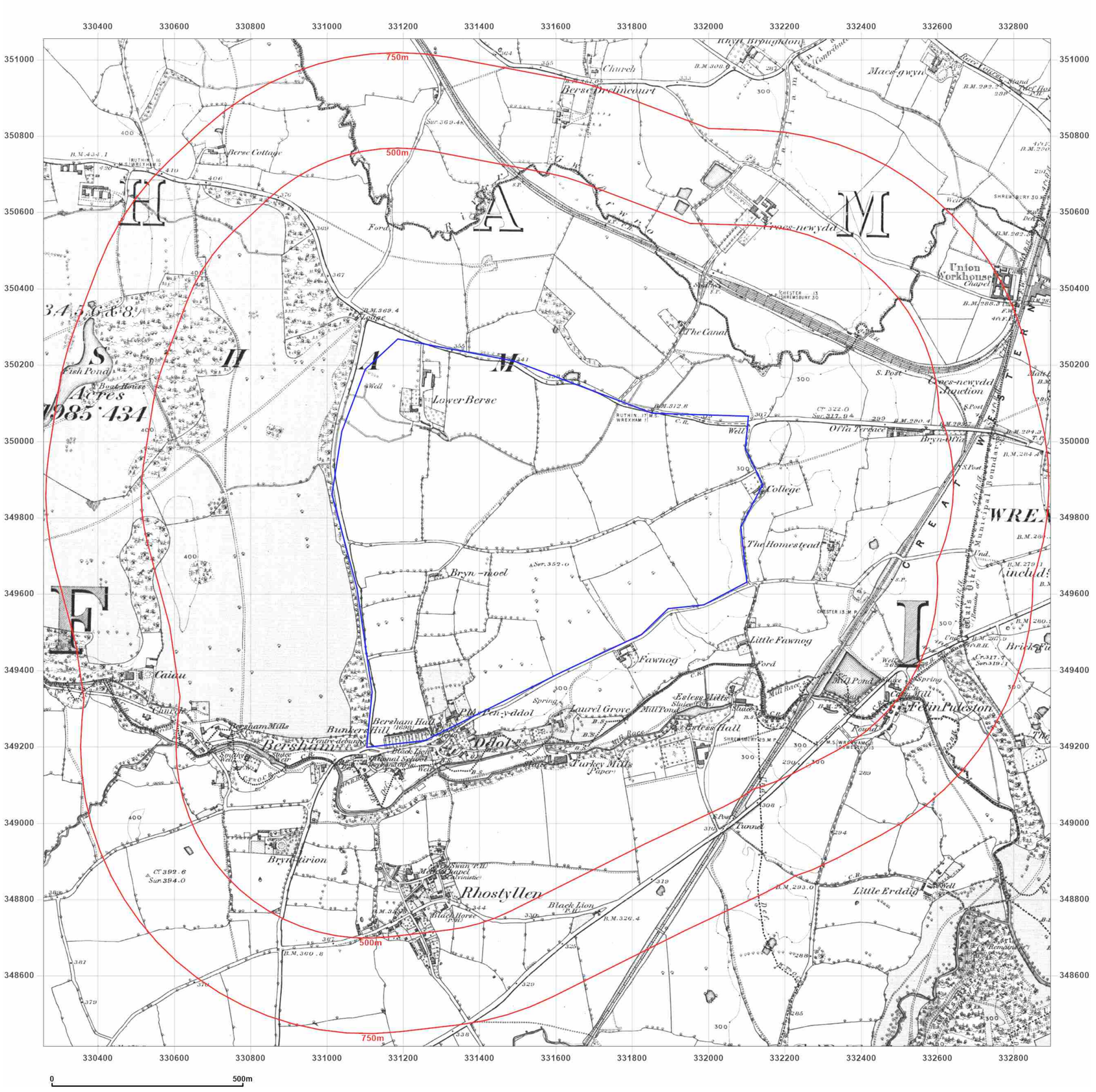
PLATE 4 – GENERAL SURFACE CONDITIONS THROUGH SOUTH OF THE SITE.



PLATE 5 YARD AREAS AND FARMHOUSE IN BACKGROUND



APPENDIX V
HISTORICAL MAPS



Groundsure INSIGHTS

Site Details:

BERSHAM HERITAGE CENTRE,
BERSHAM HERITAGE CENTRE,
BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: County Series

Map date: **1872**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1872
Revised 1872
Edition N/A
Copyright N/A
Levelled N/A

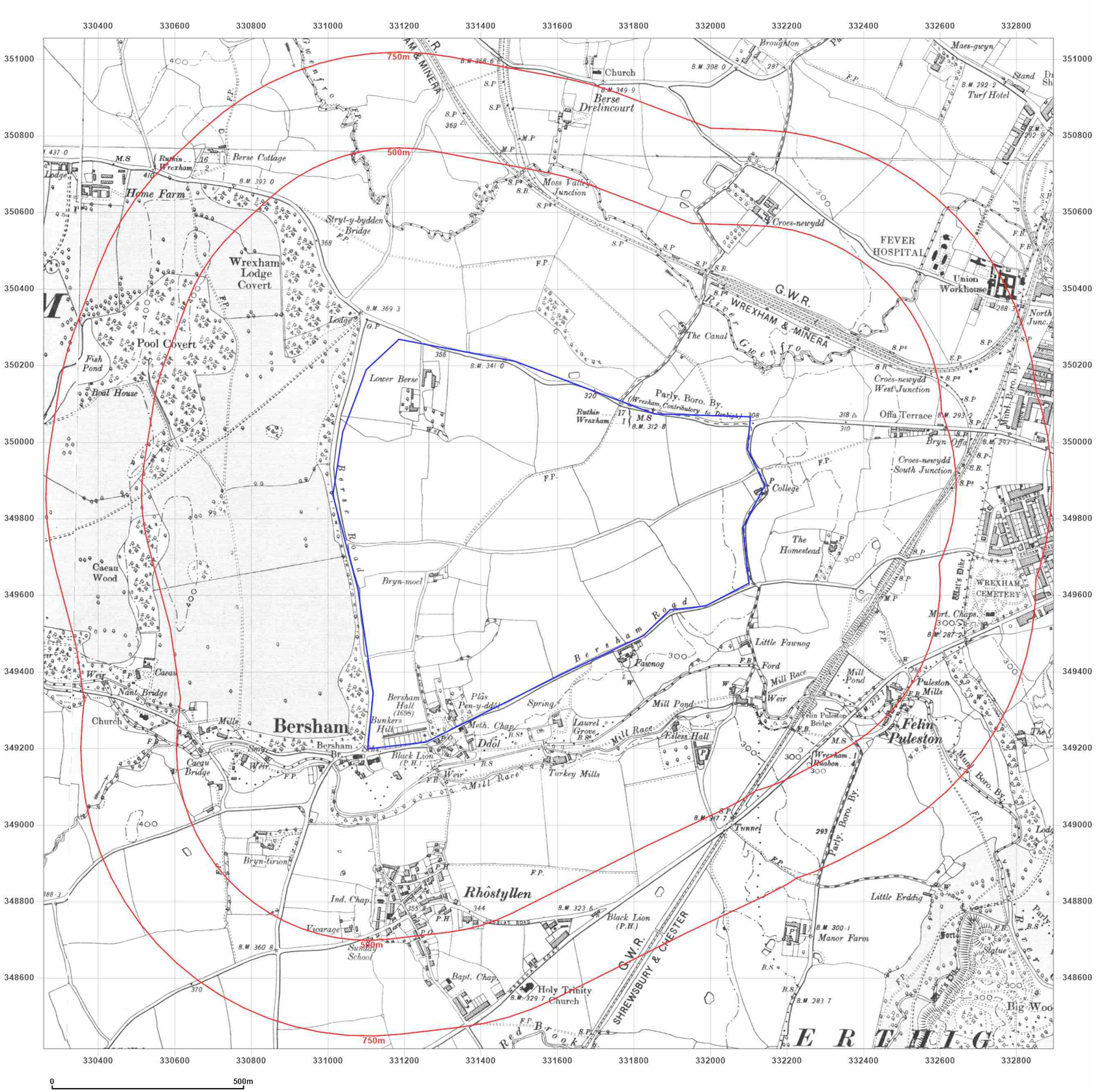
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Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: County Series
Map date: **1898-1900**
Scale: 1:10,560
Printed at: 1:10,560

