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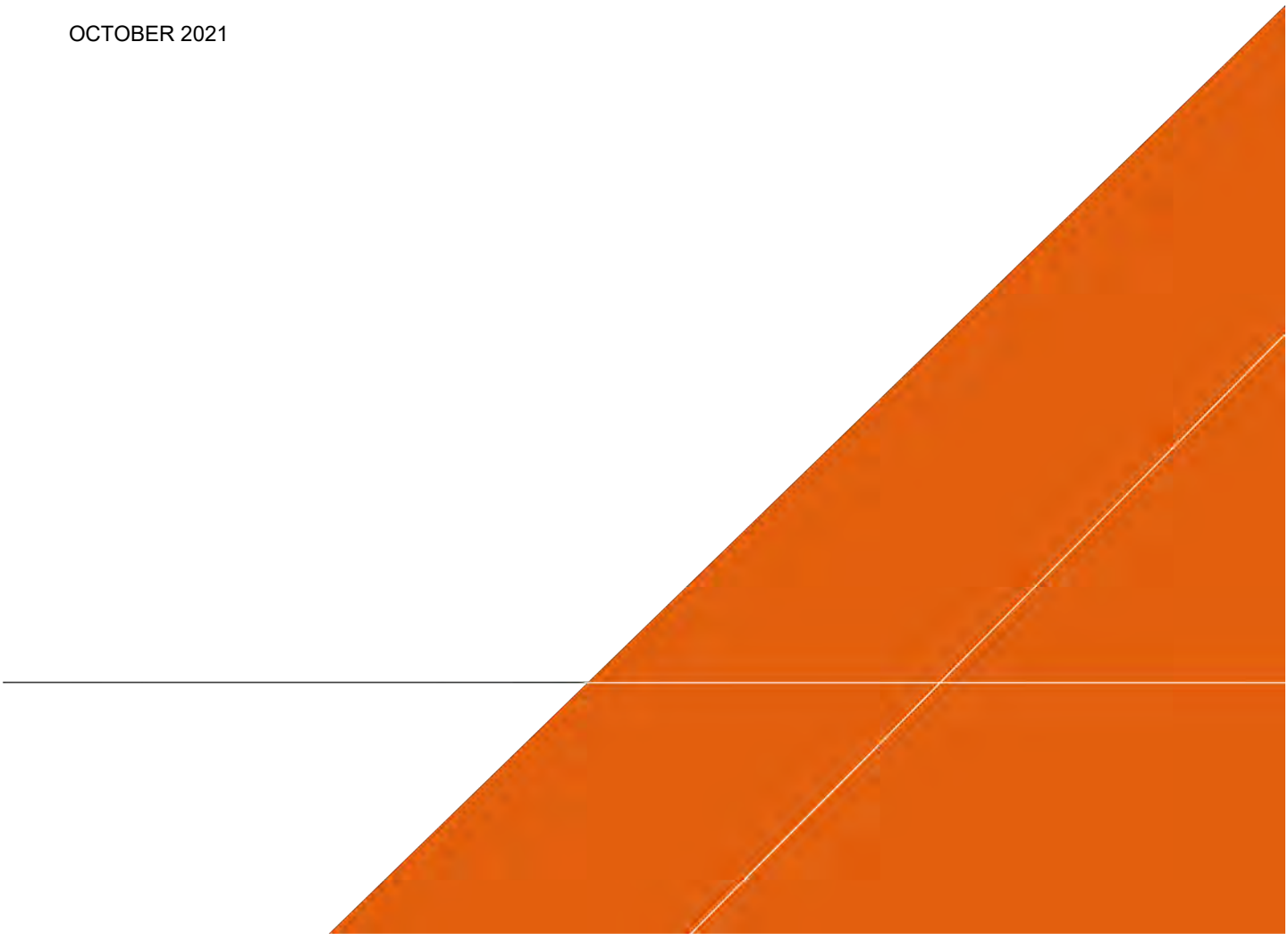
BE FIRST REGENERATION LIMITED INNOVATIVE SITES PROGRAMME

GARAGE BLOCKS AT FAMBRIDGE ROAD, DAGENHAM, RM8 1NS

Phase 1 Desk Study and Preliminary Ground Investigation Report

10046791-AUK-XX-XX-RP-GE-0125-01

OCTOBER 2021



Garage Blocks at Fambridge Road, Dagenham, RM8 1NS

Phase 1 Desk Study and Preliminary Ground Investigation Report

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Report No 10046791-AUK-XX-XX-RP-GE-0125-01-Fambridge Road GI

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This report dated 22 October 2021 has been prepared for Be First Regeneration Ltd (the "Client") in accordance with the terms and conditions of appointment dated 28 January 2021 (the "Appointment") between the Client and Arcadis UK Ltd ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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1 INTRODUCTION

1.1 Terms of Reference

Arcadis (UK) Limited (Arcadis) has been commissioned by Be First Regeneration Ltd on behalf of London Borough of Barking and Dagenham (the Client) to undertake a Geotechnical and Geo-environmental Phase 1 Desk Study and Phase 2 Ground Investigation for three land parcels located off Fambridge Road, Dagenham, RM8 1NS, hereafter referred to as “North Plot”, “East Plot” and “South Plot”.

The Client is aiming to divest a number of small sites to enable regeneration. The objective of the Innovative Sites Programme is to provide robust and pragmatic advice that sensibly de-risks each of the sites such that an unreasonable “abnormal” development costs are not incurred by developers.

The objectives of this review are to:

- Review geo-environmental information regarding the site and its surrounding area;
- Provide information on potential geo-environmental and geotechnical constraints which may impact on the redevelopment potential for the site;
- Identify potential development constraints due to geotechnical and geo-environmental conditions on site; and
- Provide a factual report following Phase 2 Ground Investigation.

The site location is shown in Figure 1, and the Site plan is shown in Figure 2 below.

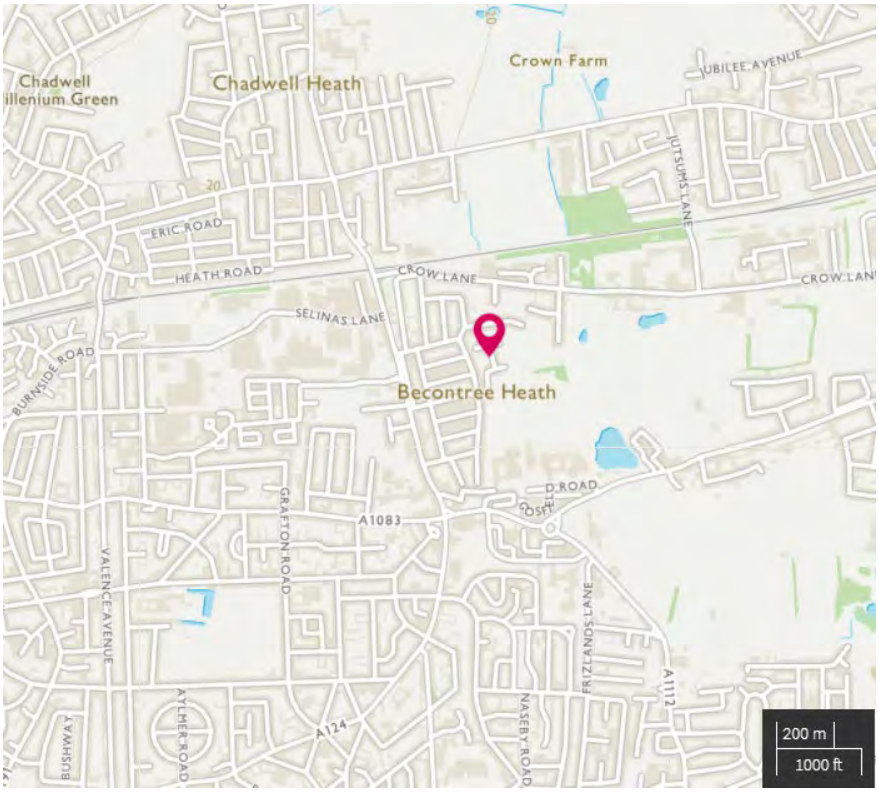


Figure 1: Fambridge Road Garages Location Plan From Ordnance Survey ©



Figure 2: Fambridge Road Garages Site Plan (shown in blue) provided by the Client

1.2 References

As part of this report various sources of information and guidance documents have been used as references and are detailed below:

- BGS Geological Survey of England and Wales 1:50,000 geological map series: Solid and Drift Sheet 257 Romford (Ref. 01).
- Magic Map Online Viewer, https://magic.defra.gov.uk/magicmap.aspx (Ref. 02).
- Environment Agency (EA), 2020. Land contamination: Risk management (LC:RM) (Ref 03)
- Site Specific Groundsure Report (appendix C)
- Site Specific UXO Risk Assessment (appendix D)
- CIRIA C552, Contaminated Land Risk Assessment. A good practice, 2001 (Ref. 04).
- CDM Regulations 2015 (Ref. 05)
- BRE Special Digest 1, Concrete in Aggressive Ground, 3rd ed, 2005 (Ref. 06).
- NHBC Standards: *Vol. 1*. (Ref. 07)
- LQM / CIEH Suitable for Use Levels (S4ULs) for Human Health Risk Assessment (Ref. 08).
- LQM / CIEH Category 4 Screening Level (C4SL) for Human Health Risk Assessment (Ref. 09).

1.3 Limitations

This report has been prepared for the Client in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by any third party. The copyright of this document, including the electronic format shall remain the property of Arcadis.

This report has been compiled from a number of sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

It should be stated that the site investigation discussed in this report is a preliminary investigation and therefore a more detailed investigation would be recommended once design plans and loadings have been finalised.

Arcadis study limitations are presented in Appendix A.

2 DESK STUDY

The following information has been researched from sources of information provided within Section 1.2 including a site specific Groundsure report (Appendix C).

Table 2-1: Site Details / Environmental Setting

Item	Description
Site Location/ Address	All three sites are located off Fambridge Road, Dagenham, approximately 52m east of Temple Avenue and 350m east of the A1112. The centre of each site is located approximately at National Grid References: **North Site**: 549101, 187474 **East Site**: 549189, 187410 **South Site**: 549140, 187359 The closest post code to all three sites is RM8 1NS.
Approximate Site Area	Combined area of 0.16 ha **North Site**: ~0.6 ha **East Site**: ~0.6 ha **South Site**: ~0.5 ha
Description of Site	A site walkover was undertaken by Arcadis during 31st March 2020, the following key points were noted. All of the three sites consist of domestic garage blocks located off Fambridge Road accessed by Temple Avenue. **North site –** The site comprising domestic garage blocks with parked cars and includes Fambridge Road to the east. Fambridge road is also located to the north. The site is surrounded by residential housing and gardens to east, west and south. The site is open access from Fambridge Road with no gate. The surface consists of good quality concrete slabs with some vegetation growing at joints. The Domestic garages are built of brick. There is some evidence of fly tipping but no other indications of contamination. **East site –**The east site has a gated entrance with no lock. The surface consists of good quality concrete slabs with some vegetation growing at joints. The Domestic garages are built of brick. There is some evidence of fly tipping but no other indications of contamination. The site has residential housing to north and west, a school playing field to the south and allotment gardens to east which have been there since 4pprox.. 1960's.

	South site –The south site is now occupied by Durkan who are also working on behalf of the council with their site compound comprising of an office, skips and welfare containers. There is an electric substation just outside the south site to the southwest. The surface consists of good quality concrete slabs with some vegetation growing at joints. The domestic garages are built of brick. There is some evidence of fly tipping but no other indications of contamination. The site is bound by school playing field to south and east and residential areas to west and north. **Surrounding Area** • **North Site:** The surrounding area of the site is predominately residential with the site being bound by private gardens. • **East Site:** The surrounding area of the site is predominately residential with private gardens to the North and west. The site is bound by open space to the south and a yard for allotments to the east. • **South Site:** The surrounding area of the site is predominately residential with private gardens to the North and west. The site is bound by open space/playing fields to the south and east. A photo log of the site walkover is presented in Appendix B
Anticipated Geology	The British Geological Survey (BGS) Solid and Drift Map Sheet 257 Romford (Ref.01) records the following geological strata's to be present for all three sites. **Superficial Deposits**: Recorded as Hackney Gravel Member described by the Lexicon as "*sand and gravel, locally with lenses of silt, clay or peat."* **Solid Geology:** Recorded as London Clay described by the Lexicon as "*bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay."* **Artificial Ground**: No made ground deposits are recorded on site by the geological maps, however there may be some present derived from the historical development of the site and surrounding area. **Linear Features:** No faults are noted within 1km of the site boundary. A review of the BGS website and Groundsure report shows no boreholes located within 250m.
Hydrogeology	The Groundsure Report (Appendix C) and Magic Map (Ref. 02) have been used to assess the anticipated hydrogeology. All three sites were recorded in having the following. **Superficial Deposits** – Secondary A aquifer

	Defined as: "Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers" **Solid Geology**: Unproductive strata *Defined as: "These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow".* Based on the contours shown on the Ordnance Survey (OS) map in Magic (Ref. 02) it is likely that the regional groundwater will flow towards the River Thames in the south for all three sites. Groundsure report (Appendix C): shows that all three sites are at a low risk from groundwater flooding. None of the three sites lie within a Source Protection Zone (SPZ). No Licensed Groundwater or Drinking Water Abstraction Points are located within 250m of any of the three sites.
Hydrology	Onsite: None recorded. Offsite: None recorded in 250m of the site. The Groundsure report indicates the site does not lie within a Flood Zone area / an area prone to flooding from rivers or seas. The site is shown to be at a 1 in 30-year risk of 0.1m – 0.3m flooding due to surface water. The above does not constitute a Flood Risk Assessment. A Flood Risk Review was carried out by Arcadis in document 10046791-AUK-XX-XX-RP-CW-0054-01-Fambridge Road Flood Risk Review. No Licensed Surface Water Abstraction Points are located within 250m of the site.
Mining	None of the three sites lie within a coal mining reporting area. With reference to the historical and BGS mapping and the Groundsure report all three sies has a historical mineral planning area noted approximately 258m to the east which was surface workings for sands and Gravels. Due to the distance and location of this, it is considered that there is not a risk from mining related hazards.
Radon	All of the three sites are located in a lower probability radon area, where less than 1% of homes are above the recommended action level requiring radon protection measures. Radon protection measures are therefore not considered to be required.
UXO	According to the Zetica UXO map the site is within an area denoted as "High" bomb risk area. High risk areas defined are those which have seen a bombing density of 50 bombs per 1000 acres or higher.

	A Detailed UXO Assessment Report was completed by 6Alpha during 2021 presented Appendix D. The report states that the site is in an area of high risk from UXO hazard. The report recommended the following mitigations: an operation UXO Emergency Response Plan, an UXO safety and awareness briefing before work, an intrusive UXO survey for blind intrusive work and an on-call UXO Engineer.
Site History Summary[1]	**On site (All Sites)** **1870 – 1920:** The Sites are shown as agricultural land. **1939 – 1961:** None of the sites are developed. Open space with areas of Allotments from circa 1939. South site is noted as playing fields circa 1959. **1970 – 2021:** Domestic garages built on all three Sites circa 1970 and are still present. **Off site (All Sites)** **1862 – 1921:** All three sites are surrounded by agricultural setting with farmhouse and ponds located in surrounding area. A railway is located approximately 400m north (at its closest point) circa 1862. **1938 – 1961:** Circa 1939, housing developments have been built 100m to the north and immediately west of the northern site. Housing has also been built along western boundary south site. The remaining areas to the east and south of the sites are marked as allotment gardens (1939) and playing fields to the south (1959). Further Allotments are shown 150m to the north between 1939 and 1983. A sand and ballast pit with associated rail sidings are shown from 1921 located approximately 500m to the west. A tile works is shown adjacent to the pits 700m to the west of the site from circa 1951. **1965 – 2021:** Continued residential development has occurred in the surrounding area circa 1970 including garages. The sand and ballast pits are no longer shown from 1967 with area now used for industrial works and depots at approximately 400m west of the site, which from 1971 are described as warehouses. A large lake is shown approximately 350m east of the site between 1967 and 1968, after which it is filed in and shown as allotments. No other significant changes were noted. An Archaeological Desktop Appraisal was completed by Arcadis in document 10046791-AUK-XX-XX-RP-LH-0028-01
Ecologically Sensitive site	According to information presented in the Groundsure Report (Appendix C), the open space bounding the south and east sites is listed as greenbelt. There are no other statutorily protected ecological sites located within a 250m radius of any of the Site. However, does lie within SSSI Impact risk zone but no sensitive sites are recorded within 2km of the site.

	An Ecological Assessment for the site was undertaken by Arcadis and I provided in Document 10046791-AUK-XX-XX-RP-EC-0114-01-Fambridge Road Ecological Assessment.
Environmental Public Registers[2]	
Onsite	On site use as Domestic garages and parking areas with associated potential fuels, lubricants and spills.
Offsite	-
Mining & surface ground workings	One large surface ground working recorded as a water body 216m East mapped in 1968.
Potentially Infilled Land / Made Ground / Worked Ground	One recorded 194m east of the site listed as infilled ground.
Land Fill	A Historic Landfill is recorded 182m East of the site at Crowlands operated by the council. This received Inert, Industrial, Commercial, Household, Liquid sludge waste. The landfill was operational between 1954 and 1972.
Industrial Land Use	A substation is located 9m off site west of the south site. A scrap metal treatment site is located 249m North of the Sites.

1 – A review of the available historical Ordnance Survey maps as presented in Appendix C has been undertaken to assess the historical development of the site and surrounding areas. It is not the intention of this report to provide a full history, but to identify those past uses on and within the vicinity of the Site that could have introduced sources of contamination to the soils and/or waters.

2 – The Groundsure report as presented in Appendix C, of public register information for the site and surrounding area (within 250m radius) has been summarised in the table above. It is not the purpose of this section to provide a comprehensive account of the environmental data but only to detail those factors that are or could impact the Site and are present within 250m of the site boundary.

2.1 Summary of Public Register Information

In terms of the environmental public register information identified in Table 2.1 the only identified potential sources of contamination likely to pose a significant risk are the onsite uses as a garage.

The other potential off-site sources of contamination have been reviewed, such as historic and current industrial uses and infilled land, are not considered to pose a significant risk due to either their distance from the Site or the anticipated hydraulic flow direction to the south. As such they are not considered further.

3 PRELIMINARY CONCEPTUAL SITE MODEL

Geo-environmental assessments are required in accordance with current regulatory guidance (Environment Agency (EA), 2020. Land contamination: Risk management (LC:RM) (Ref. 03) to consider the significance of potential contamination in terms of plausible source-pathway-receptor pollutant linkages. As part of this process, it is necessary to develop a conceptual model of these potential pollutant linkages by identifying the potential contamination sources, sensitive receptors and any potential exposure pathways. A risk assessment is then undertaken to determine the likelihood that these potential pollutant linkages are complete.

3.1 Potential Contaminant Sources

Based on the information obtained from the historical and environmental research, the following potential sources of contamination have been identified on site and within the surrounding area (Table 3.1).

It should be noted that it is considered unlikely that all these substances would be present at significant concentrations within the Site.

Table 3-1: Potential on-site and off-site sources of contamination

Source	Potential Contaminants
On Site	
[1,2 &3] Made Ground associated with current development.	Asbestos, metals, inorganics, Polycyclic Aromatic Hydrocarbons (PAH), hydrocarbons, ground gas
[1,2&3] Car parking garage use.	Hydrocarbons, lubricants and solvents from potential spills/leaks from vehicle maintenance activities and asbestos.
[1,2 &3] London Clay bedrock underlying the sites	Sulphates
Off Site	
[1,2 &3] Made Ground from offsite developments	Polycyclic Aromatic Hydrocarbons (PAH), hydrocarbons, leachate and ground gas
[1,2&3] Historic land fill 185m east	Ground gas and Leachate

1 northern Site, 2 eastern Site, 3 Southern Site

3.2 Potential Receptors

The proposed end use of the site comprises of residential dwellings. As a precautionary approach the potential receptors detailed below take into consideration the most conservative end use as residential properties with private gardens and landscaped areas. It is considered possible that any potential contamination within the soils may be disturbed during the construction phase, or during gardening or landscaping undertaken by any future site users.

3.2.1 Human Health

- Future site users (residents, visitors, maintenance workers and contractors)

Contamination risks to construction workers are not appraised by chronic (long term) exposure human health risk assessments. There are no appropriate published criteria applicable to the assessment of potential risks to construction workers. The potential risks should be addressed by a site-specific construction workers risk assessment and implementation of appropriate health and safety measures, to adequately mitigate any potential risks. All works should be conducted in accordance with the CDM Regulations 2015 (Ref. 05) or any other relevant guidance.

3.2.2 Controlled Waters

- Secondary A Aquifer

3.2.3 Buildings

- Foundations & underground services

3.3 Potential Pathways

Potential pathways are the routes that link the receptor to the contamination. The potential pathways for this site are summarised in Table 3.2 below.

Table 3-2: Potential Pathways

Receptor	Pathway
Human health (future site users/residents, visitors, maintenance workers and contractors)	Ingestion of contaminants within soil, water and dust. Inhalation of dust, vapours and ground gases Dermal contact with contaminants within soil, water and dust. Ingestion of contaminated vegetables and soil attached to vegetables.
Controlled waters (Secondary A Aquifer)	Leaching of contaminants from unsaturated zone into underlying groundwater. Vertical migration of soluble contaminants through the unsaturated zone into groundwater beneath the site. Lateral migration of contaminants onto the Site from offsite sources and subsequent leaching to the ground water beneath. Creation of preferential pathways i.e. services, piles, etc.
Buildings and structures including water supply pipes	Direct contact of building services or foundations with contaminants in the soil and Made Ground. Accumulation of ground gases in confined and poorly ventilated spaces. Potential for build-up of explosive gases or vapour.

4 FIELDWORK

4.1 General

Ground investigation works were carried out by Arcadis between 9th and 10th June 2021.The scope of the ground investigation, including the location, scheduled depth and type of exploratory hole undertaken was determined by Arcadis Consulting (UK) Ltd and is summarised in Table 4.1.

The ground investigation methods were undertaken in general accordance with the principles set out in BS EN 1997-2:2007 and with the general practice described in BS5930:2020. The geo-environmental aspects of the ground investigation complied with the general requirements of BS 10175+A2:2017.

Table 4-1: Initial ground investigation scope

Location ID	Hole Type	Scheduled Depth (m)	Requirements
North Plot			
WS0601	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.
WS0602	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.
WS0603	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.
East Plot			
WS0604	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.
WS0605	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.

Location ID	Hole Type	Scheduled Depth (m)	Requirements
South Plot			
WS0607	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.
WS0608	IP + DS	5.0	Determine thickness of engineering soils; determine soil contamination, collect representative samples of strata and undertake in situ tests. To allow triangulation of groundwater flow direction.

Notes

DS = dynamic sampling, IP = Inspection Pit

4.2 Exploratory Holes

4.2.1 Exploratory Hole Locations

The co-ordinates and elevations of the exploratory hole locations were obtained by Arcadis using a Leticia GPRS system, allowing an accuracy of +/-50 mm. All locations were cleared by a 3rd Party survey company prior to the advancement of hand dug inspection pits. An exploratory hole location plan is present in Appendix E.

4.2.2 Investigation Methodology

The following methods and techniques were undertaken to construct the exploratory holes at the Site.

The exploratory hole records are presented in Appendix F. Details of the methods of investigation and associated standards adopted and a key to the notation and symbols used on the logs are presented in Appendix G.

4.2.3 Dynamic Sampling

Dynamic sampling was completed using a track-mounted sampling rig (Dando Terrier rig) capable of driving windowless sampling tubes using a mechanical hammer dropped repeatedly from a self-governed height/hydraulic hammer drive head to advance window sample tubes into the ground.

The number of blows for the mechanical hammer was recorded together with a description of the recovered materials by the supervising engineer or the lead driller.

Due to the method of investigation, the materials recovered within the sampler apparatus were generally disturbed and were assessed as complying with Class 3 to Class 5 of BS EN 22475-2. Sub-samples of the material recovered in the liners were taken to enable representative laboratory testing. Generally small, disturbed samples were taken at each change in stratum and at 0.5 m intervals

thereafter in clay soils; and small bulk samples were taken at 1 m intervals where the sand and gravel content of the soil was significant.

4.2.4 Completed Works

An Exploratory Hole Plan presented in Appendix E displays the as-constructed exploratory hole locations while the co-ordinates and elevation of the ground surface at each exploratory hole location are given on the individual logs Appendix F. The completed scope of investigation is summarised in Table 4-2.

Table 4-2: Summary of completed exploratory holes

Location ID	Hole Type	Date	Final depth (m)	Termination Reason	Comment
North Plot					
WS0601	IP	9 Jun 2021	0.4	Refusal	Target depth of inspection Pit not achieved
WS0602	IP	9 Jun 2021	0.3	Refusal	Target depth of inspection Pit not achieved
WS0603	IP + DS	9 Jun 2021	2.0	Refusal	Rig unable to progress through granular material.
East Plot					
WS0604	IP	9 Jun 2021	1.05	Refusal	Target depth of inspection Pit not achieved
WS0605	IP	9 Jun 2021	0.95	Refusal	Target depth of inspection Pit not achieved
South Plot					
WS0607	IP	10 Jun 2021	0.2	Refusal	Target depth of inspection Pit not achieved
WS0608	IP	10 Jun 2021	0.3	Refusal	Target depth of inspection Pit not achieved Drilling was stopped at 0.3m depth due to suspected Asbestos containing material

Notes

DS = dynamic sampling, RC = rotary coring, IP = Inspection Pit

4.3 In situ Testing

4.3.1 General

In situ testing was carried out within the relevant exploratory holes. Where tests were undertaken within or associated with a specific borehole, the test data is presented on the relevant exploratory hole log or as additional sheets to that log. As such, the location details will be the same as the associated hole and its position will be the same as the exploratory hole with which it is associated.

4.3.2 Penetration Testing

4.3.2.1 Standard Penetration Tests

Standard penetration tests (SPT) were carried out as required in the investigation scope and in accordance with the methods given in the standard procedures presented within Appendix G.

The N-values as determined in the field are presented on the borehole logs as uncorrected values that do not take into account the energy losses or efficiency of the automatic trip hammer used to drive the test tool into the ground.

4.3.3 VOC Head Space Screening

The presence of Volatile Organic Compounds (VOC) within the ground and groundwater was determined using a photoionization detector (PID) to detect the ‘headspace’ vapours emitted by the compounds. The method is applicable to a wide range of compounds that have sufficiently high volatility to be effectively liberated from the soil or water matrix in normal temperature and pressure ranges.

The headspace tests were undertaken on the freshly extracted soil samples at regular intervals by placing a small amount of material was placed into polythene bags which were enclosed to capture as much air as possible around the soil sample. The soil sample was gently broken up and left for approximately 15 minutes prior to the bag being pierced and a *Photo-Ionisation Detector (PID) fitted with a 10.6eV Ultraviolet (UV) lamp inserted to test for ionisable VOCs.

4.4 Installations and Post-fieldwork Monitoring

4.4.1 Installations

Due to drilling difficulties only one installation was installed to enable long term monitoring of the Site. The details are summarised in Table 4.3 and are also provided on the relevant borehole logs.

Table 4-3: Summary exploratory hole installations

Location ID	Installation type	Response Zone Top (m bgl)	Response Zone Bottom (m bgl)	Comment
WS0603	Slotted	0.50	2.00	Screened within superficial granular material

4.4.2 Post-fieldwork Monitoring

One standpipe was installed during the ground investigation (WS0603) to allow for water monitoring and water sampling. Ground gas and groundwater monitoring has been undertaken on one occasion on the 11th of June 2021 to provide a preliminary ground gas assessment. The result of this is presented within Appendix H.

4.5 Laboratory Testing

4.5.1 General

Geotechnical and geo-environmental chemical testing was undertaken on selected samples obtained from the exploratory holes. The testing was scheduled by the geotechnical and geo-environmental engineer and the testing was undertaken by an Arcadis approved testing laboratory.

4.5.2 Geotechnical Laboratory Testing

The geotechnical tests were carried out in accordance with either BS1377:1990: Parts 1 to 8; BS EN ISO 17892; BRE SD 1:2005; or other methods as listed in Table 4.4.

The results of the geotechnical laboratory testing are presented in Appendix I.

Table 4-4: Summary of geotechnical test data

Test	Method	No of Determinations
Moisture content	BS1377 Pt 2 - 3.2	[2]1
Atterberg Limits	BS 1377 Pt 2 -method 5	[2]1
Particle Size Distribution - Wet sieving	BS1377 Pt 2 - 9.2 & 9.4	[1]2 [2]1
pH, water soluble sulphate;	BRE SD1 preferred methods	11

1 = North plot, 2 = East Plot, 3 = South Plot

4.5.3 Geo-Environmental Laboratory Testing

Geo-environmental laboratory tests were undertaken on soil and groundwater samples collected from the Site. Testing was carried out for the contaminants detailed in Table 4.5.

The results geo-environmental laboratory testing is presented in Appendix J.

Table 4-5: Summary of geo-environmental test data – soil matrix

Test type	Method	No of Determinations
Metals (Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Zinc)	ICP-OES	[1]4 [2]4 [3]1
TPH CWG	Gas Chromatography –Mass Spectrometry (GC-MS)	[1]4 [2]4 [3]1
BTEX	Determination of Volatile Organic Compounds by Headspace/ GC-MS	[1]2 [2]2 [3]1
MTBE	Determination of Volatile Organic Compounds by Headspace/ GC-MS	[1]2 [2]2 [3]1
Asbestos screen and ID	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	[1]3 [2]2 [3]1
Total Organic Carbon	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	[1]2 [2]1 [3]1
Total Cyanide	Determination of total cyanide by distillation followed by colorimetry.	[1]4 [2]4 [3]1
Hexavalent Chromium	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	[1]4 [2]4 [3]1
Phenol (total), Chlorinated Phenols	Gas Chromatography –Mass Spectrometry (GC-MS)	[1]4 [2]4 [3]1

1 = North plot, 2 = East Plot, 3 = South Plot

5 GROUND MODEL

5.1 Ground Conditions

5.1.1 Introduction

The anticipated ground conditions identified within the Chapter 2 and the published BGS Solid and Drift Map Sheet 257 Romford (Ref.01) were expected to comprise sands and gravels (superficial deposits) above bedrock recorded as the London Clay.

Full engineering logs are included within Appendix F while a summary of the general succession of strata encountered for North and East plots are presented in Table 5.1. However, due to the variable nature of the made ground encountered, window sample boreholes could not progress past the made ground in some areas therefore superficial deposits and bedrock were not encountered in some locations during the investigation works. Every effort was made during the works to relocate borehole positions, however due to access and utility constraints this could not be achieved. This was mostly apparent within the south plot.

Therefore, a summary of ground conditions encountered within the south plot is provided below.

5.1.1.1 South Plot Ground Conditions

- GL – 0.16 (max) – Concrete
- 0.15 -0.30 (max) – Made Ground comprising gravelly sand. The extent of the made ground was not proven.
- Potential asbestos containing materials (ACM) were recorded in WS608 at 0.30 m bgl.

The laboratory report for geotechnical laboratory tests undertaken during the ground investigation are presented within Appendix I. The laboratory report for geo-environmental laboratory tests undertaken during the ground investigation are presented within Appendix J.

Due to the variable nature of the made ground encountered, window sample boreholes could not progress past the made ground in some areas therefore superficial deposits and bedrock were not encountered in some locations during the investigation works. Every effort was made during the works to relocate borehole positions, however due to access and utility constraints this could not be achieved.

Table 5-1: Ground Conditions Encountered

Stratum	General Description	Depth range to top of strata (m bgl)	Thickness range (m)	Depth range to base of stratum (m bgl)	In situ data SPT -N value
North Plot					
Made Ground	Concrete was present at the surface for all locations at a thickness between 0.13m and 0.18m. Made Ground was generally described as comprising sandy Gravel, slightly silty gravely sand as well as being recovered as black silty sandy gravel. Gravels were described subangular fine to coarse. *The extent of made ground was not found within WS601 and WS602.*	GL	0.33 -0.50	0.33 -0.50	N/A
Superficial Deposits (Alluvium)	Generally described as gravelly sand. Sand is medium to coarse. Gravel is subangular to subrounded. *Found within WS603 only. The extent was not proved.*	0.50	1.50	2.00	30 - >50
East Plot					
Made Ground	***Granular*** Concrete was present at the surface for all locations at a thickness between 0.19m and 0.20m. Made Ground was generally described as comprising black lightly silty sandy gravel. Sand is fine to coarse. Gravel is subangular fine to coarse. Sometimes recovered with cobbles	0.15 -0.20	0.04-0.30	0.19 – 0.50	N/A
	Cohesive Very sandy gravelly clay. Sand is medium to coarse. Gravel is subrounded fine to coarse flint.	0.50 -0.60	0.35-0.65	0.95-1.05	N/A

Superficial Deposits (Alluvium)	Sandy gravelly clay. Sand is medium to coarse. Gravel is subrounded fine to coarse flint.	0.50-0.60	0.35-0.65	0.95-1.05	N/A

5.2 Range of Geotechnical Parameters

The range of laboratory and in situ tests results for Made ground and superficial deposits encountered within the exploratory holes are summarised in Table 5.2 and 5.3 below. These are based on laboratory test results, in situ test results and published data.

Due to the variable nature of the made ground encountered, window sample boreholes could not progress past the made ground in some areas therefore superficial deposits and bedrock were not encountered in some locations during the investigation works. Whilst every effort was made during the works to relocate borehole positions, due to access and utility constraints this could not be achieved. This therefore meant that limited in situ testing and sampling were undertaken.

As a result, no samples were taken for testing within Plot South due to the limited excavation depths. No in situ testing was undertaken within Plot East or Plot South.

Due to the limited depths achieved during the investigation at each of the three sites whereby made the extent of made ground was not found within 4 out of the 7 positions it is considered likely that further investigation will be required within each of the three sites.

Laboratory results are provided within Appendix I.

Table 5-2: Summary of Geotechnical Properties for superficial deposits – Granular

North Plot				
Test	**No. of results**	**Min**	**Max**	**Recorded Value**
SPT (N values)	2	30	>50	

Table 5-3: Summary of Geotechnical Properties for superficial deposits – Cohesive

East Plot				
Test	**No. of results**	**Min**	**Max**	**Recorded Value**
Natural moisture content (mc - %)	1	-	-	20
Liquid Limit (LL) %	1	-	-	51
Plastic Limit (PL) %	1	-	-	22
Plasticity Index (PI) %	1	-	-	29

5.2.1 Particle Size Distribution (PSD) Sieve Test Results

Three PSD tests were undertaken by wet sieving across the Site at the following locations.

- WS603 (0.30m bgl) – North Plot, within made ground.
- WS603 (0.50 m bgl) – North Plot, within natural superficial deposits; and
- WS604 (0.50m bgl) – East Plot, within made ground.

No samples were taken from South Plot due to limited progress.

PSD results recorded for the Made Ground tested materials (North Plot) as being predominantly granular with between 90 -94% coarse material and between 6 % and 10% fines.

PSD results recorded within Superficial deposits recovered from (East Plot) were noted as predominantly cohesive in nature comprising 39% coarse material and 61% fines. The samples were recovered as slightly gravelly sandy clay, which broadly corresponds with the engineer's description upon the investigation logs.

It is recommended that the parameters for cohesive deposits be conservatively adopted for design.

It should be stated that some log descriptions do not correspond with the PSD results. At the time of writing the log descriptions have not been amended and therefore for the purposes of this assessment the PSD results have been considered representative of the ground conditions encountered.

The test results correspond with the log descriptions attached as Appendix F.

PSD results are attached as part of the Appendix I.

5.2.2 Moisture Content & Atterberg Testing

One moisture content and Atterberg test was carried out on one sample recovered from superficial deposits recovered from East Plot. Atterberg limit tests indicate the cohesive superficial deposits to have a high plasticity and with medium volume change potential.

Due to the limited excavation depths no other testing could be completed within North or South Plot.

5.2.3 Standard Penetration Tests

SPTs values were undertaken within granular superficial and cohesive deposits where possible. Due to the limited excavation depths PSDs were only undertaken within granular superficial deposits found within North Plot only.

SPT N values were recorded to range between 30 and 50. These results would typically imply dense granular materials.

SPT test results as well as the engineer logs are attached in Appendix F.

5.3 Ground Chemistry

Chemical testing of soils for concrete classification was undertaken in accordance with BRE SD1 (Ref. 07). The results are discussed in Chapter 6 and are attached as Appendix J. The bedrock of the London Clay was

not encountered during these works, therefore further investigation would be required to ascertain sulphate measures within the London Clay.

5.4 Olfactory/Visual contamination evidence

Suspected asbestos containing material was encountered in WS0608 on the south site at 0.30m bgl during the ground investigation. The corresponding soil sample was not found to contain any asbestos when subject to laboratory analysis.

No other visual or olfactory evidence of potential contamination was noted.

5.5 Groundwater

No groundwater strikes were recorded during the ground investigation or from the monitoring period at any of the three sites.

6 GEOTECHNICAL ASSESSMENT

6.1 Proposed Development

Arcadis understands that the proposed development will be to divest a number of small sites to enable regeneration. At the time of writing no proposed end use was provided to Arcadis. Therefore, for the purposes of this assessment it has been assumed that the new proposed structures at each of the three sites will be a 2 -3 storey structure and be relatively lightly loaded structures in the order of 80kPa.

The existing domestic garage blocks and car parking area at the sites have been in place since circa 1959 (based on historical mapping) and are currently still in operation within the active site. Details of any structural survey carried out (if any) have not be passed to Arcadis for review.

6.2 Foundations

6.2.1 Floor Slabs

- North Plot

The extent of made ground was not proved within 2 out of the 3 exploratory holes undertaken within the North Plot. Where it was proven, it was recovered to 0.50m bgl overlying granular superficial deposits. Therefore, should the amount of made ground recovered be similar to that recovered from WS0603 whereby less than 0.60 m was recorded with no cohesive deposit of variable strength then a ground bearing slab can be utilised. Otherwise, a suspended floor slab would be recommended where it is not deemed possible to replace any variable made ground or soft cohesive deposits with a suitable type 1 granular material and proof rolled.

- East Plot

Variable made ground deposits were recovered between 0.50 and 0.60m bgl overlying sandy gravelly clays. In accordance with NHBC Chapter 5 (Ref. 09) due to the variable nature of the made ground which is equal to 0.60 m in thickness in places then a suspended floor slab would be recommended. However, a ground bearing slab may be suitable if any variable made ground and soft cohesive deposits are removed, replaced with suitable type 1 granular material and proof rolled.

- South Plot

The extent of made ground within this area was not proven and therefore will require further investigation. Should the thickness of made ground be found to exceed 0.60m bgl then In accordance with NHBC Chapter 5 (Ref. 09) due to the variable nature of the made ground which is equal to 0.60 m in thickness then a suspended floor slab would be recommended. However, a ground bearing slab may be suitable if any variable made ground is removed, replaced with suitable type 1 granular material and proof rolled.

6.2.2 Shallow Foundations

Ground conditions were found to comprise granular Made Ground to a maximum depth of 0.60m bgl where proven (East Plot) above granular and cohesive superficial deposits. Bedrock was not encountered at any of the 3 locations.

The depth of made ground was not proven within the South Plot and 2 out of 3 positions at the North Plot. Furthermore, only a limited amount of superficial deposits were recovered due to the limited progression during drilling, and where is was encountered, there was limited to no in situ data, and it is not known what lies beneath the material.

- **North Plot**

Shallow strip foundations should be possible within the North Plot within medium to dense sands recovered at a depth in the order of 1.5m bgl at WS0603. However, it is not clear whether soft compressible deposits lie beneath this strata in excess of 2m bgl. Furthermore, the extent of made ground was not proved within the other exploratory holes. Therefore, further investigation would be required to confirm suitable ground conditions across the site for shallow foundations.

Groundwater was not encountered to a depth of 2 m bgl and therefore dewatering measures may not be required at this location. However, this will be dependent upon the depth of foundation used and will be confirmed after further investigation has been undertaken.

- **East Plot**

Although the extent of made ground was found at this location. The extent of the underlying cohesive strata was not. Therefore, due to the limited depths achieved and no in situ data for the cohesive deposits. It is recommended that further investigation be carried out at this locality.

- **South Plot**

Progress was halted due to visual observation of potential asbestos containing materials. The extent of made ground was therefore not found and thus further investigation will be required in this area.

6.2.2.1 General

Every effort was made during the works to relocate borehole positions where the target depth could not be reached, however due to access and utility constraints this could not be achieved. Therefore, as the extent of the made ground could not be confirmed and the nature of the underlying natural deposits could not be assessed in some locations. Therefore, foundation recommendations cannot therefore be provided or confirmed at this stage. As the maximum depth of made ground within the site could not be confirmed it is recommended that further ground investigation be carried out when acceptable to confirm the depth of the made ground and establish the strength of the natural deposits using cable percussive boreholes.

6.3 Concrete Classification

Limited chemical testing of soils for concrete classification was undertaken in accordance with BRE SD1 (Ref. 07) for each of the three site locations.

Based upon samples taken, the results indicate the following;

- North Plot & East Plot – A design sulphate class of DS-2 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-2 for below ground concrete at the proposed construction depth.
- South Plot - A design sulphate class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1 for below ground concrete at the proposed construction depth.

However due to a limited data set it is recommended that these be reassessed after further investigation. The above concrete classification is based upon samples from made ground and superficial deposits. London clay was not encountered and therefore further testing would be required in London clay to confirm appropriate measures.

7 CONTAMINATION ASSESSMENT

7.1 Generic Quantitative Risk Assessment

Laboratory testing was undertaken on nine soil samples for a range of geo-environmental determinants as listed within Table 4.5. This was to target potential sources of contamination as detailed in Table 3.1.

The distribution of soil samples tested within each of the three locations is shown below:

- North Plot – 3 within Made Ground and 2 within natural soils.
- East Plot – 2 samples within Made Ground and 2 within natural soils.
- South Plot – 1 soils sample from Made Ground.

7.2 Soil Screening Values (SSVs)

In accordance with current UK guidance and legislation, the analytical data has been compared to Generic Assessment Criteria (GAC) for a Tier 1 screening assessment.

Soil screening values have been taken from LQM / CIEH Suitable for Use Levels (S4ULs) for Human Health Risk Assessment (Ref. 08). In the absence of a S4UL for Lead, the Category 4 Screening Level (C4SL) has been adopted (Ref 09).

The most conservative approach was adopted for the Site comprising screening criteria for a **Residential with Plant Uptake** end use for the initial screening process.

Criteria relating to a soil organic matter content of 1% have been adopted for this assessment as it considered to be a more stringent worst scenario.

The Sites have been split into three areas for the assessment as the North, East and South sites.

7.3 Tier 1 screening Assessment Soils – Human Health

7.3.1 Asbestos

Out of the six soils taken for asbestos testing across all 3 plots, only one soil sample was found to have contained asbestos fibres. This was located within the Made Ground of WS0603 (North Plot). Details are provided in Table 7.1 below. Drilling was stopped at 0.3m bgl in WS0608 on the south site due to suspected asbestos containing material, however lab results indicated no asbestos present.

It is advised that a watching brief should be adopted during construction in accordance with best practice. Damping down should be incorporated to reduce soil disturbance during any groundworks. Should asbestos be found, quantification testing should be undertaken to determine whether this would make the soil hazardous before disposal.

All soil results are presented in Appendix J.

Table 7-1: Details of Asbestos Detections

Borehole ID and Depth (mbgl)	Plot	Asbestos Description	Quantification testing result (%)	Strata description	Comment
WS0603 (0.20-0.3)	North Plot	Loose Fibres Chrysotile	0.003	MADE GROUND: greyish brown slightly silty gravelly SAND. Sand is fine to coarse. Gravel is angular fine to coarse type 1 material. Cobbles are 15 angular brick (~10%).	Found in demolition made ground material. Quantification result below the hazardous waste threshold. Loose fibres present poses a risk to human health if disturbed during construction.

7.3.2 Soil Contaminants

Nine soils samples were taken for laboratory testing across the 3 plots. Samples were tested for metals, inorganics, phenols, PAH 16, TPHCWG and BTEX.

Out of the nine soils taken for testing across all 3 plots, only one soil sample was found to have exceeded the screening criteria for Residential with Plant Uptake thresholds. Details are provided in Table 7.2 below.

All other samples were either below the screening value or below the limit of detection.

Table 7-2: Details of soil elevations against the GAC for residential with plant update thresholds

Deteminand	Maximum concentration	SSV 1% organic matter	Number of exceedances	Borehole ID & Plot	Comment
Lead	230	220	1	WS602 (0.30m bgl) North Plot	Marginal exceedance within made ground

All soil results are presented in Appendix J.

7.4 Tier 1 screening Assessment Soils – Controlled Waters

The site is located on a Secondary A Aquifer. No groundwater abstractions are identified on site. No surface water feature is recorded within 250m.

Groundwater was encountered during the site investigation or subsequent monitoring visits to site. Therefore, no groundwater samples were able to be taken and testing of groundwater could not be carried out. Groundwater was likely not recovered due to the difficulty in reaching target depth during the ground investigation. It is recommended that further ground investigation is carried out across each of the 3 plot and groundwater samples taken to assess the risk to controlled waters at each plot.

No Leachate testing was carried out as part of this ground investigation.

7.5 Ground Gas Monitoring

One round of ground gas monitoring was undertaken on the 11th June 2021 by Arcadis. Due to the limited depths drilled no gas monitoring installations could be installed within East Site and South Site. Therefore a preliminary assessment for those sites cannot be done and further investigation is required to determine the gas regime of those sites. As only one installation was installed in the North Site there is limited data to carry out a preliminary assessment and further monitoring would be recommended pending further investigations.

The ground gas monitoring was undertaken using an infra-red gas analyser and flow pod. Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) in %, Hydrogen Sulphide (H_2S) and Carbon Monoxide in ppm and ground gas flow in litres per hour (l/h) were recorded during the visit. After the monitoring was undertaken, the well was dipped to record the groundwater level.

A summary of the results is presented in Table 7.3 below.

For the purposes of the assessment a worst case of <0.1% was used where no results were recorded. Concentrations of carbon dioxide (up to 3.2% v/v) were recorded and a maximum concentration of methane of 0.00 % was recorded.

The full gas monitoring data is included in Table 1 of Appendix H.

Table 7-3: Gas Monitoring Result – North Plot

Monitoring Well	Steady Flow (l/hr)	Max CH_4 (%v/v)	Max CO_2 (%v/v)
WS0603	<0.1	<0.1	3.2

7.5.1 General

Hydrocarbon vapour was assessed via Photo Ionisation Detection (PID) analysis of the soils during the site investigation and were recorded <5ppm across all three sites, with the highest recorded reading of 3.4ppm, these levels are not considered to be of concern.

7.5.2 Preliminary Hazard Gas Assessment – North Plot

Current guidance for the assessment of risk associated with the presence of hazardous ground gases (principally methane and carbon dioxide within ground gas) is provided in two key documents listed below which have been used for the assessment:

- Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings. British Standard Institution (BS 8485: 2015+A1:2019); and
- Assessing Risks posed by Hazardous Ground Gases to Buildings. CIRIA (C665, 2007).

A semi-quantitative estimate of risk from hazardous ground gases can be provided, based upon the qualitative risk model and gas monitoring results.

Based on the measured flow rates and measured hazardous gas concentrations, individual “hazardous gas flow rates” (Q_{hg}) can be derived for each monitoring point, from which the “site characteristic hazardous gas flow rate” (Q_{hgs}), and then the “Characteristic Situation” can be determined.

BS8485 provides guidance on the level of required gas protection based upon the characteristic situation and the type of development.

A Gas Screening Value (GSV) is calculated using the following equation.

GSV = borehole flow rate (l/h) x gas concentration (v/v %)

Methane – 0.0001 (v/v %)

Carbon Dioxide – 0.032 (v/v %)

Flow Rate – 0.1 (l/h)

GSV = 0.0001 (l/h) (methane)

GSV = 0.0032 (l/h) (carbon dioxide)

The ground conditions recorded in this location comprised Made Ground to 0.6m bgl. No organic or putrescible waste was noted in the Made Ground, and therefore a significant source of ground gas generation is not present.

Based on the above assessment the site would likely be classifiable as Characteristic Situation 1 (‘Very Low gas risk), whereby gas protection measures would not be required for new structures at the site. However, it should be noted that this a preliminary assessment based on a limited data set, therefore, further gas

monitoring would be required to confirm this classification. Also, the extent of Made Ground in other locations on the North site was not proven and further investigation would be required.

8 ENVIRONMENTAL RISK ASSESSMENT

8.1 Methodology

Based on the assessment of soil and groundwater data the potential contaminant linkages identified within Section 3 have been updated in accordance with CIRIA Guidance C552 (Ref. 04), identifying the 'contaminant linkages' (contaminant source-pathway-receptor relationships) that may be present at the Site based upon the laboratory analysis and monitoring completed.

