

OAK ROAD, WREXHAM

Report No F9042-19/1

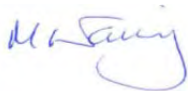
VOLUME 01: PHASE 1 REPORT : DESK STUDY AND SITE RECONNAISSANCE

September 2019

Issue No 01

Carried out for:
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Report No F9042-19/1

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REPORT STRUCTURE

DATE	TITLE	REPORT No
September 2019	PHASE 1 REPORT: DESK STUDY AND SITE RECONNAISSANCE	F9042-19/1
September 2019	PHASE 2 REPORT : CONTAMINATED LAND ASSESSMENT FACTUAL AND INTERPRETATIVE REPORT	F9042-19/2
TBC	PHASE 2 REPORT : GEOTECHNICAL ASSESSMENT FACTUAL AND INTERPRETATIVE REPORT	F9042-19/3

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1 INTRODUCTION

SOCOTEC UK Limited was commissioned in August 2019 by Conrad Energy Limited (Conrad Energy), to carry out a Desk Study and Site Reconnaissance and contamination assessment at Oak Road, Wrexham. This was required to obtain geotechnical and geoenvironmental information for a proposed small scale flexible fuelled power generation project. The contamination assessment is preliminary to assist with the planning conditions. A geotechnical site investigation is progressing.

This report comprises the desk study and has been prepared in accordance with British Standards BS 5930 (2015) and BS 10175:2011+A2 (2017) and all normative references, including Environment Agency guidance report CLR 11, *Model Procedures for the Management of Land Contamination*.

The desk study which incorporates a site reconnaissance (walkover survey), see Appendix E, presents and discusses the available data obtained for the site and surrounding area regarding its physical, historical and environmental setting. It identifies the potential issues at the site, develops an initial conceptual site model (CSM) for geoenvironmental considerations and provides an assessment of geotechnical aspects and other pertinent ground hazards that could affect the development.

The principal objective of this investigation and the context of the CSM developed within this report is to provide an assessment of potential significant risks in order to:

- conduct a Preliminary Contamination Risk Assessment.
- assess the potential requirements for further mitigation or investigation of land contamination risks to ensure that the proposed development will be 'suitable for use'.
- give an account of the anticipated ground conditions at the site based upon published geological and hydrogeological information.
- provide information for detailed scoping of intrusive investigations.

2 SOURCES OF INFORMATION

The following sources of information have been used in preparation of this report:

- Extracts of available historical Ordnance Survey (OS) maps covering the period from 1872 to 2014 which are presented in Appendix B.
- A GroundSure EnviroInsight (EnviroInsight report) produced by GroundSure for an area up to 1 km from the centre of the site which is reproduced in Appendix C. The EnviroInsight report is compiled from the database of information maintained by various statutory bodies listed within Appendix C.
- A GroundSure GeoInsight (GeoInsight report) produced by GroundSure for an area up to 1 km from the centre of the site which is reproduced in Appendix D. The GeoInsight report is compiled from the database of information maintained by various statutory bodies listed within Appendix D. It included a series of maps showing the approximate position of the listed data together with details on geology, ground workings, mining and extraction, borehole records and estimated background soil chemistry.
- The British Geological Survey (BGS) websites.
- A site walkover undertaken on 21 August 2019.

3 SITE LOCATION AND DESCRIPTION

3.1 Site Location

The site is located approximately 5 km east of Wrexham, to the south east of the Wrexham Industrial Estate, at National Grid reference SJ386495, see Site Location Plan in Appendix A.

3.2 Site Description and Reconnaissance

The notes made during the site walkover undertaken on 21 August 2019 together with photographs taken are presented in Appendix E.

The site comprises a roughly rectangular shaped plot covering an area of approximately 0.3 hectares [photo 2].

The site boundary comprised a wooden bar fence along the west and south, a palisade fence along the northern boundary and palisade fencing and mature trees on the east boundary [photo 1]. The site is bounded by Oak Road to the south, Abbey Road South to the west, and industrial units to the north and east.

The site is generally level, with a gully (approximately 1.5 m deep [photo 3]) running roughly north west –south east from a roughly central location towards the south east corner of the site. At the west end of the gully there is a concrete service chamber cover, with a pipe exit on the eastern side [photo 6]. A pipe entry is shown on the north bank of the gully [photo 5] several metres away and these may have once been a single pipe but are now no longer connected. A rusted drum is located on the north side of the concrete service chamber [photo 4]. No identifying marks were apparent to indicate origin.

An electrical overhead line (OHL) crosses the site from north to south in the eastern part of the site, with an OHL tower located on site.

4 PROPOSED DEVELOPMENT

From information and the most recent development plan provided by Conrad Energy it is understood that the proposed development will comprise a small scale flexible fuelled power generation project.

This will include but is not limited to the following:

- Gas engines
- Oil Tanks
- Amenity Buildings
- Gas Kiosk
- Ecological mitigation area along the route of the OHL across the site.

5 PHYSICAL AND HISTORICAL SETTING

5.1 Historical Land Usage

The development of the site and surrounding area has been reviewed by reference to the historical maps and is summarised in Table 1 below.

TABLE 1 : SUMMARY OF SITE HISTORY

DATE AND MAP SCALE	ON SITE DEVELOPMENT	NEARBY DEVELOPMENT
1872 / 1873	The earliest maps reviewed record the site to be fields with an unnamed road running east to west central to the site area. A small pond is shown on the north west corner of the site.	The surrounding area generally comprises open land separated but field boundaries and minor roads. The Redwither Brook is shown approximately 300 m to the south, with River Clywedog 500 m to the south. Several small ponds are recorded within 250 m of the site boundary, the closest is approximately 100 m to the south.
1897 / 1899 / 1909 / 1912 / 1938	Small pond no longer shown by 1897.	1912 map records a well approximately 50 m east of the site.
1949 / 1959	Road alignment on site now covers south west corner only. Railway siding indicated as extending into the west of the site (1949 map only)	Considerable development off site up to site boundary and named as Wrexham Trading Estate. This would appear to be the redevelopment of the ROF Wrexham site which was operating during WWII. Redwither Brook has been possibly culverted as the path of the brook is smooth and no longer meandering. Several hydrants and structures within 250 m to the south and west. Works are noted to west. Electrical OHL shown 100 m east. Trigonometrical Station approx. 60 m north of the site.
1960-64	No significant changes	Single track railway terminating approximately 200 m north of the site, extends to north circling the Wrexham Industrial Estate and various works.
1971 / 1972	OHL line shown running north south through east of the site	1971 map shows two electrical substations : approximately 150 m north east and 240 m north



1979-1982	No significant changes	Wrexham Industrial Estate extends to cover area to west of the site.
1982	Road alignment now shows Oak Road along southern site boundary	Works on northern site boundary. Trigonometrical Station no longer shown.
1991-1992	No significant changes	Wrexham Industrial Estate extends to cover area to east of the site. 1991 map electrical substation approximately 80 m west
1994 / 2012	No significant changes	No significant changes

Not shown on the historical maps (due to security reasons) is an historic military site which is identified as including the site area. This was Royal Ordnance Factory (ROF) Wrexham and, between construction in January 1940 until the end of WWII when it was decommissioned, the site produced cordite. The site appears to have covered a large area, including the current Industrial Estate and surrounding area. Detailed maps of the site have not been located but there is no current indication that any structures were present within the site boundary. Many of the structures were demolished however anecdotal evidence indicates some buildings are still extant in the undeveloped local areas to the south of the site. These were not visited as part of the walkover.

5.2 Published Geology

The published geological map for the area, (BGS Sheet 122, 1967), and the BGS GeoIndex Onshore online viewer (2019) show the site located on Till comprising diamicton which is a unsorted and unstratified generally overconsolidated material deposited by glacial processes and consists of clay, sand, gravel and boulders. The underlying solid geology comprises Triassic Kinnerton Sandstone Formation (sandstone) on the east of the site and Permian and Carboniferous Salop Formation (mudstone, sandstone, conglomerate) on the west of the site.

Local BGS boreholes between 90 and 190 m to south and east record clay (Till) to a maximum depth of 32 m, overlying a sand layer proven to 34 m. Rockhead was not shown in any of the available BGS logs.

Localised areas of Made Ground are possible due to the development in the surrounding area and the realignment of the road, although a significant depth is not anticipated.

5.3 Geological Hazards

Information on various geological hazards are contained within the GroundSure GeolInsight report where the risks are classified between no data being supplied to a high risk geological hazard. Based on this information the site is categorised as follows.

TABLE 2 : SUMMARY OF POTENTIAL GEOLOGICAL HAZARDS

HAZARD	RISK CATEGORY
Shrink Swell Clay	Very low
Landslides	Very low
Ground Dissolution of Soluble Rocks	Negligible
Compressible Deposits	Negligible
Collapsible Deposits	Very low
Running Sand	Very low
Ground Workings – on site	No
Mining, Extraction and Natural Cavities – on site	No
Artificial Ground	No

5.4 Ground Workings

The GeolInsight indicates no historical surface ground working features on site.

5.5 Mining, Extraction and Natural Cavities

The available data does not indicate any past or present mining and/or quarrying within 1 km of the site.

5.6 Hydrogeology and Groundwater Abstraction

The hydrogeological characteristics of the site are summarised below:

TABLE 3 : SUMMARY OF HYDROGEOLOGICAL CHARACTERISTICS

HAZARD	REMARKS
Aquifer Classification within Superficial Geology	Secondary Aquifer – Undifferentiated.
Aquifer Classification within Bedrock	Kinnerton Sandstone – Secondary A Aquifer Salop Formation - Unproductive
Groundwater/ Potable Water Licence Abstraction	There is on groundwater abstraction licence 429 m south west from a 144m deep borehole for Calypso Drinks. (noted multiple times, 429 m nearest location) There are no potable water licence abstractions within 1 km of the site.
Source Protection Zones	A source protection zone 3 is shown 33 m south west and a source protection zone 2 is shown 85 m south west.

5.7 Hydrology, Flooding and Surface Water Abstraction

Information on the hydrological characteristics of the site are summarised below:

TABLE 4 : SUMMARY OF HYDROGEOLOGICAL CHARACTERISTICS

HAZARD	REMARKS
Surface Water Features / River Network	Watercourse/ditch 65 m south, 324 m south Redwither Brook, 445m south River Clywedog
River Quality (Biological and Chemical)	River Clywedog Biological quality B, 480 m south, Chemical quality C
Surface Water Abstractions	There are no surface water abstraction licences within 1.0 km of the site.
Flood Plain Risk	None identified / very low risk (<1 in 1000 chance of flooding)
Flood Defences / Groundwater Flooding / Susceptibility and Confidence Areas	The BGS groundwater flood risk map suggests the site is within an area susceptible to the risk of superficial deposits flooding.

6 GROUND GAS

6.1 Radon

According to the GeoInsight report the site is not within a radon affected area, and therefore radon protection measures are not required.

6.2 Made Ground

Artificial or Made Ground is not recorded to underlie the site. However, localised areas of Made Ground can be expected due the development in the surrounding area and the realignment of the road, although a significant amount is not anticipated.

