

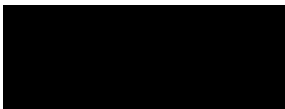
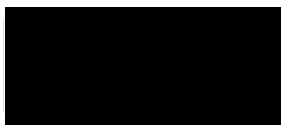
**REPORT ON
GROUND INVESTIGATION
AT
THE PROMISED LAND FARM,
BICESTER**



REPORT STATUS SHEET

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EXECUTIVE SUMMARY

APPENDICES

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EXECUTIVE SUMMARY

Investigation Objective	Pre-acquisition survey – comprising desk study and trial pitting investigation to assess potential geotechnical hazards and contaminated land issues associated with the site and inform the Client regarding possible liabilities relating to the ownership of the site.
Site Description	Promised Land Farm, located off Wendlebury Road, approximately 1.5km southwest of Bicester town centre. Site covers an area of approximately 15.35ha and comprises three undeveloped fields. Langford Brook bounds the site to the east, Wendlebury Farm to the southwest, Wendlebury Road to the west and an access road leading on to the Severn Trent Sewage works to the north.
Site History	The site has comprised undeveloped fields since 1885. The site was bounded to the east by Langford Brook, the west by Roman Road (now Wendlebury Road) and the north and south by fields, with farm buildings relating to the Promised Land Farm 150m to the southwest and a Sewage Works 200m to the northeast. Two 'old clay pits' were also shown approximately 225m southwest. By 1950, the MOD Bicester, military storage and distribution centre had been developed 400m to the east. By 1967, a drain was shown along the southern boundary of the site. The north of the site was bound by an access road, connecting to the sewage works, which had been redeveloped and expanded to approximately 150m east of the site. By 1983, development of Wendlebury Farm (consistent with the current layout) had taken place adjacent to the southwest of the site. A nursery was located 50m to the north of the site, which was later developed into a garden centre. By 2002, the Bicester Village Retail Park had been developed approximately 725m to the north and a nature reserve was located 150m to the east.
Anticipated Geology	Published information indicates that the majority of the site is initially underlain by Alluvium. The Alluvium is absent in the northwest and southwest of the site, where River Terrace Deposits are shown. Solid geology of the Kellaways Formation is anticipated below, comprising interbedded sandstone and siltstone of the Kellaways Sand Member, underlain by mudstone, interbedded with siltstone and sandstone of the Kellaways Clay Member. Kellaways Sand is shown to be absent in the north of the site. The Kellaways Formation is anticipated to be underlain by limestone of the Cornbrash Formation.
Other Pertinent Desk Study Data	<p>No current or historical records of landfills sites within 250m of the site;</p> <p>One recorded pollution incident within 250m of the site located 160m north east associated with microbiological pollutant (2002);</p> <p>No recorded petrol/fuel sites identified within 250m;</p> <p>Five current industrial land uses, relating to electricity substations and the Sewage Works;</p> <p>Superficial Deposits and Kellaways Sand Member are designated as Secondary A Aquifers. Kellaways Clay Member is designated as Unproductive strata;</p> <p>The site is within a Zone 3 Floodplain, where probability of annual flooding estimated as 1 in 100;</p> <p>No ecologically sensitive areas within 1000m of the site;</p>
Scope of Investigation	Eighteen machine excavated trial and chemical and geotechnical laboratory testing of soils.
Ground Conditions	<p>Made Ground was not encountered. Topsoil and subsoil was encountered at surface across the site and underlain by Superficial Deposits comprising Alluvium and River Terrace Deposits. The Superficial Deposits were underlain by the Kellaways Formation, predominantly comprising clay, with initial horizons of sand in the southeast of the site.</p> <p>Groundwater was recorded as seepages in nearly all of the trial pits, within the River Terrace Deposits from depths of between 0.5m and 1.3m bgl, with a fast inflow noted in the north of the site. Seepages were also noted within the Kellaways Clay in three locations in the east of the site at depths of between 1.3m and 2.7m.</p>
Geo-environmental Assessment	Contamination related risks appear to be negligible. Hence, in this respect, potential liabilities associated with ownership are extremely limited.
Geotechnical Overview	<p>Conventional shallow foundations should be considered for light or moderate loads, although some construction difficulty may arise owing to shallow groundwater.</p> <p>An alternative consideration could be given to a piled foundation.</p> <p>No special concrete design measures are required for shallow foundations placed within the River Terrace Deposits. Deeper foundations placed in the underlying Kellaways Formation, will require sulphate resisting concrete (DS-4/AC-4).</p> <p>Soakaway drainage capacity is likely to be severely restricted by shallow groundwater occurrence.</p>
Further Recommendations	It is understood that the site has now been acquired and further site investigation is recommended to provide sufficient information for design and compliance.

1.0 INTRODUCTION

1.1 Objectives and Scope of Investigation

Applied Geology were instructed in June 2018 by Bailey Johnson Hayes (Engineer to the Client) on behalf of Albion Land Ltd (the Client) to undertake a pre-acquisition ground investigation at an area of land at The Promised Land Farm, Bicester (the site).

The site comprises three unoccupied tree-lined fields, forming part of the Promised Land Farm.

The objectives of this pre-acquisition ground investigation are to provide information to assess geotechnical hazards and potential contaminated land issues associated with the site in order to inform the Client regarding possible liabilities relating to the ownership of the site.

The terms of reference/brief for the works were mutually developed between Bailey Johnson Hayes and Applied Geology in accordance with Bailey Johnson Hayes Scope of Works and Proposed Trial Pit Location Plan, (reference S1358-Ext-01) and Applied Geology's proposal and estimate (reference AG18-6435-01, dated 30th May 2018).

The full scope of works undertaken by Applied Geology comprised:

- A site inspection and walkover survey
- A review of the following desk study sources:
 - ❑ GroundSure – GeoInsight & EnviroInsight environmental databases.
 - ❑ GroundSure – MapInsight historical maps.
 - ❑ British Geological Survey (BGS) - published information & on-line borehole database.
 - ❑ Multi-Agency Geographical Information for the Countryside (MAGIC) on-line database.
 - ❑ Environment Agency Web Site.
- Ground investigation, comprising trial pitting together with sampling and a programme of geo-environmental and geotechnical laboratory testing.
- Assessment and reporting of the results of the works.

Underground service plans for the site were obtained by Applied Geology in advance of the investigation. At the time of the ground investigation and subsequent reporting a topographic survey was not available.

1.2 Report Layout

This report presents a description of the site, the desk study data and the factual results of the intrusive investigations carried out. An interpretation of the ground conditions and a discussion/assessment of the findings is presented in the later report text sections. The report should be read in conjunction with the general procedures detailed in Appendix E, which provides details of investigation techniques, assessment methodology and standards, health & safety and limitations and exceptions of the report. Drawings and factual data including

exploratory hole records, laboratory testing results and desk study records are presented in the other Appendices.

2.0 SITE DESCRIPTION



The site is located off Wendlebury Road, approximately 1.5km to the southwest of Bicester town centre. The Ordnance Survey grid reference for the centre of the site is 457226 220693 as shown on the Site Location Plan included in Appendix A. Access to the site was gained through a gate off Wendlebury Road in the northwest of the site.

The site is approximately ‘L-shaped’, tapering slightly towards the eastern boundary with dimensions of approximately 360m from east to west, and between approximately 335m (western boundary) and 430m (eastern boundary) from north to south. The site covers an approximate area of 15.35ha. A topographic survey was not available; however, the site appears to slope gently to the southeast.

At the time of the walkover the site comprised three undeveloped grassed fields, understood to be used as grazing for cattle. The fields were unoccupied at the time of the walkover; however, it is understood that the farmer had relocated the cattle for the duration of the investigation works. With the exception of the northern boundary of the site and the boundary with Wendlebury Farm in the south, the fields were all lined with hedgerows and semi-mature and mature trees. Electricity pylons with associated overhead cables, orientated north-south were located along the west of the site with two sets also located in the east. A pond, which was almost entirely hidden by overgrown vegetation and reeds, was present in the south of the site, covering an area of circa 10m x 20m.

The site was bound to the north by an access road to the Severn Trent sewage works, which was segregated by a post and rail fence line, to the east by Langford Brook, to the south by Wendlebury Farm and further fields belonging to the Promised Land Farm and to the west by Wendlebury Road.

No obvious sources of potential contamination or potentially contaminative activities were observed at the site during the investigation.

	
Gated entrance to the site in the northwest	Pylons with associated overhead cables in the west of the site

Pond in the south of the site, facing west towards Wendlebury Farm	Northern boundary of the site, facing east along the access road to the Severn Trent Sewage Works

2.1 Site Proposals

It is understood that the site has now been acquired and it is intended that as much of the site as possible will be developed, together with the adjacent Wendlebury Farm, also under Client ownership. Specific redevelopment purposes are not formulated as yet.