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Surveyed 1870
Revised 1900
Edition N/A
Copyright N/A
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Surveyed 1877
Revised 1898
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1873
Revised 1898
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1898
Edition N/A
Copyright N/A
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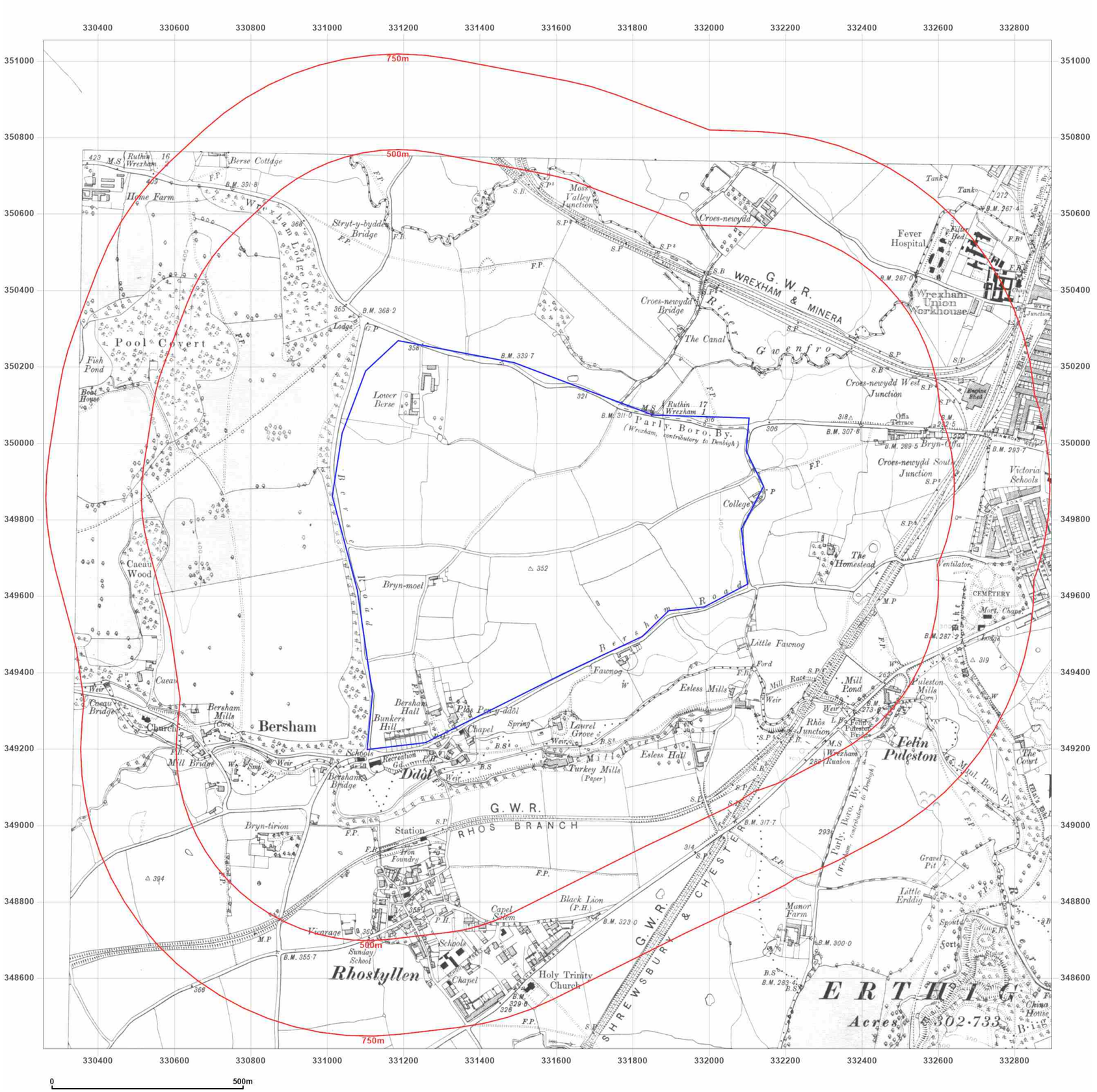
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WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: County Series

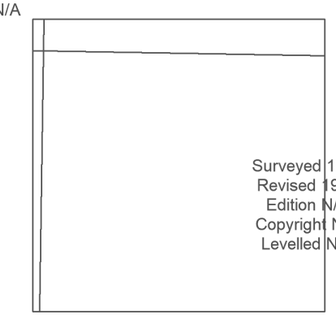
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Revised 1910
Edition N/A
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Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