Historical mapping records several offsite unspecified pits or heaps within 250 m of the site which could be a potential source of ground gas. The closest feature was located on site, dated 1872.

6.3 Landfill

There are 10 records of landfills or other waste sites within 1 km of the site. The closest site is 170 m north for incineration of clinical waste; this has been historically noted as a landfill location also with variable distances from site up to 250 m north. This could be a potential source of ground gas.

6.4 Archaeology / Ecology

No archaeological or ecological consultation has been undertaken for this study.

6.5 Utilities

Information from the client and salient observations made during the site walkover, record a gas main and drain underlying or in close proximity to the site.

6.6 Unexploded Ordnance (UXO)

The available online UXO risk mapping indicates a low risk for the site and wider area; no special precautions are required. A Luftwaffe target is noted approximately 500 m west of the site and is likely to be indicating the ROF Wrexham site as a whole as a target.

7 ENVIRONMENTAL SETTING

7.1 Designated Environmentally Sensitive Sites

In the context of this report sensitive land usage covered by the EnviroInsight report includes the following:

- Sites of Special Scientific Interest (SSSI) and Ramsar.
- Local and National Nature Reserves (LNR, NNR,).
- Special Protection Areas (SPA) and Special Areas of Conservation (SAC).
- World Heritage Sites and Ancient Woodlands.
- Areas of Outstanding Natural Beauty (AONB) and Environmentally Sensitive Areas (ESA).
- Forest and National Parks.
- Nitrate Sensitive Areas and Nitrate Vulnerable Zones (NSA, NVZ).

The proposed development site does not lie within or close to any sensitive land uses as defined by the EnviroInsight report.

7.2 Environmental Permits, Incidents and Registers Map

From the information provided in the EnviroInsight report, there are

- Five Integrated Pollution Prevention and Control (IPPC) sites within 500 m
- No water industry referrals (potentially harmful discharges to the sewer) within 500 m of the site
- One record of Licenced Discharge Consent within 250m of the site.
- No Red or List 1 dangerous or hazardous sites (including COMAH and NIHHS sites) within 500 m of the site.
- Two List 2 dangerous substance inventory sites are recorded within 500 m.
- Four Part B permits within 500 m.
- One Radioactive substance authorisation within 500 m.
- Seven pollution incidents on the National Incidents Recording System (NIRS) within 250 m of the site. Only one incident was noted as category 2 (significant) impact, the others are all minor or no impact.



- An fire occurred at a local site – Village Bakery 1.20 km west – on 19 August 2019. This was after the date of the EnviroInsight report and is not included within the dataset. At present the impact of the fire on the site is not known, but due to the distance is assumed to be low impact.

These records are summarised in the table below in distance order from site.

TABLE 5 : SUMMARY OF ENVIRONMENTAL PERMITS, INCIDENTS AND REGISTERS

SITE	LOCATION	TYPE	DETAILS
RC MOTORS	138 m, west	Part B permit (new legislation applies)	Waste oil burner, no enforcement notified
N/A	148 m, west	Pollution incident	Incident date 14-07-2002. Pollutant: smoke. Water impact: minor Land impact : no impact Air impact : significant
TRADEBE HEALTHCARE	170 m, north	IPPC Authorised Activities	Incineration of Hazardous Waste Effective as 30-04-2019
POLKACREST WALES	222 m, north	Part B permit (historical)	Combustion & incineration, no enforcement notified
TRINCO	222 m, north	Disposal of Radioactive Waste (was Rda60 Section 6)	Revoked/cancelled, Last updated 01-01-2015
MARCHWIEL ABBEY	224 m, north west	Licensed discharge consent	33 kV substation unnamed tributary of Redwither Brook Issue date 16-04-1963
TRADEBE HEALTHCARE	229 m, north	IPPC Authorised Activities	Clinical Waste Treatment Facility Effective as 30-04-2019
LLOYDS ANIMAL FEEDS	334 m, north west	IPPC Authorised Activities	Treatment and processing Effective as 30-04-2019
WASTE RECYCLING	359 m, north	IPPC Authorised Activities	Recovery and Disposal of Non Hazardous Waste Effective as 30-04-2019



PRYSMIAN CABLES	364 m, east	IPPC Authorised Activities Part B permit (historical)	Melting of non -ferrous metals, wood processing. Effective as 30-04-2019 Date of enforcement 30-03-2006
TRITECH PRECISION PRODUCTS	413 m, west	Part B permit (current)	Other metal process Date of enforcement 12-03-2007
BLUESTONE CHEMICALS	457 m, west	List 2 Dangerous Substances Inventory	Authorised substances : Chromium, Copper Not active
WELSH DEVELOPMENT AGENCY PCB CELL 283	495 m, west	List 2 Dangerous Substances Inventory	Authorised substance : Biphenyl

7.3 Landfill and Other Waste Sites

7.3.1 Landfill Sites

According to the information provided in the EnviroInsight report there are three landfills within 1 km of the site. These are summarised in the table below.

TABLE 6 : SUMMARY OF LANDFILL SITES

NAME	LOCATION	WASTES	STATUS
Marlborough Road	250 m, north west	A2 Other landfill site taking Special Waste	Operator: Welsh Assembly Government. No status given – same location as IPPC Tradebe.
BICC Cables	445 m, north east	Inert, liquid sludge	Last recorded 31-12-1977
British Celanese	600 to 673 m, north west	Industrial, liquid sludge	Last recorded 31-12-1983

7.3.2 Other Waste Sites

In addition to the landfills listed in Section 7.3.1, the EnviroInsight report indicates that there are eight licensed waste management facilities and registered waste transfer sites within 1 km of the site. These are summarised in the table below.

TABLE 7 : LICENSED WASTE MANAGEMENT FACILITIES AND REGISTERED WASTE TRANSFER SITES

SITE	LOCATION	WASTES	STATUS
Marlborough Road	183 to 250 m, north	Clinical waste incineration plant	Historic planning application and transfer of licence to IPPC (Tradebe)
Unit 2 Redwither Road	307 m, west	Tyre recycling	Historic planning application
Bluestone Chemicals	311 m, west	Chemical treatment facility	Expired 13-09-1999
Redwither Road	333 m, west	Waste transfer station	Historic planning application
Bryn Lane	359 m, north	Biological Treatment Facility	Issued
ASH Wrexham Recycling	378 to 417 m, south west	Household, commercial & industrial waste transfer station	Not given
Entrec	402 m, west	Metal recycling site (vehicle dismantler)	Effective
Unit 1 Redwither Road	503 m, west	Special Waste Transfer Station	Expired 01-05-2012

7.4 Current Land Uses

The EnviroInsight report covers other potential contamination sources close to the site including:

- Current Industrial Data
- Petrol and Fuel Stations
- Underground High Pressure Oil and Gas Pipelines

According to the EnviroInsight report, the proposed development site is recorded to be within 250 m of the following potentially contaminative industrial sites:

- OHL tower on site, plus one tower 143 m north and two towers south at 172 and 244 m
- Electrical substation 78 m west, 157 m north east and 241 m north
- Motoring or vehicle related
 - o RC Motors 137 m west, vehicle breakdown and recovery services
 - o JB Auto Clinic, 201 m south east vehicle parts and accessories
 - o TRW, 202 m west, vehicle parts and accessories
 - o KTC offroad supplies, 210 m south east vehicle components
 - o Brake Engineering, 241 m west vehicle components
- Tradebe Healthcare, 215 m, west, recycling services

Based on the data within the EnviroInsight report the site does not lie within 500 m of a petrol or fuel site, high voltage underground electricity cables or high pressure gas pipelines. However, from information provided by Conrad Energy a gas main underlies the site. A utility survey is scheduled to be undertaken to confirm the location of any buried services.

8 INITIAL CONCEPTUAL SITE MODEL

8.1 General

In line with existing legislation and the current regime for the management of contaminated land, assessments are undertaken using a risk based approach. It is necessary to define a Conceptual Site Model (CSM) for the site which identifies the potential sources of contamination, the receptors and the pathways that can connect them. In order for there to be a risk from contamination, one or more relevant pollutant linkages must exist, connecting a contamination source, a receptor (an entity which might be affected by the contamination) and a pathway (or mechanism) by which the receptor can be exposed to the contaminant.

A discussion of potential sources, pathways and receptors and a tabulated summary of the CSM indicating potential pollutant linkages follows. The criteria used for assessing the relevance of identified potential pollutant linkages are based on the objectives stated above. The site the construction of new industrial units/generators, including associated hardstanding, helping to reduce the pathway for any potential contamination derived from new on site activities. The end use for the site as such classed as an industrial site with the users including workers, visitors and site maintenance staff. Selected areas of the site are to be retained in situ as an ecological mitigation

area.

8.2 Potential Sources of Contamination

Potential sources of contamination are usually associated with current and former industrial activities, where the processing, storage, use, transportation and disposal of raw materials, products and wastes often leads to the contamination of underlying ground and groundwater. In addition, natural processes can also give rise to contamination such as hazardous gases.

Based on the information presented above, potential sources of contamination from current and historical site uses and from potentially significant off site sources have been assessed. Potential sources of contamination and contaminants at and within the site boundary are summarised in the table below. These are based in the desk study data obtained and published guidance.

TABLE 8 : POTENTIAL SOURCES OF CONTAMINATION

SITE USE / ACTIVITY AND AREA	SOURCES	TYPICAL CONTAMINANTS
Underlying services and other general Made Ground; small historical pond on site; former ROF cordite factory	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos
Offsite infilled ponds located within 250 of the perimeter of the site.	Organic rich infill potentially generating ground gases.	Gases including methane and carbon dioxide.
Electrical substation located approximately 78 m to the west.	Leaching and migration of contaminants.	PCB's.
On site historic railway sidings	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos
On site OHL tower	Leaching of contaminants.	PCB's.
Unidentified drum on site	Leaching of contaminants.	Unknown.
Offsite industrial sites and landfills within 250 m of the perimeter of the site	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, solvents, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs),asbestos

8.3 Potential Migration Pathways

The following potential pathways have been identified as potential migration pathways:

- Direct soil, soil dust and/or water ingestion.
- Inhalation of soil dust, soil vapour and/or water vapour.
- Dermal contact with contaminated soil, soil dust and/or water.
- Lateral and vertical migration of gases and/or vapours through permeable strata.
- Permeable ground conditions/rainfall infiltration.
- Leaching of contaminants from soils into soil pore water and shallow groundwater.
- Downward migration of soil pore water and shallow groundwater.
- Lateral groundwater flow.
- Preferential pathways including existing and proposed service trenches.
- Surface water runoff into drains.

8.4 Potential Receptors

Potential receptors have been identified and categorised as follows:

8.4.1 Human Health

- Construction workers
- Future site users including site staff or visitors
- Neighbouring site occupants
- Maintenance workers

8.4.2 Controlled Waters

- Superficial deposits (Till) are noted as a Secondary Unproductive Aquifer, the Kinnerton Sandstone bedrock is classed as a Secondary A Aquifer, while the Salop Formation bedrock is classed as Unproductive.
- Nearest groundwater abstraction licence is at least 429 m south west from a deep borehole (144 m).