Risk assessment involves identifying hazards and determining their potential severity and likelihood of an impact occurring on identified receptors. Risks are generally managed by changing the receptor, isolating the sensitive receptor by intercepting, or interrupting the exposure pathway, or removing the source. If no pollutant linkages are formed, there is no risk.

The following risk assessment focuses on the potential contaminants identified on the Site and the proposed development of the Site. A summary of the Risk Assessment method is presented in Appendix K.

8.2 Potential Contaminants of Concern

The laboratory analysis of soil samples has identified and refined the following potential contaminants of concern which are subsequently incorporated into risk assessment:

- **Soil**

A marginal exceedance against C4SL was found for Lead in one made ground soil sample from North Plot.

No significant sources of contamination have been identified in the area of exceedance and there is a lack of elevated metal concentrations within the other soils tested within the North Plot. Therefore, as the marginally elevated concentrations, are below an order of magnitude above relevant screening values it may represent background levels. It is also considered likely that the Made Ground in this area could be removed during the development of the site.

- **Asbestos**

A detection of Asbestos was recorded for one Made Ground sample from WS0603 (North Plot). This was described by the laboratory as loose fibrous debris, containing only chrysotile, and represented 0.003% weight/weight of the soil sample.

- **Sulphates**

Neutral to alkaline conditions identified – appropriate concrete classification provided for mitigation as follows;

- North Plot & East Plot – A design sulphate class of DS-2 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-2 for below ground concrete at the proposed construction depth.
- South Plot - A design sulphate class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-1 for below ground concrete at the proposed construction depth.

However due to a limited data set it is recommended that these be reassessed after further investigation.

8.3 Contaminant Linkages – Conceptual Model

Based upon the contaminants of concern, the potential receptors and pathways identified in previous sections and with reference to the desk study report, Table 8.1 provides an assessment of each contaminant linkage to establish the potential risk to the sensitive receptors.

The proposed development at the Site has been considered and the risk assessment has been developed based on these specific redevelopment scenarios.

Table 8-1: Revised contaminant Linkages Table

PL No.	Source	Sensitive Receptor	Pathway	Hazard (Severity)	Likelihood (Probability)	Potential Risk & Mitigated Risk	Further Assessment and /or Remedial Action Required.
PL1	**Soil –Metals (Lead)**	Groundwater (Secondary A Aquifer)	migration of soluble contaminants into groundwater through unsaturated zone.	**Mild**	**Low** mitigation during construction works to minimise potential favourable conditions for migration	**Low**	No widespread source of lead was identified. The screening value is conservative for soils and levels recorded could be background levels. No groundwater or leachate samples taken which would be recommended during further investigation. No remedial action is considered likely subject to regulatory approval.
PL2		Human Health	Inhalation, ingestion & Dermal contact	**Medium**	**Low** Contaminant concentrations found to be marginally elevated at one location. Mitigation during construction works to minimise potential favourable conditions for migration	**Moderate / Low** Reduced to low with mitigation	Marginal exceedance was found at one locality (north plot) with near surface soils and was not found to be widespread. Exceedance was marginal and below an order of magnitude above C4SL screening criteria. It is considered likely that the material would be removed as part of the construction works or covered with hard standing/clean cover. Adopt appropriate mitigation during construction works to minimise potential favourable conditions to cause migration of any contamination. Regulatory Consultation may be required.

PL3	**Soil – Asbestos**	Human Health	Inhalation	**Medium**	**Unlikely** mitigated through appropriate watching brief and dampening down	**Moderate** **Reduced to Low** Through mitigation	A suitable clean capping layer would be required in any development to prevent disturbance of and contact with Made Ground, especially in areas of any private gardens or proposed soft landscaping. The disturbance of Made Ground may release asbestos fibres during any ground works. Reference should be made to The Control of Asbestos Regulations (CAR) 2012 which provides the legal framework for working with asbestos and guidance outlined in CAR-SOIL (CL:AIRE 2016), Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance. More testing in area for appropriate assessment of extent of asbestos impact and for classification of waste soils.
PL4	**Sulphates and PH in ground**	Buildings	Direct contact	**Medium**	**Low** mitigated through appropriate concrete design	**Moderate /low** **Reduced to Low**	Risk is reduced with design sulphate class. North Plot & East Plot –DS-2/AC2 East Plot - DS-1/AC1 South Plot - DS-1/AC1 The above assessment is based upon on made ground and superficial clays. London clay bedrock was not reached and therefore further testing is required in the London clay to confirm appropriate measures.
PL5	**Ground Gas**	Human Health	Build-up of ground gases in confined space leading to inhalation. Asphyxiation	**Severe**	**Unlikely** CS1	**Moderate / Low** Reduced to low with mitigation	No gas protection measures required. However, limited data set for the North Site only. Therefore further monitoring from future investigations would be required for the East and South Site.
		Buildings	Explosion	**Severe**	**Unlikely** CS1	**Moderate / Low** Reduced to low with mitigation	

9 RECOMMENDATIONS AND CONCLUSIONS

Arcadis was instructed to undertake a preliminary intrusive site investigation for the proposed site regeneration. Based upon the information outlined within this report, the following conclusions were made. Further site investigation will be required as the development proposals are detailed.

9.1 Geo-environmental

No evidence of widespread contamination was identified, although elevations of lead and asbestos was detected in soils. Remedial actions of a capping layer above the Made ground would be recommended. This could comprise any proposed buildings / hardstanding with clean imported materials required in areas of landscaping / gardens to provide a suitable capping layer, and additionally in the absence of topsoil's a growth medium. A pre-demolition asbestos assessment should be carried out on all buildings on the site to assess materials.

- ***Soil Samples***

  North Site: One exceedance for Lead against C4SL within made ground. Also, one detection of Asbestos within Made Ground, a watching brief is recommended during construction for any asbestos, contamination and a specialist informed if required. Groundworks should be carried out in line with the requirements and guidance presented in CAR-2012 and CAR-Soil. A clean capping layer above the Made ground would be required.

  East Site: No exceedances or asbestos detected

  South Site: No exceedances or asbestos detected

9.2 Geotechnical

Ground conditions across the Site were found to comprise made ground above a mix of granular and cohesive superficial deposits.

The key geotechnical considerations in relation to the proposed construction development are summarised below.

- ***Founding***

  For the North and East Plots a suspended floor slab is recommended based upon variable strength of made ground deposits being present up to than 0.60m bgl. However, a ground floor slab could be used should made ground materials be excavated and replaced with a type 1 granular fill and compacted. As the depth of the Made ground was not proven on the southern plot further investigation would be required.

  For the North plot based upon the ground conditions encountered shallow foundations should be achievable for the proposed structure within dense granular superficial deposits at a depth in the order of 1.5m bgl in the area of WS0603. However, consideration should be taken for the potential presence

of compressible cohesive strata beneath this and the unproven depth of Made ground at other locations, which would require further investigation.

Due to limited info and an unproven depth of the Made Ground for the East and South Plot a recommendation for foundation cannot be Given. Further investigation is recommended for these areas.

- ***Concrete***

  North Plot & East Plot –DS-2 / AC2, South Plot - DS-1 / AC1.

  Due to a limited data set and the results being based on Made Ground and Superficial deposits, it is recommended that these be reassessed after further investigation. London clay bedrock was not reached and therefore further testing required in the London clay to confirm appropriate measures.

- ***UXO***

  The sites are deemed at High risk of UXO which should be considered for future development of the site with appropriate risk assessments and process during construction.

APPENDIX A

Study Limitations

IMPORTANT. This appendix should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1 This report has been prepared by Arcadis (UK) Limited ('Arcadis'), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with Be First Regeneration Limited (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.

2 This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing. otherwise in writing. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.

3 Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis is unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.

4 All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis has no obligation to advise the Client or any other party of such changes or their repercussions.

5 This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6 Whilst this report and the opinions made are correct to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties. provided by third parties. Arcadis has taken reasonable steps to ensure that the information sources used for this assessment provided accurate information and has therefore assumed this to be the case.

7 This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.

8 This report refers, within the limitations stated, to the condition of the Site at the time of the inspection. No warranty is given as to the possibility of changes in the condition of the Site since the time of the investigation.

9 The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.

10 Where intrusive investigation techniques have been employed, they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases, the investigation is further limited by Site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the Site have not been investigated.

11 If below ground intrusive investigations have been conducted as part of the scope, safe location of exploratory holes has been carried out with reference to the Arcadis ground disturbances procedure. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on Site.

12 Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.

13 Unless otherwise stated, an inspection of the Site has not been undertaken and there may be conditions present at the Site which have not been identified within the scope of this assessment.

14 Unless otherwise stated, samples from the Site (soil, groundwater, building fabric or other samples) have not been obtained.

15 Arcadis has relied upon the accuracy of documents, oral information and other material and information provided by the Client and others, and Arcadis assumes no liability for the accuracy of such data, although in the event of apparent conflicts in information, Arcadis would highlight this and seek to resolve.

16 Unless otherwise stated, the scope of works has not included an environmental compliance review, health and safety compliance review, hazardous building materials assessment, interviews or contacting Local Authority, requests for information to the petroleum officer, sampling or analyses of soil, ground water, surface water, air or hazardous building materials or a chain of title review.

17 Unless otherwise stated, this assessment has considered the ongoing use of the Site and has not been prepared for the purposes of redevelopment which may act as a trigger for Site investigation and remediation works not needed for ongoing use

APPENDIX B

Photo Log

CLIENT:	Be First Regeneration Ltd		**DATE:**	31/03/2021
REFERENCE:	10046791	**SITE NAME:**	Fambridge Road	

ARCADIS Design & Consultancy for natural and built assets

Plate 1.

Direction photo taken: South.

Description: North Site Garages with concrete surfaced carpark.



Plate 2.

Direction photo taken: West.

Description:
North Site
Garages constructed of brick



CLIENT:	Be First Regeneration Ltd		**DATE:**	31/03/2021
REFERENCE:	10046791	**SITE NAME:**	Fambridge Road	

ARCADIS Design & Consultancy for natural and built assets

Plate 3. Direction photo taken: South. Description: North Site Concrete surfacing with some waste material on site.	
Plate 4. Direction photo taken: South. Description: North Site Overgrown vegetation on site.	

CLIENT:	Be First Regeneration Ltd		**DATE:**	31/03/2021
REFERENCE:	10046791	**SITE NAME:**	Fambridge Road	

ARCADIS Design & Consultancy for natural and built assets

Plate 5.

Direction photo taken:
South.

Description:
North Site
Garages and concrete surfacing.



Plate 6.

Direction photo taken:
North.

Description:
South Site
Brick built Garages on concrete surfacing



CLIENT:	Be First Regeneration Ltd		**DATE:**	31/03/2021
REFERENCE:	10046791	**SITE NAME:**	Fambridge Road	

ARCADIS Design & Consultancy for natural and built assets

Plate 7.

Direction photo taken:
North.

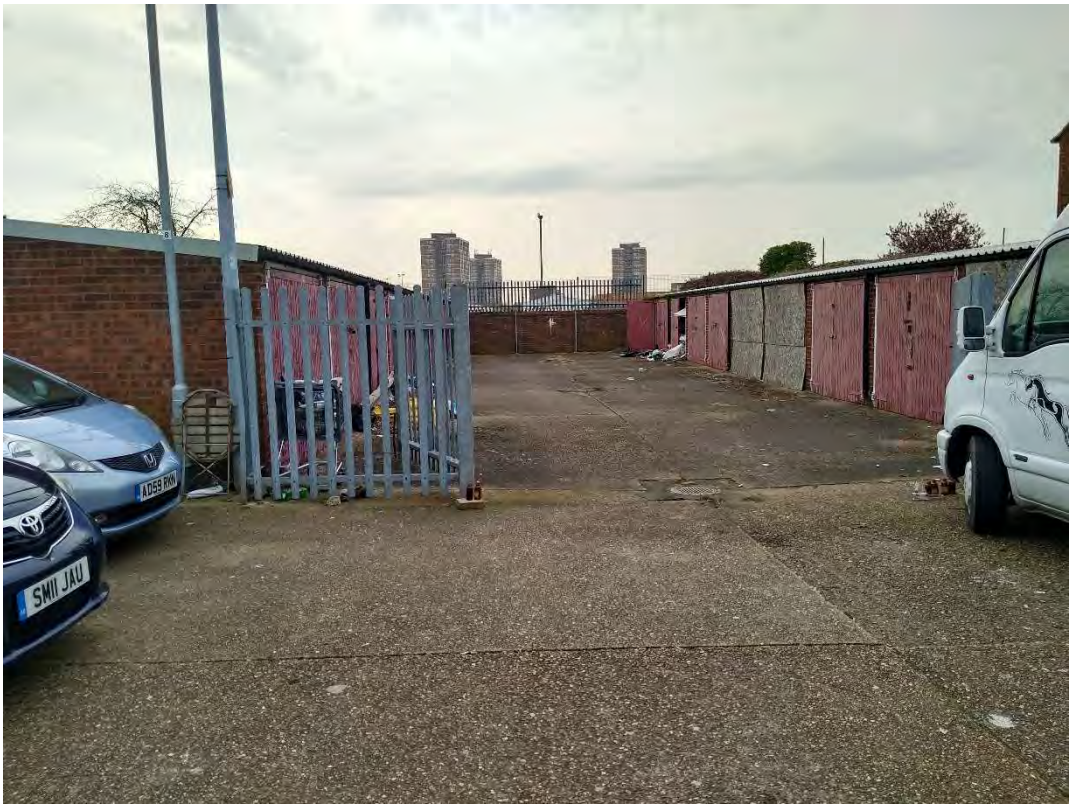
Description:
South Site
Garages with site drainage.



Plate 8.

Direction photo taken:
South.

Description:
East Site
Entrance to the site.



CLIENT:	Be First Regeneration Ltd	DATE:	31/03/2021
REFERENCE:	10046791	SITE NAME:	Fambridge Road

ARCADIS Design & Consultancy for natural and built assets

Plate 9. Direction photo taken: West. Description: East Site Western set of brick-built garages on concrete surface.	
Plate 10. Direction photo taken: West. Description: East Site Eastern set of brick-built garages with some fly tipped rubbish.	

APPENDIX C

Groundsure Report

Groundsure
LOCATION INTELLIGENCE

Enviro+Geo Insight

FAMBRIDGE ROAD, RM8 1NS

Order Details

Date: 09/03/2021

Your ref: PO14047811_PN10046791_FAMBRIDGE_RD

Our Ref: GS-7642652

Client: Arcadis Consulting (UK) Ltd

Site Details

Location: 549155 187428

Area: 0.16 ha

Authority: London Borough of Barking and Dagenham



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Summary of findings p. 2

OS MasterMap site plan p.13

Aerial image p. 8

groundsure.com/insightuserguide

Contact us with any questions at:
info@groundsure.com
08444 159 000

Summary of findings

Page	Section	Past land use	On site	0-50m	50-250m	250-500m	500-2000m
14	1.1	Historical industrial land uses	0	0	0	25	-
16	1.2	Historical tanks	0	0	0	1	-
16	1.3	Historical energy features	0	1	1	15	-
17	1.4	Historical petrol stations	0	0	0	0	-
17	1.5	Historical garages	0	0	0	4	-
18	1.6	Historical military land	0	0	0	0	-
Page	Section	Past land use - un-grouped	On site	0-50m	50-250m	250-500m	500-2000m
19	2.1	Historical industrial land uses	0	0	0	30	-
21	2.2	Historical tanks	0	0	0	2	-
21	2.3	Historical energy features	0	1	3	37	-
23	2.4	Historical petrol stations	0	0	0	0	-
23	2.5	Historical garages	0	0	0	5	-
Page	Section	Waste and landfill	On site	0-50m	50-250m	250-500m	500-2000m
24	3.1	Active or recent landfill	0	0	0	0	-
24	3.2	Historical landfill (BGS records)	0	0	0	0	-
25	3.3	Historical landfill (LA/mapping records)	0	0	1	2	-
25	3.4	Historical landfill (EA/NRW records)	0	0	1	0	-
26	3.5	Historical waste sites	0	0	0	1	-
26	3.6	Licensed waste sites	0	0	0	2	-
27	3.7	Waste exemptions	0	0	1	14	-
Page	Section	Current industrial land use	On site	0-50m	50-250m	250-500m	500-2000m
29	4.1	Recent industrial land uses	0	1	4	-	-
30	4.2	Current or recent petrol stations	0	0	0	1	-
30	4.3	Electricity cables	0	0	0	0	-
30	4.4	Gas pipelines	0	0	0	0	-
31	4.5	Sites determined as Contaminated Land	0	0	0	0	-

31	4.6	Control of Major Accident Hazards (COMAH)	0	0	0	0	-
31	4.7	Regulated explosive sites	0	0	0	0	-
31	4.8	Hazardous substance storage/usage	0	0	0	0	-
31	4.9	Historical licensed industrial activities (IPC)	0	0	0	0	-
32	4.10	Licensed industrial activities (Part A(1))	0	0	0	0	-
32	**4.11**	**Licensed pollutant release (Part A(2)/B)**	0	0	0	8	-
33	4.12	Radioactive Substance Authorisations	0	0	0	0	-
33	**4.13**	**Licensed Discharges to controlled waters**	0	0	4	0	-
34	4.14	Pollutant release to surface waters (Red List)	0	0	0	0	-
34	4.15	Pollutant release to public sewer	0	0	0	0	-
34	4.16	List 1 Dangerous Substances	0	0	0	0	-
35	4.17	List 2 Dangerous Substances	0	0	0	0	-
35	**4.18**	**Pollution Incidents (EA/NRW)**	0	0	0	1	-
35	4.19	Pollution inventory substances	0	0	0	0	-
35	4.20	Pollution inventory waste transfers	0	0	0	0	-
36	4.21	Pollution inventory radioactive waste	0	0	0	0	-

Page	Section	Hydrogeology	On site	0-50m	50-250m	250-500m	500-2000m
37	**5.1**	**Superficial aquifer**	Identified (within 500m)				
38	**5.2**	**Bedrock aquifer**	Identified (within 500m)				
39	**5.3**	**Groundwater vulnerability**	Identified (within 50m)				
40	5.4	Groundwater vulnerability- soluble rock risk	None (within 0m)				
40	5.5	Groundwater vulnerability- local information	None (within 0m)				
41	**5.6**	**Groundwater abstractions**	0	0	0	0	7
43	**5.7**	**Surface water abstractions**	0	0	0	0	1
44	5.8	Potable abstractions	0	0	0	0	0
44	5.9	Source Protection Zones	0	0	0	0	-
44	5.10	Source Protection Zones (confined aquifer)	0	0	0	0	-

Page	Section	Hydrology	On site	0-50m	50-250m	250-500m	500-2000m
45	6.1	Water Network (OS MasterMap)	0	0	0	-	-

45	6.2	Surface water features	0	0	0	-	-
46	**6.3**	**WFD Surface water body catchments**	1	-	-	-	-
46	**6.4**	**WFD Surface water bodies**	0	0	0	-	-
47	6.5	WFD Groundwater bodies	0	-	-	-	-
Page	Section	River and coastal flooding	On site	0-50m	50-250m	250-500m	500-2000m
48	7.1	Risk of Flooding from Rivers and Sea (RoFRaS)	None (within 50m)				
48	7.2	Historical Flood Events	0	0	0	-	-
48	7.3	Flood Defences	0	0	0	-	-
48	7.4	Areas Benefiting from Flood Defences	0	0	0	-	-
49	7.5	Flood Storage Areas	0	0	0	-	-
50	7.6	Flood Zone 2	None (within 50m)				
50	7.7	Flood Zone 3	None (within 50m)				
Page	Section	Surface water flooding					
51	**8.1**	**Surface water flooding**	1 in 100 year, 0.1m - 0.3m (within 50m)				
Page	Section	Groundwater flooding					
53	**9.1**	**Groundwater flooding**	Low (within 50m)				
Page	Section	Environmental designations	On site	0-50m	50-250m	250-500m	500-2000m
54	10.1	Sites of Special Scientific Interest (SSSI)	0	0	0	0	0
55	10.2	Conserved wetland sites (Ramsar sites)	0	0	0	0	0
55	10.3	Special Areas of Conservation (SAC)	0	0	0	0	0
55	10.4	Special Protection Areas (SPA)	0	0	0	0	0
55	10.5	National Nature Reserves (NNR)	0	0	0	0	0
56	**10.6**	**Local Nature Reserves (LNR)**	0	0	0	0	3
56	10.7	Designated Ancient Woodland	0	0	0	0	0
56	10.8	Biosphere Reserves	0	0	0	0	0
57	10.9	Forest Parks	0	0	0	0	0
57	10.10	Marine Conservation Zones	0	0	0	0	0
57	**10.11**	**Green Belt**	1	0	1	1	1
57	10.12	Proposed Ramsar sites	0	0	0	0	0

58	10.13	Possible Special Areas of Conservation (pSAC)	0	0	0	0	0
58	10.14	Potential Special Protection Areas (pSPA)	0	0	0	0	0
58	10.15	Nitrate Sensitive Areas	0	0	0	0	0
58	**10.16**	**Nitrate Vulnerable Zones**	0	0	0	1	0
60	**10.17**	**SSSI Impact Risk Zones**	1	-	-	-	-
61	10.18	SSSI Units	0	0	0	0	0
Page	Section	Visual and cultural designations	On site	0-50m	50-250m	250-500m	500-2000m
62	11.1	World Heritage Sites	0	0	0	-	-
62	11.2	Area of Outstanding Natural Beauty	0	0	0	-	-
62	11.3	National Parks	0	0	0	-	-
62	11.4	Listed Buildings	0	0	0	-	-
63	11.5	Conservation Areas	0	0	0	-	-
63	11.6	Scheduled Ancient Monuments	0	0	0	-	-
63	11.7	Registered Parks and Gardens	0	0	0	-	-
Page	Section	Agricultural designations	On site	0-50m	50-250m	250-500m	500-2000m
64	**12.1**	**Agricultural Land Classification**	Non Agricultural (within 250m)				
65	12.2	Open Access Land	0	0	0	-	-
65	12.3	Tree Felling Licences	0	0	0	-	-
65	12.4	Environmental Stewardship Schemes	0	0	0	-	-
65	12.5	Countryside Stewardship Schemes	0	0	0	-	-
Page	Section	Habitat designations	On site	0-50m	50-250m	250-500m	500-2000m
66	13.1	Priority Habitat Inventory	0	0	0	-	-
66	13.2	Habitat Networks	0	0	0	-	-
66	13.3	Open Mosaic Habitat	0	0	0	-	-
66	13.4	Limestone Pavement Orders	0	0	0	-	-
Page	Section	Geology 1:10,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
67	**14.1**	**10k Availability**	Identified (within 500m)				
68	**14.2**	**Artificial and made ground (10k)**	0	0	1	4	-
70	**14.3**	**Superficial geology (10k)**	1	0	0	1	-

71	14.4	Landslip (10k)	0	0	0	0	-
72	14.5	Bedrock geology (10k)	1	0	0	0	-
73	14.6	Bedrock faults and other linear features (10k)	0	0	0	0	-
Page	Section	Geology 1:50,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
74	15.1	50k Availability	Identified (within 500m)				
75	15.2	Artificial and made ground (50k)	0	0	1	3	-
76	15.3	Artificial ground permeability (50k)	0	0	-	-	-
77	15.4	Superficial geology (50k)	1	0	0	1	-
78	15.5	Superficial permeability (50k)	Identified (within 50m)				
78	15.6	Landslip (50k)	0	0	0	0	-
78	15.7	Landslip permeability (50k)	None (within 50m)				
79	15.8	Bedrock geology (50k)	1	0	0	0	-
80	15.9	Bedrock permeability (50k)	Identified (within 50m)				
80	15.10	Bedrock faults and other linear features (50k)	0	0	0	0	-
Page	Section	Boreholes	On site	0-50m	50-250m	250-500m	500-2000m
81	16.1	BGS Boreholes	0	0	0	-	-
Page	Section	Natural ground subsidence					
82	17.1	Shrink swell clays	Moderate (within 50m)				
83	17.2	Running sands	Very low (within 50m)				
84	17.3	Compressible deposits	Negligible (within 50m)				
85	17.4	Collapsible deposits	Very low (within 50m)				
86	17.5	Landslides	Very low (within 50m)				
87	17.6	Ground dissolution of soluble rocks	Negligible (within 50m)				
Page	Section	Mining, ground workings and natural cavities	On site	0-50m	50-250m	250-500m	500-2000m
88	18.1	Natural cavities	0	0	0	0	-
89	18.2	BritPits	0	0	0	0	-
89	18.3	Surface ground workings	0	0	1	-	-
89	18.4	Underground workings	0	0	0	0	0
89	18.5	Historical Mineral Planning Areas	0	0	0	1	-

90	18.6	Non-coal mining	0	0	0	0	0
90	18.7	Mining cavities	0	0	0	0	0
90	18.8	JPB mining areas	None (within 0m)				
90	18.9	Coal mining	None (within 0m)				
90	18.10	Brine areas	None (within 0m)				
91	18.11	Gypsum areas	None (within 0m)				
91	18.12	Tin mining	None (within 0m)				
91	18.13	Clay mining	None (within 0m)				

Page	Section	Radon	
92	**19.1**	**Radon**	Less than 1% (within 0m)

Page	Section	Soil chemistry	On site	0-50m	50-250m	250-500m	500-2000m
93	**20.1**	**BGS Estimated Background Soil Chemistry**	1	1	-	-	-
93	**20.2**	**BGS Estimated Urban Soil Chemistry**	4	5	-	-	-
94	20.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-

Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
95	21.1	Underground railways (London)	0	0	0	-	-
95	21.2	Underground railways (Non-London)	0	0	0	-	-
96	21.3	Railway tunnels	0	0	0	-	-
96	21.4	Historical railway and tunnel features	0	0	0	-	-
96	21.5	Royal Mail tunnels	0	0	0	-	-
96	21.6	Historical railways	0	0	0	-	-
96	21.7	Railways	0	0	0	-	-
97	**21.8**	**Crossrail 1**	0	0	0	1	-
97	21.9	Crossrail 2	0	0	0	0	-
97	21.10	HS2	0	0	0	0	-

Recent aerial photograph



Capture Date: 29/06/2019

Site Area: 0.16ha

Recent site history - 2018 aerial photograph



Capture Date: 02/08/2018

Site Area: 0.16ha

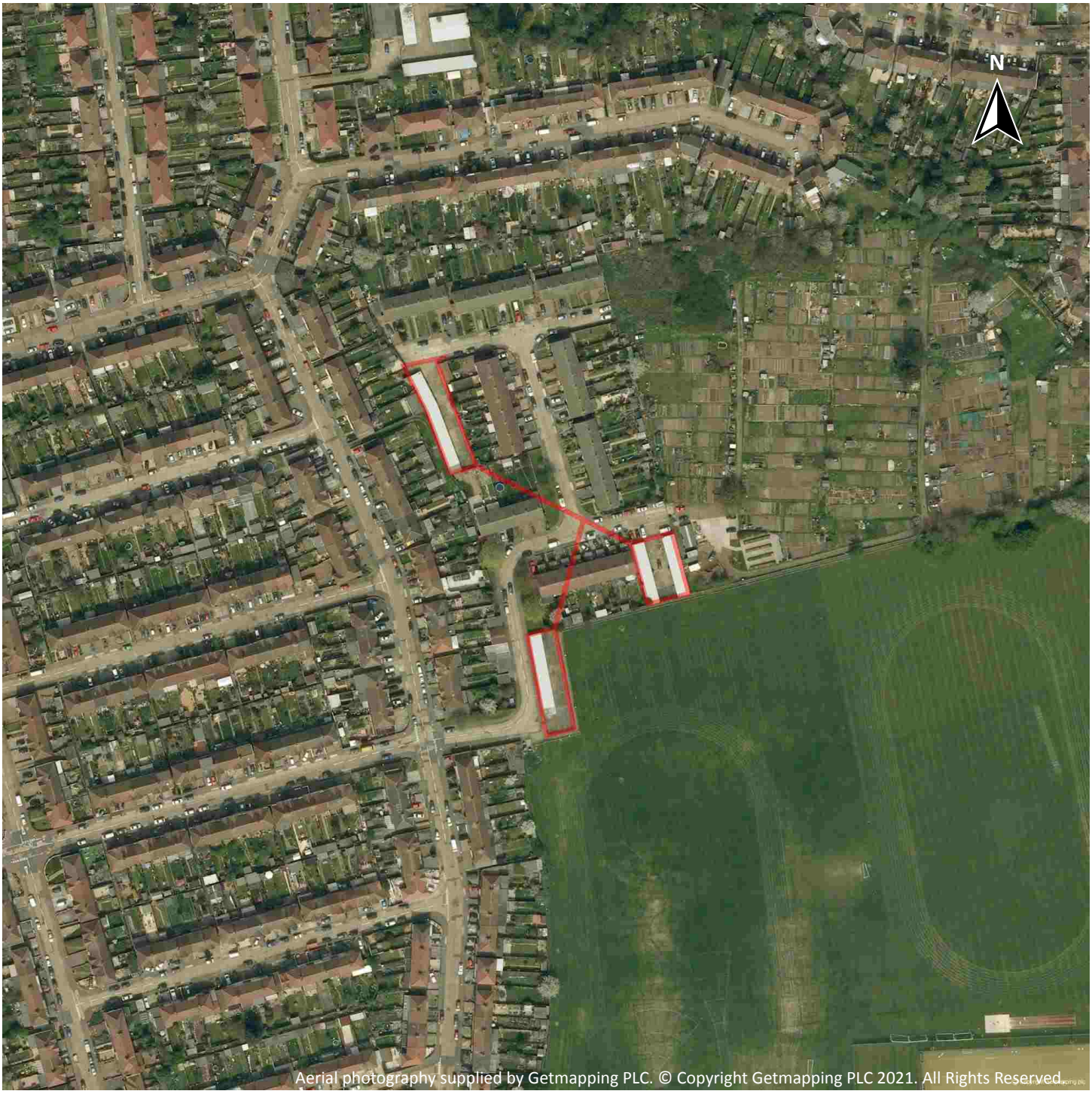
Recent site history - 2013 aerial photograph



Capture Date: 20/04/2013

Site Area: 0.16ha

Recent site history - 2010 aerial photograph



Capture Date: 24/04/2010

Site Area: 0.16ha

Recent site history - 1999 aerial photograph



Capture Date: 06/09/1999

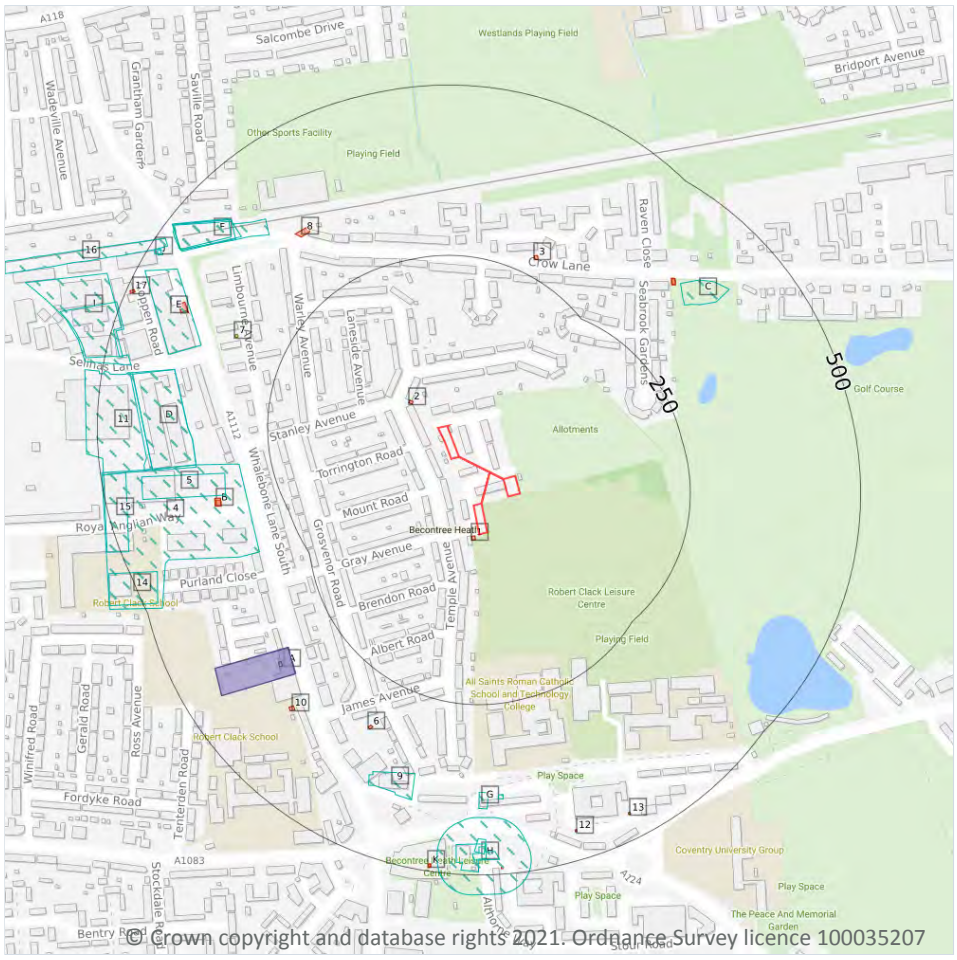
Site Area: 0.16ha

OS MasterMap site plan



Site Area: 0.16ha

1 Past land use



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Site Outline

Search buffers in metres (m)

Historical industrial land uses

Historical tanks

Historical energy features

Historical garages

1.1 Historical industrial land uses

Records within 500m	25

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 1:10,560 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
4	296m W	Unspecified Works	1968 - 1975	2288652

ID	Location	Land use	Dates present	Group ID
5	320m W	Unspecified Warehouse	1975	2138608
C	353m NE	Unspecified Heap	1968	2136915
D	359m W	Unspecified Works	1968	2213945
D	359m W	Unspecified Factory	1975	2151019
9	364m S	Corn Mill	1895	2152900
E	368m W	Unspecified Depot	1975	2147278
F	376m NW	Cuttings	1862 - 1894	2188803
G	379m S	Smithy	1895	2167479
G	383m S	Smithy	1862	2167478
F	402m NW	Cuttings	1938	2271079
F	407m NW	Cuttings	1921	2247396
F	413m NW	Cuttings	1950	2231696
H	416m S	Smithy	1921	2176815
11	423m W	Unspecified Depot	1968 - 1975	2292476
H	447m S	Smithy	1895	2289450
H	454m S	Smithy	1938	2262960
H	458m S	Smithy	1921	2280168
I	460m W	Unspecified Depots	1968	2163872
14	462m W	Unspecified Warehouse	1975	2138607
15	463m W	Unspecified Factory	1975	2151018
I	474m W	Unspecified Works	1975	2159967
J	477m NW	Railway Building	1921 - 1938	2268585
16	478m NW	Cuttings	1862	2198679
J	480m NW	Railway Building	1950	2243857

This data is sourced from Ordnance Survey / Groundsure.

1.2 Historical tanks

Records within 500m	1

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
7	323m NW	Unspecified Tank	1959 - 1960	405138

This data is sourced from Ordnance Survey / Groundsure.

1.3 Historical energy features

Records within 500m	17

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
1	7m W	Electricity Substation	1995	246877
2	52m NW	Electricity Substation	1983 - 1985	266907
3	275m NE	Electricity Substation	1983 - 1985	272426
6	322m SW	Electricity Substation	1979	246875
B	335m W	Electricity Substation	1979	287926
B	336m W	Electricity Substation	1967 - 1970	258159
8	344m NW	Electricity Substation	1982 - 1994	263429
C	363m NE	Electricity Substation	1983	288687
C	363m NE	Electricity Substation	1985	280356
10	371m SW	Electricity Substation	1979	246876

ID	Location	Land use	Dates present	Group ID
E	403m NW	Electricity Substation	1982 - 1994	275401
12	455m S	Electricity Substation	1993 - 1996	278011
13	461m SE	Electricity Substation	1993 - 1996	267592
17	487m NW	Electricity Substation	1982 - 1994	276902
K	489m S	Electricity Substation	1992 - 1996	259297
H	489m S	Electricity Substation	1992 - 1996	264352
K	489m S	Electricity Substation	1983	279562

This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m	0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m	4

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
A	325m SW	Garage	1979	77481
A	326m SW	Garage	1959 - 1970	80777
A	326m SW	Garage	1960	75147
A	345m SW	Garage	1967	74476

This data is sourced from Ordnance Survey / Groundsure.

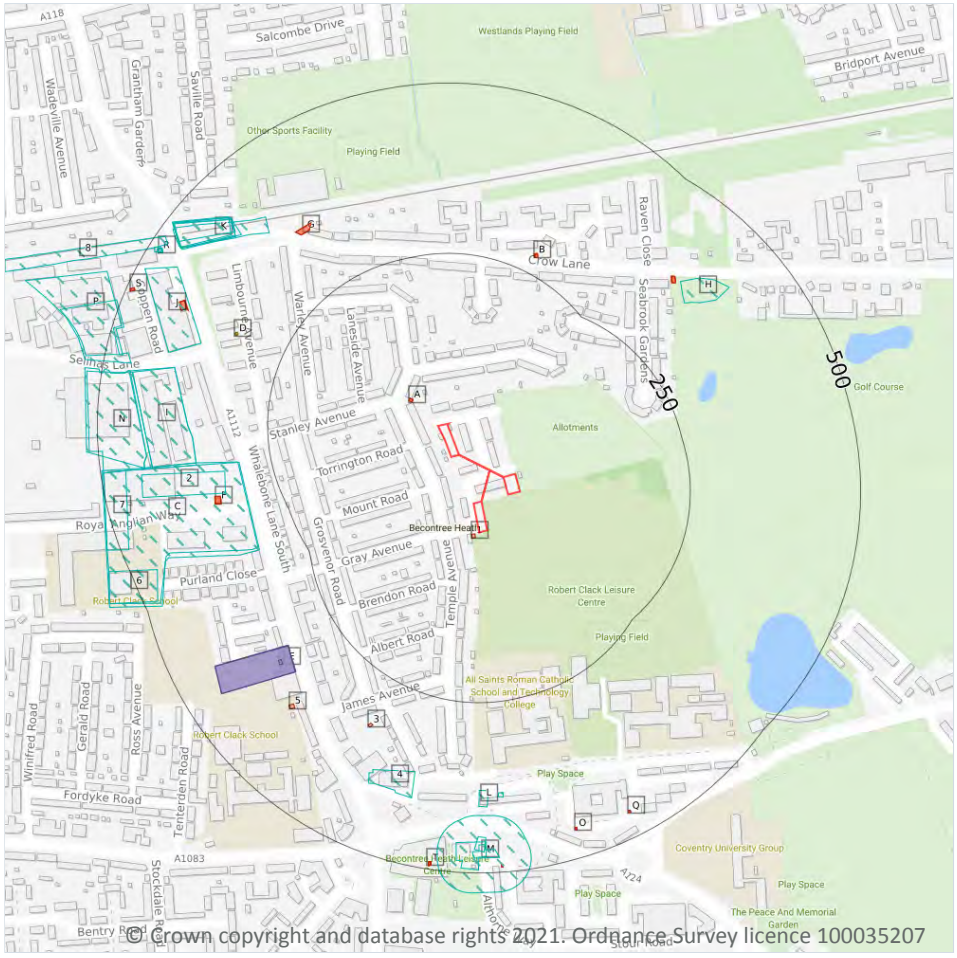
1.6 Historical military land

Records within 500m	0

Areas of military land digitised from multiple sources including the National Archives, local records, MOD records and verified other sources, intelligently grouped into contiguous features.

This data is sourced from Ordnance Survey / Groundsure / other sources.

2 Past land use - un-grouped



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Site Outline

Search buffers in metres (m)

Historical industrial land uses

Historical tanks

Historical energy features

Historical garages

2.1 Historical industrial land uses

Records within 500m	30

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 10,560 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 19**

ID	Location	Land Use	Date	Group ID
C	296m W	Unspecified Works	1975	2288652
C	298m W	Unspecified Works	1968	2288652
2	320m W	Unspecified Warehouse	1975	2138608

ID	Location	Land Use	Date	Group ID
H	353m NE	Unspecified Heap	1968	2136915
I	359m W	Unspecified Works	1968	2213945
I	359m W	Unspecified Factory	1975	2151019
4	364m S	Corn Mill	1895	2152900
J	368m W	Unspecified Depot	1975	2147278
K	376m NW	Cuttings	1862	2188803
L	379m S	Smithy	1895	2167479
L	383m S	Smithy	1862	2167478
K	402m NW	Cuttings	1938	2271079
K	407m NW	Cuttings	1921	2247396
K	409m NW	Cuttings	1921	2247396
K	412m NW	Cuttings	1894	2188803
K	413m NW	Cuttings	1950	2231696
M	416m S	Smithy	1921	2176815
N	423m W	Unspecified Depot	1975	2292476
N	430m W	Unspecified Depot	1968	2292476
M	447m S	Smithy	1895	2289450
M	454m S	Smithy	1938	2262960
M	458m S	Smithy	1921	2280168
P	460m W	Unspecified Depots	1968	2163872
6	462m W	Unspecified Warehouse	1975	2138607
7	463m W	Unspecified Factory	1975	2151018
P	474m W	Unspecified Works	1975	2159967
R	477m NW	Railway Building	1938	2268585
8	478m NW	Cuttings	1862	2198679
R	479m NW	Railway Building	1921	2268585
R	480m NW	Railway Building	1950	2243857

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m	2

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 19**

ID	Location	Land Use	Date	Group ID
D	323m NW	Unspecified Tank	1960	405138
D	324m NW	Unspecified Tank	1959	405138

This data is sourced from Ordnance Survey / Groundsure.

2.3 Historical energy features

Records within 500m	41

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 19**

ID	Location	Land Use	Date	Group ID
1	7m W	Electricity Substation	1995	246877
A	52m NW	Electricity Substation	1985	266907
A	52m NW	Electricity Substation	1983	266907
A	52m NW	Electricity Substation	1983	266907
B	275m NE	Electricity Substation	1983	272426
B	275m NE	Electricity Substation	1983	272426
B	275m NE	Electricity Substation	1985	272426
3	322m SW	Electricity Substation	1979	246875
F	335m W	Electricity Substation	1979	287926
F	336m W	Electricity Substation	1967	258159
F	336m W	Electricity Substation	1970	258159
G	344m NW	Electricity Substation	1994	263429

ID	Location	Land Use	Date	Group ID
G	344m NW	Electricity Substation	1982	263429
H	363m NE	Electricity Substation	1983	288687
H	363m NE	Electricity Substation	1983	288687
H	363m NE	Electricity Substation	1985	280356
5	371m SW	Electricity Substation	1979	246876
J	403m NW	Electricity Substation	1994	275401
J	407m NW	Electricity Substation	1982	275401
O	455m S	Electricity Substation	1993	278011
O	455m S	Electricity Substation	1996	278011
O	455m S	Electricity Substation	1996	278011
O	455m S	Electricity Substation	1995	278011
Q	461m SE	Electricity Substation	1993	267592
Q	461m SE	Electricity Substation	1996	267592
Q	461m SE	Electricity Substation	1996	267592
Q	461m SE	Electricity Substation	1995	267592
S	487m NW	Electricity Substation	1994	276902
S	488m NW	Electricity Substation	1982	276902
T	489m S	Electricity Substation	1993	259297
T	489m S	Electricity Substation	1996	259297
T	489m S	Electricity Substation	1996	259297
T	489m S	Electricity Substation	1995	259297
T	489m S	Electricity Substation	1992	259297
M	489m S	Electricity Substation	1993	264352
M	489m S	Electricity Substation	1996	264352
M	489m S	Electricity Substation	1996	264352
M	489m S	Electricity Substation	1995	264352
M	489m S	Electricity Substation	1992	264352
T	489m S	Electricity Substation	1983	279562

ID	Location	Land Use	Date	Group ID
T	489m S	Electricity Substation	1983	279562

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m	**0**

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

2.5 Historical garages

Records within 500m	**5**

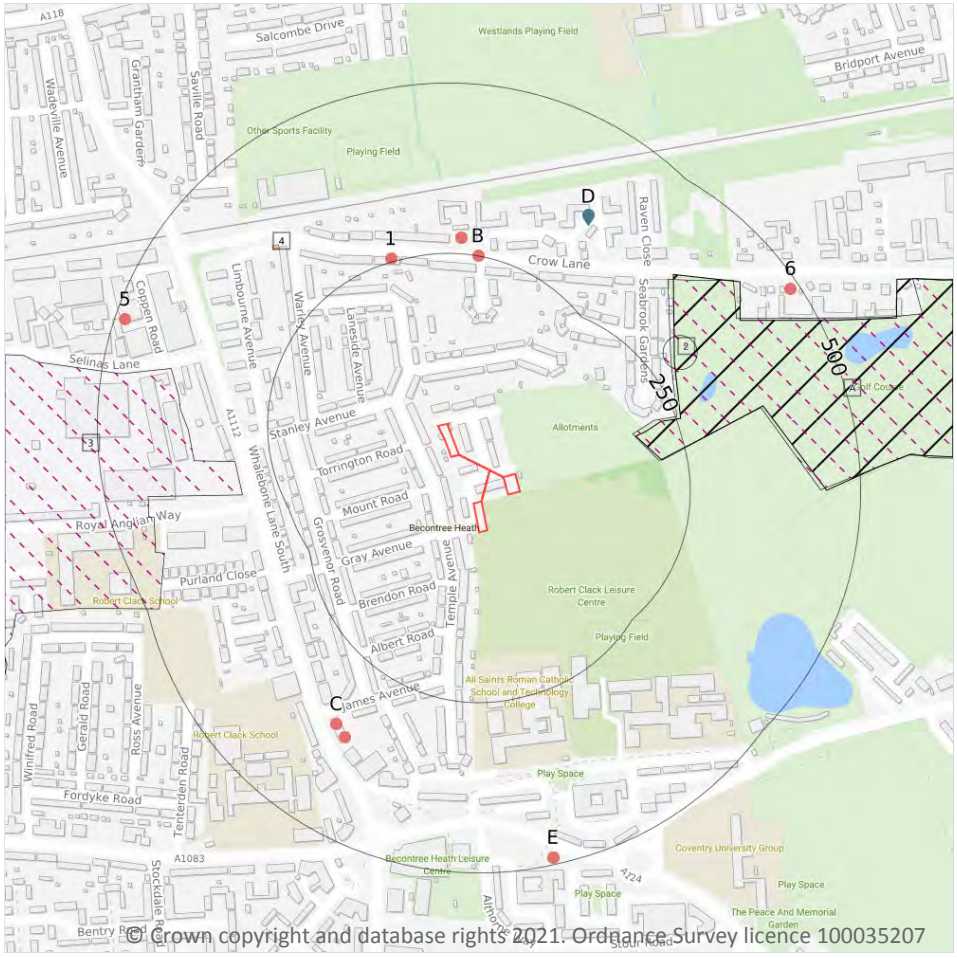
Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 19**

ID	Location	Land Use	Date	Group ID
E	325m SW	Garage	1979	77481
E	326m SW	Garage	1959	80777
E	326m SW	Garage	1970	80777
E	326m SW	Garage	1960	75147
E	345m SW	Garage	1967	74476

This data is sourced from Ordnance Survey / Groundsure.

3 Waste and landfill



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Site Outline

Search buffers in metres (m)

Historical landfill (EA/NRW)

Historical landfill (LA/OS)

Historical waste sites

Licensed waste sites

Waste exemptions

3.1 Active or recent landfill

Records within 500m	0

Active or recently closed landfill sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.2 Historical landfill (BGS records)

Records within 500m	0

Landfill sites identified on a survey carried out on behalf of the DoE in 1973. These sites may have been closed or operational at this time.

This data is sourced from the British Geological Survey.

3.3 Historical landfill (LA/mapping records)

Records within 500m	3

Landfill sites identified from Local Authority records and high detail historical mapping.

Features are displayed on the Waste and landfill map on **page 24**

ID	Location	Site address	Source	Data type
A	182m E	27 Seabrook Gardens, Romford,RM7 0EU	London Brough of Havering	Polygon
2	276m NE	Landfill site: Crowlands Open Space, Crow Lane, Romford. Report Site: 27 Seabrook Gardens, Romford RM7 0EU	Havering London Borough Council	Point
3	302m W	Land to south of Selinas Lane	London Borough of Barking and Dagenham	Polygon

This data is sourced from the Ordnance Survey/Groundsure and Local Authority records.

3.4 Historical landfill (EA/NRW records)

Records within 500m	1

Known historical (closed) landfill sites (e.g. sites where there is no PPC permit or waste management licence currently in force). This includes sites that existed before the waste licensing regime and sites that have been licensed in the past but where a licence has been revoked, ceased to exist or surrendered and a certificate of completion has been issued.