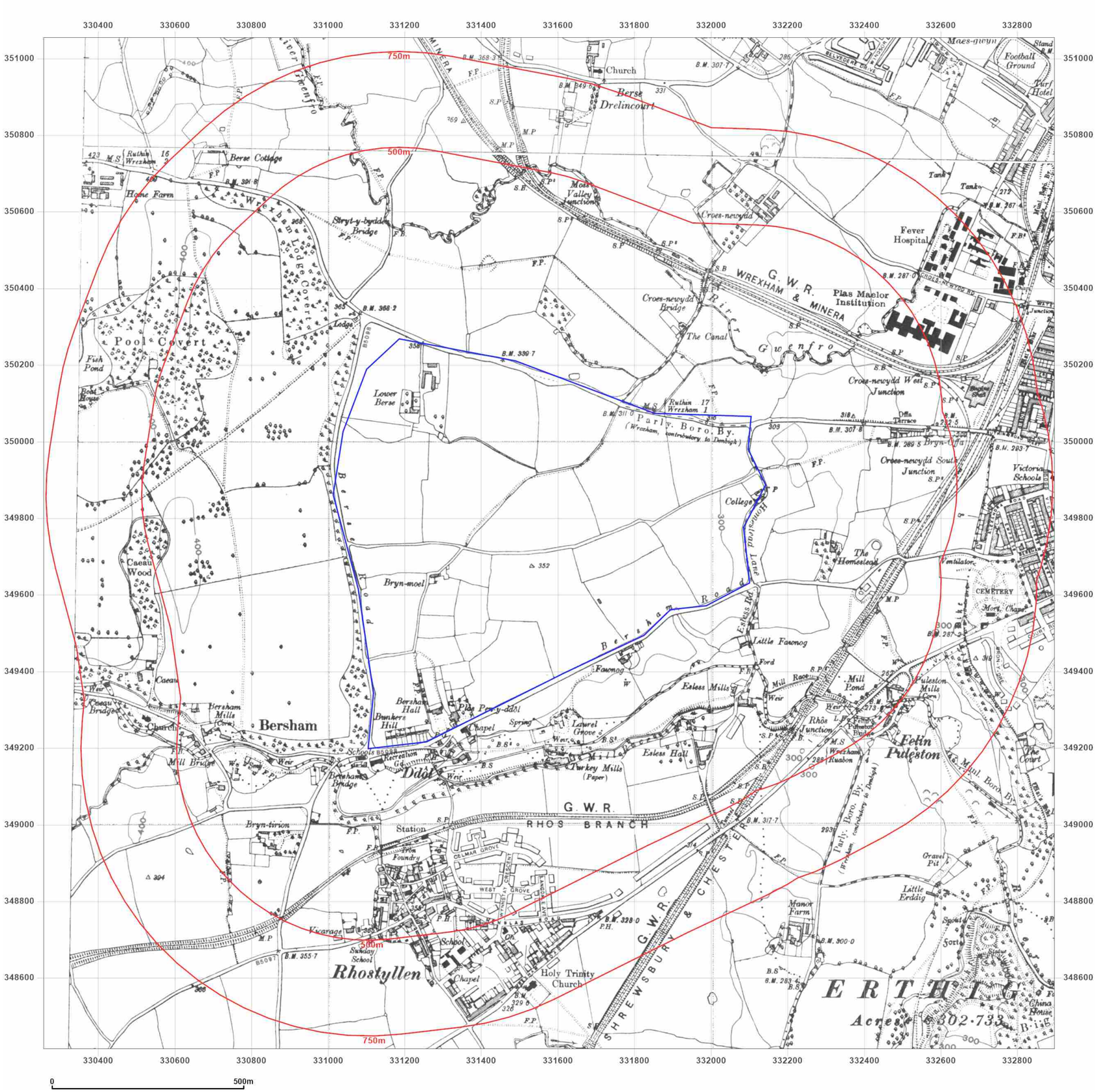
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Client Ref: 14854
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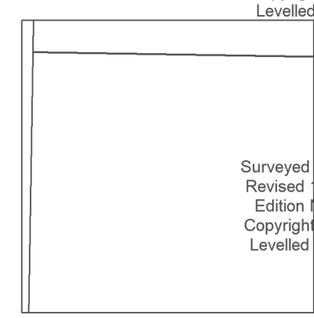
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Scale: 1:10,560

Printed at: 1:10,560

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Revised 1938
Edition N/A
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WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: County Series

Map date: **1938**

Scale: 1:10,560

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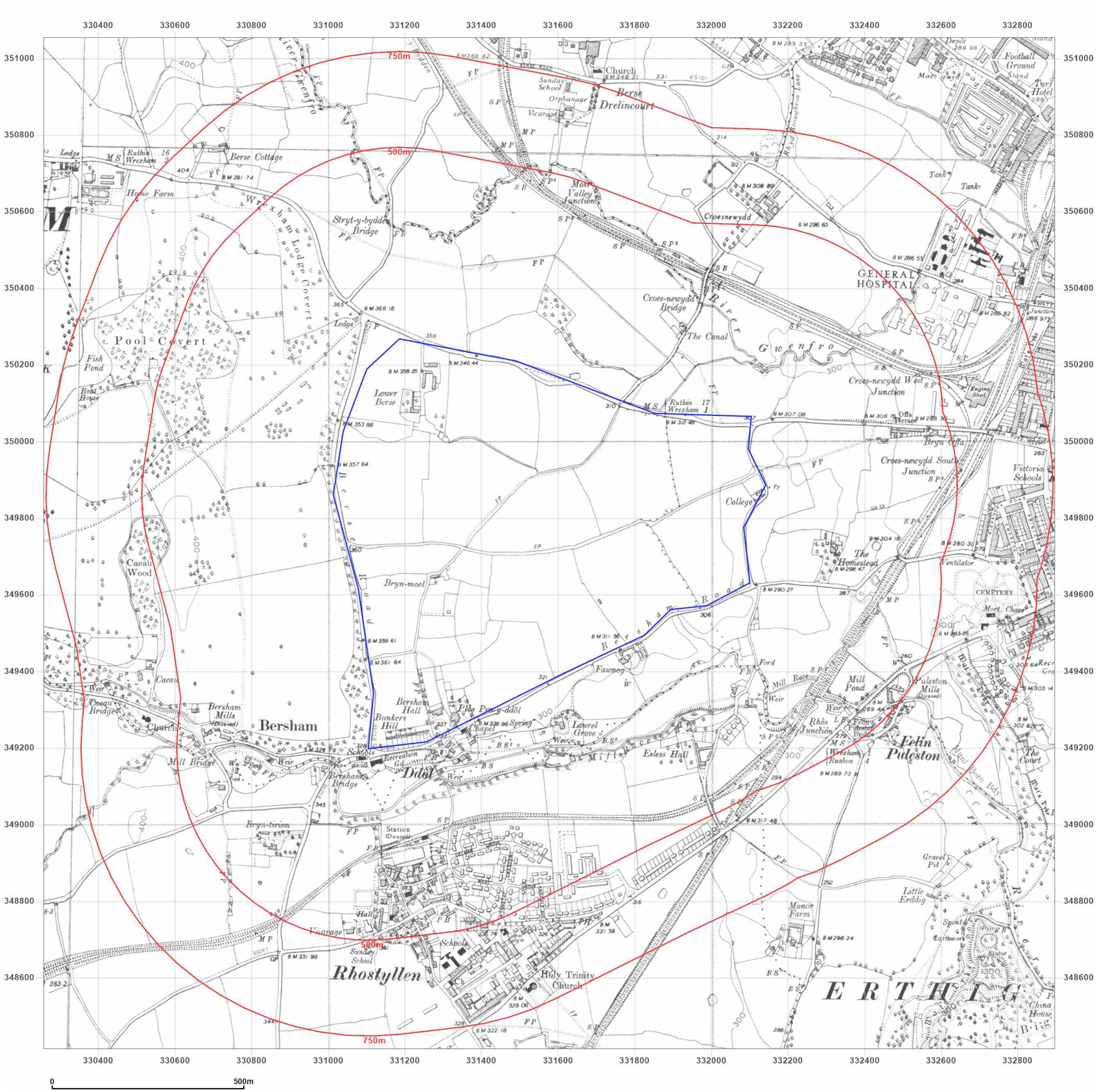
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Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: County Series