3.0 DESK STUDY INFORMATION

Site History	<ul style="list-style-type: none"> • 1885 – Site and surrounding area are agricultural fields, the Oxford to Bletchley railway line runs northeast – southwest approximately 105m southeast of the site. Two 'Old Clay Pits' are indicated 225m southwest of the site. Roman Road, orientated north-south bounds the site to the west. Buildings associated with the Promised Land Farm are located approximately 150m southwest. A sewage works is located 200m to the northeast. • 1950 – The A41 is located 55m to the northwest of the site, orientated northeast – southwest. MOD Bicester, military storage and distribution centre has been developed 400m to the east. • 1966 – A drain is shown along the southern boundary of the site. The north of the site is bound by an access road, connecting to the sewage works, which has been redeveloped and expanded to approximately 150m east of the site. • 1983 – Wendlebury Farm is now shown (consistent with the current layout) adjacent to the southwest of the site. A nursery is located 50m to the north of the site. • 1992-95 – The A41 has been widened. • 1995 – The nursery to the north is now a garden centre and has expanded south. • 2002 - Bicester Village Retail Park has been developed approximately 725m to the north and a nature reserve is located 150m to the east. • No further significant changes to present day.
Anticipated Geology and Ground Conditions	<ul style="list-style-type: none"> • Published BGS Map shows Alluvium across the majority of the site. The Alluvium is absent in the northwest and southwest of the site, where River Terrace Deposits are shown. Solid geology of the Kellaways Formation is anticipated below, comprising interbedded sandstone and siltstone of the Kellaways Sand Member, underlain by mudstone, interbedded with siltstone and sandstone of the Kellaways Clay Member. Kellaways Sand is shown to be absent in the north of the site. The Kellaways Formation is anticipated to be underlain by limestone of the Cornbrash Formation. • Nearest BGS archive borehole, undertaken at Wendlebury Farm (28m to southwest) recorded Alluvium to 1.37m bgl, over Kellaways Clay Member to 5.49m and the Great Oolite Group (Cornbrash Formation) to 15.24m,

	<p>the base of the borehole. Artesian groundwater was encountered within the borehole and was at rest at 0.83m above ground level at the end of boring. There is no record of what depth the artesian groundwater was encountered, however it is likely to be near the base of the borehole, within the Cornbrash Formation.</p> <ul style="list-style-type: none"> Site is not in a radon affected area, with <1% of homes above the Action Level. No radon protection measures are therefore considered necessary for new properties.
Mining/Quarrying and Other Geohazards	<ul style="list-style-type: none"> Site not indicated to be within area of underground coal or other mining. Site not in area associated with natural cavity formation. The BGS have indicated a moderate risk of shrinkable/swelling clay and compressible deposits on the site. The earliest OS map editions indicate the extraction of clay 225m southwest of the site. Although archaeological findings are noted within the GroundSure report, the Roman Road (now Wendlebury Road), which bounds the site to the west, is an indication that there may be possible archaeology on the site.
Hydrology	<ul style="list-style-type: none"> The nearest surface watercourse is Langford Brook, which bounds the site to the east. Water quality data, taken from Langford Brook, 45m southeast of the site, indicated a chemical and biological grade of B in 2009. There are no surface water abstractions within 500m of site. There are 10 no. licensed discharges within 250m of site, the nearest being located 45m to the southeast of the site and associated with sewage discharges into Langford Brook. This license was revoked on 01/11/1989. The site is within a Zone 2 and Zone 3 floodplain and the highest RoFRaS flood rating is High.
Hydrogeology	<ul style="list-style-type: none"> The superficial deposits underlying the site are a Secondary A Aquifer, The Kellaways Sand Member is a Secondary A Aquifer and the Kellaways Clay Member is listed as unproductive strata. 4 No. groundwater abstraction licenses are shown within 1000m of the site, with the closest being located at Faccenda Chicken Ltd, 58m west, for general farming and domestic uses. Most likely groundwater flow direction is to the southeast, following the topography and towards Langford Brook. The site is not located within a Source Protection Zone.
Other Environmental data	<ul style="list-style-type: none"> No landfills or licensed waste sites within 500m. Five potentially contaminative industries are located within 250m of the site, relating to electricity substations (26m and 169m northeast) and the Sewage Works from 175m east. No petrol or fuel sites are located within 500m of the site. One pollution incident was recorded within 500m of the site, located 160m to the northeast, relating to a microbiological pollutant on 09/02/2002 and was assigned a Category 3 (minor) impact to water. The site is within a Nitrate Vulnerable Zone.

4.0 CONCEPTUAL SITE MODEL

4.1 Diagrammatical Illustration

The Conceptual Model for the site, showing the main elements of the surface and subsurface conditions and including the potential contaminant sources, pathways and receptors identified from the desk study information is presented in Appendix A as Drawing No AG2875-18-03. The potential sources, pathways and receptors are defined in the following sections:

4.2 Sources

- Made Ground soils on site associated with adjacent site development;

- Hydrocarbon leaks from farming vehicles/plant;
- On site ground gases associated with decomposition of organic material in Made Ground or hydrocarbon spillages;
- Sulphates in Made Ground or underlying natural strata;
- Pesticides within the near surface materials.

The substation located 26m to the northeast of the site is not considered to be a viable source, due to the distance from the site and the low mobility of PCBs.

4.3 Pathways

- Human dermal contact;
- Human ingestion via soil directly or via bioavailable contaminants within vegetables grown in contaminated soils;
- Human inhalation of dust or vapours;
- Leaching and/or migration through permeable soils (granular Made Ground, River Terrace Deposits and Kellaways Sand);
- Direct contact with buried concrete/water supply services.

4.4 Receptors

- End user residents, workers and visitors, (Human Health);
- Superficial Deposits and Kellaways Sand Member – Secondary A Aquifer (Controlled Waters);
- Buried foundation/substructure concrete (Building Materials);
- Water supply services (Building Materials).

4.5 Source/Pathway/Receptor Linkage and Assessed Risk

Source-pathway-receptor (SPR) linkages are tabulated below together with the qualitatively assessed risk. The risk to ground workers and construction workers is not included in the table as it is assumed that these risks will be sensibly negated by the adoption of good hygiene practices and the appropriate use of relevant PPE/RPE when exposed to potentially contaminated soils. Comments regarding contamination issues with respect to ground workers and construction workers are included in the health and safety section of the Standard Procedures included as Appendix E.

Source	Pathway	Receptor	Risk*
Potential contaminants within Made Ground or resulting from adjacent site development.	Inhalation, ingestion, dermal contact.	End users, adjacent residents	Low
	Migration and Leaching	Superficial Deposits and Kellaways Sand Member (Secondary A Aquifers)	Negligible
Soil gas from Made Ground – both on site and off site sources (methane, carbon dioxide)	Migration into buildings, service ducts etc.	End users	Low
Elevated sulphates in Made ground or natural	Direct contact, leaching and contact with	Buried concrete	Low-medium (see 7.2)

Source	Pathway	Receptor	Risk*
soils	groundwater		
Hydrocarbon contaminants from vehicle/plant leaks	Inhalation, ingestion, dermal contact.	End users	Low
	Migration/leaching	Superficial Deposits and Kellaways Sand Member (Secondary A Aquifers)	Negligible
	Direct contact	Water supply services	Low

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

5.0 GROUND INVESTIGATION WORKS

5.1 Fieldwork

The following scope of fieldwork was undertaken:

- 18 No Machine excavated trial pits (ref: TP1 to TP18) to depths of between 2.35m and 4.1m below ground level (bgl).

The locations of the exploratory holes were selected in general accordance with the proposed borehole location plan provided by Bailey Johnson Hayes and set out on site by Applied Geology Limited. A number of the positions were constrained by the presence of a sewer, which bisected the site, orientated northeast to southwest and also the pylons and associated overhead cables. The sampling strategy for the exploratory hole locations was to provide best overall coverage. The locations of the trial pits are presented on Drawing No. AG2875-18-02 in Appendix A. The positions are approximated in relation to field boundaries and identifiable features on the site plan.

5.2 Laboratory Testing

Geotechnical laboratory testing was undertaken on selected samples and comprised the following:

- 8 No natural moisture content tests;
- 8 No Atterberg limit tests;
- 5 No particle size distribution tests;
- 5 No BRE SD1 suite tests;
- 4 No BRE SD1 with pyrite suite tests.

Chemical testing was undertaken based upon the desk study, walkover and site observations during the fieldwork. Selected samples were analysed for the following suite of contaminants:

- Selected metals suite [arsenic, beryllium, boron, cadmium, chromium (total), copper, mercury, nickel, lead, zinc, selenium, vanadium] (10 samples);
- Chromium hexavalent and trivalent (2 samples);
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH) (10 samples);
- Phenols (total) (2 samples);
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) (3 samples);
- pH (10 samples);
- Soluble sulphate (10 samples);
- Organic matter (10 samples);
- Asbestos Containing Material (ACM) (5 samples);
- Pesticides (5 samples).

Laboratory test results are included in Appendix D.

6.0 GROUND CONDITIONS

Topsoil and subsoil was encountered at surface across the site and was underlain by Superficial Deposits comprising Alluvium and River Terrace Deposits, which in turn was underlain by the Kellaways Formation, predominantly comprising clay, with initial horizons of sand in the southeast of the site. This is broadly consistent with the published geological records. Full details of the strata encountered are given on the borehole records presented in Appendix C, however, a generalised ground profile is presented below to summarise the information.

Stratum	Depth to Top of Strata (m bgl)	Thickness range (m)	Comments
Topsoil	GL	0.15 – 0.35	Encountered at all locations
Subsoil	0.15 – 0.30	0.10 – 0.45	Encountered in TP1, TP2, TP7-12 and TP14
Alluvium	0.15 – 0.45	0.15 – 1.25	Not encountered in TP1, TP2, TP7 or TP14
River Terrace Deposits	0.35 – 1.20	0.20 – 1.30	Not encountered in TP3, TP11 or TP12
Kellaways Formation	0.60 – 1.80	>2.65	Encountered at all locations, base not proven

6.1 Topsoil and Subsoil

Topsoil was encountered from ground level at all locations, to a depth of between 0.15m and 0.35m bgl and generally comprised firm dark brown slightly sandy friable clay with rootlets and occasional shell fragments.

Underlying subsoil was encountered at around half of the locations to depths of between 0.35m and 0.7m bgl and generally comprised stiff brown friable clay, with

occasional rootlets and occasional fine to coarse subangular to subrounded limestone.

6.2 Alluvium

Strata considered to represent alluvial deposits were encountered at all locations, with the exception of TP1, TP2, TP7 and TP14 (generally absent in the northwest of the site), beneath the Topsoil or Subsoil to depths of between 0.5m and 1.6m bgl. The Alluvium generally comprised soft to firm orangish-brown and light greyish brown mottled slightly sandy silty clay.