Features are displayed on the Waste and landfill map on **page 24**

ID	Location	Details		
A	185m E	Site Address: Crowlands Open Space, Crow Lane, Romford Licence Holder Address: -	Waste Licence: - Site Reference: 8HV044, 4380/0023 Waste Type: Inert, Industrial, Commercial, Household, Liquid sludge Environmental Permitting Regulations (Waste) Reference: - Licence Issue: - Licence Surrender: -	Operator: - Licence Holder: London Borough of Barking First Recorded 01/01/1954 Last Recorded: 31/12/1972

This data is sourced from the Environment Agency and Natural Resources Wales.

3.5 Historical waste sites

Records within 500m	**1**

Waste site records derived from Local Authority planning records and high detail historical mapping.

Features are displayed on the Waste and landfill map on **page 24**

ID	Location	Address	Further Details	Date
4	348m NW	Site Address: N/A	Type of Site: Refuse Pit Planning application reference: N/A Description: N/A Data source: Historic Mapping Data Type: Polygon	1920

This data is sourced from Ordnance Survey/Groundsure and Local Authority records.

3.6 Licensed waste sites

Records within 500m	**2**

Active or recently closed waste sites under Environment Agency/Natural Resources Wales regulation.

Features are displayed on the Waste and landfill map on **page 24**

ID	Location	Details		
D	366m NE	Site Name: P F Ahern & Sons Ltd, Romford Site Address: P F Ahern & Sons Ltd, 228, Crow Lane, Romford, Essex, RM7 0HA Correspondence Address: P F Ahern & Sons Ltd, 420, Gants Hill, Illford, Essex, IG2 4HT	Type of Site: Incinerator Size: Unknown Environmental Permitting Regulations (Waste) Licence Number: AHE001 EPR reference: - Operator: P F Ahern & Sons Ltd Waste Management licence No: 80096 Annual Tonnage: 0	Issue Date: 27/09/1994 Effective Date: - Modified:: - Surrendered Date: 22/07/1998 Expiry Date: - Cancelled Date: - Status: Surrendered
D	366m NE	Site Name: P F Ahern & Sons Ltd, Romford Site Address: P F Ahern & Sons Ltd, 228, Crow Lane, Romford, Essex, RM7 0HA Correspondence Address: -	Type of Site: Incinerator Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: AHE001 EPR reference: EA/EPR/YP3896NG/S002 Operator: P F Ahern & Sons Ltd Waste Management licence No: 80096 Annual Tonnage: 1494	Issue Date: 27/09/1994 Effective Date: - Modified:: - Surrendered Date: Jul 22 1998 12:00AM Expiry Date: - Cancelled Date: - Status: Surrendered

This data is sourced from the Environment Agency and Natural Resources Wales.

3.7 Waste exemptions

Records within 500m	15

Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit. Exemptions have specific limits and conditions that must be adhered to.

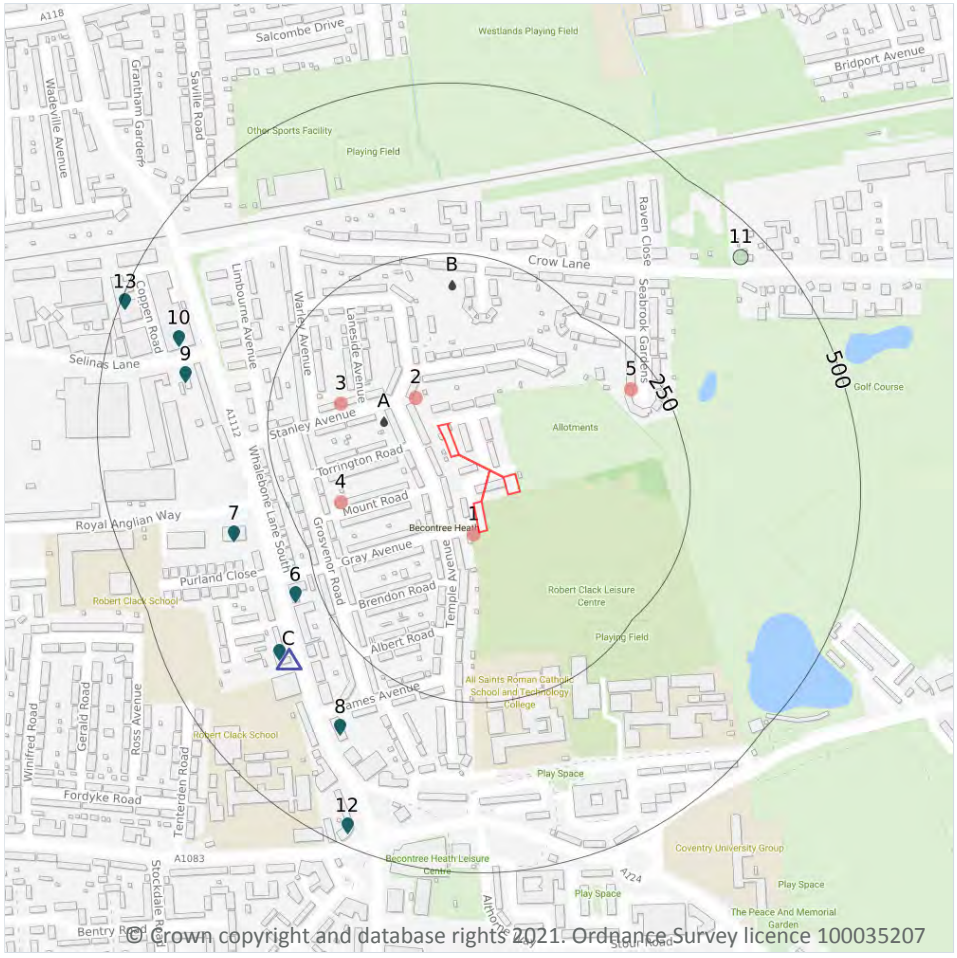
Features are displayed on the Waste and landfill map on **page 24**

ID	Location	Site	Reference	Category	Sub-Category	Description
B	249m N	288 Crow Lane ROMFORD RM7 0HJ	EPR/YF0808SK /A001	Treating waste exemption	Non-Agricultural Waste Only	Recovery of scrap metal
1	255m N	UNIT 1A, CROW LANE, ROMFORD, RM70HH	WEX152237	Treating waste exemption	Not on a farm	Recovery of scrap metal
B	273m N	288, CROW LANE, ROMFORD, RM7 0HJ	WEX254914	Treating waste exemption	Not on a farm	Recovery of scrap metal
B	273m N	288, CROW LANE, ROMFORD, RM7 0HJ	WEX111150	Treating waste exemption	Not on a farm	Recovery of scrap metal
C	352m SW	26, WHALEBONE LANE SOUTH, DAGENHAM, RM8 1BJ	WEX240442	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
C	352m SW	26, WHALEBONE LANE SOUTH, DAGENHAM, RM8 1BJ	WEX098134	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
C	360m SW	26 Whalebone Lane South DAGENHAM Essex RM8 1BJ	EPR/KF0733RK /A001	Treating waste exemption	Non-Agricultural Waste Only	Sorting and de-naturing of controlled drugs for disposal
5	485m W	Units 1 & 2 Capricorn Centre, Units 1 & 2 Capricorn Centre, Coppen Road, Dagenham, RM8 1HJ	WEX127795	Storing waste exemption	Not on a farm	Storage of waste in a secure place
6	487m NE	143, CROW LANE, ROMFORD, RM7 0ES	WEX108760	Treating waste exemption	Not on a farm	Recovery of scrap metal
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX188984	Storing waste exemption	Not on a farm	Storage of waste in secure containers
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX188984	Storing waste exemption	Not on a farm	Storage of waste in a secure place
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX243418	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX100937	Storing waste exemption	Not on a farm	Storage of waste in secure containers

ID	Location	Site	Reference	Category	Sub-Category	Description
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX100937	Storing waste exemption	Not on a farm	Storage of waste in a secure place
E	490m S	420, WOOD LANE, DAGENHAM, RM10 7FP	WEX100937	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal

This data is sourced from the Environment Agency and Natural Resources Wales.

4 Current industrial land use



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Site Outline

Search buffers in metres (m)

Recent industrial land uses

Current or recent petrol stations

Licensed pollutant release (Part A(2)/B)

Licensed Discharges to controlled waters

Pollution Incidents (EA/NRW)

4.1 Recent industrial land uses

Records within 250m	5

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on **page 29**

ID	Location	Company	Address	Activity	Category
1	9m W	Electricity Sub Station	Greater London, RM8	Electrical Features	Infrastructure and Facilities
2	53m NW	Electricity Sub Station	Greater London, RM8	Electrical Features	Infrastructure and Facilities
3	146m W	B R Waste Solution	21, Stanley Avenue, Dagenham, Greater London, RM8 1JB	Recycling, Reclamation and Disposal	Recycling Services

ID	Location	Company	Address	Activity	Category
4	176m W	The Sugar Boutique	3, Mount Road, Dagenham, Greater London, RM8 1NA	Baking and Confectionery	Foodstuffs
5	211m NE	Romford Recovery & Recycling	42, Seabrook Gardens, Romford, Greater London, RM7 0EU	Vehicle Breakdown and Recovery Services	Personal, Consumer and Other Services

This data is sourced from Ordnance Survey.

4.2 Current or recent petrol stations

Records within 500m	**1**

Open, closed, under development and obsolete petrol stations.

Features are displayed on the Current industrial land use map on **page 29**

ID	Location	Company	Address	LPG	Status
C	336m SW	TEXACO	79, Whalebone Lane South, Dagenham, Outer London, RM8 1AJ	No	Open

This data is sourced from Experian.

4.3 Electricity cables

Records within 500m	**0**

High voltage underground electricity transmission cables.

This data is sourced from National Grid.

4.4 Gas pipelines

Records within 500m	**0**

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.5 Sites determined as Contaminated Land

Records within 500m	0

Contaminated Land Register of sites designated under Part 2a of the Environmental Protection Act 1990.

This data is sourced from Local Authority records.

4.6 Control of Major Accident Hazards (COMAH)

Records within 500m	0

Control of Major Accident Hazards (COMAH) sites. This data includes upper and lower tier sites, and includes a historical archive of COMAH sites and Notification of Installations Handling Hazardous Substances (NIHHS) records.

This data is sourced from the Health and Safety Executive.

4.7 Regulated explosive sites

Records within 500m	0

Sites registered and licensed by the Health and Safety Executive under the Manufacture and Storage of Explosives Regulations 2005 (MSER). The last update to this data was in April 2011.

This data is sourced from the Health and Safety Executive.

4.8 Hazardous substance storage/usage

Records within 500m	0

Consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

This data is sourced from Local Authority records.

4.9 Historical licensed industrial activities (IPC)

Records within 500m	0

Integrated Pollution Control (IPC) records of substance releases to air, land and water. This data represents a historical archive as the IPC regime has been superseded.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.10 Licensed industrial activities (Part A(1))

Records within 500m	0

Records of Part A(1) installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.11 Licensed pollutant release (Part A(2)/B)

Records within 500m	8

Records of Part A(2) and Part B installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

Features are displayed on the Current industrial land use map on **page 29**

ID	Location	Address	Details	
6	285m W	Klass Dry Cleaners, 74 Whalebone Lane South, Dagenham, Essex, RM8 1BB	Process: Dry Cleaning Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
7	338m W	Shell, Tripton Whalebone Rd Sth, Dagenham, RM8 1AJ	Process: Petrol Vapour Recovery Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
C	342m SW	Park Garage Group PLC, Hassell's Garage, 79 Whalebone Lane South, Dagenham, RM8 1AJ	Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
8	351m SW	24 Whalebone Lane South, Dagenham, Essex, RM8 1BJ	Process: Dry Cleaning Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
9	378m W	I.D. Morris Bodyshop, 1 Selinas Lane, Dagenham, Essex, RM8 1QH	Process: Respraying of Road Vehicles Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified

ID	Location	Address	Details	
10	401m W	RAC Auto Windscreens, Unit 2, Cromwell Centre, Coppen Road, Dagenham, Essex, RM8 1QH	Process: Respraying of Road Vehicles Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
12	472m SW	4 Cinema Parade, Whalebone Lane South, Dagenham, Essex, RM8 1AA	Process: Dry Cleaning Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified
13	494m W	Apollo 2000, International House, Coppen Road, Dagenham, RM8 1HJ	Process: Respraying of Road Vehicles Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified

This data is sourced from Local Authority records.

4.12 Radioactive Substance Authorisations

Records within 500m	**0**

Records of the storage, use, accumulation and disposal of radioactive substances regulated under the Radioactive Substances Act 1993.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.13 Licensed Discharges to controlled waters

Records within 500m	**4**

Discharges of treated or untreated effluent to controlled waters under the Water Resources Act 1991.

Features are displayed on the Current industrial land use map on **page 29**

ID	Location	Address	Details	
A	80m W	Temple Avenue	Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: TEMP.2049 Permit Version: 1 Receiving Water: WANTZ STREAM	Status: TEMPORARY CONSENTS (WATER ACT 1989, SECTION 113) Issue date: 02/11/1989 Effective Date: 02/11/1989 Revocation Date: 02/09/2010

ID	Location	Address	Details	
A	80m W	Temple Avenue	Effluent Type: SEWAGE DISCHARGES - PUMPING STATION - WATER COMPANY Permit Number: TEMP.2049 Permit Version: 2 Receiving Water: Wantz Stream	Status: SURRENDERED UNDER EPR 2010 Issue date: 03/09/2010 Effective Date: 03/09/2010 Revocation Date: 13/10/2015
B	203m N	SEMLINAS LANE INDUSTRIAL SITE, CROW, SEMLINAS LANE INDUSTRIAL SITE C, ROW LANE DAGENHAM ROMFORD	Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: CECR.0019 Permit Version: 1 Receiving Water: WANTZ STREAM	Status: REVOKED - UNSPECIFIED Issue date: 21/04/1955 Effective Date: 21/04/1955 Revocation Date: 19/05/1992
B	203m N	CROW LANE, ROMFORD, ESSEX, CROW LANE ROMFORD ESSEX	Effluent Type: TRADE DISCHARGES - UNSPECIFIED Permit Number: CEKR.0103 Permit Version: 1 Receiving Water: ROM	Status: REVOKED - UNSPECIFIED Issue date: 21/12/1962 Effective Date: 21/12/1962 Revocation Date: 22/05/1991

This data is sourced from the Environment Agency and Natural Resources Wales.

4.14 Pollutant release to surface waters (Red List)

Records within 500m	0

Discharges of specified substances under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.15 Pollutant release to public sewer

Records within 500m	0

Discharges of Special Category Effluents to the public sewer.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.16 List 1 Dangerous Substances

Records within 500m	0

Discharges of substances identified on List I of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.17 List 2 Dangerous Substances

Records within 500m	0

Discharges of substances identified on List II of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.18 Pollution Incidents (EA/NRW)

Records within 500m	1

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

Features are displayed on the Current industrial land use map on **page 29**

ID	Location	Details	
11	459m NE	Incident Date: 29/07/2020 Incident Identification: 1831704 Pollutant: Pollutant Not Identified Pollutant Description: Not Identified	Water Impact: Category 3 (Minor) Land Impact: Category 2 (Significant) Air Impact: Category 3 (Minor)

This data is sourced from the Environment Agency and Natural Resources Wales.

4.19 Pollution inventory substances

Records within 500m	0

The pollution inventory (substances) includes reporting on annual emissions of certain regulated substances to air, controlled waters and land. A reporting threshold for each substance is also included. Where emissions fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.20 Pollution inventory waste transfers

Records within 500m	0

The pollution inventory (waste transfers) includes reporting on annual transfers and recovery/disposal of controlled wastes from a site. A reporting threshold for each waste type is also included. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

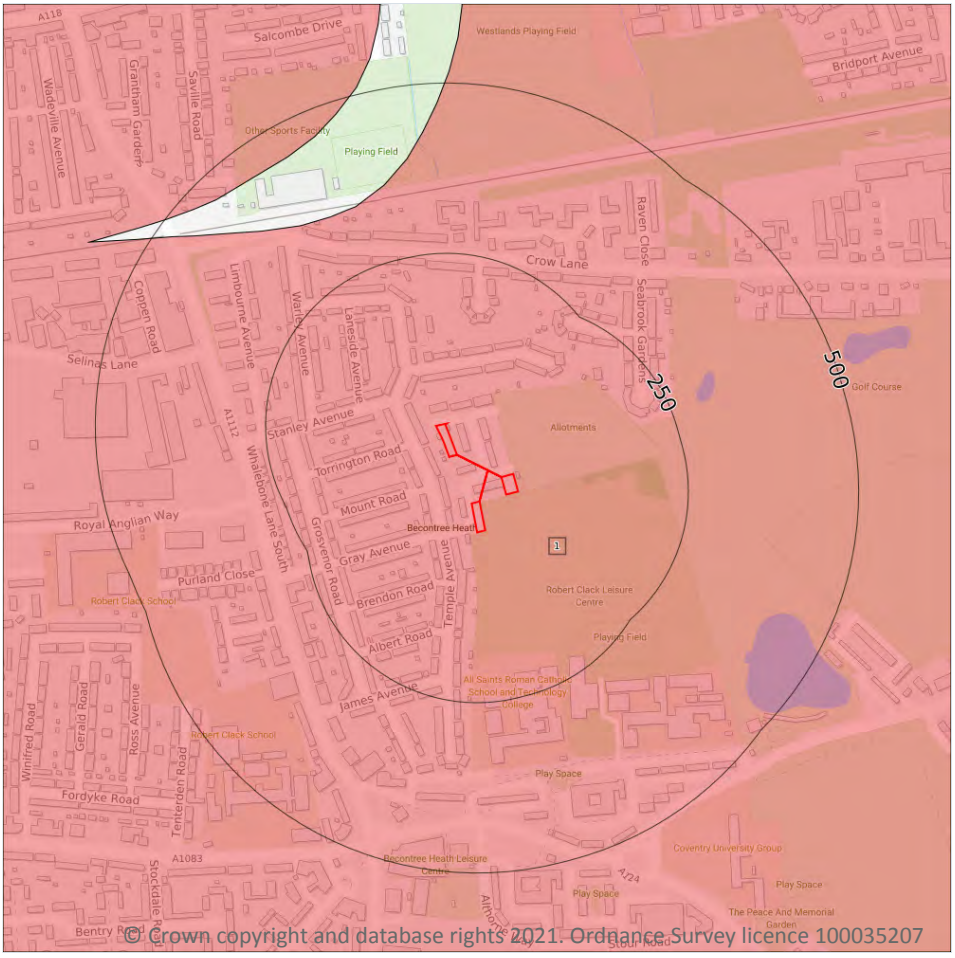
4.21 Pollution inventory radioactive waste

Records within 500m	0

The pollution inventory (radioactive wastes) includes reporting on annual releases of radioactive substances from a site, including the means of release. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

5 Hydrogeology - Superficial aquifer



Site Outline

Search buffers in metres (m)

- Principal
- Secondary A
- Secondary B
- Secondary Undifferentiated
- Unproductive
- Unknown

5.1 Superficial aquifer

Records within 500m	1

Aquifer status of groundwater held within superficial geology.

Features are displayed on the Hydrogeology map on **page 37**

ID	Location	Designation	Description
1	**On site**	**Secondary A**	**Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers**

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Bedrock aquifer



Site Outline

Search buffers in metres (m)

- Principal
- Secondary A
- Secondary B
- Secondary Undifferentiated
- Unproductive

5.2 Bedrock aquifer

Records within 500m	1

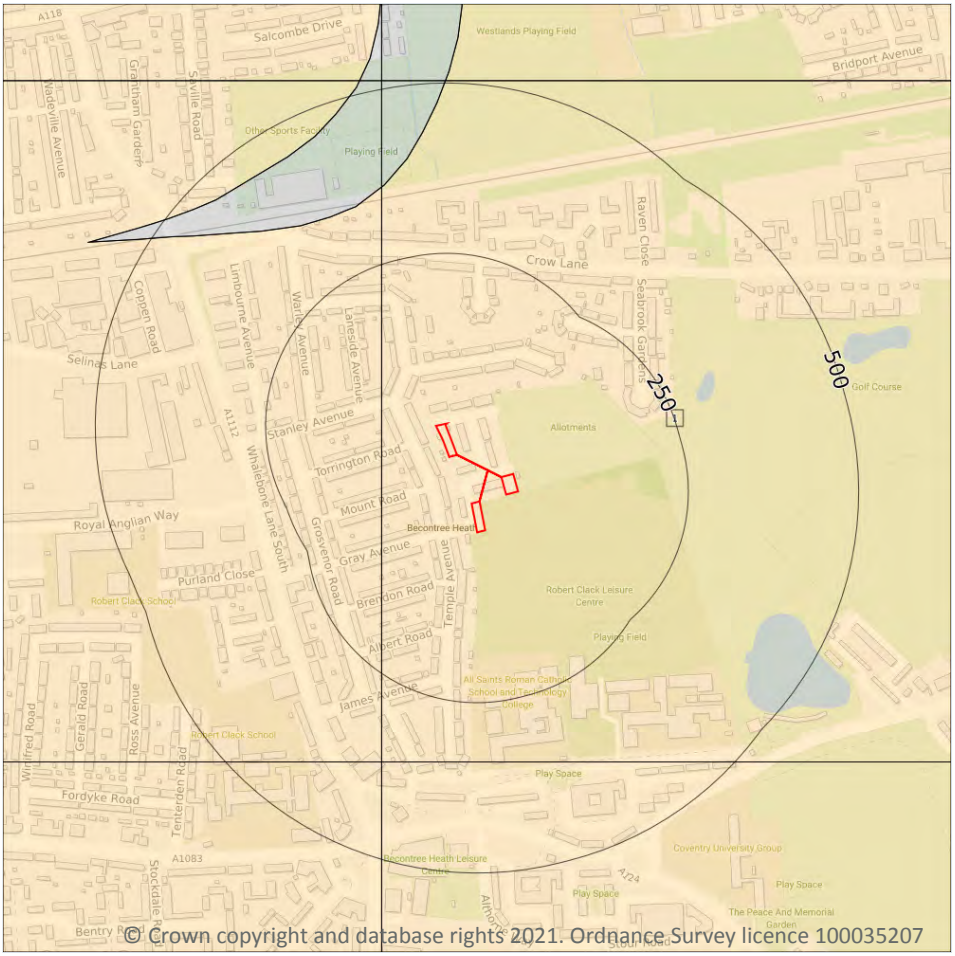
Aquifer status of groundwater held within bedrock geology.

Features are displayed on the Bedrock aquifer map on **page 38**

ID	Location	Designation	Description
1	**On site**	**Unproductive**	**These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow**

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Groundwater vulnerability



Site Outline

Search buffers in metres (m)

Superficial vulnerability

- Principal superficial aquifer, high vulnerability
- Secondary superficial aquifer, high vulnerability
- Principal superficial aquifer, medium vulnerability
- Secondary superficial aquifer, medium vulnerability
- Principal superficial aquifer, low vulnerability
- Secondary superficial aquifer, low vulnerability

Bedrock vulnerability

- Principal bedrock aquifer, high vulnerability
- Secondary bedrock aquifer, high vulnerability
- Principal bedrock aquifer, medium vulnerability
- Secondary bedrock aquifer, medium vulnerability
- Principal bedrock aquifer, low vulnerability
- Secondary bedrock aquifer, low vulnerability

Other information

- Unproductive aquifer
- Soluble rock risk
- Local information

5.3 Groundwater vulnerability

Records within 50m	1

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Features are displayed on the Groundwater vulnerability map on **page 39**

ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
1	On site	**Summary Classification: Secondary superficial aquifer - High Vulnerability Combined classification: Unproductive Bedrock Aquifer, Productive Superficial Aquifer**	**Leaching class: Intermediate Infiltration value: >70% Dilution value: <300mm/year**	**Vulnerability: High Aquifer type: Secondary Thickness: <3m Patchiness value: >90% Recharge potential: No Data**	**Vulnerability: Unproductive Aquifer type: Unproductive Flow mechanism: Mixed**

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

5.4 Groundwater vulnerability- soluble rock risk

Records on site	0

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

This data is sourced from the British Geological Survey and the Environment Agency.

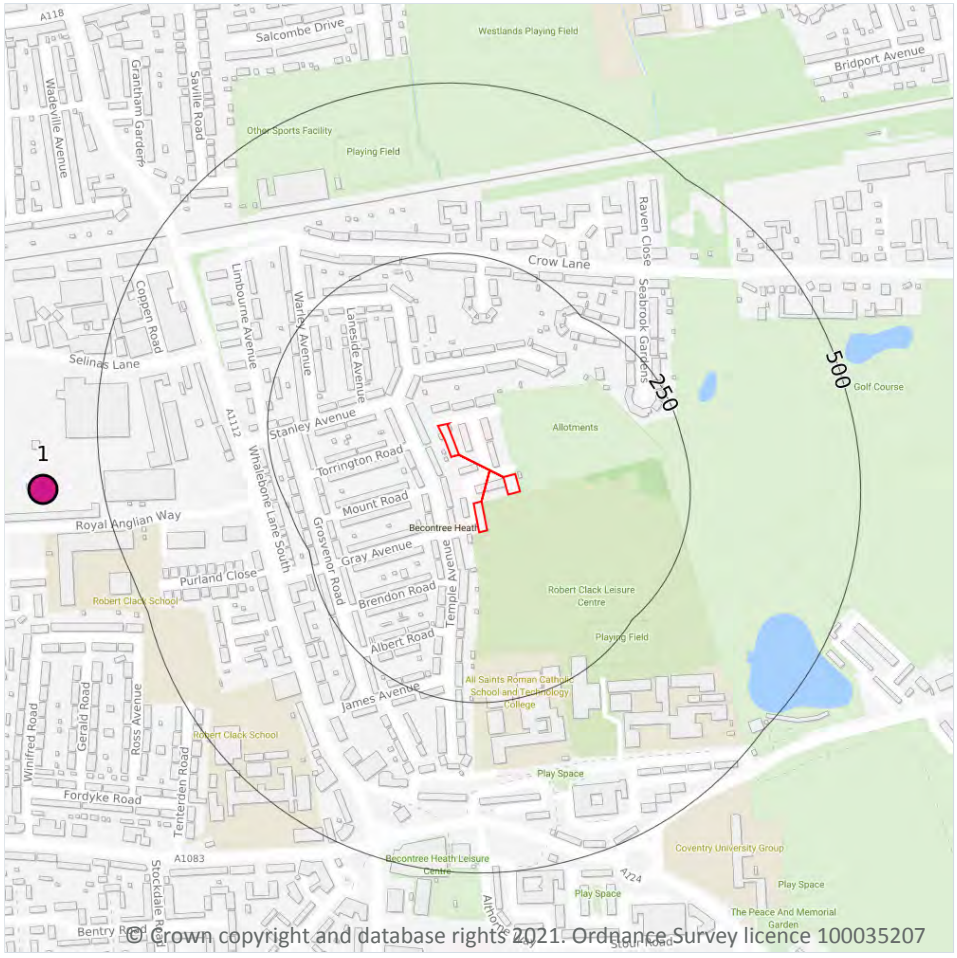
5.5 Groundwater vulnerability- local information

Records on site	0

This dataset identifies areas where additional local information affecting vulnerability is held by the Environment Agency. Further information can be obtained by contacting the Environment Agency local Area groundwater team through the Environment Agency National Customer Call Centre on 03798 506 506 or by email on enquiries@environment-agency.gov.uk.

This data is sourced from the British Geological Survey and the Environment Agency.

Abstractions and Source Protection Zones



Site Outline

Search buffers in metres (m)

- Source Protection Zone 1 — Inner catchment
- Source Protection Zone 2 — Outer catchment
- Source Protection Zone 3 — Total catchment
- Source Protection Zone 4 — Zone of Special Interest
- Source Protection Zone 1c — Inner catchment - confined aquifer
- Source Protection Zone 2c — Outer catchment - confined aquifer
- Source Protection Zone 3c — Total catchment - confined aquifer
- Drinking water abstraction licences
- Drinking water abstraction licences — Polygon features
- Drinking water abstraction licences — Linear features
- Groundwater abstraction licence (point)
- Groundwater abstraction licence (area)
- Groundwater abstraction licence (linear)
- Surface Water Abstractions (point)
- Surface Water Abstractions (area)
- Surface Water Abstractions (linear)

5.6 Groundwater abstractions

Records within 2000m	7

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 41**

ID	Location	Details	
1	587m W	Status: Historical Licence No: 08/37/54/0041 Details: Process water Direct Source: THAMES GROUNDWATER Point: SELINAS LANE, DAGENHAM - BOREHOLE (2) Data Type: Point Name: DAIRY CREST LTD Easting: 548500 Northing: 187400	Annual Volume (m^3): 291171 Max Daily Volume (m^3): 795.55 Original Application No: - Original Start Date: 14/05/1980 Expiry Date: - Issue No: 100 Version Start Date: 01/04/1989 Version End Date: -
-	686m W	Status: Historical Licence No: 08/37/54/0041 Details: Process Water Direct Source: THAMES GROUNDWATER Point: SELINAS LANE, DAGENHAM - BOREHOLE (1) Data Type: Point Name: Muller UK & Ireland Group LLP Easting: 548400 Northing: 187400	Annual Volume (m^3): 291171 Max Daily Volume (m^3): 795.55 Original Application No: - Original Start Date: 14/05/1980 Expiry Date: - Issue No: 103 Version Start Date: 07/03/2017 Version End Date: -
-	706m W	Status: Historical Licence No: 08/37/54/0041 Details: Process Water Direct Source: THAMES GROUNDWATER Point: DAIRY CREST, SELINAS LANE- BOREHOLE B Data Type: Point Name: Muller UK & Ireland Group LLP Easting: 548400 Northing: 187300	Annual Volume (m^3): 291171 Max Daily Volume (m^3): 795.55 Original Application No: - Original Start Date: 14/05/1980 Expiry Date: - Issue No: 103 Version Start Date: 07/03/2017 Version End Date: -
-	1103m N	Status: Historical Licence No: 08/37/55/0086 Details: General Farming & Domestic Direct Source: THAMES GROUNDWATER Point: CROWN FARM, ROMFORD - WELL Data Type: Point Name: J FOWLER & SONS Easting: 549390 Northing: 188560	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 30/09/1991 Expiry Date: - Issue No: 100 Version Start Date: 30/09/1991 Version End Date: -
-	1385m N	Status: Active Licence No: TH/037/0054/008 Details: Spray Irrigation - Direct Direct Source: THAMES GROUNDWATER Point: BOREHOLE - CONFINED CHALK - CHADWELL HEATH Data Type: Point Name: D W F Sports Limited Easting: 548620 Northing: 188800	Annual Volume (m^3): 45,000 Max Daily Volume (m^3): 288 Original Application No: - Original Start Date: 25/03/2011 Expiry Date: 31/03/2025 Issue No: 1 Version Start Date: 25/03/2011 Version End Date: -

ID	Location	Details	
-	1850m SW	Status: Historical Licence No: 08/37/54/0054 Details: Pollution Remediation Direct Source: THAMES GROUNDWATER Point: BECONTREE SERVICE STATION- POINT A Data Type: Point Name: TOTAL UK LIMITED Easting: 547430 Northing: 186630	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 01/12/2003 Expiry Date: 31/12/2005 Issue No: 1 Version Start Date: 01/12/2003 Version End Date: -
-	1927m N	Status: Historical Licence No: 08/37/55/0097 Details: Mineral Washing Direct Source: THAMES GROUNDWATER Point: BOREHOLE AT MARK WARREN FARM, ROMFORD Data Type: Point Name: BRETT AGGREGATES LIMITED Easting: 548860 Northing: 189410	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 24/10/2000 Expiry Date: 31/12/2005 Issue No: 1 Version Start Date: 24/10/2000 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m	**1**

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 41**

ID	Location	Details	
-	829m N	Status: Historical Licence No: 08/37/55/0027 Details: Spray Irrigation - Direct Direct Source: THAMES SURFACE WATER - NON TIDAL Point: CROWN FARM, CHADWELL HEATH - TRIB OF RIVER ROM Data Type: Line Name: J FOWLER & SONS Easting: 549500 Northing: 189000	Annual Volume (m^3): 8182.98 Max Daily Volume (m^3): 545.532 Original Application No: - Original Start Date: 23/11/1966 Expiry Date: - Issue No: 100 Version Start Date: 23/11/1966 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.8 Potable abstractions

Records within 2000m	0

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.9 Source Protection Zones

Records within 500m	0

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination.

This data is sourced from the Environment Agency and Natural Resources Wales.

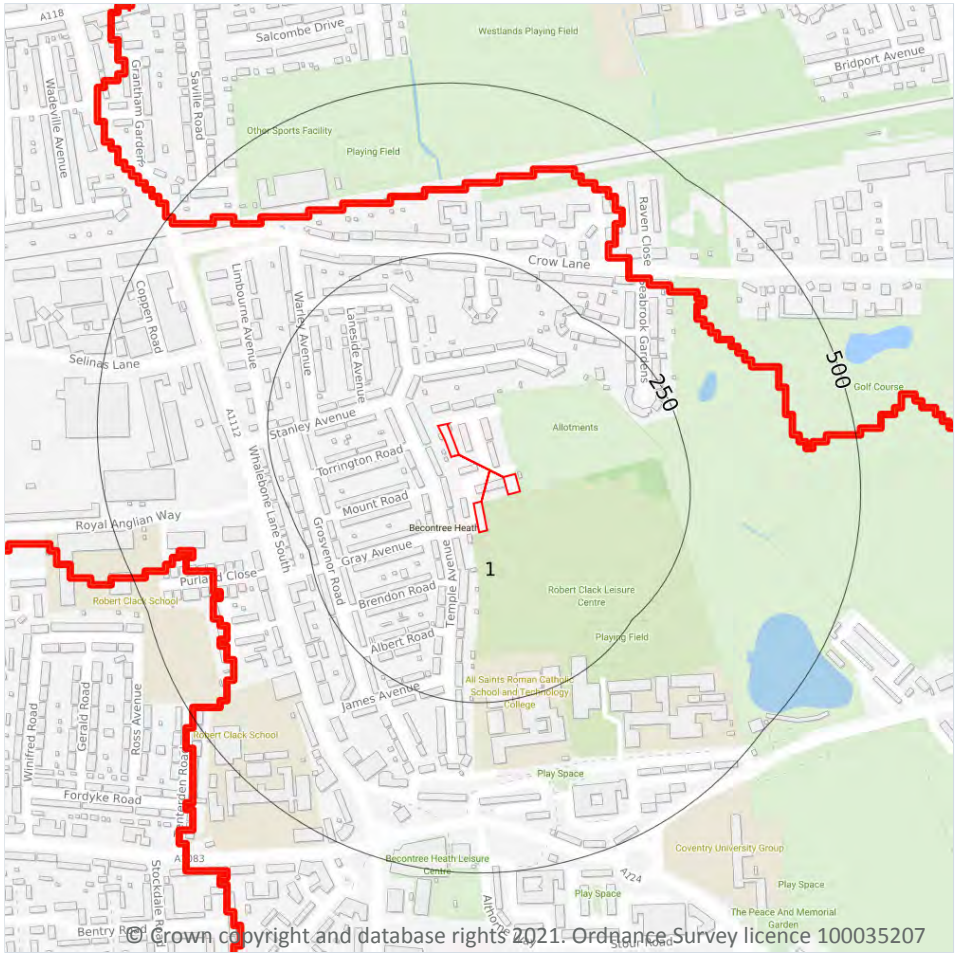
5.10 Source Protection Zones (confined aquifer)

Records within 500m	0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.

6 Hydrology



Site Outline

Search buffers in metres (m)

Water Network (OS MasterMap)

Surface water features (wider than 5m)

Surface water features (narrower than 5m)

WFD River, canal and surface water transfer water bodies

WFD Lake water bodies

WFD Transitional and coastal water bodies

WFD Surface water body catchments boundaries

WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m	0

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m	0

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.

This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site	1

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on **page 45**

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
1	**On site**	**River WB catchment**	**Beam and Ravensbourne**	**GB106037028100**	**Roding, Beam and Ingrebourne**	**Roding, Beam and Ingrebourne**

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified	1

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed.

Features are displayed on the Hydrology map on **page 45**

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
-	3047m SE	River	Beam and Ravensbourne	GB106037028100	Moderate	Good	Moderate	2016

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site	0

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

This data is sourced from the Environment Agency and Natural Resources Wales.

7 River and coastal flooding

7.1 Risk of Flooding from Rivers and Sea (RoFRaS)

Records within 50m	0

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance).

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m	0

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m	0

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.4 Areas Benefiting from Flood Defences

Records within 250m	0

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m	0

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.

River and coastal flooding - Flood Zones

7.6 Flood Zone 2

Records within 50m	0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

This data is sourced from the Environment Agency and Natural Resources Wales.

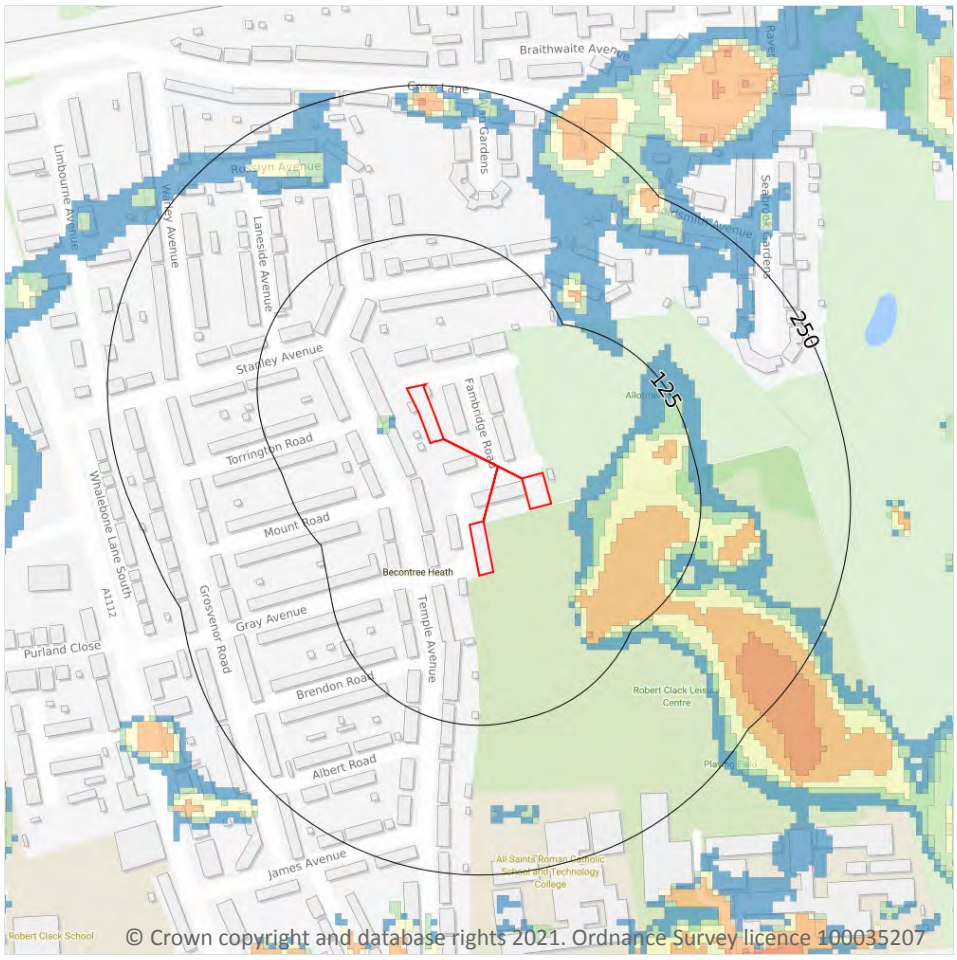
7.7 Flood Zone 3

Records within 50m	0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

8 Surface water flooding



Site Outline

Search buffers in metres (m)

1 in 1000 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 250 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 100 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 30 return period
- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

8.1 Surface water flooding

Highest risk on site	**Negligible**
Highest risk within 50m	**1 in 100 year, 0.1m - 0.3m**

Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

Features are displayed on the Surface water flooding map on **page 51**

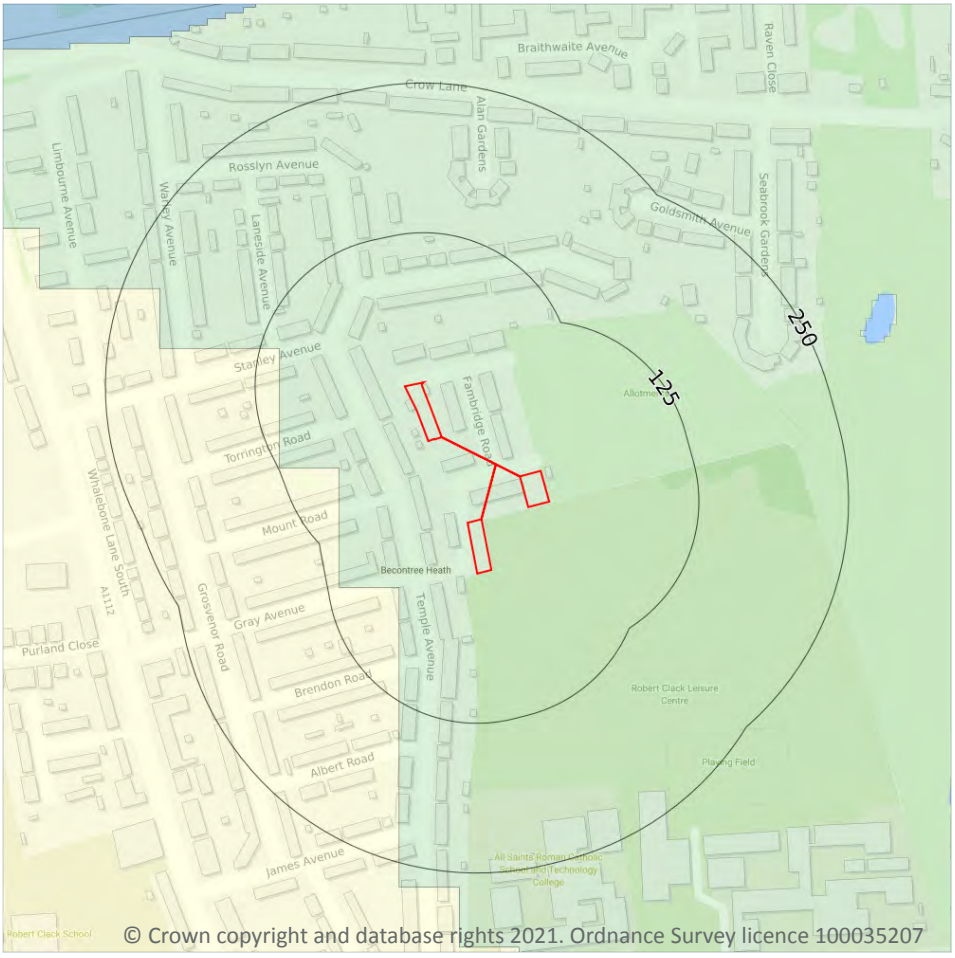
The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site.

The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Negligible
1 in 250 year	Negligible
1 in 100 year	Negligible
1 in 30 year	Negligible

This data is sourced from Ambiental Risk Analytics.

9 Groundwater flooding



Site Outline

Search buffers in metres (m)

- High
- Moderate - High
- Moderate
- Low
- Negligible

9.1 Groundwater flooding

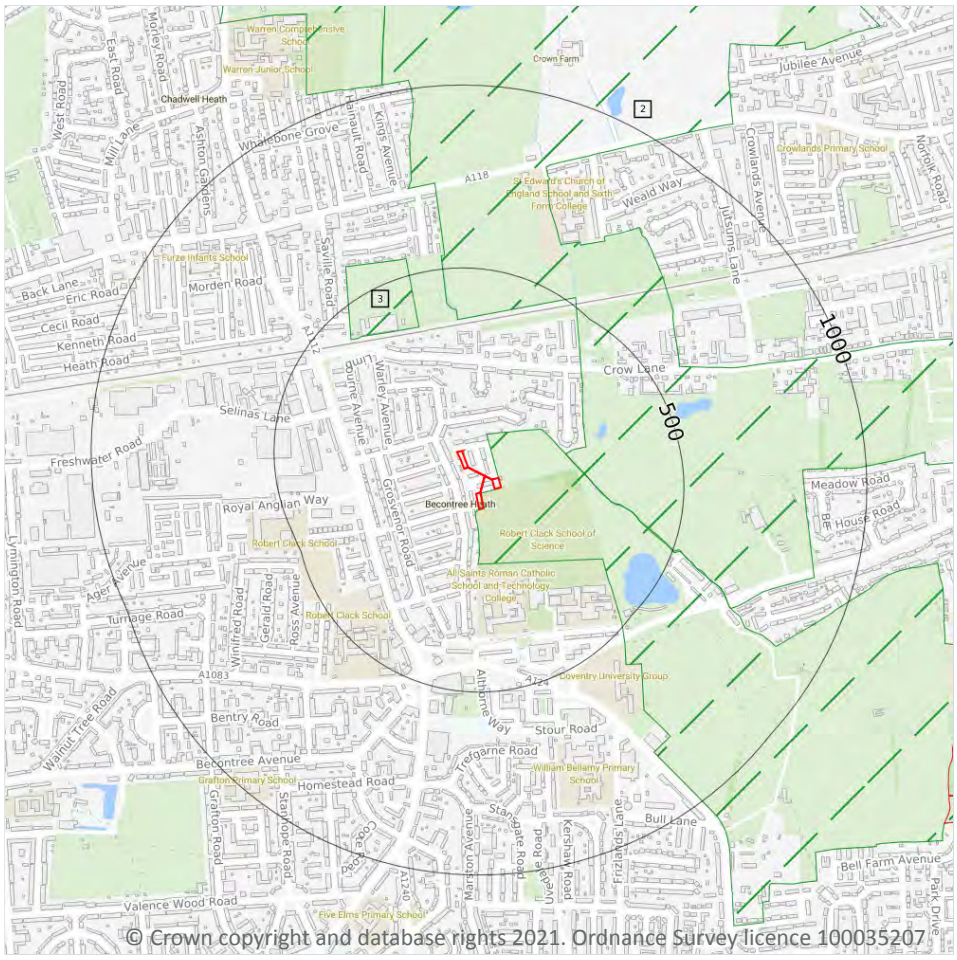
Highest risk on site	**Low**
Highest risk within 50m	**Low**

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on **page 53**

This data is sourced from Ambiental Risk Analytics.

10 Environmental designations



10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m	0

Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m	0

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. They cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. These sites cover a broad definition of wetland; marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, and even some marine areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.3 Special Areas of Conservation (SAC)

Records within 2000m	0

Areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.4 Special Protection Areas (SPA)

Records within 2000m	0

Sites classified by the UK Government under the EC Birds Directive, SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.5 National Nature Reserves (NNR)

Records within 2000m	0

Sites containing examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats, provide special opportunities for scientific study or to provide public recreation compatible with natural heritage interests.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.6 Local Nature Reserves (LNR)

Records within 2000m	3

Sites managed for nature conservation, and to provide opportunities for research and education, or simply enjoying and having contact with nature. They are declared by local authorities under the National Parks and Access to the Countryside Act 1949 after consultation with the relevant statutory nature conservation agency.

Features are displayed on the Environmental designations map on **page 54**

ID	Location	Name	Data source
5	1423m SE	East Brookend Country Park	Natural England
-	1951m SE	East Brookend Country Park	Natural England
-	1996m SE	East Brookend Country Park	Natural England

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.7 Designated Ancient Woodland

Records within 2000m	0

Ancient woodlands are classified as areas which have been wooded continuously since at least 1600 AD. This includes semi-natural woodland and plantations on ancient woodland sites. 'Wooded continuously' does not mean there is or has previously been continuous tree cover across the whole site, and not all trees within the woodland have to be old.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.8 Biosphere Reserves

Records within 2000m	0

Biosphere Reserves are internationally recognised by UNESCO as sites of excellence to balance conservation and socioeconomic development between nature and people. They are recognised under the Man and the Biosphere (MAB) Programme with the aim of promoting sustainable development founded on the work of the local community.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.9 Forest Parks

Records within 2000m	0

These are areas managed by the Forestry Commission designated on the basis of recreational, conservation or scenic interest.

This data is sourced from the Forestry Commission.

10.10 Marine Conservation Zones

Records within 2000m	0

A type of marine nature reserve in UK waters established under the Marine and Coastal Access Act (2009). They are designated with the aim to protect nationally important, rare or threatened habitats and species.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.11 Green Belt

Records within 2000m	4

Areas designated to prevent urban sprawl by keeping land permanently open.

Features are displayed on the Environmental designations map on **page 54**

ID	Location	Name	Local Authority name
1	**On site**	**London**	**Barking and Dagenham**
2	195m E	London	Havering
3	357m N	London	Barking and Dagenham
4	1024m N	London	Barking and Dagenham

This data is sourced from the Ministry of Housing, Communities and Local Government.