Map date: **1949**

Scale: 1:10,560

Printed at: 1:10,560

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Revised 1949
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1871
Revised 1949
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1872
Revised 1949
Edition N/A
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Levelled N/A

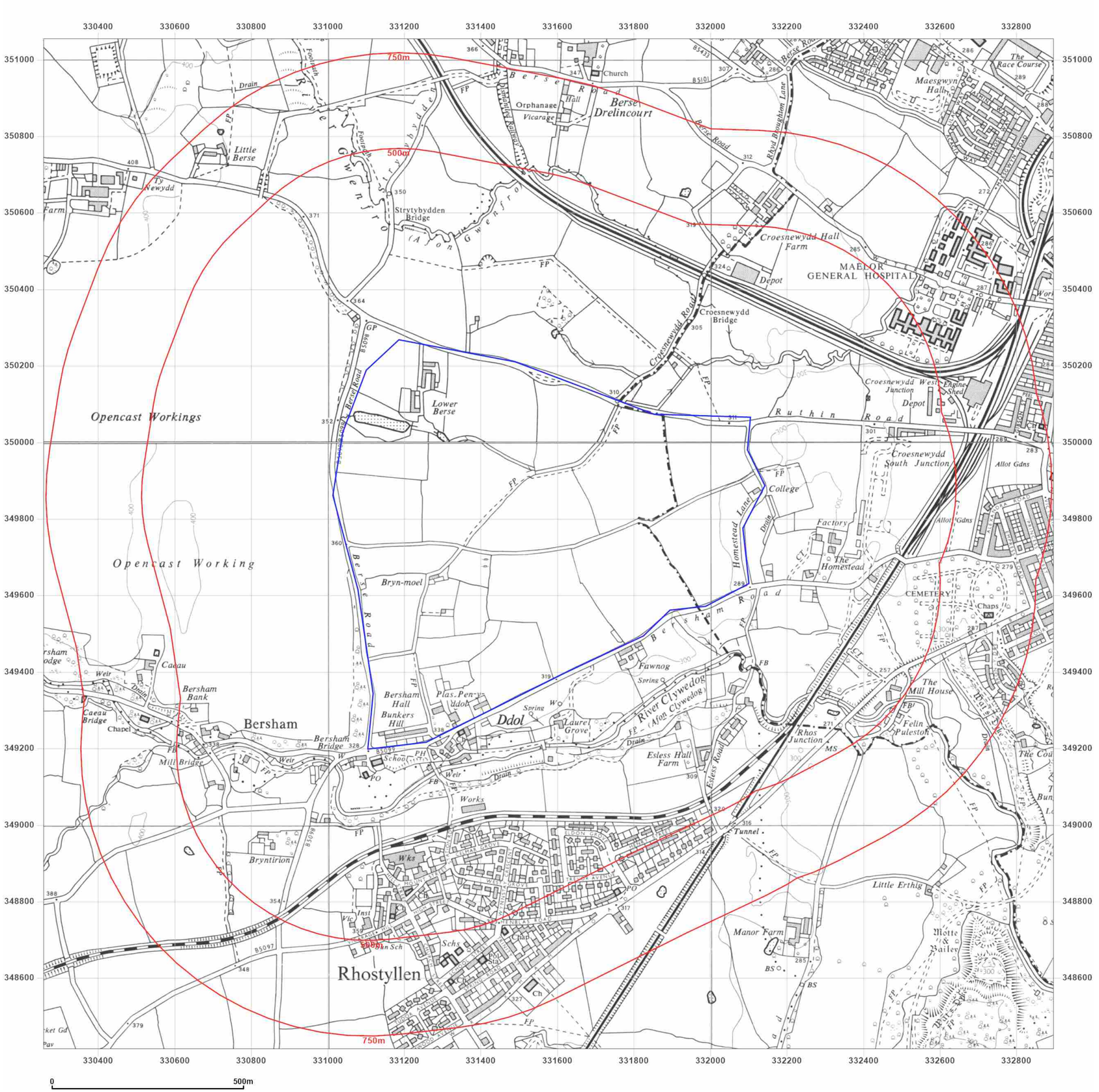
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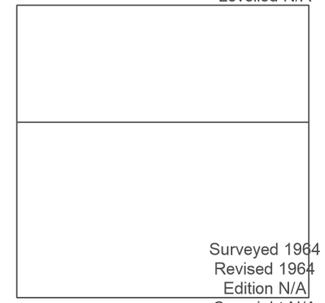
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Edition N/A
Copyright N/A
Levelled N/A



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Revised 1964
Edition N/A
Copyright N/A
Levelled N/A

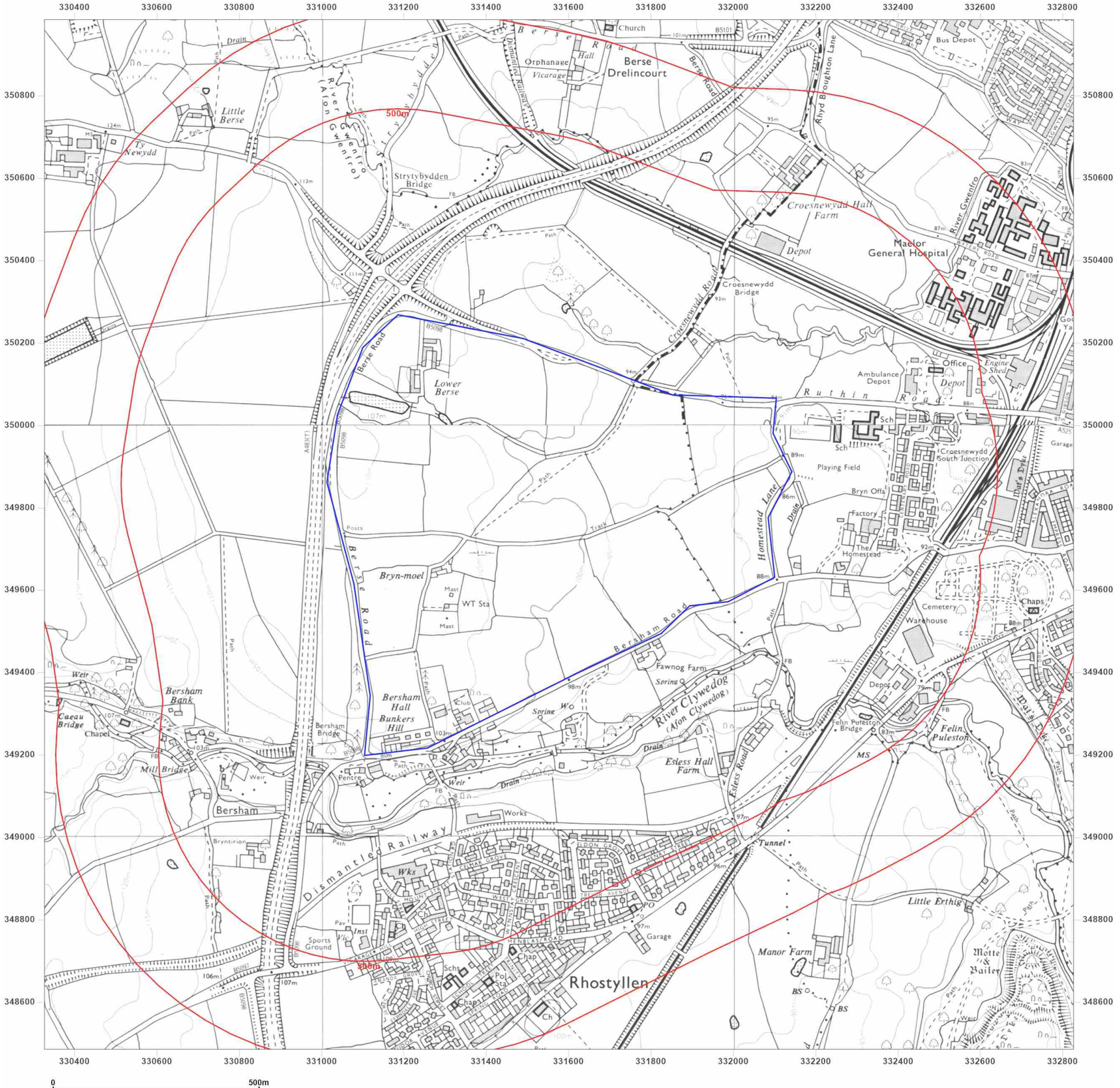
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WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: National Grid