The results of two Atterberg limit tests undertaken on the Alluvium have indicated plasticity indices of 20% and 51% (corrected to between 16.8% and 48.96%), indicating these soils to be of moderate to high shrinkability as defined by NHBC Standards. Uncorrected liquid limits of 32% and 73%, plastic limits of 12% and 22% and moisture contents of 17.2% and 26.4% were also recorded. These results indicate the clays to be of medium to high plasticity.

6.3 River Terrace Deposits

River Terrace Deposits were encountered at all locations with the exception of TP3, TP11 and TP12, beneath the Subsoil or Alluvium to depths of between 0.6m and 1.8m, generally shallower in the northwest of the site. The strata generally comprised orangish-brown silty sand and gravel, with the gravel comprising fine to coarse subangular to subrounded limestone.

The results of two particle size distribution tests undertaken on the River Terrace Deposits at depths of 0.6m and 1.2m bgl, have indicated the following proportions: 30 to 40% sand, 47 to 54% gravel and 13 to 16% fines (clay and silt).

6.4 Kellaways Formation

Strata considered to represent the Kellaways Formation were encountered beneath the Superficial Deposits, to depths of between 2.35m and 4.1m bgl. The strata typically comprised firm becoming stiff bluish grey silty clay, occasionally with thin indistinct laminations, occasional fine to coarse subrounded to subangular limestone gravel and with rare fossil shell fragments. Occasional gypsum crystals were noted within the clay within nine of the trial pits (generally absent in the southeast of the site) from depths of between 1.25m and 3.5m bgl. In the southeast of the site, the strata often initially comprised a granular layer, generally comprising bluish grey slightly clayey silty gravelly fine to coarse sand (silt in TP13), with the gravel comprising fine to coarse subangular to subrounded limestone. The granular layer was encountered directly beneath the Superficial Deposits to depths of between 1.75m and 3.3m bgl and underlain by further cohesive deposits of the Kellaways Formation.

Hand shear vane tests undertaken on the cohesive Kellaways Formation, recorded undrained shear strengths of between 35kN/m² and 90kN/m², generally increasing in strength with depth.

The results of a number of particle size distribution tests undertaken on granular horizons of the Kellaways Formation at depths of between 0.8m and 2.3m bgl, have

indicated the following proportions: 35 to 60% sand, 11 to 44% gravel and 21 to 39% fines (clay and silt).

The results of Atterberg limit tests undertaken on the cohesive Kellaways Formation have indicated plasticity indices of between 10% and 51% (corrected to between 8.1% and 51%), indicating these soils to vary substantially between low and high shrinkability as defined by NHBC Standards. Uncorrected liquid limits of between 26% and 75%, plastic limits of between 13% and 25% and moisture contents of between 14.3% and 38.2% were also recorded. These results indicate the clays to be of low to high plasticity.

6.5 Groundwater

Groundwater was recorded as seepages in all trial pits, with the exception of TP12 (no River Terrace Deposits present) within the River Terrace Deposits at depths of between 0.5m and 1.3m bgl. The groundwater generally occurred as seepages, although fast inflows were noted in TP4 (from 0.8m) and TP5 (from 1.2m). Seepages were also noted within the Kellaways Formation in TP3 from 2.7m, TP11 from 1.3m and TP15 from 1.9m bgl. Details of the groundwater occurrence are summarised in the following table:

Trial Pit	Depth	Behaviour
TP1	0.5m	Seepage
TP2	0.6m	Seepage
TP3	2.7m	Seepage
TP4	0.8m	Fast inflow, causing continual collapse of the long sides of the trial pit.
TP5	1.2m	Fast inflow, causing continual collapse of the long sides of the trial pit.
TP6	0.9m	Seepage
TP7	1.0m	Seepage
TP8	2.9m	Seepage rising from base of trial pit
TP9	1.3m	Seepage
TP10	1.2m	Seepage
TP11	1.3m	Seepage
TP12	Dry	N/A
TP13	0.9m	Medium inflow, causing collapse of trial pit between 0.7m and 1.35m bgl.
TP14	0.7m	Seepage
TP15	1.9m	Seepage

Trial Pit	Depth	Behaviour
TP16	1.2m	Seepage
TP17	0.6m and 3.0m	Seepage
TP18	0.35m	Seepage

6.6 Contamination

No obvious visual or olfactory evidence of potential contamination was observed during the fieldwork undertaken by Applied Geology.

7.0 ASSESSMENT

7.1 Geo-environmental Overview

The results of the chemical testing on soils have been subjected to human health risk assessment as described in Appendix E, with specific details as follows:

- Proposed end-use – not yet known;
- Screening criteria – residential with plan uptake (for a conservative initial assessment), assuming 6% SOM;
- Assuming a single dataset based on the site's history and current land-use.

The spreadsheets summarising the laboratory results and relevant screening values for each dataset are presented in Appendix D. The spreadsheet shows that none of the results of the testing for the proposed development exceed the conservative human health screening criteria.

TPH concentrations were recorded at below the laboratory detection limits.

The Asbestos screening tests did not detect the presence of any ACM.

The pesticides/herbicides screening tests did not detect the presence of any pesticides.

Based on the above assessments, it is considered that the risks to human health at the site are negligible.

The testing has not found concentrations of any determinants within the soils, which would be considered representative of contamination. Given the absence of a significant source and no pollutant linkage to controlled waters, there is considered to be a negligible risk to Controlled Waters.

Furthermore, the TPH results have not given concentrations that would exceed UKWIR limits for the use of polyurethane (PE) or polyvinylchloride (PVC) water supply pipes. Barrier supply pipes are therefore not likely to be required. Further guidance on this subject is included within Appendix E.

In the light of the trial pit investigation findings, the risks relating to contamination issues, as assessed above, have been updated in the following table:

Source	Pathway	Receptor	Notes from Investigation	Updated Risk*
Potential contaminants within Made Ground or resulting from adjacent site development.	Inhalation, ingestion, dermal contact.	End users, adjacent residents	No Made Ground encountered on site. Low concentrations of contaminants identified in near surface soils	Negligible
	Migration and Leaching	Superficial Deposits and Kellaways Sand Member (Secondary A Aquifers)	No Made Ground encountered on site. Low concentrations of contaminants identified in near surface soils	Negligible
Soil gas from Made Ground – both on site and off site sources (methane, carbon dioxide)	Migration into buildings, service ducts etc.	End users	No Made Ground encountered at the site. Ground gases from alluvium or underlying strata has not yet been assessed.	Low
Elevated sulphates in Made ground or natural soils	Direct contact, leaching and contact with groundwater	Buried concrete	River Terrace Deposits	Low
			Kellaways Formation – Granular	Low
			Kellaways Formation - Cohesive	High
Hydrocarbon contaminants from vehicle/plant leaks	Inhalation, ingestion, dermal contact.	End users	Low/trace concentrations of contaminants identified	Negligible
	Migration/leaching	Superficial Deposits and Kellaways Sand Member (Secondary A Aquifers)	Low/trace concentrations of contaminants identified	Negligible
	Direct contact	Water supply services	Low/trace concentrations of contaminants identified	Negligible

7.2 Geotechnical Overview

The dominant factors affecting the design options for any new foundations at the site are the presence of soft Alluvium, which was encountered to depths of up to 1.6m bgl, together with shallow groundwater levels.

For typical light to moderate loads, conventional pads or strips/trenchfill foundations could be considered, taken down below any Topsoil/Subsoil, Alluvium or loose/soft zones and placed within the underlying competent River Terrace Deposits or Kellaways Formation.

A minimum founding depth of 0.75m is likely generally for foundations placed within the granular River Terrace Deposits. For foundations placed within the Kellaways Formation, a minimum founding depth of 1.0m is likely to be needed to cater for seasonal effects. Further deepening will be required in the influencing zone of existing, recently felled or proposed trees, in line with requirements for soils up to

high shrinkage potential. We understand that conventional foundations are preferred and hence, comments on potential construction difficulties are provided as follows.

Groundwater occurrence appears to be associated predominantly with the variations in the depths and thickness of the granular River Terrace Deposits across the site. In the northwest, the groundwater appears to be perched within shallow River Terrace Deposits and separated from areas to the east by a thicker wedge of cohesive alluvium (TP3). Hence, in the northwest, the groundwater should be relatively easily sealed off, such that foundations can be placed into the underlying Kellaways Clay. Progressing southeast through the site, the granular deposits generally become thicker and are more saturated. A faster inflow was noted in the northeast of the site (TP4 and TP5) and this, together with an increased depth to the underlying Kellaways Clay, may result in greater difficulties in sealing off the groundwater. In central and southern areas, the ground appears to be generally less saturated. Here, it is likely to be possible to place some foundations within the granular River Terrace Deposits above the groundwater. In other areas, excavations may need to involve cutting off the groundwater by sealing into the underlying clay.

Owing to the potential for construction difficulties to arise locally, alternative foundation solutions, such as ground improvement or piles could be considered in those areas. If this is to be further considered, it would be prudent to seek the advice of an appropriate specialist contractor.

It is understood that ground bearing floor slabs will be required. Owing to the presence of shrinkable subsoil generally underlying the site, there will be a need to ensure that any soft, loose or potentially desiccated materials are removed and replaced with compacted granular material. In areas where the River Terrace Deposits are present with reasonable thickness, the need for excavation and treatment is unlikely. The floor slab should be constructed on a compacted granular mattress of appropriately designed thickness.

Excavations of typical dimensions for foundations and service trenches should generally be achievable using conventional hydraulic plant. As discussed above, the groundwater occurrence will lead to a requirement for control measures, depending upon depth and location. Appropriate trench supports/cut offs are likely to be required to achieve stability together with sump pumping to maintain dry excavations.