10.12 Proposed Ramsar sites

Records within 2000m	0

Ramsar sites are areas listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) 1971. The sites here supplied have a status of 'Proposed' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m	0

Special Areas of Conservation are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive. Those sites supplied here are those with a status of 'Possible' having been identified for potential adoption under the framework.

This data is sourced from Natural England and Natural Resources Wales.

10.14 Potential Special Protection Areas (pSPA)

Records within 2000m	0

Special Protection Areas (SPAs) are areas designated (or 'classified') under the European Union Wild Birds Directive for the protection of nationally and internationally important populations of wild birds. Those sites supplied here are those with a status of 'Potential' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.15 Nitrate Sensitive Areas

Records within 2000m	0

Areas where nitrate concentrations in drinking water sources exceeded or was at risk of exceeding the limit of 50 mg/l set by the 1980 EC Drinking Water Directive. Voluntary agricultural measures as a means of reducing the levels of nitrate were introduced by DEFRA as MAFF, with payments being made to farmers who complied. The scheme was started as a pilot in 1990 in ten areas, later implemented within 32 areas. The scheme was closed to further new entrants in 1998, although existing agreements continued for their full term. All Nitrate Sensitive Areas fell within the areas designated as Nitrate Vulnerable Zones (NVZs) in 1996 under the EC Nitrate Directive (91/676/EEC).

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

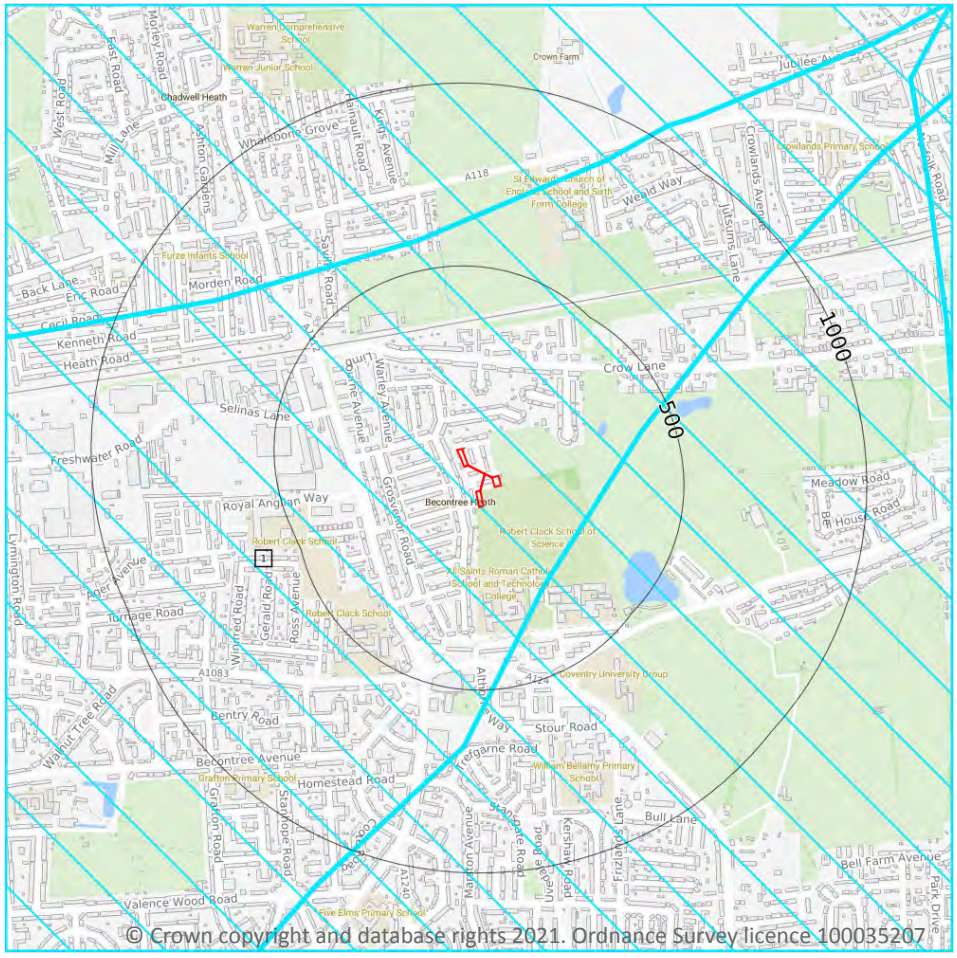
Records within 2000m	1

Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

Location	Name	Type	NVZ ID	Status
341m N	Rom / Beam (Including Bourne Brook, from Watton's Green to confluence with Ravensbourne) NVZ	Surface Water	S439	Existing

This data is sourced from Natural England and Natural Resources Wales.

SSSI Impact Zones and Units



Site Outline

Search buffers in metres (m)

SSSI Impact Risk Zones

SSSI Units

- Not recorded
- Favourable
- Unfavourable - Recovering
- Unfavourable - No change
- Unfavourable - Declining
- Partially destroyed
- Destroyed

10.17 SSSI Impact Risk Zones

Records on site	1

Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

Features are displayed on the SSSI Impact Zones and Units map on **page 60**

ID	Location	Type of developments requiring consultation
1	**On site**	**Infrastructure - Airports, helipads and other aviation proposals.** **Air pollution - Livestock & poultry units with floorspace > 500m², slurry lagoons > 4000m².** **Combustion - General combustion processes >50MW energy input. Incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion** **Discharges - Any discharge of water or liquid waste of more than 20m³/day to ground (ie to seep away) or to surface water, such as a beck or stream (NB This does not include discharges to mains sewer which are unlikely to pose a risk at this location)**

This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m	**0**

Divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment, however, the size of units varies greatly depending on the types of management and the conservation interest.

This data is sourced from Natural England and Natural Resources Wales.

11 Visual and cultural designations

11.1 World Heritage Sites

Records within 250m	0

Sites designated for their globally important cultural or natural interest requiring appropriate management and protection measures. World Heritage Sites are designated to meet the UK's commitments under the World Heritage Convention.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.2 Area of Outstanding Natural Beauty

Records within 250m	0

Areas of Outstanding Natural Beauty (AONB) are conservation areas, chosen because they represent 18% of the finest countryside. Each AONB has been designated for special attention because of the quality of their flora, fauna, historical and cultural associations, and/or scenic views. The National Parks and Access to the Countryside Act of 1949 created AONBs and the Countryside and Rights of Way Act, 2000 added further regulation and protection. There are likely to be restrictions to some developments within these areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

11.3 National Parks

Records within 250m	0

In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well-being of those living within them. In Scotland National Parks have the additional purpose of promoting the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities. The National Parks and Access to the Countryside Act 1949 established the National Park designation in England and Wales, and The National Parks (Scotland) Act 2000 in Scotland.

This data is sourced from Natural England, Natural Resources Wales and the Scottish Government.

11.4 Listed Buildings

Records within 250m	0

Buildings listed for their special architectural or historical interest. Building control in the form of 'listed building consent' is required in order to make any changes to that building which might affect its special interest. Listed buildings are graded to indicate their relative importance, however building controls apply to all buildings equally, irrespective of their grade, and apply to the interior and exterior of the building in its entirety, together with any curtilage structures.

This data is sourced from English Heritage, Cadw and Historic Environment Scotland.

11.5 Conservation Areas

Records within 250m	0

Local planning authorities are obliged to designate as conservation areas any parts of their own area that are of special architectural or historic interest, the character and appearance of which it is desirable to preserve or enhance. Designation of a conservation area gives broader protection than the listing of individual buildings. All the features within the area, listed or otherwise, are recognised as part of its character. Conservation area designation is the means of recognising the importance of all factors and of ensuring that planning decisions address the quality of the landscape in its broadest sense.

This data is sourced from English Heritage, Cadw and Historic Environment Scotland.

11.6 Scheduled Ancient Monuments

Records within 250m	0

A scheduled monument is an historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. The Schedule of Monuments has c.20,000 entries and includes sites such as Roman remains, burial mounds, castles, bridges, earthworks, the remains of deserted villages and industrial sites. Monuments are not graded, but all are, by definition, considered to be of national importance.

This data is sourced from English Heritage, Cadw and Historic Environment Scotland.

11.7 Registered Parks and Gardens

Records within 250m	0

Parks and gardens assessed to be of particular interest and of special historic interest. The emphasis being on 'designed' landscapes, rather than on planting or botanical importance. Registration is a 'material consideration' in the planning process, meaning that planning authorities must consider the impact of any proposed development on the special character of the landscape.

This data is sourced from English Heritage, Cadw and Historic Environment Scotland.

12 Agricultural designations



Site Outline

Search buffers in metres (m)

- Grade 1 - excellent quality
- Grade 2 - very good quality
- Grade 3 - good to moderate quality
- Grade 3a - good quality
- Grade 3b - moderate quality
- Grade 4 - poor quality
- Grade 5 - very poor quality
- Non-agricultural land
- Urban land
- Exclusion land
- Tree felling licences
- Open Access land

12.1 Agricultural Land Classification

Records within 250m	2

Classification of the quality of agricultural land taking into consideration multiple factors including climate, physical geography and soil properties. It should be noted that the categories for the grading of agricultural land are not consistent across England, Wales and Scotland.

Features are displayed on the Agricultural designations map on **page 64**

ID	Location	Classification	Description
1	**On site**	**Urban**	**-**
2	90m E	Non Agricultural	-

This data is sourced from Natural England.

12.2 Open Access Land

Records within 250m	0

The Countryside and Rights of Way Act 2000 (CROW Act) gives a public right of access to land without having to use paths. Access land includes mountains, moors, heaths and downs that are privately owned. It also includes common land registered with the local council and some land around the England Coast Path. Generally permitted activities on access land are walking, running, watching wildlife and climbing.

This data is sourced from Natural England and Natural Resources Wales.

12.3 Tree Felling Licences

Records within 250m	0

Felling Licence Application (FLA) areas approved by Forestry Commission England. Anyone wishing to fell trees must ensure that a licence or permission under a grant scheme has been issued by the Forestry Commission before any felling is carried out or that one of the exceptions apply.

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m	0

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment.

This data is sourced from Natural England.

12.5 Countryside Stewardship Schemes

Records within 250m	0

Countryside Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. Main objectives are to improve the farmed environment for wildlife and to reduce diffuse water pollution.

This data is sourced from Natural England.

13 Habitat designations

13.1 Priority Habitat Inventory

Records within 250m	0

Habitats of principal importance as named under Natural Environment and Rural Communities Act (2006) Section 41.

This data is sourced from Natural England.

13.2 Habitat Networks

Records within 250m	0

Habitat networks for 18 priority habitat networks (based primarily, but not exclusively, on the priority habitat inventory) and areas suitable for the expansion of networks through restoration and habitat creation.

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m	0

Sites verified as Open Mosaic Habitat. Mosaic habitats are brownfield sites that are identified under the UK Biodiversity Action Plan as a priority habitat due to the habitat variation within a single site, supporting an array of invertebrates.

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

Records within 250m	0

Limestone pavements are outcrops of limestone where the surface has been worn away by natural means over millennia. These rocks have the appearance of paving blocks, hence their name. Not only do they have geological interest, they also provide valuable habitats for wildlife. These habitats are threatened due to their removal for use in gardens and water features. Many limestone pavements have been designated as SSSIs which affords them some protection. In addition, Section 34 of the Wildlife and Countryside Act 1981 gave them additional protection via the creation of Limestone Pavement Orders, which made it a criminal offence to remove any part of the outcrop. The associated Limestone Pavement Priority Habitat is part of the UK Biodiversity Action Plan priority habitat in England.

This data is sourced from Natural England.

14 Geology 1:10,000 scale - Availability



14.1 10k Availability

Records within 500m	1

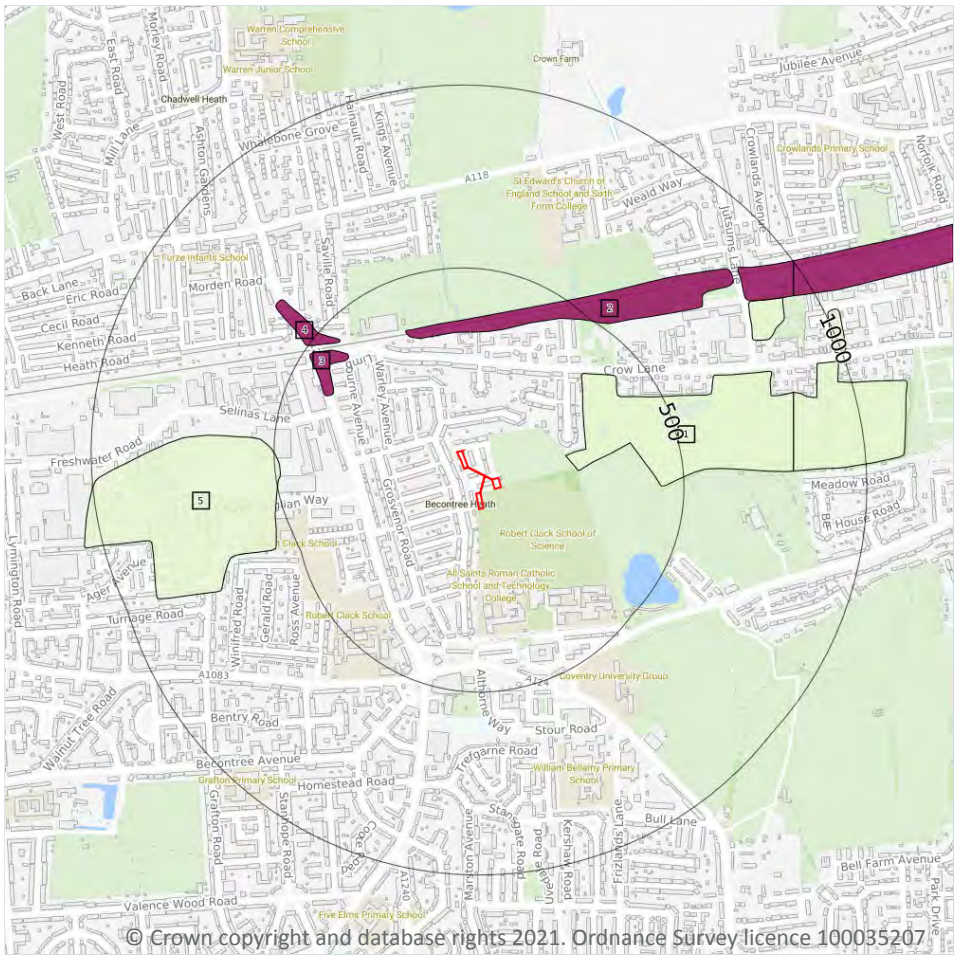
An indication on the coverage of 1:10,000 scale geology data for the site, the most detailed dataset provided by the British Geological Survey. Either 'Full', 'Partial' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:10,000 scale - Availability map on **page 67**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	**On site**	**Full**	**Full**	**Full**	**No coverage**	**TQ48NE**

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Artificial and made ground



14.2 Artificial and made ground (10k)

Records within 500m	5

Details of made, worked, infilled, disturbed and landscaped ground at 1:10,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

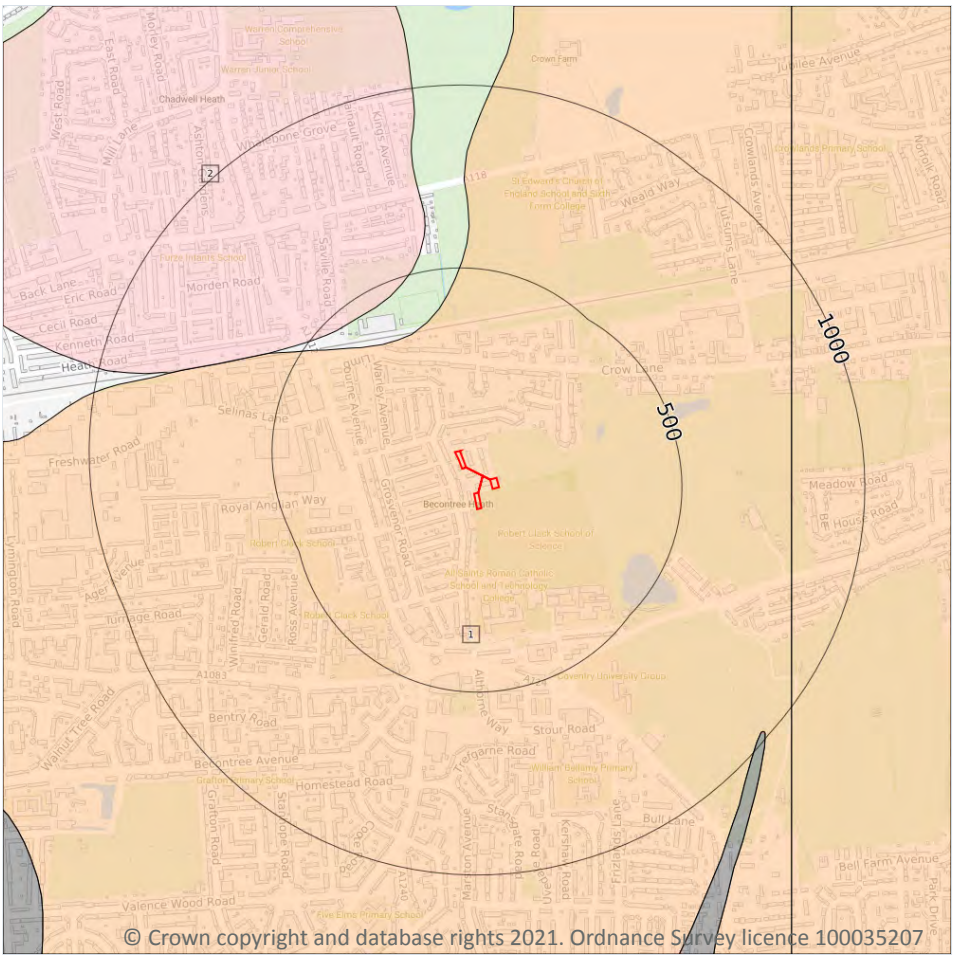
Features are displayed on the Geology 1:10,000 scale - Artificial and made ground map on **page 68**

ID	Location	LEX Code	Description	Rock description
1	194m E	WMGR-UKNOWN	Infilled Ground	Unknown/unclassified Entry
2	323m N	MGR-UKNOWN	Made Ground (Undivided)	Unknown/unclassified Entry
3	374m NW	MGR-UKNOWN	Made Ground (Undivided)	Unknown/unclassified Entry
4	440m NW	MGR-UKNOWN	Made Ground (Undivided)	Unknown/unclassified Entry

ID	Location	LEX Code	Description	Rock description
5	486m W	WMGR-UKNOWN	Infilled Ground	Unknown/unclassified Entry

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (10k)

Superficial geology (10k)
Please see table for more details.

14.3 Superficial geology (10k)

Records within 500m	2

Superficial geological deposits at 1:10,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:10,000 scale - Superficial map on **page 70**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**HAGR-XSV**	**Hackney Gravel Member - Sand And Gravel**	**Sand And Gravel**
2	450m NW	BHT-XSV	Boyn Hill Gravel Member - Sand And Gravel	Sand And Gravel

This data is sourced from the British Geological Survey.

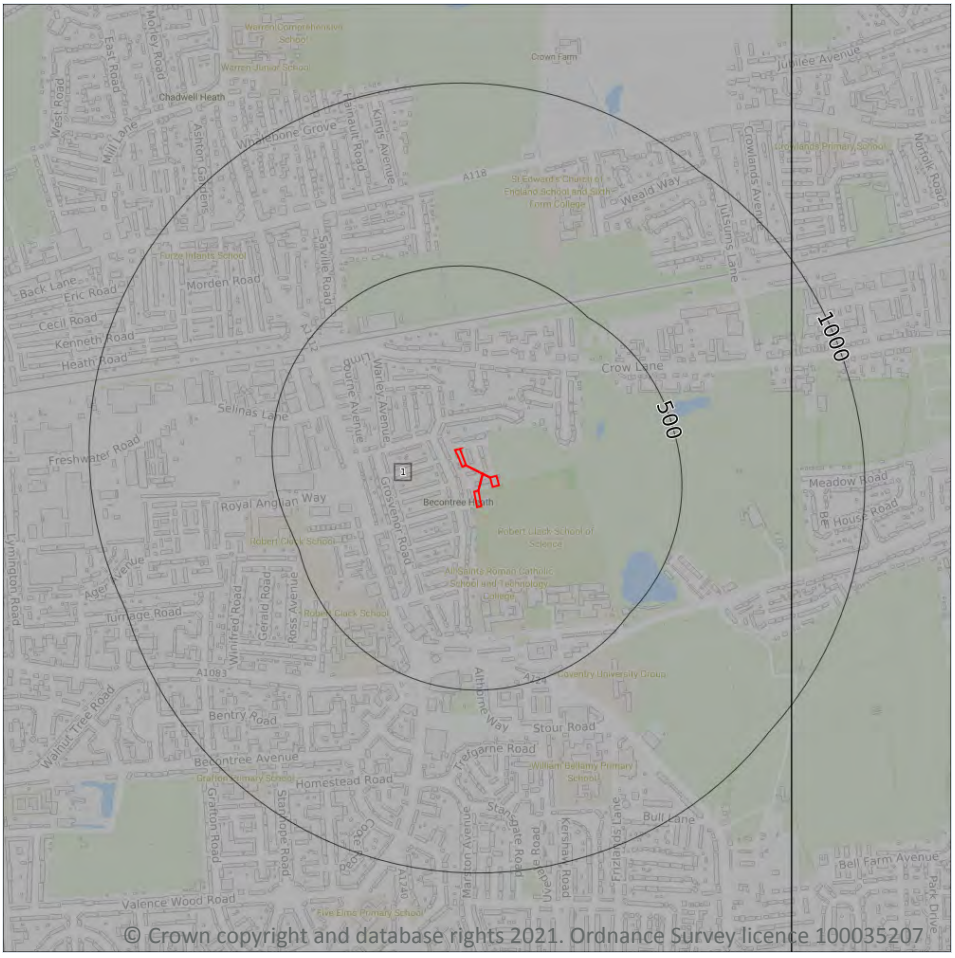
14.4 Landslip (10k)

Records within 500m	0

Mass movement deposits on BGS geological maps at 1:10,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (10k)

Bedrock geology (10k)
Please see table for more details.

14.5 Bedrock geology (10k)

Records within 500m	1

Bedrock geology at 1:10,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:10,000 scale - Bedrock map on **page 72**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**LC-CLAY**	**London Clay Formation - Clay**	**Eocene Epoch**

This data is sourced from the British Geological Survey.

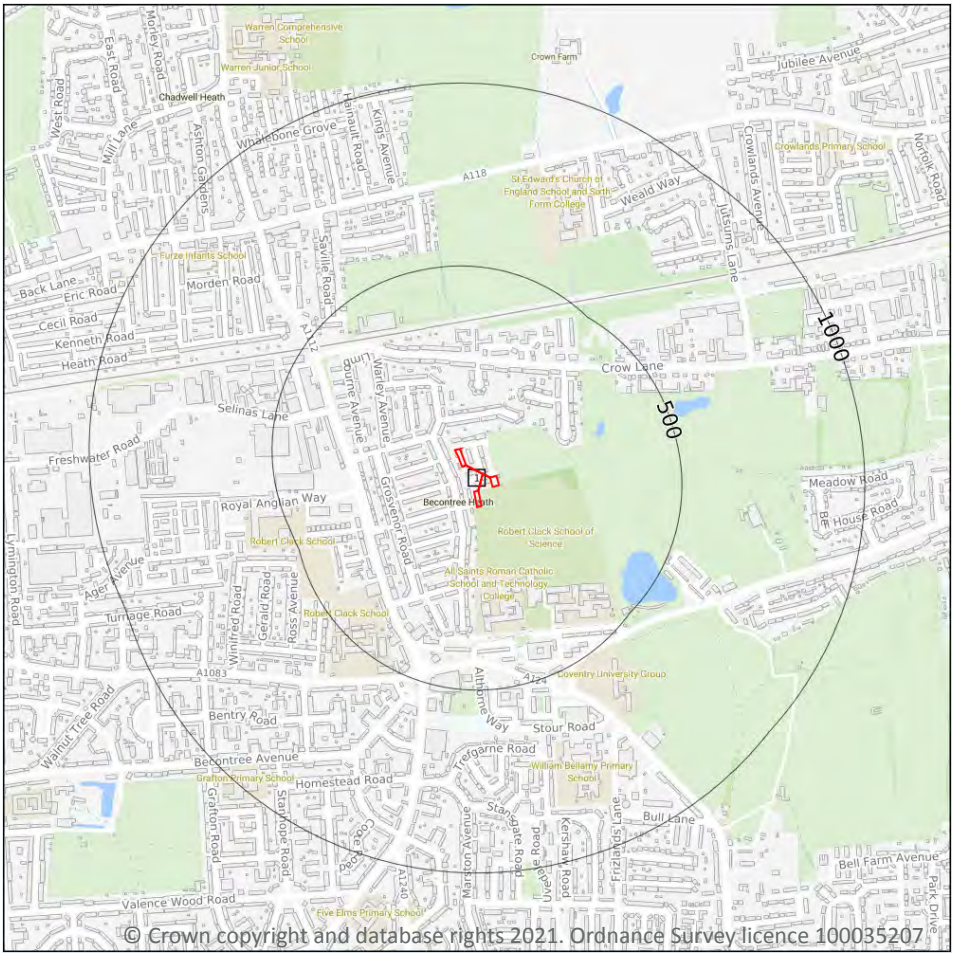
14.6 Bedrock faults and other linear features (10k)

Records within 500m	0

Linear features at the ground or bedrock surface at 1:10,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

15 Geology 1:50,000 scale - Availability



15.1 50k Availability

Records within 500m	1

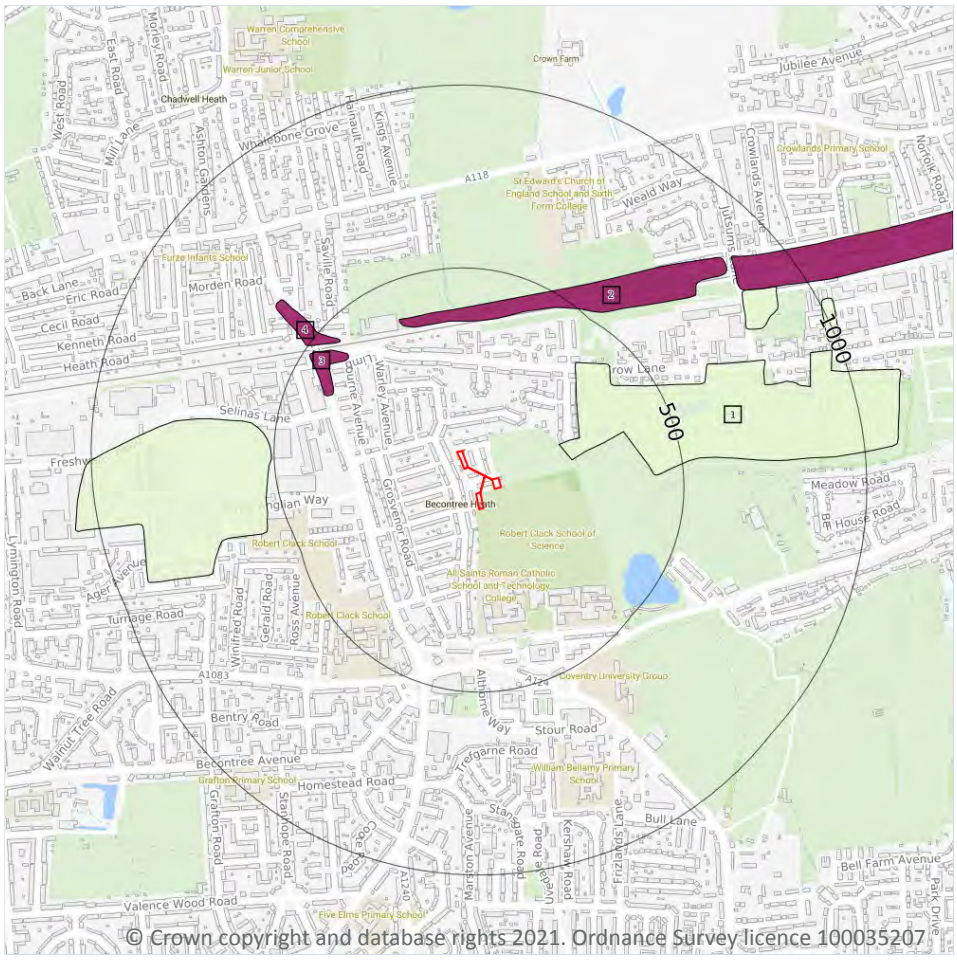
An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:50,000 scale - Availability map on **page 74**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	**On site**	**Full**	**Full**	**Full**	**Full**	**EW257_romford_v4**

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Artificial and made ground



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15.2 Artificial and made ground (50k)

Records within 500m	4

Details of made, worked, infilled, disturbed and landscaped ground at 1:50,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:50,000 scale - Artificial and made ground map on **page 75**

ID	Location	LEX Code	Description	Rock description
1	189m NE	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
2	354m N	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
3	375m NW	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
4	440m NW	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

This data is sourced from the British Geological Survey.

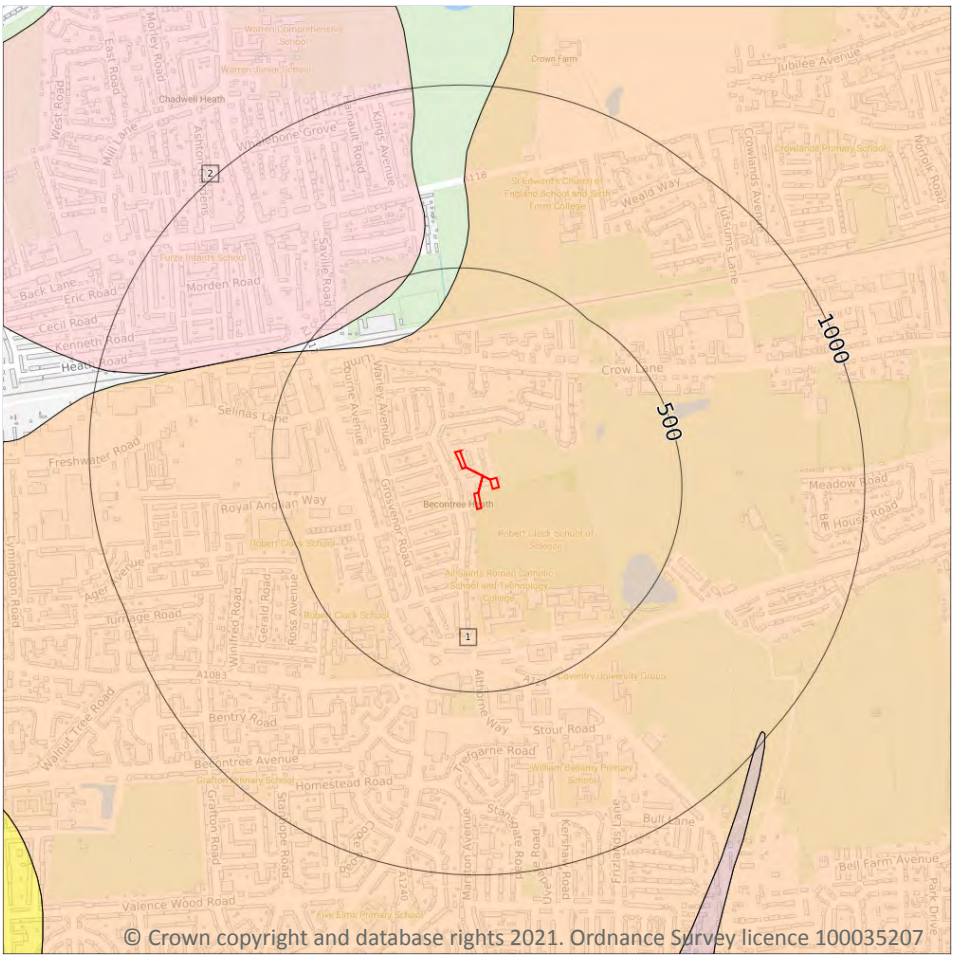
15.3 Artificial ground permeability (50k)

Records within 50m	0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any artificial deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (50k)

Superficial geology (50k)
Please see table for more details.

15.4 Superficial geology (50k)

Records within 500m **2**

Superficial geological deposits at 1:50,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:50,000 scale - Superficial map on **page 77**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**HAGR-XSV**	**HACKNEY GRAVEL MEMBER**	**SAND AND GRAVEL**
2	451m NW	BHT-XSV	BOYN HILL GRAVEL MEMBER	SAND AND GRAVEL

This data is sourced from the British Geological Survey.

15.5 Superficial permeability (50k)

Records within 50m	1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	**Intergranular**	**Very High**	**High**

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m	0

Mass movement deposits on BGS geological maps at 1:50,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

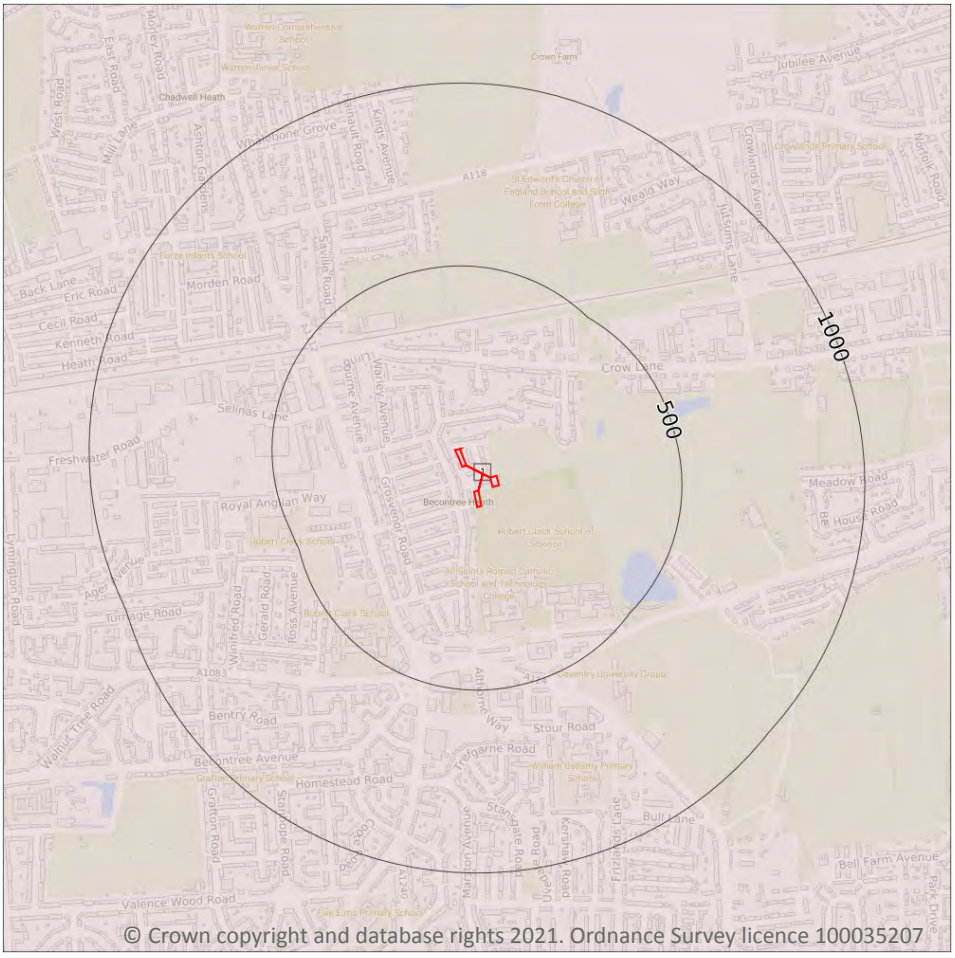
15.7 Landslip permeability (50k)

Records within 50m	0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any landslip deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (50k)

Bedrock geology (50k)
Please see table for more details.

15.8 Bedrock geology (50k)

Records within 500m	1

Bedrock geology at 1:50,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:50,000 scale - Bedrock map on **page 79**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**LC-XCZS**	**LONDON CLAY FORMATION - CLAY, SILT AND SAND**	**YPRESIAN**

This data is sourced from the British Geological Survey.

15.9 Bedrock permeability (50k)

Records within 50m	1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of bedrock (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	**Mixed**	**Moderate**	**Very Low**

This data is sourced from the British Geological Survey.

15.10 Bedrock faults and other linear features (50k)

Records within 500m	0

Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

16 Boreholes

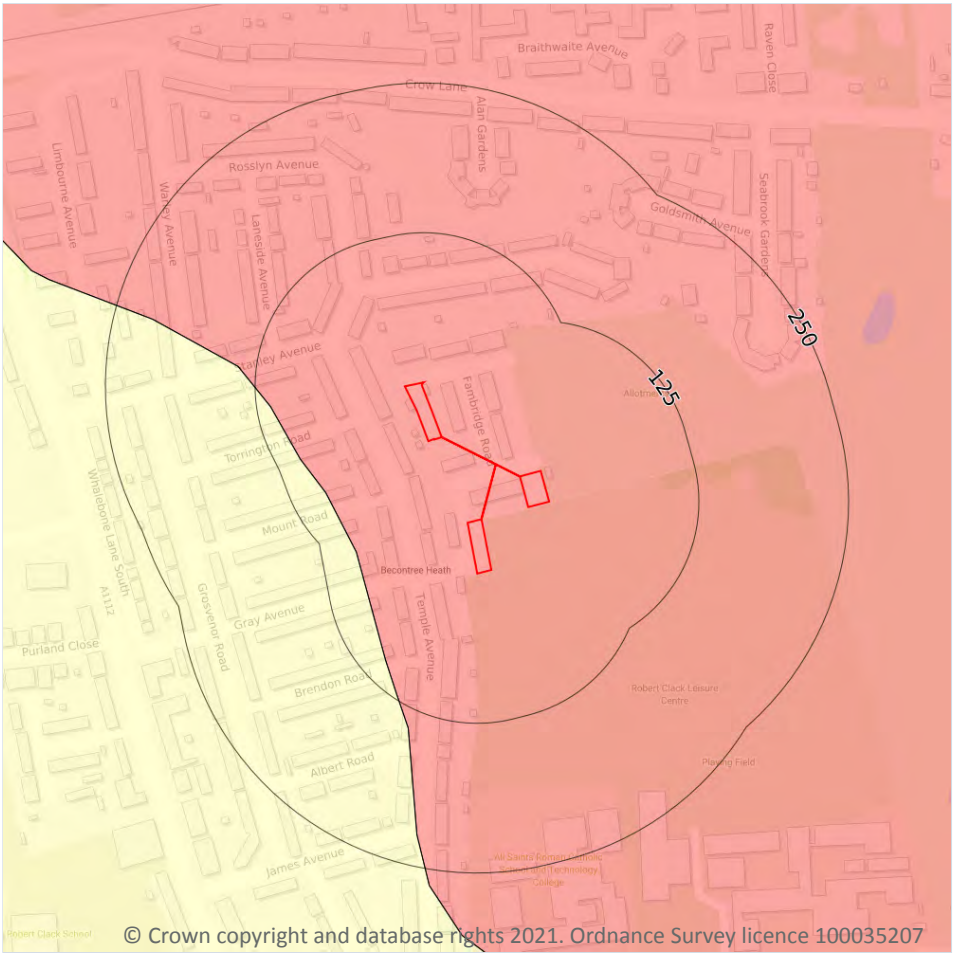
16.1 BGS Boreholes

Records within 250m	0

The Single Onshore Boreholes Index (SOBI); an index of over one million records of boreholes, shafts and wells from all forms of drilling and site investigation work held by the British Geological Survey. Covering onshore and nearshore boreholes dating back to at least 1790 and ranging from one to several thousand metres deep.

This data is sourced from the British Geological Survey.

17 Natural ground subsidence - Shrink swell clays



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.1 Shrink swell clays

Records within 50m	1

The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and local drainage).

Features are displayed on the Natural ground subsidence - Shrink swell clays map on **page 82**

Location	Hazard rating	Details
On site	**Moderate**	**Ground conditions predominantly high plasticity.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Running sands



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.2 Running sands

Records within 50m	1

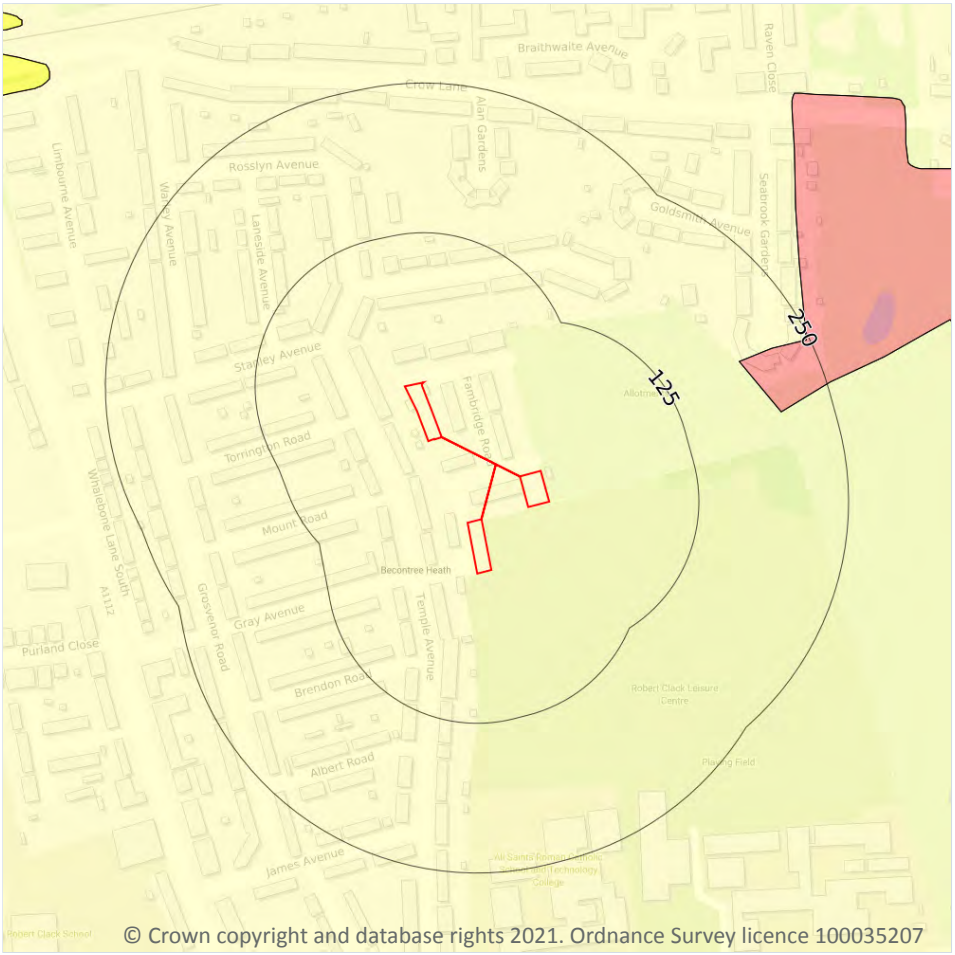
The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

Features are displayed on the Natural ground subsidence - Running sands map on **page 83**

Location	Hazard rating	Details
On site	**Very low**	**Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Compressible deposits



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.3 Compressible deposits

Records within 50m	1

The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

Features are displayed on the Natural ground subsidence - Compressible deposits map on **page 84**

Location	Hazard rating	Details
On site	**Negligible**	**Compressible strata are not thought to occur.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Collapsible deposits



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.4 Collapsible deposits

Records within 50m	1

The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

Features are displayed on the Natural ground subsidence - Collapsible deposits map on **page 85**

Location	Hazard rating	Details
On site	**Very low**	**Deposits with potential to collapse when loaded and saturated are unlikely to be present.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Landslides



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.5 Landslides

Records within 50m	1

The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

Features are displayed on the Natural ground subsidence - Landslides map on **page 86**

Location	Hazard rating	Details
On site	**Very low**	**Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Ground dissolution of soluble rocks



Site Outline

Search buffers in metres (m)

- No data
- Negligible
- Very low
- Low
- Moderate
- High

17.6 Ground dissolution of soluble rocks

Records within 50m	1

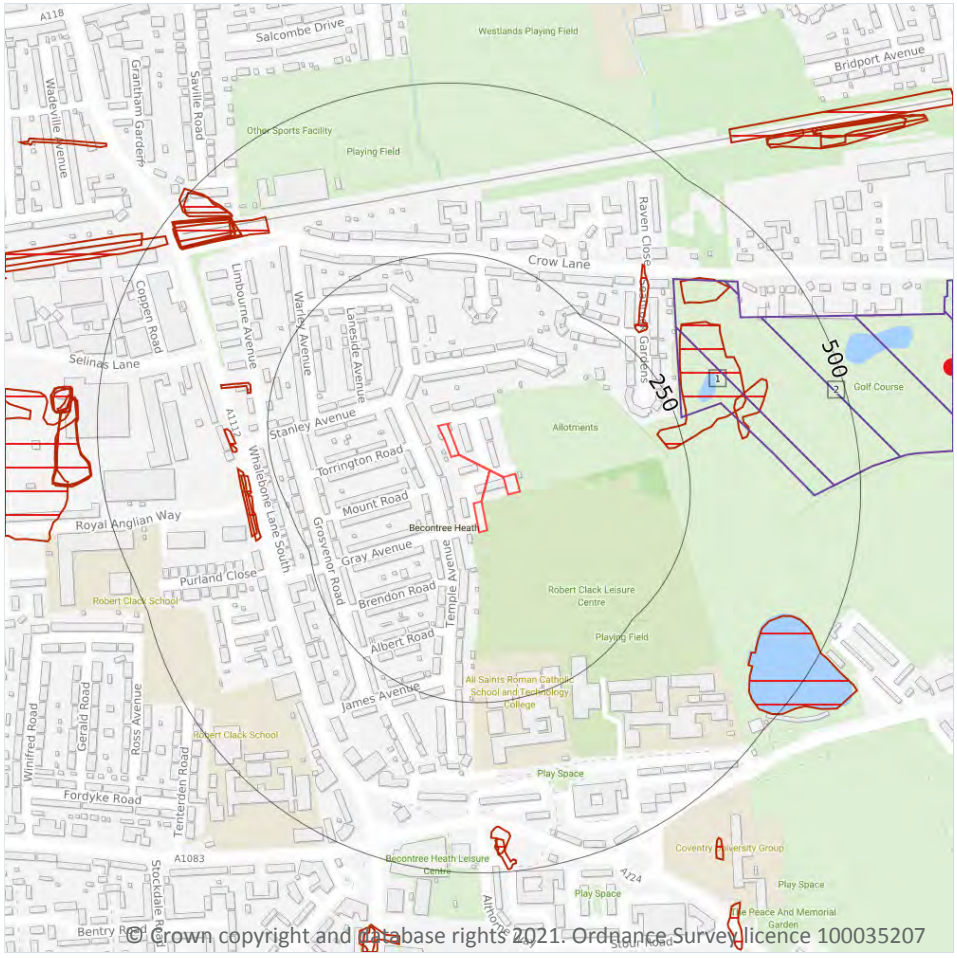
The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on **page 87**

Location	Hazard rating	Details
On site	**Negligible**	**Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.**

This data is sourced from the British Geological Survey.

18 Mining, ground workings and natural cavities



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- Site Outline

Search buffers in metres (m)

- Natural cavities (Area)
- Natural cavities (Point)
- BritPits
- Surface ground workings
- Underground workings
- Historical Mineral Planning Areas
- Mining Cavities

Non Coal Mining

- Sporadic underground mining of restricted extent possible
- Localised small scale underground mining possible
- Small scale mining possible
- Underground mining known or likely within or in close proximity
- Underground mining known within or in very close proximity

18.1 Natural cavities

Records within 500m	0

Industry recognised national database of natural cavities. Sinkholes and caves are formed by the dissolution of soluble rock, such as chalk and limestone, gulls and fissures by cambering. Ground instability can result from movement of loose material contained within these cavities, often triggered by water.

This data is sourced from Peter Brett Associates (PBA).

18.2 BritPits

Records within 500m	0

BritPits (an abbreviation of British Pits) is a database maintained by the British Geological Survey of currently active and closed surface and underground mineral workings. Details of major mineral handling sites, such as wharfs and rail depots are also held in the database.

This data is sourced from the British Geological Survey.

18.3 Surface ground workings

Records within 250m	1

Historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled.

Features are displayed on the Mining, ground workings and natural cavities map on **page 88**

ID	Location	Land Use	Year of mapping	Mapping scale
1	216m E	Water Body	1968	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

18.4 Underground workings

Records within 1000m	0

Historical land uses identified from Ordnance Survey mapping that indicate the presence of underground workings e.g. mine shafts.