Map date: **1974-1979**

Scale: 1:10,000

Printed at: 1:10,000

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Revised 1974
Edition N/A
Copyright 1974
Levelled 1969

Surveyed 1975
Revised 1979
Edition N/A
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WREXHAM, LL14 4HT

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Grid Ref: 331576, 349734

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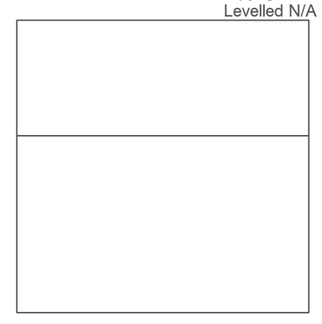
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Surveyed 1980
Revised 1980
Edition N/A
Copyright N/A
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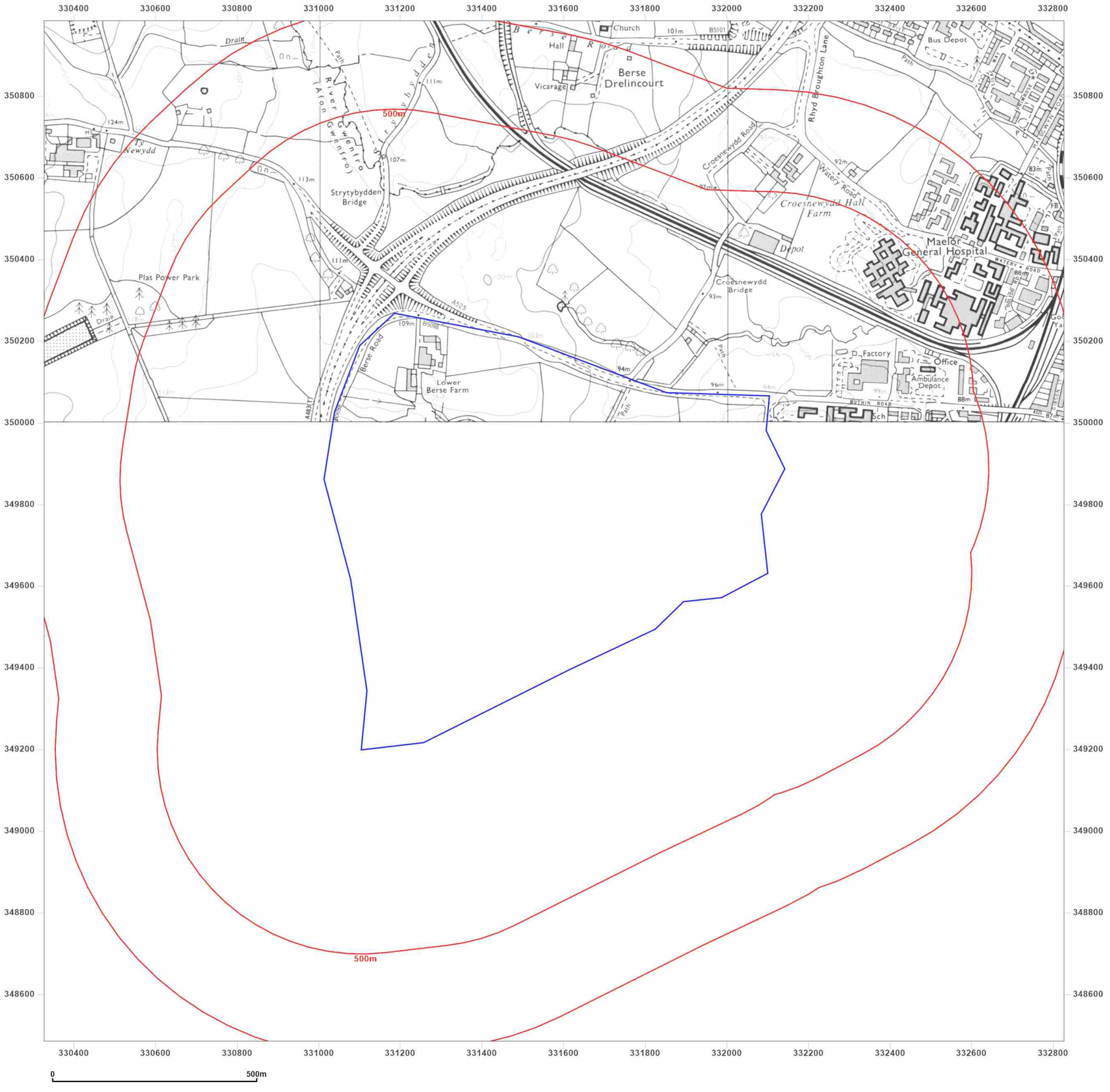
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BERSHAM HERITAGE CENTRE,
BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

