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DRAFT

Harbury Future Energy & e-Wheels

Ground Investigation

Harbury Electric Vehicle Charging Station Facility, Harbury Playing Fields, Constance Drive, Harbury Warwickshire CV33 9HZ

Report No: 21.04.022
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For and on behalf of ListersGeo, trading name of Listers Geotechnical Consultants Ltd

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EXECUTIVE SUMMARY

Project Reference	21.04.022
Site Location	Harbury Playing Fields, Constance Drive, Warwickshire CV33 9HZ
OS Grid Reference	437319, 259530
Development Proposals	An electric vehicle charging station facility, complete with a wind turbine, solar panels, electrical storage battery and ancillary services
Current Site Use and Existing Buildings	Village Hall at the northern end, with car park, grassed playing fields, all weather sports pitches, cycle sports area and skate park beyond
Topography	The site is generally flat and slopes very gently up to the south, with an elevation difference, across the site, of about 2m
Vegetation	The interior of the site was devoid of significant vegetation, but there was a hedge of trees and shrubs along nearly all of the eastern and southern boundaries, parts of the western boundary, around the children's play area, and on the eastern side of the car park. More specifically to the four areas of proposed development, are the following approximated distances to significant vegetation: Area B: <2m to a 2m high hedgerow (to the west) and 13.2m to 10m high trees (to the east); Area C: <2m to a 2m high hedgerow (to the west) and <2m to 10m high trees (to the east); Area W1: 12.5m to an 8m high tree hedge (to the east); Area W2: 9.7m to a 14m high Oak? tree (to the north-east) and 8.8m to a 14m high Oak? tree (to the south-east)
Published Geology	Quaternary superficial Till, with the Late Triassic bedrock Rugby Limestone Member (of the Blue Lias Formation) beneath
Site History	The site was formed of two large agricultural fields, on the southern (agricultural) side of the village, from the date of the earliest map (1885) and the map of 1971 shows the Village Hall at the northern end and the remainder of the site marked as Playing Fields (and, later, as Recreation Ground). The all-weather (tennis) court is first shown on the map of 1987 and the cycle sports area and skate park are first seen on aerial imagery dated 2006
Unexploded Ordnance	Low risk
Ground Conditions Encountered	A cover of Fill/Topsoil and localised Made Ground to a maximum depth of 0.80m; over Till, with thin beds of Glacio-Fluvial Deposits; and Glacio-Fluvial Deposits below about 4.2m at the southern end of the site
Groundwater	Not encountered. (Water inflow in CT02 was, most likely, from a broken land drain)
Chemical Attack on Buried Concrete	Design Sulphate Class DS-1, characteristic pH, 6.4 Aggressive Chemical Environment for Concrete, AC-1
Foundations (Proposed Battery Store and Proposed Wind Turbine)	The existing pavement construction area for the proposed battery store area should be adequate to support modest loadings without undergoing undue settlement. The Till should prove a suitable bearing stratum for foundations to support the wind turbine on spread foundations, such as pads or a raft. Foundation depths to be assessed in accordance with NHBC Standards, with a recommended *minimum* depth for pad foundations, of 0.90m. If the bearing pressure stated below are insufficient, then consideration should be given to the use of short pile foundations bearing into the Glacio-Fluvial Deposits (below about 4.2m depth).
Bearing Pressures (Proposed Battery Store and Proposed Wind Turbine)	Safe Bearing Pressure of 100kPa for a raft foundation, with a recommendation to assess likely settlements once building loads are known. Allowable Bearing Pressure (for 25mm total settlement) of 140kPa for isolated square bases up to 3.00m wide at 0.90m depth, increasing, with depth of placement, at a uniform rate of 10kPa/0.2m depth, to a maximum of 220kPa at a depth of 2.50m
Hardstanding Design (Proposed Car Park)	Preliminary design California Bearing Ratio values: • Till: 3.0% • Made Ground (if extensive): 1.0% These soils are potentially frost-susceptible

Recommendations	The ground is seldom homogenous and variations likely to affect our conclusions may, inevitably, occur between and beyond our test locations. We, therefore, recommend that the developer maintains a watching brief for suspicious soils or ground conditions. Should ground conditions vary noticeably from our Ground Model, then we recommend further assessment by a suitably qualified person or persons. If additional, deeper, ground investigation is required for pile design, this could be achieved using a cable percussion borehole: conducting Standard Penetration Tests and nominally undisturbed tube sampling, with supplementary geotechnical laboratory testing.

This executive summary should be read in conjunction with the main report.

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GROUND INVESTIGATION REPORT

INTRODUCTION

A Ground Investigation has been undertaken for the proposed Harbury Electric Vehicle Charging Station Facility at Harbury Playing Fields, Harbury, Warwickshire CV33 9HZ: at the location shown on the Site Location Plan in Appendix A. The Ordnance Survey National Grid reference for the approximate centre of the site is 437319, 259530.

Instructions to undertake the investigation were received from Allen Construction Consultancy Ltd, on behalf of the client, Harbury Future Energy & e-Wheels, in their email dated 20th April 2021.

This report describes the desk study and intrusive site investigation activities carried out by ListersGeo in order to provide an evaluation of the ground conditions. On the basis of those findings, and subsequent laboratory testing, and with regard to the proposed development, the report presents geotechnical assessment and recommendations.

The site has, to our knowledge, not been the subject of any previous ground investigations.

This report has been prepared for the sole use of the client and their professional advisors. This report shall not be relied-upon by third parties without the express written authority of ListersGeo. If an unauthorised third-party comes into possession of this report they must not rely on it and the authors owe them no duty of care and skill.

SCOPE OF THE INVESTIGATION

The scope of the investigation was to undertake a desk study and walkover survey and to provide an assessment of the geotechnical engineering properties of the ground.

PROPOSALS

It is proposed to develop the site to accommodate an electric vehicle charging station facility, complete with a wind turbine, solar panels, electrical storage battery and ancillary services. For the purpose of this investigation, the four areas of proposed development (and the abbreviations used through this report) are as follows:

- Area B: Proposed Battery Storage
- Area C: Proposed Car Park Extension
- Areas W1: Proposed Wind Turbine location (North)
- Areas W2: Proposed Wind Turbine location (South)

A plan showing the proposed site layout is presented in Appendix A.

SITE INFORMATION AND WALKOVER SURVEY

A walkover survey of the site and its immediate surrounds was undertaken on the 29th April 2021, in conjunction with the fieldwork. An annotated plan, showing the existing site layout is presented in Appendix A.

The site is to the south of the centre of the village of Harbury, and is bounded by:

- South Parade to the north
- Residential properties and (further south) allotment gardens and fields to the east
- Agricultural fields to the south and south-west, with a collection of farm buildings (Pineham Farm) adjacent to the south-eastern corner
- Residential properties on Ridgely Way, Hereburgh Way, Margaret Close and Constance Drive to the west and, at the northern end of that boundary, Constance Drive

The site is approximately (reversed) L-shaped on plan, measuring about 500m from north to south and a maximum of 110m from east to west: covering 4.38ha.

The northern end of the site is at an elevation of about +122.0mOD (Ordnance Datum) on a relatively flat and broad plateau above river valleys to the east and west. The site is generally flat and slopes very gently up to the south, with an elevation difference, across the site, of about 2m.

The site mostly comprised grassed playing fields, with peripheral footpaths and:

- Harbury Village Hall and a Children's play area, at the northern end
- All-weather sports pitches and a sports hut, within the north-eastern quarter
- A cycle sports park and a skate park, within the south-eastern quarter
- A paved car park, within the north-western quarter

The interior of the site was devoid of significant vegetation, but there was a hedge of trees and shrubs along nearly all of the eastern and southern boundaries, parts of the western boundary, around the children's play area, and on the eastern side of the car park. More specifically to the four areas of proposed development, are the following approximated distances to significant vegetation:

- Area B: <2m to a 2m high hedgerow (to the west) and 13.2m to 10m high trees (to the east)
- Area C: <2m to a 2m high hedgerow (to the west) and <2m to 10m high trees (to the east)
- Area W1: 12.5m to an 8m high tree hedge (to the east)
- Area W2: 9.7m to a 14m high Oak? tree (to the north-east) and 8.8m to a 14m high Oak? tree (to the south-east)

Cursory inspection of the village hall did not reveal any significant structural defects and the car park, also, showed no significant signs of structural defects.

DESK STUDY AND BACKGROUND INFORMATION

A desk study review of the site and its history has been undertaken to assess the former land uses and aid our geotechnical assessment. The data obtained have been sourced from maps, aerial images, online sources and a third-party desk study report, a copy of which is presented in Appendix D of this report.

The information provided is obtained from independent third-party sources. We have relied on this information, but no guarantee can be given as to the accuracy or completeness of the data used. It should be appreciated that such data is not exhaustive and is constantly being updated and reviewed in light of new information and procedures. In such an event, or if the development commences after expiry of one year from publication of this report, then we recommend this report be referred to us for reassessment.

The desk study comprises a review of the following consultations and information sources:

- Environment Agency (EA)
- National Geoscience Information Service
- Public Health England
- Centre for Ecology & Hydrology
- British Geological Survey (BGS)
- Historical Ordnance Survey maps
- Aerial Imagery

The information has been used to develop the Ground Model for use in the geotechnical appraisal.

GEOLOGY

Reference to the British Geological Survey 1:50,000 scale map, Sheet 184 (Warwick, 1984) and other published geological information on the area, indicates that the site is underlain by Quaternary superficial Till, with the Late Triassic bedrock Rugby Limestone Member (of the Blue Lias Formation) beneath.

Worked-Out Ground and Artificial Ground

There is no record of Worked-out Ground or of Artificial Ground on site, or in close proximity.

Superficial

Till (formerly known as Boulder Clay) is an overconsolidated glacial soil that comprises an admix of all grain-sizes (from boulder to clay), but predominantly silt and clay. Subordinate lenses of sand and gravel, clay and silt are not uncommon. This stratum is thought to be about 5m thick beneath the site.

Bedrock

The Rugby Limestone Member generally comprises alternating beds of grey argillaceous limestone and mudstone and is thought to be about 20m thick beneath the site.

POTENTIAL GEOTECHNICAL HAZARDS

Geological

The risk of naturally-occurring ground stability hazards at the site is recorded to be as follows:

Ground Stability Hazard	Hazard Rating	Comments
Shrink-swell clays	Low	The Till can be present as a shrinkable soil of Low to Medium Volume-Change Potential
Running sand	Very Low	Some horizons of the Till can include water-bearing sands that will be unstable in excavations
Collapsible deposits	Very Low	No collapsible strata anticipated
Landslides	Very Low	Site is on relatively flat ground
Dissolution	Very Low	No significantly soluble strata anticipated
Compressible deposits	Negligible	No significantly compressible strata anticipated

Mining

The only recorded mining activity in the area is surface extraction of limestone for cement manufacture, and the nearest known instance of this is 249m to the east.

RADON GAS

The site is recorded to be in an area not significantly affected by Radon gas.

HISTORY OF THE SITE

The history of the site has been assessed by reviewing available historical Ordnance Survey maps, online references and aerial images of the area and has revealed the following:

The site was formed of two large agricultural fields, on the southern (agricultural) side of the village, from the date of the earliest map (1885) and the map of 1971 shows the Village Hall at the northern end and the remainder of the site marked as Playing Fields (and, later, as Recreation Ground). The all-weather (tennis) court is first shown on the map of 1987 and the cycle sports area and skate park are first seen on aerial imagery dated 2006.

The village is shown expanding southwards around the site on the map of 1955 and, by 1971, the village is at approximately the current extent around the site.

UNEXPLODED ORDNANCE AND BOMB SITES

The Zetica Unexploded Ordnance Preliminary Risk assessment tool indicates that the site is within an area generally at Low risk of encountering unexploded ordnance in the ground.

INITIAL GEOTECHNICAL GROUND MODEL

The site is underlain by approximately 5m of superficial glacial Till, above >20m of the bedrock Rugby Limestone Member.

The Till may present seasonal shrink-swell problems and may contain water-bearing sand beds that present running sand problems in excavation but should prove suitable for traditional shallow spread foundations.

EXPLORATION AND TESTING

The intrusive fieldworks comprised four continuous tube sampler boreholes (CT01 to CT04) formed on the 14th April 2021, and these were supplemented by geotechnical laboratory testing.

The positions of the exploratory holes are shown on the Exploratory Hole Location Plan in Appendix A. The logs and field test results are provided in Appendix B and the laboratory test report in Appendix C.

Engineering conclusions given in this report are based on data obtained from these sources, but it should be noted that variations, which affect these conclusions, may inevitably occur between and beyond the test locations. Also, water levels may vary seasonally and with other factors.

SAMPLING STRATEGY

The exploratory holes were arranged across the proposed development footprint, as detailed below:

- CT01 – Area B: battery storage location
- CT02 – Area C: car park southern extension
- CT03 – Area W1 possible wind turbine locations (north)
- CT04 – Area W2 possible wind turbine locations (south)

METHODOLOGY

Prior to commencement of boring, and in order to minimise the dangers from and to buried services, the proposed locations were scanned using a Cable Avoidance Tool and a service avoidance pit was dug, using hand tools, to a depth of around 1.2m bgl (below ground level).

The boreholes were put down using an Archway Competitor Dart rig towards target depths of 2.50m (CT01 & CT02) and 6.00m bgl (CT03 & CT04), but the deeper boreholes were terminated at depths of 4.50m (CT03) and 5.50m (CT04) on impenetrable strata. The boreholes were advanced using a plastic-lined steel tube sampling system, driven into the ground by a top-drive percussive hammer. A near continuous 87mm to 57mm diameter core sample was recovered of the sampled materials to allow examination and sub-sampling. A record was made of groundwater strikes and, where encountered, of the standing level on completion. Hand Penetrometer tests were conducted at regular intervals on the extracted core samples (and the results recorded on the log), prior to sub-sampling for subsequent laboratory inspection and testing.

On completion of boring, the boreholes were backfilled with arisings and the original surfacing reinstated.

GROUND CONDITIONS

The intrusive investigation, in general, confirmed the published geology, revealing the following succession of strata: a cover of Fill/Topsoil; localised Made Ground; Till, with thin beds of Glacio-Fluvial Deposits; and Glacio-Fluvial Deposits to the depths summarised below for each of the four Areas:

Area & CT ref	**Depth to base of stratum (m)**				
	Topsoil	**Fill**	**Made Ground**	**Till**	**Glacio-Fluvial Deposits**
B: CT01	-	0.35	0.55	≥2.50	
C: CT02	0.10	-	0.80	≥2.50*	
W1: CT03	0.70	-	-	4.10*	≥4.50
W2: CT04	0.30	-	-	4.40	≥5.50

Notes: * With subordinate beds of Glacio-Fluvial Deposits

Further details of the relative disposition and properties of each of these strata are provided below:

TOPSOIL

Topsoil was present at surface of Areas C, W1 and W2 and comprised dark brown, slightly sandy and gravelly, organic, silty clay, 0.10m, 0.70m and 0.30m thick, respectively.

FILL

Fill was present at surface in Area B and comprised pavement construction, of block paviours on bedding sand to 0.15m, over 0.20m of a sub-base material of dark grey-brown, sandy gravel, which was assessed as Medium Dense, from the ease of hand-digging.

MADE GROUND

Made Ground was encountered beneath the surfacing in Areas B and C, where it extended to depths of 0.55m and 0.80m, respectively.

The Made Ground in CT01 (Area B) comprised 0.20m of dark brown, slightly clayey, sandy gravel, with a low cobble content. The clay was slightly organic; the gravel was of flint, cement-concrete and lesser amounts of clinker and brick, and the cobbles were of cement-concrete. This was assessed as Loose, from ease of digging.

The Made Ground in CT02 (Area C) comprised 0.55m of an admixture of: dark brown, slightly gravelly, organic silty clay; and clayey sand. This overlay a clay land drain (0.20m) and seems to be backfill following placement of the drain and is, therefore, likely to be quite localised.

Laboratory testing revealed the following:

Parameter	Range	Comments
Water Content (%)	15 & 16	No suggestion of desiccation
Liquid Limit (%)	31	CLAY of Low Plasticity (BS5930 Casagrande)
Plastic Limit (%)	14	
Plasticity Index (%)	17	
Retained on 425µm sieve (%)	7	BS1377 'coarse soil' fraction
Modified Plasticity Index (%)	16	Shrinkable soil of Low Volume Change Potential (NHBC Standards)
Passing 63µm sieve (%)	52	Fines (silt/clay) fraction

TILL

Till was encountered in all four boreholes, below depths of between 0.10m and 0.80m, and extended to the base of the boreholes in Areas B and C, at 2.50m depth, and to 4.10m and 4.40m in Areas W1 and W2, respectively.

The Till comprised, in general, firm, becoming stiff and very stiff with increasing depth, brown and dark brown, or red-brown and orange-brown, veined blue-grey or dark grey, slightly sandy and gravelly, silty clay. Small pockets of silt and a low content were recorded in CT04 (Area W2). Subordinate beds of red-brown, silty, locally slightly gravelly sand (Glacio-Fluvial Deposits) were encountered in CT02 (Area C), between 1.40m and 1.80m, and CT03 (Area W1) between 1.80m and 2.40m depths. The Till was also underlain by Glacio-Fluvial Deposits in CT03 (Area W1) and CT04 (Area W2) and further details of all of the Glacio-Fluvial Deposits are provided in that sub-section, below.

The results of the field strength tests are summarised below:

Parameter	Range	Comments
SPT 'N_{60}' value	8 to 33	Generally increasing with depth. Some tests pass between fine and coarse soils and should be treated with caution. On the basis of the Stroud conversion, and a conversion factor, f_1, of 6.0, the results are interpreted to indicate Medium to, predominantly, High and Very High strength soils (BS5930: Table 9)

Laboratory testing revealed the following:

Parameter	Range	Comments
Water Content (%)	13 15 to 22	Slightly low in CT01 at 1.50m and CT02 at 1.00m, possibly reflecting locally higher stone content, or localised desiccation Normal range elsewhere
Liquid Limit (%)	24 to 44	CLAY of Low to Intermediate Plasticity (BS5930 Casagrande)
Plastic Limit (%)	13 to 20	
Plasticity Index (%)	10 to 24	

Parameter	Range	Comments
Retained on 425µm sieve (%)	6 to 33	BS1377 'coarse soil' fraction
Modified Plasticity Index (%)	7 to 23	Non-shrinkable to Shrinkable soil of Low to Medium Volume Change Potential (NHBC Standards)
Passing 63µm sieve (%)	32 to 74	Fines (silt/clay) fraction

GLACIO-FLUVIAL DEPOSITS

We have identified the coarse-grained beds within, and beneath, the Till as Glacio-Fluvial Deposits (GFD).

Within the Till, these soils were found as subordinate beds, 0.40m and 0.60m thick, respectively, in CT02 (Area C), between 1.40m and 1.80m depths, and CT03 (Area W1) between 1.80m and 2.40m depths, where they were present as red-brown, silty, locally slightly gravelly sand.

Beneath the Till, in CT03 (Area W1) at 4.10m depth, and CT04 (Area W2), the GFD was present as red-brown, silty sand (CT03) and red-brown and light brown, very silty, very sandy gravel of sub-angular to sub-rounded siltstone, sandstone and quartzite (CT04).

The results of the field strength tests are summarised below:

Parameter	Range	Comments
SPT '$(N_1)_{60}$' value	12 & 17 66 & 86	Medium dense subordinate beds Dense and Very Dense basal beds

Laboratory testing revealed the following:

Parameter	Range	Area	Comments
Portion <63mm and >2mm (%)	0 47	W1 W2	Gravel fraction WS1
Portion <2mm and >63µm (%)	69 35	W1 W2	Sand fraction
Passing 63µm sieve (%)	31 18	W1 W2	Fines (silt/clay) fraction

GROUNDWATER

The only potential groundwater strike was in CT02 (Area C) at 0.70m depth, but this was, almost certainly, inflow from the land drain at that depth.

OBSERVED SOIL CONTAMINATION

There was no evidence, either visual or olfactory, of potential contamination in any of the exploratory holes.

CONCRETE AGGRESSION TESTS

The results of the laboratory pH and water-soluble sulphate tests on samples of soil are summarised below:

Stratum	Water-soluble Sulphate (mg/l)	pH (pH units)	No. tested
Made Ground	120	6.4	1
Till	120 to 150	7.2 to 7.5	3

INFRASTRUCTURE RISK ASSESSMENT

SUBSURFACE CONCRETE

The concrete design mix recommendations for subsurface concrete have been assessed in terms of BRE Special Digest 1, as follows:

Type of Site	Groundwater condition	Characteristic Sulphate	Characteristic	
		Soil Soluble (mg/l)	Design Sulphate Class	pH (pH units)
Natural ground location	Mobile*	150	DS-1	6.4

Note: * In the absence of data to contrary

The above assessment provides an Aggressive Chemical Environment for Concrete (ACEC) class of **AC-1**.

GEOTECHNICAL ENGINEERING CONCLUSIONS

It is proposed to develop the site to accommodate an electric vehicle charging station facility, complete with a wind turbine, solar panels, electrical storage battery and ancillary services. Building loads are not known at the time of writing and these recommendations may need to be reviewed once the actual loadings are known.

The boreholes of this investigation have revealed a cover of Topsoil/Fill; over localised Made Ground to a maximum depth of 0.80m; and the anticipated Superficial glacial Till, with subordinate and basal beds of Glacio-Fluvial Deposits.

The Till was, characteristically, present as stiff to very stiff, high strength, slightly sandy and gravelly, silty clay of medium volume-change potential.

The coarse-grained Glacio-Fluvial Deposits were present (Areas W1 and W2 only) as medium dense, red-brown, silty, locally slightly gravelly, sand interbeds of about 0.5m thick; and dense to very dense, red-brown, silty to very silty, sand and gravel mixture basal beds, below depths of 4.10m (Area W1) and 4.40m (Area W2).

Groundwater was (most likely) not encountered during boring, although water was encountered in Area C (CT02) at a depth of 0.70m, this was thought to be from a land drain that the borehole passed through.

The Till should prove suitable for the proposed form of development, supporting moderately loaded pad foundations.

SITE EXCAVATION

Conventional hydraulic plant should be satisfactory for excavating the soils on site.

In line with HSE guidelines, all excavations requiring personnel access should be adequately supported to avoid the risk of collapse. Consideration should also be given to the stability of open trenches where personnel are working in close proximity.

Excavations are likely to remain open, unsupported, in the absence of water, but, where water enters the excavation, then internal erosion and wall collapse is probable in the presence of the Glacio-Fluvial Deposits.

Significant groundwater ingress into shallow excavations is not anticipated but it must be noted that groundwater levels can vary significantly in response to weather and other factors. If groundwater inflow does occur, it should be possible to control water levels through the use of suitable screen sump pumping.

FOUNDATION SOLUTIONS (AREAS A, W1 AND W2)

Area A is to house a battery storage area and it is understood that this will take the form of a container shed. The existing pavement construction and underlying soils should be adequate to support modest loadings without undergoing undue settlement.

Areas W1 and W2 are the two options for a wind turbine. Options are given, below, for traditional spread, raft and pile foundations.

Pad Foundations

For the medium volume-change potential Till, we recommend a minimum foundation depth of 0.90m below existing ground level, with foundation depths increased in accordance with NHBC Standards on account of nearby trees and for any new planting proposed.

As an example, on the basis of the nearest (possible) Oak tree to W1, a foundation depth of 2.20m would be required.

The allowable bearing pressure recommended below is made on the assumption of an acceptable total settlement, for the proposed structure, of 25mm. Should the turbine require a significantly different serviceability limit state (tolerance to settlement) then it is recommended that these recommendations be revised accordingly.

At the minimum depth (0.90m) provided above, an allowable bearing pressure of 140kPa may be adopted on isolated square pad foundations up to 3.00m wide: increasing, with depth of placement, at a uniform rate of 10kPa/0.2m depth, to a maximum of 220kPa at a depth of 2.50m. This allows for a suitable factor of safety against general shear failure and should result in acceptable levels of differential and total vertical settlement, with the majority likely to take a few months to years to complete.

It is recommended that foundation excavations be subject to careful inspection by an experienced professional, with localised deepening carried out if desiccated or root-infested shrinkable clays are encountered.

Raft foundations

Raft construction should proceed only after proof-rolling of the formation and removal/replacement of the Topsoil and any very soft/loose deposits and hard spots: either with lean-mix concrete, or well-compacted coarse-grained fill.

On the assumption that all of the Topsoil will be removed (due to the inherent potential for unacceptable levels of differential settlement), and that the raft will be placed on a suitably-compacted coarse-grained blanket, it should be possible to adopt a raft foundation, provided that the loads are evenly distributed over the foundation area and will not exceed the safe bearing capacity of the underlying soils, which would be a maximum of 100kPa at 0.5m depth. A raft foundation will stress the underlying soils to a significant depth and thus the suitability of the raft will be significantly influenced by potential settlements. Once building loads are known, further consideration should be given to the feasibility of using a raft with regards to limit states.

In order to determine a safe foundation depth, we recommend that the guidelines contained within NHBC Standards Chapter 4.2 are followed: assuming a classification of medium volume-change potential.

It is recommended that foundation excavations be subject to careful inspection by an experienced professional, with localised deepening carried out if desiccated or root-infested shrinkable clays are encountered.

Pile Foundations

If the bearing pressure stated above is insufficient, then consideration should be given to the use of short pile foundations bearing into the Glacio-Fluvial Deposits.