This is data is sourced from Ordnance Survey/Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m	1

Boundaries of mineral planning permissions for England and Wales. This data was collated between the 1940s (and retrospectively to the 1930s) and the mid 1980s. The data includes permitted, withdrawn and refused permissions.

Features are displayed on the Mining, ground workings and natural cavities map on **page 88**

ID	Location	Site Name	Mineral	Type	Planning Status	Planning Status Date
2	258m E	Rush Green	Sand and gravel	Surface mineral working	Valid	8/1/60

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m	0

The potential for historical non-coal mining to have affected an area. The assessment is drawn from expert knowledge and literature in addition to the digital geological map of Britain. Mineral commodities may be divided into seven general categories - vein minerals, chalk, oil shale, building stone, bedded ores, evaporites and 'other' commodities (including ball clay, jet, black marble, graphite and chert).

This data is sourced from the British Geological Survey.

18.7 Mining cavities

Records within 1000m	0

Industry recognised national database of mining cavities. Degraded mines may result in hazardous subsidence (crown holes). Climatic conditions and water escape can also trigger subsidence over mine entrances and workings.

This data is sourced from Peter Brett Associates (PBA).

18.8 JPB mining areas

Records on site	0

Areas which could be affected by former coal mining. This data includes some mine plans unavailable to the Coal Authority.

This data is sourced from Johnson Poole and Bloomer.

18.9 Coal mining

Records on site	0

Areas which could be affected by past, current or future coal mining.

This data is sourced from the Coal Authority.

18.10 Brine areas

Records on site	0

The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

This data is sourced from the Cheshire Brine Subsidence Compensation Board.

18.11 Gypsum areas

Records on site	0

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.12 Tin mining

Records on site	0

Generalised areas that may be affected by historical tin mining.

This data is sourced from Mining Searches UK.

18.13 Clay mining

Records on site	0

Generalised areas that may be affected by kaolin and ball clay extraction.

This data is sourced from the Kaolin and Ball Clay Association (UK).

19 Radon



Site Outline

Search buffers in metres (m)

- Greater than 30%
- Between 10% and 30%
- Between 5% and 10%
- Between 3% and 5%
- Between 1% and 3%
- Less than 1%

19.1 Radon

Records on site	1

Estimated percentage of dwellings exceeding the Radon Action Level. This data is the highest resolution radon dataset available for the UK and is produced to a 75m level of accuracy to allow for geological data accuracy and a 'residential property' buffer. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain. The data was derived from both geological assessments and long term measurements of radon in more than 479,000 households.

Features are displayed on the Radon map on **page 92**

Location	Estimated properties affected	Radon Protection Measures required
On site	**Less than 1%**	**None****

This data is sourced from the British Geological Survey and Public Health England.

20 Soil chemistry

20.1 BGS Estimated Background Soil Chemistry

Records within 50m **2**

The estimated values provide the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km^2. In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km^2; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	**15 mg/kg**	**No data**	**No data**	**No data**	**No data**	**60 - 90 mg/kg**	**15 - 30 mg/kg**
3m N	15 mg/kg	No data	No data	No data	No data	60 - 90 mg/kg	15 - 30 mg/kg

This data is sourced from the British Geological Survey.

20.2 BGS Estimated Urban Soil Chemistry

Records within 50m **9**

Estimated topsoil chemistry of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc and bioaccessible Arsenic and Lead in 23 urban centres across Great Britain. These estimates are derived from interpolation of the measured urban topsoil data referred to above and provide information across each city between the measured sample locations (4 per km^2).

Location	Arsenic (mg/kg)	Bioaccessible Arsenic (mg/kg)	Lead (mg/kg)	Bioaccessible Lead (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Nickel (mg/kg)	Tin (mg/kg)
On site	**14**	**2.5**	**198**	**136**	**0.6**	**76**	**60**	**21**	**16**
On site	**14**	**2.5**	**199**	**137**	**0.6**	**76**	**60**	**21**	**16**
On site	**14**	**2.5**	**193**	**133**	**0.5**	**73**	**63**	**22**	**14**
On site	**14**	**2.5**	**203**	**139**	**0.6**	**77**	**60**	**21**	**17**
1m E	14	2.5	203	139	0.6	78	59	21	17
3m NW	14	2.5	191	131	0.5	71	66	24	13
6m N	14	2.5	196	135	0.5	74	62	22	15

Location	Arsenic (mg/kg)	Bioaccessible Arsenic (mg/kg)	Lead (mg/kg)	Bioaccessible Lead (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Nickel (mg/kg)	Tin (mg/kg)
32m SW	14	2.5	192	132	0.5	73	60	22	15
37m S	14	2.5	198	136	0.6	74	56	21	18

This data is sourced from the British Geological Survey.

20.3 BGS Measured Urban Soil Chemistry

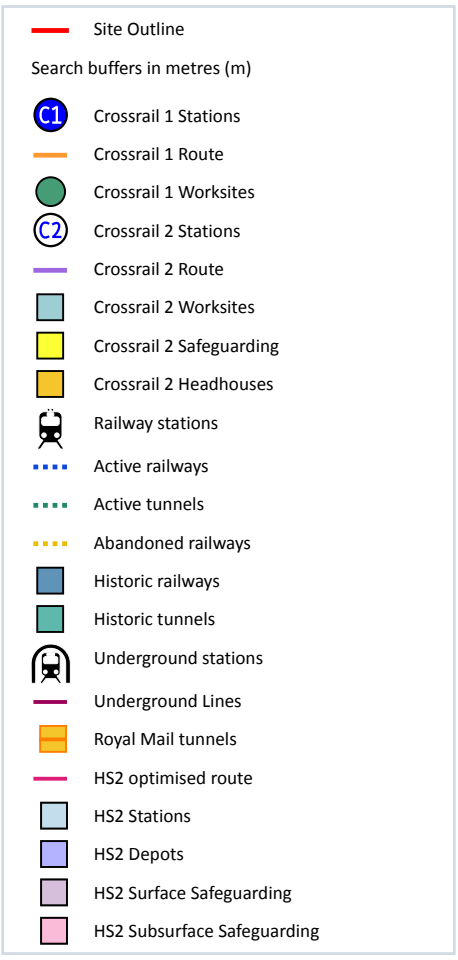
Records within 50m	**0**

The locations and measured total concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc in urban topsoil samples from 23 urban centres across Great Britain. These are collected at a sample density of 4 per km^2.

This data is sourced from the British Geological Survey.

21 Railway infrastructure and projects





21.1 Underground railways (London)

Records within 250m	0

Details of all active London Underground lines, including approximate tunnel roof depth and operational hours.

This data is sourced from publicly available information by Groundsure.

21.2 Underground railways (Non-London)

Records within 250m	0

Details of the Merseyrail system, the Tyne and Wear Metro and the Glasgow Subway. Not all parts of all systems are located underground. The data contains location information only and does not include a depth assessment.

This data is sourced from publicly available information by Groundsure.

21.3 Railway tunnels

Records within 250m	0

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

21.4 Historical railway and tunnel features

Records within 250m	0

Railways and tunnels digitised from historical Ordnance Survey mapping as scales of 1:1,250, 1:2,500, 1:10,000 and 1:10,560.

This data is sourced from Ordnance Survey/Groundsure.

21.5 Royal Mail tunnels

Records within 250m	0

The Post Office Railway, otherwise known as the Mail Rail, is an underground railway running through Central London from Paddington Head District Sorting Office to Whitechapel Eastern Head Sorting Office. The line is 10.5km long. The data includes details of the full extent of the tunnels, the depth of the tunnel, and the depth to track level.

This data is sourced from Groundsure/the Postal Museum.

21.6 Historical railways

Records within 250m	0

Former railway lines, including dismantled lines, abandoned lines, disused lines, historic railways and razed lines.

This data is sourced from OpenStreetMap.

21.7 Railways

Records within 250m	0

Currently existing railway lines, including standard railways, narrow gauge, funicular, trams and light railways.

This data is sourced from Ordnance Survey and OpenStreetMap.

21.8 Crossrail 1

Records within 500m	1

The Crossrail railway project links 41 stations over 100 kilometres from Reading and Heathrow in the west, through underground sections in central London, to Shenfield and Abbey Wood in the east.

Features are displayed on the Railway infrastructure and projects map on **page 95**

Location	Route Type
343m N	Surface Alignment

This data is sourced from publicly available information by Groundsure.

21.9 Crossrail 2

Records within 500m	0

Crossrail 2 is a proposed railway linking the national rail networks in Surrey and Hertfordshire via an underground tunnel through London.

This data is sourced from publicly available information by Groundsure.

21.10 HS2

Records within 500m	0

HS2 is a proposed high speed rail network running from London to Manchester and Leeds via Birmingham. Main civils construction on Phase 1 (London to Birmingham) of the project began in 2019, and it is currently anticipated that this phase will be fully operational by 2026. Construction on Phase 2a (Birmingham to Crewe) is anticipated to commence in 2021, with the service fully operational by 2027. Construction on Phase 2b (Crewe to Manchester and Birmingham to Leeds) is scheduled to begin in 2023 and be operational by 2033.

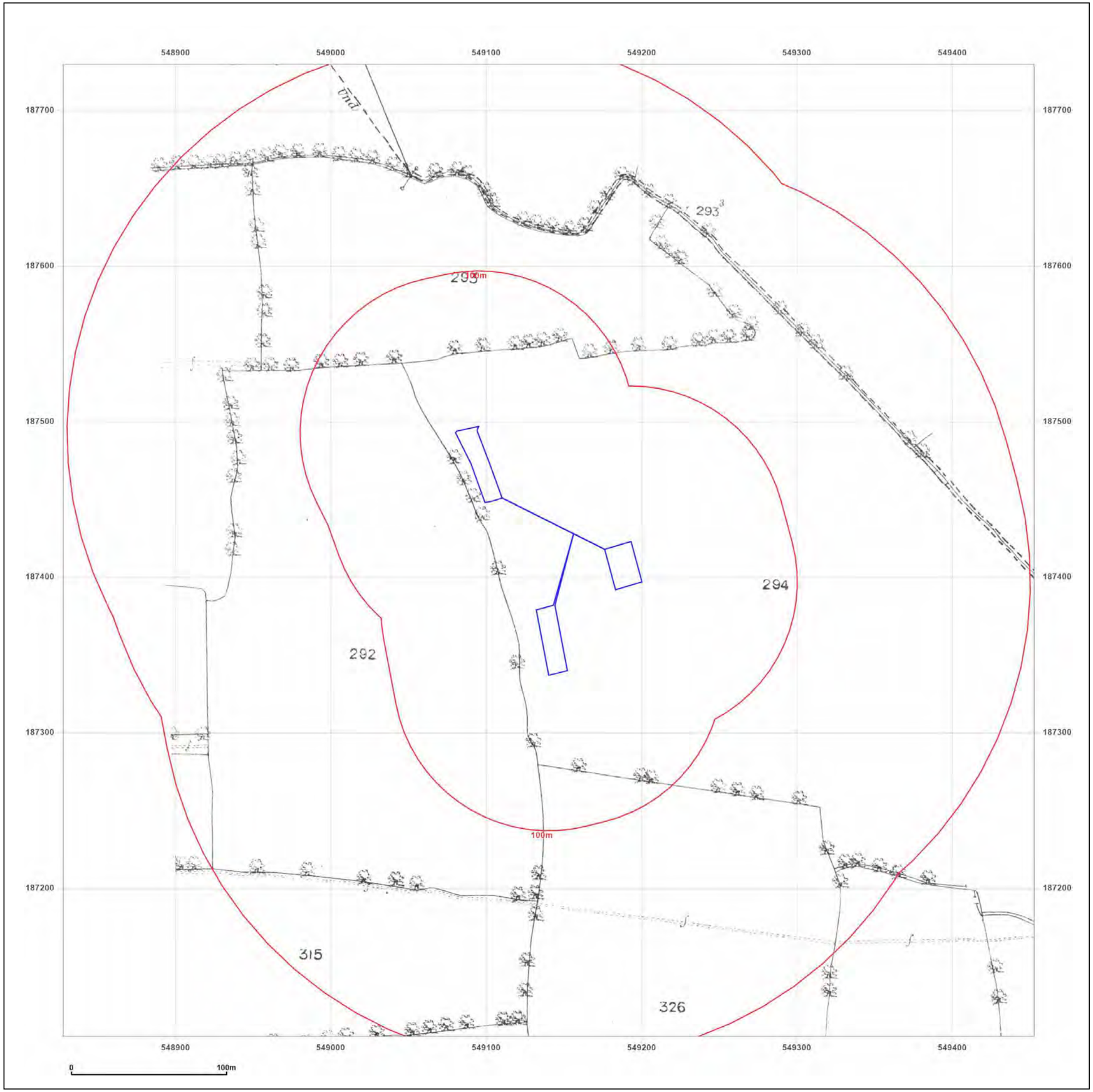
This data is sourced from HS2 ltd.

Data providers

Groundsure works with respected data providers to bring you the most relevant and accurate information. To find out who they are and their areas of expertise see https://www.groundsure.com/sources-reference.

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Report Ref: GS-7642651
Grid Ref: 549140, 187417

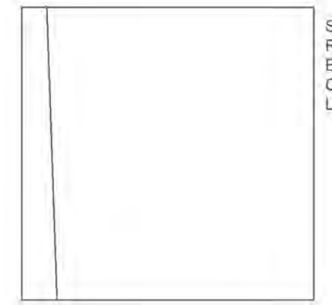
Map Name: County Series

Map date: **1870**

Scale: 1:2,500

Printed at: 1:2,500

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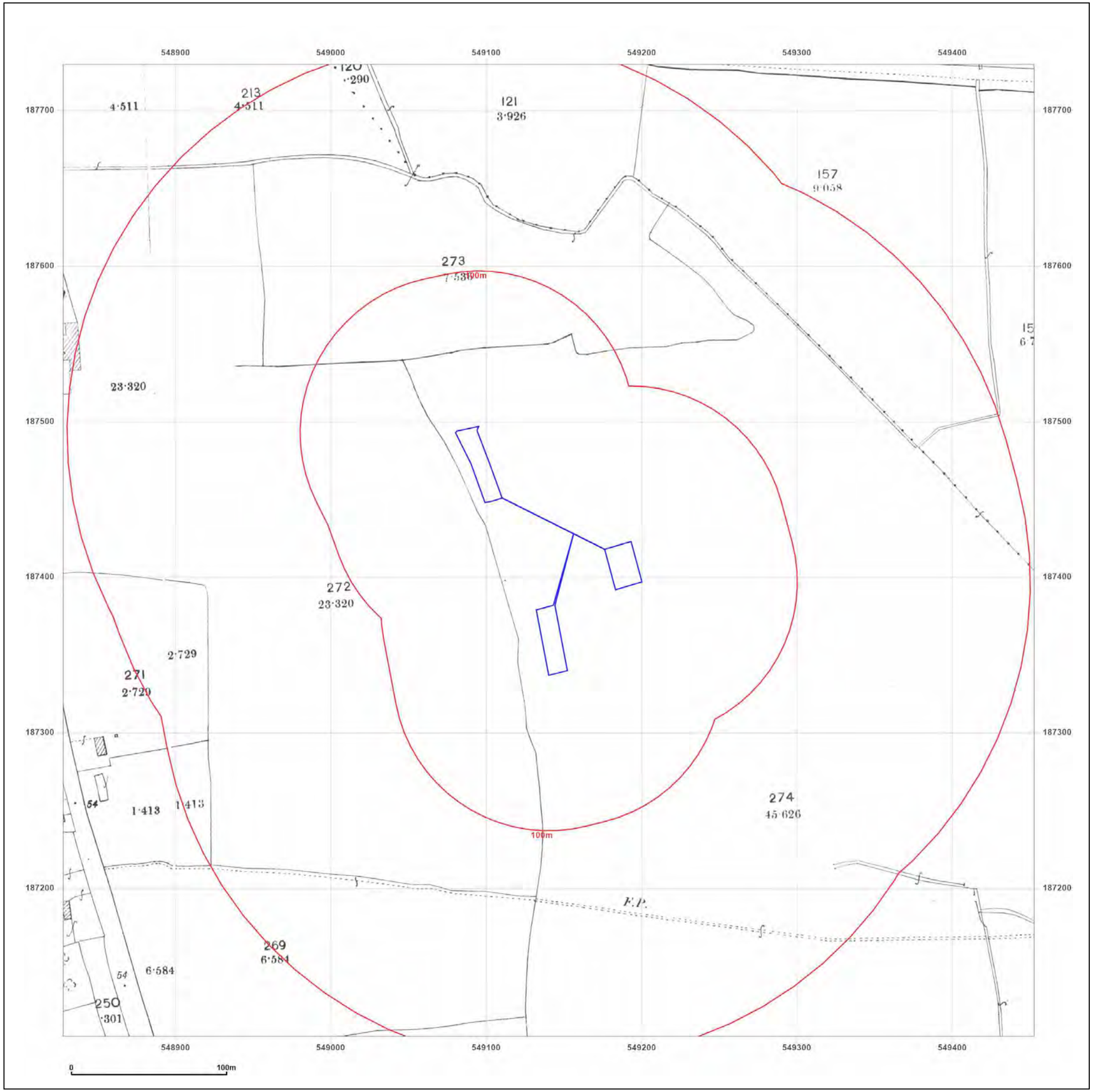
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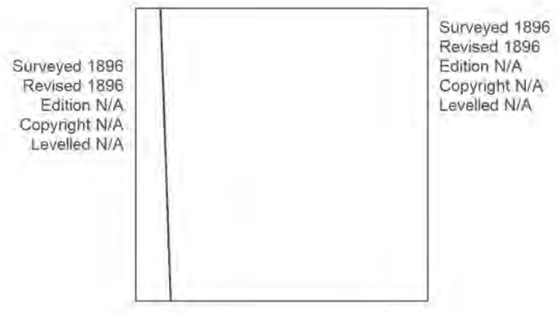
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: County Series
Map date: **1896**
Scale: 1:2,500
Printed at: 1:2,500

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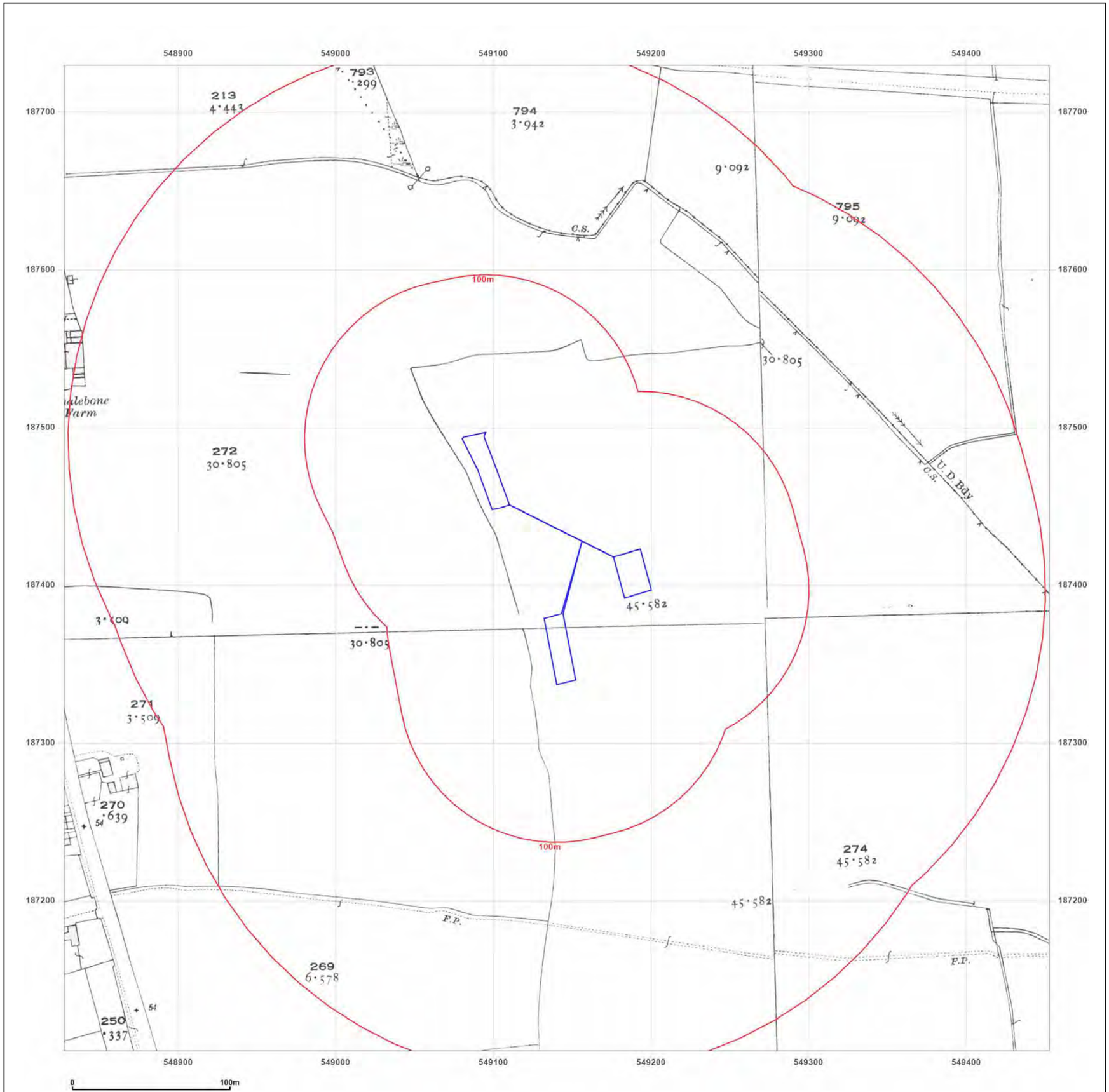
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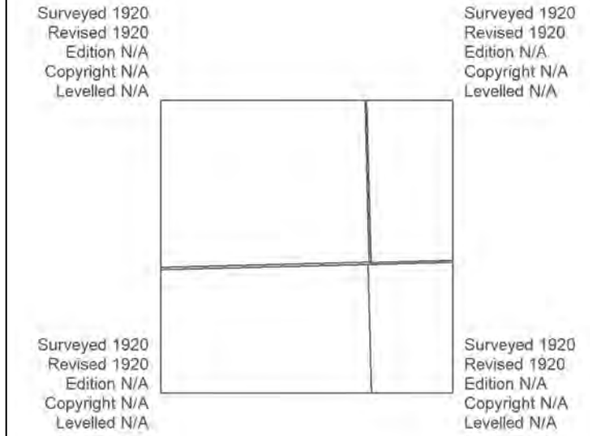
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Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: County Series
Map date: **1920**
Scale: 1:2,500
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: County Series

Map date: **1938-1939**

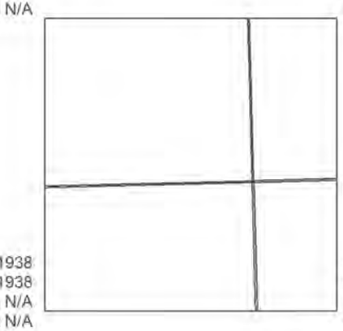
Scale: 1:2,500

Printed at: 1:2,500

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Revised 1938
Edition N/A
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Levelled N/A

Surveyed 1939
Revised 1939
Edition N/A
Copyright N/A
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1959**

Scale: 1:2,500

Printed at: 1:2,500

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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1960**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1959
Revised 1959
Edition N/A
Copyright 1960
Levelled 1948

Surveyed 1959
Revised 1959
Edition N/A
Copyright 1960
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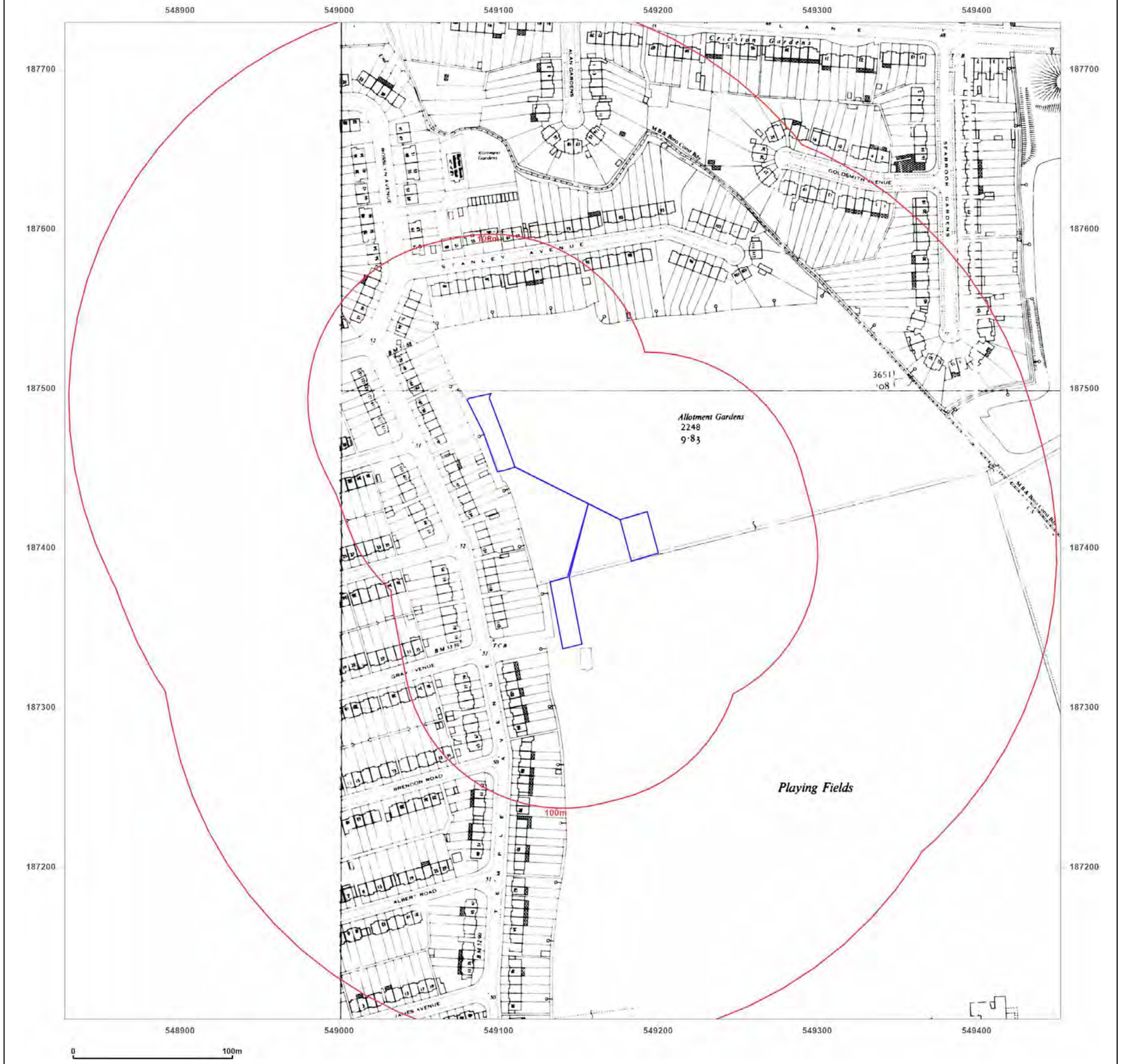
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Map Name: National Grid

Map date: **1961**

Scale: 1:2,500

Printed at: 1:2,500

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Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1965-1970**

Scale: 1:1,250

Printed at: 1:2,000

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Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

Surveyed 1959
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1970**

Scale: 1:2,500

Printed at: 1:2,500

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Revised 1970
Edition N/A
Copyright 1971
Levelled 1961

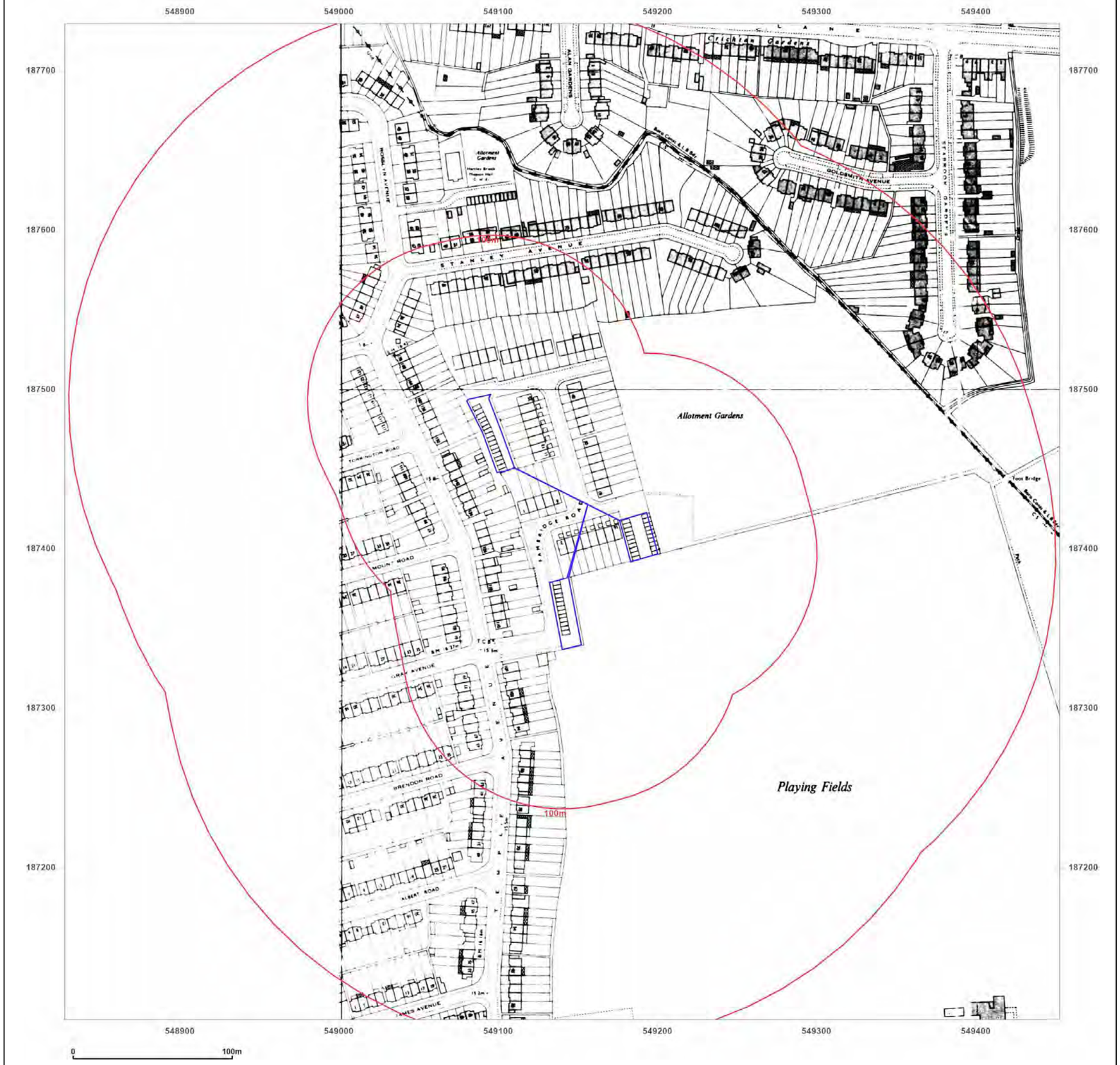
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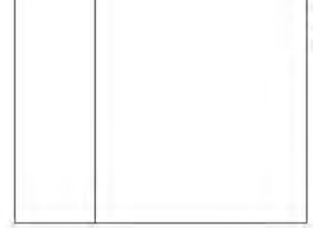
Map Name: National Grid

Map date: **1971**

Scale: 1:2,500

Printed at: 1:2,500

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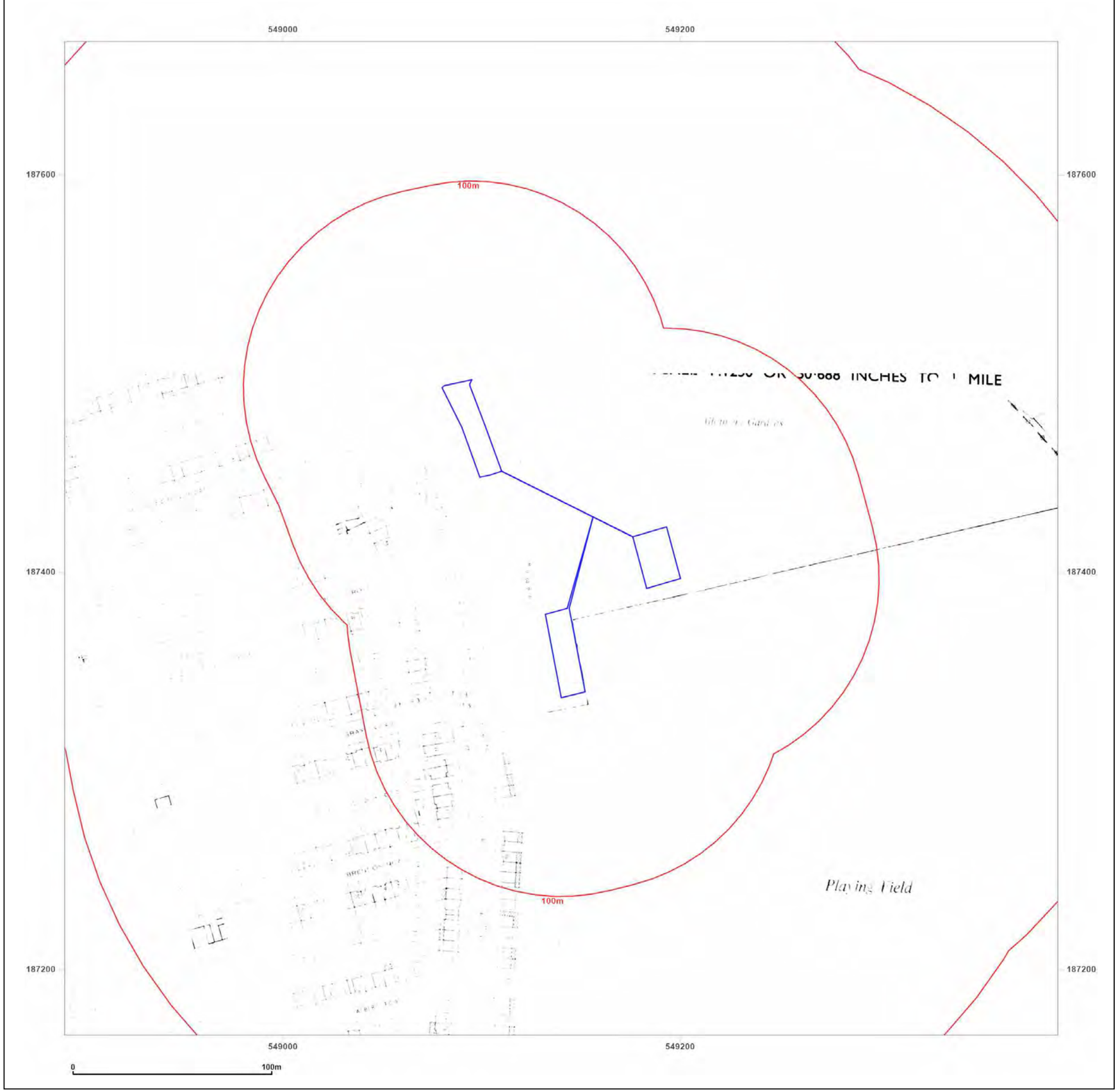
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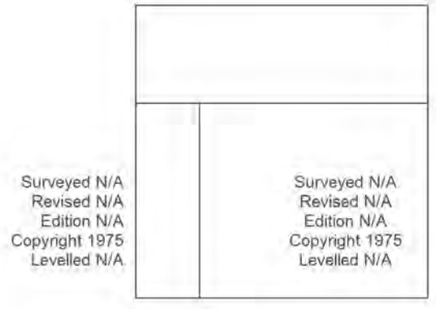
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FAMBRIDGE ROAD, RM8 1NS

Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid
Map date: **1975**
Scale: 1:1,250
Printed at: 1:2,000

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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid
Map date: **1979-1983**
Scale: 1:1,250
Printed at: 1:2,000

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W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1961

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Map Name: National Grid

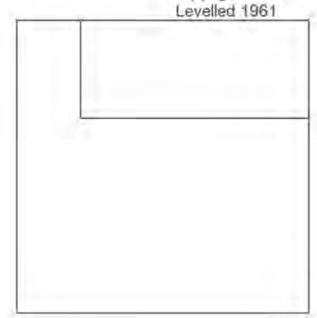
Map date: **1983**

Scale: 1:1,250

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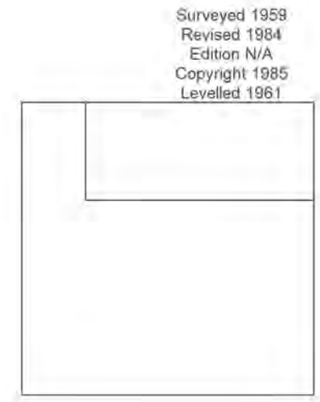
Map Name: National Grid

Map date: **1985**

Scale: 1:1,250

Printed at: 1:2,000

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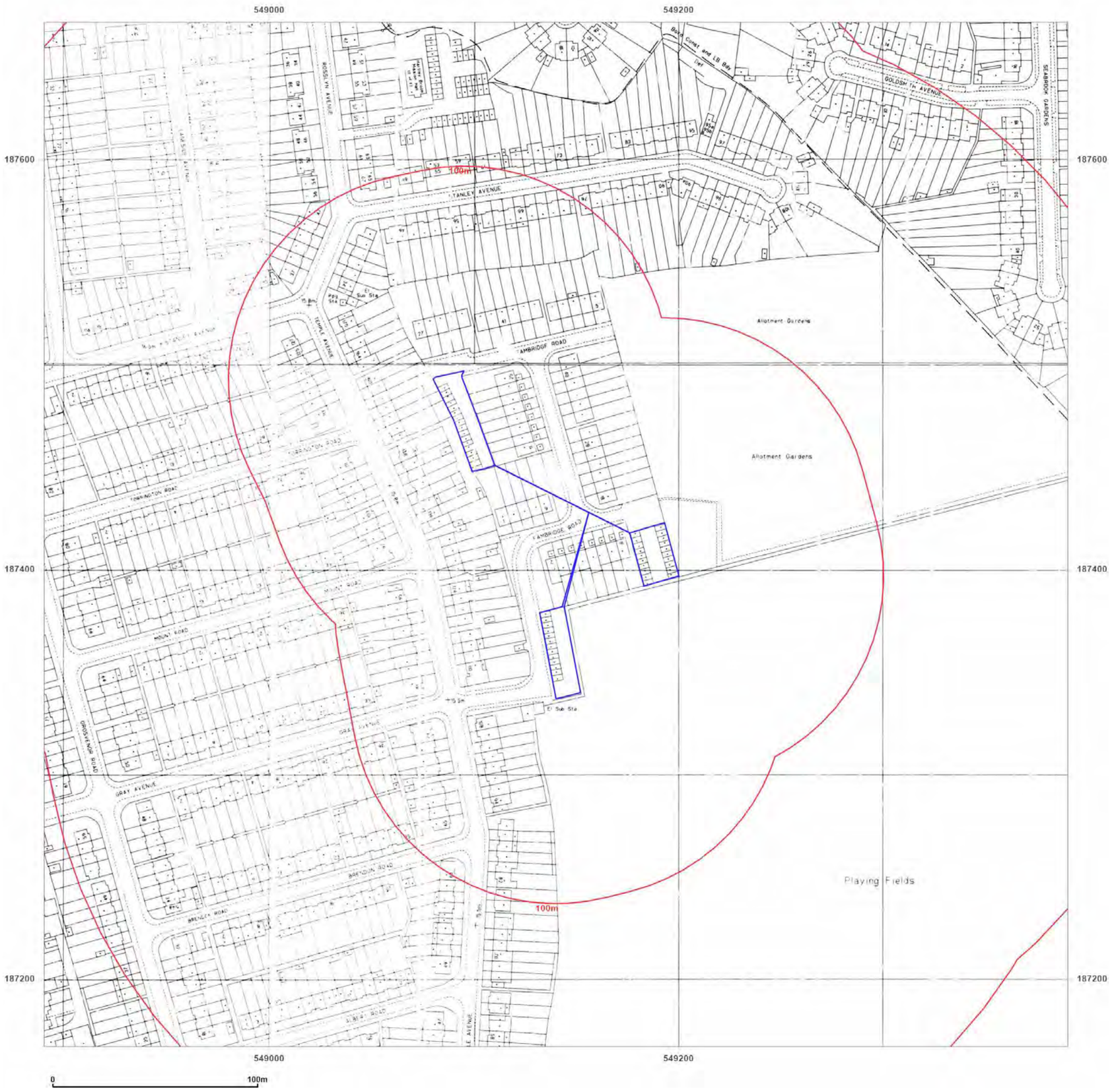
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,000

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

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Revised N/A
Edition N/A
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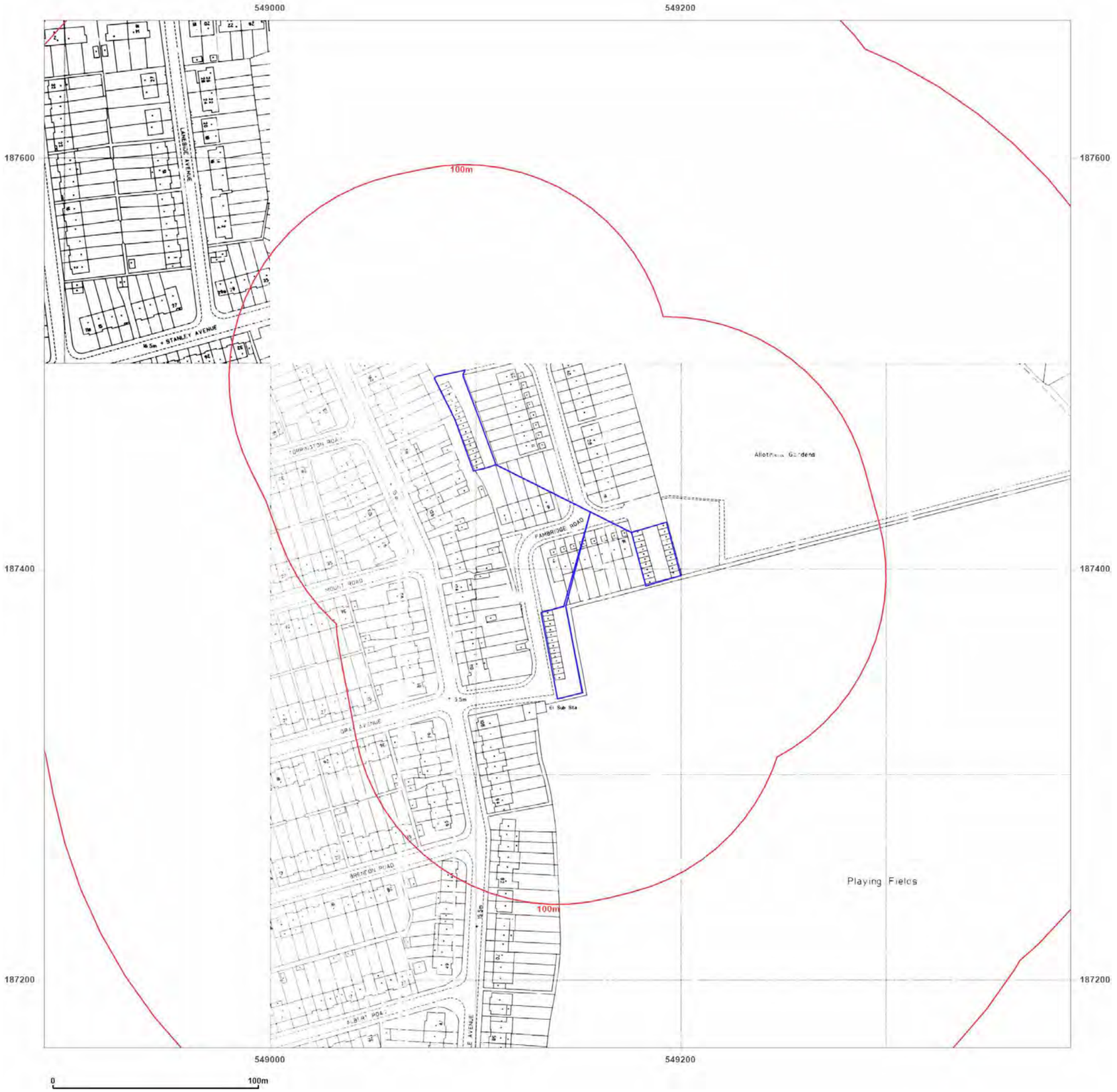
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid
Map date: **1994-1995**
Scale: 1:1,250
Printed at: 1:2,000

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Edition N/A
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **1994-1995**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed 1994
Revised 1994
Edition N/A
Copyright 1994
Levelled N/A

Surveyed N/A
Revised N/A
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Report Ref: GS-7642651
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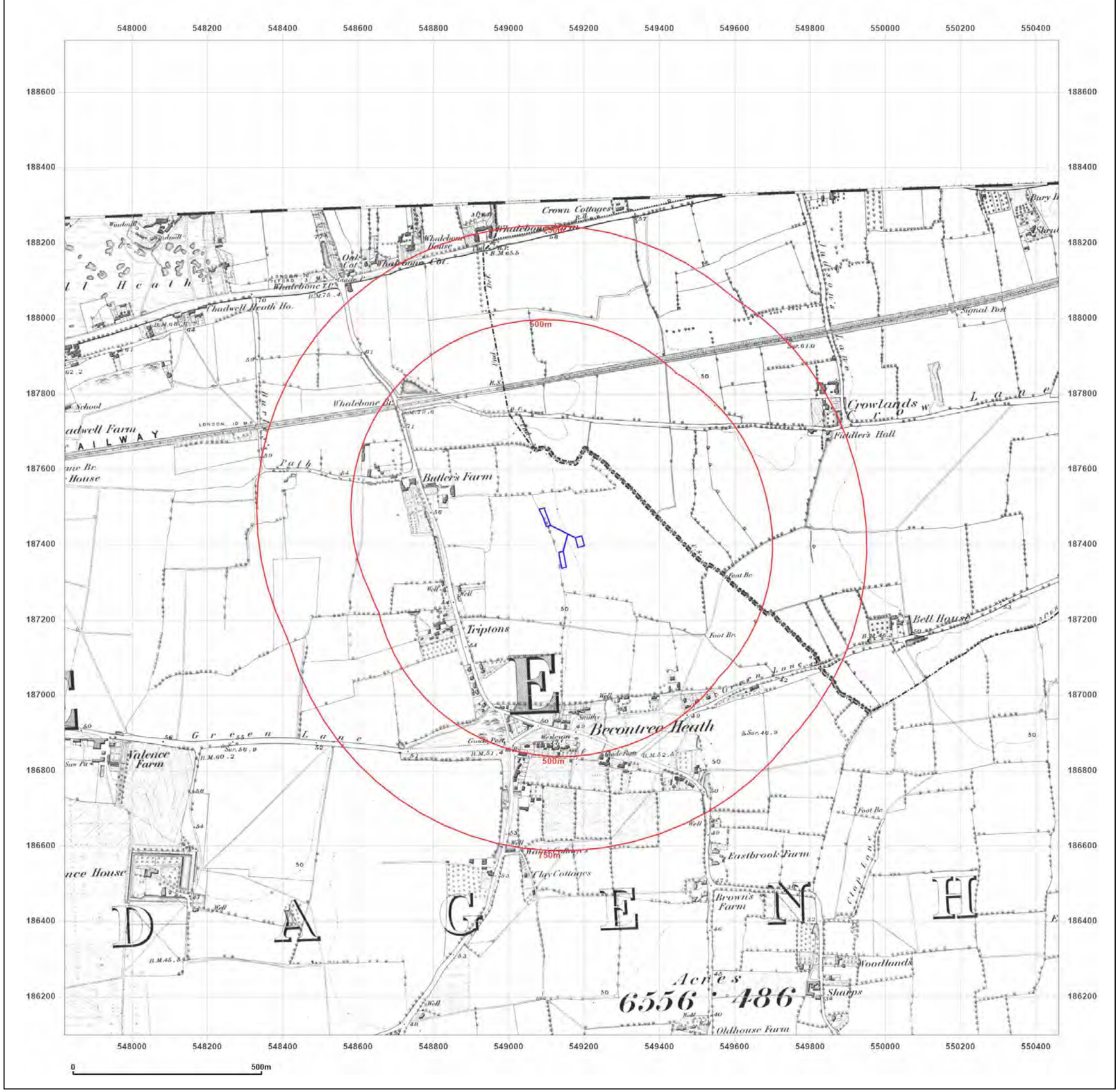
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