- Zone III Source Protection Zone 33 m south west and Zone II 85 m south west.
- Unnamed brook 65 m to the south, and may be in a culvert; Redwither Brook 324 m south; River Clywedog 445 m south. Unnamed brook is a potential receptor.

8.4.3 Environmental Receptors

- No significant environmental receptors have been identified and as such are not being considered.

8.4.4 Built Environment

- Potential risk to buried concrete, potable water pipes or any new services. New buildings could be potentially be affected by ground gas

8.5 Summary

The relevant pollutant linkages based on the potential sources, pathways and receptors outlined above are tabulated below:

TABLE 9 : INITIAL CONCEPTUAL SITE MODEL

SOURCE	PATHWAY	RECEPTOR
Potential localised areas of Made Ground, Underlying services and other general Made Ground; small historical pond on site; former ROF cordite factory	Ingestion, direct contact, inhalation of dust	Construction site workers Future users
	Lateral Groundwater Migration	Unnamed brook to the south and underlying aquifers
	Direct contact with soil / groundwater	Built environment and services
Offsite infilled ponds within 250 m of the site boundary.	Lateral and vertical migration of ground gas.	Future users and built environment
Offsite landfill within 250 m of the site boundary		

There are currently a series of uncertainties and assumptions in the CSM presented above as this is based on desk study information only:

- Ground conditions have been conceptualised based on BGS geological maps and other primarily desk based information.
- The presence and depth of any groundwater bodies at the site is currently unknown.
- The ground gas regime within the site has not been characterised.

9 PRELIMINARY RISK ASSESSMENT

9.1 Assessment of Environmental Risks Methodology

The identification of potential pollutant linkages is a key aspect of the evaluation of potentially contaminated land. An approach based on CIRIA report C552 has been adopted. For each of the pollutant linkages, an estimate is made of:

- The potential severity of the risk; and
- The likelihood of the risk occurring.

Table 10 below presents the classification of the severity of the risk:

TABLE 10 : SEVERITY OF RISK

RISK FACTOR	TYPICAL EXAMPLES
Severe	Acute risks to human health; Major pollution of controlled waters (<<the water environment>>)
Medium	Chronic (long-term) risk to human health; Pollution of controlled waters (<<the water environment>>)
Minor	Damage to non-sensitive species or ecosystems, buildings or services

The probability of the risk occurring is classified according to the criteria provided in Table 11 below:

TABLE 11 : PROBABILITY OF RISK OCCURRING

PROBABILITY RATING	DESCRIPTION
High Likelihood	Pollutant linkage may be present, and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
Low Likelihood	Pollutant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

An overall qualitative evaluation of the level of risk is gained from a comparison of the severity and probability as presented in Table 12 below:

TABLE 12 : RISK RATING EVALUATION

	SEVERITY		
	SEVERE	MEDIUM	MINOR



PROBABILITY	HIGH LIKELIHOOD	Very high risk	High Risk	Moderate / low risk
	LIKELY	High risk	Moderate risk	Low risk
	LOW LIKELIHOOD	Moderate risk	Moderate/ low risk	Very low risk
	UNLIKELY	Moderate / low risk	Low risk	Very low risk

9.2 Preliminary Risk Assessment

Table 13 below details the potential risks associated with the various potential pollutant linkages identified through the assessment of the data collated in this report. The risk category should be reviewed if further information is made available or the environmental setting of the site changes, for example through a proposed change in the development layout or end use.

TABLE 13 : PRELIMINARY RISK ASSESSMENT

SOURCE	PATHWAY	RECEPTOR	SEVERITY	PROBABILITY	RISK RATING	COMMENTS
Potential localised areas of Made Ground, Underlying services and other general Made Ground; small historical pond on site; former ROF cordite factory	Soil ingestion Dermal contact Inhalation of soil dust / vapours	Construction site workers Future site users Built environment	Medium	Unlikely based on low sensitivity end use and future hardstanding provision	Low Risk	Soil samples to be recovered during site investigation. Reassess after completion of ground investigation. Full PPE to be worn by construction workers to reduce any risks.
	Lateral Groundwater Migration	Minor watercourse/ drainage ditch	Medium	Unlikely based on low sensitivity end use and future hardstanding provision	Low Risk	Soil and water samples to be recovered during site investigation.
	Leaching of contaminants and vertical migration to the groundwater	Underlying Secondary Aquifer and unnamed brook	Medium	Unlikely based on low sensitivity end use and future hardstanding provision	Low Risk	Due to predominantly cohesive strata anticipated.
Offsite electrical sub-station (approximately 78 m to the west)	Leaching of PCB contaminants and vertical migration to the groundwater.	Future site users	Medium	Low Likelihood based on low sensitivity end use and future hardstanding provision	Low Risk	Due to predominantly cohesive strata anticipated.
Offsite infilled ponds and landfill within 250 m of the site boundary.	Lateral and vertical migration of ground gas.	Future site users	Medium	Unlikely based on low sensitivity end use and future hardstanding provision	Low Risk	Given the distance from the site and the underlying cohesive strata limiting migration of ground gases to the site.

10 GEOTECHNICAL ASPECTS

10.1 Anticipated Ground Model and Potential Hazards

The anticipated ground conditions are expected to comprise a thin layer of Made Ground overlying Till, with bedrock likely to be in excess of 30 m. The groundwater table is expected to be within any granular lenses within the Till deposits.

10.2 Possible Foundation Options

Prior to detailed intrusive works it is assumed that traditional spread foundations are likely to be suitable for the structures of the proposed development, founding within the Till deposits. However, if the Till deposits are dominated by clays, and the cleared vegetation includes some substantial trees, then foundation depths may need to be increased to ensure foundations are not adversely effected by swelling of the clays as a consequence of the tree removal.

10.3 Excavations

Based on the anticipated ground conditions and the absence of underlying obstructions (including historical footings), excavation of the underlying soils should be easily achieved during the ground investigation using conventional drilling techniques.

It is considered unlikely that dewatering will be required. However, an allowance for simple dewatering techniques (i.e groundwater pumping from sumps) should be made.

10.4 Pavements / Hardstandings

To be considered following the information obtained from intrusive ground investigation.

10.5 Drainage

Drainage is to be designed following the provision of final layout plans provided by the designer. The Till deposits are likely to contain a significant proportion of clay, and so are unlikely to be suitable for the use of soakaways.

11 CONCLUSIONS AND RECOMMENDATIONS

It should be appreciated that the desk study can only give only give indications of the likely geotechnical and geoenvironmental conditions. Review of the information and the initial CSM highlights potential pollutant linkages. The Preliminary Risk Assessment shows risk ratings of Low, and in order to investigate the risks presented by these, an intrusive investigation is recommended and subsequently will be able to provide further information on actual contaminants present and viable pathways to sensitive receptors. The investigation should provide information to allow for the assessment of geotechnical parameters along with an assessment of potential contamination on site and should include:

- Geotechnical and Chemical analysis of the soils.
- Clarify the Initial Conceptual Site Model
- Clarify the Preliminary Risk Assessment
- Provide data for the design of any remedial works that may be required
- Benchmark the contamination status of the site
- Develop a Final Conceptual Site Model and Risk Assessment
- Provide geotechnical parameters for foundations
- Provide groundwater and gas information for the site
- Waste classification for re-use or off site disposal

To achieve these objectives, a ground investigation is proposed which will comprise 2 no. cable percussion boreholes and a minimum of 5 no. dynamically sampled boreholes.

12 REFERENCES

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APPENDIX A

FIGURES AND DRAWINGS

Site Location Plan
Proposed Layout Plan

A1
WXM-GA-01 Rev B

Site Location Plan



THE
SITE

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Notes: Scale 1:50 000	Project Wrexham SI Project No. F9042-19 Carried out for Conrad Energy	Figure A1
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APPENDIX B

HISTORICAL ORDNANCE SURVEY MAP EXTRACTS

Historical Mapping Legends

GS-6237863 Large Scale
GS-6237863 Small Scale

Site Details:

WREXHAM INDUSTRIAL
ESTATE, WREXHAM, LL13 9RG

Client Ref: A9008-19
Report Ref: GS-6237863
Grid Ref: 338692, 349504

Map Name: County Series

Map date: 1873

Scale: 1:2,500

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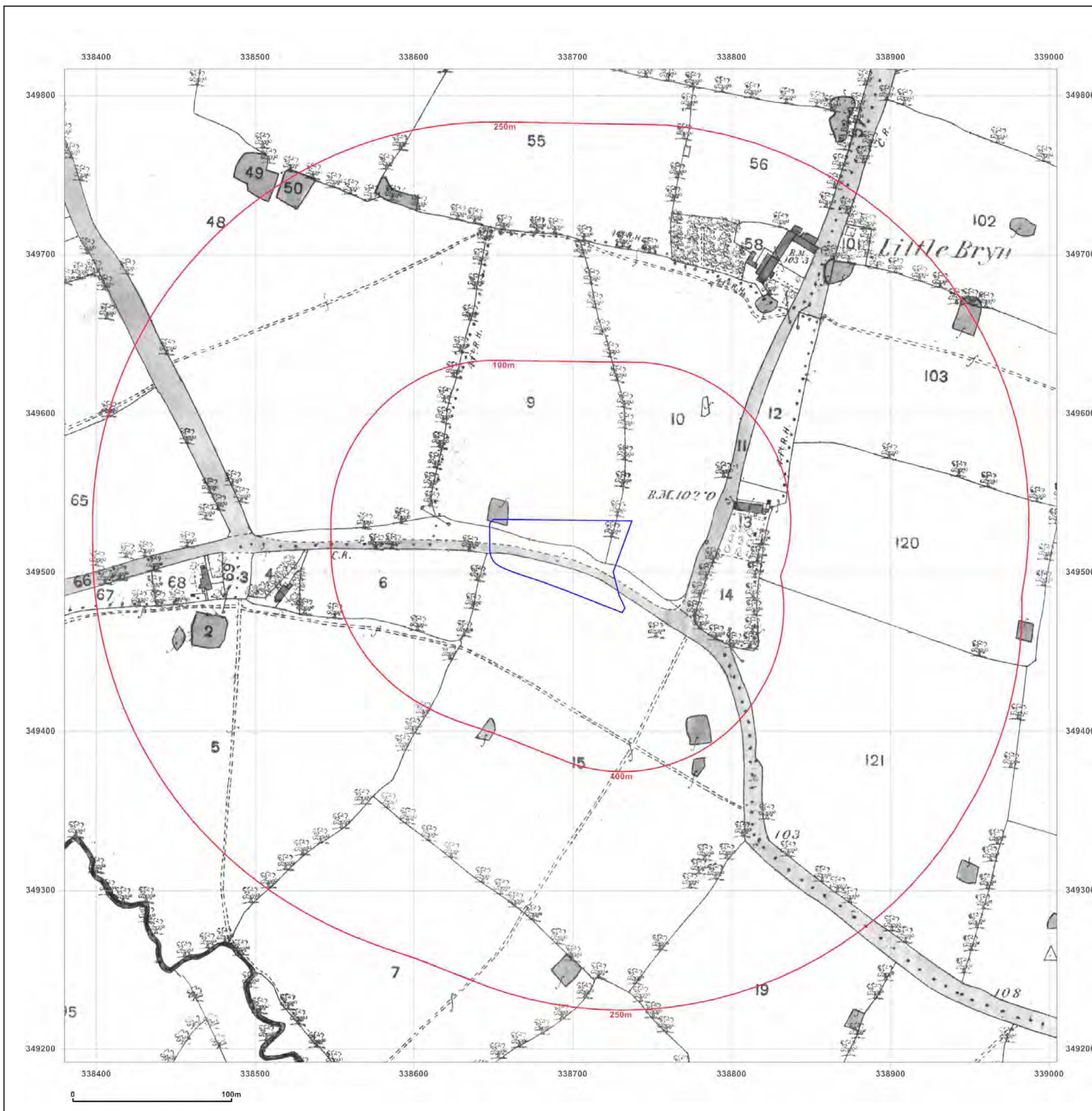