Further recommendations for a pile foundation solution are outside the scope of this report and it is recommended that a specialist piling contractor be consulted as to the choice and design of piles. The piling contractor/designer may require additional, deeper, ground investigation: such as to provide confirmation of the nature and state of the soils beneath the Glacio-Fluvial Deposits, including suitable soil/rock parameters and additional concrete aggression testing.

PARKING (AREA C)

Following re-grading, the areas of proposed pavement should be proof-rolled and inspected by a suitably qualified person. Any unsuitable zones, such as soft or highly compressible soils, should be removed and replaced with suitable backfill, compacted in layers using appropriate plant.

It is noted that the proposed car park area is peripheral to mature vegetation. Although no locally desiccated clay soils have been identified during our exploratory work, the presence of trees will mean that there is potential for ongoing desiccation issues which may affect the pavement surfacing within influencing distance. Thus, safeguarding against desiccation in this regard could be considered, such as lime/cement stabilisation to appropriate depth, which can limit shrinkage/swelling desiccation effects by altering the properties of the clay. Alternatively, it could be accepted that some movements may occur, and which could be accommodated through flexible surface finishes.

The structural design of a road or hard standing is based on the strength of the subgrade, which is assessed on the California Bearing Ratio (CBR) scale. It is anticipated that the stratum at formation level will be the Till. Laboratory testing of samples of remoulded Till sample gave a CBR value of 3.0%. With reference to Transport and Road Research Laboratory, Report LR1132, and laboratory classification tests, it is recommended that for formation prepared in the Till, a subgrade CBR value of 3.0% is adopted for preliminary design purposes based on equilibrium soil conditions, a thin pavement construction, low water table and poor construction conditions.

In the event that the Made Ground is more extensive than anticipated, for formation prepared in the Made Ground a subgrade CBR of 1% is recommended.

However, both the Made Ground and Till are likely to be strongly frost-susceptible and, for prevention of frost damage, should be protected by a non-frost-susceptible thermal blanket of suitable thickness.

The site conditions should be reassessed at the time of construction and the CBR/pavement design updated accordingly if considered necessary.

RECOMMENDATIONS

The ground is seldom homogenous and variations likely to affect our conclusions may, inevitably, occur between and beyond our test locations. We, therefore, recommend that the developer maintains a watching brief for suspicious soils or ground conditions. Should ground conditions vary noticeably from our Ground Model, then we recommend further assessment by a suitably qualified person or persons.

If additional, deeper, ground investigation is required for pile design, this could be achieved using a cable percussion borehole: conducting Standard Penetration Tests and nominally undisturbed tube sampling, with supplementary geotechnical laboratory testing.

REFERENCES

- British Standards Institution (BSI), Site Investigations, Code of Practice, BS 5930:2015.
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- BSI, Foundations, BS 8004:2015.
- National House Building Council (NHBC) Standards, Chapter 4.2 Building Near Trees, 2020.
- Transport and Road Research Laboratory (TRRL), The Structural Design of Bituminous Roads, Laboratory Report LR1132, 1984.

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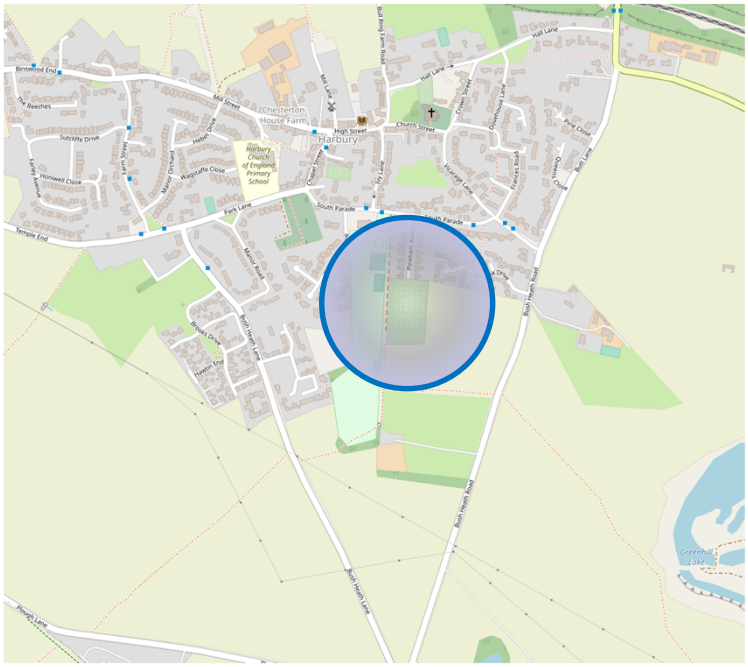
APPENDIX A
PLANS, SECTION AND PHOTOGRAPHS

Extract from 1:50,000 Ordnance Survey Explorer Map

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved (Licence No: 100006010)



© OpenStreetMap contributors

Key: Approximate site location

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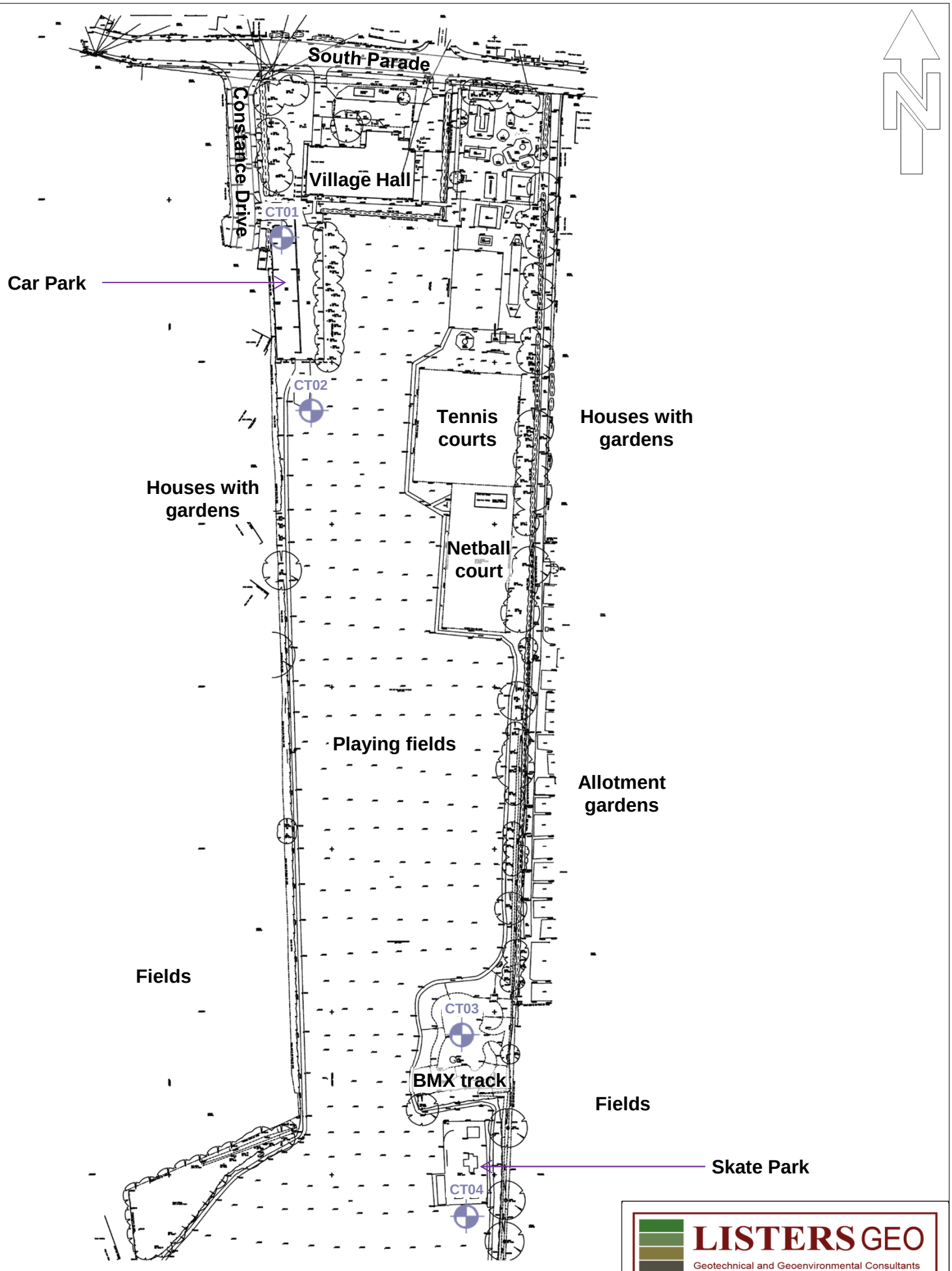
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title: Site Location Plan

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Scale: NTS **Job Number**: 21.04.022 **Drawn By**: MX



Extract from Midland Survey Ltd's drawing, 38224, dated March 2021

Key:

Continuous Tube Sampler Borehole

LISTERS GEO
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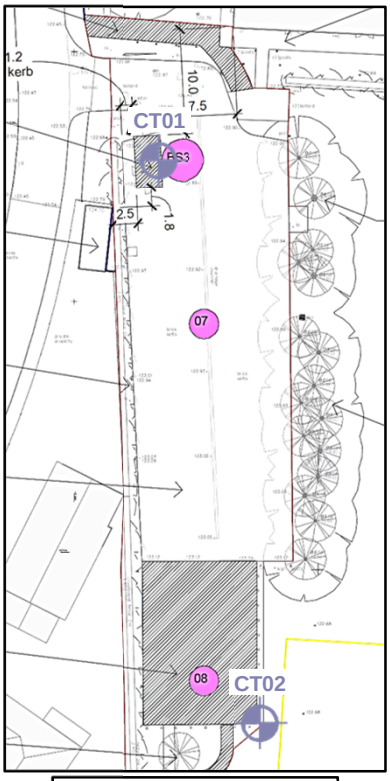
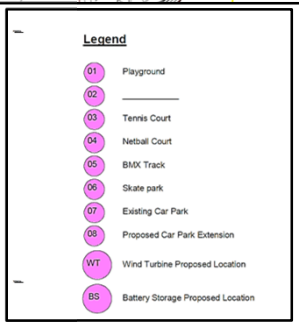
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

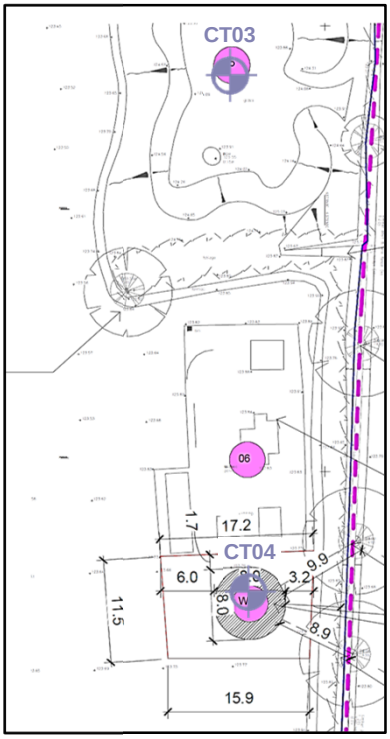
Title: Exploratory Hole Location Plan – Existing Layout

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Scale: NTS **Job Number**: 21.04.022 **Drawn By**: MX







Extracts from Allen Construction Consultancy Ltd's drawing, 6541-ACC-00-ZZ-DR-A-0010_P1, dated 09/04/2021

Key:

Continuous Tube Sampler Borehole

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Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title: Exploratory Hole Location Plan – Proposed Layout

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Scale: NTS **Job Number**: 21.04.022 **Drawn By**: MX

View southwards across car park. Rig on position of CT01

View northwards towards car park. CT02 painted out

View northwards from CT03

View southwards from close to CT03

View northwards towards skate park. CT04 painted out

View southwards from CT04

Site Photographs
29/04/2021

Report:
21.04.022

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APPENDIX B
FIELDWORK

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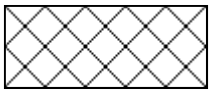
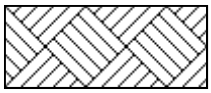
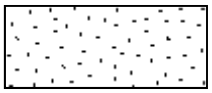
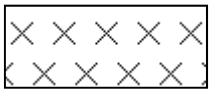
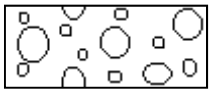
LEGEND - Soils

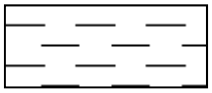

Made Ground

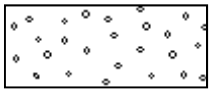

Topsoil

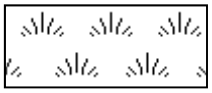

Sand


Silt

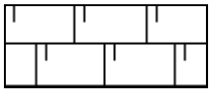

Boulders and Cobbles

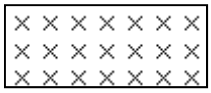

Clay

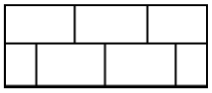

Gravel

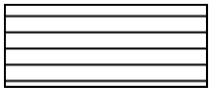

Peat

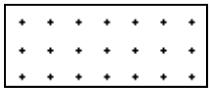
LEGEND - Rocks (Sedimentary)


Chalk


Siltstone


Limestone


Mudstone


Sandstone


Coal


Conglomerate


Breccia

LOG ABREVIATIONS

W	Water Sample	▽	Water Strike
B	Bulk Sample	▼	Water (Standing Level)
D	Disturbed Sample	PP	Pocket Penetrometer
J	Jar Sample	HV	Hand Vane
U	Undisturbed Sample	SPT	Standard Penetration Test
(No. of blows shown in brackets for U100 samples)		CPT	Cone Penetration Test
WAC	Waste Acceptance Criteria Sample	CBR	California Bearing Ratio
		*	Extrapolated Value

Pocket penetrometer testing provides values of unconfined compressive strength. The results have been converted to an approximate equivalent shear strength which should be used with due circumspection. As the pocket penetrometer tends to overestimate shear strength, we have used an appropriate reduction factor.

LOG KEY

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Continuous Tube Sampler Log

Borehole No. CT 01

Project Location: Harbury Playing Field, Constance Drive, Harbury, Warwickshire. CV33 9HZ

Co-ords: 437284E - 259738N

Level: +122.90mOD

Dates: 14/04/2021

Project Number: 21.04.022

Logged By: Matthew Clarke to BS 5930:2015

Well	Ground water	Sample and In Situ Testing			Depth (m)	Level (mOD)	Legend	Stratum Description
		Depth (m)	Type	Result				
		0.10 - 0.35	D		0.15	+122.75		FILL Block paving on orange-brown bedding sand.
		0.35 - 0.55	D		0.35	+122.55		FILL Dark grey-brown, sandy GRAVEL sub-base. (Assessed as Medium Dense, from ease of hand-digging)
		0.55	CBR		0.55	+122.35		MADE GROUND Dark brown, slightly clayey, sandy GRAVEL, with low cobble content. Clay is slightly organic. Gravel is of sub-angular to angular flint, cement-concrete and lesser amounts of clinker and brick. Cobbles are of cement-concrete. (Assessed as Loose, from ease of digging)
		0.55 - 0.90	D					
		0.90 - 1.50	D		0.90	+122.00		
		1.00	PP	1.8kg/cm²				
		1.00	SPT	N=13 (3/2,3,4,4)				
		1.25	PP	1.8kg/cm²				
		1.50 - 2.00	D					TILL Stiff, brown and dark brown, veined blue-grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		1.50	PP	2.0kg/cm²				
		1.75	PP	2.0kg/cm²				
		2.00	SPT					TILL Stiff, red-brown and orange-brown, veined blue-grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		2.00	PP	2.0kg/cm²				
		2.00	SPT	N=15 (5/4,4,4,3)				
		2.25	PP	2.2kg/cm²				
		2.50	PP	2.5kg/cm²	2.50	+120.40		End of Borehole at 2.50m

1 2 3 4 5

Diameter: 87mm to 77mm

Instrumentation: Backfilled with arisings

Groundwater: Not encountered

Remarks:
No live roots seen.
Ground level and co-ordinates interpolated from field measurements and Midland Survey Ltd's drawing 38224

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Continuous Tube Sampler Log

Borehole No. CT 02

Project Location: Harbury Playing Field, Constance Drive, Harbury, Warwickshire. CV33 9HZ

Co-ords: 437294E - 259685N

Level: +122.75mOD

Dates: 14/04/2021

Project Number: 21.04.022

Logged By: Matthew Clarke to BS 5930:2015

Well	Ground water	Sample and In Situ Testing: Depth (m)	Type	Result	Depth (m)	Level (mOD)	Legend	Stratum Description
		0.10 - 0.65	D		0.10	+122.65		TOPSOIL Dark brown, slightly sandy and gravelly, organic, silty CLAY.
								MADE GROUND Admixture of: dark brown, slightly gravelly, organic silty CLAY; and clayey SAND.
					0.65	+122.10		Clay land drain.
		0.80 - 1.00	D		0.80	+121.95		TILL Stiff, red-brown and orange-brown, veined blue-grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		1.00 - 1.40	D					
		1.00	PP	3.0kg/cm²				
		1.00	SPT	N=11 (4/3,2,3,3)				
		1.25	PP	2.0kg/cm²				
		1.40 - 1.80	D		1.40	+121.35		GLACIO-FLUVIAL DEPOSITS Medium dense, red-brown, silty, slightly gravelly SAND. Sand is fine and medium. Gravel is fine, of quartzite.
		1.80 - 2.00	D		1.80	+120.95		TILL Firm, becoming stiff below 1.9m, red-brown and light brown, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		2.00	PP	1.5kg/cm²				
		2.00	SPT	N=17 (8/5,5,4,3)				
					2.50	+120.25		End of Borehole at 2.50m

1 2 3 4 5

Diameter: 87mm to 77mm

Instrumentation: Backfilled with arisings

Groundwater: Strike at 0.70m. Standing at 1.75m on completion

Remarks:
No live roots seen.
Ground level and co-ordinates interpolated from field measurements and Midland Survey Ltd's drawing 38224

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Continuous Tube Sampler Log

Borehole No. CT 03

Project Location: Harbury Playing Field, Constance Drive, Harbury, Warwickshire. CV33 9HZ

Co-ords: 437340E - 259493N

Level: +124.00mOD

Dates: 14/04/2021

Project Number: 21.04.022

Logged By: Matthew Clarke to BS 5930:2015

Well	Ground water	Sample and In Situ Testing			Depth (m)	Level (mOD)	Legend	Stratum Description
		Depth (m)	Type	Result				
		0.10 - 0.50	D					TOPSOIL Dark brown, slightly sandy and gravelly, organic, silty CLAY.
		0.50 - 0.70	D					
		0.70 - 1.00	D		0.70	+123.30		TILL Firm, brown and dark brown, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		1.00 - 1.30	D					
		1.00	PP	2.0kg/cm²				
		1.00	SPT	N=7 (2/1,2,2,2)				
		1.25	PP	2.2kg/cm²	1.30	+122.70		TILL Stiff, red-brown and orange-brown, veined blue-grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite and lesser amounts of sandstone and siltstone.
		1.30 - 1.80	D					
		1.50	PP	3.0kg/cm²				
		1.75	PP	3.0kg/cm²				
		1.80 - 2.00	D		1.80	+122.20		GLACIO-FLUVIAL DEPOSITS Medium dense, red-brown, silty SAND. Sand is fine and medium.
		2.00 - 2.40	D					
		2.00	SPT	N=10 (5/3,3,2,2)				
		2.40 - 2.70	D		2.40	+121.60		TILL Stiff, red-brown and orange-brown, veined blue-grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		2.50	PP	1.0kg/cm²				
		2.70 - 3.00	D					
		2.75	PP	4.0kg/cm²				
		3.00 - 3.40	D					
		3.00	PP	4.0kg/cm²				
		3.00	SPT	N=20 (5/4,4,6,6)				
		3.25	PP	4.2kg/cm²				
		3.40 - 4.00	D		3.40	+120.60		TILL Very stiff, dark brown, locally veined dark grey, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.
		3.50	PP	4.2kg/cm²				
		3.75	PP	4.2kg/cm²				
		4.00	SPT					
		4.00	PP	5.0kg/cm²	4.10	+119.90		GLACIO-FLUVIAL DEPOSITS Very dense, red-brown, silty SAND. Sand is fine and medium.
		4.00	SPT	N=70 (10/15,21,17,17)				
					4.50	+119.50		End of Borehole at 4.50m

Diameter: 87mm to 67mm

Instrumentation: Backfilled with arisings

Groundwater: Not encountered

Remarks:
No live roots seen.
No further progress possible.
Ground level and co-ordinates interpolated from field measurements and Midland Survey Ltd's drawing 38224

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Continuous Tube Sampler Log

Borehole No. CT 04

Project Location: Harbury Playing Field, Constance Drive, Harbury, Warwickshire. CV33 9HZ

Co-ords: 437342E - 259436N

Level: +123.80mOD

Dates: 14/04/2021

Project Number: 21.04.022

Logged By: Matthew Clarke to BS 5930:2015

Well	Ground water	Sample and In Situ Testing			Depth (m)	Level (mOD)	Legend	Stratum Description	
		Depth (m)	Type	Result					
		0.10 - 0.30	D					TOPSOIL Dark brown, slightly sandy and gravelly, organic, silty CLAY.	
		0.30 - 0.70	D		0.30	+123.50		TILL Stiff, brown, slightly sandy and gravelly, silty CLAY. Gravel is of quartzite.	
		0.70 - 1.00	D		0.70	+123.10		TILL Stiff, becoming very stiff below 2.4m, red-brown, veined blue-grey, slightly sandy and gravelly, silty CLAY, with some small pockets of silt and a low cobble content. Gravel is of siltstone, sandstone and quartzite. Cobble (one) is of limestone.	1
		1.00 - 1.50	D						
		1.00	PP	2.8kg/cm²					
		1.00	SPT	N=10 (3/2,2,3,3)					
		1.25	PP	3.0kg/cm²					
		1.50 - 2.00	D						
		1.50	PP	3.0kg/cm²					
		1.75	PP	3.0kg/cm²					
		2.00 - 2.50	D						2
		2.00	PP	4.0kg/cm²					
		2.00	SPT	N=22 (4/4,4,5,9)					
		2.25	PP	4.2kg/cm²					
		2.50 - 3.00	D		2.50	+121.30		TILL Very stiff, dark brown, locally veined dark grey, slightly sandy and gravelly, silty CLAY, with low cobble content. Gravel is of quartzite. Cobble (one) is of siltstone.	
		2.50	PP	>5.0kg/cm²					
		2.75	PP	>5.0kg/cm²					
		3.00 - 3.50	D						3
		3.00	PP	>5.0kg/cm²					
		3.00	SPT	N=25 (7/5,5,7,8)					
		3.25	PP	>5.0kg/cm²					
		3.50 - 4.00	D						
		3.50	PP	5.0kg/cm²					
		3.75	PP	5.0kg/cm²					
		4.00 - 4.40	D						4
		4.00	PP	4.8kg/cm²					
		4.00	SPT	N=29 (8/6,7,7,9)					
		4.25	PP	5.0kg/cm²					
		4.40 - 5.00	D		4.40	+119.40		GLACIO-FLUVIAL DEPOSITS Dense, becoming very dense below 4.7m, red-brown and light brown, very silty, very sandy GRAVEL. Sand is medium. Gravel is medium and coarse, of sub-angular to sub-rounded siltstone, sandstone and quartzite	
		5.00	SPT						5
		5.00	SPT	N=60 (20/15,13,16,16)					
					5.50	+118.30		End of Borehole at 5.50m	

Diameter: 87mm to 57mm

Instrumentation: Backfilled with arisings

Groundwater: Not encountered

Remarks:
No live roots seen.
No further progress possible.
Ground level and co-ordinates interpolated from field measurements and Midland Survey Ltd's drawing 38224

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Test Location	Depth at Start of Test (m)	Spoon or Cone	Blows per 75mm Penetration (unless otherwise stated)				Field 'N' Value	'$(N_1)_{60}$'/'N_{60}' Value	Stratum
CT 01	**1.00**	**S**	2	3	4	4	13	**15**	**TILL**
	2.00	**S**	4	4	4	3	15	**17**	
CT 02	**1.00**	**S**	3	2	3	3	11	**12**	**TILL/GFD**
	2.00	**S**	5	5	4	3	17	**19**	**TILL**
CT 03	**1.00**	**S**	1	2	2	2	7	**8**	**TILL**
	2.00	**S**	3	3	2	2	10	**17**	**GFD/TILL**
	3.00	**S**	4	4	6	6	20	**23**	**TILL**
	4.00	**S**	15	21	17	17	70	**86**	**TILL/GFD**
CT 04	**1.00**	**S**	2	2	3	3	10	**11**	**TILL**
	2.00	**S**	4	4	5	9	22	**25**	
	3.00	**S**	5	5	7	8	25	**28**	
	4.00	**S**	6	7	7	9	29	**33**	**TILL/GFD**
	5.00	**S**	15	13	16	16	60	**66**	**GFD**

Key: **TILL = GLACIAL TILL**

TILL/GFD = GLACIAL TILL INTO GLACIO-FLUVIAL DEPOSITS

GFD/TILL = GLACIO-FLUVIAL DEPOSITS INTO TILL

GFD = GLACIO-FLUVIAL DEPOSITS

* = N-value extrapolated in accordance with CIRIA R143.
Other corrections in accordance with BS EN ISO 22476-3, 2005, National Annex A; using Energy Ratio (68%) from current equipment calibrations