For foundations placed in the River Terrace Deposits, testing suggests that DS-1 conditions will apply, which no special measures are required. For foundations placed in the cohesive Kellaways Formation, sulphate resisting concrete appropriate to DS-4/AC-4 is likely to be required.

The capacity for soakaway drainage is likely to be severely restricted on the site, owing to the generally shallow groundwater levels. It would therefore be prudent to seek an offsite source for drainage.

7.3 Conclusions and Recommendations

Based on the pre-acquisition investigation, contamination related to risks to human health and Controlled Water receptors appear to be negligible. It is considered that

remedial measures in this regard, are very unlikely and hence, associated potential liability is extremely limited.

Conventional shallow foundations should be considered for light to moderate loads, but some construction difficulties may arise, associated with shallow groundwater. The trial pits suggest that these risks may be greatest in the northeast of the site, although localised difficulties could be experienced in the central and southern parts of the site. To avoid such difficulties, a piled foundation could be considered.

No special measures relating to buried concrete are required for foundations placed in the River Terrace Deposits, although foundations placed in the Kellaways Formation are likely to require sulphate resisting concrete appropriate to DS-4/AC-4 conditions.

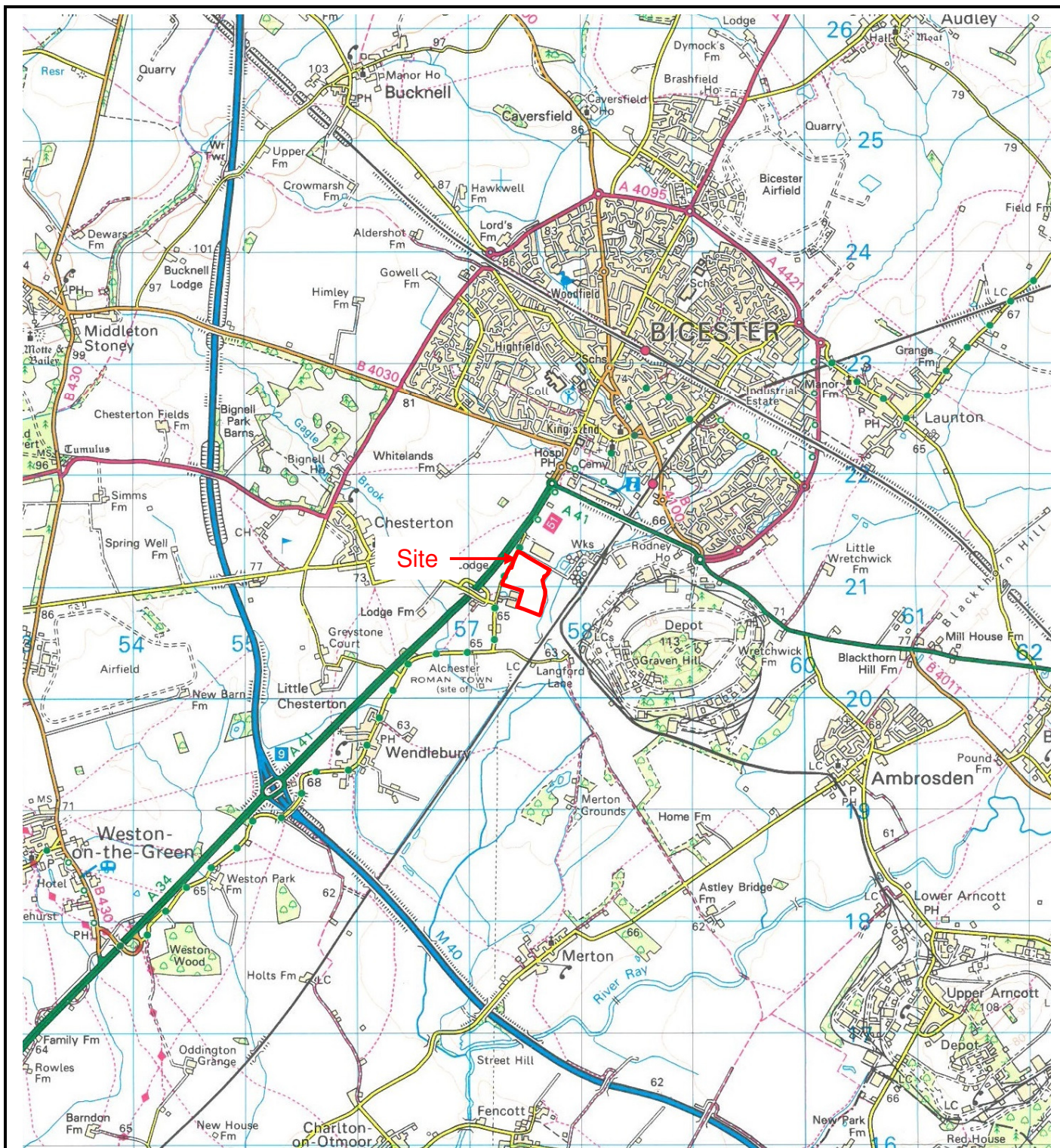
It is recommended that an offsite source of drainage is sought for the site.

It is understood that the site has now been acquired and further site investigation will be required based on the proposed development layout. This should include a number of boreholes, geared towards the proposed site layout, with a programme of groundwater and groundgas monitoring to provide sufficient information for final engineering designs. Some further contamination testing should be included to ensure appropriate coverage for compliance and audit trail.

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APPENDIX A



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APPLIED GEOLOGY

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Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client:

ALBION LAND LTD

Project:

THE PROMISED LAND FARM, BICESTER

Drawn By:

JS

Checked By:

FHJ

Paper Size:

A4

Scale:

1:50,000

Date:

06.09.2018

NGR:

457226 220693

Title:

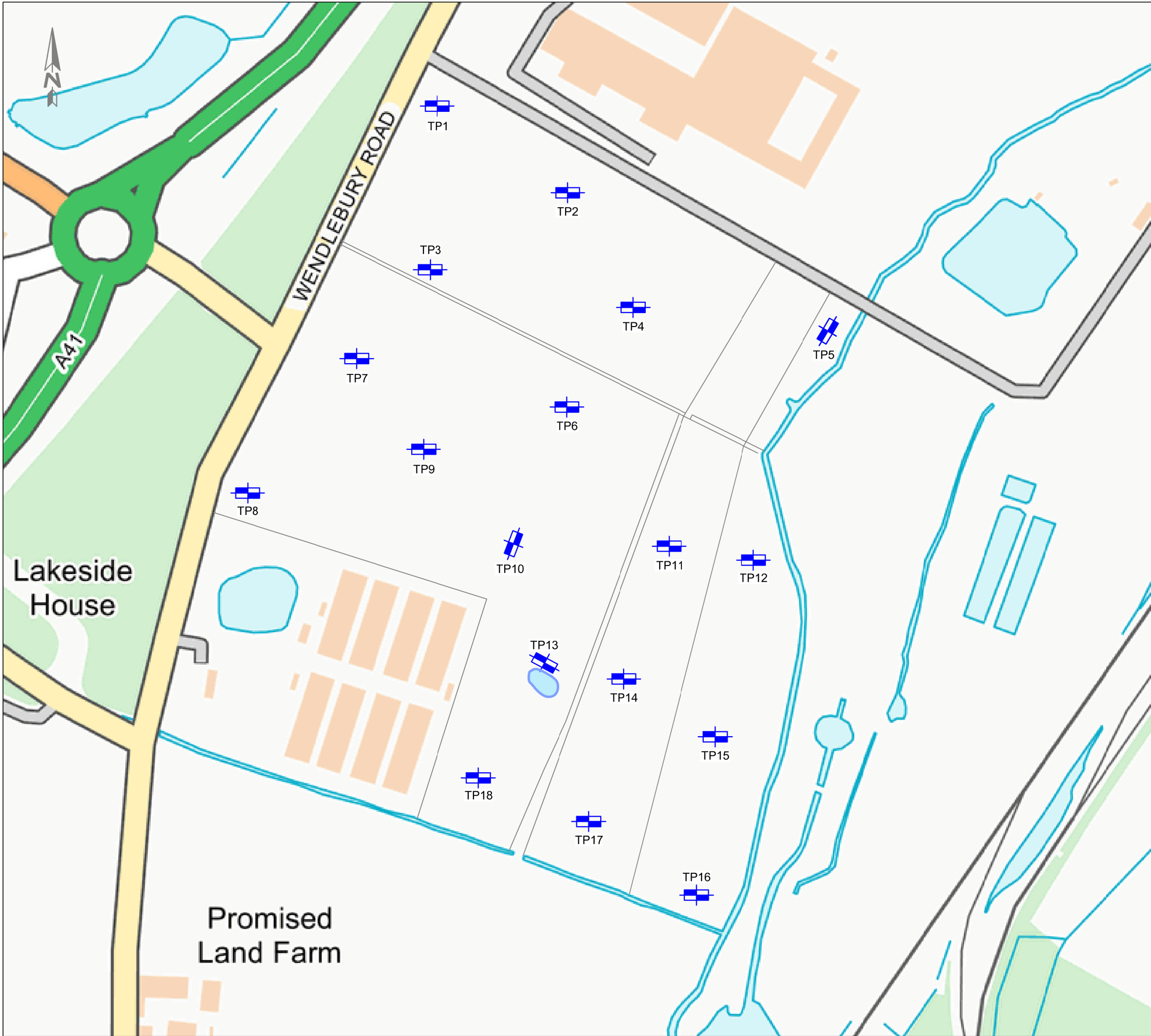
SITE LOCATION PLAN

Drawing No:


AG2875-18-01

Revision:

0



KEY:

 Trial Pit

TP1

Drawing based on StreetMap image dated 24/07/2018.