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Map Name: National Grid

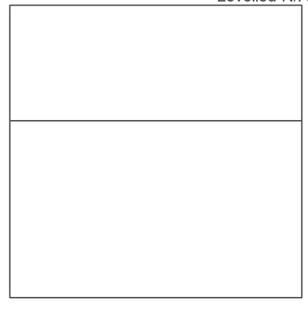
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Surveyed 1985
Revised 1985
Edition N/A
Copyright N/A
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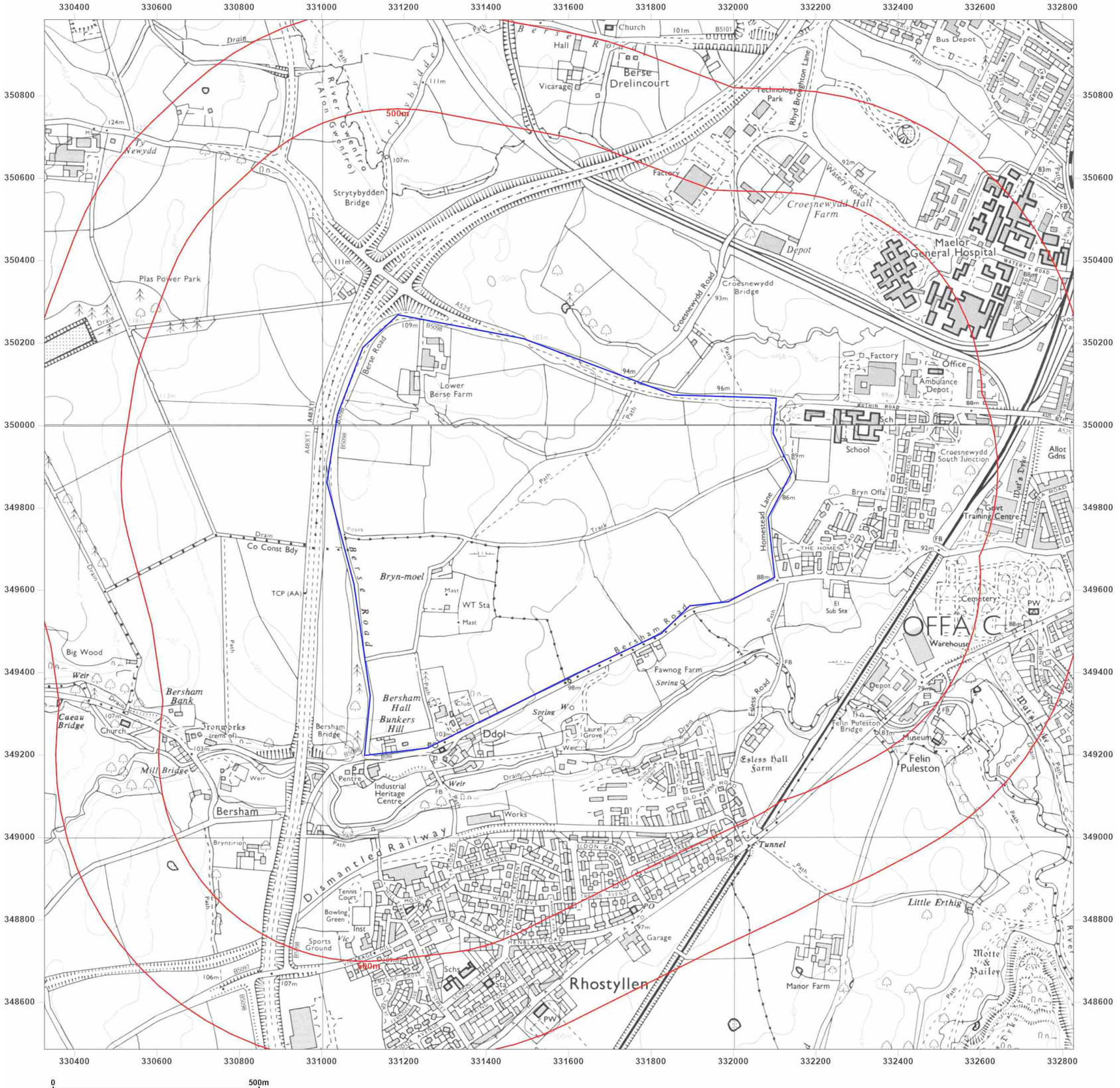
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BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: National Grid