STANDARD PENETRATION TEST SUMMARY

Report:
21.04.022
Sheet 1 of 1

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APPENDIX C
LABORATORY TEST REPORT

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

PROJECT INFORMATION		SAMPLE INFORMATION		
Site Location:-	Harbury Playing Field Constance Drive Harbury Warwickshire CV33 9HZ	**Laboratory Tests Undertaken:-**		
		TEST TYPE	**TEST METHOD**	**TESTED**
		Natural Water Contents (WC%)	(BS 1377:Part 2:1990 Clause 3.2)	✓
		Liquid Limits (%)	(BS 1377:Part 2:1990 Clause 4.3)	✓
		Plastic Limits (%)	(BS 1377:Part 2:1990 Clause 5.3)	✓
		Plasticity Index (%)	(BS 1377:Part 2:1990 Clause 5.4)	✓
		Linear Shrinkage (%)	(BS 1377:Part 2:1990 Clause 6.5)	
		PSD - Wet Sieving	(BS 1377:Part 2:1990 Clause 9.2)	✓
Client Reference:-	-	Engineering Sample Descriptions	(BS 5930 : Section 6)	
		Passing 425/63 (μm)	-	✓
		Hydrometer	(BS 1377:Part 2:1990 Clause 9.5)	
Date Samples Received:-	30th April 2021	Loss on Ignition (%)	-	
Date Testing Completed:-	18th May 2021	Soil Suctions (kPa)	BRE Digest IP 4/93, 1993	
		Bulk Density (Mg/m^3)	(BS 1377:Part 2:1990 Clause 7.2)	
		Strength Tests	(BS 1377:Part 7:1990 Clause 8 & 9)	
		Soluble Sulphate Content (SO_4g/l)	(BS 1377:Part 3:1990 Clause 5.3)	✓
		pH value	(BS 1377:Part 3:1990 Clause 9.4)	✓
		California Bearing Ratios (CBR)	(BS 1377:Part 4:1990 Clause 7)	✓
		Compaction Tests	(BS 1377:Part 4:1990 Clauses 3.0-3.6)	
The results relate only to the samples tested				

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Laboratory testing in accord with BS EN ISO/IEC 17025-2000 and Quality Management in accord with ISO 9001

Signed on behalf of GroundTech Laboratories:-_____ Technical Signatory

Quality Assured to ISO 9001

GEOTECHNICAL LABORATORY TEST RESULTS

Report No: 21.04.022

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
CT 01	D	0.10		5.3																				
	D	0.35		14																				
	CBR	0.55		19																				
	D	0.55	PI/63	18	24	14	10	67	7	CL	32	0.75	16	0.40										
	D	0.90		23																			7.2	0.12
	D	1.50	PI/63	13	26	13	13	81	11	CL	46	0.50	15	0.00										
	SPT	2.00		22																				
CT 02	D	0.10		16																			6.4	0.12
	D	0.80	PI/63	15	31	14	17	93	16	CL	52	0.48	16	0.06										
	D	1.00		13																				
	D	1.40	PSD	15																				
	D	1.80		15																				
CT 03	D	0.10		13																				
	D	0.50		14																				
	D	0.70		15																				
	D	1.00	PI/63	20	37	17	20	91	18	CI	64	0.54	19	0.15										
	D	1.30		22																				
	D	1.80		12																				
	D	2.00	PSD	14																				
	D	2.40		24																			7.5	0.15
	D	2.70		17																				
	D	3.00	PI/63	18	38	17	21	92	19	CI	74	0.47	19	0.05										
	D	3.40		18																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.04.022

GroundTech Laboratories

Geotechnical Testing Facility

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Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
CT 03	SPT	4.00		5.6																				
CT 04	D	0.10		15																				
	D	0.30		15																				
	D	0.70	PI/63	19	33	16	17	93	16	CL	61	0.58	18	0.18										
	D	1.00		19																			7.5	0.13
	D	1.50		17																				
	D	2.00	PI/63	18	42	19	23	94	22	CI	76	0.43	21	-0.04										
	D	2.50		19																				
	D	3.00		18																				
	D	3.50	PI/63	17	44	20	24	94	23	CI	78	0.39	22	-0.13										
	D	4.00		18																				
	D	4.40	PSD	6.2																				
	SPT	5.00		8.3																				

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.04.022

GroundTech Laboratories

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Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Test Location: CT 02

Sample Depth: 1.40m -1.80m

Sample Description:

Hydrometer No.:

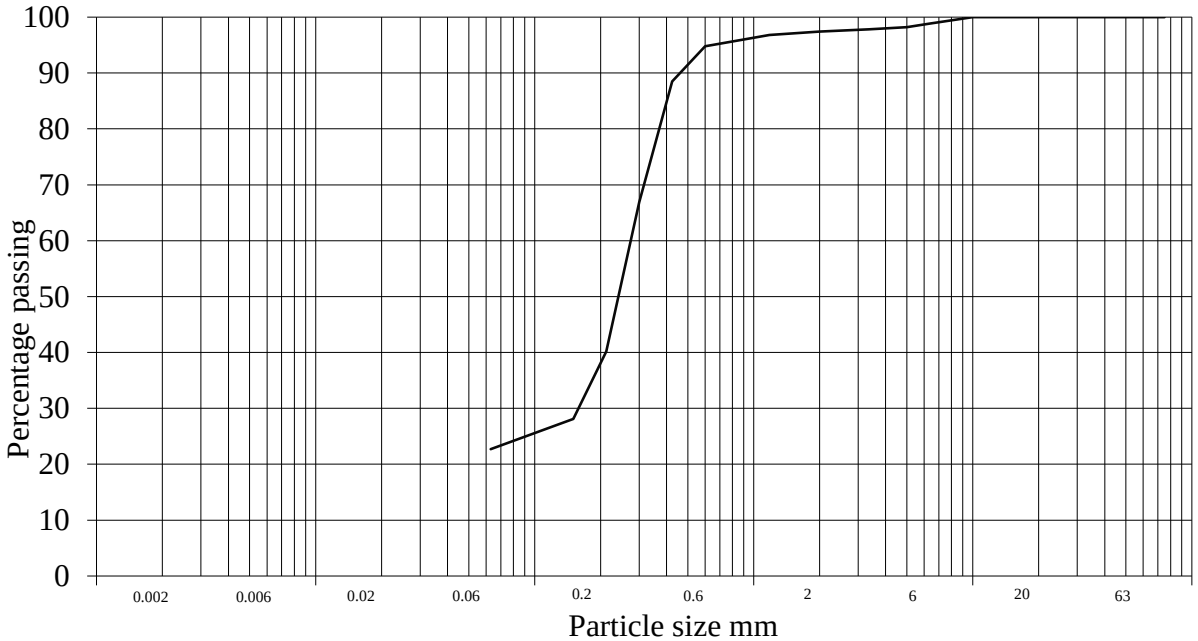
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	98.80		
5mm	98.20		
3.5mm	97.80		
2mm	97.40		
1.18mm	96.80		
600µm	94.80		
425µm	88.50		
300µm	66.90		
212µm	40.20		
150µm	28.10		
63µm	22.70		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
23%				75%			3%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.04.022

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Test Location: CT 03

Sample Depth: 2.00m -2.40m

Sample Description:

Hydrometer No.:

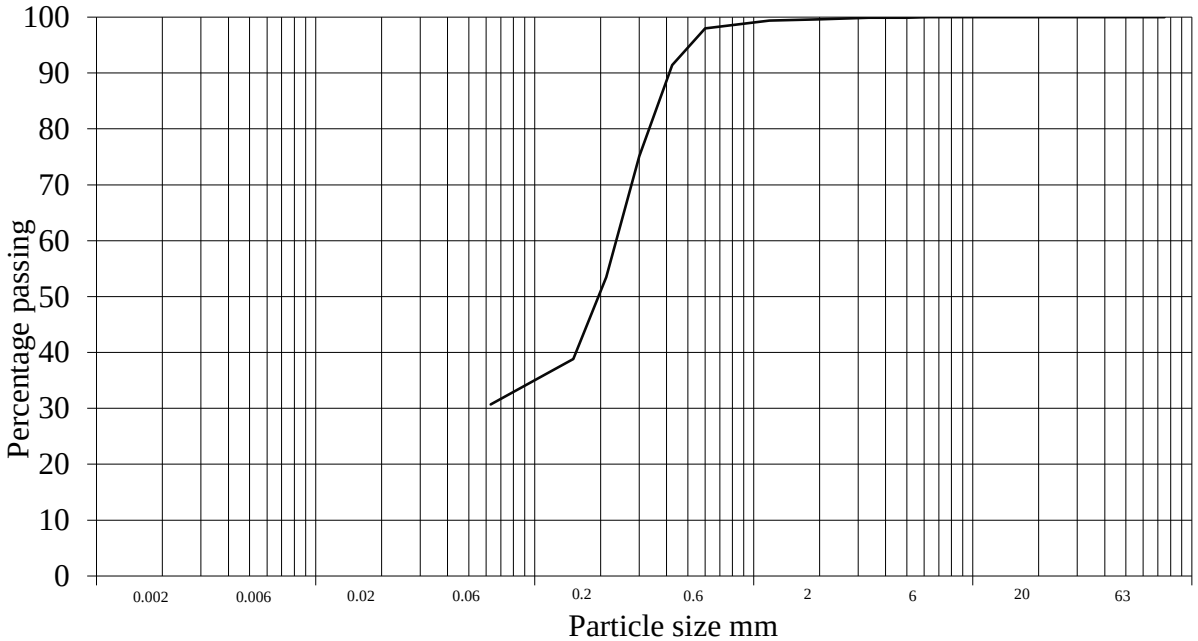
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	99.90		
3.5mm	99.90		
2mm	99.60		
1.18mm	99.40		
600µm	98.00		
425µm	91.40		
300µm	75.10		
212µm	53.50		
150µm	38.80		
63µm	30.70		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
31%				69%			0%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference 21.04.022

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

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Quality Assured ISO 9001

Site: Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Test Location: CT 04

Sample Depth: 4.40m -5.00m

Sample Description:

Hydrometer No.:

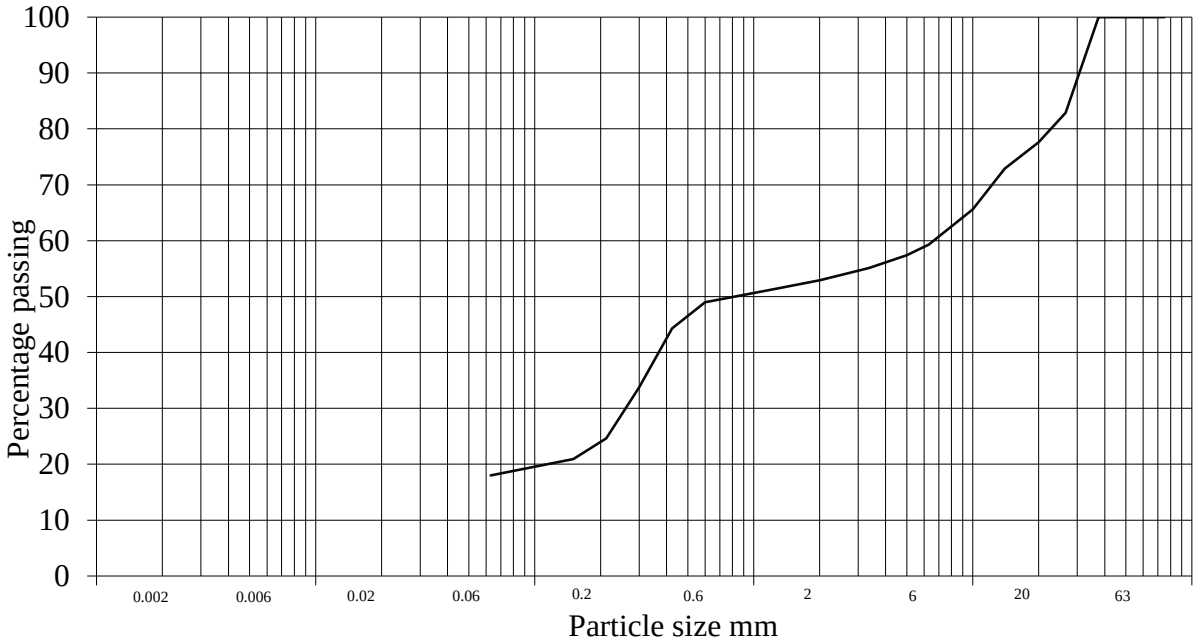
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	82.90		
20mm	77.60		
14mm	72.90		
10mm	65.60		
6.3mm	59.30		
5mm	57.40		
3.5mm	55.10		
2mm	52.90		
1.18mm	51.20		
600µm	49.00		
425µm	44.30		
300µm	33.80		
212µm	24.60		
150µm	20.90		
63µm	18.00		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
18%				35%			47%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.04.022

GroundTech Laboratories

Geotechnical Testing Facility

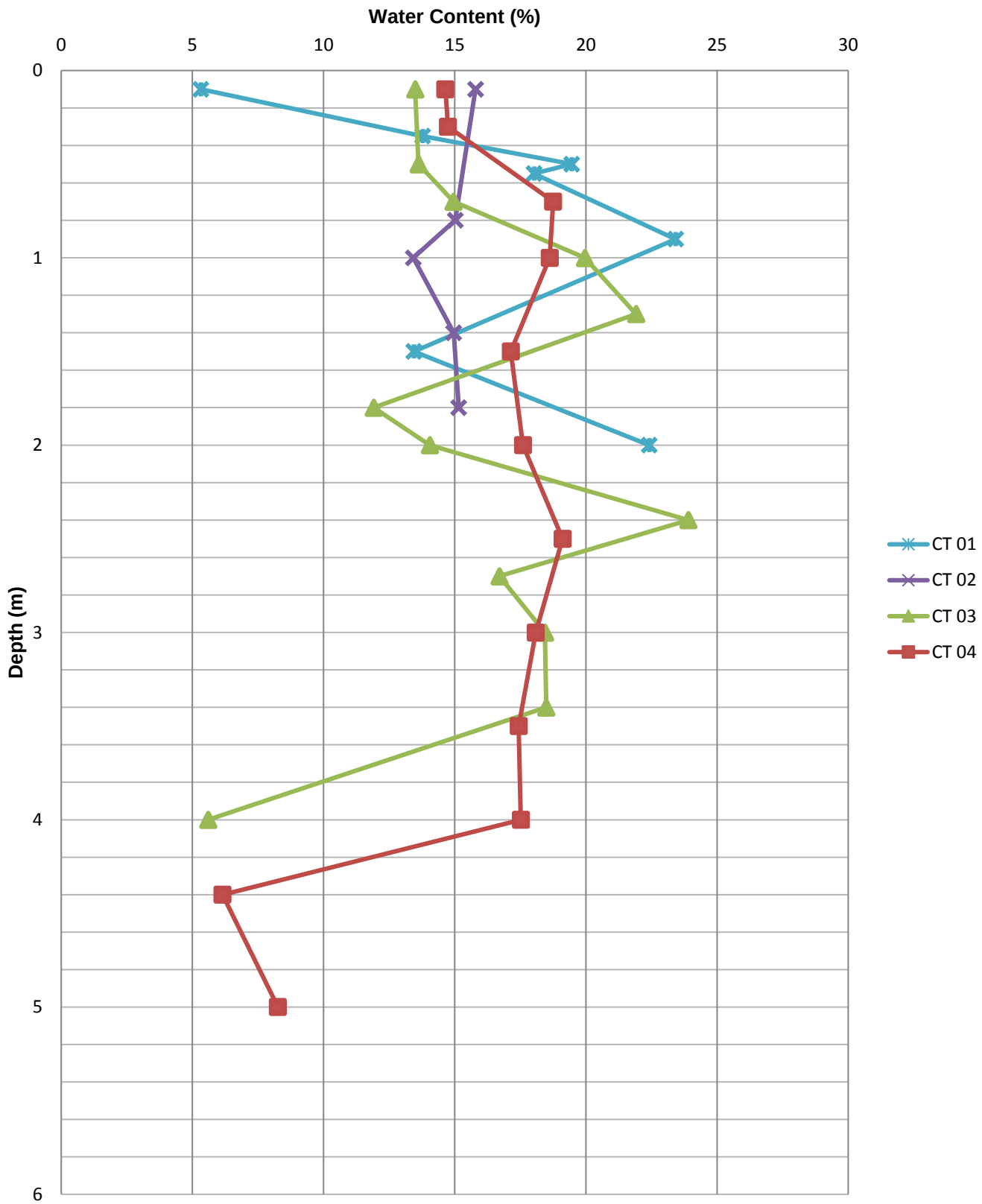
Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430

Test Location	Depth (m)	C.B.R. Value % Top:	Base	Final Water Content %	Bulk Density Mg/m3	Dry Density Mg/m3	Remarks
CT 01	0.55	3.0	2.9	19	1.81	1.52	Soft to firm brown slightly silty slightly sandy slightly gravelly CLAY Gravel is fine to medium sub rounded quartzitic flint and quartzitic sandstone

Samples recompacted using standard compaction
Surcharge 8kg

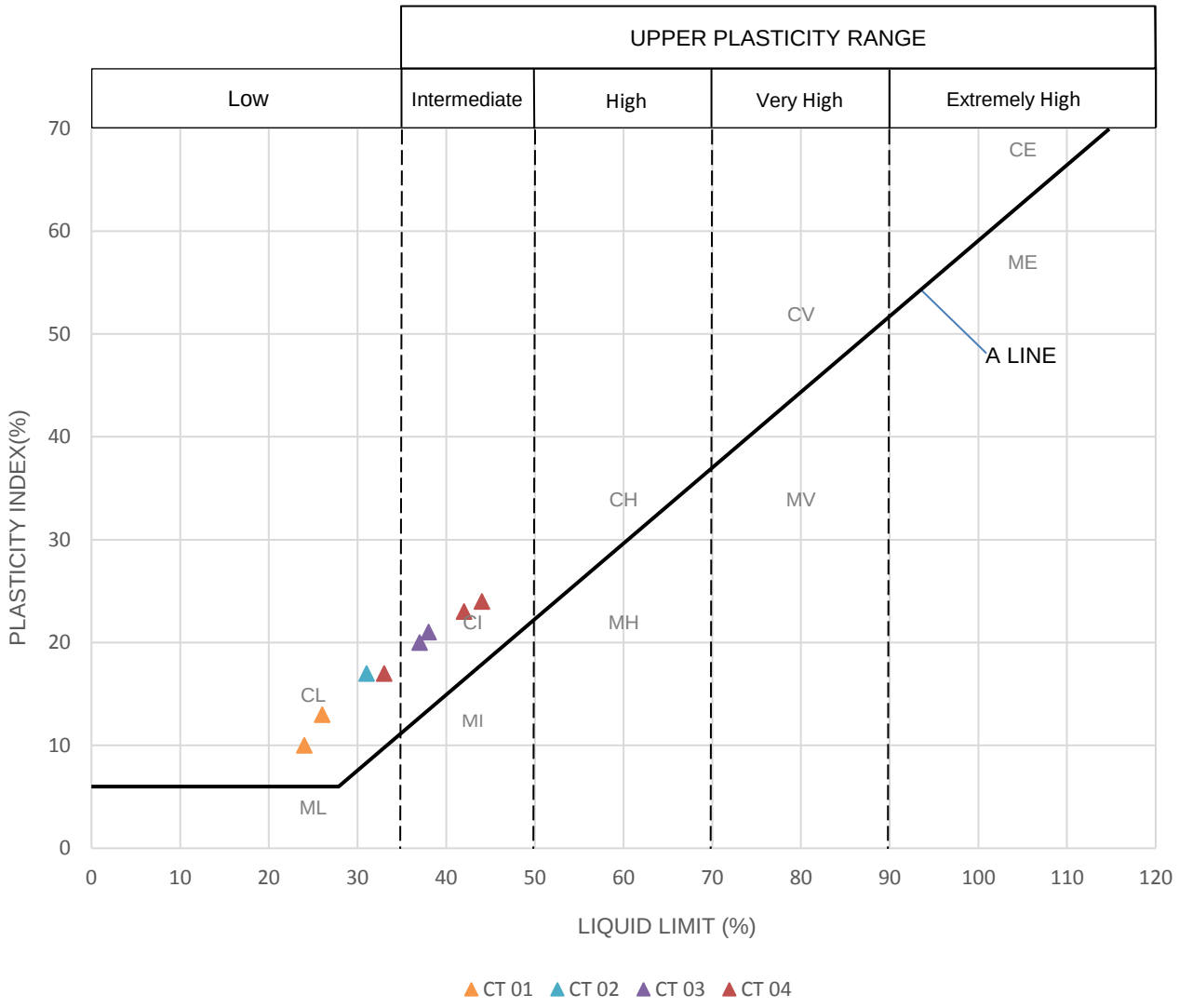
CALIFORNIA BEARING RATIO

Report No.
21.04.022



WATER CONTENT v DEPTH

Report:
21.04.022



PLASTICITY CHART

Report:
21.04.022

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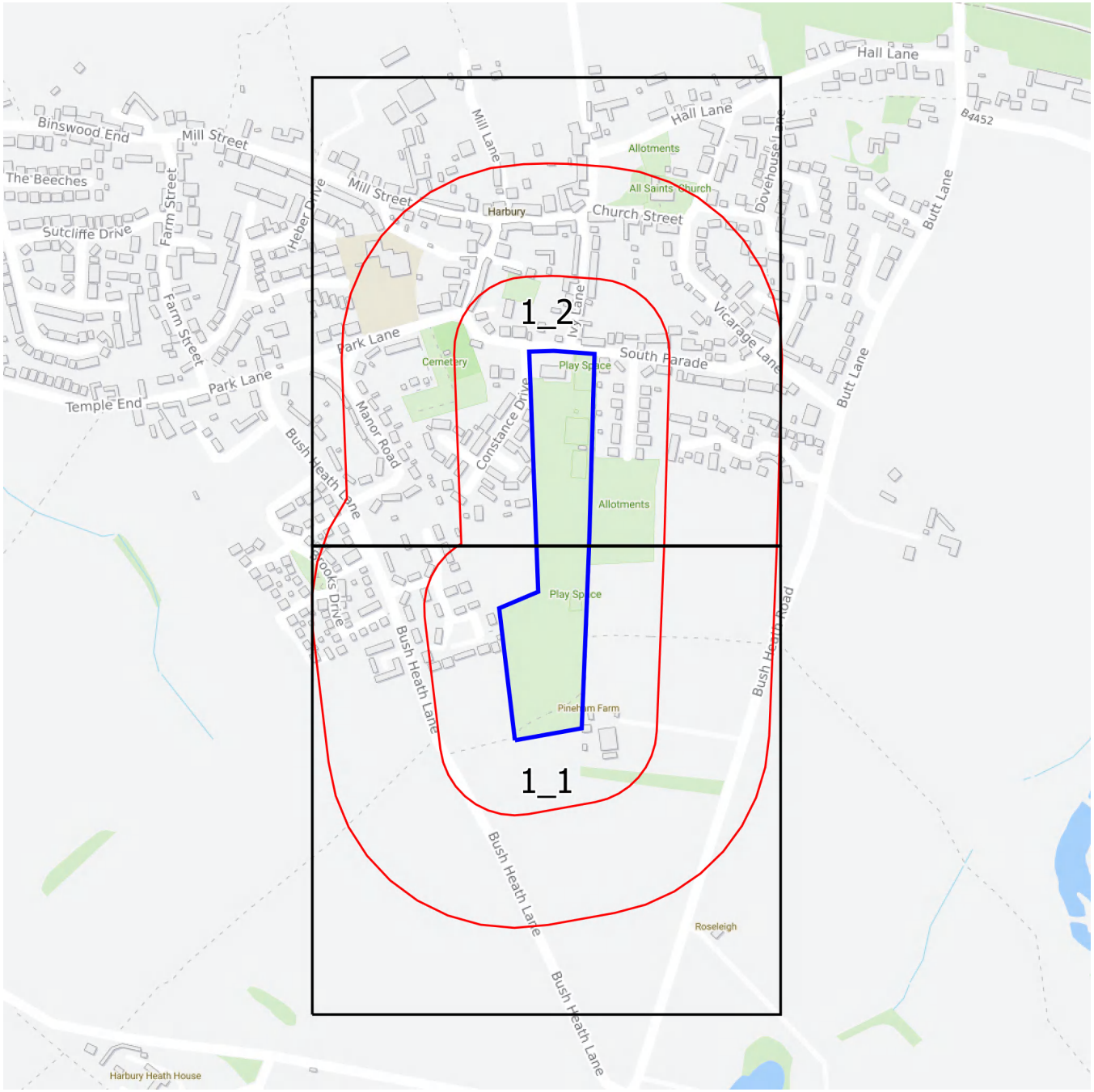
Geotechnical and Geoenvironmental Consultants