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Map date: **1862**

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Printed at: 1:10,560

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Surveyed 1862
Revised 1862
Edition N/A
Copyright N/A
Levelled N/A

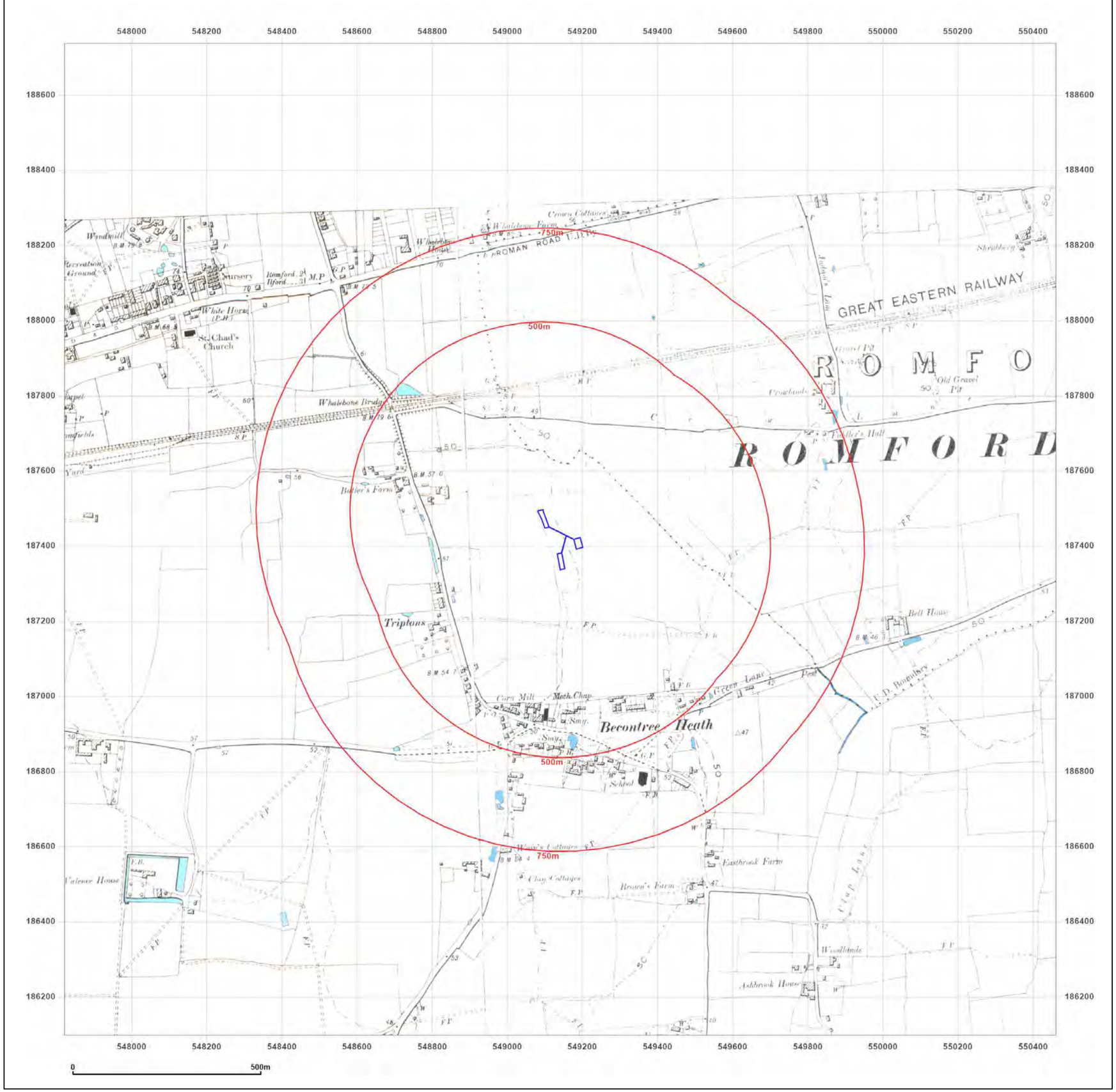
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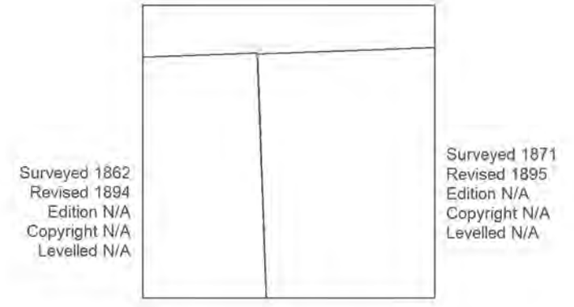
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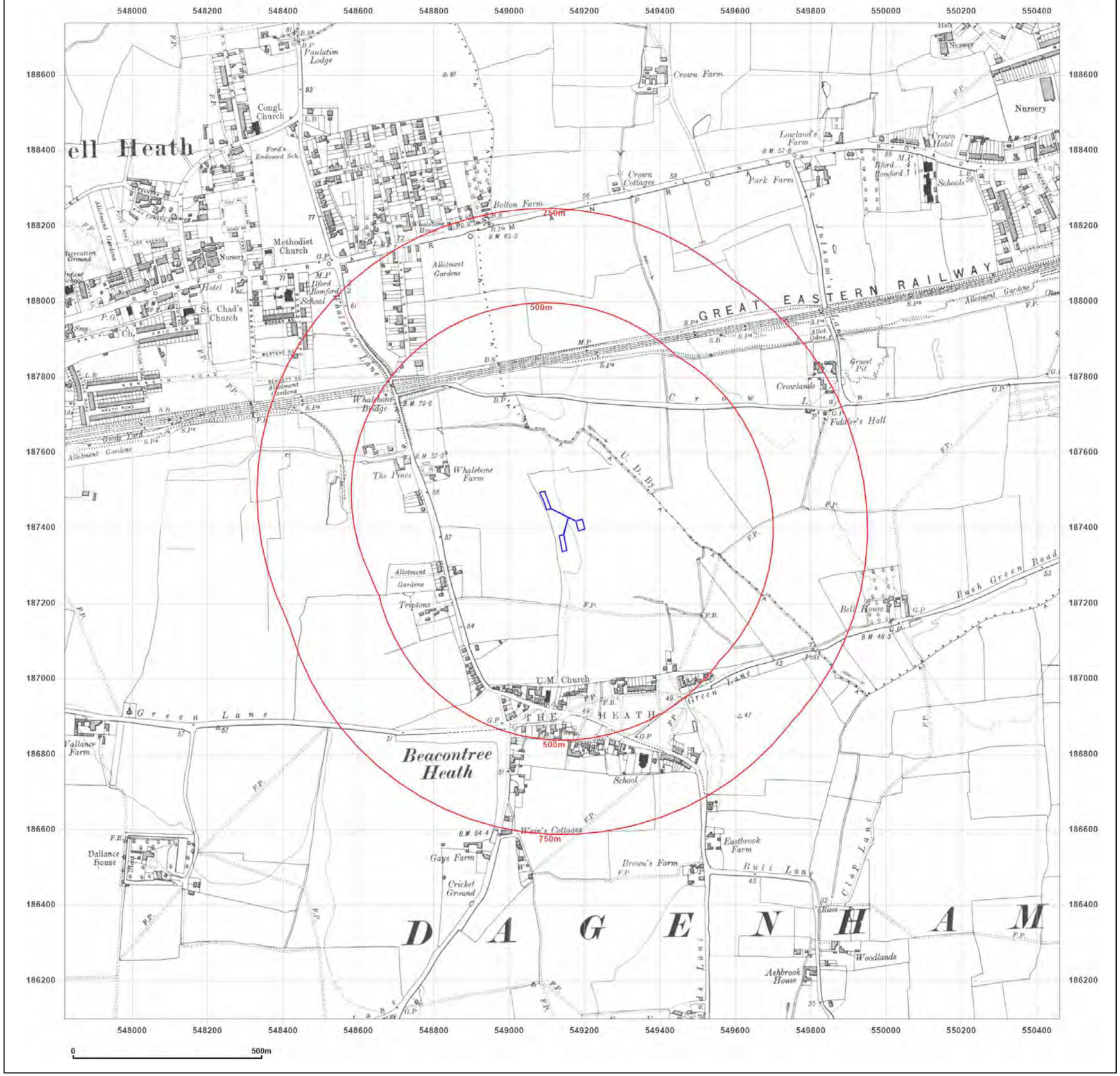
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Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: County Series

Map date: **1921**

Scale: 1:10,560

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Surveyed 1871
Revised 1921
Edition 1921
Copyright N/A
Levelled N/A

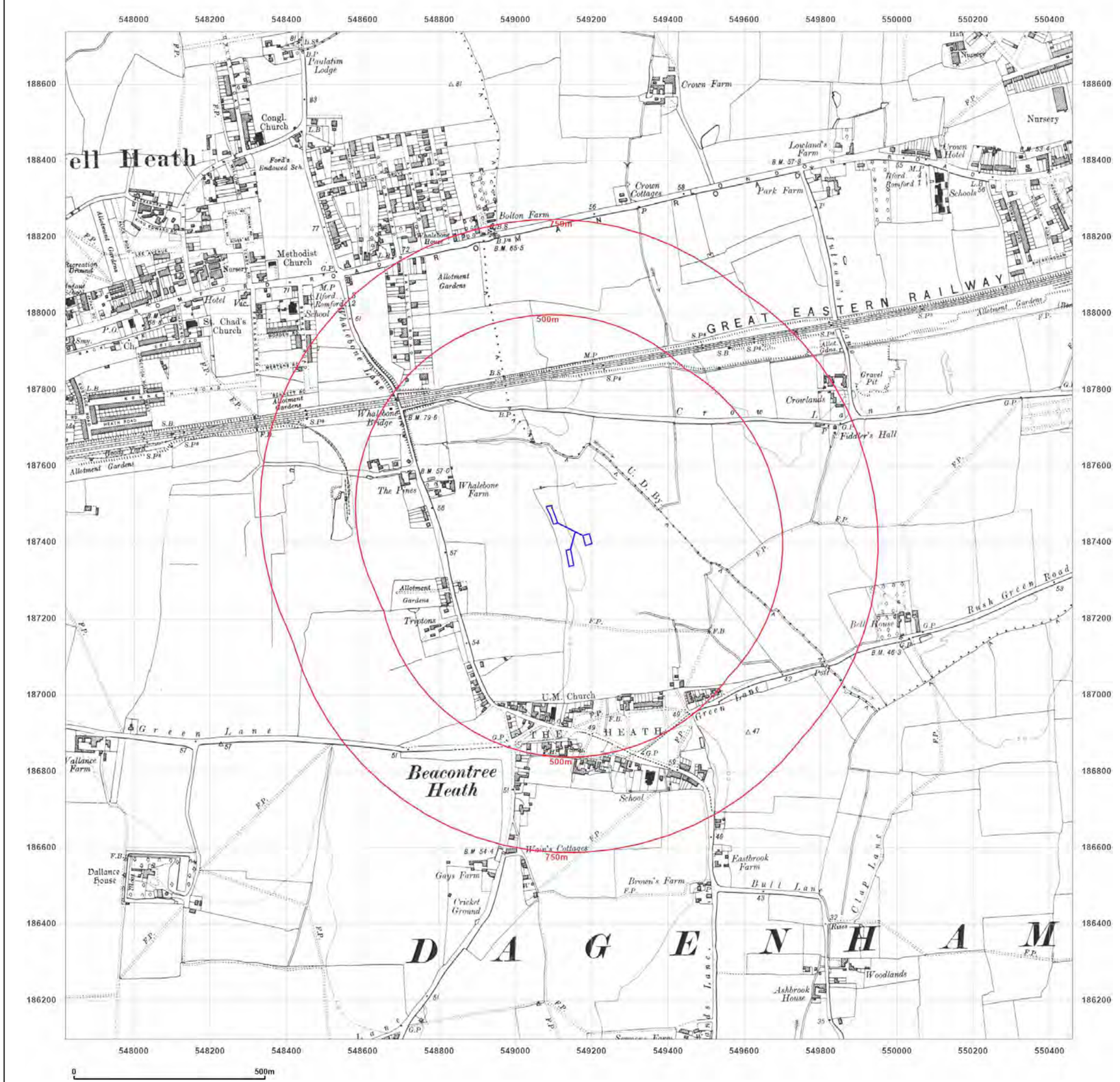
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Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

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Map date: **1921**

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Surveyed 1871
Revised 1921
Edition N/A
Copyright N/A
Levelled N/A

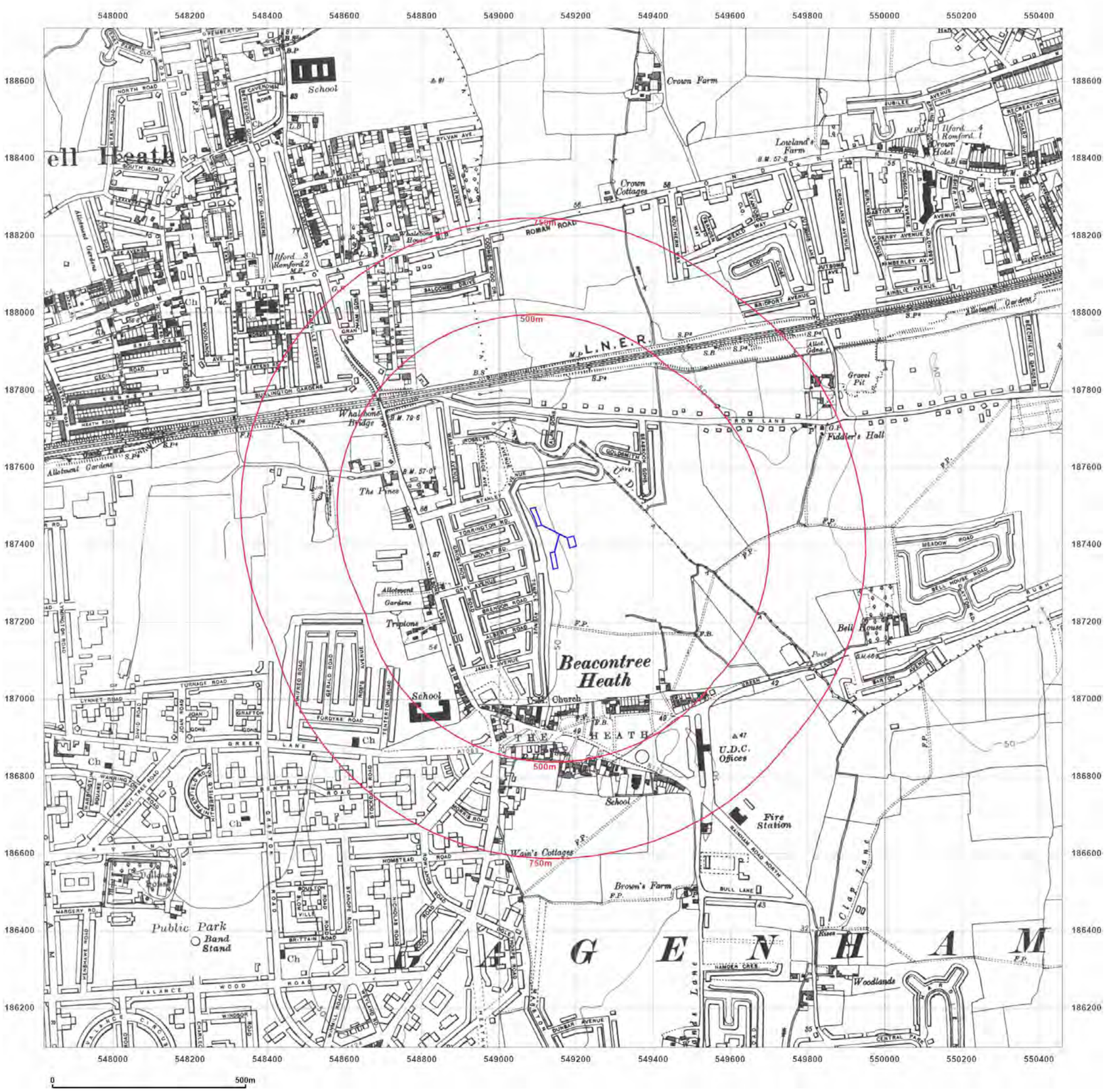
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Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: County Series

Map date: **1938**

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Surveyed 1871
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

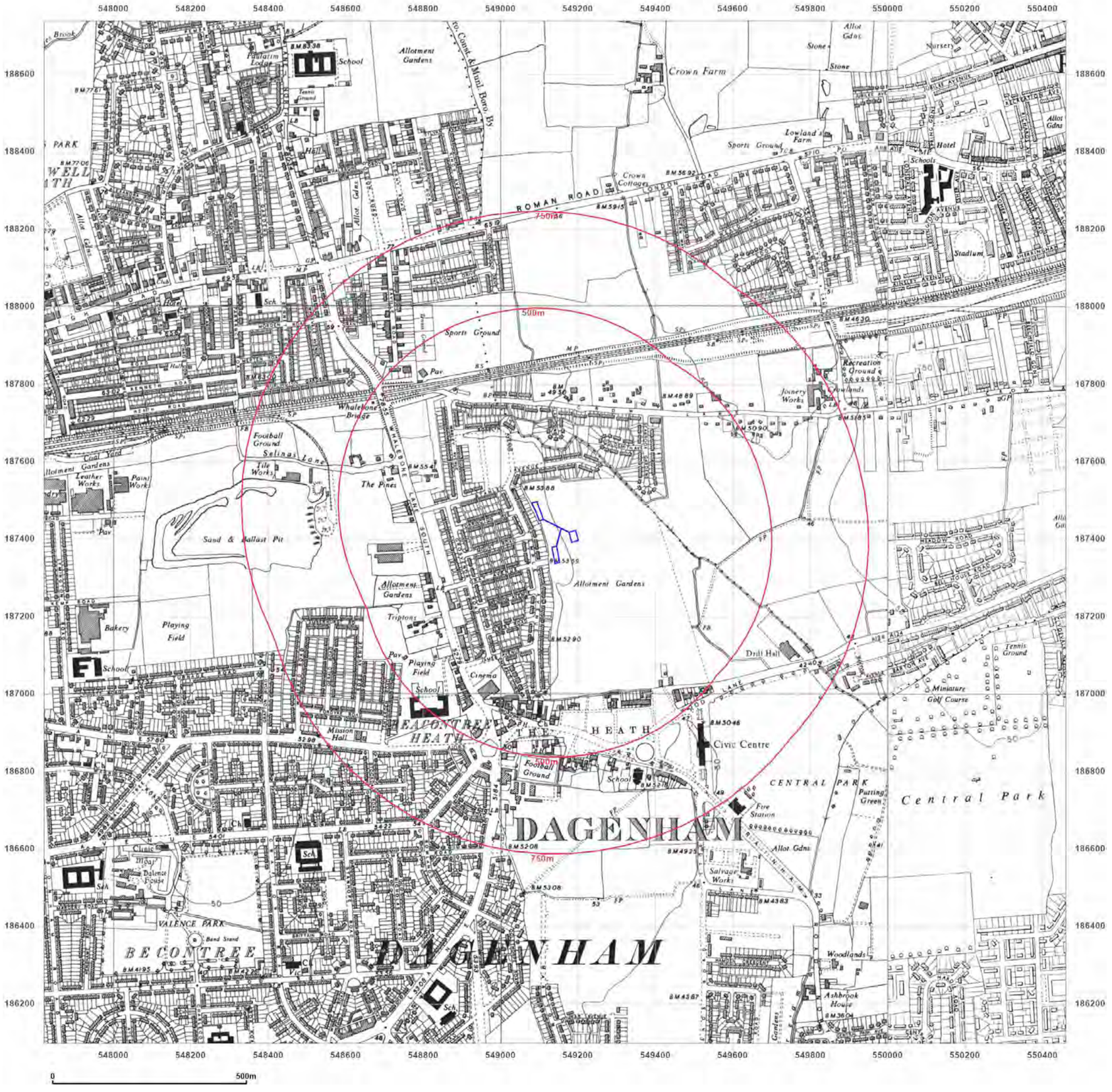
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Grid Ref: 549140, 187417

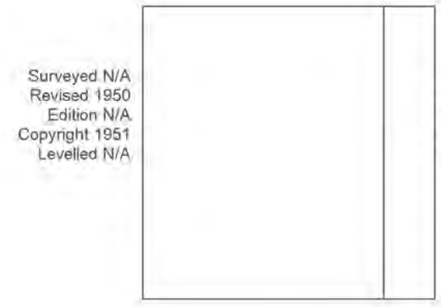
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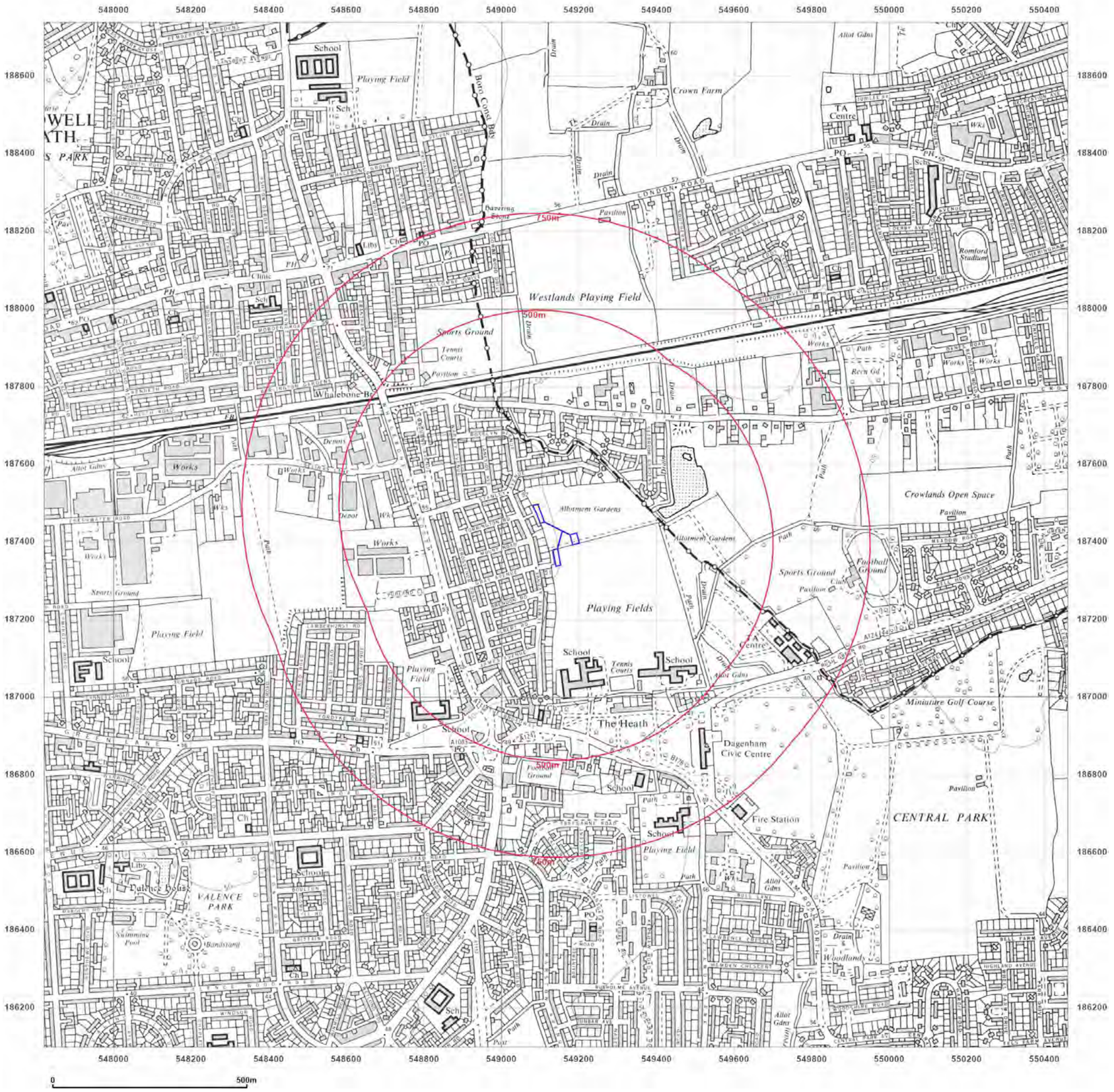
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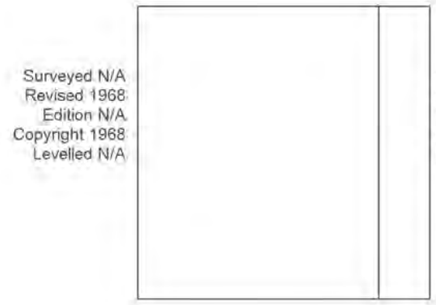
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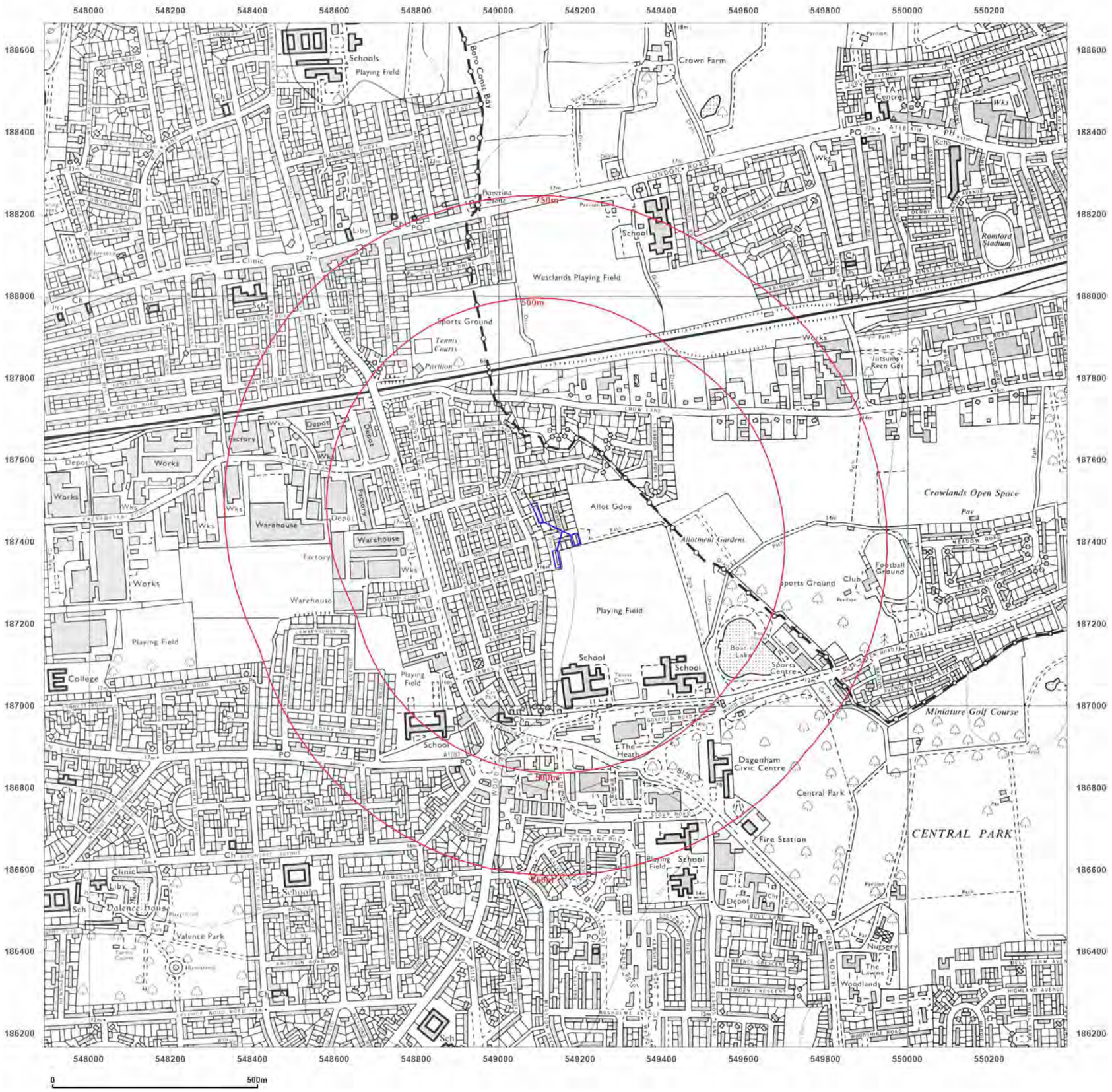
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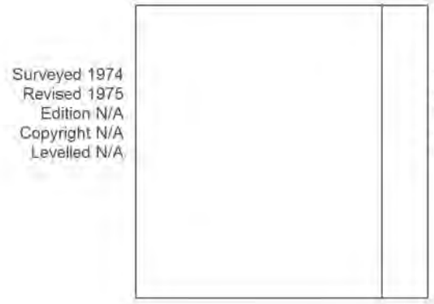
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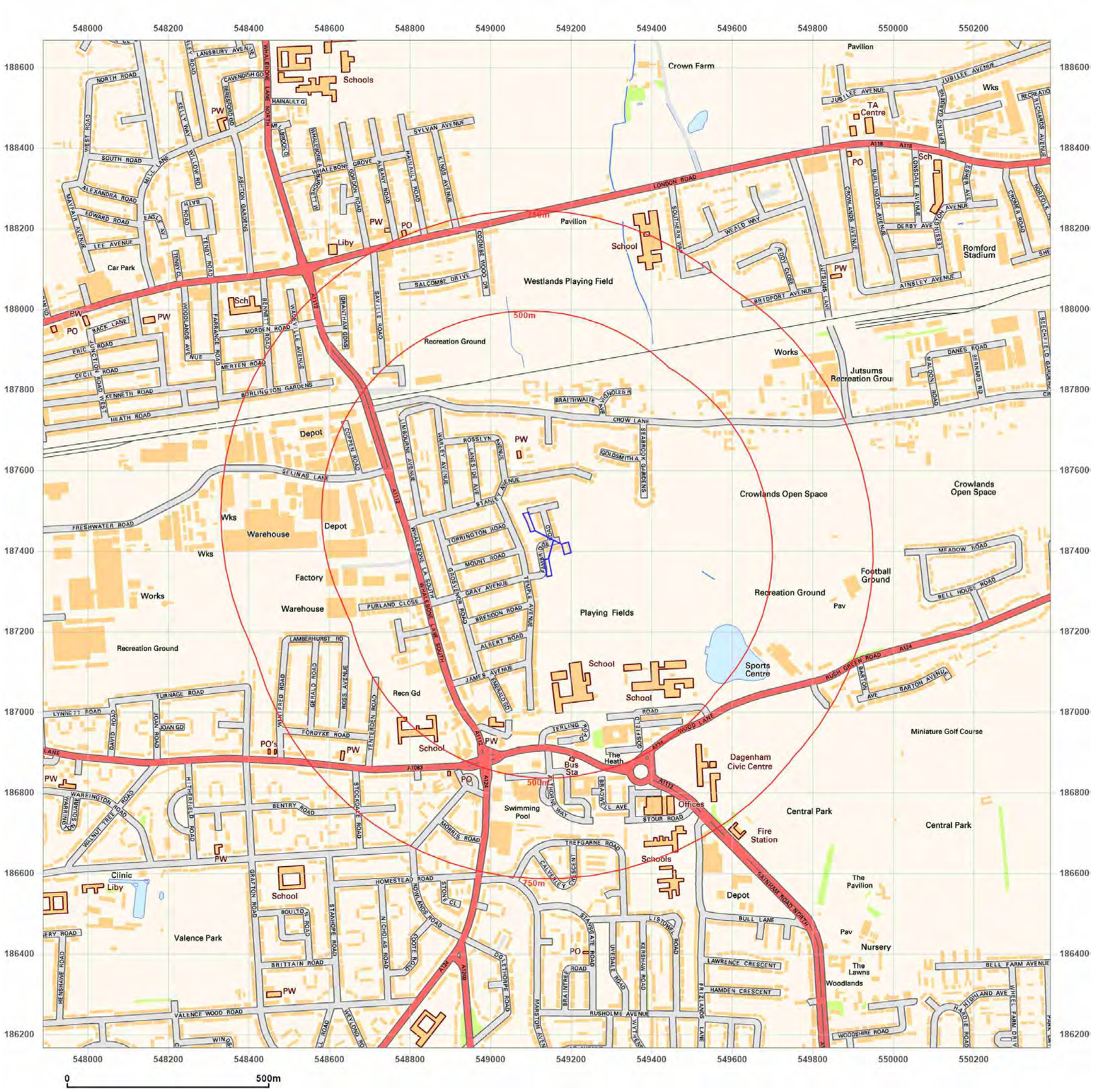
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Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

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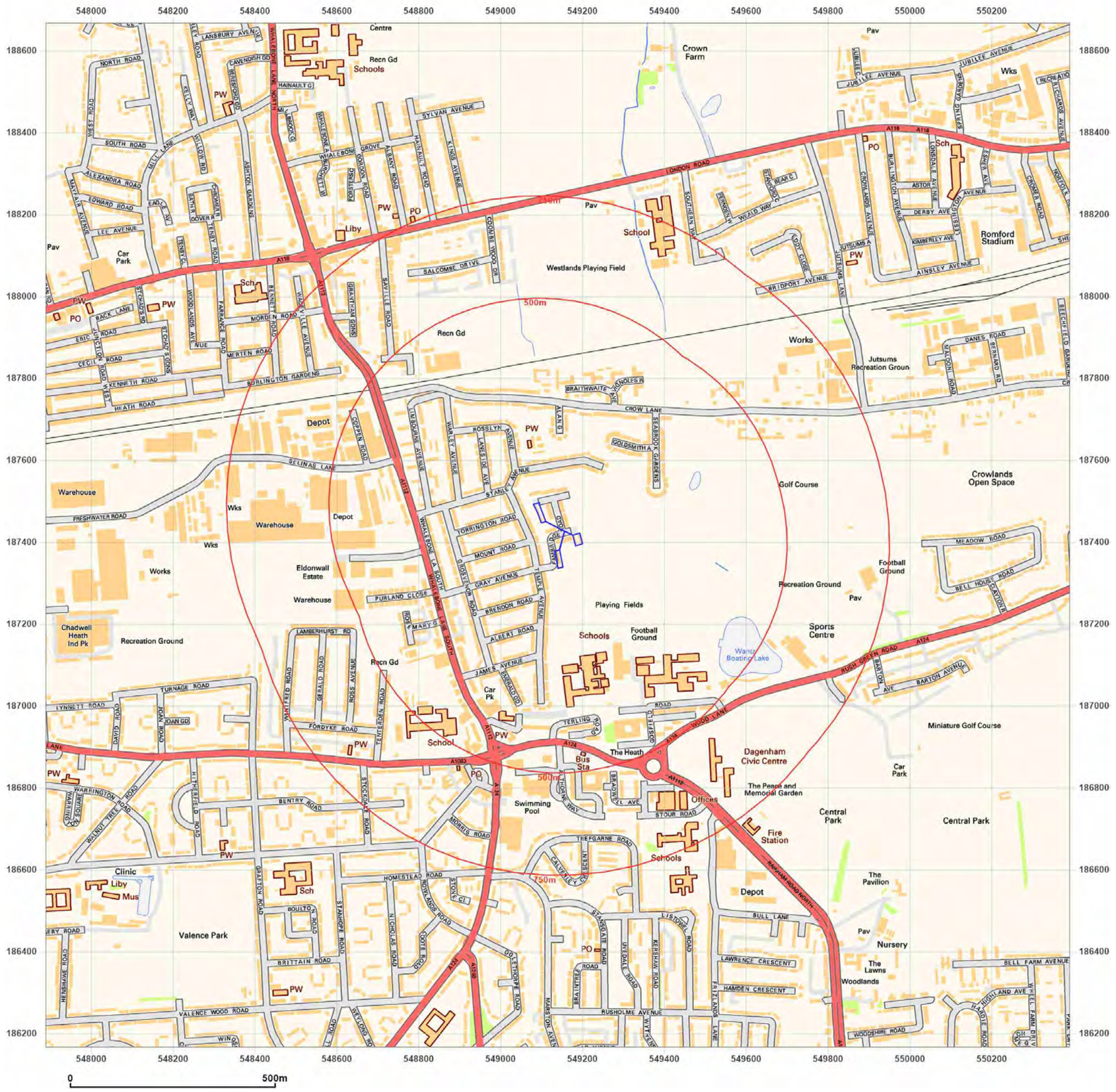
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Report Ref: GS-7642651
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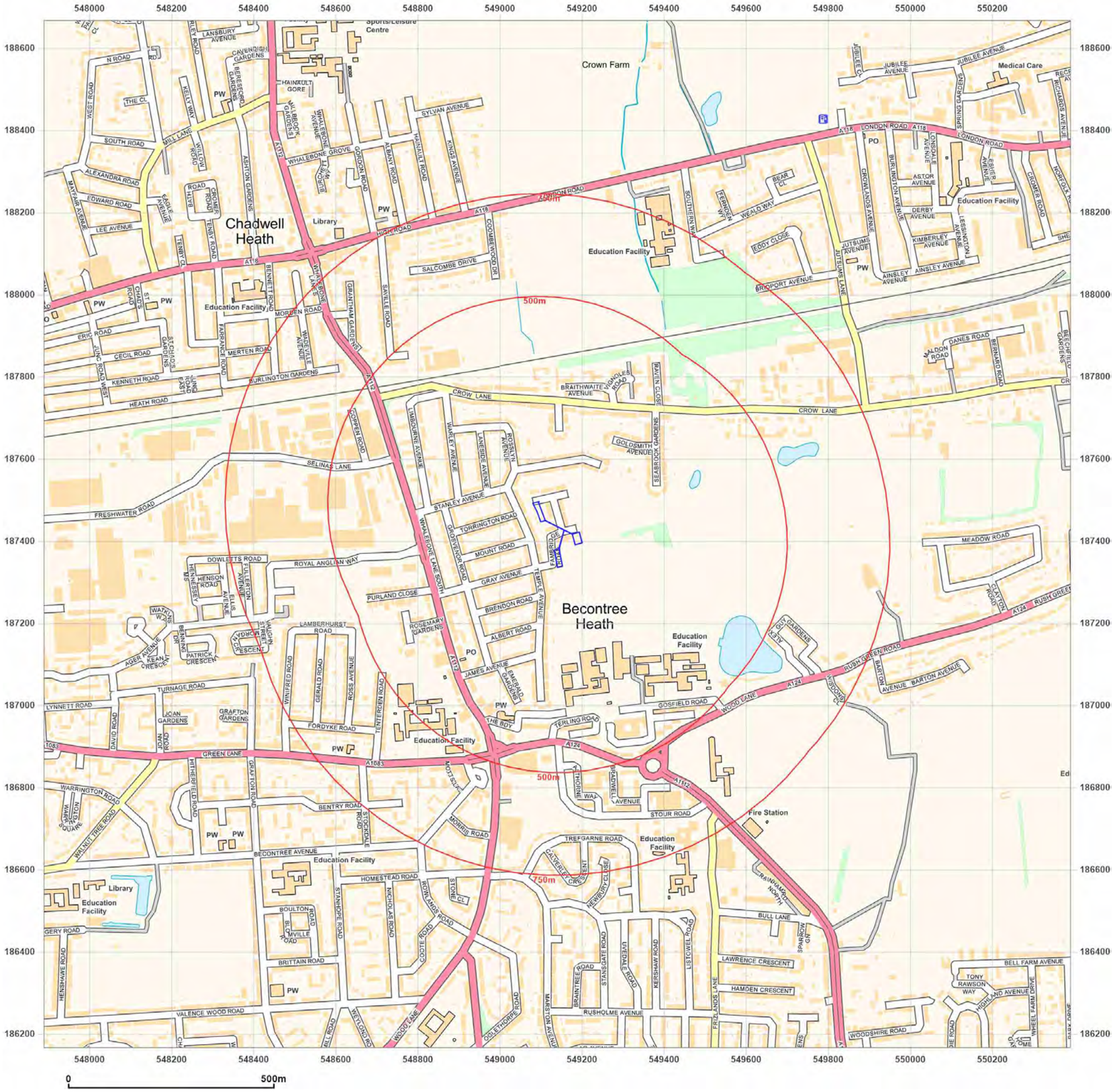
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Client Ref: PO14047811_PN10046791_FAMBRIDGE_RD
Report Ref: GS-7642651
Grid Ref: 549140, 187417

Map Name: National Grid

Map date: **2021**

Scale: 1:10,000

Printed at: 1:10,000

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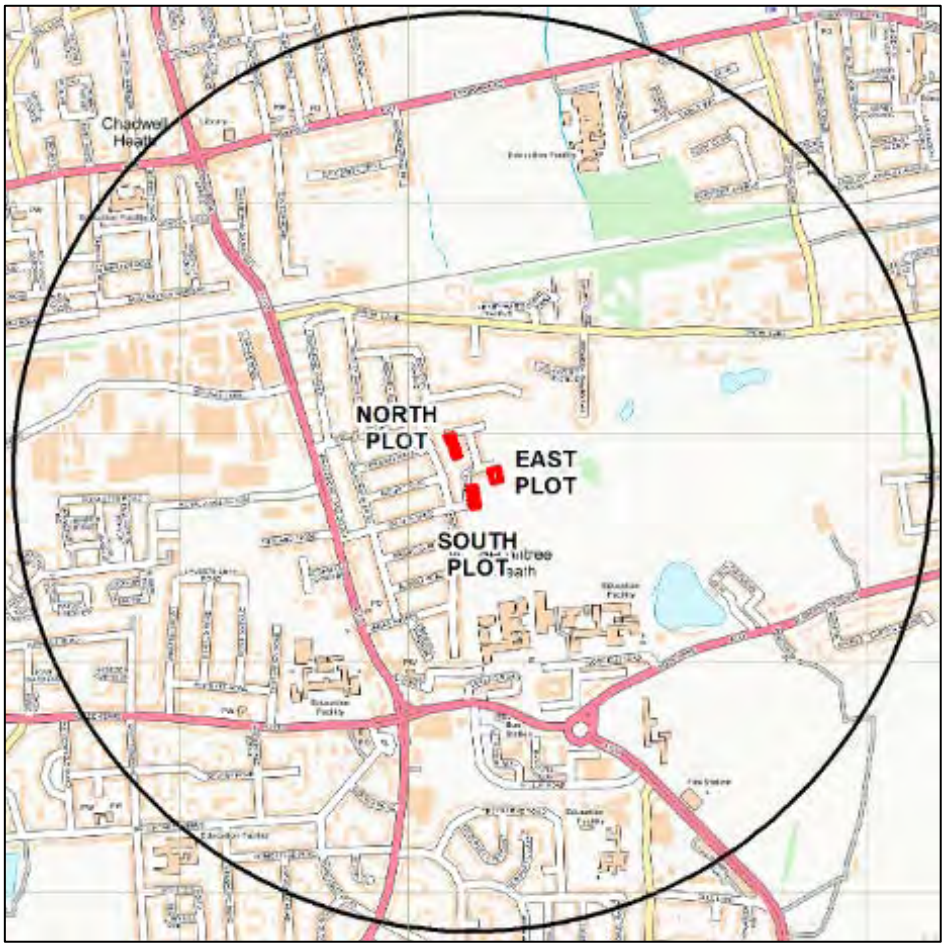
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APPENDIX D

UXO Report

Detailed Unexploded Ordnance (UXO) Threat & Risk Assessment

Meeting the requirements of *CIRIA* C681 'Unexploded Ordnance (UXO) A guide for the Construction Industry' Risk Management Framework



PROJECT NUMBER	8584_5	**ORIGINATOR**	D. Barrett
VERSION NUMBER	1.0	**REVIEWED BY**	B. Wilkinson (15th March 2021)
CLIENT	Arcadis	**RELEASED BY**	L. Gregory (16th March 2021)
STUDY SITE	Fambridge Road, RM8 1NS		
RATING	**MEDIUM** - This Study Site requires limited further action to reduce risk to ALARP during intrusive activities.		

alpha ASSOCIATES
special risks consultancy

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T: +44 (0)2033 713 900 | W: www.6alpha.com

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Acronyms and Abbreviations

AA	Anti-Aircraft
AAA	Anti-Aircraft Ammunition
ALARP	As Low As Reasonably Practicable
AOD	Above Ordnance Datum
ARP	Air Raid Precaution
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
bgl	Below Ground Level
BGS	British Geological Survey
BH	Borehole
BPD	Bomb Penetration Depth
CDP	Cast Driven Piles
CFA	Continuous Flight Auger
CIRIA	Construction Industry Research and Information Association
CPT	Cone Penetration Testing
CS	County Series
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
GI	Ground Investigation
GIS	Geographic Information Systems
GL	Ground Level
GP	General Purpose
GPS	Global Positioning Systems
HAA	Heavy Anti-Aircraft
HE	High Explosive
HO	Home Office
HSE	Health and Safety Executive
IB	Incendiary Bomb
kg	Kilograms
km	Kilometres
LAA	Light Anti-Aircraft
LCC	London County Council
LE	Low Explosive
LSA	Land Service Ammunition
m	Metres
MoD	Ministry of Defence
mm	Millimetres
NEQ	Net Explosive Quantity
NFF	National Filling Factory
NGR	National Grid Reference
OD	Ordnance Datum
OS	Ordnance Survey
PM	Parachute Mine
PoW	Prisoner of War
RADAR	Radio Detection And Ranging
RAF	Royal Air Force
RN	Royal Navy
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SAA	Small Arms Ammunition
TA	Territorial Army
TNT	Trinitrotoluene
UK	United Kingdom
UN	United Nations
USAAF	United States Army Air Force
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V Weapons	*Vergeltungswaffen* – Vengeance Weapons
WD	War Department
WWI	World War One
WWII	World War Two

EXECUTIVE SUMMARY

Study Site

The Client has defined the Study Site as "Fambridge Road, RM8 1NS" and is centred on NGR 549138, 187415.

Risk Level

MEDIUM

Potential Threat Sources

The most probable UXO threat is posed by WWII *German* HE bombs and IBs whilst *British* AAA projectiles (which were used to defend against *German* bombing raids) pose a residual threat.

Risk Pathway

Whilst there is a residual UXO risk within this Study Site, 6 Alpha do not believe there is a significant risk pathway to warrant on-site pro-active UXO risk mitigation measures.

Key Findings

During WWII, the Study Site was situated within *Dagenham Municipal Borough,* which recorded 18 HE bomb strikes per 100 hectares, a low level of bombing.

Luftwaffe aerial reconnaissance photography associated with the Study Site did not identify any primary bombing targets on-site or within 1,000m of it.

ARP records associated with the Study Site did not note any HE bomb strikes within it however, six were recorded in the vicinity; 155m to the north-east, 200m to the south-east, 235m to the south-east, 255m to the south-south-west, 280m to the south-south-east and 300m to the east-south-east. In addition, a UXIB was recorded 75m to the west, with an analysis of additional bomb strike mapping noted IBs also impacting on *Temple Avenue* 45m to the west.

LCC bomb damage mapping did not cover the Study Site. Nonetheless, further research of historical records noted that the impact of an UXIB formed a bomb crater on *Temple Avenue* (45m to the west). In addition, analysis of 1945 aerial photography identified a clearance area on *Bennet Road* (800m to the north-west) which further research confirms was likely caused by bomb damage. In addition, further research noted that *Whalebone House* (780m to the north-north-west) was destroyed by bombing, and bomb damage was also identified on *Woodside Avenue* (865m to the north-west) and *Hainault Road* (890m to the north-north-west).

Pre-WWII mapping (1938) and aerial photography (1945) associated with the Study Site shows that it was located within a densely developed docklands area during WWII, with all three plots consisting of *Allotment Gardens*. As a result, it is considered likely that a local civilian would have observed and reported any UXB entry holes within the Study Site.

By 1971, structures had been built in all three plots – although none have seen significant development since then. Consequently, it is considered likely that any UXO within post-war disturbed and developed ground would potentially have been discovered and removed, however, the potential for deep buried UXO to be present within remaining areas is assessed to be extant.

Given that WWII bomb strikes were recorded in the vicinity of the Study Site, combined with the potential for the proposed works to encounter previously undisturbed ground, the following risk mitigation measures are recommended as a minimum, in order to reduce risks ALARP, during intrusive works in all previously undisturbed ground i.e. that which has not previously been excavated, probed, drilled or otherwise intrusively disturbed since it was potentially contaminated with UXO.

EXECUTIVE SUMMARY (…continued)

Recommended Risk Mitigation Measures Overview

"Open" Intrusive Works

Engineering Methodology	UXO Emergency Response Plan	UXO Safety and Awareness Briefing	On-Call EODE	UXO Risk Rating (Post-Mitigation)
Excavations	✔	✔	✔	**ALARP**

"Blind" Intrusive Works

Engineering Methodology	UXO Emergency Response Plan	UXO Safety and Awareness Briefing	On-Call EODE	UXO Risk Rating (Post-Mitigation)
Boreholes	✔	✔	✔	**ALARP**
Window Sampling	✔	✔	✔	

A full and detailed guide to the recommended risk mitigation measures is presented at Section 5 of this report.