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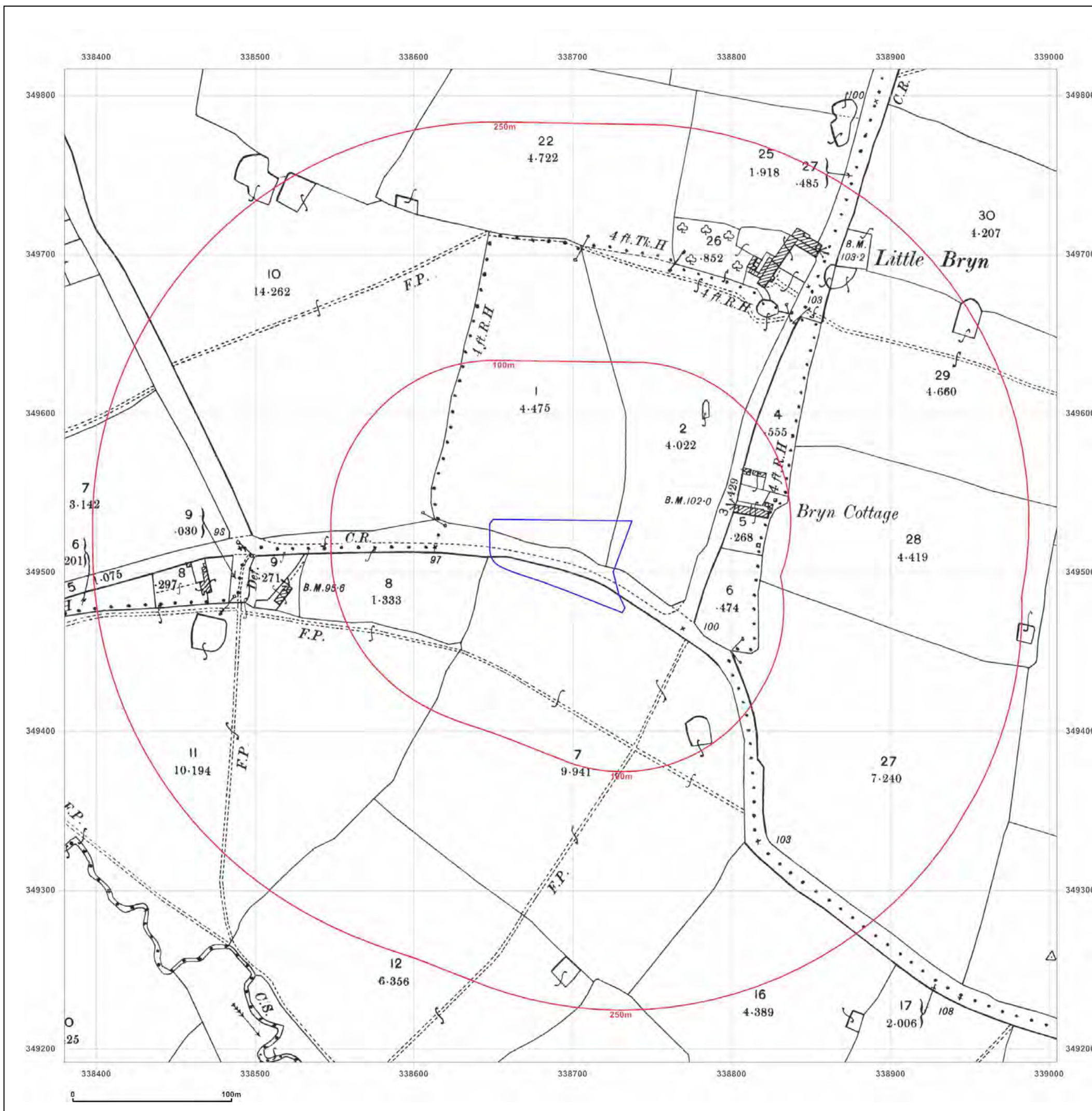


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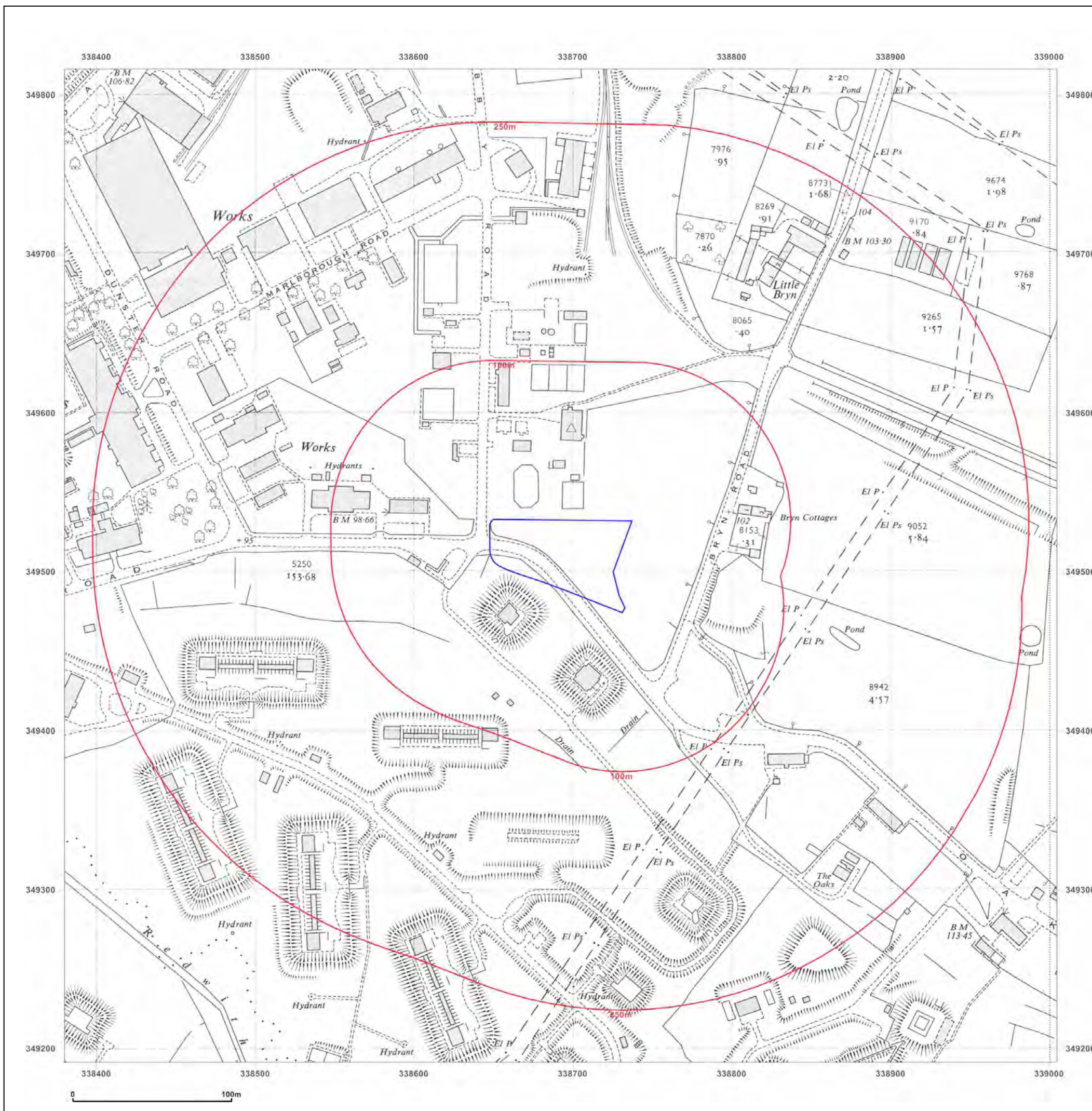


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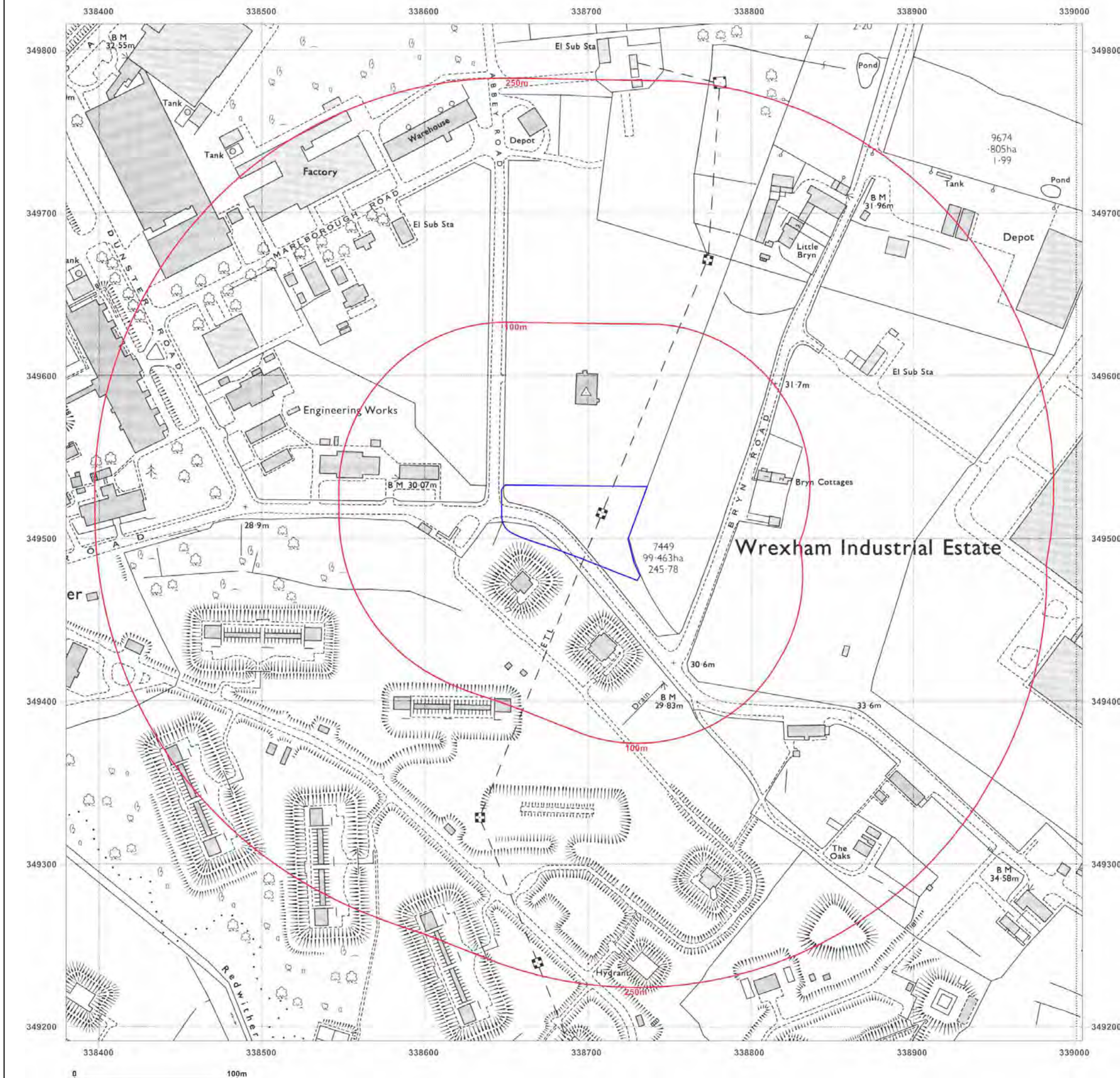