APPENDIX D
DESK STUDY DATA



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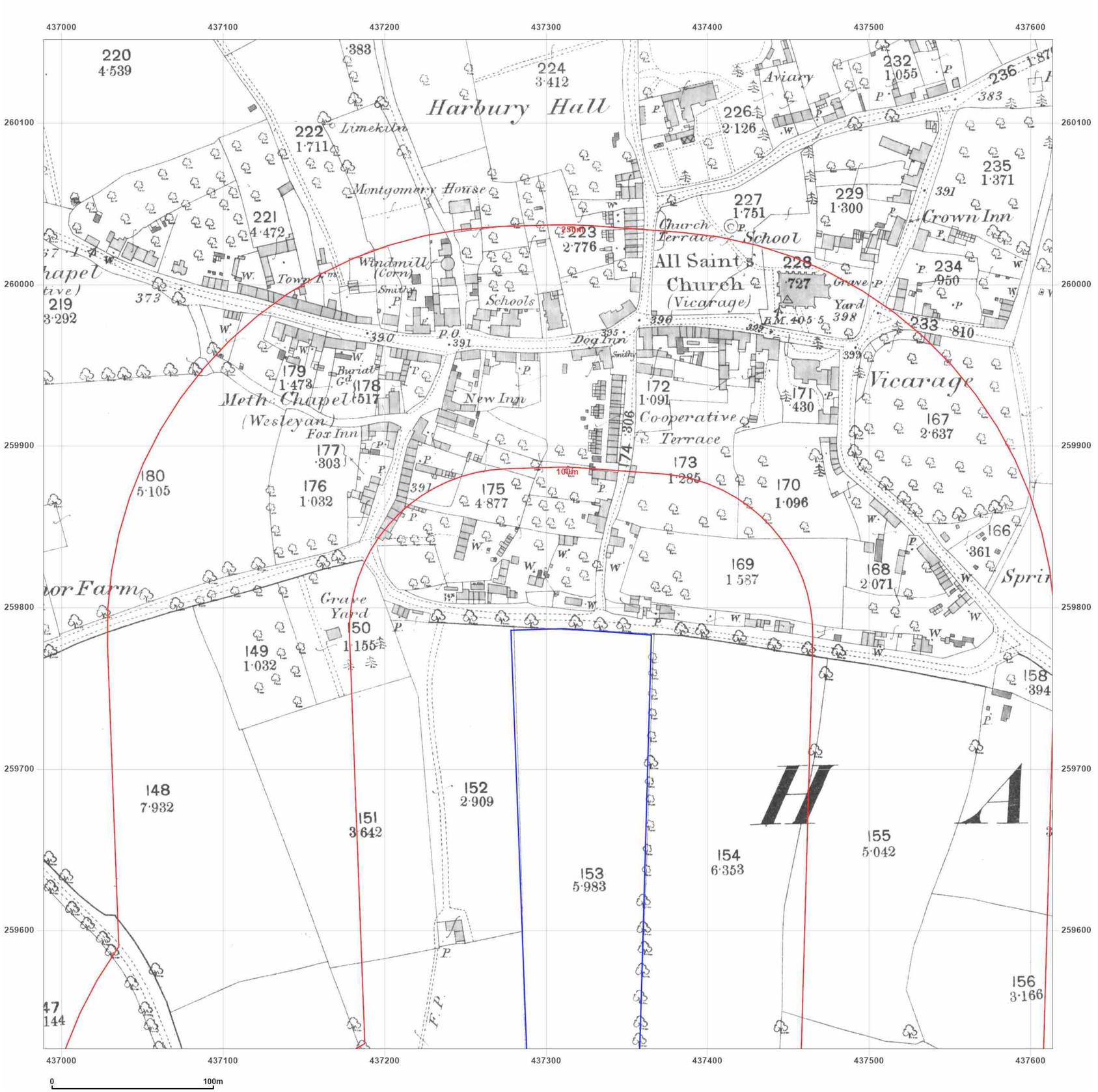

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_2
Grid Ref: 437301, 259839

Map Name: County Series

Map date: **1887**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1887
Revised 1887
Edition N/A
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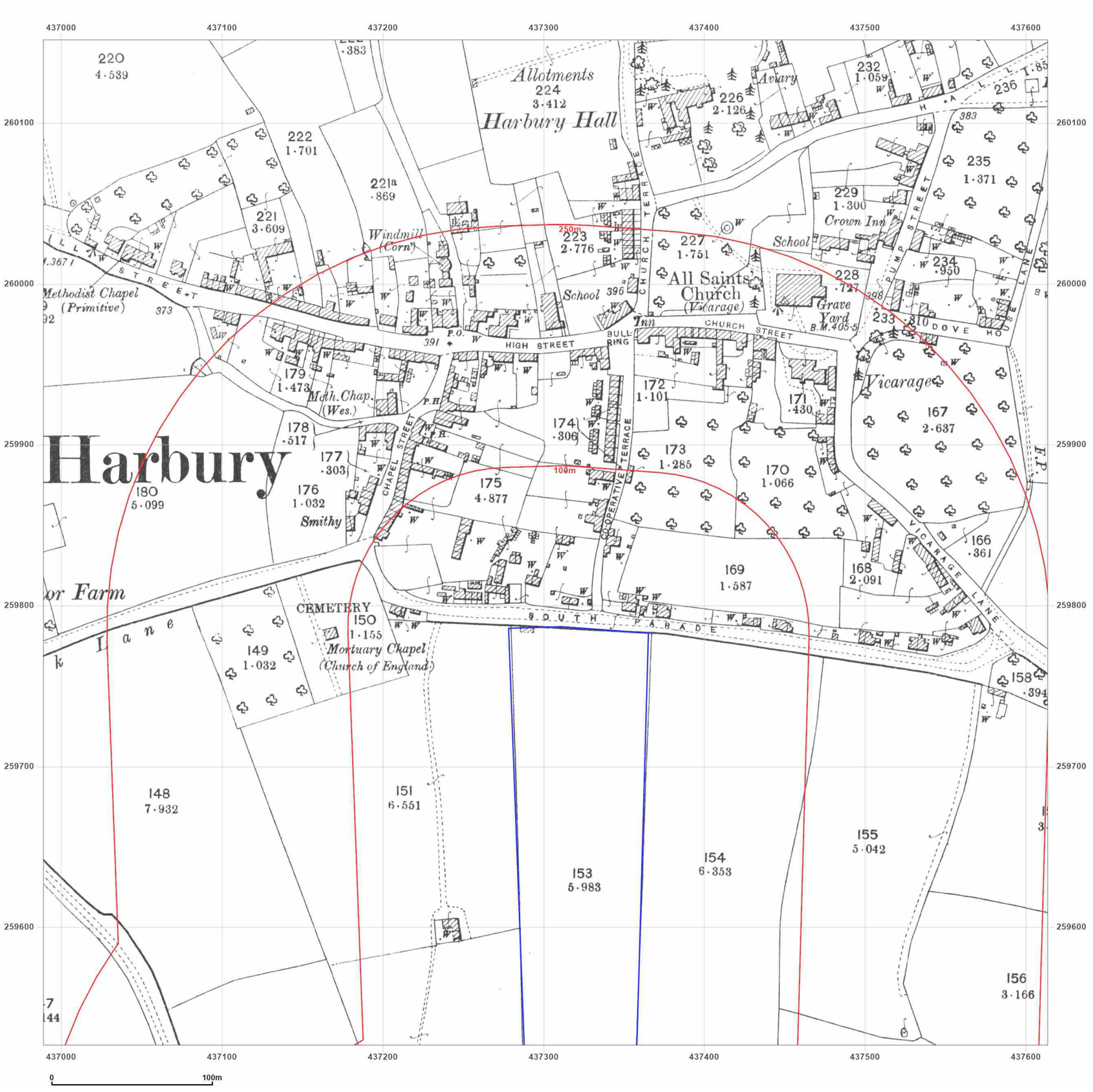

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Site Details:

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Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_2
Grid Ref: 437301, 259839

Map Name: County Series

Map date: **1905**

Scale: 1:2,500

Printed at: 1:2,500

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Grid Ref: 437301, 259839

Map Name: National Grid

Map date: **1971**

Scale: 1:2,500

Printed at: 1:2,500

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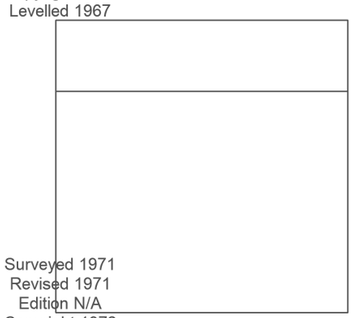

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Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_2
Grid Ref: 437301, 259839

Map Name: National Grid

Map date: **1972**

Scale: 1:2,500

Printed at: 1:2,500

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Revised N/A
Edition N/A
Copyright N/A
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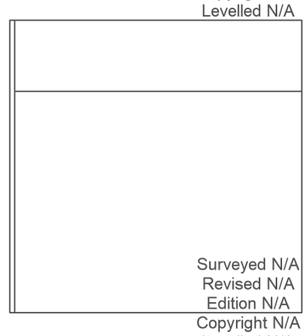

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Site Details:

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Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_2
Grid Ref: 437301, 259839

Map Name: National Grid

Map date: **1987**

Scale: 1:2,500

Printed at: 1:2,500

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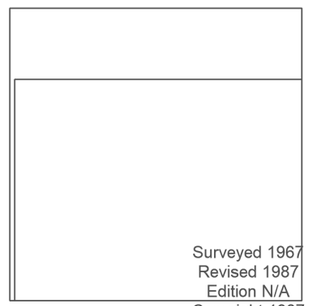

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Site Details:

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Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_2
Grid Ref: 437301, 259839

Map Name: National Grid

Map date: **1991-1993**

Scale: 1:2,500

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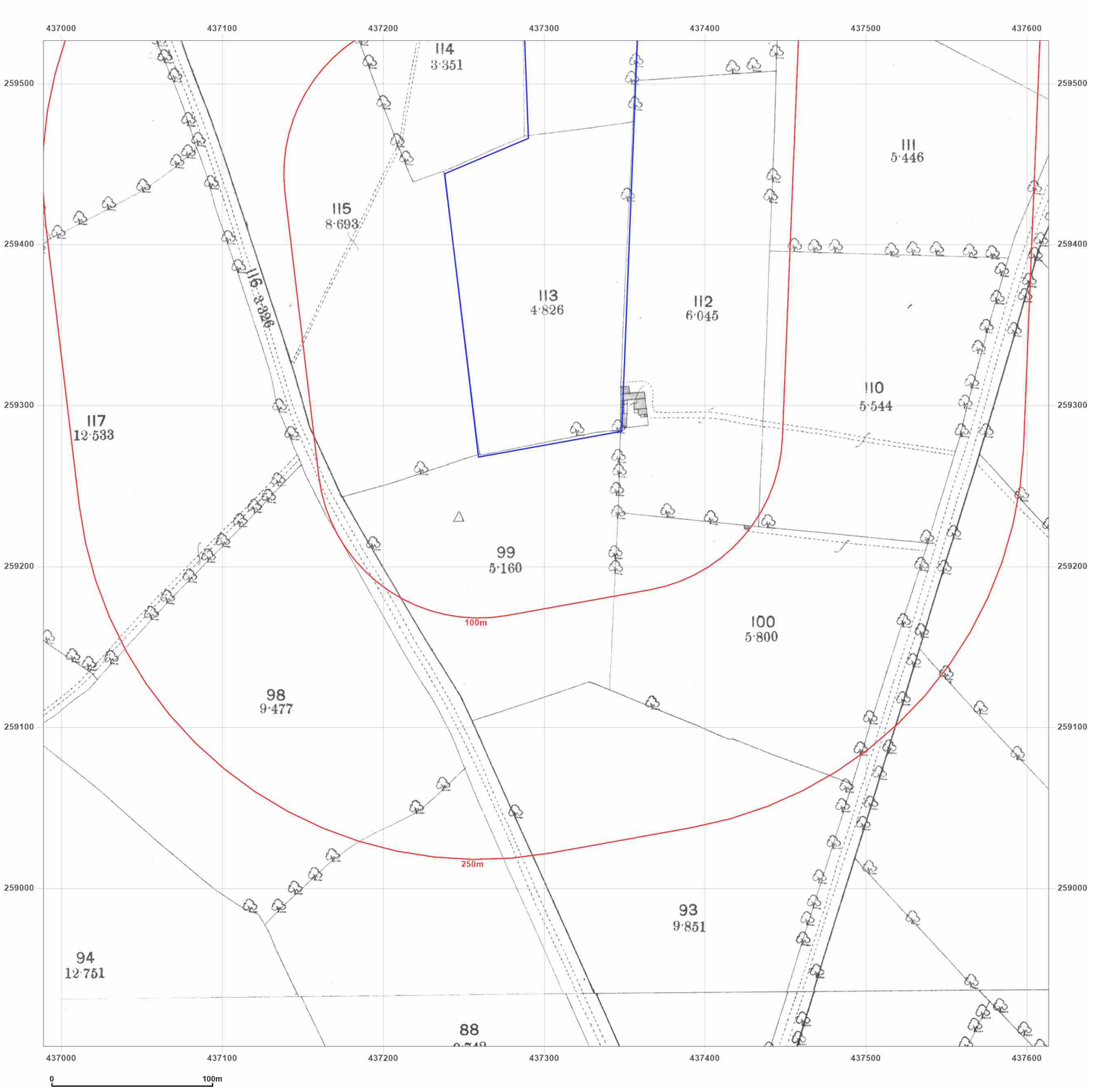

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: County Series

Map date: **1887**

Scale: 1:2,500

Printed at: 1:2,500

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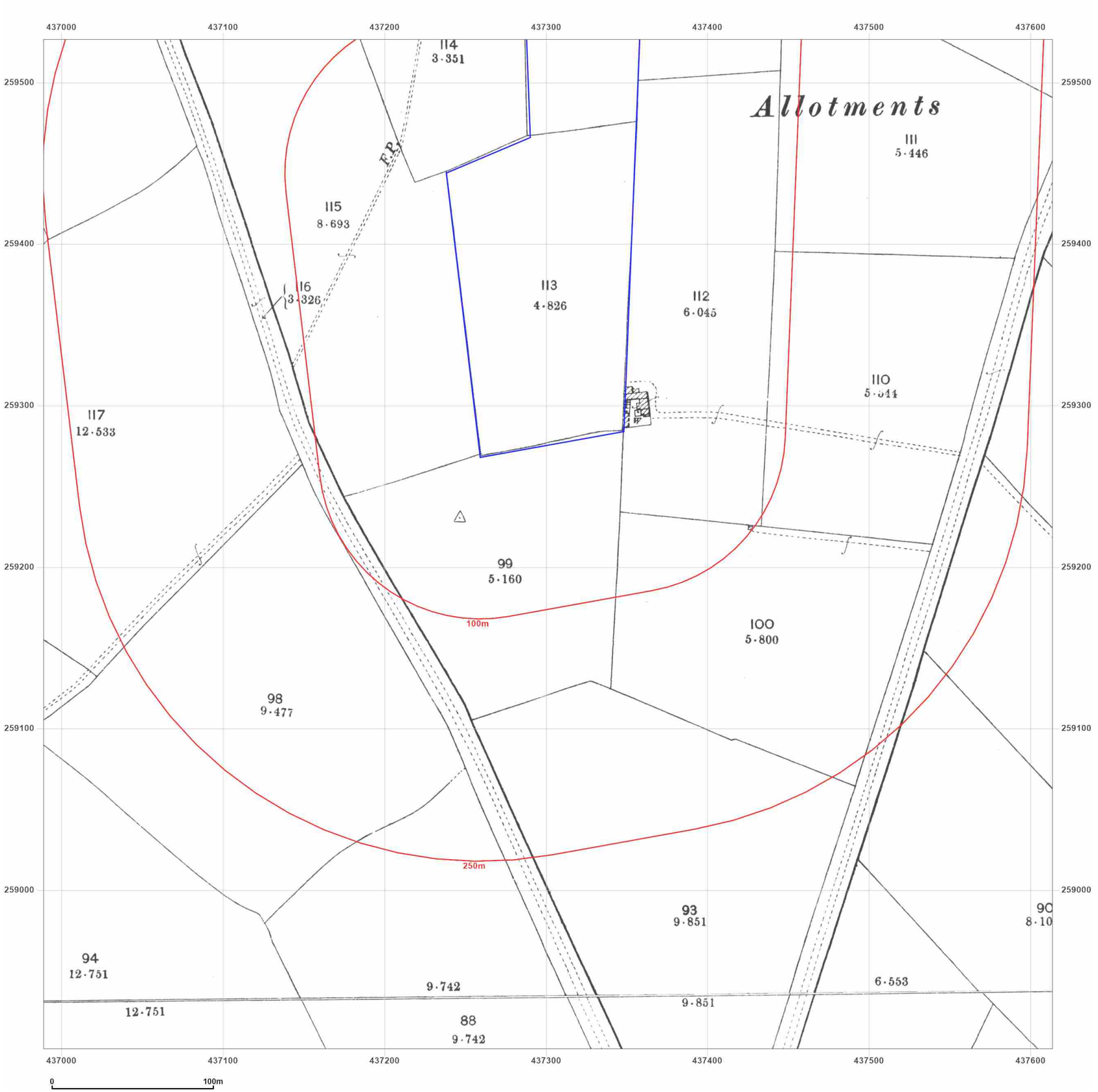

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: County Series

Map date: **1905**

Scale: 1:2,500

Printed at: 1:2,500

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Revised 1905
Edition N/A
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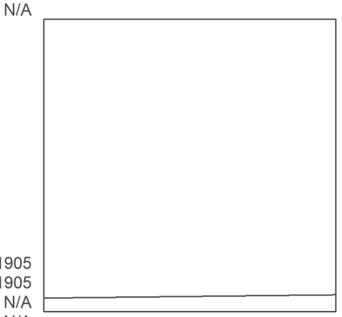

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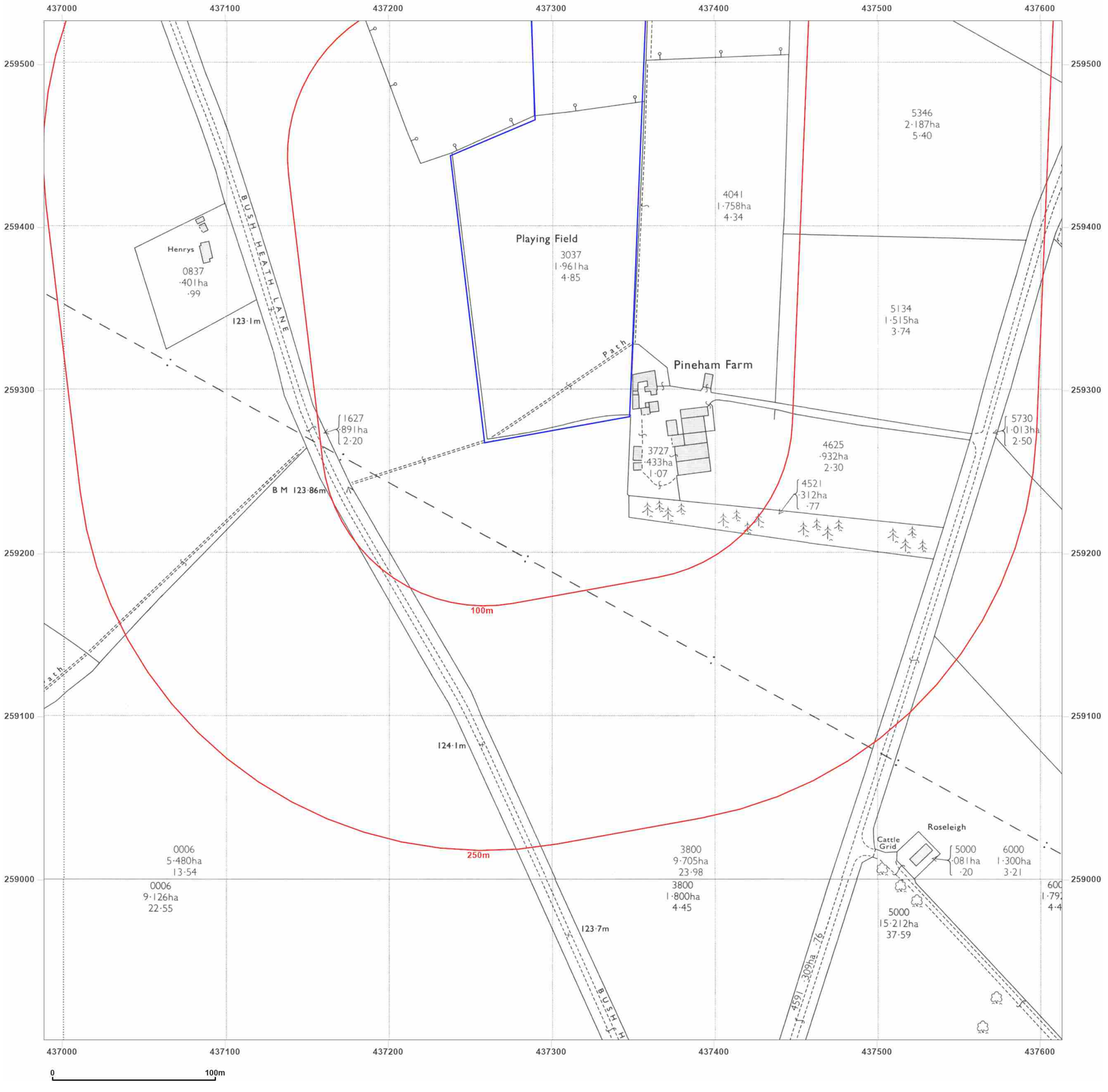

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: National Grid

Map date: **1971**

Scale: 1:2,500

Printed at: 1:2,500

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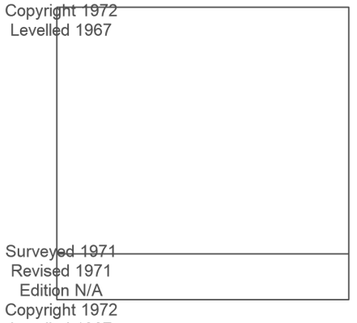
Surveyed 1971
Revised 1971
Edition N/A
Copyright 1972
Levelled 1967



Surveyed 1971
Revised 1971
Edition N/A
Copyright 1972
Levelled 1967

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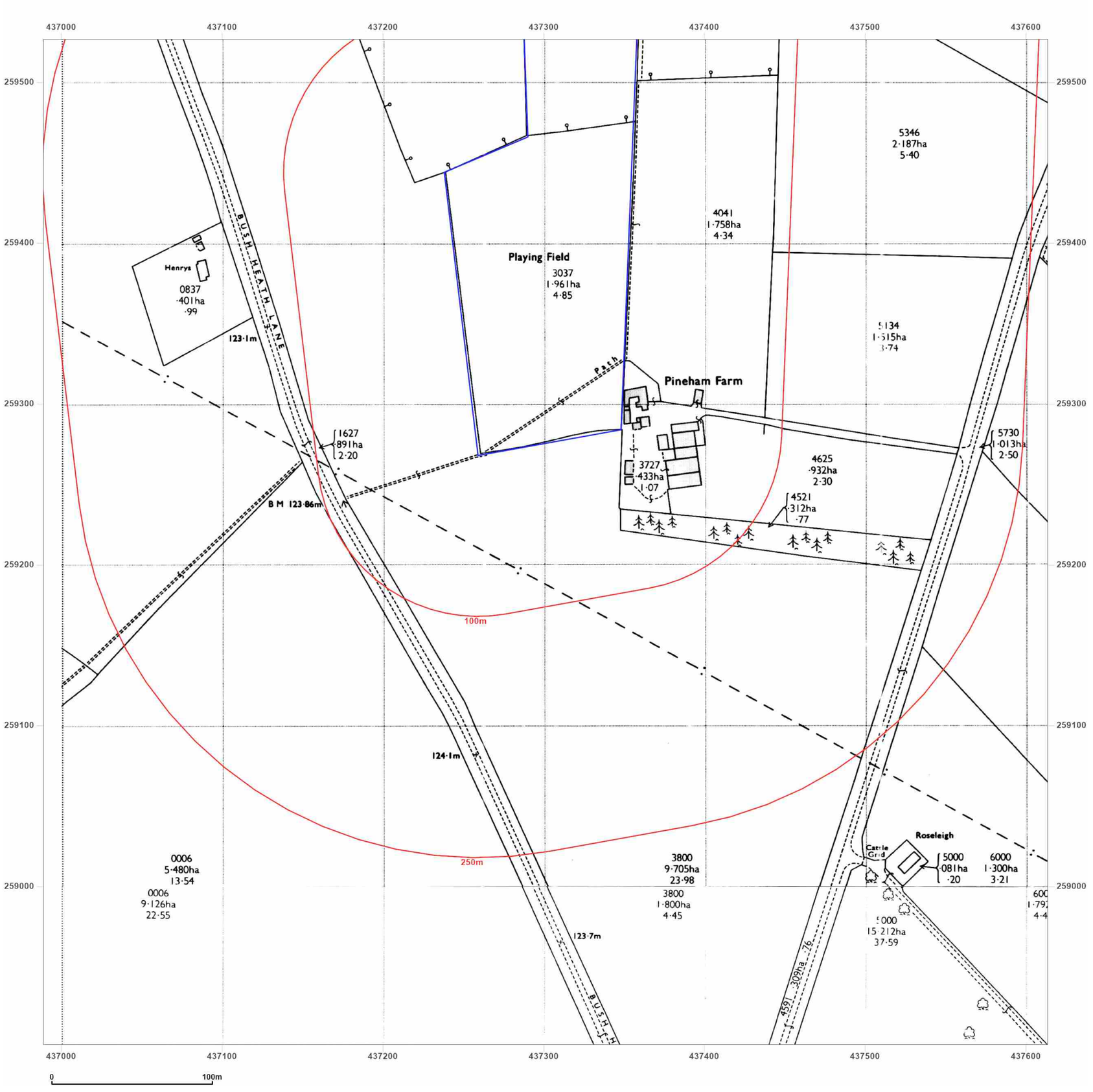

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: National Grid
Map date: **1972**
Scale: 1:2,500
Printed at: 1:2,500