For further information, please contact *6 Alpha Associates*:

Website: http://www.6alpha.com

Telephone: +44 (0)2033 713 900

Email: enquiry@6alpha.com

ASSESSMENT METHODOLOGY

Approach

6 Alpha Associates is an independent, specialist risk management consultancy practice, which has assessed the risk of encountering UXO (as well as buried bulk high explosives) at this Study Site, by employing a process advocated for this purpose by *CIRIA*. The *CIRIA* guide for managing UXO risks in the construction industry (C681) not only represents best practice but has also been endorsed by the *HSE*. Any risk mitigation solution is recommended *only* because it delivers the Client a risk reduced to ALARP at best value.

UXO hazards can be identified through the investigation of local and national archives associated with the Study Site, *MoD* archives, local historical sources, historical mapping as well as contemporaneous aerial photography (if it is available). Hazards will have only been recorded if there is specific information that could reasonably place them within the boundaries of the Study Site. The amalgamation of information is then assessed to enable the researcher to provide relevant and accurate risk mitigation practices.

The assessment of UXO risk is a measure of *probability of encounter* and *consequence of encounter*; the former being a function of the identified hazard and proposed development methodology; the latter being a function of the type of hazard and the proximity of personnel (and/or other 'sensitive receptors', such as equipment) to the hazard, at the moment of encounter.

If UXO risks are identified, the methods of mitigation we have recommended are considered reasonably and sufficiently robust to reduce them to ALARP. We advocate the adoption of the legal ALARP principle because it is a key factor in efficiently and effectively ameliorating UXO risks. It also provides a ready means for assessing the Client's tolerability of UXO risk. In essence, the principle states that if the cost of reducing a risk significantly outweighs the benefit, then the risk may be considered tolerable. This does not mean that there is never a requirement for UXO risk mitigation, but that any mitigation must demonstrate that it is beneficial. Any additional mitigation that delivers diminishing benefits and that consume disproportionate time, money and effort are considered *de minimis* and thus unnecessary. Because of this principle, UXB and UXO risks will rarely be reduced to zero (nor need they be).

Important Notes

Key source material is referenced within this document, whilst secondary/anecdotal information may be available upon request.

Although this report is up to date and accurate at the time of writing, our databases are continually being populated as and when additional information becomes available. Nonetheless, *6 Alpha* have exercised all reasonable care, skill and due diligence in providing this service and producing this report.

The assessment levels are based upon our professional opinion and have been supported by our interpretation of historical records and third-party data sources. Wherever possible, *6 Alpha* has sought to corroborate and to verify the accuracy of all data we have employed, but we are not accountable for any inherent errors that may be contained in third party data sets (e.g. *National Archive* or other library sources), and over which *6 Alpha* cannot exercise control.

STAGE ONE – STUDY SITE LOCATION AND DESCRIPTION

Study Site

The Client has defined the Study Site as "Fambridge Road, RM8 1NS". The Study Site is centred at NGR 549138, 187415 as presented at *Figures 1* and *2,* respectively.

Location Description

The Study Site is situated within the *London Borough of Barking and Dagenham* and totals an area of 0.17 hectares (ha).

Furthermore, the Study Site is bounded by:

- North: *Fambridge Road;*
- East: *Fambridge Road* and *Temple Avenue;*
- South: *Fambridge Road* and undeveloped ground*;*
- West: *Fambridge Road*, various structures, and undeveloped ground.

Aerial Photography (2020) (*Figure 3*)

Current aerial photography corroborates the information above and shows that the Study Site is situated within a densely developed urban area. The Study Site itself consists of three plots, with each plot consisting of at least one structure and areas of hardstanding,

Proposed Works

The Client has informed *6 Alpha* of the following proposed works:

"We are proposing to undertake a one-day, 3-4 window sample holes at each site by way of preliminary ground investigation to a maximum depth of 6m bgl with installations for groundwater and ground gas monitoring purposes."

Ground Conditions

It is important to establish the specific ground conditions in order to determine the maximum *German* UXB penetration depth as well as the potential for other types of munitions to be buried.

If the site investigations and/or construction methodologies change, and/or if a specific methodology is to be employed, and/or if the scope of work is focused upon a specific part of the Study Site, then *6 Alpha* are to be informed so that the prospective UXO risks and the associated risk mitigation methodology might be re-assessed. Certain ground conditions may also constrain certain types of UXO risk mitigative works e.g. magnetometer survey is adversely affected in mineralised and made ground.

It is important to establish the provenance of made ground, where this is recorded as being part of the ground make-up, in order to accurately determine the ground levels at the time when UXO contamination may have occurred so as to accurately determine the average/maximum bomb penetration depths and subsequently to make appropriate recommendations aimed at reducing the risk to ALARP.

STAGE ONE – STUDY SITE LOCATION AND DESCRIPTION (…continued)

Ground Conditions

BGS borehole log "TQ48NE232 – Whalebone Lane South Chadwell Heath Essex 2" (located 430m to the west-south-west form the northern plot of the Study Site), recorded the following strata:

Depth bgl (m)	Strata	Description
0.00m to 1.00m	Made Ground	Dark brown, very silty sand topsoil/clay fill with flint.brick, concrete and occasional slate fragments.
1.00m to 2.00m	Sand	Dense clayey SAND with flint fragments
2.00m to 3.00m	Sand/Gravel	Very dense medium to coarse SAND with fine to medium subangular to rounded flint GRAVEL.
3.00m to 4.00m	Sand/Gravel	Very dense, fine, medium, coarse to cobble GRAVEL with medium to coarse SAND.
4.00m to 7.00m	Clay	Stiff, light reddish brown, silty waxy CLAY.

In addition, the *British Geological Survey* describes the general area as being comprised of *"London Clay Formation – Clay, Silt And Sand"*.

STAGE TWO – REVIEW OF HISTORICAL DATASETS

Sources of Information Consulted

The following primary information sources have been used in order to establish the background UXO threat:

1. *6 Alpha*'s *Azimuth* Database;
2. *Home Office* WWII Bomb Census Maps;
3. WWII and post-WWII aerial photography;
4. Official Abandoned Bomb Register;
5. Information gathered from the *National Archives* at *Kew*;
6. Historic UXO information provided by *33 Engineer Regiment* (Explosive Ordnance Disposal) at *Carver Barracks, Wimbish*.

Potential Sources of UXO Contamination

In general, there are several activities that might contaminate a site with UXO, but the three most common ways are: legacy munitions from military training/exercises; deliberate or accidental dumping (AXO) and ordnance resulting from war fighting activities (also known as the Explosive Remnants of War (ERW)).

During WWII, the *Luftwaffe* undertook bombing campaigns all over the *UK*. The most common type of UXO discovered today is the aerially delivered high explosive (HE) bomb, which are comparatively thick-skinned and were dropped from *Luftwaffe* aircraft. If the bomb did not detonate when it was dropped, the force of impact enabled the UXO to penetrate the ground, often leaving behind it a UXB entry hole. These entry holes were not always apparent, and some went unreported, leaving the bomb buried and unrecorded. More rarely, additional forms of *German* UXO are occasionally discovered including *inter alia V1* and *V2* rockets, Incendiary Bombs (IBs), and Anti-personnel (AP) bomblets.

Although the *Luftwaffe* had designated primary bombing targets across the *UK*, their high-altitude night bombing was not accurate. As a result, thousands of buildings were damaged and civilian fatalities were common. Bombs were also jettisoned over opportunistic targets and residential areas were sometimes struck.

As the threat of invasion lingered over *Britain* during WWII, defensive actions were undertaken. The *British* and *Allied Forces* requisitioned large areas of land for military training and bomb storage (including HE bombs, naval shells, artillery and tank projectiles, explosives, LSA and SAA). Thousands of tonnes of these munitions were used for the *Allied Forces* weapon testing and military training alone. It has been estimated that at least 20 per cent of the *UK*'s land has been used for military training at some point.

The best practice guide for dealing with your UXO risks on land (CIRIA publication C681) suggests that approximately 10 per cent of all munitions deployed failed to function as designed. ERW are therefore, still commonly encountered, especially whist undertaking construction and civil engineering groundwork.

Furthermore, in exceptional circumstances, UXO is discovered unexpectedly and without apparent rational explanation. There are several ways this might occur:

- When *Luftwaffe* aircraft wished to swiftly escape e.g. from an aerial attack, they would jettison some or all of their bombs and flee. This is commonly referred to as *tip and run* and it has resulted in bombs being found in unexpected locations;
- Transportation of aggregate containing munitions to an area that was previously free of UXO, usually related to construction activities employing material dredged from a contaminated offshore borrow site;
- Poor precision during targeting (due to high altitude night bombing and/or poor visibility) resulted in bombs landing off target, but within the surrounding area;
- *British* decoy sites were also constructed to deliberately cause incorrect targeting. For obvious reasons, such sites were often built in remote and uninhabited areas.

Study Site Development History From an analysis of the CS and OS historical mapping associated with the Study Site, the following history can be deduced:	
Year	Analysis
1898 CS Map	The Study Site was located in a largely undeveloped rural area. The Study Site did not consist of any structures.
1921 CS Map	Changes were not recorded at the Study Site.
1938 CS Map	*Allotment Gardens* had been labelled in all three plots of the Study Site.
1951 OS Map	Changes were not recorded at the Study Site.
1961 OS Map	*Playing Fields* had been labelled in the southern plot.
1971 OS Map	Numerous small structures were constructed in the three plots, and *Allotment Gardens* were no longer labelled on-site.
1999 Aerial Photography	Hardstanding was visible across all three plots.
2013 Aerial Photography	Changes were not recorded at the Study Site.
2018 Aerial Photography	Additional Structures were noted in the southern plot
2019 Aerial Photography	Structures in the southern plot were partially cleared,
2021 OS Map	Changes were not recorded at the Study Site.

The Study Site history assessment is our best interpretation of the data available at the time of writing. Given that yearly revisions of neither CS and OS mapping, nor aerial photography, are available for analysis, there are gaps between the mapping revisions.

Consequently, it should not be assumed that any new structures and/or features that are labelled on a map revision were constructed, developed, installed or demolished in the exact year that the mapping illustrates the change. It is possible – and indeed likely – that the exact date of development occurred somewhere between the two closest mapping revisions. Specifically, this may be particularly relevant where there is a gap between pre and post-WWII mapping, as it may not be clear whether structures were present during WWII or if they were constructed in the post-WWII period.

WWII Site Use (*Figure 4*)

The CS mapping prior to WWII (1938) and 1945 aerial photography shows that the Study Site was located within a densely developed docklands area during WWII, with all three plots consisting of *Allotment Gardens*. As a result, it is considered possible that a local civilian would have observed and reported any UXB entry holes which would have been dealt with at the time.

WWII Bombing of *London*

The most intensive period of bombing over *London* was the nine months between October 1940 and May 1941, known as 'The Blitz'. During this period the *Luftwaffe* attempted to overwhelm *Britain's* air defences, destroy key military and industrial facilities, as well as logistical capabilities, prior to invasion.

A total of 18,000 tons of bombs were dropped on *London* between 1940 and 1945. Many residential, commercial and industrial buildings were targeted during air raids and sustained large scale damage. Public services were also affected, with gas, electricity and water supplies often cut-off following damage to either the installations themselves or to the supply infrastructure. In addition, thousands of civilians were killed and injured, and many were forced to evacuate as their homes were destroyed.

WWII HE Bomb Density (*Figure 5*)

The Study Site was located within *Dagenham Municipal Borough,* which recorded 18 HE bombs per 100 hectares, a low level of bombing.

WWII Luftwaffe Bombing Targets

Prior to WWII, the *Luftwaffe* conducted numerous aerial photographic reconnaissance missions over *Britain*, recording key military, industrial and commercial facilities for attack, in the event of war. In addition, logistics infrastructure and public services, such as railways, canals, power stations, reservoirs, water and gas works were also considered viable bombing targets.

Luftwaffe aerial reconnaissance photography associated with the Study Site did not identify any primary bombing targets on-site or within 1,000m of it.

WWII HE Bomb Strikes (*Figure 6*)

During WWII, ARP wardens compiled detailed logs of bomb strikes across their respective districts. However, ARP records associated with the Study Site did not note any HE bomb strikes within it. Nonetheless, six were recorded in the wider area; 155m to the north-east, 200m to the south-east, 235m to the south-east, 255m to the south-south-west, 280m to the south-south-east and 300m to the east-south-east. Further research also identified an additional HE bomb strike on *Albert Road* 150m to the south-south-west.

Furthermore, whilst IBs may have fallen within the Study Site, they fell in such large numbers that accurate record keeping was either non-existent or perfunctory therefore, their prospective presence cannot be either corroborated or discounted. Nonetheless, IB strikes were noted 45m to the west, 255m to the south, 465m to the south and 815m to the south-west. In addition, five parachute mines were recorded impacting; 730m to the west, 775m to the north-north-west, 825m to the north-west, 825m to the north-west and 860m to the north-west. Finally, four AA shells were noted landing; 365m to the north-west, 430m to the north-west, 905m to the north-west and 990m to the west-south-west.

In addition to IBs and HE bomb strikes, during the latter part of the war when aerial bombing had significantly declined, the main threat came from *V* type weapons. The first recorded *V1* strike on *London* was on the 13th June 1944, with the first recorded *V2* strike on *London* on the 8th September 1944. *V1* and *V2* rockets were thin-skinned, unmanned and inaccurate weapons. One *V1* rocket strike was recording landing 615m to the north-west, and two *V2* rocket strikes 915m to the west and 990m to the north-west. Further research also identified an additional *V2* rocket strike 190m to the east-north-east.

The potential penetration depth of an UXB was dependent on a number of factors including but not restricted to those prior to striking the ground e.g. velocity and orientation of the UXB which in turn will be influenced on factors such as the release altitude from the aircraft and encounters with infrastructure during its fall; those encountered at the point of impact i.e. was the impact on concrete, grass, water etc. and finally, the below ground level conditions which were encountered such as infrastructure e.g. services, basements, foundations, and geology e.g. made ground, clay, sand, etc. Further, as the UXB penetrated the ground, it's velocity naturally slowed where, it either came to an abrupt stop e.g. against foundations or would continue for 10's of feet along a route of least resistance which often resulted in a curving of the trajectory back towards the surface. This is known as the "J Curve" effect and often resulted in a considerable horizontal off-set from the point of entry. This is often the reason why UXBs have been discovered against or under the foundations of buildings, which were present during WWII, or many meters from the point of impact.

WWII Bomb Damage

LCC bomb damage mapping did not cover the Study Site. Nonetheless, further research of historical records noted that the impact of an UXIB formed a bomb crater on *Temple Avenue* (45m to the west). In addition, analysis of 1945 aerial photography identified a clearance area on *Bennet Road* (800m to the north-west) which further research confirms was likely caused by bomb damage. In addition, further research noted that *Whalebone House* (780m to the north-north-west) was destroyed by bombing, and bomb damage was also identified on *Woodside Avenue* (865m to the north-west) and *Hainault Road* (890m to the north-north-west).

Abandoned Bombs

An examination of the official abandoned bomb records did not identify any abandoned bomb on-site, or within 1,000m of the Study Site boundary.

Records of WWII UXB Disposal Tasks

An examination of the civil defence records listing UXBs dealt with in the *Borough of Barking and Dagenham* from 1940-45 has identified the following tasks within the Study Site's vicinity:

- One 50kg UXIB was removed from *Temple Avenue between Albert/Brendon Road* (located 115m to the south-west) on the 20th April 1944;
- One 50kg UXIB was removed from *Whalebone Lane South, between Roundabout & Cinema* (located approximately 435m to the south-west) on the 20th April 1944;
- One UXB was removed from *Outside Three Travellers Public House, Becontree Heath* (located 455m to the south-south-west) on the 23rd September 1940;
- One 6ft *Italian UXIB* was removed from *Open Field, rear of Tripton's School, Green Lane* (situated 520m to the south-west) on the 28th December 1940.

In addition, an analysis of ARP mapping associated with the Study Site identified six UXB encounters within 1,000m of the Study Site during WWII; 400m to the south-west, 420m to the west, 420m to the north-west, 420m to the south, 430m to the south and 440m to the south-east. Furthermore, four UXIBs were recorded; 75m to the west, 120m to the south-west, 420m to the south-west, and 835m to the south-west. Finally, five unexploded AA shells (UXAA) were also recorded; 475m to the north-west, 645m to the south-west, 670m to the west-south-west, 690m to the north-west and 925m to the north-west.

Records of Post-WWII UXB Disposal Tasks

An examination of the post-WWII BDO tasks associated with the area has not identified any BDO operations within the Study Site itself, however the following tasks were undertaken in the area:

- The removal of the remnants of one phosphorus IB, found during construction, on *Temple Avenue* (located 45m to the west at its closest point) on the 16th July 2013.

Military Activity

One pillbox was located 990m to the south-east during WWII. Further research could not corroborate whether military personnel were previously stationed in the pillbox, but in any case it is considered highly unlikely that munitions were stored, located and/or fired from this Study Site during WWII or that military training would have taken place.

Sources of UXO Contamination

The most likely source of UXO contamination is from *German* aerially delivered ordnance, which ranges from small IBs through to large HE bombs (the latter forms the principal threat). Additional residual contamination may be present from *British* AAA projectiles (which were used to defend the UK against *German* bombing raids).

STAGE THREE – DATA ANALYSIS

Variable	Result	Comment
Was the area considered to be a primary bombing target?	✗	No primary targets were identified within 1,000m.
Was the Study Site or the immediate area bombed during WWII?	✓	ARP records identified six HE bomb strikes within 300m, the closest being 155m to the north-east.
Did the Study Site or the immediate area experience bomb damage?	✓	Potential bomb damage was identified 45m to the west.
Was the ground undeveloped during WWII?	✗	The Study Site consisted of *Allotment Gardens* during WWII.
Would the footfall have been high in the area?	✓	Given that *Allotment Gardens* were located on-site and in the immediate vicinity, it is likely that footfall would have been relatively frequent.
Would a UXB entry hole have been observed during WWII?	✓	Given that footfall would have been moderately high, it is likely a UXB entry hole would have been observed.
Have military personnel ever occupied the Study Site?	✗	No military facilities were identified on-site or in the immediate vicinity.
Would munitions have been manufactured, stored and/or fired from the Study Site?	✗	There is no evidence to suggest munitions were located or fired from this Study Site.
Would previous intrusive works have removed the potential for UXO to be present?	✗	The Study Site has been subjected to some redevelopment; therefore, it is likely that any UXO within post-war disturbed and developed ground would potentially have been discovered and removed, whilst the surrounding areas remain extant.
Are proposed intrusive works likely to extend into previously undisturbed ground?	✓	Some areas of the Study Site have remained undeveloped since WWII and therefore some proposed works may extend into previously undisturbed ground.
Is there potential for an unplanned encounter with UXO to occur during proposed intrusive works?	✓	Given that WWII bomb strikes were recorded in the vicinity, it is considered possible for an unplanned encounter with UXO to occur.
Does the probability of UXO vary across the Study Site?	✓	The probability of discovering UXO within post-war disturbed and developed ground is considered to be remote, however, the probability of UXO discovery within all previously undisturbed areas of the Study Site is extant.

N.B. The ✓ / ✗ symbology is intended to act only as a succinct visual indicator as to whether the data analysis has returned a positive (i.e. ✓) or negative (✗) answer to each question concerning the potential for UXO contamination at the Study Site.

STAGE FOUR – RISK ASSESSMENT

Threat Items

The most probable UXO threat items are *German* HE bombs and IBs whilst *British* AAA projectiles pose a residual threat. The consequences of initiating *German* HE bombs are more severe than initiating IBs or AAA projectiles, and thus they pose the greatest prospective risk to intrusive works.

Bomb Penetration Depth

Considering the ground conditions (highlighted in Stage 1), the average BPD for a 250kg *German* HE bomb is assessed to be approximately 6m bgl, with the maximum BPD considered to be approximately 15m bgl. Although it is possible that the *Luftwaffe* deployed larger bombs in the area, their deployment was infrequent, and to use such larger (or the largest) bombs for BPD calculations are not justifiable on either technical or risk management grounds.

WWII *German* bombs have a greater penetration depth when compared to IBs and AAA projectiles, which are unlikely to be encountered at depths greater than 1m bgl. However, due to the "J Curve" and the potential for structures to impede the penetration into the ground, HE bombs have been discovered at much shallower depths than the average.

Risk Pathway

Whilst there is a residual UXO risk within this Study Site, 6 Alpha do not believe there is a significant risk pathway to warrant on-site pro-active UXO risk mitigation measures. Whilst not all UXO encountered aggressively will initiate upon contact, such a discovery could lead to serious impact on the project especially in terms of critical injury to personnel, damage to equipment and project delay.

Prospective Consequences

Consequences of UXO initiation include:

1. Fatally injure personnel;
2. Severe damage to plant and equipment;
3. Deliver blast and fragmentation damage to nearby buildings;
4. Rupture and damage underground utilities/services.

Consequences of UXO discovery include:

1. Delay to the project and blight;
2. Disruption to local community/infrastructure;
3. The expenditure of additional risk mitigation resources and EOD clearance;
4. Incurring additional time and cost.

UXO RISK CALCULATION

Site Activities

Although there is some variation in the probability of encountering and initiating items of UXO when conducting different types of intrusive activities, a number of investigative and construction methodologies have been described for analysis at this Study Site. The consequences of initiating UXO vary greatly, depending upon, *inter alia* the mass of HE in the UXO and how aggressively it might be encountered. For this reason, *6 Alpha* has conducted separate risk rating calculations for each investigative and construction methodology that might be employed.

Risk Rating Calculation

6 Alpha's Semi-Quantitative Risk Assessment assesses and rates the risks posed by the most probable threat items when conducting a number of different activities on the site. Risk Rating is determined by calculating the probability of encountering UXO and the consequences of initiating it.

UXO Risk Calculation Table – All Areas				
Activity	**Threat Item**	**Probability (SH+EM=P)**	**Consequence (D+PSR=C)**	**Risk Rating (PXC=RR)**
Window Sampling	HE Bombs	1+3=4	3+2=5	4x5=20
	AAA Projectiles	1+3=4	3+1=4	4x4=16
	IBs	2+3=5	3+1=4	5x4=20
Boreholes	HE Bombs	1+3=4	3+2=5	4x5=20
	AAA Projectiles	1+3=4	3+1=4	4x4=16
	IBs	2+3=5	3+1=4	5x4=20
Excavations	HE Bombs	1+2=3	3+3=6	3x6=18
	AAA Projectiles	1+2=3	3+1=4	3x4=12
	IBs	2+2=4	3+1=4	4x4=16
Abbreviations – Site History (SH), Engineering Methodology (EM), Probability (P), Depth (D), Consequence (C), Proximity to Sensitive Receptors (PSR) and Risk Rating (RR).				

STAGE FIVE – RECOMMENDED RISK MITIGATION MEASURES

Do the ground conditions support a geophysical UXO survey?

Non-Intrusive Methods of Mitigation – Magnetometer results may be affected by ferro-magnetic contamination due to previous construction activities and made ground within the Study Site.

Intrusive Methods of Mitigation – Intrusive magnetometry may be effective on this Study Site, prior to boreholing especially. However, any ferrous metal/red brick contamination in made ground/old foundations may affect the detection capability of the UXB survey equipment, as it passes through the contaminated layer especially. Nonetheless, beyond the contaminated strata such a survey should prove effective.

Mitigation Measures to Reduce Risk to 'ALARP'

Activity	Risk Mitigation Measures	Final Risk Rating
All Activities in All Areas	**1. Operational UXO Emergency Response Plan;** appropriate site management documentation should be held on-site to guide and plan for the actions which should be undertaken in the event of a suspected or real UXO discovery (this plan can be supplied by *6 Alpha*); **2. UXO Safety & Awareness Briefings;** the briefings are essential when there is a possibility of explosive ordnance encounter and are a vital part of the general safety requirement. All personnel working on the site should receive a briefing on the identification of a UXB, what actions they should take to keep people and equipment away from such a hazard and to alert site management. Information concerning the nature of the UXB threat should be held in the site office and displayed for general information on notice boards, both for reference and as a reminder for ground workers. The safety awareness briefing is an essential part of the *Health & Safety Plan* for the site and helps to evidence conformity with the principles laid down in the *CDM* regulations 2015 (this brief can be delivered directly, or in some cases remotely, by *6 Alpha*). **3. On-Call Engineer**; An on-call EOD Engineer will be able to identify and/or advise on the appropriate course of action in the event of any suspicious and/or real UXO finds. *6 Alpha* offer three tiers of immediate telephone and/or email response.	**ALARP**

This assessment has been conducted based on the information provided by the Client, should the proposed works change then *6 Alpha* should be re-engaged to refine this risk assessment

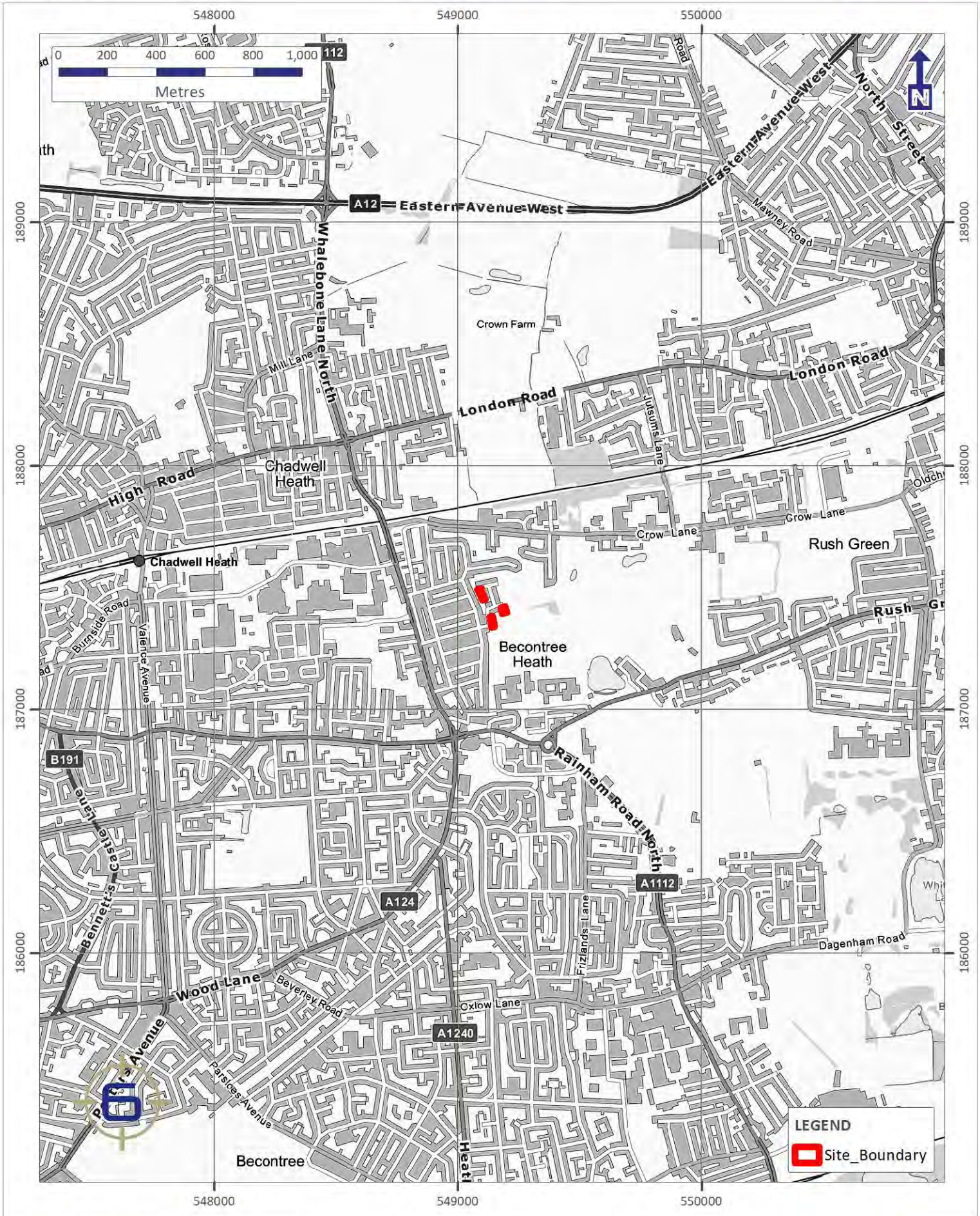
Report Figures

Figure One - Study Site Location

FAMBRIDGE ROAD, RM8 1NS

Site Location

BRITISH NATIONAL GRID



PROJECT NO.	FIGURE	DRAWN	CHECKED	DATE		
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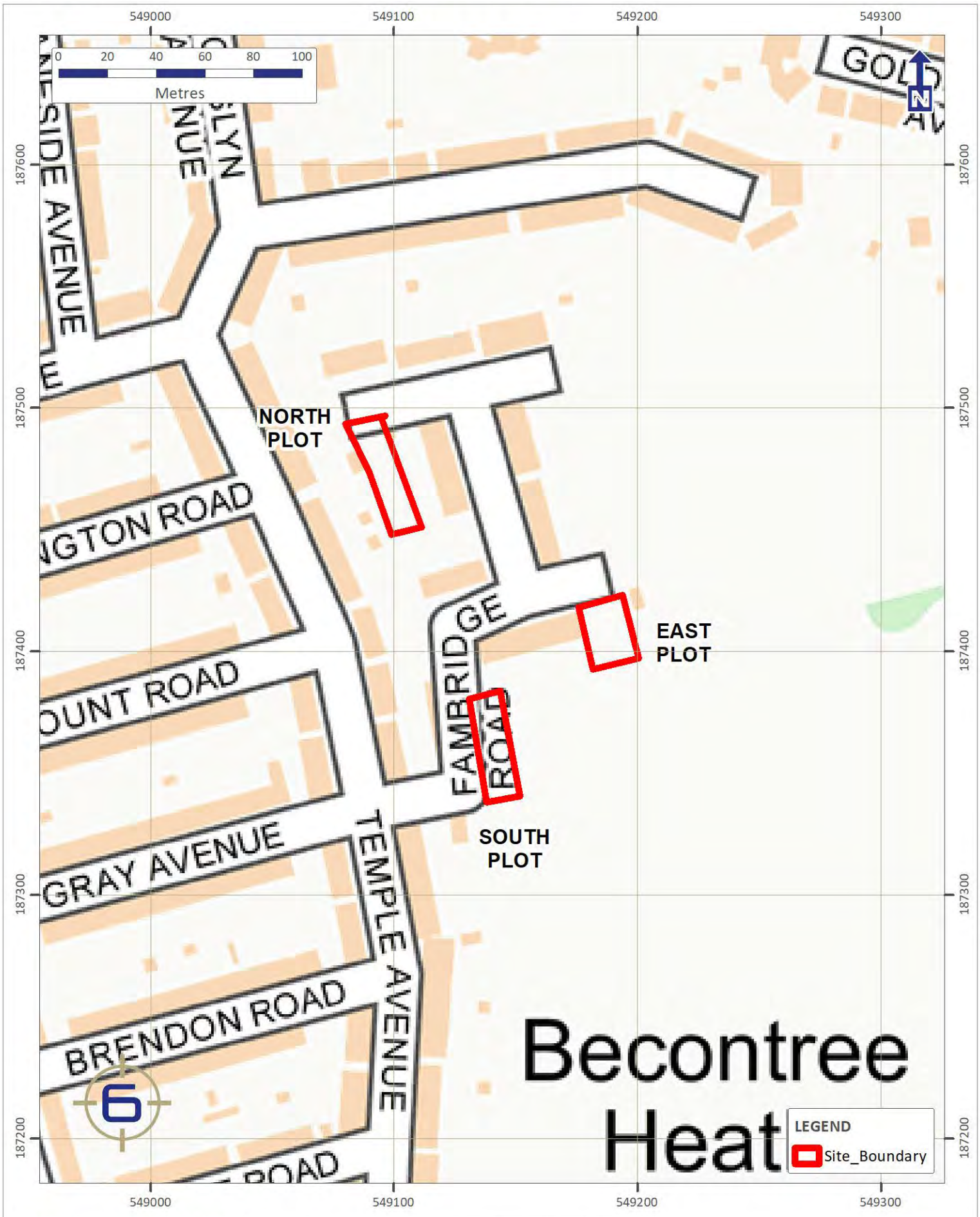
Figure Two - Study Site Boundary

BRITISH NATIONAL GRID

FAMBRIDGE ROAD, RM8 1NS

Site Boundary

BOMB SEARCH
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Figure Three - Aerial Photography (2020)

BRITISH NATIONAL GRID

FAMBRIDGE ROAD, RM8 1NS

Aerial Photography (2020)

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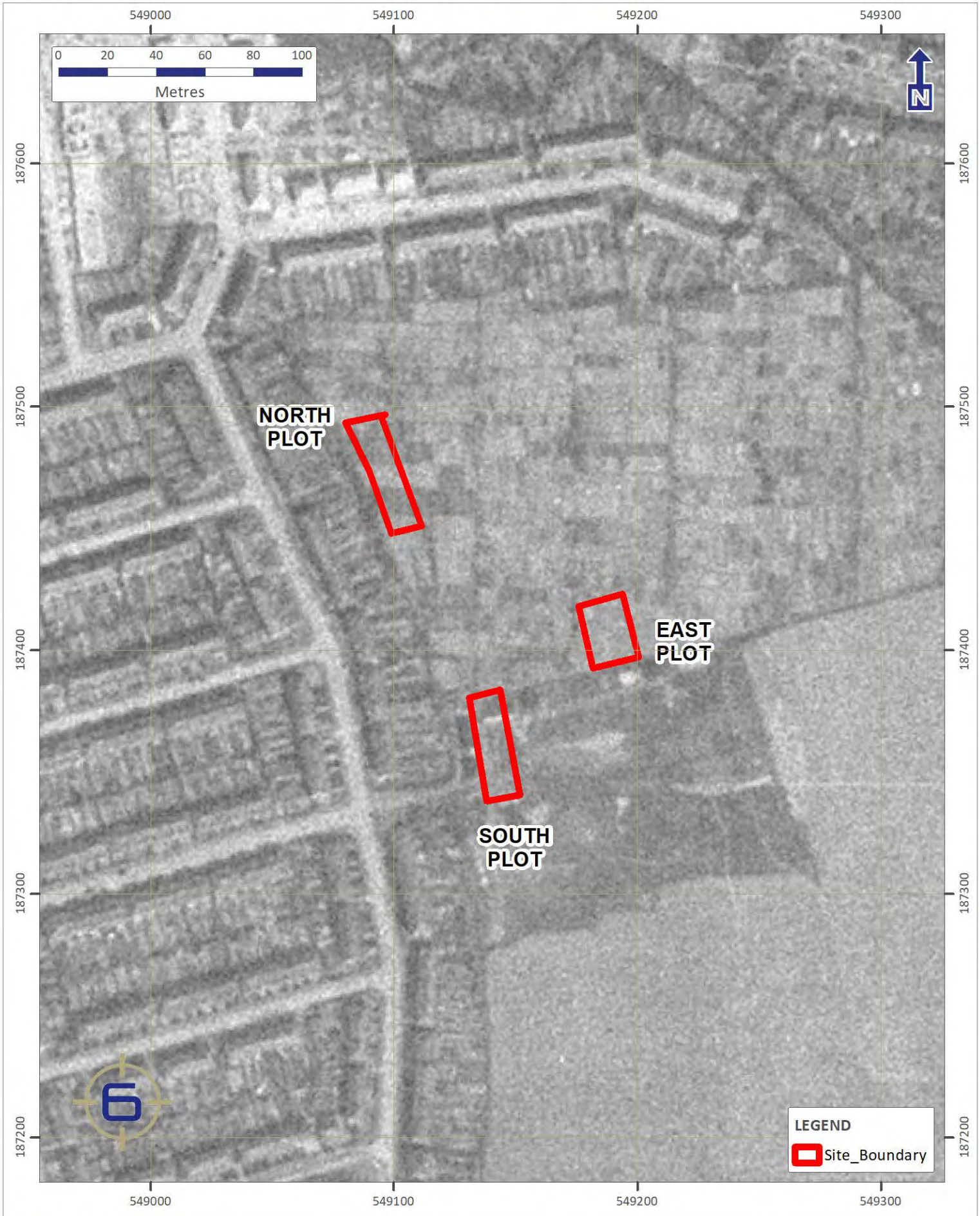
Figure Four - Aerial Photography (1945)

BRITISH NATIONAL GRID

FAMBRIDGE ROAD, RM8 1NS

Aerial Photography (1945)

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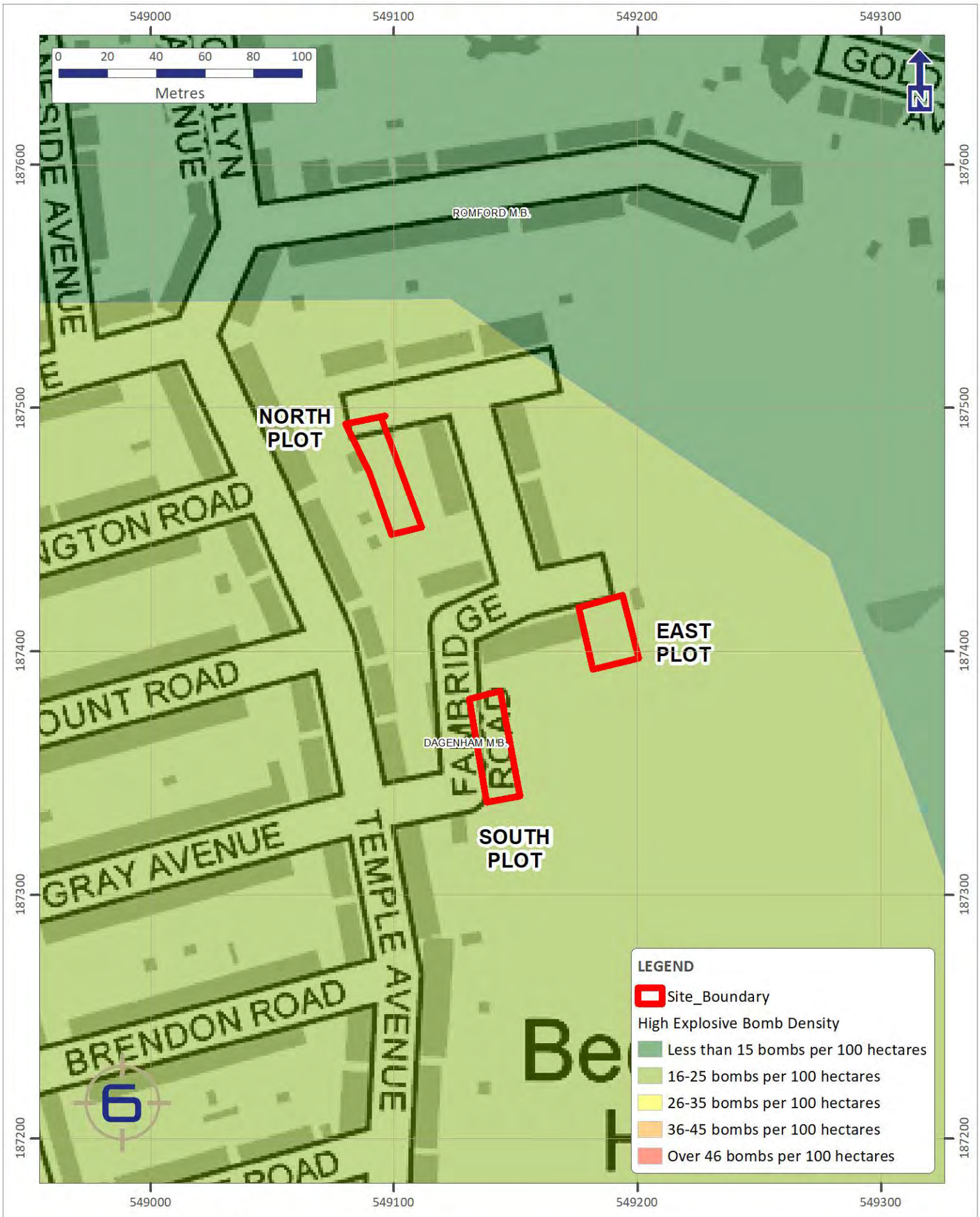
Figure Five - WWII High Explosive Bomb Density

BRITISH NATIONAL GRID

FAMBRIDGE ROAD, RM8 1NS

WWII High Explosive Bomb Density

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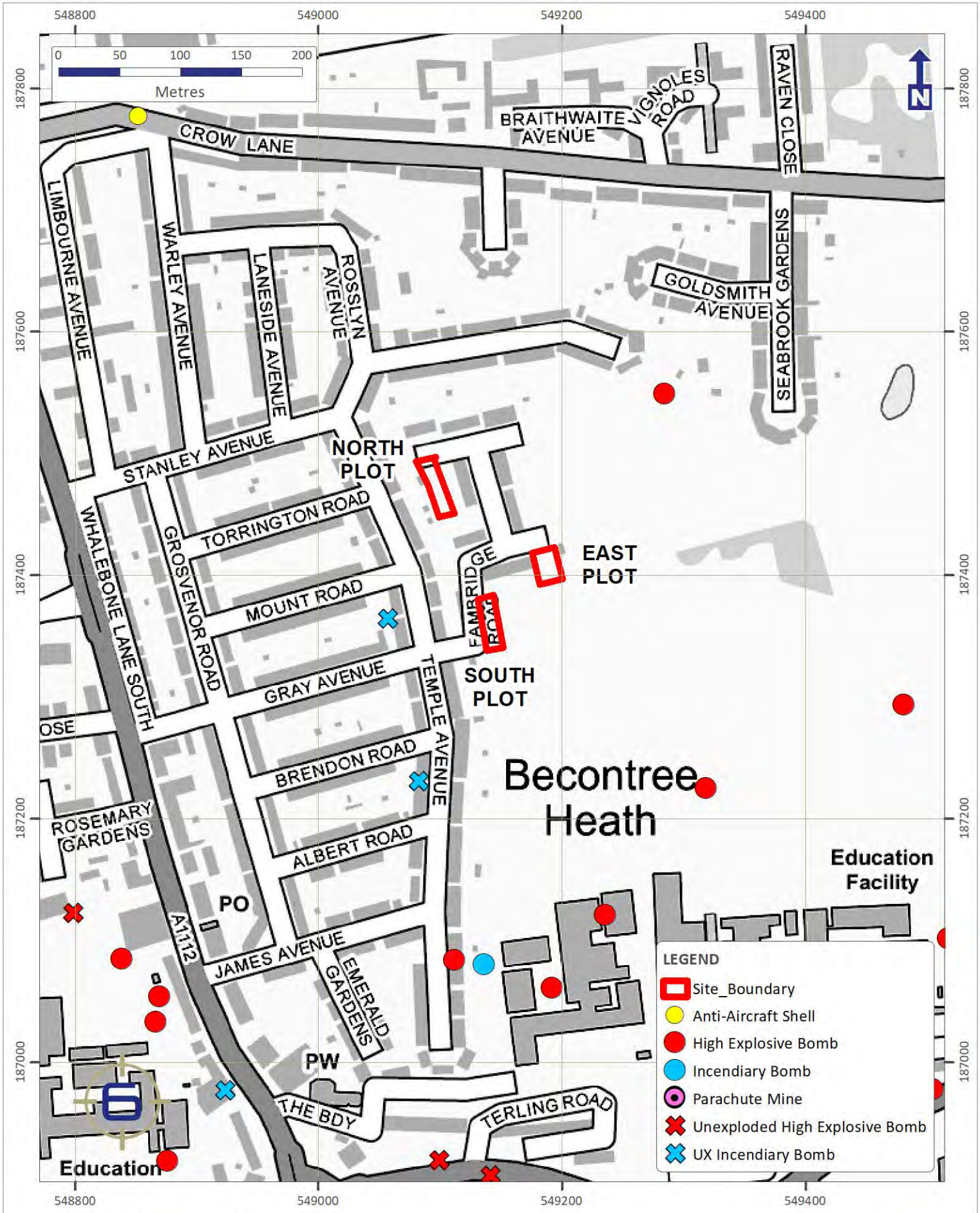
Figure Six - WWII Consolidated Bomb Strikes

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FAMBRIDGE ROAD, RM8 1NS

WWII Consolidated Bomb Strikes

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APPENDIX E

Exploratory Hole Plan



LEGEND

- SITE BOUNDARY
- EXPLORATORY HOLE LOCATION
- NOT DRILLED

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 2.25 4.5 9 13.5 18 22.5 Metres

TITLE:

EXPLORATORY HOLE LOCATION PLAN

SITE :

FAMBRIDGE ROAD

CLIENT : **BE FIRST REGENERATION LTD (ON BEHALF OF LONDON BOROUGH OF BARKING & DAGENHAM)**

PROJECT : **10046791**	**FIGURE 1**
DATE : 19/10/21	DRAWN BY : AP
DRG No. : 10046791-AUK-XX-XX-DR-ZZ-0135-P1 GIS	
SCALE : **1 : 600**	PRINT : **A3**

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APPENDIX F

Exploratory Hole Logs

Dynamic Sample Borehole Log

WS0601

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**15.07**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549089.40**	**187490.89**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES		TESTS		PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
(ES1) 0.40	PID (1) 0.40	3.3ppm				MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.13) 0.13	14.94	
						MADE GROUND: greyish brown sandy GRAVEL with low cobble content. Sand is medium to coarse. Gravel is subangular fine to coarse limestone type 1 material. Cobbles are up to 10cm angular bricks (~5%).		(0.27) 0.40	14.67	

DRILLING TECHNIQUE			CHISELLING			WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
From	To	Type	Hard Strata From	Hard Strata To	Duration	Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	0.13	Inspection Pit																
0.13	0.40	Inspection Pit																

Remarks

Concrete corer from 0.00m to 0.13m.
Refusal in handpit.

Termination Depth: 0.40m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0602

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**15.11**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549095.57**	**187476.26**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES		TESTS		PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
(ES1) 0.30	PID (2) 0.30	2.3ppm				MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.17) 0.17	14.94	
						MADE GROUND: orangish brown slightly silty gravelly SAND.		(0.16) 0.33	14.82	
						MADE GROUND: dark brown slightly silty sandy GRAVEL.			14.78	

DRILLING TECHNIQUE		
From	To	Type
0.00	0.17	Inspection Pit
0.17	0.33	Inspection Pit

CHISELLING		
Hard Strata From	Hard Strata To	Duration

WATER OBSERVATIONS					
Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed

HOLE/CASING DIAMETER			
Hole Dia.	Depth	Casing Dia.	Depth

WATER ADDED		
From	To	Volume (ltr)

Remarks

Concrete corer from 0.00m to 0.17m.
Refusal in handpit.

Termination Depth: 0.30m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0603

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**15.10**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549104.97**	**187453.07**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES	TESTS			PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
(ES1) 0.20-0.30 (D2) 0.30-0.40						MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.18) 0.18	14.92	
(B3) 0.50-1.20 (ES4) 0.60-0.70						MADE GROUND: greyish brown slightly silty gravelly SAND. with medium cobble content Sand is fine to coarse. Gravel is angular fine to coarse limestone type 1 material. Cobbles are up to 15cm angular bricks (~10%).		(0.32) 0.50	14.60	
	SPT(S) 1.20	N=30 (2,4/6,8,6,10)				Dense orangish brown with light grey gravelly SAND. Sand is medium to coarse. Gravel is subangular to subrounded fine to coarse flint.		(1.50)		
	SPT(S) 2.00	N>50 (3,12/12,12,15,11 for 25mm)						2.00	13.10	

DRILLING TECHNIQUE			CHISELLING			WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
From	To	Type	Hard Strata From	Hard Strata To	Duration	Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00 0.18 1.20	0.18 1.20 2.00	Inspection Pit Inspection Pit Window Sample																

Remarks

Concrete corer from 0.00m to 0.18m.
Refusal on SPT at 2.00m.

Termination Depth: 2.00m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Dando Terrier Rig**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0604

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**14.73**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549183.67**	**187416.42**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES	TESTS			PROGRESS		STRATA		Depth (Thickness)	Level	Install/ Backfill
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend			
						MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.20) 0.20	14.52	
(ES1) 0.30-0.40	PID (1) 0.30	1.1ppm				MADE GROUND: dark brown slightly silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse limestone type 1 material. Cobbles are up to 8cm angular bricks (~5%).		(0.30) 0.50	14.22	
(B2) 0.50-1.05 (ES3) 0.60-0.70										
	PID (2) 0.90	<1ppm				Orange sandy gravelly CLAY. Sand is medium to coarse. Gravel is subrounded fine to coarse flint.		(0.55) 1.05	13.68	

DRILLING TECHNIQUE			CHISELLING			WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
From	To	Type	Hard Strata From	Hard Strata To	Duration	Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00 0.20	0.20 1.05	Inspection Pit Inspection Pit																

Remarks

Concrete corer from 0.00m to 0.20m.
Refusal in handpit.