APPLIED GEOLOGY

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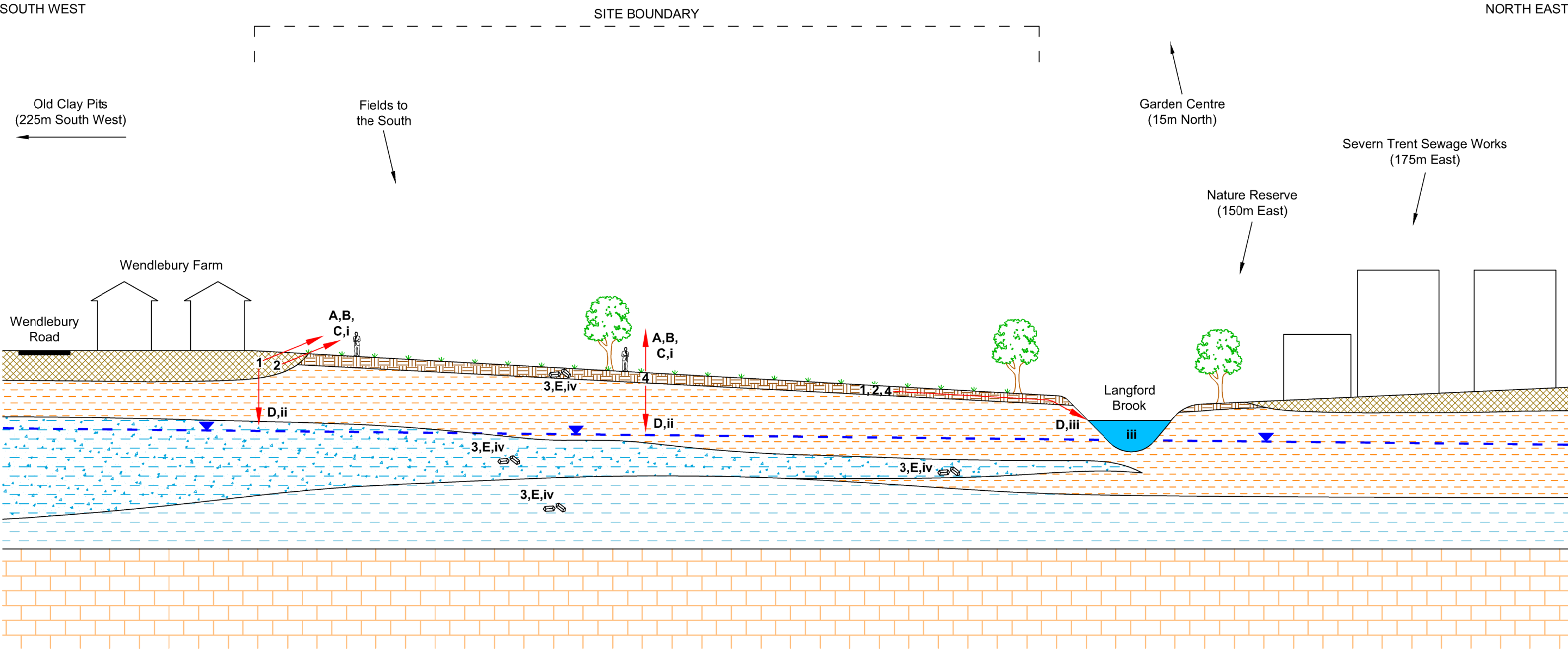
Project:

THE PROMISED LAND FARM, BICESTER

Title:

EXPLORATORY HOLE LOCATION PLAN

Drawn By:	JS	Checked By:	FHJ	Paper Size:	A3
Scale:	NTS		Date:	24.07.2018	
Drawing No:	AG2875-18-02			Revision:	0



SOURCES

- 1. Made Ground/Topsoil
- 2. Soil gas
- 3. Elevated sulphates
- 4. Hydrocarbons(spillages / leaks from former vehicles / plant)


PATHWAYS


- A. Inhalation
- B. Ingestion
- C. Dermal contact
- D. Leaching/migration
- E. Direct contact


RECEPTORS


- i. End users
- ii. Aquifer
- iii. Watercourse
- iv. Buried concrete


Key:


Topsoil


Made Ground

Alluvium
(Secondary A Aquifer)

River Terrace Deposits
(Secondary A Aquifer)

Kellaways Formation
(Secondary A Aquifer)

Cornbrash Formation
(Principal Aquifer)

Groundwater

APPLIED GEOLOGY

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Client:
ALBION LAND LTD

Project:
THE PROMISED LAND FARM, BICESTER

Title:

CONCEPTUAL SITE MODEL

Drawn By: JS	Checked By: FHJ	Paper Size: A3
Scale: NTS	Date: 17.09.2018	
Drawing No: AG2875-18-03	Revision: 0	

APPENDIX B

County Series 1:10,560 scale

VEGETATION



Fir Wood



Deciduous Wood



Mixed Wood



Brushwood



Orchard



Reeds



Rough Pasture



Furze



Marsh



Osiers

ROADS



Railway over Road



Road over Railway



Road over River or Canal



Level Crossing



Railway over River



Road over Stream



Road over Stream



Sunken Road



Raised Road

RAILWAYS



Double Lines of Railway



Single Lines of Railway and Tramway

GENERAL FEATURES



Gravel Pit



Sand Pit



Quarry



Shingle



Other Pits



Antiquities, Site of



Arrow, showing direction of flow of water



Trigonometrical Station

BOUNDARIES



County Boundary



Parish Boundary



Contours



Parliamentary Division Boundary



Union Boundary



Rural District Boundary

National Grid 1:10,000 scale

HEIGHTS (METRES)

Values are given in metres above mean sea level at Newlyn.

Surface heights determined by ground survey 163m
air survey 164m

Bench marks and their values are shown on large scale maps, and bench mark lists containing fuller and possibly later levelling information are obtainable from the Director General, Ordnance Survey.

Contours are at 5 metres vertical interval.

ROCK FEATURES

Loose rock

Boulders

Outcrop

Scree

Vertical face

CONVERSION SCALE

Metres - Feet

2000 Metres 6500 Feet

6000

5000

1500

4000

ABBREVIATIONS

BP,BS Boundary Post or Stone

Ch Church

CH Club House

F Sta Fire Station

FB Foot Bridge

Fn Fountain

GP Guide Post

MP,MS Mile Post or Stone

P Pole or Post

Pol Sta Police Station

PO Post Office

PC Public Convenience

PH Public House

S Stone

Spr Spring

TCB Telephone Call Box

TCP Telephone Call Post

TH Town Hall

W Well

Y Youth hostel

ROADS

Road

Track

Where unfenced shown by pecked lines.

Path

RAILWAYS

Cutting Embankment

Road over

Level crossing

Foot Bridge

Road under

Multiple track

Single track

Siding, tramway or mineral line

Narrow gauge

GENERAL FEATURES

Antiquity, (site of)

Boulders

Building

Pylon

Pole

Glasshouse

Triangulation station

Electricity transmission line

Shingle

Sand

Direction of flow of water

Refuse or slag heap

Chalk pit, clay pit or quarry

Gravel pit

Sand pit

Refuse or slag heap

Shingle

Sand

Direction of flow of water

Refuse or slag heap

Shingle

Sand

Direction of flow of water

Refuse or slag heap

Shingle

Sand

Direction of flow of water

Refuse or slag heap

VEGETATION

Bracken, rough grassland

Marsh

Saltings

Heath

Reeds

Coppice

Orchard

Coniferous trees

Non-coniferous trees

In some areas bracken () and rough grassland () are shown separately.



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Historical Map Pack Legend

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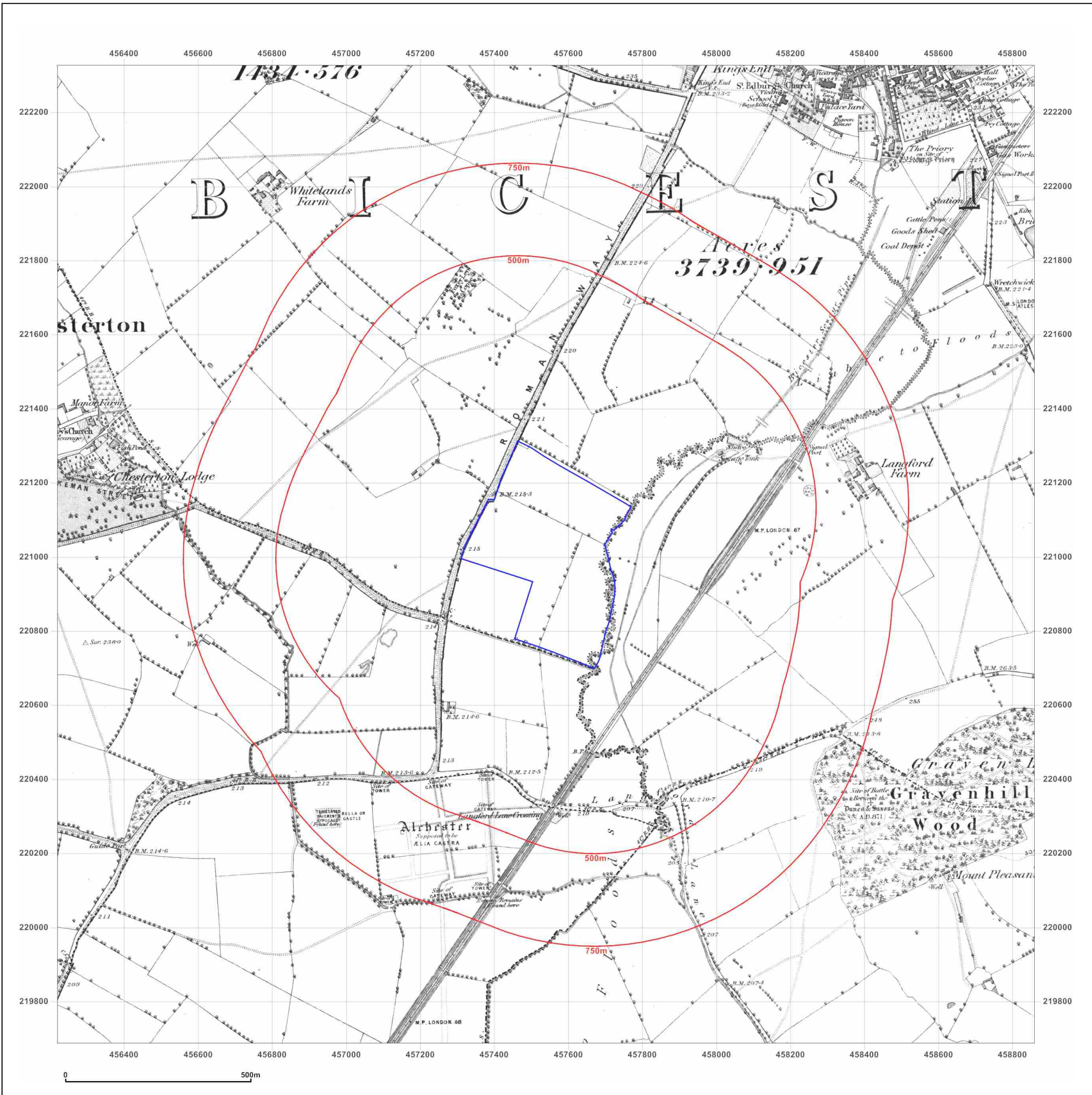