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

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

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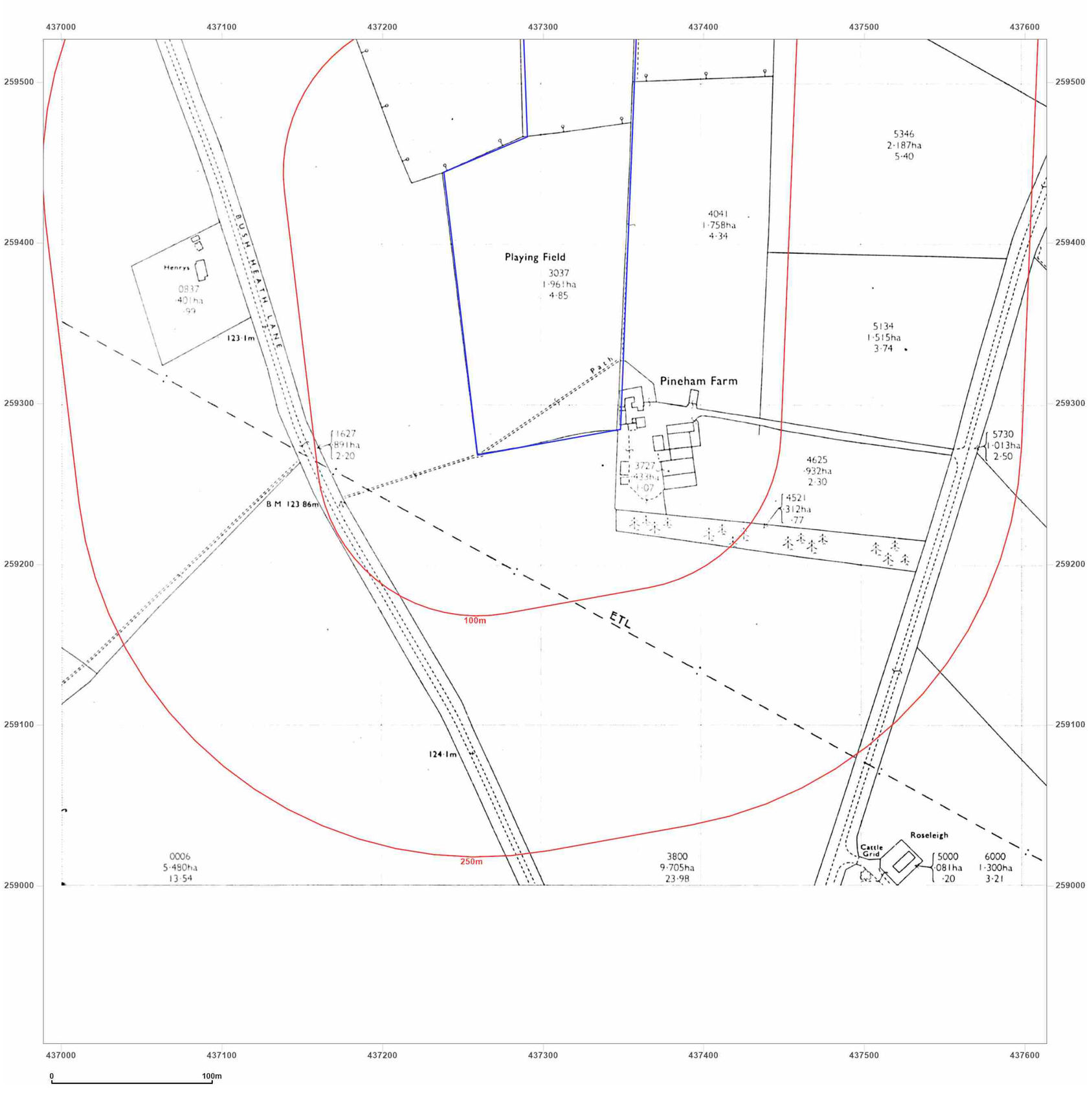

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: National Grid

Map date: **1987**

Scale: 1:2,500

Printed at: 1:2,500

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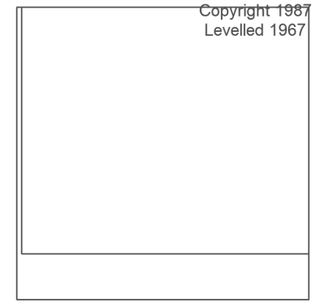
Surveyed 1967
Revised 1987
Edition N/A
Copyright 1987
Levelled 1967



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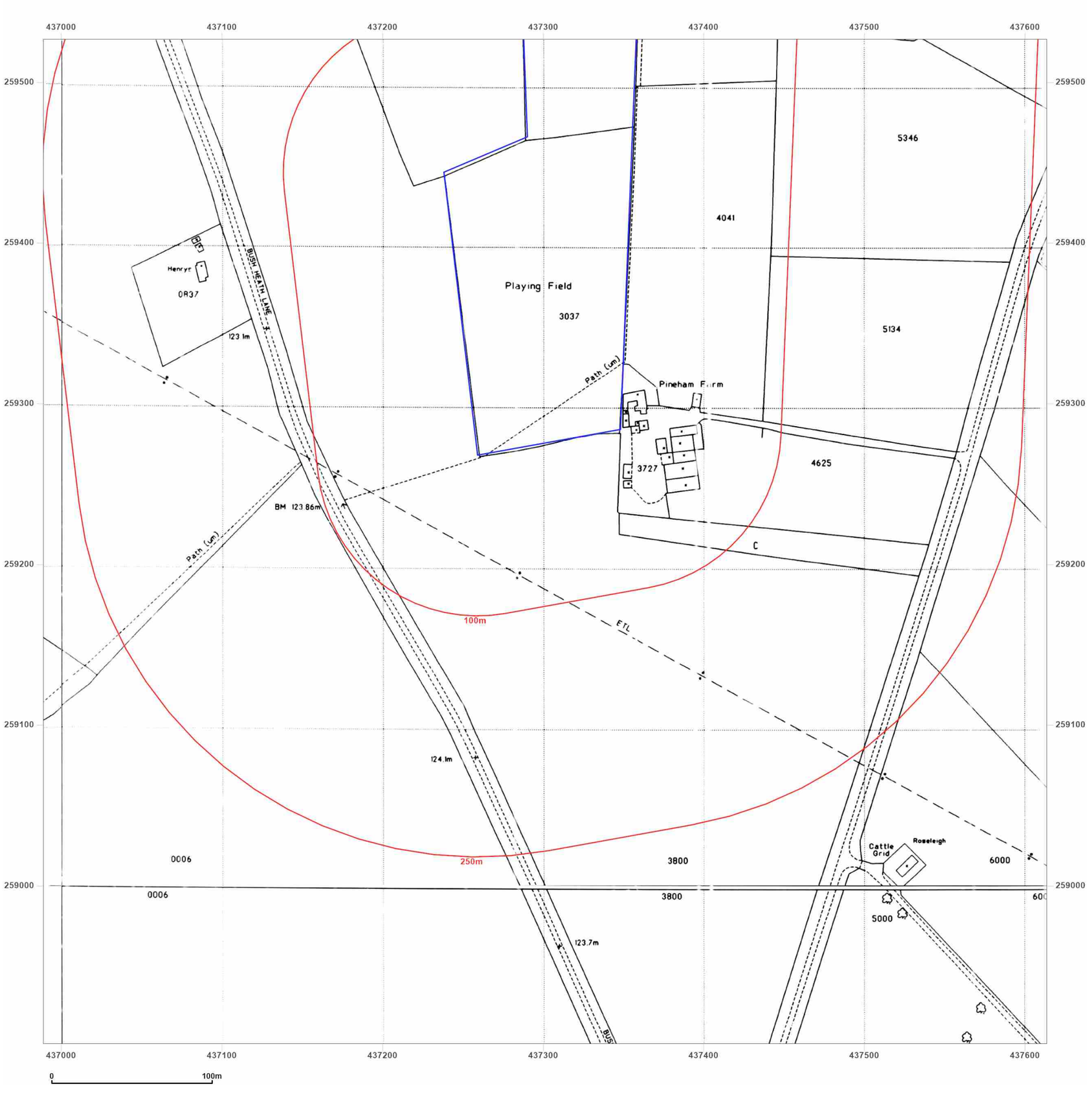

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_LS_1_1
Grid Ref: 437301, 259214

Map Name: National Grid
Map date: **1993**
Scale: 1:2,500
Printed at: 1:2,500

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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed N/A
Revised N/A
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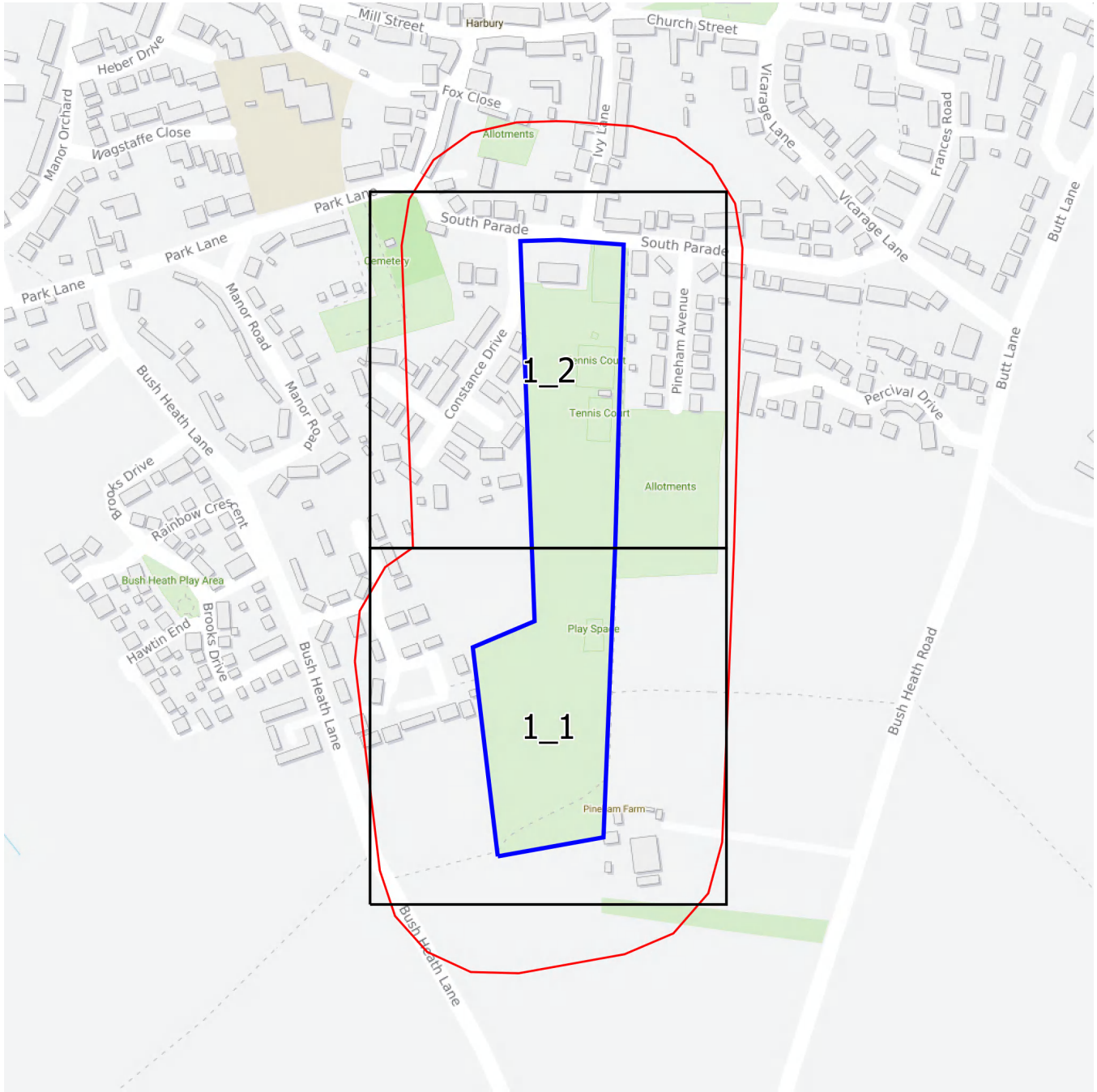
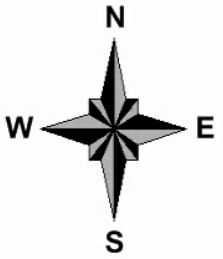


Groundsure INSIGHTS

Landline Scale Grid Index



Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_Landline_1_2
Grid Ref: 437301, 259677

Map Name: LandLine
Map date: **2003**
Scale: 1:1,250
Printed at: 1:1,250

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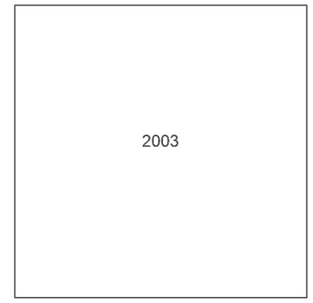

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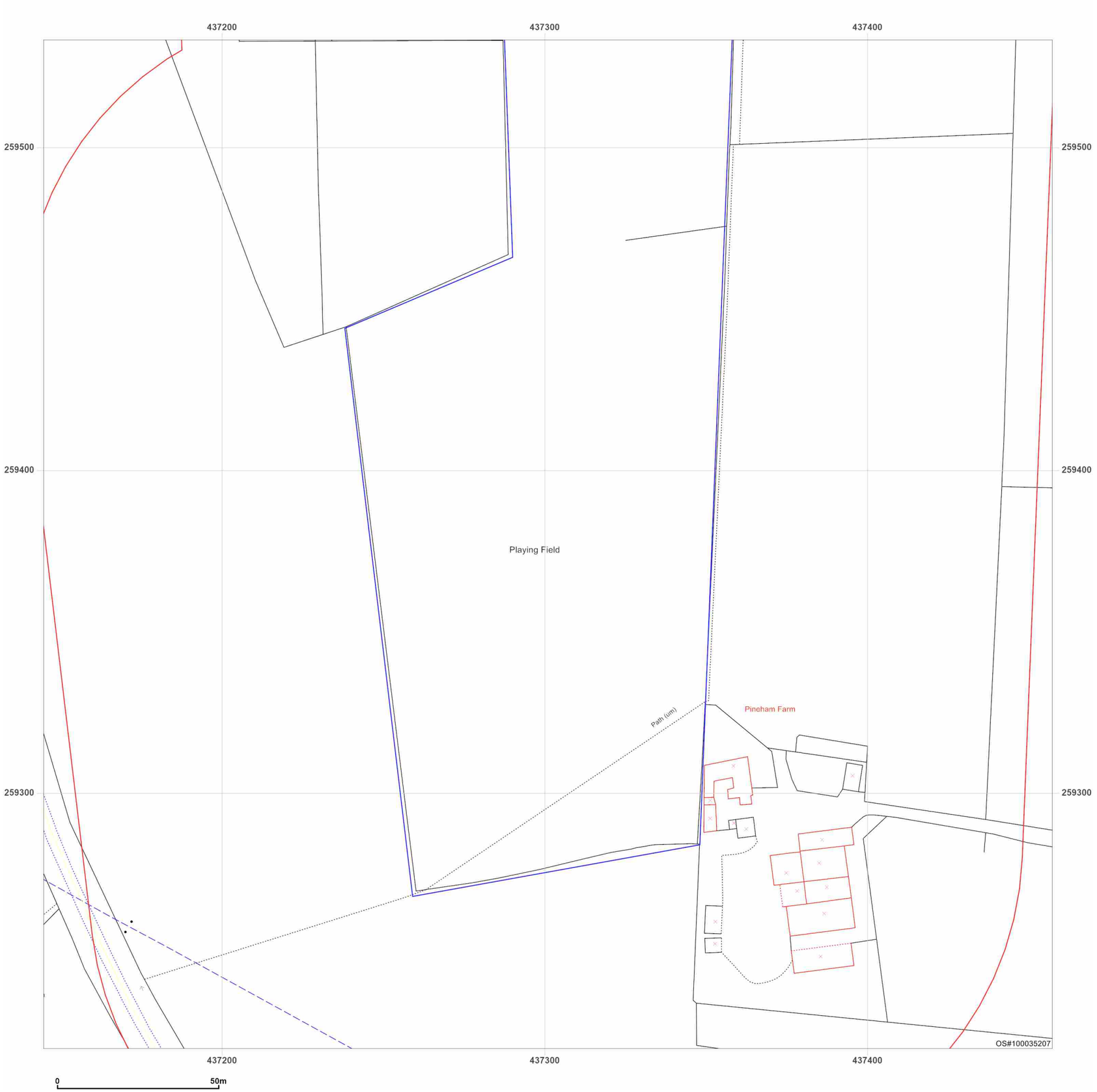

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013_Landline_1_1
Grid Ref: 437301, 259377

Map Name: LandLine
Map date: **2003**
Scale: 1:1,250
Printed at: 1:1,250

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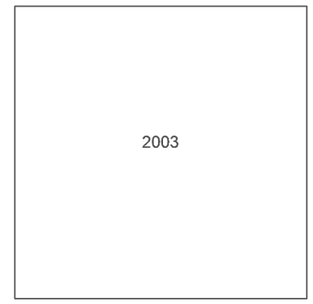

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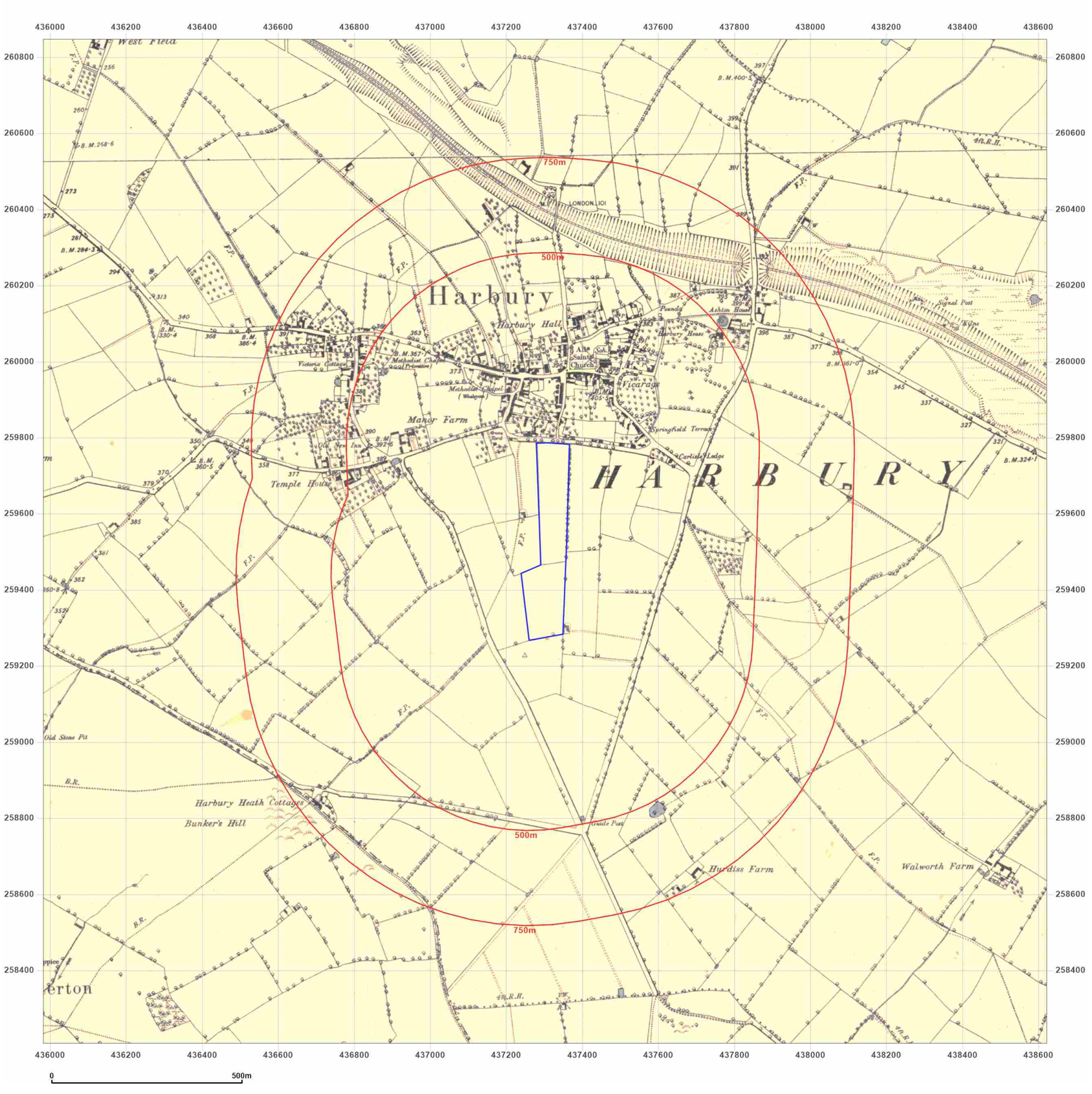

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: County Series

Map date: **1885**

Scale: 1:10,560

Printed at: 1:10,560

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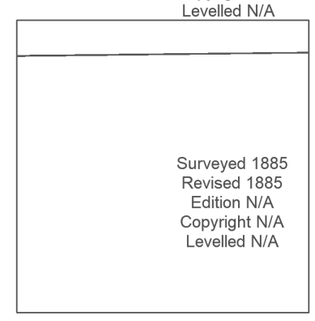
Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1885
Revised 1885
Edition N/A
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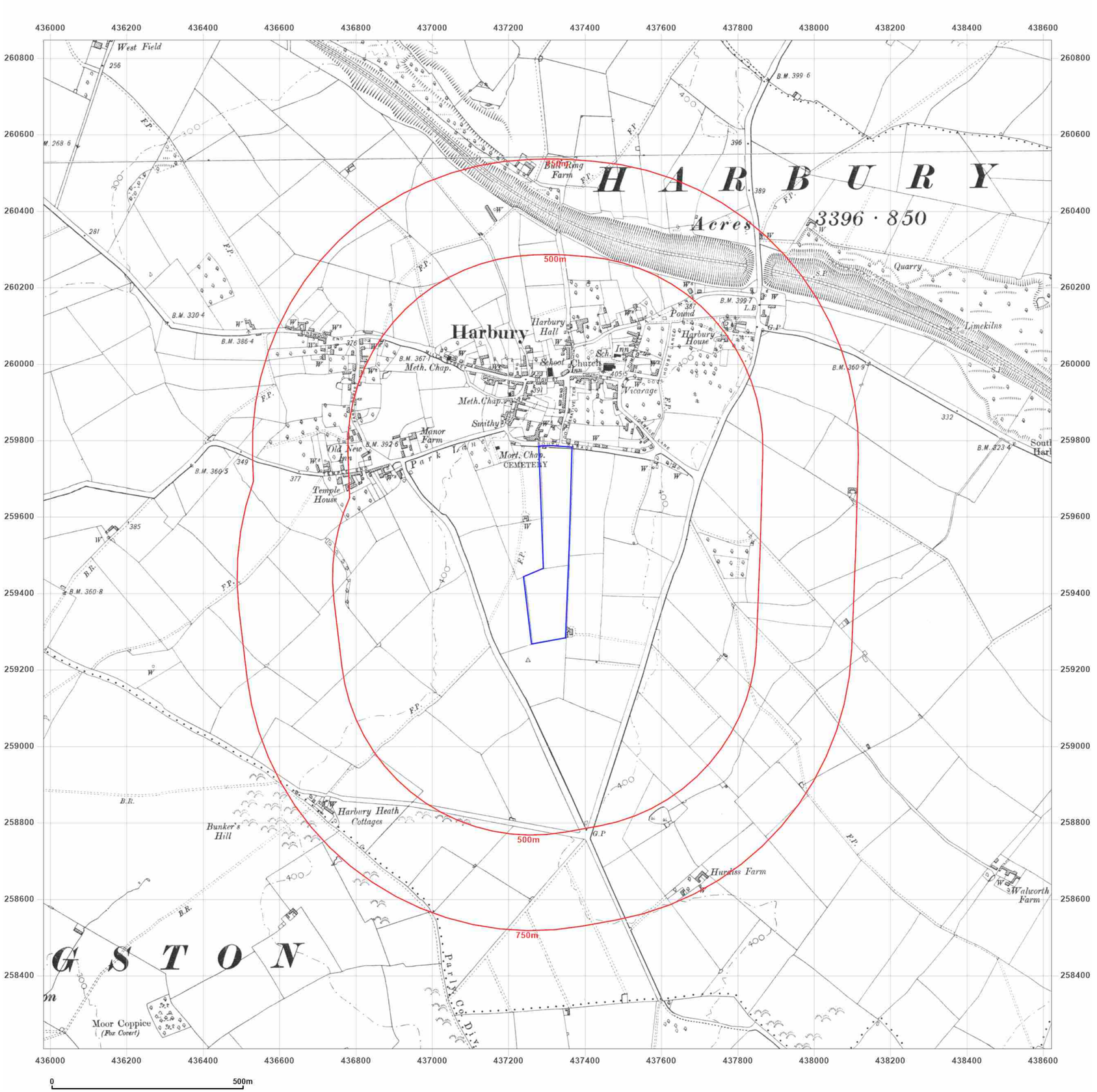