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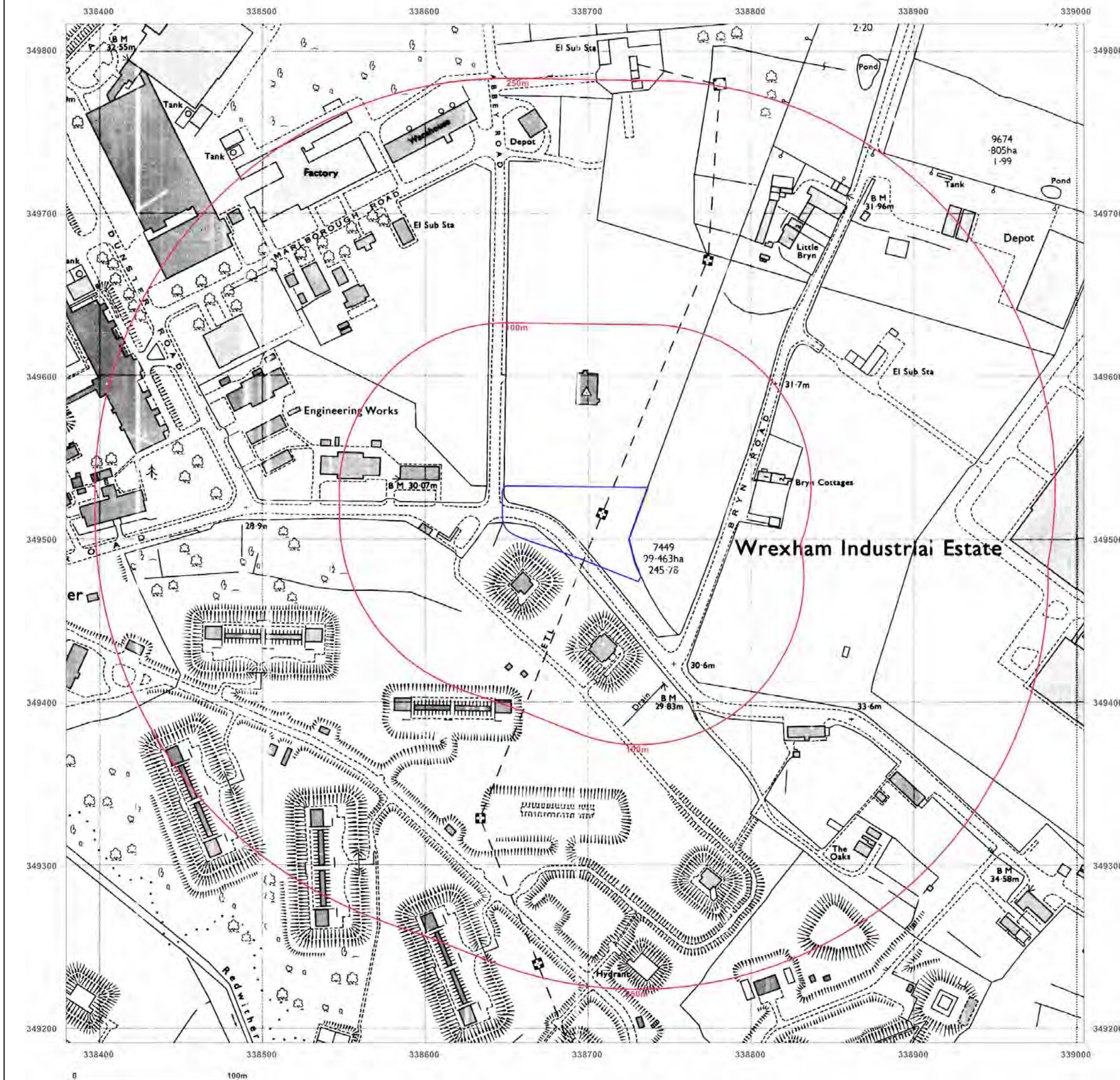


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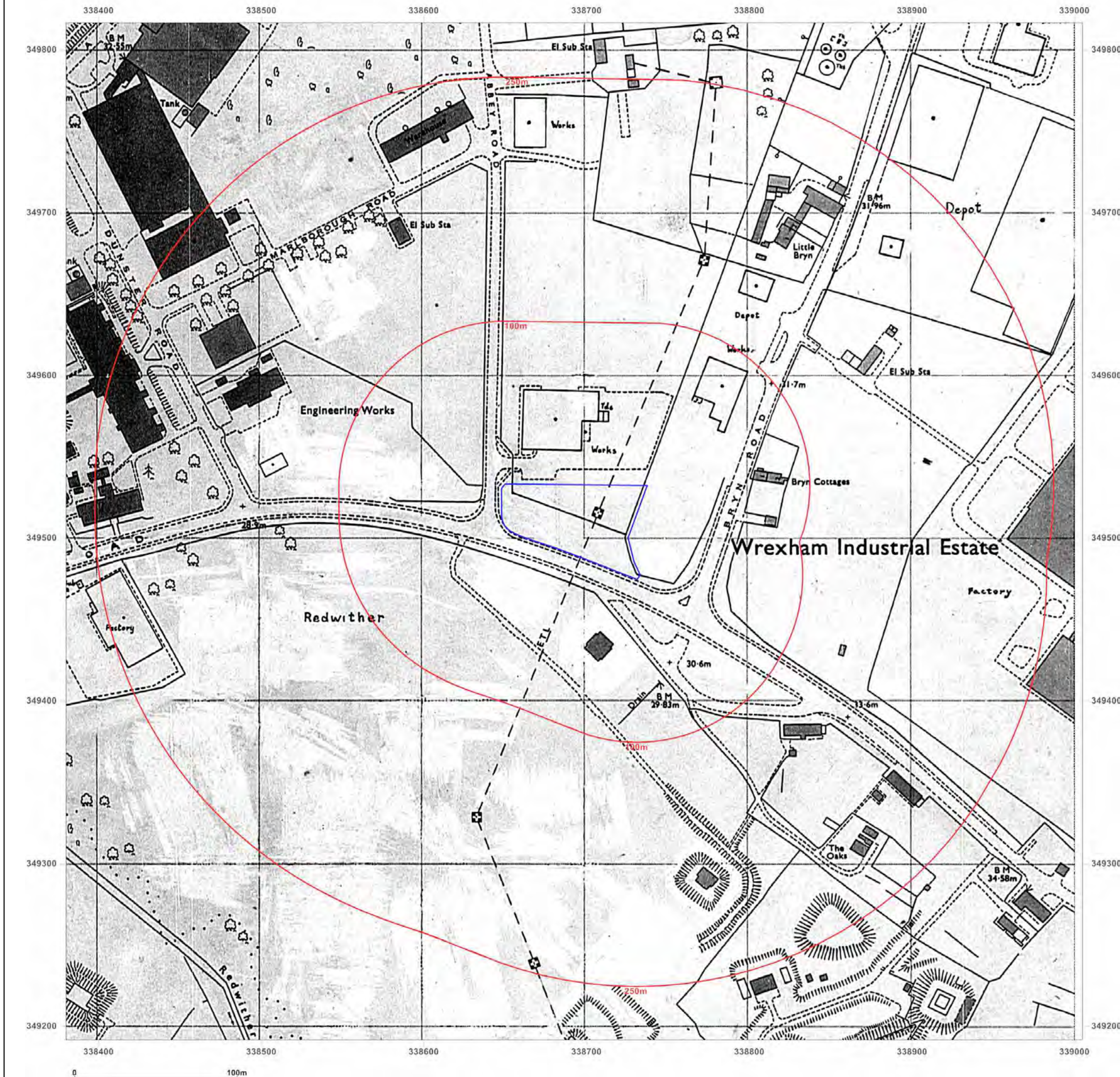