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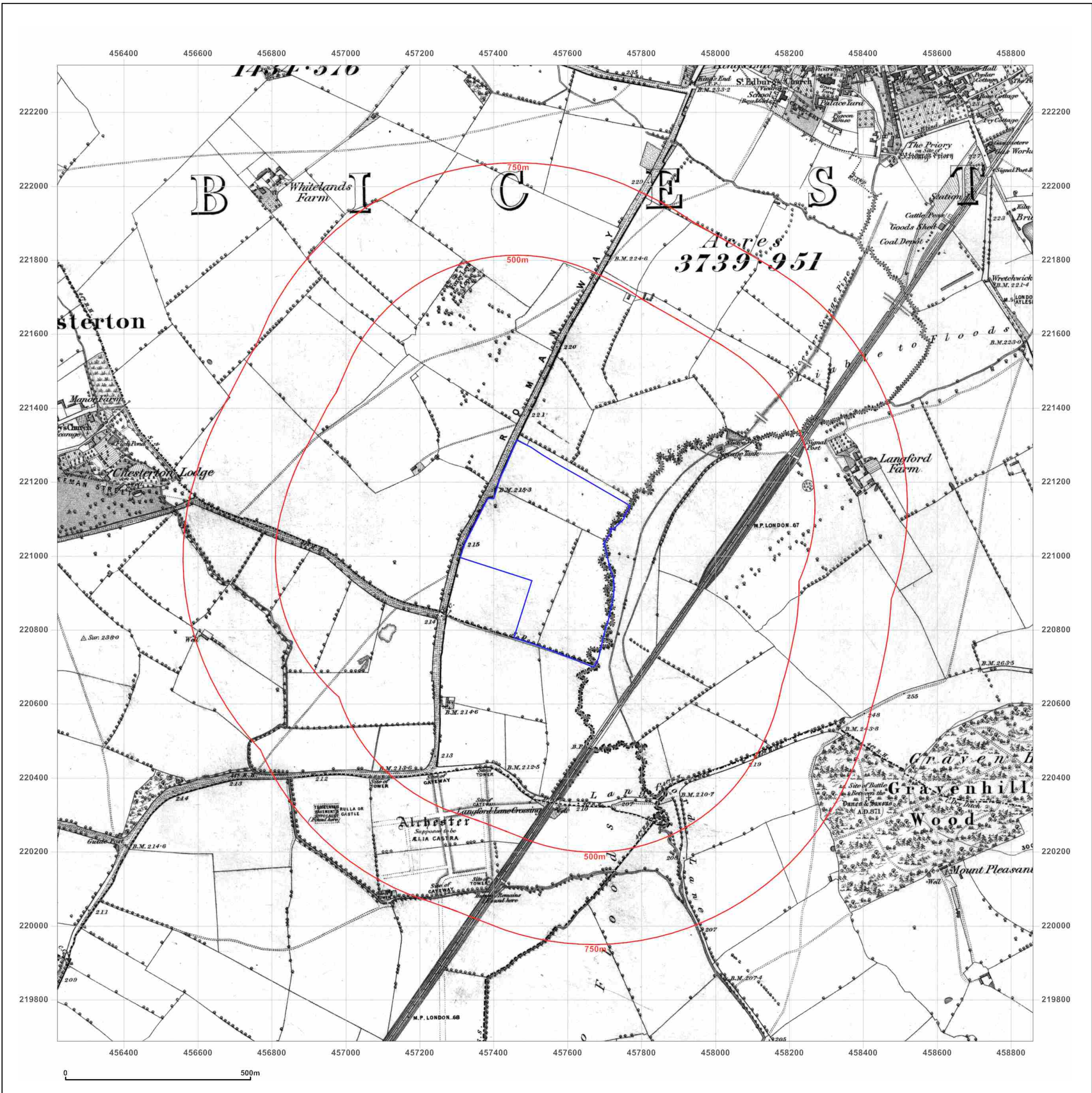


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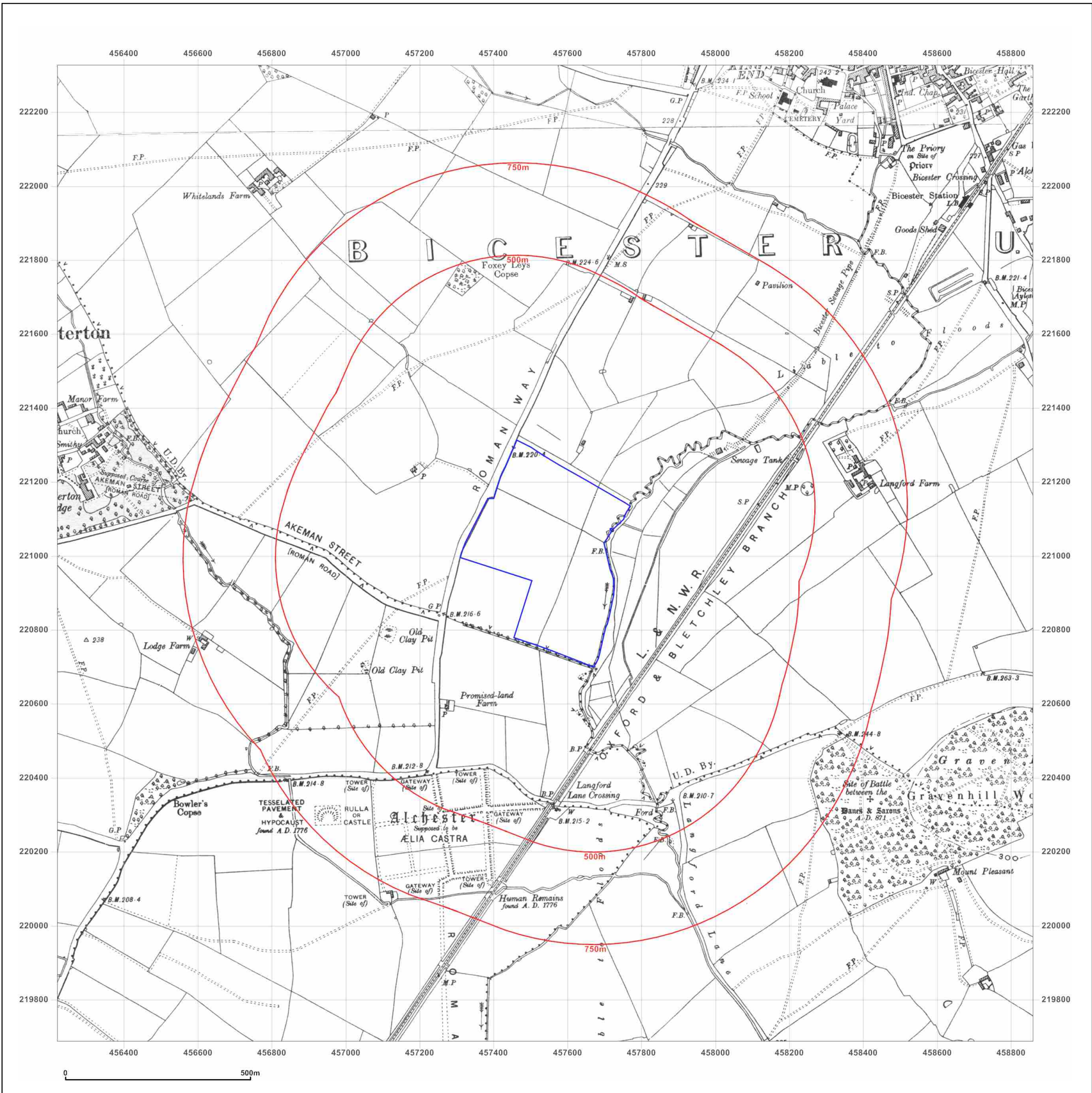