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: County Series

Map date: **1904**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1904
Revised 1904
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1904
Revised 1904
Edition N/A
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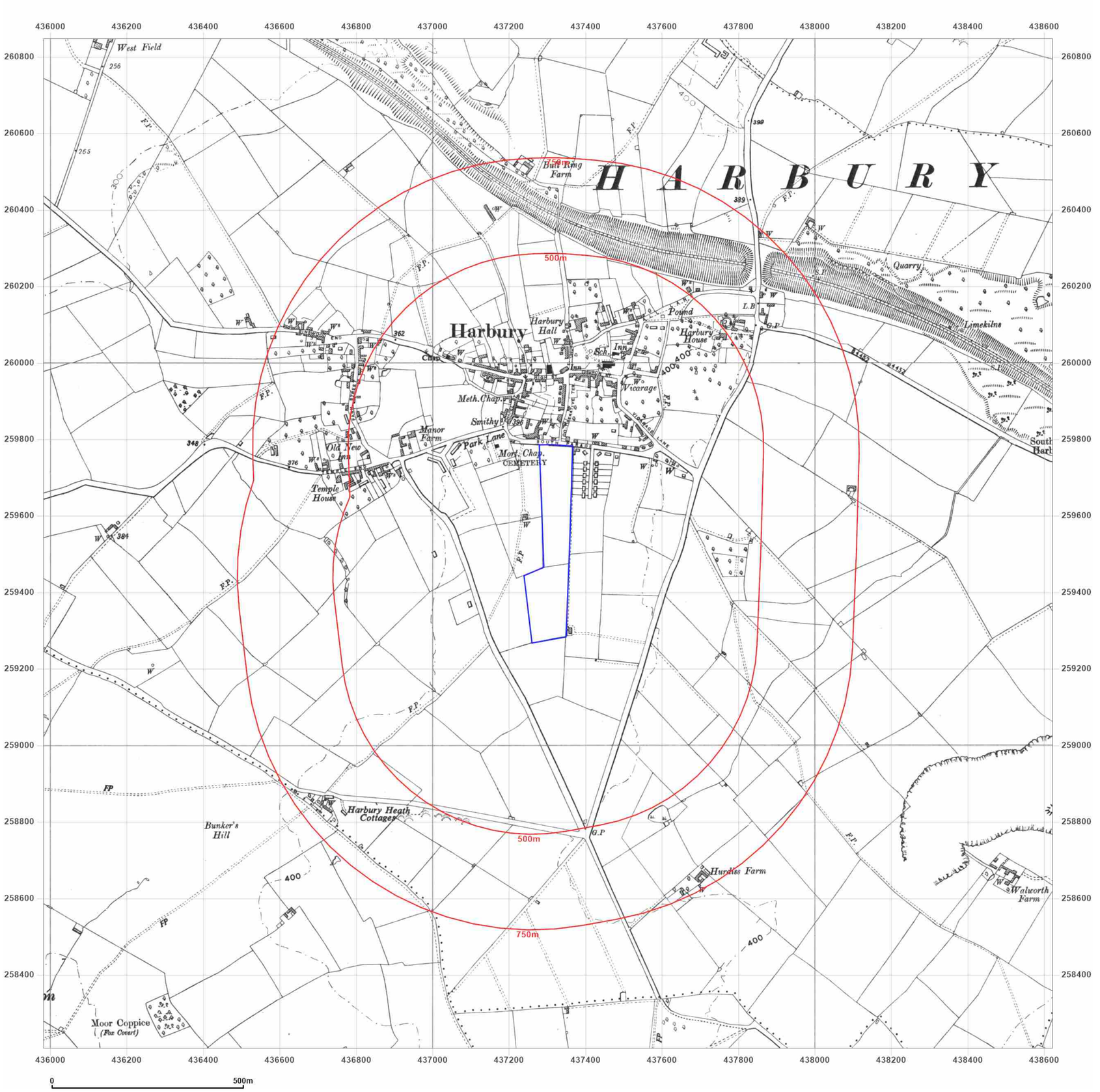

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: Provisional

Map date: **1954-1955**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1950
Revised 1955
Edition N/A
Copyright 1955
Levelled N/A

Surveyed 1950
Revised 1950
Edition N/A
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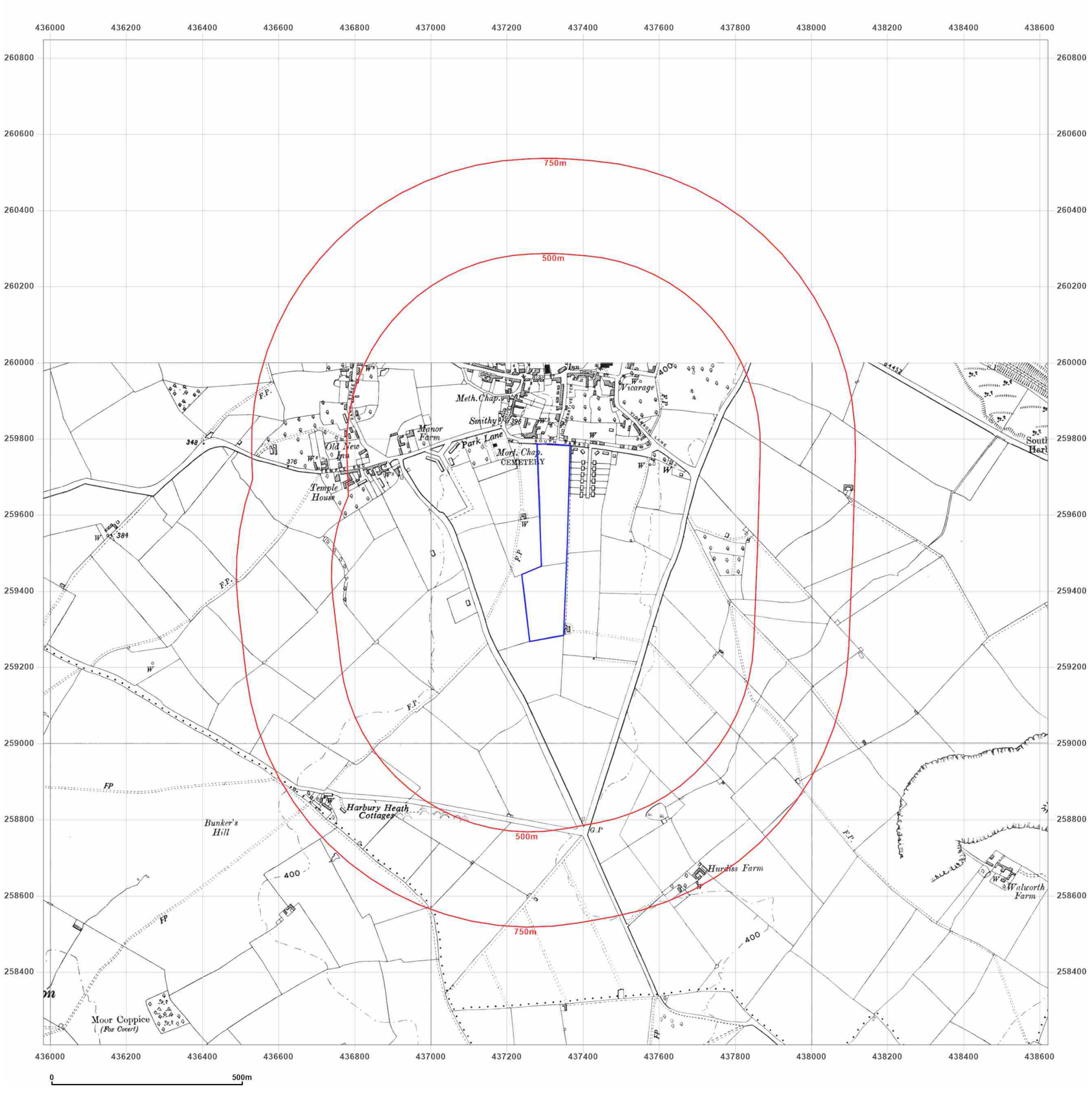

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: Provisional

Map date: **1965**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
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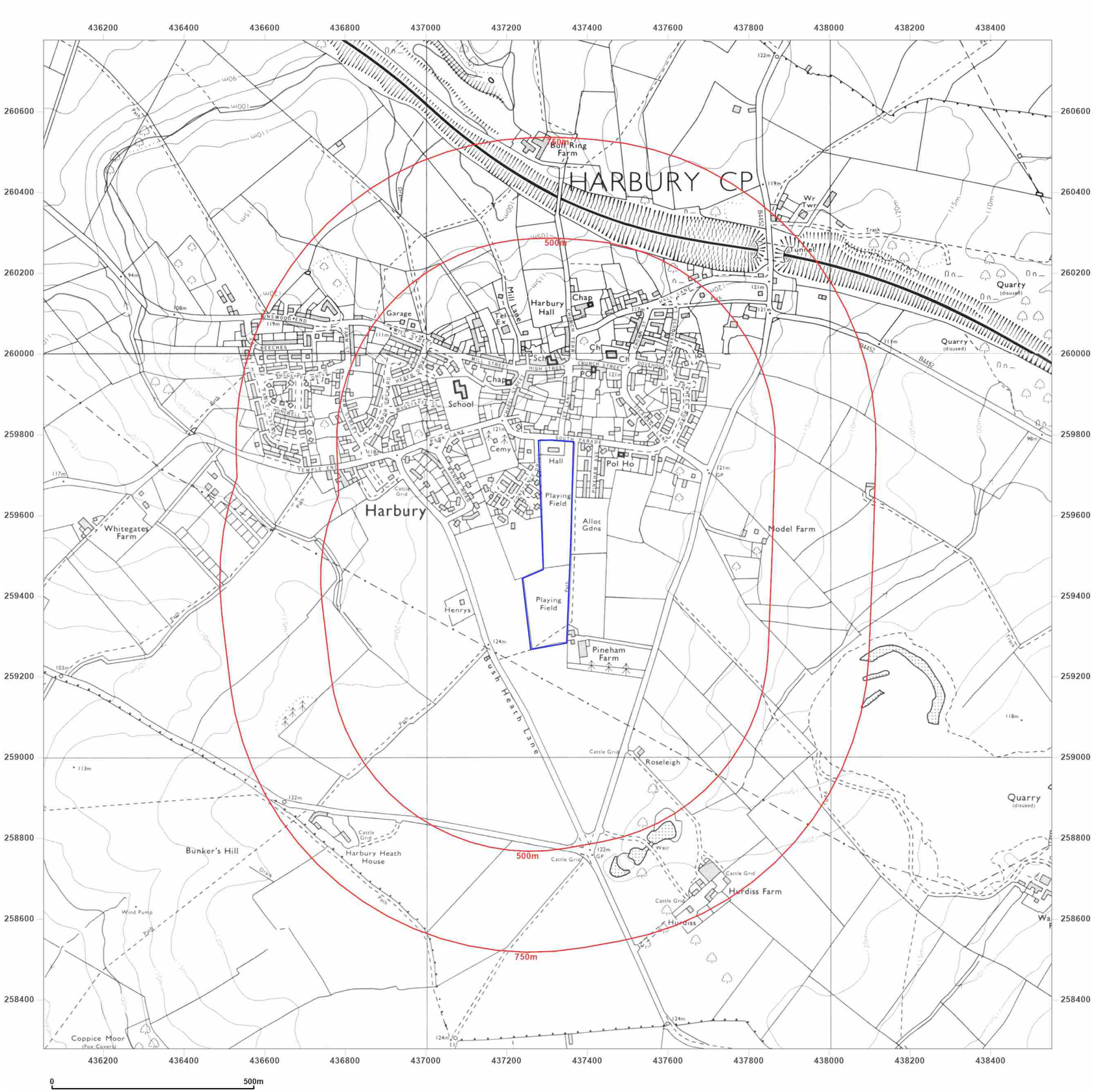

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: National Grid

Map date: **1974**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1972
Revised 1974
Edition N/A
Copyright 1974
Levelled 1970

Surveyed 1971
Revised 1974
Edition N/A
Copyright 1974
Levelled 1974

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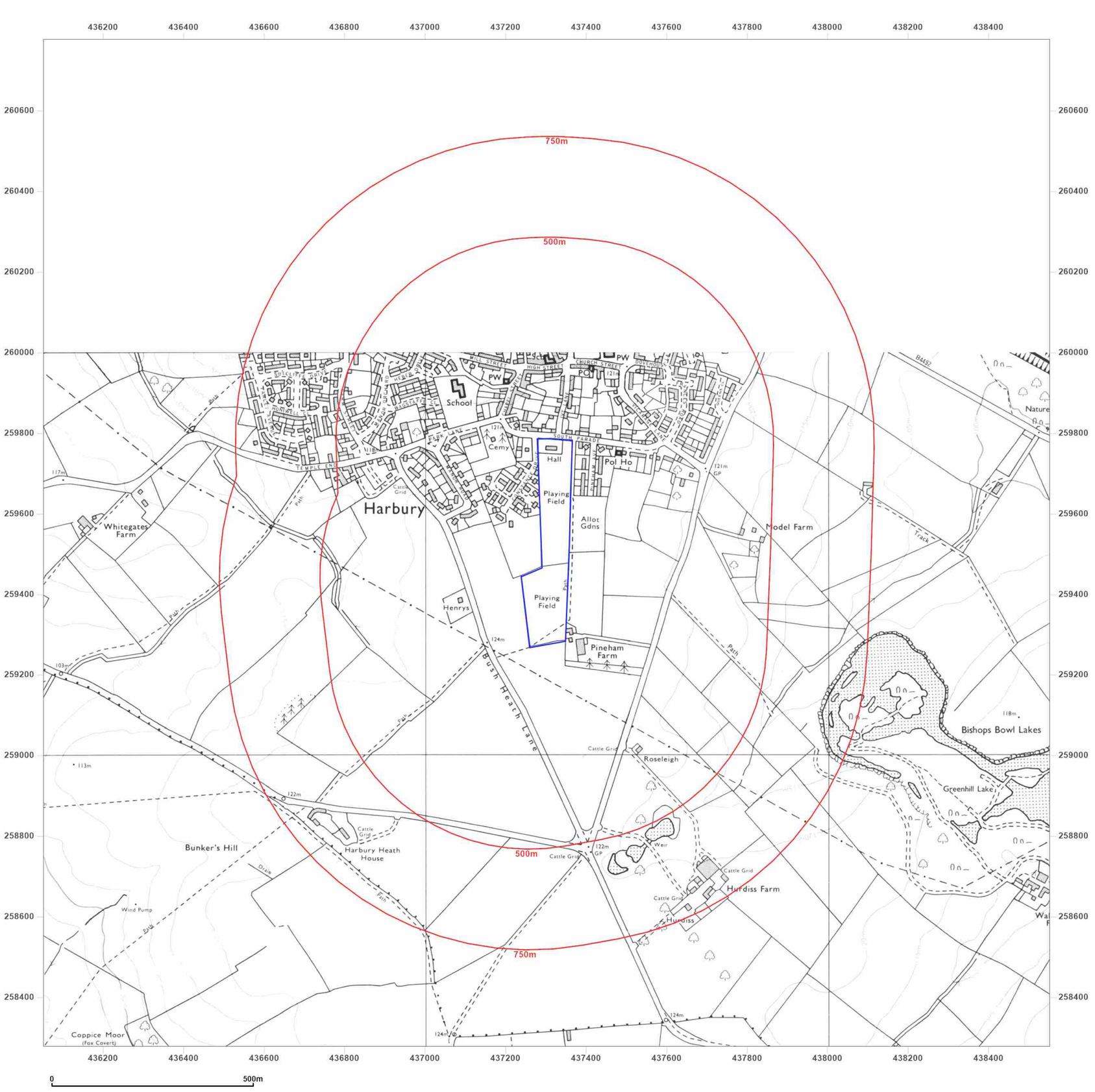

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: National Grid

Map date: **1993**

Scale: 1:10,000

Printed at: 1:10,000

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Surveyed 1971
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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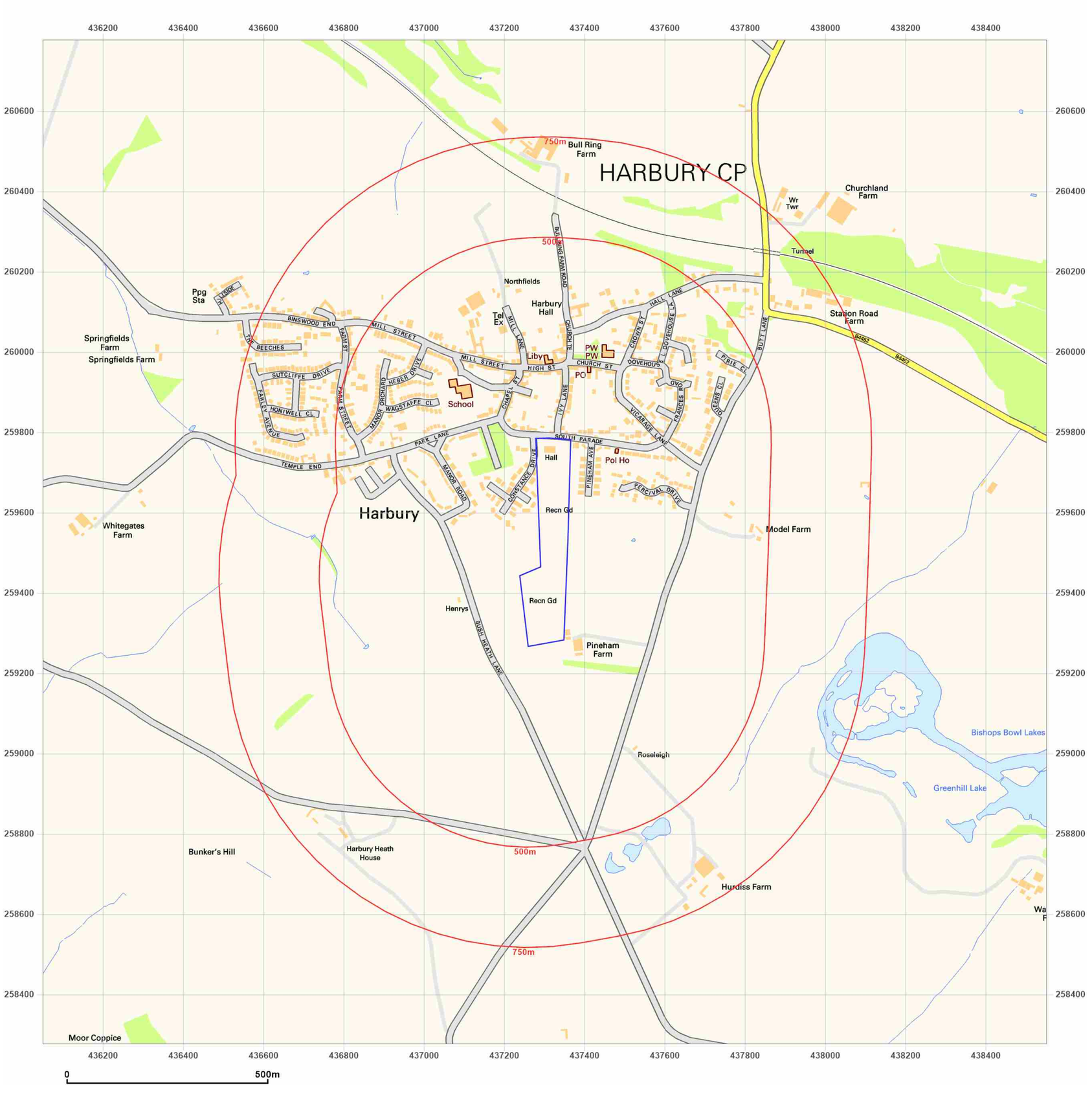

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: National Grid

Map date: **2001**

Scale: 1:10,000

Printed at: 1:10,000

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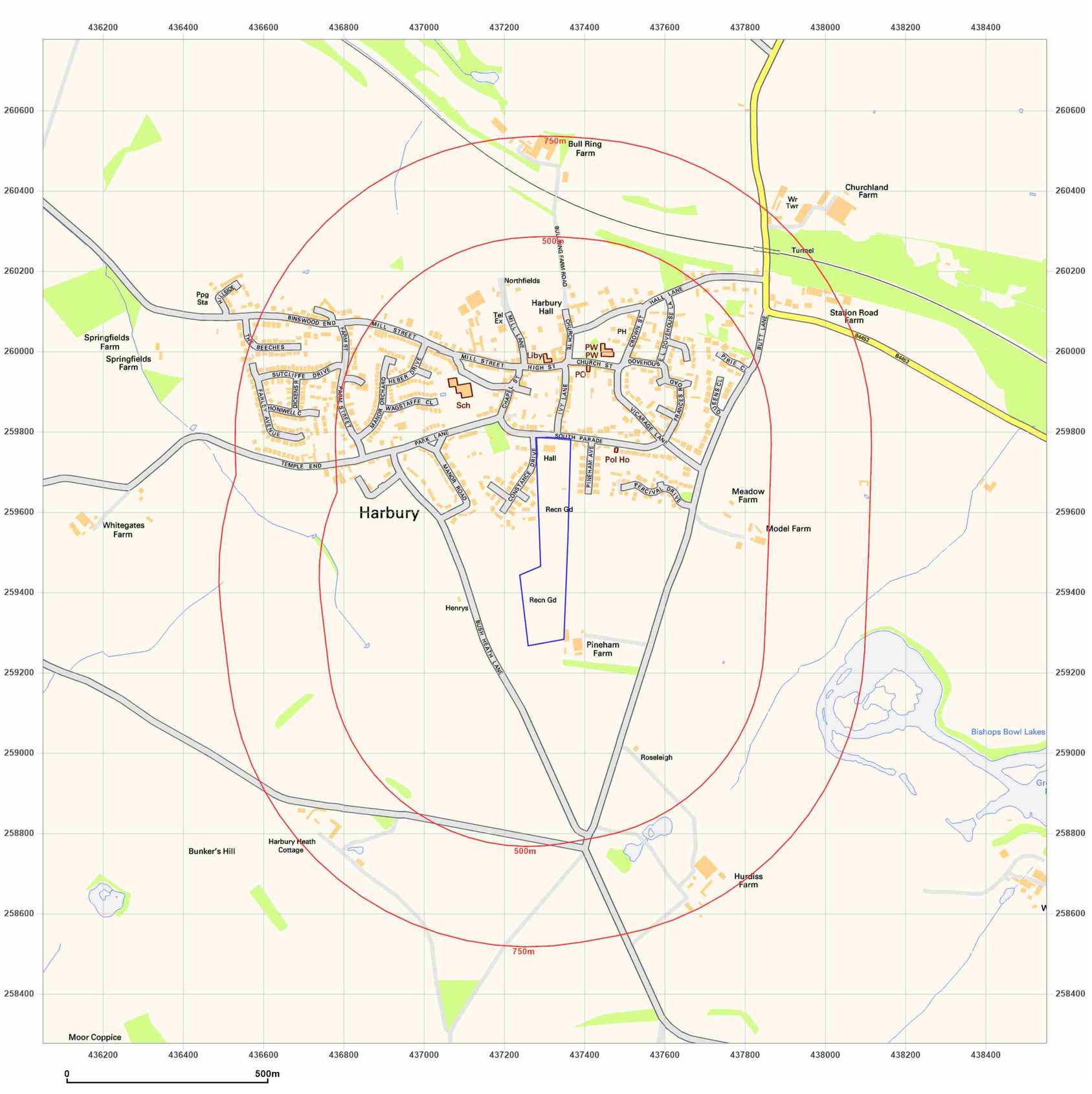

Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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Groundsure INSIGHTS

Site Details:

Harbury Playing Field,
Constance Drive, Harbury,
Warwickshire, CV33 9HZ

Client Ref: 21_04_022-889
Report Ref: GS-7802013
Grid Ref: 437301, 259527

Map Name: National Grid

Map date: **2021**

Scale: 1:10,000

Printed at: 1:10,000

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Groundsure LOCATION INTELLIGENCE

Geo Insight

Harbury Playing Field, Constance Drive, Harbury, Warwickshire, CV33 9HZ

Order Details

Date: 28/04/2021

Your ref: 21_04_022-889

Our Ref: GS-7802012

Client: Listers Geotechnical Consultants Ltd

Site Details

Location: 437319 259530

Area: 4.38 ha

Authority: Stratford-on-Avon District Council

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

Summary of findings

Page	Section	Geology 1:10,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
11	1.1	10k Availability	Identified (within 500m)				
12	1.2	Artificial and made ground (10k)	0	0	0	0	-
13	1.3	Superficial geology (10k)	1	0	2	1	-
14	1.4	Landslip (10k)	0	0	0	0	-
15	1.5	Bedrock geology (10k)	1	0	1	3	-
16	1.6	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
17	2.1	50k Availability	Identified (within 500m)				
18	2.2	Artificial and made ground (50k)	0	0	0	0	-
18	2.3	Artificial ground permeability (50k)	0	0	-	-	-
19	2.4	Superficial geology (50k)	1	0	0	1	-
20	2.5	Superficial permeability (50k)	Identified (within 50m)				
20	2.6	Landslip (50k)	0	0	0	0	-
20	2.7	Landslip permeability (50k)	None (within 50m)				
21	2.8	Bedrock geology (50k)	1	0	0	2	-
22	2.9	Bedrock permeability (50k)	Identified (within 50m)				
22	2.10	Bedrock faults and other linear features (50k)	0	0	0	0	-
Page	Section	Boreholes	On site	0-50m	50-250m	250-500m	500-2000m
23	3.1	BGS Boreholes	0	2	6	-	-
Page	Section	Natural ground subsidence					
25	4.1	Shrink swell clays	Low (within 50m)				
26	4.2	Running sands	Very low (within 50m)				
27	4.3	Compressible deposits	Negligible (within 50m)				
28	4.4	Collapsible deposits	Very low (within 50m)				
29	4.5	Landslides	Very low (within 50m)				
30	4.6	Ground dissolution of soluble rocks	Very low (within 50m)				