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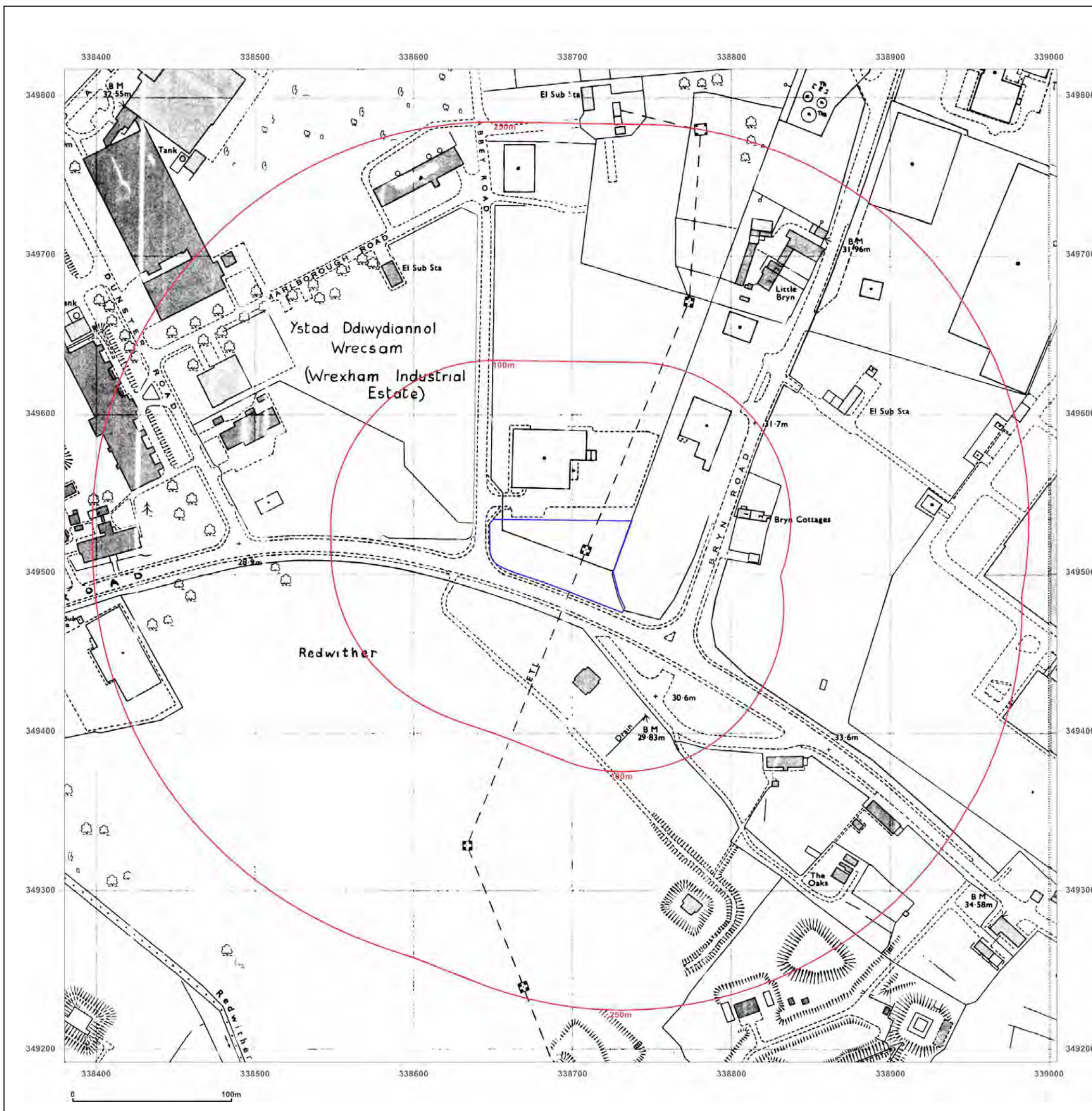


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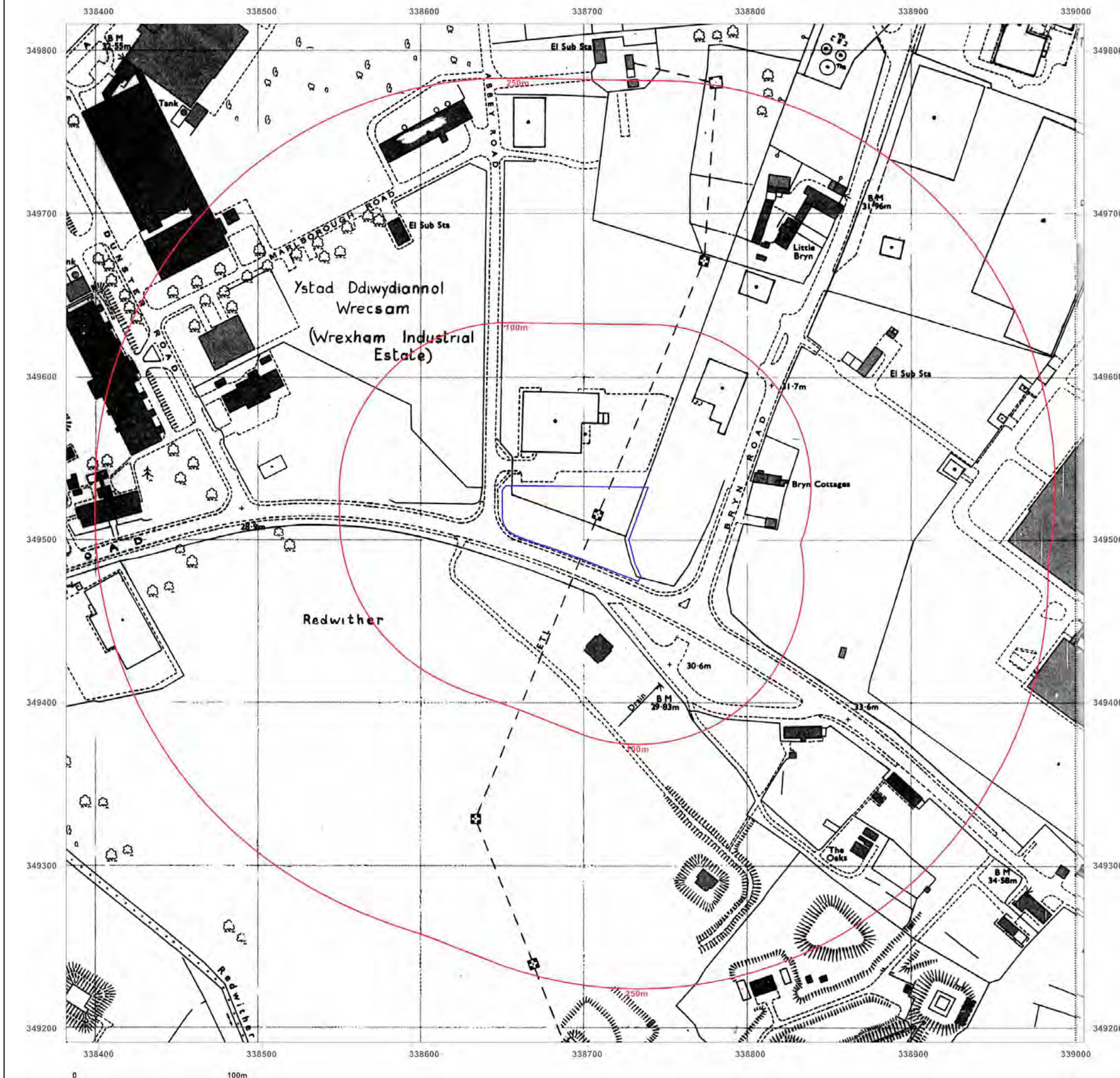


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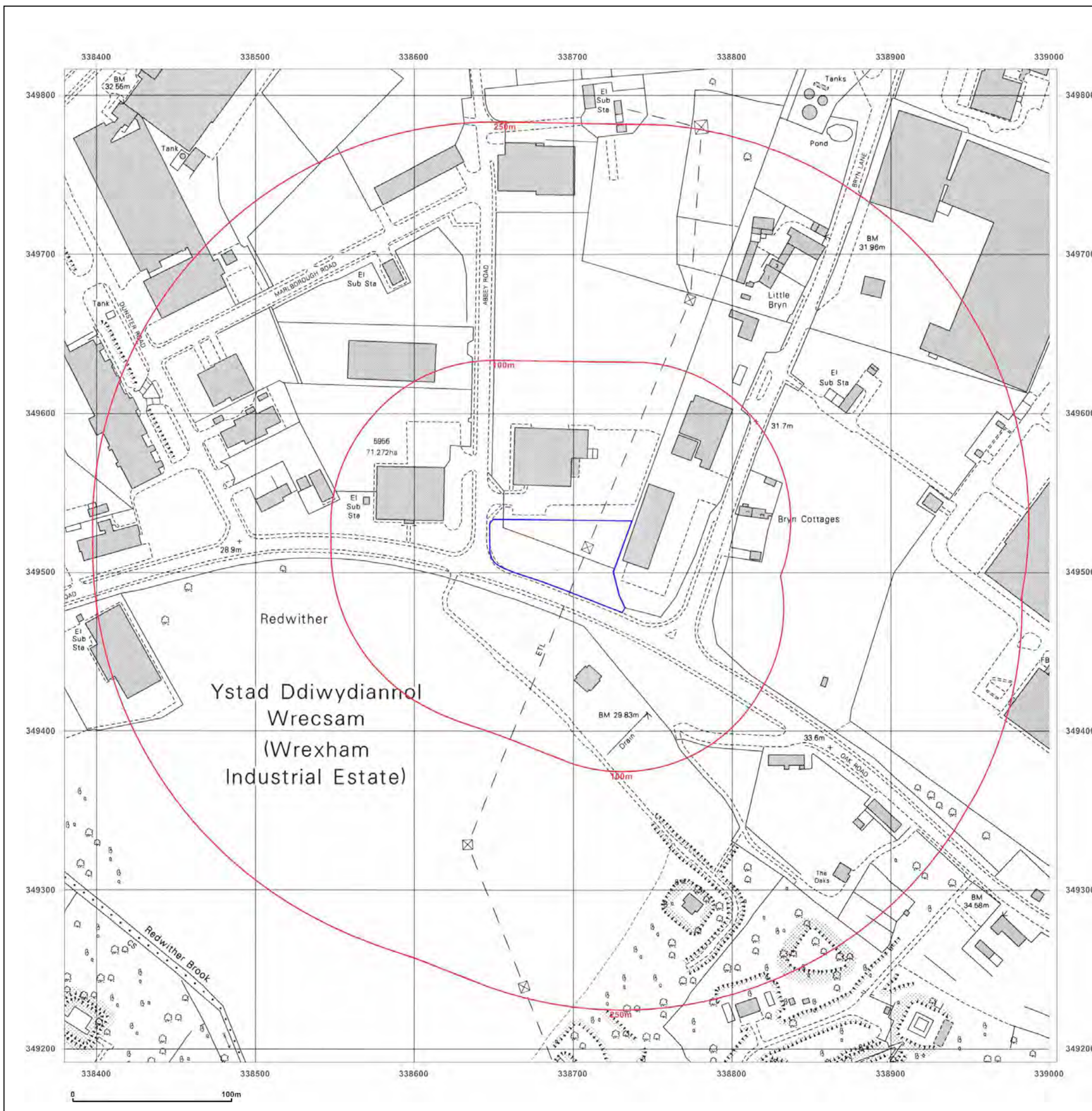