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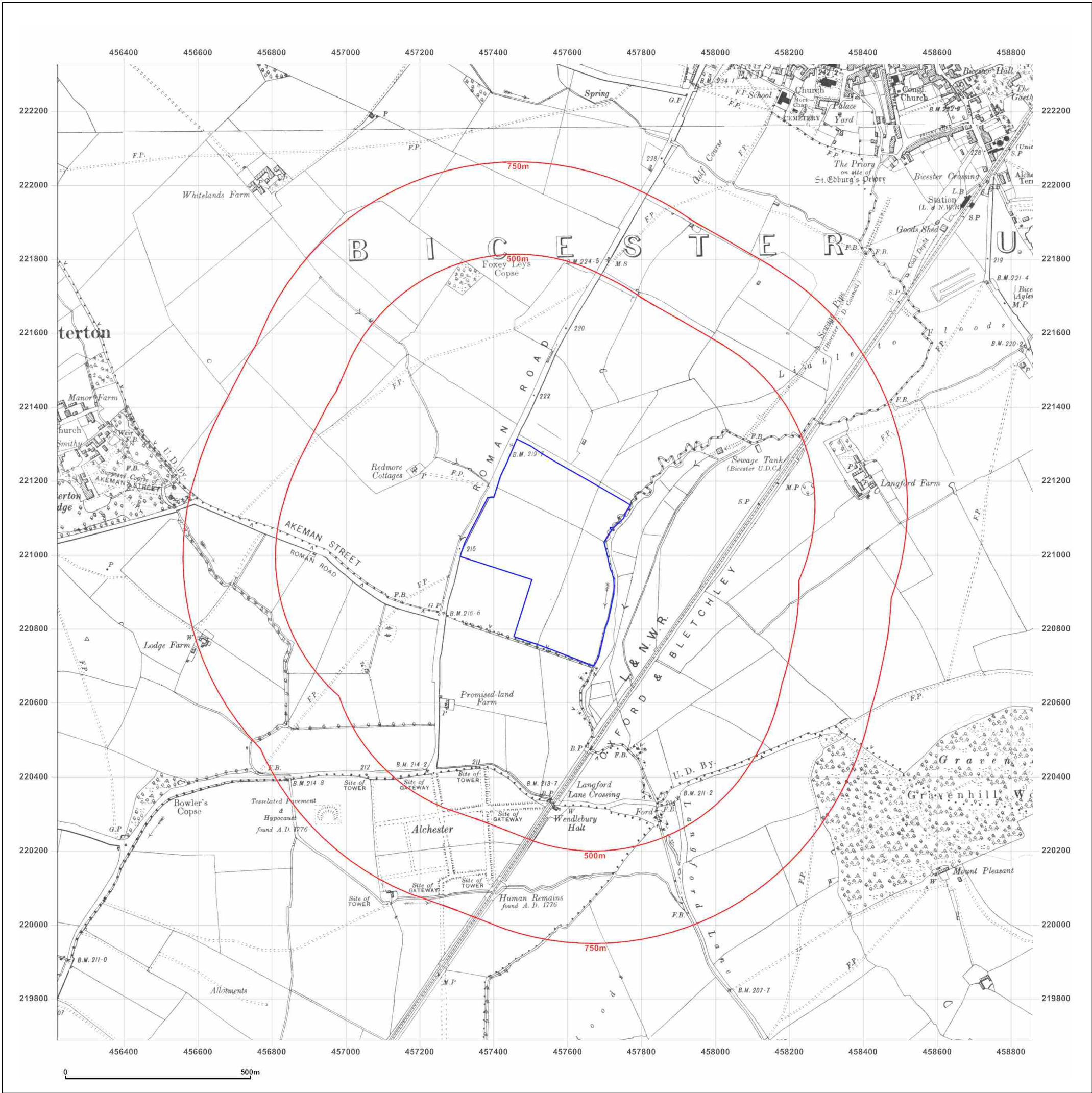


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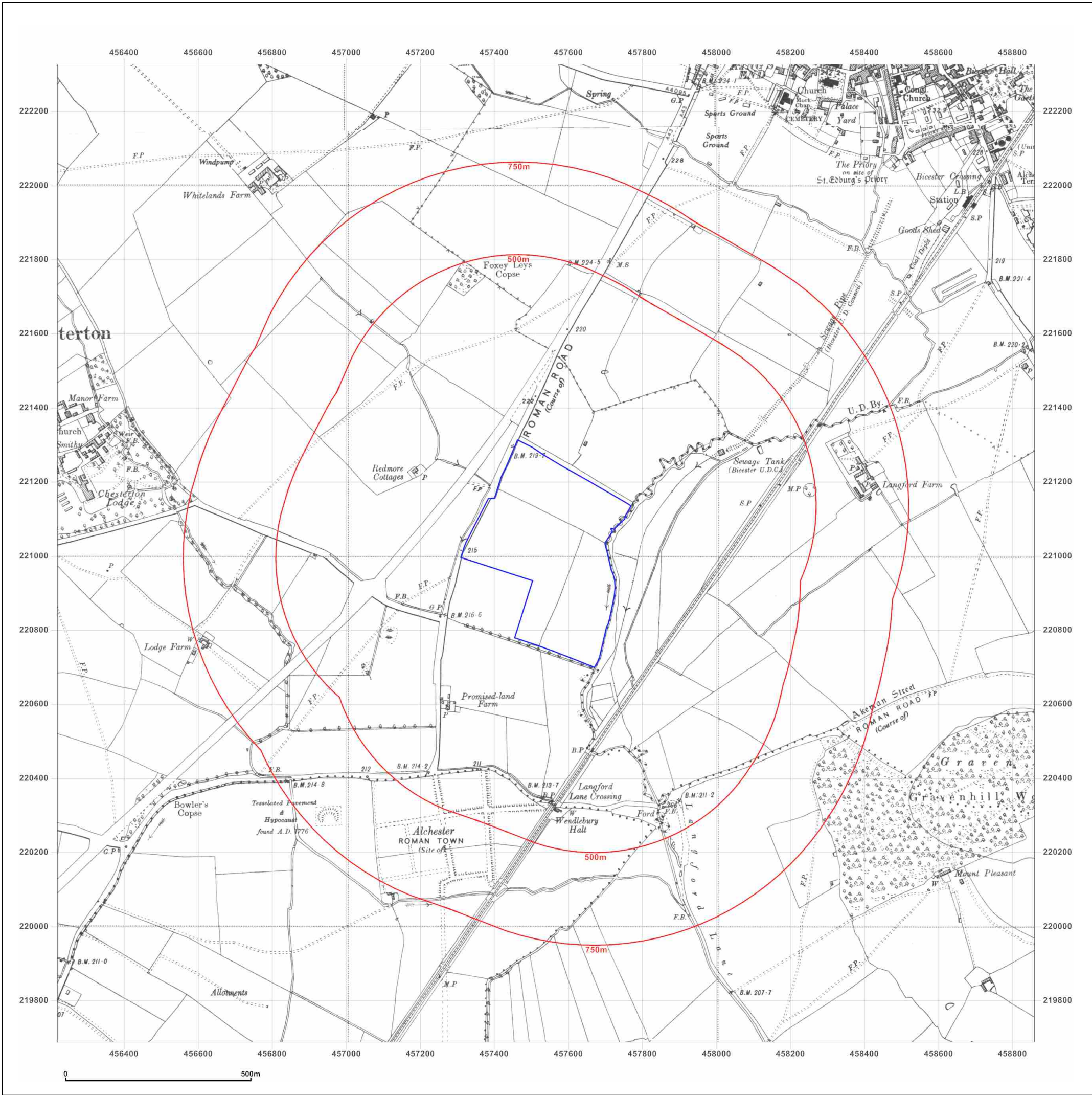


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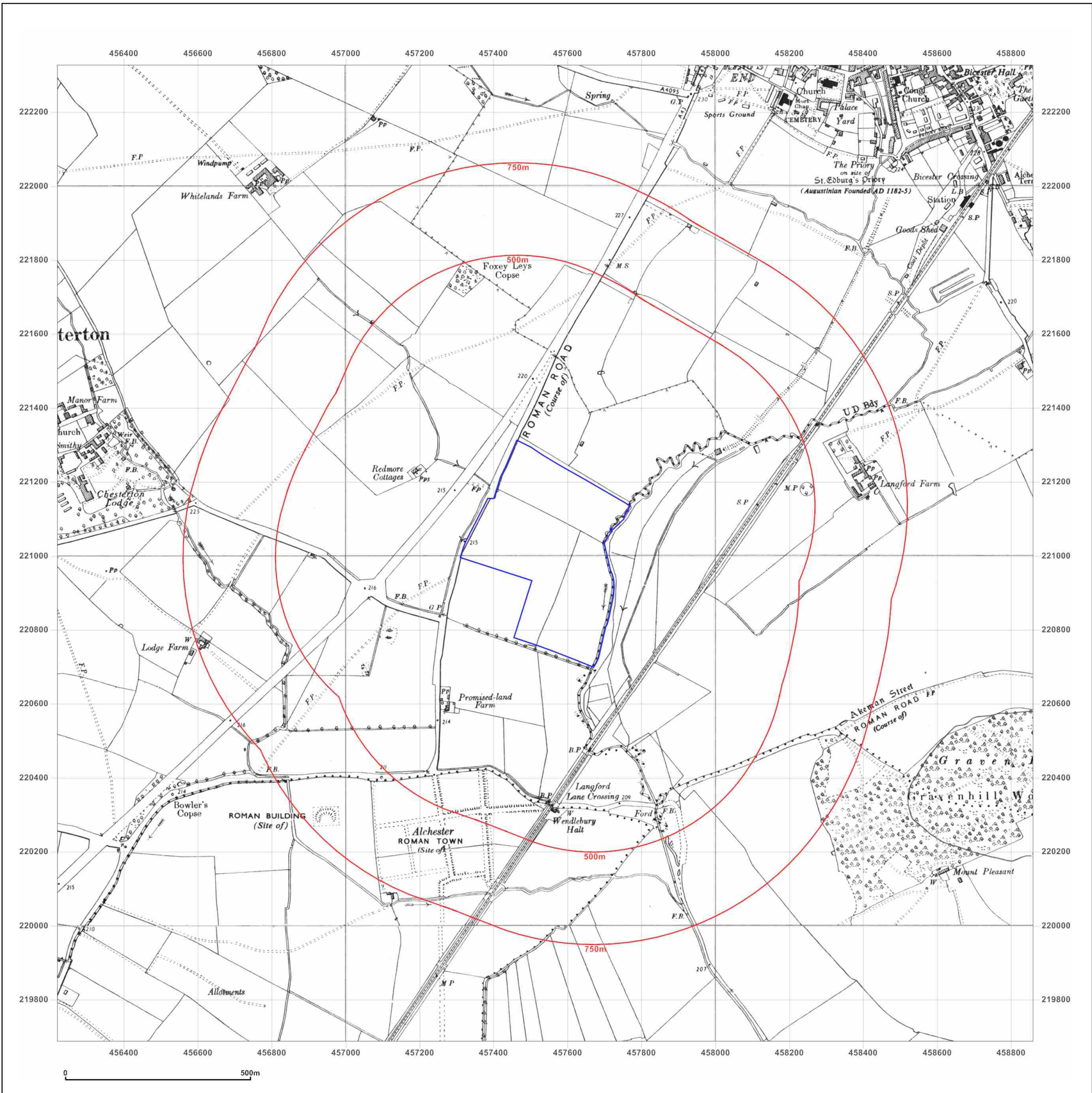