Page	Section	Mining, ground workings and natural cavities	On site	0-50m	50-250m	250-500m	500-2000m
32	5.1	Natural cavities	0	0	0	0	-
33	5.2	BritPits	0	0	0	0	-
33	**5.3**	**Surface ground workings**	0	0	5	-	-
33	**5.4**	**Underground workings**	0	0	0	0	1
34	**5.5**	**Historical Mineral Planning Areas**	0	0	1	0	-
34	5.6	Non-coal mining	0	0	0	0	0
34	5.7	Mining cavities	0	0	0	0	0
34	5.8	JPB mining areas	None (within 0m)				
35	5.9	Coal mining	None (within 0m)				
35	5.10	Brine areas	None (within 0m)				
35	5.11	Gypsum areas	None (within 0m)				
35	5.12	Tin mining	None (within 0m)				
35	5.13	Clay mining	None (within 0m)				

Page	Section	Radon	
36	**6.1**	**Radon**	Less than 1% (within 0m)

Page	Section	Soil chemistry	On site	0-50m	50-250m	250-500m	500-2000m
37	**7.1**	**BGS Estimated Background Soil Chemistry**	2	0	-	-	-
37	7.2	BGS Estimated Urban Soil Chemistry	0	0	-	-	-
37	7.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-

Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
38	8.1	Underground railways (London)	0	0	0	-	-
38	8.2	Underground railways (Non-London)	0	0	0	-	-
38	8.3	Railway tunnels	0	0	0	-	-
38	8.4	Historical railway and tunnel features	0	0	0	-	-
38	8.5	Royal Mail tunnels	0	0	0	-	-
39	8.6	Historical railways	0	0	0	-	-
39	8.7	Railways	0	0	0	-	-
39	8.8	Crossrail 1	0	0	0	0	-

39	8.9	Crossrail 2	0	0	0	0	-
39	8.10	HS2	0	0	0	0	-

Recent aerial photograph

Capture Date: 06/05/2020

Site Area: 4.38ha

Recent site history - 2019 aerial photograph

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Capture Date: 24/08/2019

Site Area: 4.38ha

Recent site history - 2013 aerial photograph

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Capture Date: 09/07/2013

Site Area: 4.38ha

Recent site history - 2010 aerial photograph

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Capture Date: 04/06/2010

Site Area: 4.38ha

Recent site history - 1999 aerial photograph

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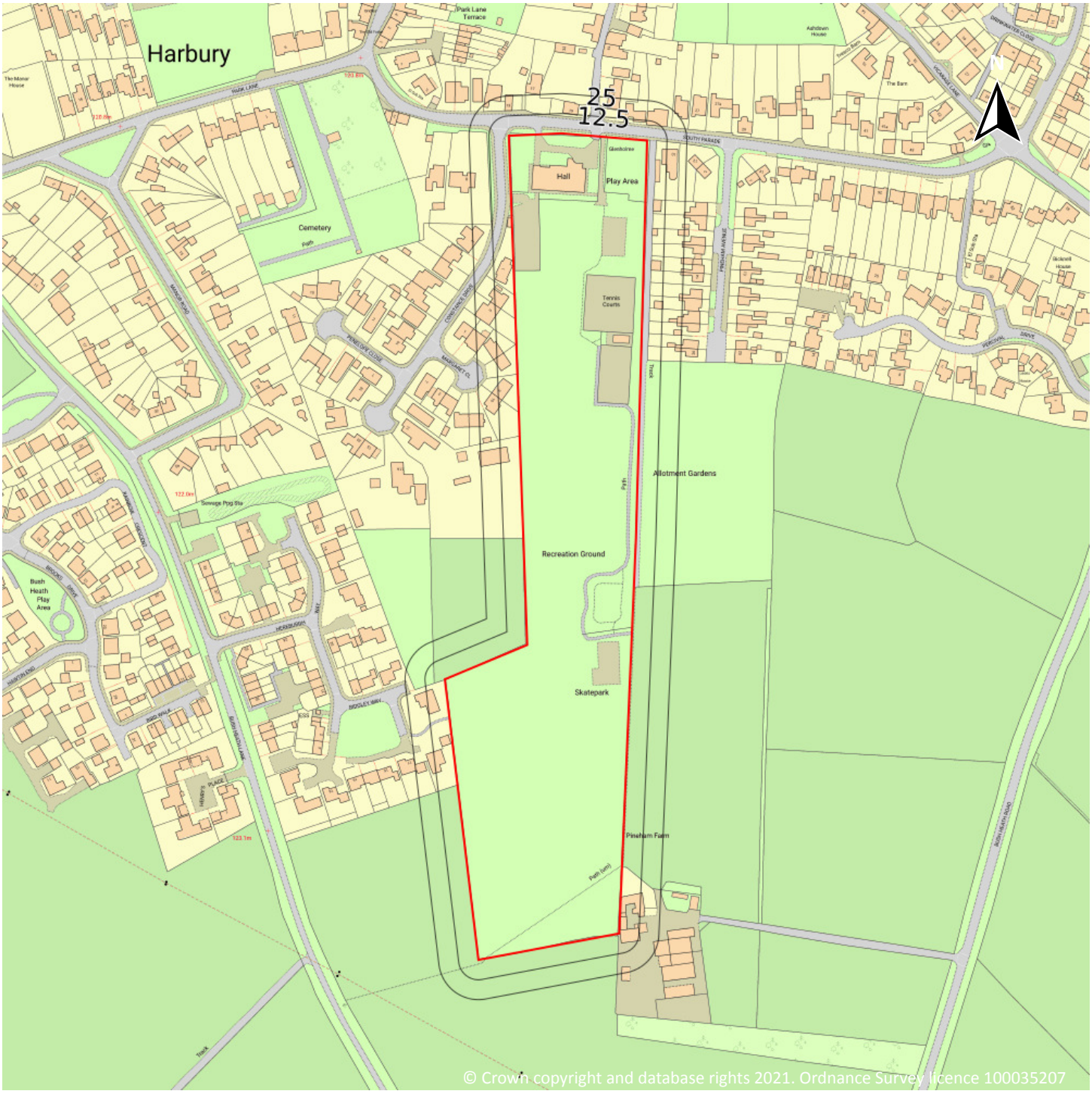
Capture Date: 18/10/1999

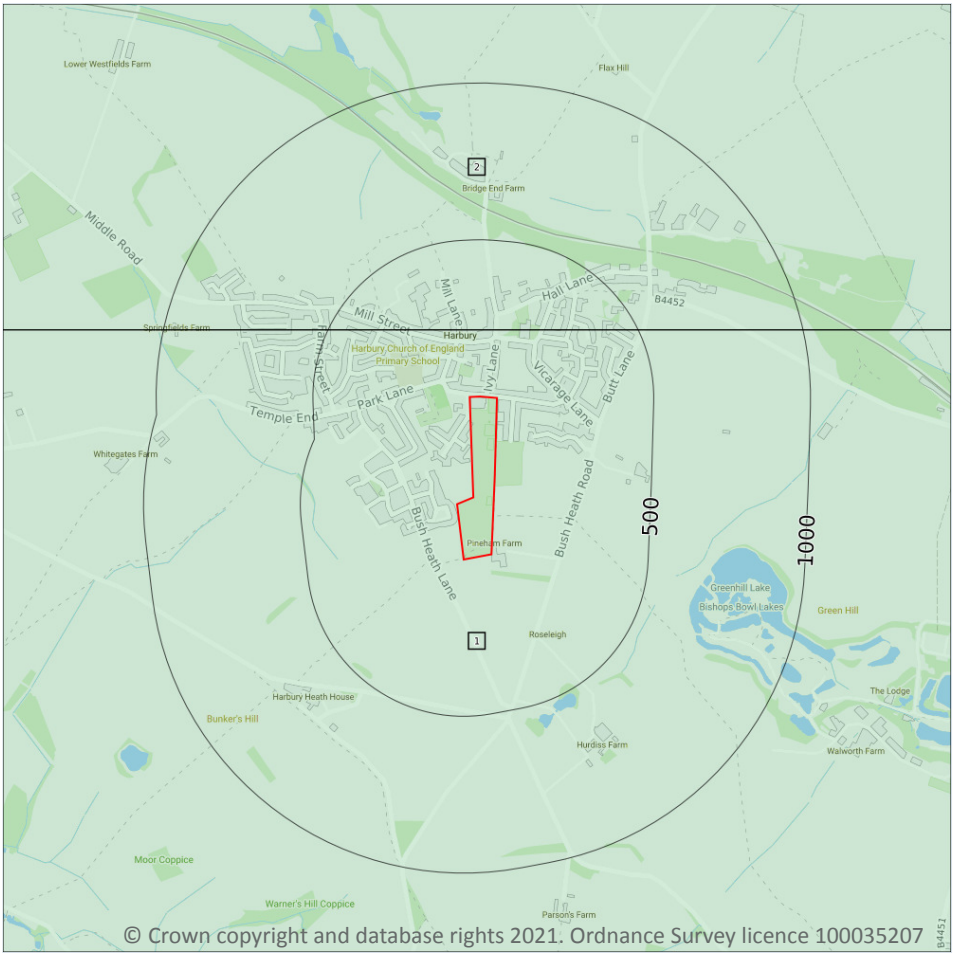
Site Area: 4.38ha

OS MasterMap site plan



Site Area: 4.38ha

1 Geology 1:10,000 scale - Availability



Site Outline

Search buffers in metres (m)

Full coverage

Partial coverage

No coverage

1.1 10k Availability

Records within 500m **2**

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 11**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	**On site**	**Full**	**Full**	**Full**	**Full**	**SP35NE**
2	213m N	Full	Full	Full	Full	SP36SE

This data is sourced from the British Geological Survey.

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

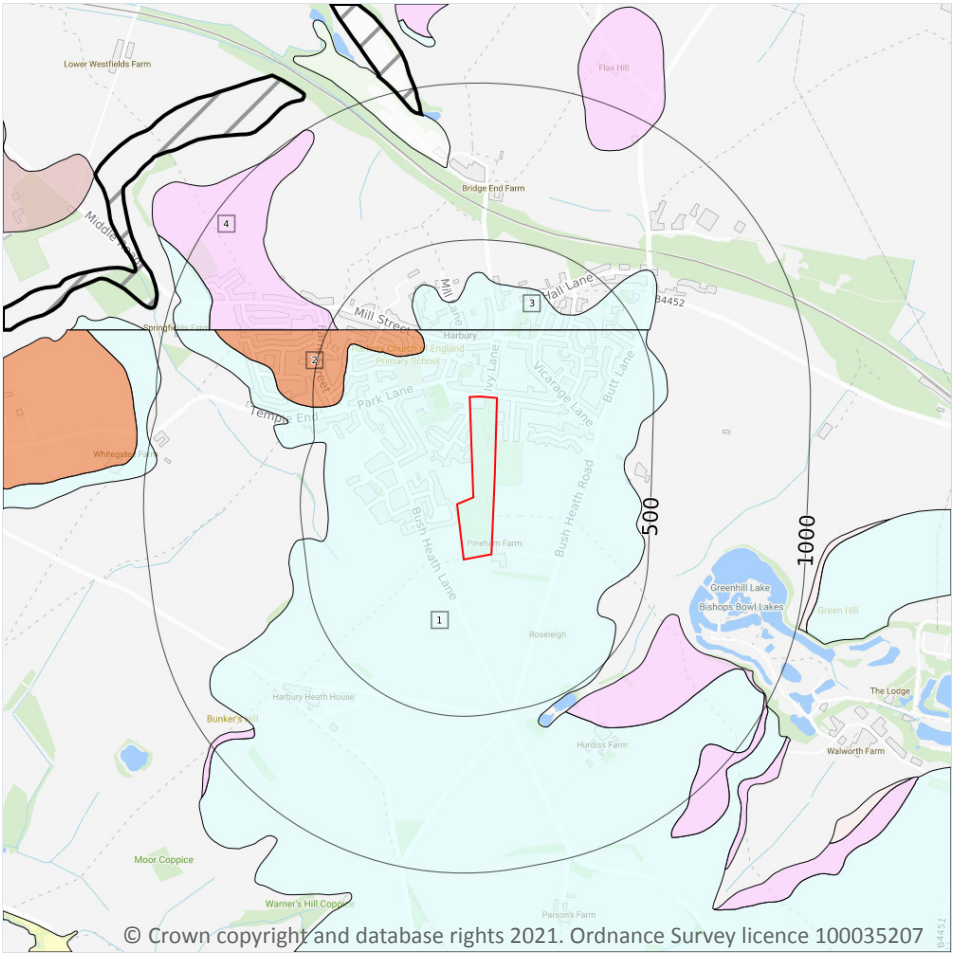
1.2 Artificial and made ground (10k)

Records within 500m	0

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.

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.

1.3 Superficial geology (10k)

Records within 500m **4**

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 13**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**TILMP-DMTN**	**Till, Mid Pleistocene - Diamicton**	**Diamicton**
2	209m NW	DMG-XSV	Dunsmore Gravel - Sand And Gravel	Sand And Gravel
3	213m N	TILMP-DMTN	Till, Mid Pleistocene - Diamicton	Diamicton

ID	Location	LEX Code	Description	Rock description
4	472m NW	GFDUA-XSV	Glaciofluvial Deposits, Anglian - Sand And Gravel	Sand And Gravel

This data is sourced from the British Geological Survey.

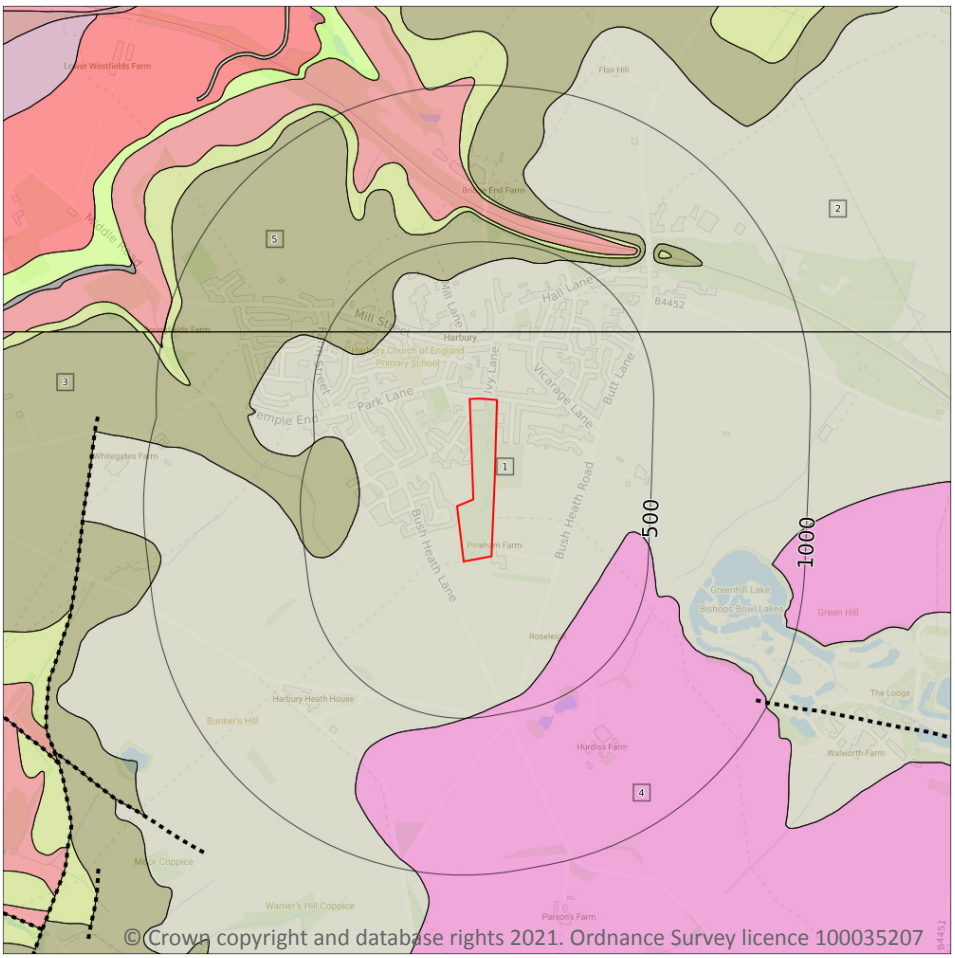
1.4 Landslip (10k)

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.

1.5 Bedrock geology (10k)

Records within 500m	5

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 15**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**RLS-MDLM**	**Rugby Limestone Member - Mudstone And Limestone, Interbedded**	**Sinemurian Age - Hettangian Age**
2	213m N	RLS-MDLM	Rugby Limestone Member - Mudstone And Limestone, Interbedded	Sinemurian Age - Hettangian Age
3	313m W	SASH-MDST	Saltford Shale Member - Mudstone	Hettangian Age - Rhaetian Age

ID	Location	LEX Code	Description	Rock age
4	329m SE	CHAM-MDST	Charmouth Mudstone Formation - Mudstone	Pliensbachian Age - Sinemurian Age
5	334m NW	SASH-MDST	Saltford Shale Member - Mudstone	Hettangian Age - Rhaetian Age

This data is sourced from the British Geological Survey.

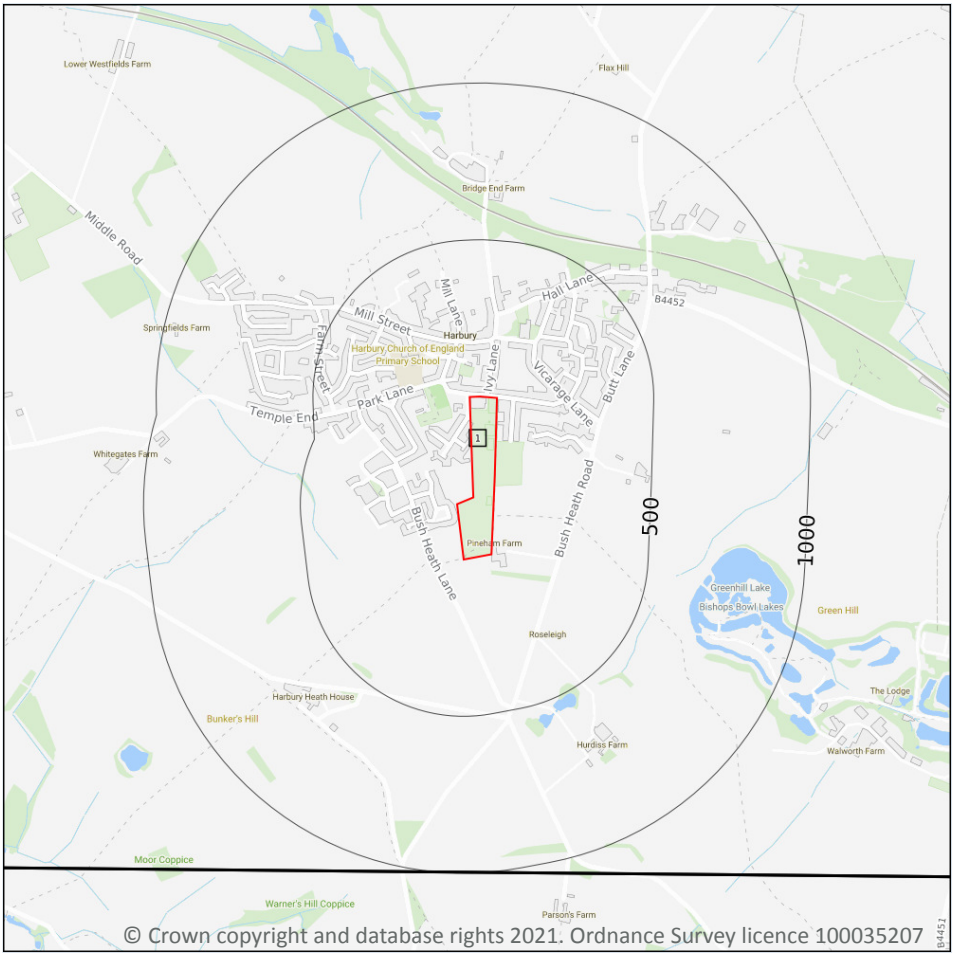
1.6 Bedrock faults and other linear features (10k)

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.

2 Geology 1:50,000 scale - Availability



Site Outline

Search buffers in metres (m)

Geological map tile

2.1 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 17**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	**On site**	**Full**	**Full**	**Full**	**Full**	**EW184_warwick_v4**

This data is sourced from the British Geological Survey.

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

2.2 Artificial and made ground (50k)

Records within 500m	0

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.

This data is sourced from the British Geological Survey.

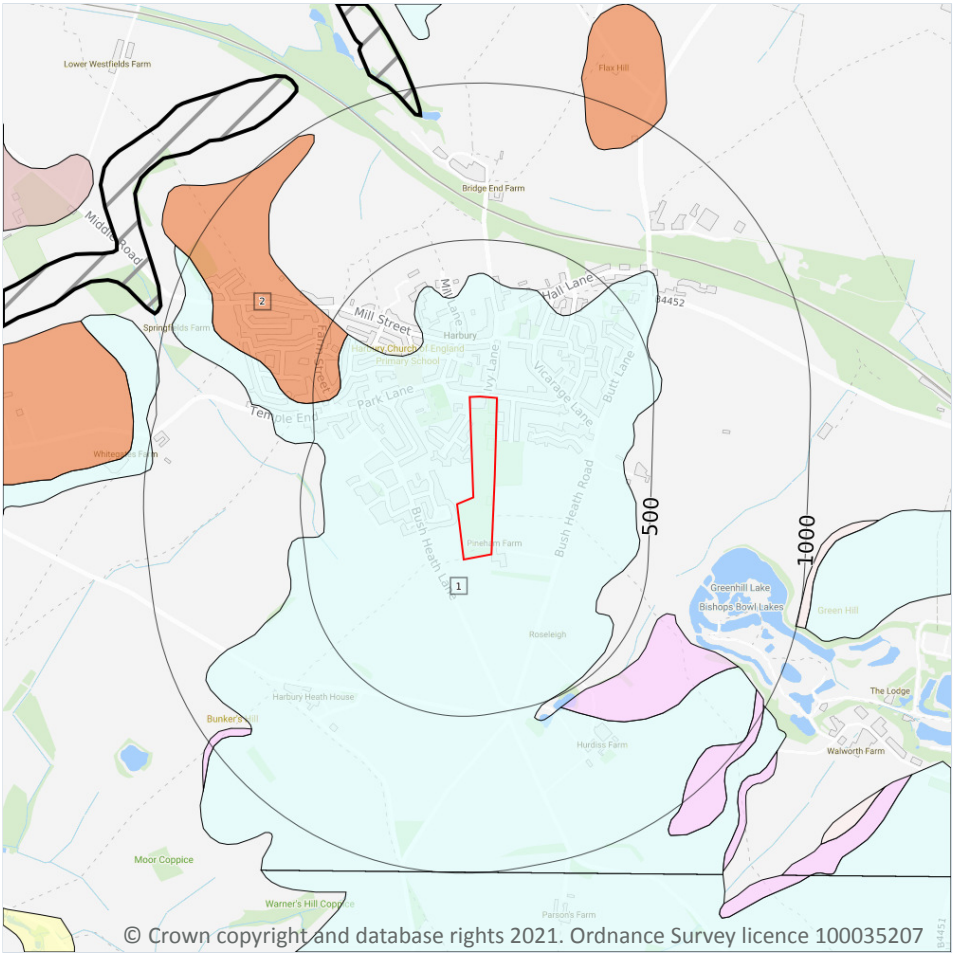
2.3 Artificial ground permeability (50k)

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.

2.4 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 19**

ID	Location	LEX Code	Description	Rock description
1	**On site**	**TILMP-DMTN**	**TILL, MID PLEISTOCENE**	**DIAMICTON**
2	413m W	DMG-XSV	DUNSMORE GRAVEL	SAND AND GRAVEL

This data is sourced from the British Geological Survey.

2.5 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	**Mixed**	**High**	**Low**

This data is sourced from the British Geological Survey.

2.6 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.