Termination Depth: 1.05m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0605

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**14.69**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549188.55**	**187399.99**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES		TESTS		PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
(ES1) 0.30-0.40	PID (1) 0.40	1.7ppm				MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.15) 0.15	14.54	
(ES2) 0.70-0.80	PID (2) 0.80	<1ppm				MADE GROUND: black angular to subangular medium to coarse limestone type 1 GRAVEL.		(0.19) 0.19 (0.41) 0.60	14.50	
						MADE GROUND: Very soft dark brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse brick fragments. Cobbles are up to 8cm angular medium strong red bricks (~5%).		(0.35) 0.95	14.09	
						Orangish brown with grey gravelly very sandy CLAY. Sand is medium to coarse. Gravel is subrounded fine to coarse flint.			13.74	

DRILLING TECHNIQUE		
From	To	Type
0.00	0.15	Inspection Pit
0.15	0.95	Inspection Pit

CHISELLING			
Hard Strata From	Hard Strata To	Duration	

WATER OBSERVATIONS					
Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed

HOLE/CASING DIAMETER			
Hole Dia.	Depth	Casing Dia.	Depth

WATER ADDED		
From	To	Volume (ltr)

Remarks

Concrete corer from 0.00m to 0.15m.
Refusal in handpit.

Termination Depth: 0.95m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0607

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**15.61**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549144.14**	**187356.67**	**10/06/2021**	**Sheet 1 of 1**

SAMPLES	TESTS			PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
						MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.15) 0.15	15.46	
						MADE GROUND: black and orangish brown mottled gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to coarse limestone type 1 material.		0.20	15.40	

DRILLING TECHNIQUE			CHISELLING			WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
From	To	Type	Hard Strata From	Hard Strata To	Duration	Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	0.15	Inspection Pit																
0.15	0.20	Inspection Pit																

Remarks

Concrete corer from 0.00m to 0.15m.
Refusal in handpit.

Termination Depth: 0.20m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

Dynamic Sample Borehole Log

WS0608

Project	Project No.	Ground Level (mAOD)	Start Date	Scale
London Borough of Barking and Dagenham	**10046791**	**15.61**	**24/05/2021**	**1:50**
Client	Easting (OS mE)	Northing (OS mN)	End Date	
Be First Regeneration Ltd.	**549140.81**	**187373.73**	**09/06/2021**	**Sheet 1 of 1**

SAMPLES	TESTS			PROGRESS		STRATA				
Type + Depth	Type + Depth	Results	Water Depth	Date & Time	Casing & Water Depth	Description	Legend	Depth (Thickness)	Level	Install/ Backfill
(ES1) 0.20-0.30	PID (1) 0.20	1.3ppm				MADE GROUND: medium strong light grey CONCRETE with mixed aggregates of angular to rounded gravel.		(0.16) 0.16	15.45	
						MADE GROUND: black and orangish brown gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to coarse limestone type 1 material. Potential ACM		(0.14) 0.30	15.31	

DRILLING TECHNIQUE			CHISELLING			WATER OBSERVATIONS						HOLE/CASING DIAMETER				WATER ADDED		
From	To	Type	Hard Strata From	Hard Strata To	Duration	Date/Time	Strike At	Time (mins)	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	From	To	Volume (ltr)
0.00	0.16	Inspection Pit																
0.16	0.30	Inspection Pit																

Remarks

Concrete corer from 0.00m to 0.16m.
Hole terminated owing to potential asbestos containing material found at 0.30m.

Termination Depth: 0.30m

AGS

Unless otherwise stated:
Depth (m), Diameter (mm), Time (hhmm), Thickness (m), Level (mOD).

Equipment Used: **Insulted Hand Tools**

Contractor: **Arcadis**

Logged By: **Annabelle Randall**

Checked By: **SG**

APPENDIX G

Standard Procedures

E0 General Principles

This ground investigation was undertaken in general accordance with the principles of BS EN 1997-1 [1] and BS EN 1997-2 [2] and the advice given in BS5930:2015 [3], which, provides complimentary guidance on the application of the primary standards. Where the requirements of the ground investigation specification differ from these primary standards, the investigation methodology was adapted as required and specific notes regarding methods and techniques employed were made in the appropriate report sections.

E1 Buried Services

Service clearance was undertaken in accordance with Arcadis' *Safety, Health and Environment (SHE) Standard – Avoidance of Sub-Surface Hazards and Structures Standard.* This document details the methods and safe working practices used to undertake excavations safely. Prior to breaking ground, services plans were consulted, and the area scanned using a Cable Avoidance Tool (CAT) with detected signals marked on the ground. For all investigation positions, other than for machine excavated trial pits, hand excavated inspection pits are completed to 1.20 m bgl prior to the use of drilling and boring plant.

E2 Sampling Requirements

The selection of sample types and sampling techniques has been chosen to take account of the soil fabric, size and quality of sample required based on whether the soils mass properties or the intact material properties of the ground are to be determined in subsequent laboratory tests. BS EN ISO 22475-1[4] describes three generic sample groups that are:

a. Sampling by drilling. Generally, a disturbed sample recovered from the drilling tool or digging equipment, typically meeting Class 3 to Class 5 requirements, with the recovered material being stored in bulk bags or sealed jar or tub containers.
b. Sampling by sampler. Typically referred to as open tube or drive sampling in which a tube with a sharp cutting edge is driven into the ground either by static thrust or dynamically driven to give a relatively undisturbed sample of Class 1 or Class 2 but may result in a Class 3 sample.
c. Block sampling. Cylindrical large diameter samples or cuboid hand-cut samples usually relatively undisturbed Class 1 and Class 2.

The open-tube sampling equipment used on the site was of a type and design that conformed to BS EN ISO 22475-1. For the purpose of this ground investigation block sampling was not required.

Generally, samples were assessed on site and any unexpected deterioration in sample quality was reported to the ground engineer by the lead drilling technician.

Sufficient and representative samples were taken to allow the geo-mechanical properties of the ground to be adequately characterised and to enable the sequence of soil strata to be described by an engineering geologist or geotechnical engineer.

Where samples have been taken for chemical tests the drilling method attempted to adopt dry drilling over the sampling range that generally was achieved by the use of drill casing to separate and isolate the upper soil layers and exclude groundwater. Cross-contamination was further reduced by regular cleaning of sampling tools. Sample integrity was maintained by sealing samples immediately on collection and storing the samples in a temperature controlled cool box. Samples were despatched from the site at the end of the shift on which they were collected or as required in the project specification. Details of best practice storage, preservation and decontamination measures undertaken are given below:

Task	Soil	Groundwater	Ground Gas
Storage	Glass jars and vials supplied by the laboratory were used for the	Glass vials supplied by the laboratory were used for the collection of	1.4L Canisters supplied by the laboratory.

	collection of soil samples to be analysed for volatile compounds. Plastic one-litre tubs were used to collect soil samples for metals analysis.	samples to be analysed for volatile compounds. Samples to be analysed for lower volatility compounds were stored in laboratory prepared glass bottles.	
Preservation	Filling of sample containers as far as practicable to minimise headspace and low storage temperature to minimise the potential for volatilisation and biodegradation of petroleum hydrocarbon compounds prior to analysis.		Not required.
Decontamination	Disposable gloves were worn and changed between sample collection to prevent cross-contamination.	Groundwater samples were collected using dedicated disposable tubing / bailers, that were changed between monitoring well locations in order to prevent cross-contamination.	Disposable gloves were worn and changed between sample collection to prevent cross contamination.
Transport	Samples stored in dedicated sample boxes provided by the laboratory. Sample details and analytical requests were recorded on the laboratory chain of custody form included with samples, prior to dispatching to laboratory for analysis. Samples were dispatched to the laboratory on the day of sampling.		

E3 Sample Description

Sample description was undertaken by the Arcadis site geologist in accordance with BS 5930: 2015. The descriptions of the individual samples were used to identify the sequence of strata at the exploratory hole location and from which representative exploratory hole logs were drawn.

E4 *In situ* Testing

In situ geotechnical tests were undertaken taking account of the investigation scope and requirement to attain the appropriate parameters required in the geotechnical design. The tests were undertaken in accordance with the requirements of the relevant parts of BS EN ISO 22476 [5, 6, 7] and other methods as follows:

Dynamic probing

Dynamic probes were undertaken in general accordance with BS EN ISO 22476-2, BS EN 1997-2 and the national annex to BS EN 1997. The tests were generally made using the super-heavy DPSH-B configuration of the apparatus, however, it should be noted that the basis for selection of the type of dynamic probe should be a consideration of the driving energy in relation to the type of ground conditions anticipated at the site.

Where adequate correlation with borehole data is available an interpretation of the estimated soil type may be made, however, it should be noted that probing can give unreliable results in mixed soils.

E5 Data Transfer Format

The data collated during the ground investigation has been organised and managed using the “AGS data format” that allows data transfer between different disciplines and organisations in accordance with BS 8574 [10].

E6 References

1. BS EN 1997-1. 2004. Eurocode 7: Geotechnical Design. Part 1 General Rules. British Standards Institution, 2013 (revised text).
2. BS EN 1997-2. 2007. Eurocode 7: Geotechnical Design. Part 2 Ground Investigation and testing. British Standards Institution, 2010 (revised text).
3. BS 5930: 2020. Code of practice for ground investigation. British Standards Institution.
4. BS EN ISO 22475-1. Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1 Technical principles for execution.
5. BS EN ISO 22476-1:2015. Geotechnical investigation and testing – Field testing – Part 1: Electrical cone and piezocone test. British Standards Institution
6. BS EN ISO 22476-2. Geotechnical investigation and testing – Field testing – Part 2: Dynamic Probing. British Standards Institution
7. BS EN ISO 22476-3 2005. Geotechnical investigation and testing – Field testing – Part 3: Standard penetration test. British Standards Institution
8. BS 1377-9. 1990. Methods of test for soils for civil engineering purposes. Part 9: In-situ tests. British Standards Institution.
9. TRL. 2004. Dynamic cone penetrometer tests and analysis. TRL Technical Report PR IN 277-04. Transport Research Laboratory, Crowthorne, England.
10. BS 8574. Code of practice for the management of geotechnical data for ground engineering projects.

APPENDIX H

Monitoring Results

Gas Monitoring Data																					
BH ID	**Date**	**Time**	**Barometric pressure (mbar)**	**Relative borehole pressure (mbar)**	**Peak flow (litres / hour)**	**Steady flow (litres / hour)**	Record Time	O2 %	CH4%	CO2%	CO	H2S	O2% MIN	CH4% MAX	CO2% MAX	CO MAX	H2S MAX	DTW Raw	DTB Raw	Dip point description	Comments	Weather
WS0603	2021-06-11	10:10:00	1020	0.1	0	0	Final:	15.9	0	3.2	2	0	15.9	0	3.2	2	0	0	1.84	Ground Level	Well is dry	Cloudy

APPENDIX I

Geotechnical Data

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Arcadis Consulting (UK) Ltd
Client Address: HCL House, St Mellon's Business Park, Cardiff, CF3 OEY
Contact: Ross Scammell
Site Address: LBBD Fambridge Road

Client Reference: 10046791
Job Number: 21-82512
Date Sampled: 09/06/2021
Date Received: 12/06/2021
Date Tested: 25/06/2021
Sampled By: Client - A Rendall

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

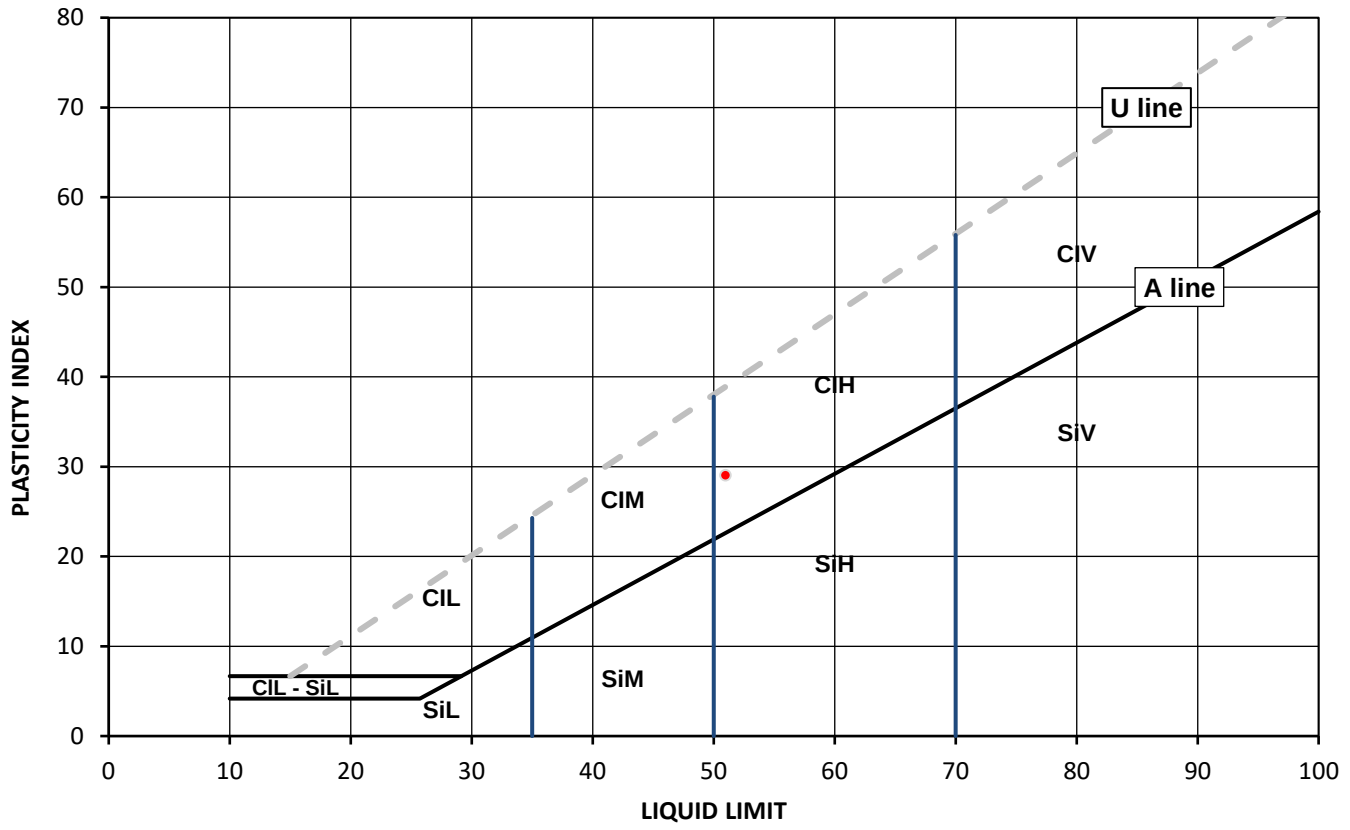
Test Results:

Laboratory Reference: 1912398
Hole No.: WS0604
Sample Reference: Not Given
Soil Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 0.50
Depth Base [m]: 1.05
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
20	51	22	29	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks: Re-issue 1: Site Address amended.

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 12/07/2021

GF 232.10

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

Client: Arcadis Consulting (UK) Ltd
Client Address: HCL House, St Mellon's Business Park, Cardiff, CF3 OEY
Contact: Ross Scammell
Site Address: LBBD Fambridge Road

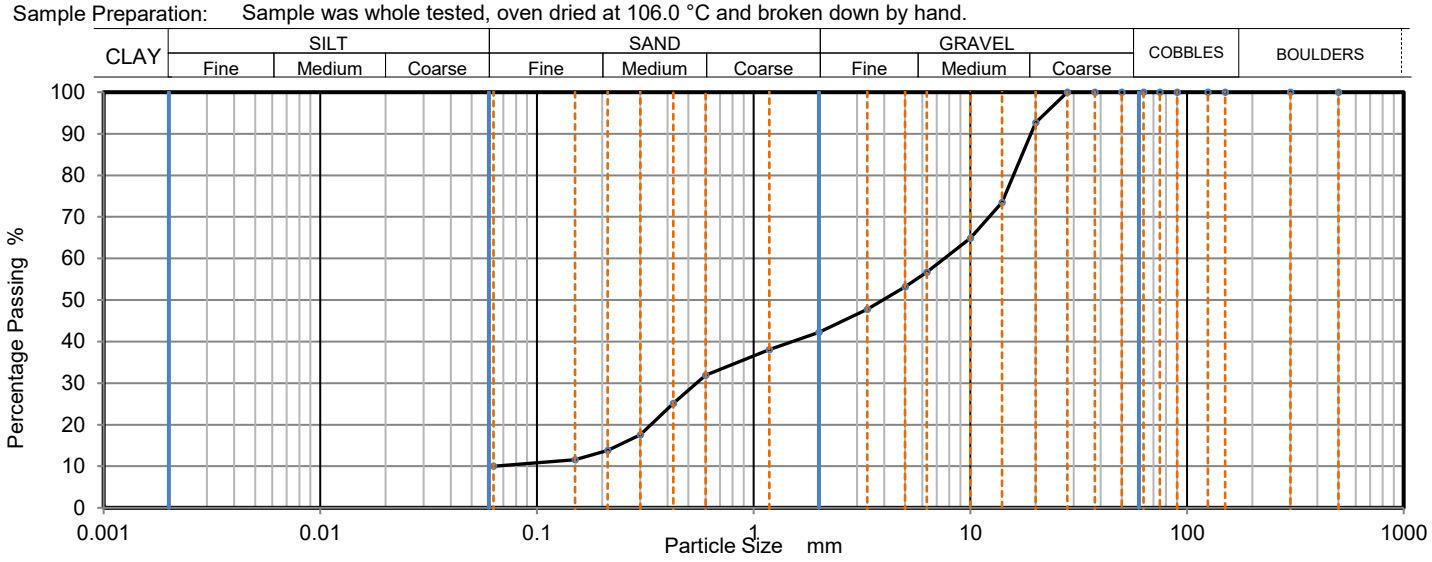
Client Reference: 10046791
Job Number: 21-82512
Date Sampled: 09/06/2021
Date Received: 12/06/2021
Date Tested: 24/06/2021
Sampled By: Client - A Rendall

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1912396
Hole No.: WS0603
Sample Reference: Not Given
Sample Description: Brown slightly clayey very sandy GRAVEL
Sample Preparation: Sample was whole tested, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 0.30
Depth Base [m]: 0.40
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	74		
10	65		
6.3	57		
5	53		
3.35	48		
2	42		
1.18	38		
0.6	32		
0.425	25		
0.3	18		
0.212	14		
0.15	12		
0.063	10		

Sample Proportions	% dry mass
Very coarse	0
Gravel	58
Sand	32
Fines <0.063mm	10

Grading Analysis		
D100	mm	28
D60	mm	7.58
D30	mm	0.545
D10	mm	0.0638
Uniformity Coefficient		120
Curvature Coefficient		0.61

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: Re-issue 1: Site Address amended.

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 02/07/2021

GF 100.20

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

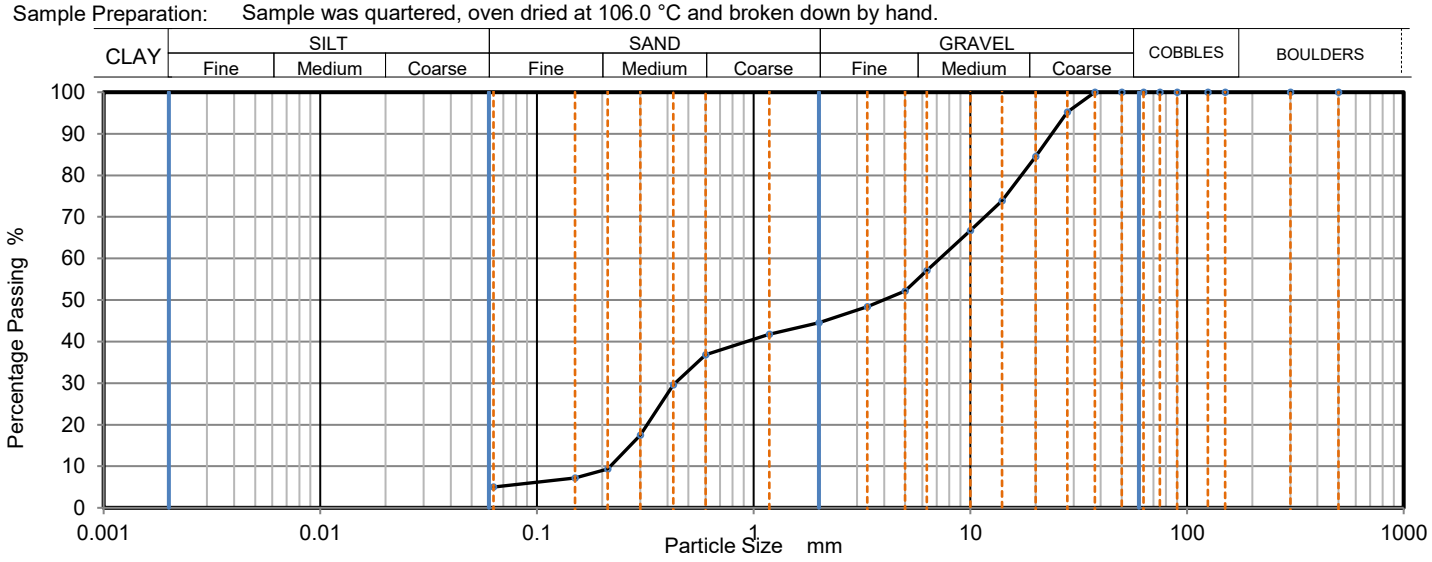
Environmental Science

Client:	Arcadis Consulting (UK) Ltd	Client Reference:	10046791
Client Address:	HCL House, St Mellon's Business Park, Cardiff, CF3 OEY	Job Number:	21-82512
		Date Sampled:	09/06/2021
		Date Received:	12/06/2021
Contact:	Ross Scammell	Date Tested:	25/06/2021
Site Address:	LBBD Fambridge Road	Sampled By:	Client - A Rendall

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1912397	Depth Top [m]:	0.50
Hole No.:	WS0603	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown slightly clayey very sandy GRAVEL		
Sample Preparation:	Sample was quartered, oven dried at 106.0 °C and broken down by hand.		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	95		
20	85		
14	74		
10	67		
6.3	57		
5	52		
3.35	48		
2	45		
1.18	42		
0.6	37		
0.425	30		
0.3	18		
0.212	9		
0.15	7		
0.063	6		

Sample Proportions	% dry mass
Very coarse	0
Gravel	55
Sand	39
Fines <0.063mm	6

Grading Analysis		
D100	mm	37.5
D60	mm	7.25
D30	mm	0.434
D10	mm	0.219
Uniformity Coefficient		33
Curvature Coefficient		0.12

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: Re-issue 1: Site Address amended.

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 02/07/2021

GF 100.20

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

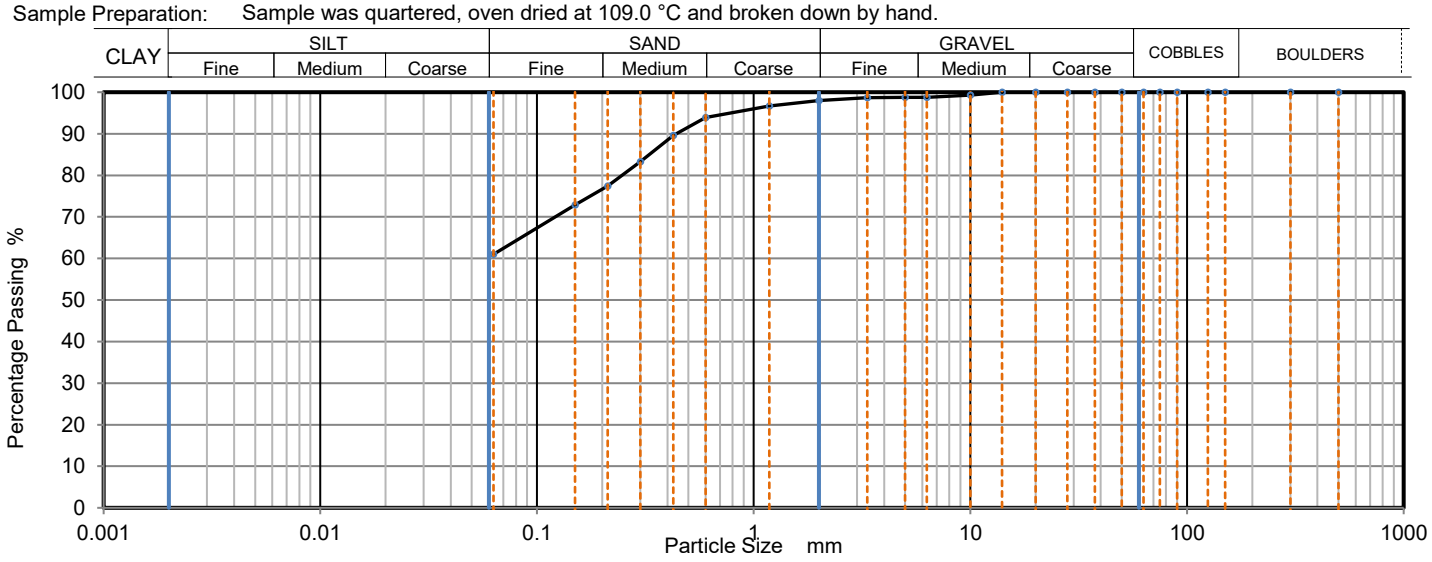
Environmental Science

Client:	Arcadis Consulting (UK) Ltd	Client Reference:	10046791
Client Address:	HCL House, St Mellon's Business Park, Cardiff, CF3 OEY	Job Number:	21-82512
		Date Sampled:	09/06/2021
		Date Received:	12/06/2021
Contact:	Ross Scammell	Date Tested:	25/06/2021
Site Address:	LBBD Fambridge Road	Sampled By:	Client - A Rendall

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1912398	Depth Top [m]:	0.50
Hole No.:	WS0604	Depth Base [m]:	1.05
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown slightly gravelly sandy CLAY		
Sample Preparation:	Sample was quartered, oven dried at 109.0 °C and broken down by hand.		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	99		
3.35	99		
2	98		
1.18	97		
0.6	94		
0.425	90		
0.3	83		
0.212	77		
0.15	73		
0.063	61		

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	37
Fines <0.063mm	61

Grading Analysis		
D100	mm	14
D60	mm	
D30	mm	
D10	mm	
Uniformity Coefficient		N/A
Curvature Coefficient		

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: Re-issue 1: Site Address amended.

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Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 02/07/2021

GF 100.20

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e: reception@i2analytical.com

Analytical Report Number : 21-82518

Replaces Analytical Report Number: 21-82518, issue no. 1
Client references/information amended.

Project / Site name:	LBBD Fambridge Road	**Samples received on:**	12/06/2021
Your job number:	10046791	**Samples instructed on/ Analysis started on:**	12/06/2021
Your order number:	14051905	**Analysis completed by:**	02/07/2021
Report Issue Number:	2	**Report issued on:**	02/07/2021
Samples Analysed:	1 soil sample		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 21-82518
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1912449
Sample Reference				WS0604
Sample Number				None Supplied
Depth (m)				0.50-1.05
Date Sampled				09/06/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	13
Total mass of sample received	kg	0.001	NONE	0.20

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.0
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.017

U/S = Unsuitable Sample I/S = Insufficient Sample

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 21-82518
Project / Site name: LBBD Fambridge Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1912449	WS0604	None Supplied	0.50-1.05	Brown clay and loam.

Analytical Report Number : 21-82518
Project / Site name: LBBD Fambridge Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

APPENDIX J

Geoenvironmental Data

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e: reception@i2analytical.com

Analytical Report Number : 21-80533-2

Replaces Analytical Report Number: 21-80533, issue no. 1
Client references/information amended.

Project / Site name:	LBBD Fambridge Road	**Samples received on:**	10/06/2021
Your job number:	10046791	**Samples instructed on/ Analysis started on:**	11/06/2021
Your order number:		**Analysis completed by:**	02/07/2021
Report Issue Number:	2	**Report issued on:**	02/07/2021
Samples Analysed:	9 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

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soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900100	1900101	1900102	1900103	1900104
Sample Reference				WS0601	WS0602	WS0603	WS0603	WS0604
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.30	0.20-0.30	0.60-0.70	0.30-0.40
Date Sampled				09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.8	11	9.1	6.2	15
Total mass of sample received	kg	0.001	NONE	1.2	1.2	1.2	1.5	1.2
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	0.003	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	0.003	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	9.3	8.3	9.2	7.5	7.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	3.4	< 1.0	< 1.0	< 1.0
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.28	0.28	1.0	0.024	0.088
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.5	0.9	-	-	1.6
Phenols by GC-MS								
Phenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorophenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Chloro-3-methylphenol	mg/kg	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Phenols								
Total Phenols (GC-MS)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900100	1900101	1900102	1900103	1900104
Sample Reference				WS0601	WS0602	WS0603	WS0603	WS0604
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.30	0.20-0.30	0.60-0.70	0.30-0.40
Date Sampled				09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	1.3	0.27	< 0.05	1.5
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.74	< 0.05	< 0.05	0.33
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	2.5	0.47	< 0.05	1.9
Pyrene	mg/kg	0.05	MCERTS	< 0.05	2.1	0.48	< 0.05	1.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.2	0.26	< 0.05	0.98
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.1	0.24	< 0.05	0.77
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.1	0.22	< 0.05	0.91
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.28	0.14	< 0.05	0.36
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.66	0.21	< 0.05	0.72
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.28	< 0.05	< 0.05	0.43
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.39	< 0.05	< 0.05	0.58
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	11.7	2.29	< 0.80	10.3
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.7	8.3	8.3	18	9.0
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.6	0.5	< 0.2	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	18	21	17	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	15	39	22	9.6	25
Lead (aqua regia extractable)	mg/kg	1	MCERTS	65	230	100	12	59
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	14	17	13	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.3	< 1.0	1.1	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	40	260	170	22	61
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0

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Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900100	1900101	1900102	1900103	1900104
Sample Reference				WS0601	WS0602	WS0603	WS0603	WS0604
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.30	0.20-0.30	0.60-0.70	0.30-0.40
Date Sampled				09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	9.3	-	< 2.0	-	10
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	16	-	< 8.0	-	17
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	9.3	-	< 8.0	-	11
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	35	-	< 10	-	38
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	-	< 10	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	21	-	< 10	-	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	24	-	< 10	-	14

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900105	1900106	1900107	1900108
Sample Reference				WS0604	WS0605	WS0605	WS0608
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60-0.70	0.30-0.40	0.70-0.80	0.20-0.30
Date Sampled				09/06/2021	09/06/2021	09/06/2021	10/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	16	15	11	18
Total mass of sample received	kg	0.001	NONE	1.0	1.5	1.2	0.70
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-
General Inorganics							
pH - Automated	pH Units	N/A	MCERTS	7.4	7.7	7.6	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0058	0.012	0.013	0.054
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	0.4	-	1.6
Phenols by GC-MS							
Phenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorophenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3	< 0.3	< 0.3	< 0.3
4-Chloro-3-methylphenol	mg/kg	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2
Total Phenols							
Total Phenols (GC-MS)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900105	1900106	1900107	1900108
Sample Reference				WS0604	WS0605	WS0605	WS0608
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60-0.70	0.30-0.40	0.70-0.80	0.20-0.30
Date Sampled				09/06/2021	09/06/2021	09/06/2021	10/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.4
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.32
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	2.9
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	2.4
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.5
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.2
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.5
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.60
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.69
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.95
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	14.5
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	7.6	9.8	13
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	0.8	1.0	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	25	38	21
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	15	15	69
Lead (aqua regia extractable)	mg/kg	1	MCERTS	15	22	13	130
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	32	16	26	28
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.7	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	45	50	36	200
Monoaromatics & Oxygenates							
Benzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0

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Analytical Report Number: 21-80533-2
Project / Site name: LBBD Fambridge Road

Lab Sample Number				1900105	1900106	1900107	1900108
Sample Reference				WS0604	WS0605	WS0605	WS0608
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60-0.70	0.30-0.40	0.70-0.80	0.20-0.30
Date Sampled				09/06/2021	09/06/2021	09/06/2021	10/06/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Petroleum Hydrocarbons							
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	4.5
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	18
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0	-	47
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0	-	40
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	110
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10	-	20
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	< 10	-	29
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	49

U/S = Unsuitable Sample I/S = Insufficient Sample

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Analytical Report Number: 21-80533
Project / Site name: LBBD Fambridge Road
Your Order No:

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1900102	WS0603	0.20-0.30	191	Loose Fibrous Debris	**Chrysotile**	0.003	**0.003**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 21-80533-2
Project / Site name: LBBD Fambridge Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1900100	WS0601	None Supplied	0.4	Brown loam and sand with gravel and vegetation.
1900101	WS0602	None Supplied	0.3	Brown sandy clay with gravel.
1900102	WS0603	None Supplied	0.20-0.30	Brown sandy clay with gravel.
1900103	WS0603	None Supplied	0.60-0.70	Brown sand with gravel.
1900104	WS0604	None Supplied	0.30-0.40	Brown sandy clay with gravel.
1900105	WS0604	None Supplied	0.60-0.70	Brown clay.
1900106	WS0605	None Supplied	0.30-0.40	Brown clay.
1900107	WS0605	None Supplied	0.70-0.80	Brown clay with gravel.
1900108	WS0608	None Supplied	0.20-0.30	Brown sandy clay with gravel.

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Analytical Report Number : 21-80533-2
Project / Site name: LBBD Fambridge Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Phenols, speciated, in soil, by GCMS	Determination of speciated phenols in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Analytical Report Number : 21-80533-2
Project / Site name: LBBD Fambridge Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Table 1														
Comparison of CoC in Soil with GAC														
				Sample ID	WS0601	WS0602	WS0603	WS0603	WS0604	WS604	WS0604	WS0605	WS0605	WS0608
				Sample Depth	0.40	0.30	0.20-0.30	0.60-0.70	0.30-0.40	0.50-1.05	0.60-0.70	0.30-0.40	0.70-0.80	0.20-0.30
				Sample Date	09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021	09/06/2021	10/06/2021
				Residential With Plant Uptake										
Chem_Group	**ChemName**	**output unit**	**EQL**	**GAC (mg/kg)**										
Metals	Arsenic (aqua regia extractable)	mg/kg	1	37	8.7	8.3	8.3	18	9.0	-	19	7.6	9.8	13
	Boron (water soluble)	mg/kg	0.2	290	0.7	0.6	0.5	< 0.2	0.3	-	0.8	0.8	1.0	0.7
	Cadmium (aqua regia extractable)	mg/kg	0.2	11	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2	< 0.2
	Chromium (hexavalent)	mg/kg	4	6	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	-	< 4.0	< 4.0	< 4.0	< 4.0
	Chromium (aqua regia extractable)	mg/kg	1	910	15	18	21	17	17	-	36	25	38	21
	Copper (aqua regia extractable)	mg/kg	1	2400	15	39	22	9.6	25	-	21	15	15	69
	Lead (aqua regia extractable)	mg/kg	1	220	65	230	100	12	59	-	15	22	13	130
	Mercury (aqua regia extractable)	mg/kg	0.3	1.2	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3
	Nickel (aqua regia extractable)	mg/kg	1	130	15	14	17	13	19	-	32	16	26	28
	Selenium (aqua regia extractable)	mg/kg	1	250	< 1.0	1.3	< 1.0	1.1	< 1.0	-	< 1.0	1.7	< 1.0	< 1.0
	Zinc (aqua regia extractable)	mg/kg	1	3700	40	260	170	22	61	-	45	50	36	200
Asbestos	Asbestos in Soil	Detect	N/A	-	Not-detected	Not-detected	Detected	-	Not-detected	-	-	Not-detected	-	Not-detected
	Asbestos Quantification (Stage 2)	%	0.001	-	-	-	0.003	-	-	-	-	-	-	-
	Asbestos Quantification Total	%	0.001	-	-	-	0.003	-	-	-	-	-	-	-
Inorganics	pH - Automated	pH Units	N/A	-	9.3	8.3	9.2	7.5	7.9	8	7.4	7.7	7.6	8.4
	Total Cyanide	mg/kg	1	-	< 1.0	3.4	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0
	Water Soluble SO4 16hr extraction (2:1 Leachate Equiv	g/l	0.0013	-	0.28	0.28	1.0	0.024	0.088	0.017	0.0058	0.012	0.013	0.054
	Total Organic Carbon (TOC)	%	0.1	-	0.5	0.9	-	-	1.6	-	-	0.4	-	1.6
	Stone Content	%	0.1	-	-	-	-	-	-	<0.1	-	-	-	-
	Moisture Content	%	0.01	-	-	-	-	-	-	13	-	-	-	-
	Total mass of sample received	kg	0.001	-	-	-	-	-	-	0.2	-	-	-	-
Phenols	Phenol	mg/kg	0.2	280	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2	< 0.2
	2,4,5-Trichlorophenol	mg/kg	0.2	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2	< 0.2
	2,4,6-Trichlorophenol	mg/kg	0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1
	2,4-Dichlorophenol	mg/kg	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3
	2,4-Dimethylphenol	mg/kg	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3
	2-Chlorophenol	mg/kg	0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1
	2-Methylphenol	mg/kg	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3
	2-Nitrophenol	mg/kg	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3
	4-Chloro-3-methylphenol	mg/kg	0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1
	4-Methylphenol	mg/kg	0.2	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2	< 0.2
	Total Phenols (GC-MS)	mg/kg	1	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0
PAH 16	Naphthalene	mg/kg	0.05	2.3 [f]	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05
	Acenaphthylene	mg/kg	0.05	170	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05
	Acenaphthene	mg/kg	0.05	210	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05
	Fluorene	mg/kg	0.05	170	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05
	Phenanthrene	mg/kg	0.05	95	< 0.05	1.3	0.27	< 0.05	1.5	-	< 0.05	< 0.05	< 0.05	1.4
	Anthracene	mg/kg	0.05	2400	< 0.05	0.74	< 0.05	< 0.05	0.33	-	< 0.05	< 0.05	< 0.05	0.32
	Fluoranthene	mg/kg	0.05	280	< 0.05	2.5	0.47	< 0.05	1.9	-	< 0.05	< 0.05	< 0.05	2.9
	Pyrene	mg/kg	0.05	620	< 0.05	2.1	0.48	< 0.05	1.8	-	< 0.05	< 0.05	< 0.05	2.4
	Benzo(a)anthracene	mg/kg	0.05	7.2	< 0.05	1.2	0.26	< 0.05	0.98	-	< 0.05	< 0.05	< 0.05	1.5
	Chrysene	mg/kg	0.05	15	< 0.05	1.1	0.24	< 0.05	0.77	-	< 0.05	< 0.05	< 0.05	1.2
	Benzo(b)fluoranthene	mg/kg	0.05	2.6	< 0.05	1.1	0.22	< 0.05	0.91	-	< 0.05	< 0.05	< 0.05	1.5
	Benzo(k)fluoranthene	mg/kg	0.05	77	< 0.05	0.28	0.14	< 0.05	0.36	-	< 0.05	< 0.05	< 0.05	0.60
	Benzo(a)pyrene	mg/kg	0.05	2.2	< 0.05	0.66	0.21	< 0.05	0.72	-	< 0.05	< 0.05	< 0.05	1.1
	Indeno(1,2,3-cd)pyrene	mg/kg	0.05	27	< 0.05	0.28	< 0.05	< 0.05	0.43	-	< 0.05	< 0.05	< 0.05	0.69
	Dibenz(a,h)anthracene	mg/kg	0.05	0.24	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05
	Benzo(ghi)perylene	mg/kg	0.05	32	< 0.05	0.39	< 0.05	< 0.05	0.58	-	< 0.05	< 0.05	< 0.05	0.95
	PAH 16 Total	mg/kg	0.8	-	< 0.80	11.7	2.29	< 0.80	10.3	-	< 0.80	< 0.80	< 0.80	14.5
TPH CWG	>C5-C6 Aliphatics	mg/kg	0.001	42	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>C6-C8 Aliphatics	mg/kg	0.001	100	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>C8-C10 Aliphatics	mg/kg	0.001	27	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>C10-C12 Aliphatics	mg/kg	1	130 (48) [vap]	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	4.5
	>C12-C16 Aliphatics	mg/kg	2	1100 (24) [sol]	9.3	-	< 2.0	-	10	-	-	< 2.0	-	18
	>C16-C21 Aliphatics	mg/kg	8	65000 (8.48) [f,sol]	16	-	< 8.0	-	17	-	-	< 8.0	-	47
	>C21-C35 Aliphatics	mg/kg	8	65000 (8.48) [f,sol]	9.3	-	< 8.0	-	11	-	-	< 8.0	-	40
	Total >C5-C35 Aliphatics	mg/kg	10	-	35	-	< 10	-	38	-	-	< 10	-	110
	>EC5-EC7 Aromatics	mg/kg	0.001	70	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>EC7-EC8 Aromatics	mg/kg	0.001	130	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>EC8-EC10 Aromatics	mg/kg	0.001	34	< 0.001	-	< 0.001	-	< 0.001	-	-	< 0.001	-	< 0.001
	>EC10-EC12 Aromatics	mg/kg	1	74	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
	>EC12-EC16 Aromatics	mg/kg	2	140	< 2.0	-	< 2.0	-	< 2.0	-	-	< 2.0	-	< 2.0
	>EC16-EC21 Aromatics	mg/kg	10	260 [f]	< 10	-	< 10	-	< 10	-	-	< 10	-	20
	>EC21-EC35 Aromatics	mg/kg	10	1100 [f]	21	-	< 10	-	< 10	-	-	< 10	-	29
	Total >EC5-EC35 Aromatics	mg/kg	10	-	24	-	< 10	-	14	-	-	< 10	-	49
BTEX	Benzene	mg/kg	1	0.087	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
	Toluene	mg/kg	1	130	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
	Ethylbenzene	mg/kg	1	47	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
	Xylene (m & p)	mg/kg	1	59	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
	Xylene (o)	mg/kg	1	60	< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0
Fuel oxygenates	MTBE	mg/kg	1		< 1.0	-	< 1.0	-	< 1.0	-	-	< 1.0	-	< 1.0

- No water quality standard identified as suitable for deriving generic assessment criteria
<100 Concentation is below laboratory method detect limit
- Sample not scheduled for analysis

APPENDIX K

Risk Assessment Methodology

CONCEPTUAL SITE MODEL

General

The aim of the initial conceptual model and risk assessment is to provide a preliminary identification of the risks to controlled waters, proposed future site users and the surrounding area posed by any contamination present on site. The assessment is based on identification of 'contaminant linkages', i.e. contaminant-pathway-receptor relationships. This approach accords with the guidance that accompanies Part 2A of the Environmental Protection Act of 1990 where land is considered to be contaminated when 'significant harm' is occurring, or where there is the 'significant possibility of significant harm' or where significant pollution of controlled waters is being, or is likely to be caused. In such cases the contaminant linkage itself is defined as being 'significant'.

A source of contamination and a pathway to receptors must be present for there to be a risk. The preliminary risk assessment assesses the strength of the link between the source, the pathway and the receptor.

Source - Contaminant that has potential to cause harm to environmental receptors. In a wider sense, sources can include particular ground conditions, for example the existence of redundant footings, which have the potential to impact on development proposals.

Pathway - The route by which the source is brought into contact with the receptor. This can include the transport of contamination via groundwater, wind-blown dust, vapours, excavation and deposition etc.

Receptor - Human beings, other living organisms, physical systems and built structures that could be affected by the source. A receptor will only be affected if a pathway from the source to the receptor is present. Groundwater and surface water systems can be considered as receptors in their own right as their quality is regulated by the statutory bodies, as well as being pathways for contaminant migration to other receptors.

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ENVIRONMENTAL RISK ASSESSMENT

Qualitative Methodology

The risk assessment considers the potential sources, receptors and pathways identified in the Conceptual Site Model.

The environmental assessment has been undertaken with due regard to Contaminated Land Guidance Documents issued by the Department of the Environment Food and Rural Affairs (DEFRA). The Guidance requires a risk-based approach; with the potential environmental risk assessed qualitatively using the 'source-pathway-target' contaminant linkage concept contained in Part 2A of the Environment Protection Act. Unless specifically stated as relating to 'Contaminated Land' as defined in the Environmental Protection Act 1990 (as amended), references to 'contamination' and 'contaminants' relate in general terms to the presence of potentially hazardous substances, in, on or under the subject site.

Based on information presented in

- CIRIA C552 (2001) Contaminated Land Risk Assessment: A guide to good practice; and
- NHBC / EA/ CIEH (2008) R&D Publication 66: (Volume 1) Guidance for the Safe Development of Housing on Land Affected by Contamination
- DEFRA (2012) Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance

Risk assessment considers the identified sources, the potential receptors and the pathways linking them together.

The designation of risk is based upon the consideration of both:

a. **the severity of the potential consequence -** this takes into account both the potential severity of the hazard and the sensitivity of the receptor
b. **the magnitude of probability** (i.e. likelihood) - this takes into account both the presence of the hazard and receptor and the integrity of the pathway

Severity (consequence) can be defined as the adverse effects (or harm) arising from a defined hazard, which impairs the quality of human health or the environment in the short or longer term. Definitions of different categories of severity are detailed in Table 1 below.

Probability can be defined as the chance of a particular event occurring in a given period of time. Definitions of different categories of probability are detailed in Table 2 below.

A contaminant linkage must first be established before tests for probability and consequence are applied. If there is no contaminant linkage then there is no potential risk.

Table 1 - Classification of Potential Consequence (Severity)

	Human Health	Controlled Water	Built Environment[1]	Ecosystems[2]
Severe	Short term (acute) risk to human health. Concentrations present likely to result in "significant harm" as defined by Part 2A.	Substantial pollution of sensitive water resources.	Catastrophic damage to buildings, structures or the environment, including building collapse.	Major damage to aquatic or other ecosystem, which is likely to result in a substantial adverse change or irreversible change in its functioning or harm to a species of special interest.
Medium	Chronic damage to human health. Concentrations present that could result in significant harm.	Pollution of sensitive water resources or small scale pollution of sensitive water resources	Significant damage to buildings, structures or the environment making it unsafe to occupy, or damage that may impair a scheduled ancient monument.	Significant damage to aquatic or other ecosystems or organism forming part of an ecosystem that could endanger the long term maintenance of a population at that location.
Mild	Slight short term health effects to humans. Exposure to human health unlikely to lead to significant harm.	Pollution to non-sensitive water resources	Minor damage to sensitive buildings, structures, services or the environment.	Minor or short lived damage to aquatic or other ecosystems.
Minor	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.)	Insubstantial pollution to non-sensitive water resources	Easily repairable effects of damage to buildings or structures	Harm (although not necessarily significant harm which may result in financial loss or expenditure to resolve e.g. loss of plants in a landscape scheme).

1. Property includes crops including timber, produce grown domestically (gardens or allotments for consumption), livestock, other owned or domesticated animals or wild animals which are subject to shooting or fishing rights. It also includes buildings, meaning any structure or erection, but does not include plant or machinery within a building or buried services.
2. Where ecological system effects relate to a Site of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Marine Nature Reserve (MNR), and areas of Special Protection for Birds, a "European site", or any habitat or site afforded protection under the Wildlife & Countryside Act 1981 and The Conservation of Habitats and Species Regulations 2010, i.e. candidate Special Areas of Conservation, potential Special Protection Areas and listed Ramsar sites.

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Table 2 Classification of Probability

(Only applies if there is a possibility of a contaminant linkage being present)

High likelihood	There is a contaminant linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
Unlikely	There is a contaminant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 3 Classification of Risk

Once the severity and probability have been classified for a contaminant linkage they can be compared to produce a risk category from very high risk to very low risk as shown in the matrix below.

Consequence				
Severe	Moderate/Low	Moderate	High	Very High
Medium	Low	Moderate/Low	Moderate	High
Mild	Very Low	Low	Moderate/Low	Moderate
Minor	Very Low	Very Low	Low	Moderate/Low
Probability	Unlikely	Low	Likely	High

Table 4 Risk Classification Descriptions

Table 4 below describes the risk classifications.

Risk Term	Description
Very High Risk	There is a high probability that significant harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action or there is evidence that significant harm to a designated receptor is already occurring.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action. Remediation works may be necessary in the short-term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However it is either relatively unlikely that any such harm would be severe or if any harm were to occur it is more likely that such harm would be relatively mild. Some remediation work may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely, at worst, that this harm if realised would normally be mild. Any subsequent remediation works are likely to be relatively limited.
Very Low Risk	It is a low possibility that harm could arise to a receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

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