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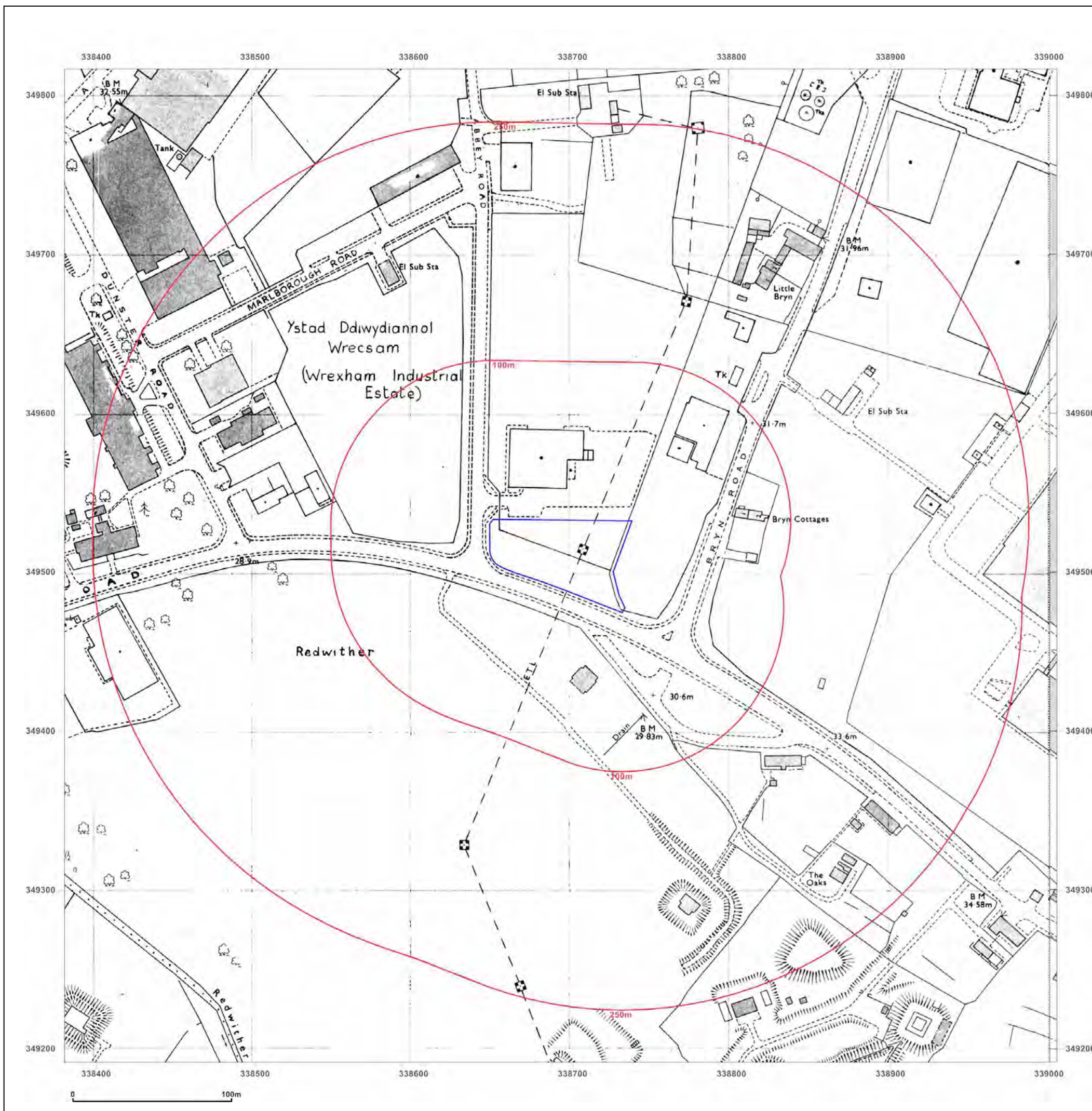


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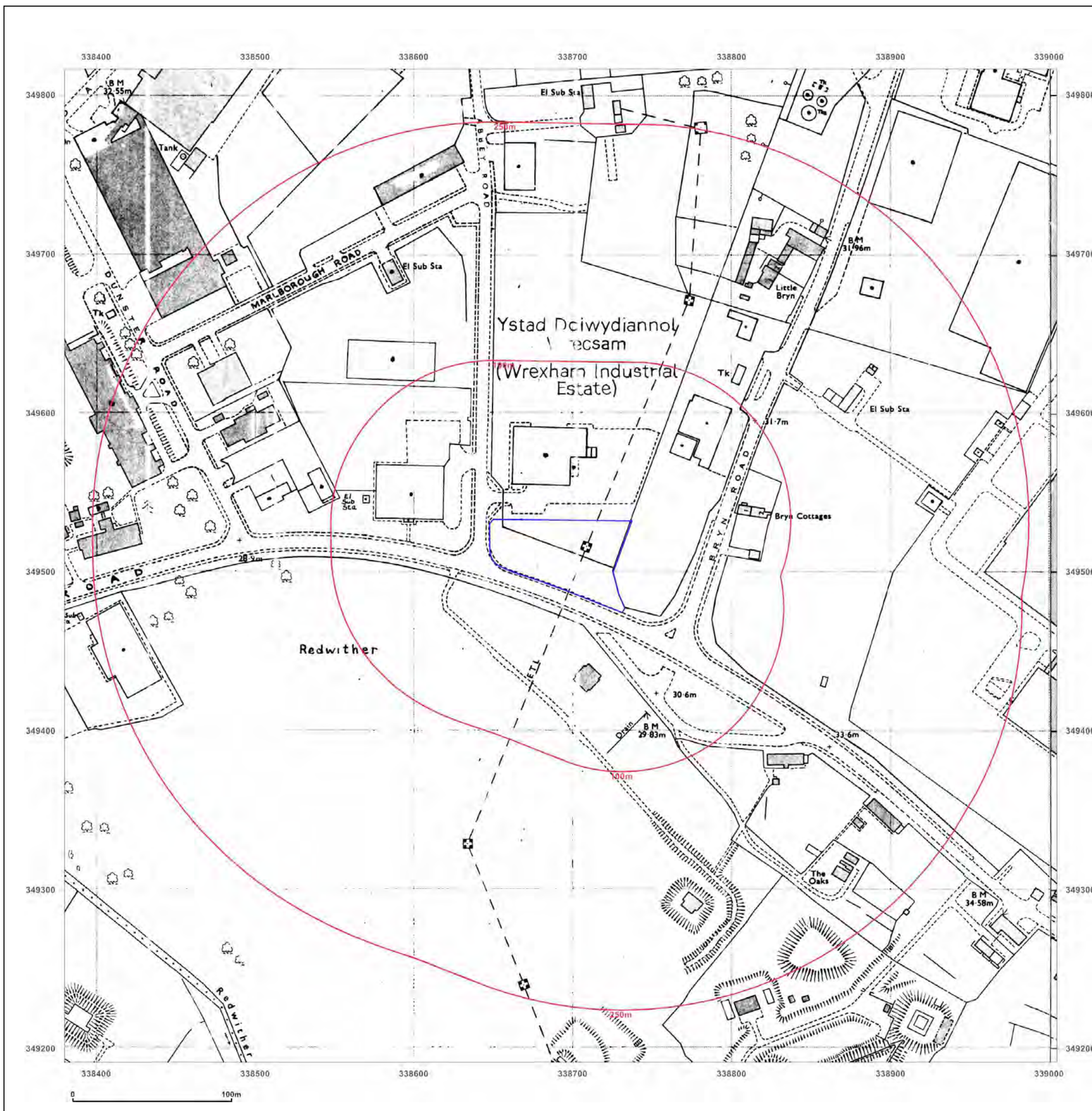


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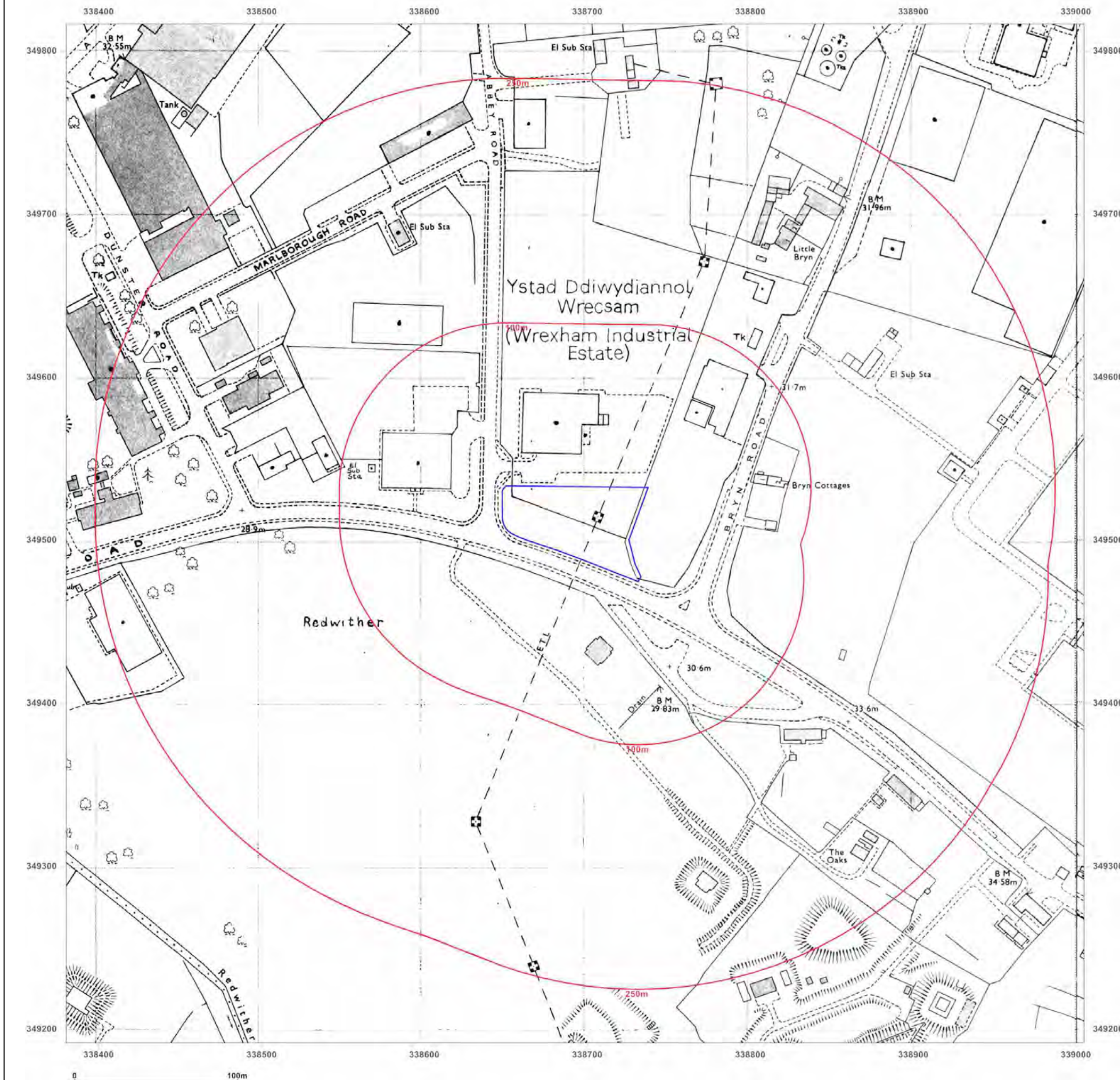