Map date: **1989-1992**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1985
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1987
Revised 1992
Edition N/A
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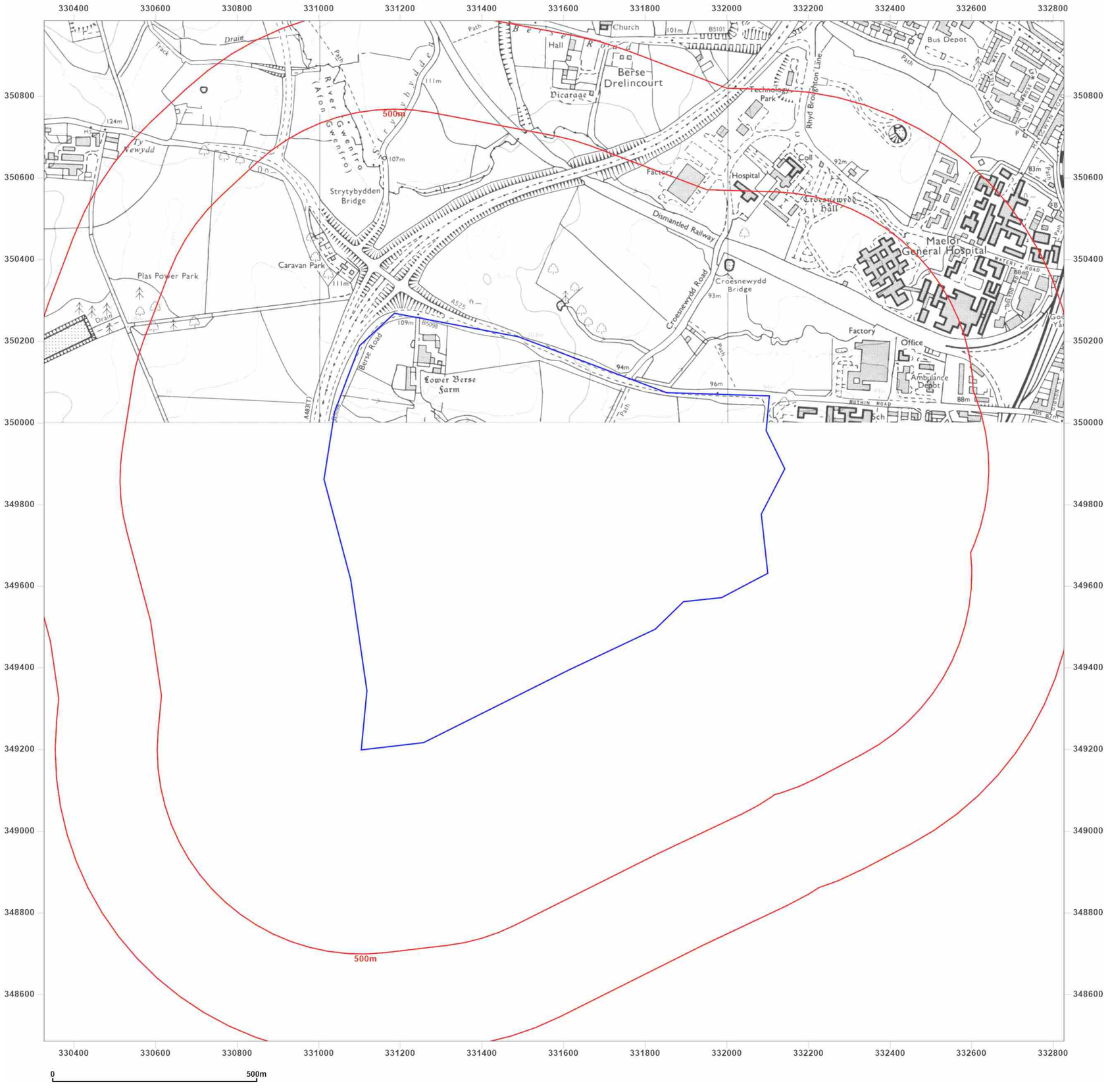
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Report Ref: GS-9121512
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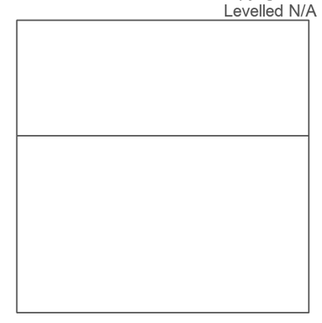
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Surveyed 1990
Revised 1992
Edition N/A
Copyright N/A
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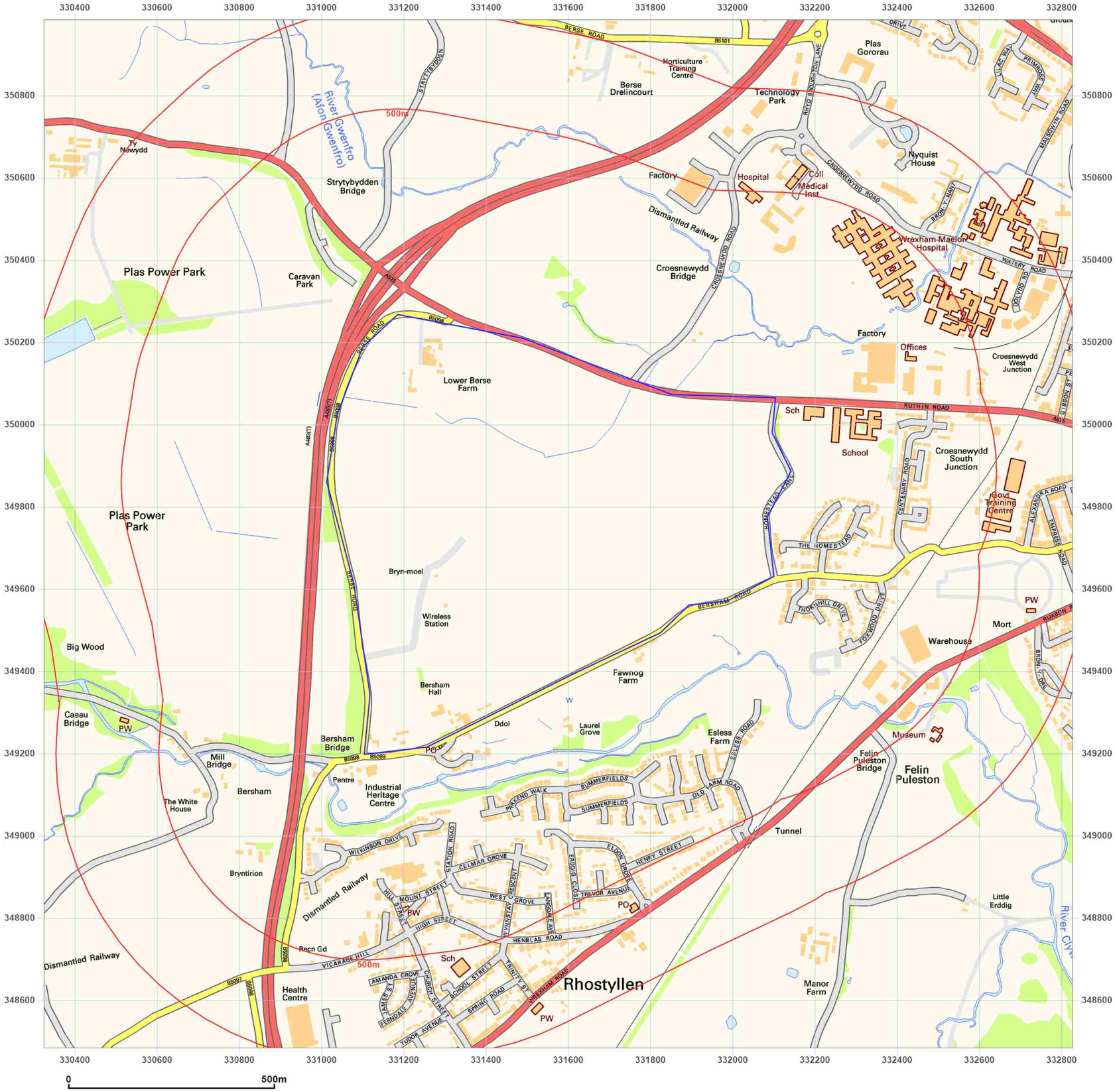
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BERSHAM HERITAGE CENTRE,
BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: National Grid
Map date: **2001**
Scale: 1:10,000
Printed at: 1:10,000