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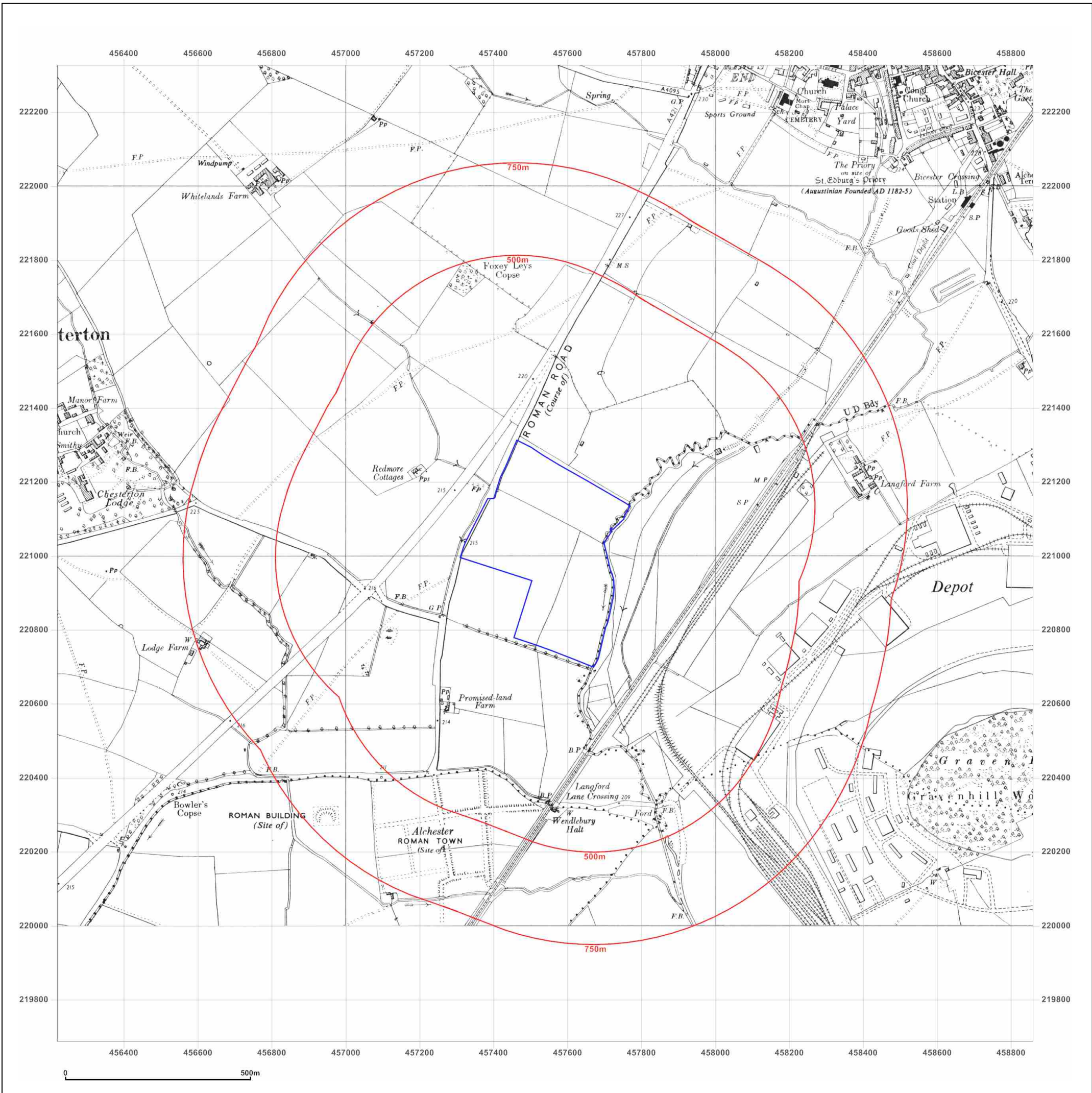


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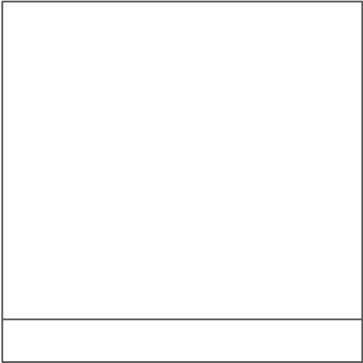
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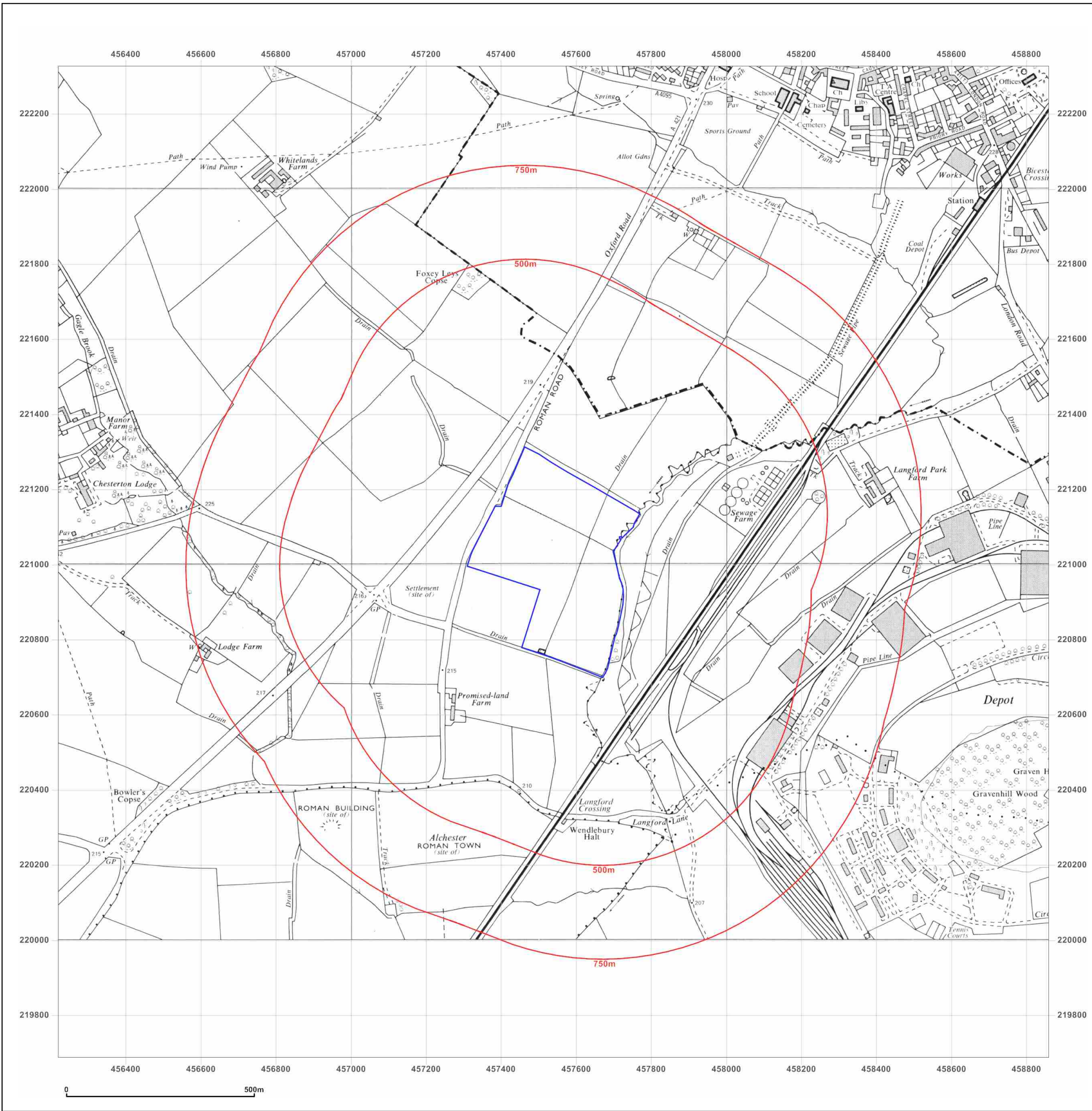


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