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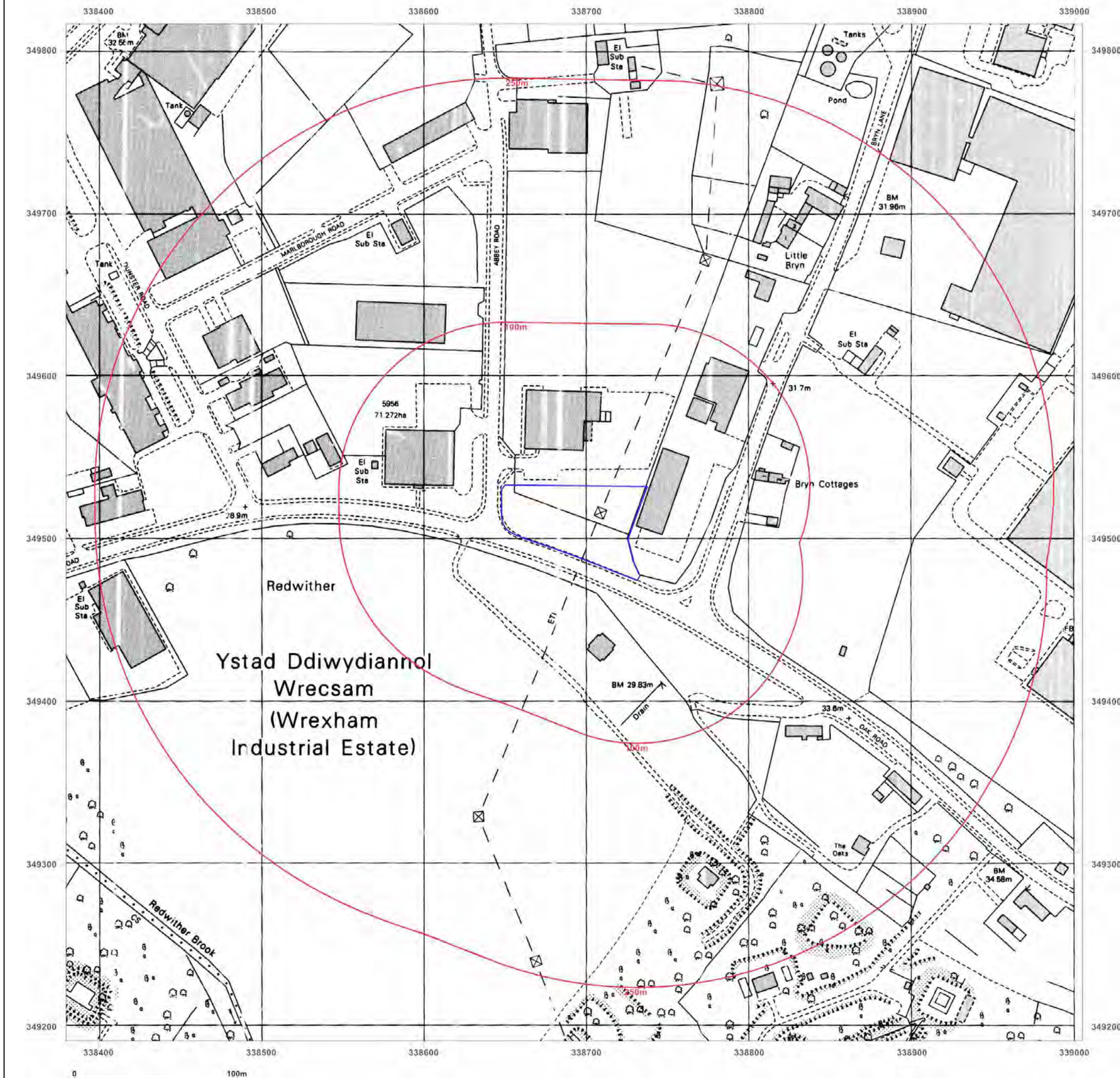


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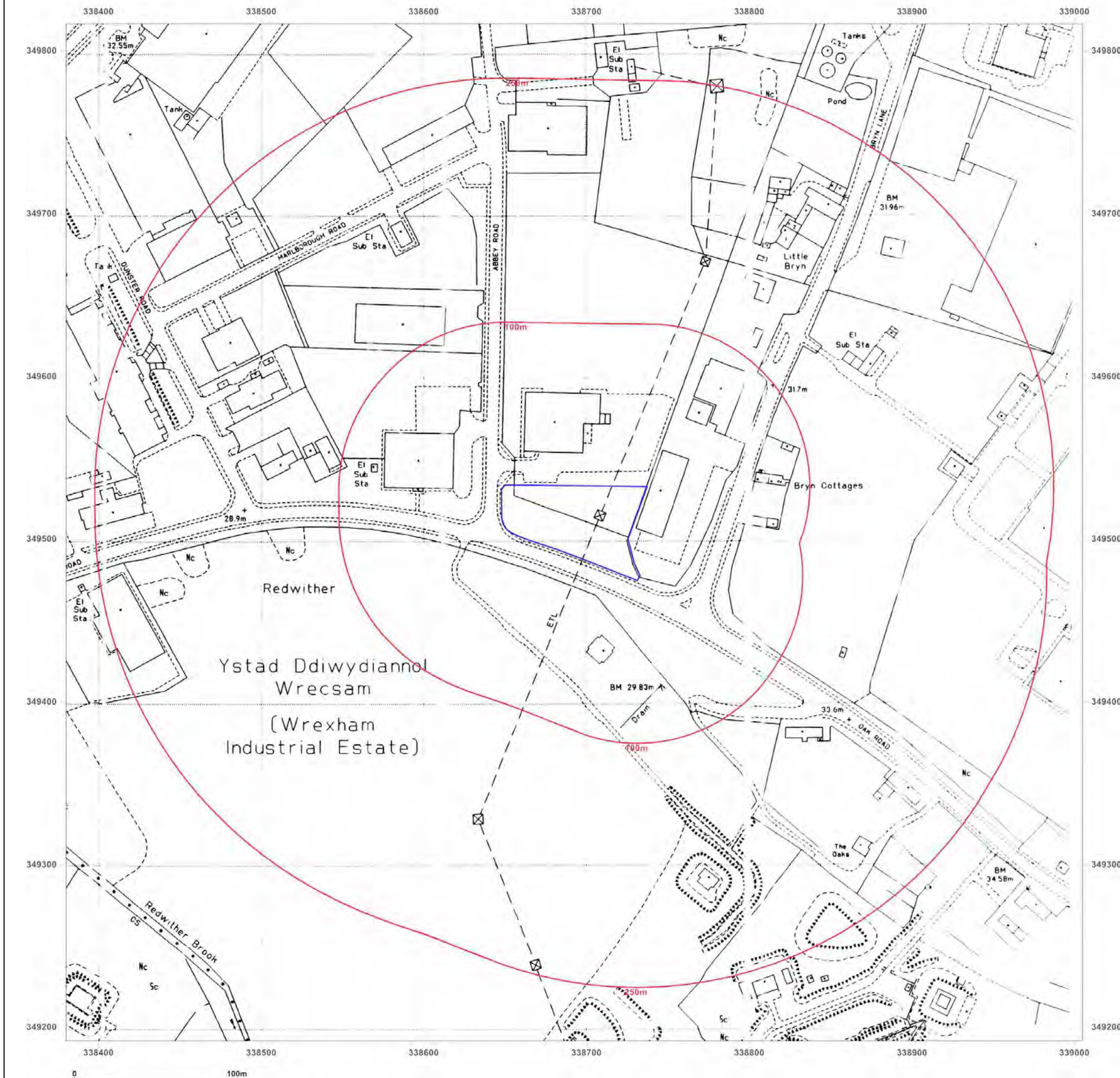


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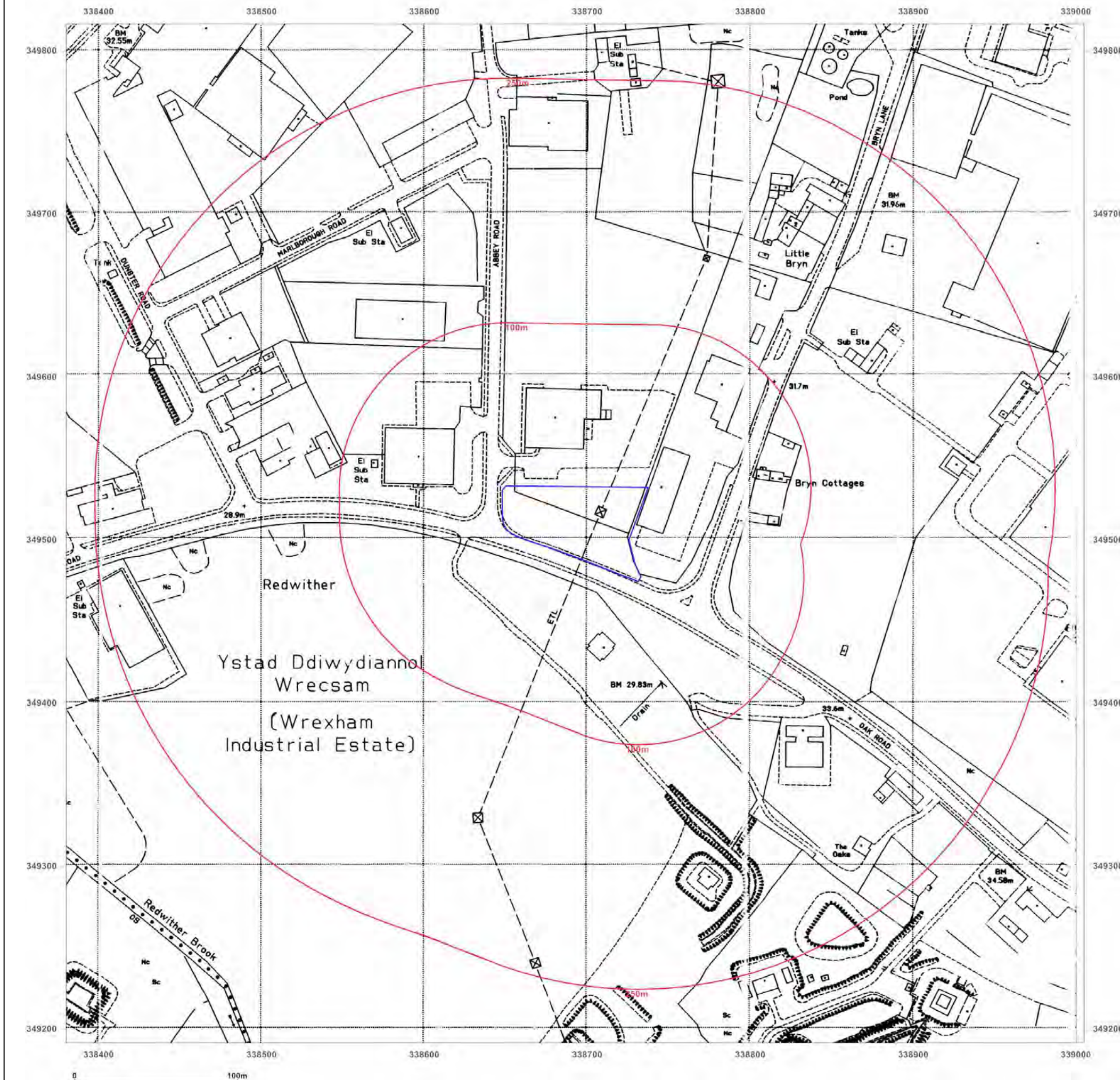


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