N
W E
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2001

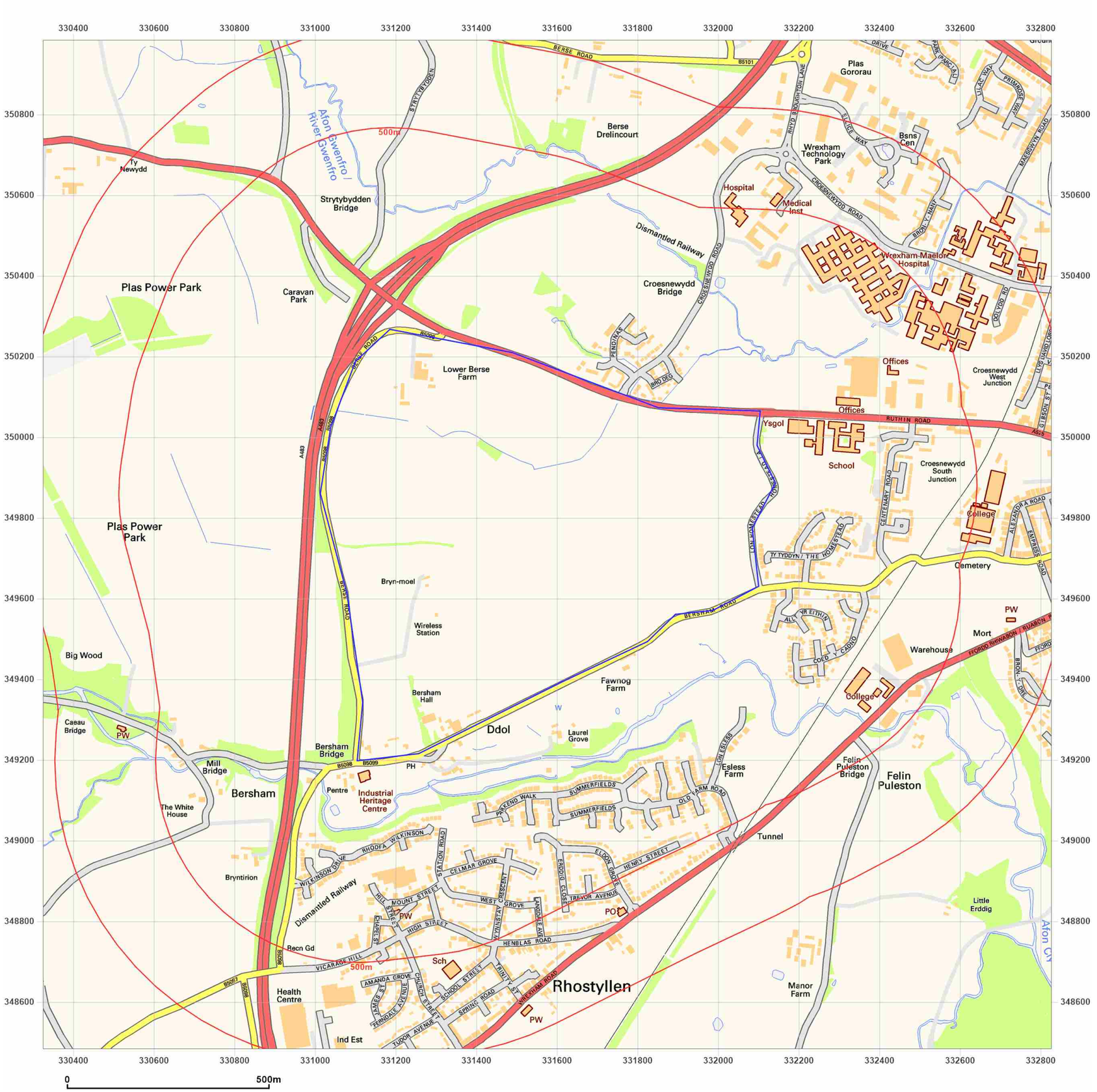
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Groundsure INSIGHTS

Site Details:

BERSHAM HERITAGE CENTRE,
BERSHAM HERITAGE CENTRE,
BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

N
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2010

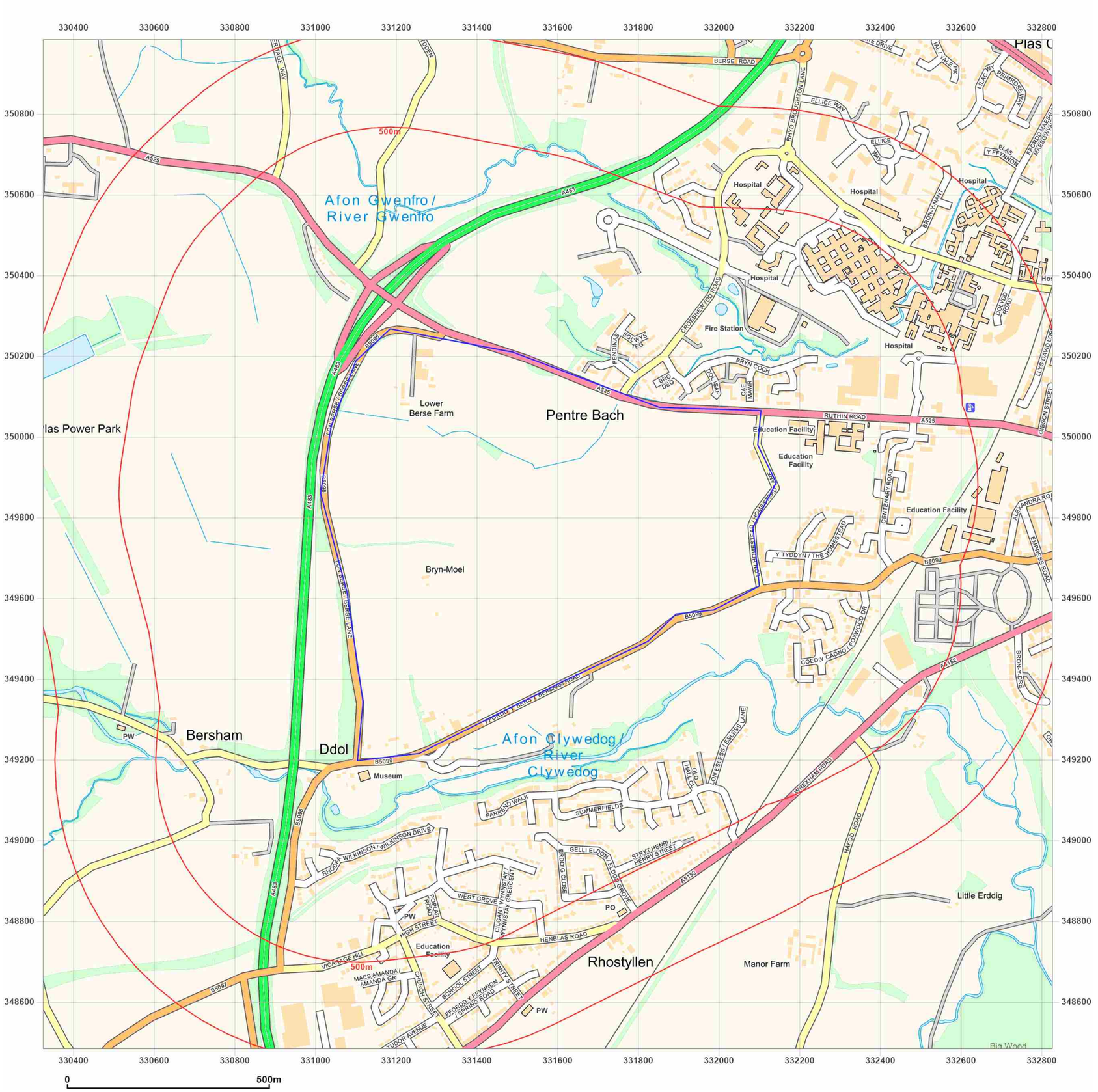
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Groundsure INSIGHTS

Site Details:

BERSHAM HERITAGE CENTRE,
BERSHAM HERITAGE CENTRE,
BERSHAM ROAD, BERSHAM,
WREXHAM, LL14 4HT

Client Ref: 14854
Report Ref: GS-9121512
Grid Ref: 331576, 349734

Map Name: National Grid
Map date: **2022**
Scale: 1:10,000
Printed at: 1:10,000

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2022

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