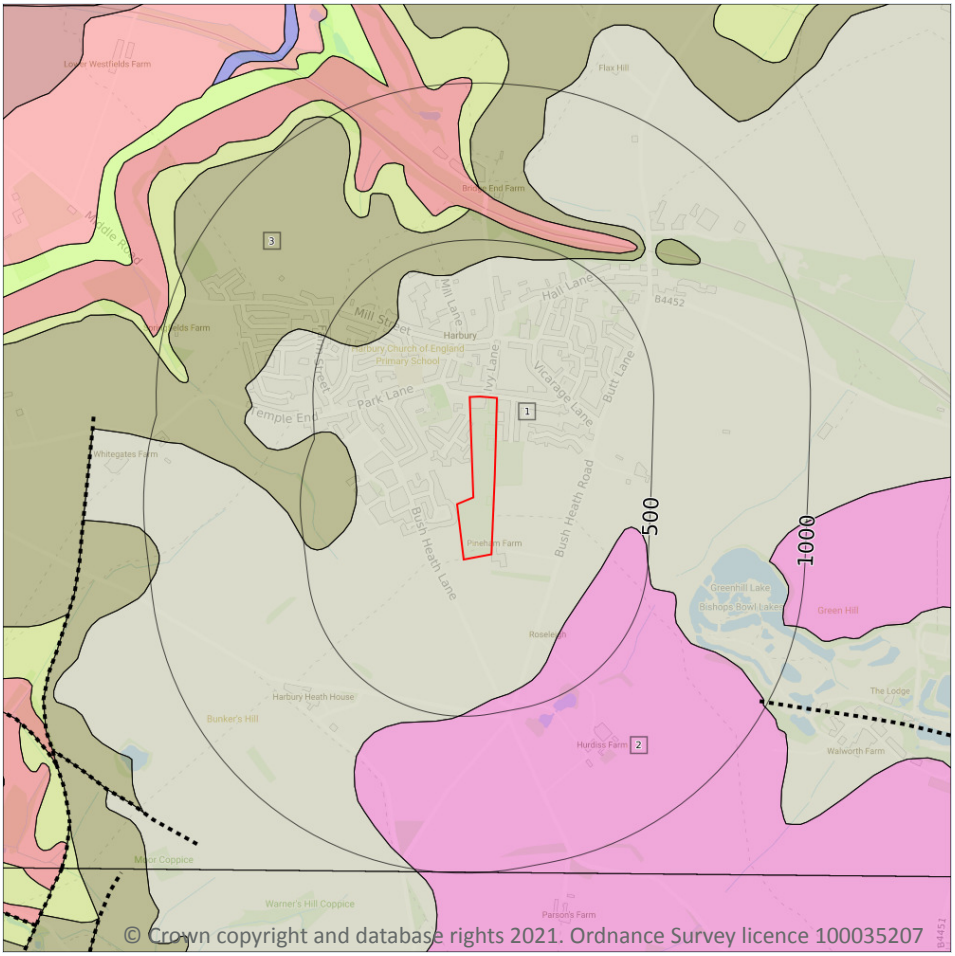
2.7 Landslip permeability (50k)

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



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Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (50k)

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

2.8 Bedrock geology (50k)

Records within 500m	3

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 21**

ID	Location	LEX Code	Description	Rock age
1	**On site**	**RLS-MDLM**	**RUGBY LIMESTONE MEMBER - MUDSTONE AND LIMESTONE, INTERBEDDED**	**HETTANGIAN**
2	316m SE	CHAM-MDST	CHARMOUTH MUDSTONE FORMATION - MUDSTONE	SINEMURIAN
3	322m W	SASH-MDST	SALTFORD SHALE MEMBER - MUDSTONE	RHAETIAN

This data is sourced from the British Geological Survey.

2.9 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	**Fracture**	**High**	**Low**

This data is sourced from the British Geological Survey.

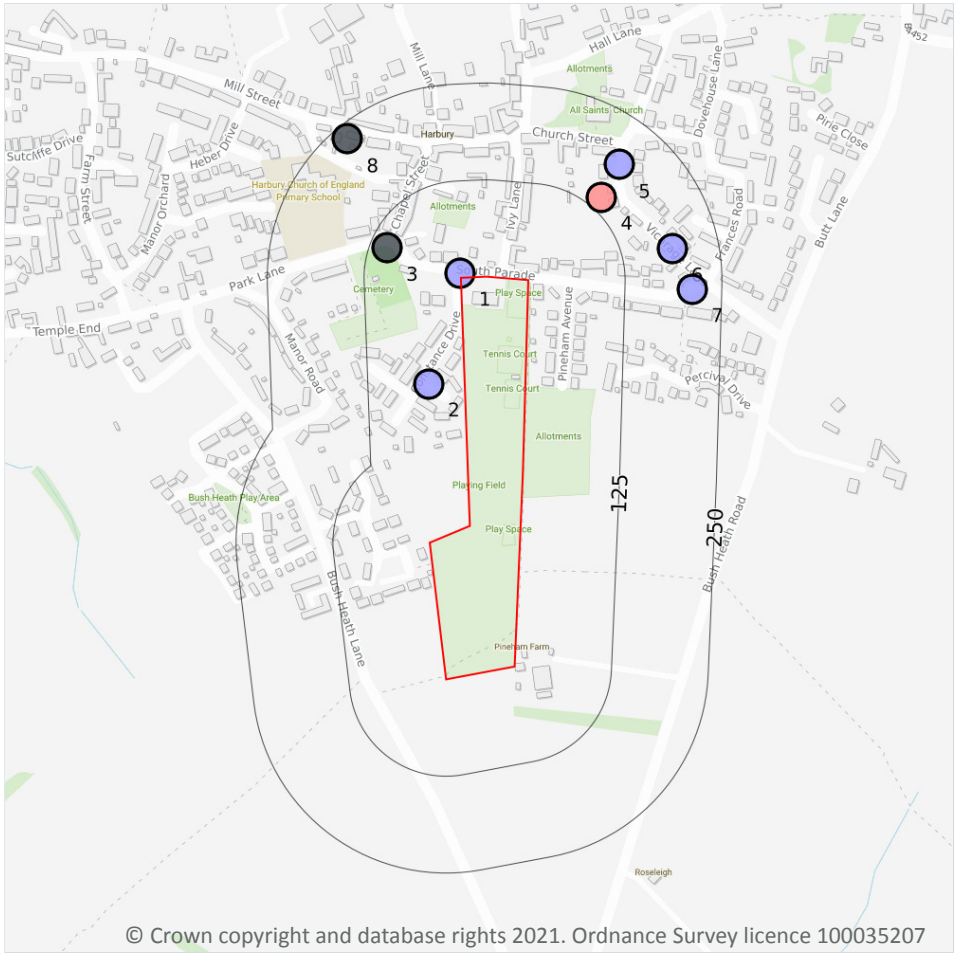
2.10 Bedrock faults and other linear features (50k)

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.

3 Boreholes



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3.1 BGS Boreholes

Records within 250m	8

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.

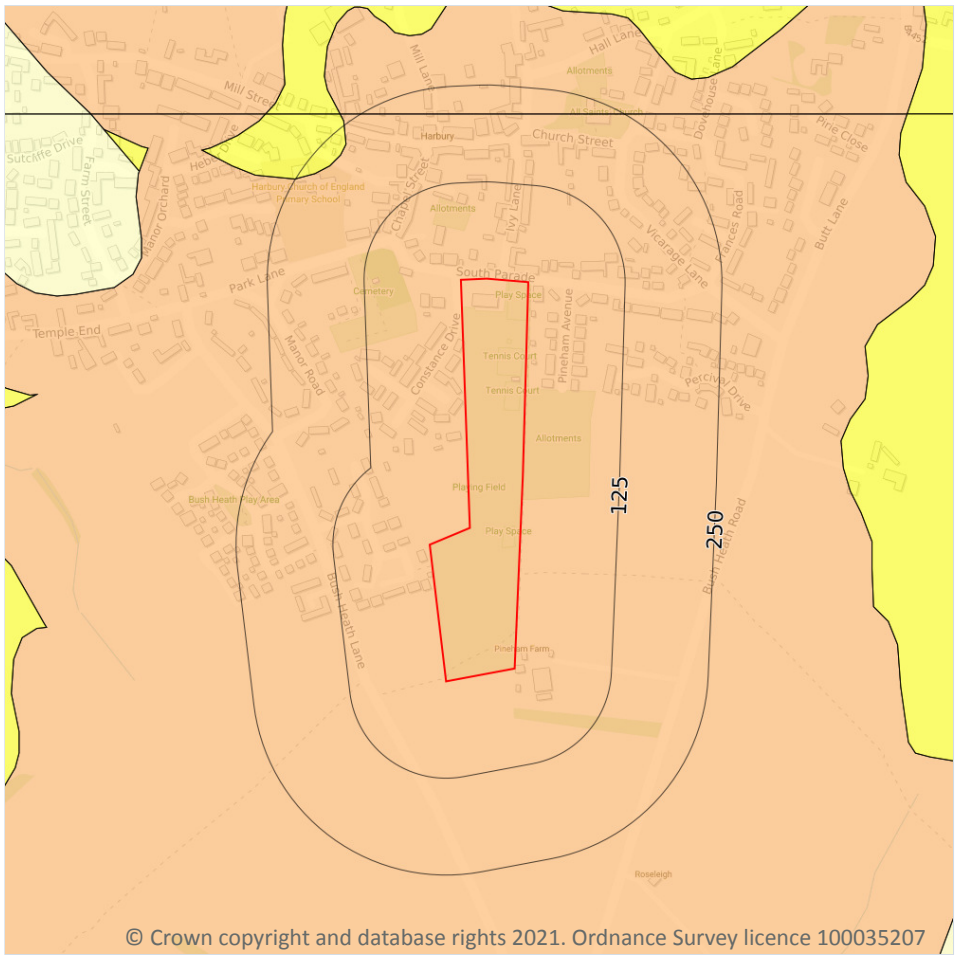
Features are displayed on the Boreholes map on **page 23**

ID	Location	Grid reference	Name	Length	Confidential	Web link
1	6m N	437277 259792	HARBURY RELIEF SEWER 2	5.0	N	320756
2	46m W	437237 259649	HARBURY RELIEF SEWER 1	5.1	N	320755
3	103m W	437183 259825	HARBURY RELIEF SEWER 13	-	Y	N/A

ID	Location	Grid reference	Name	Length	Confidential	Web link
4	143m NE	437460 259890	BINSWOOD END HARBURY	129.54	N	320614
5	190m NE	437483 259932	HARBURY RELIEF SEWER 5	5.05	N	320759
6	190m E	437551 259824	HARBURY RELIEF SEWER 4	5.05	N	320758
7	212m E	437577 259771	HARBURY RELIEF SEWER 3	5.3	N	320757
8	231m NW	437132 259965	HARBURY RELIEF SEWER 12	-	Y	N/A

This data is sourced from the British Geological Survey.

4 Natural ground subsidence - Shrink swell clays



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4.1 Shrink swell clays

Records within 50m	1

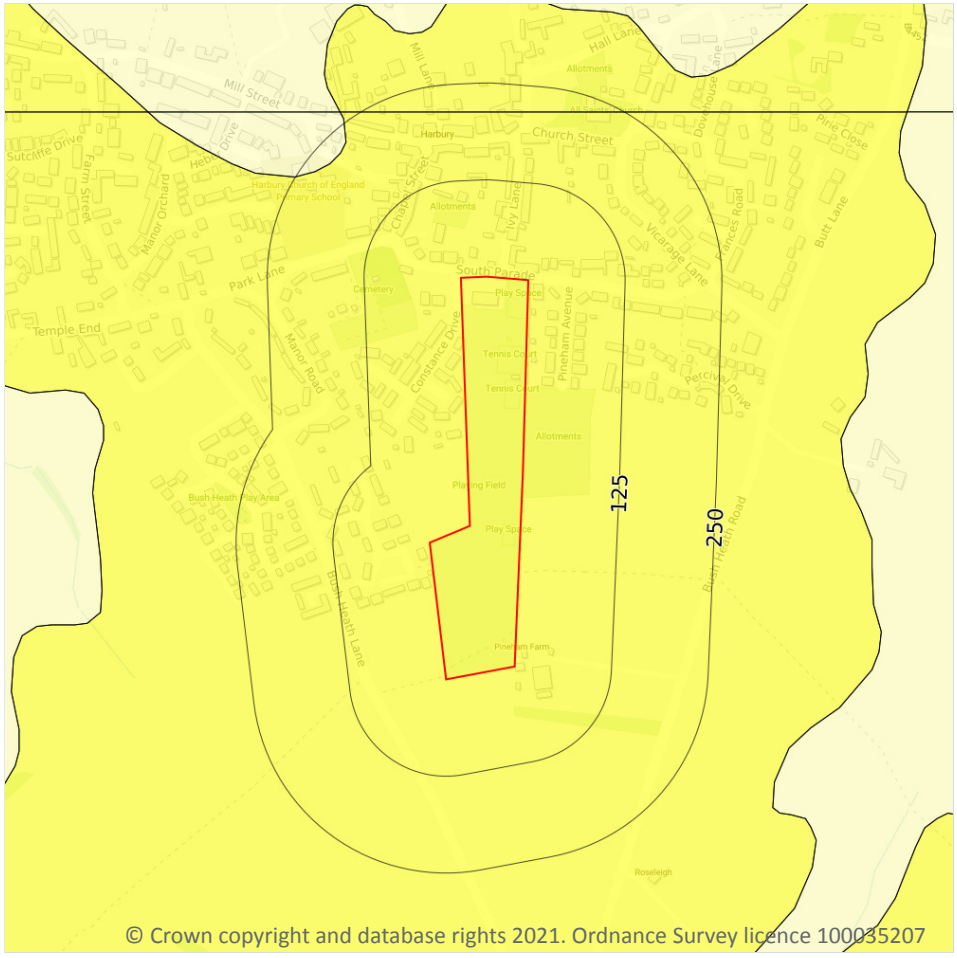
The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and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

Features are displayed on the Natural ground subsidence - Shrink swell clays map on **page 25**

Location	Hazard rating	Details
On site	**Low**	**Ground conditions predominantly medium plasticity.**

This data is sourced from the British Geological Survey.

Natural ground subsidence - Running sands



4.2 Running sands

Records within 50m	1

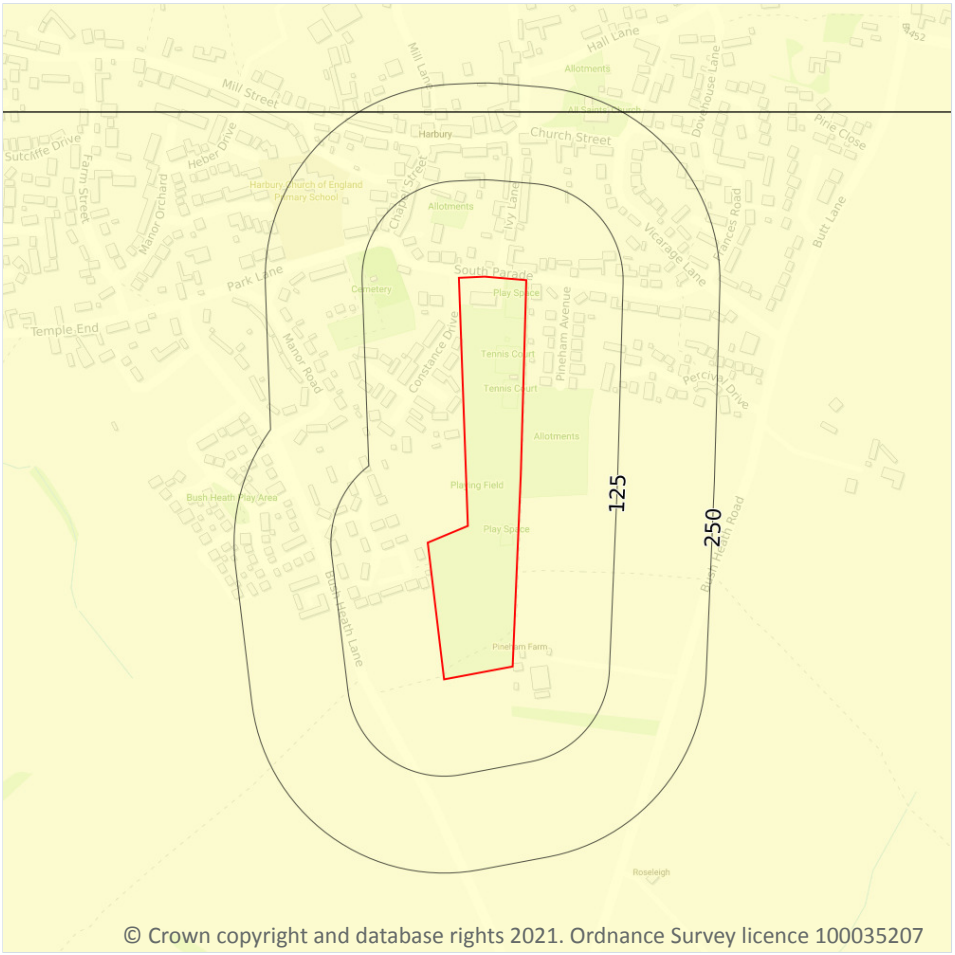
The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

Features are displayed on the Natural ground subsidence - Running sands map on **page 26**

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



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Site Outline

Search buffers in metres (m)

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

4.3 Compressible deposits

Records within 50m	1

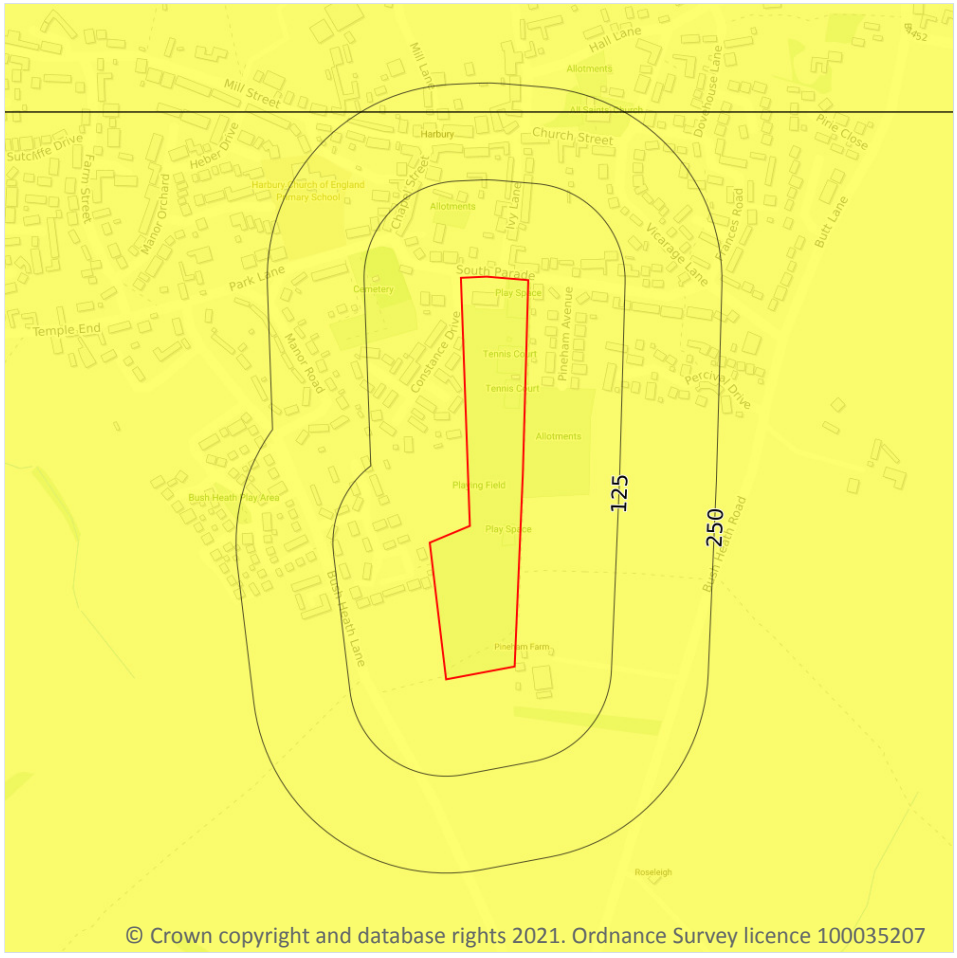
The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

Features are displayed on the Natural ground subsidence - Compressible deposits map on **page 27**

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

4.4 Collapsible deposits

Records within 50m	1

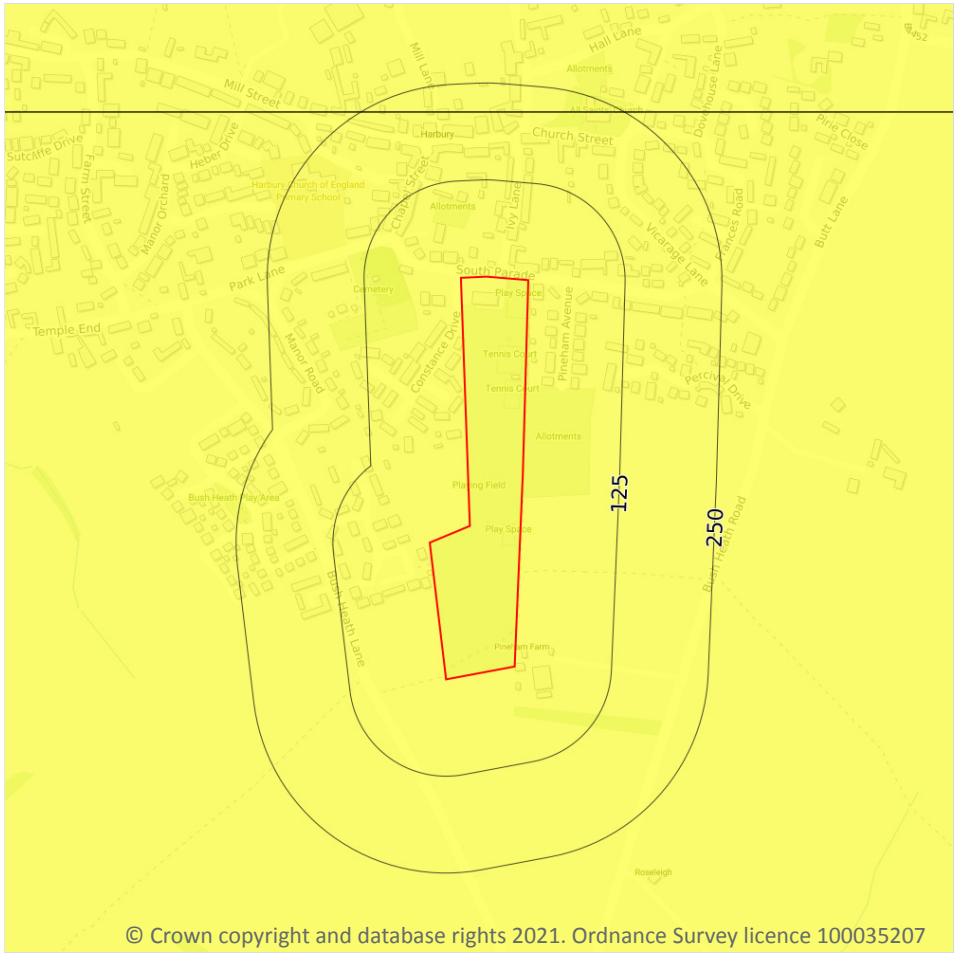
The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

Features are displayed on the Natural ground subsidence - Collapsible deposits map on **page 28**

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



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4.5 Landslides

Records within 50m	1

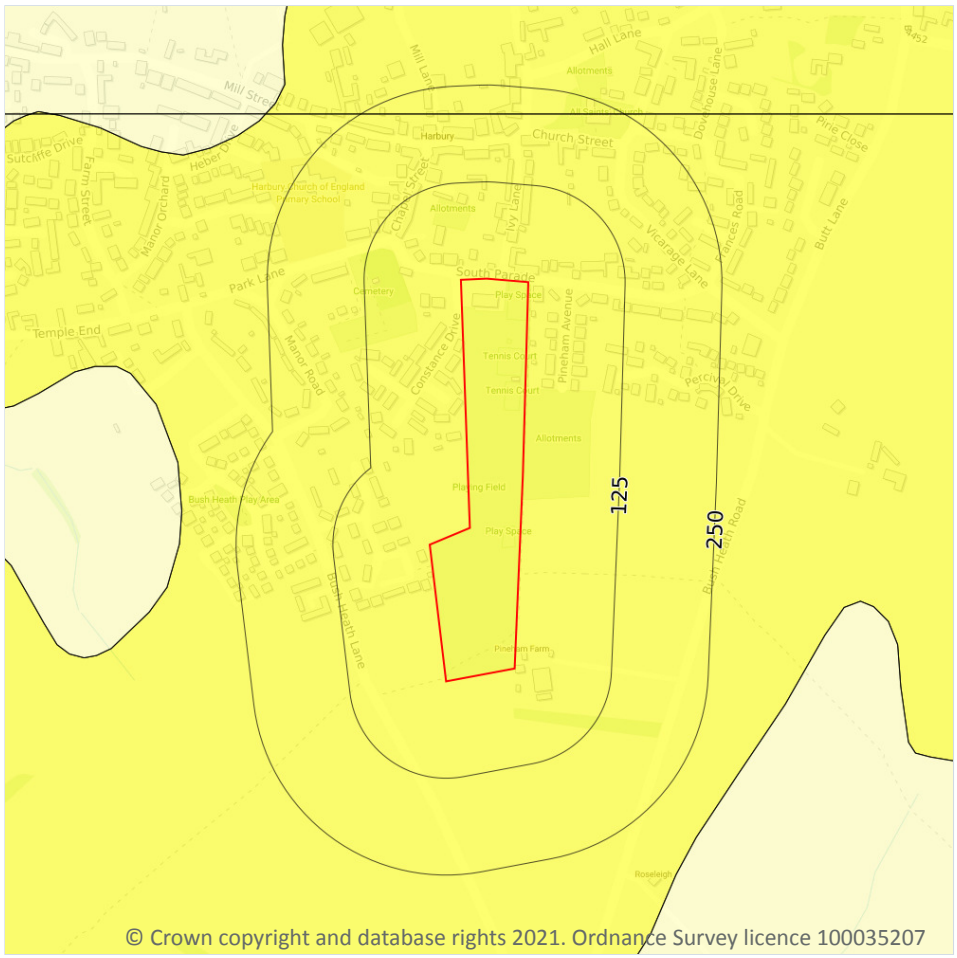
The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

Features are displayed on the Natural ground subsidence - Landslides map on **page 29**

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

4.6 Ground dissolution of soluble rocks

Records within 50m	1

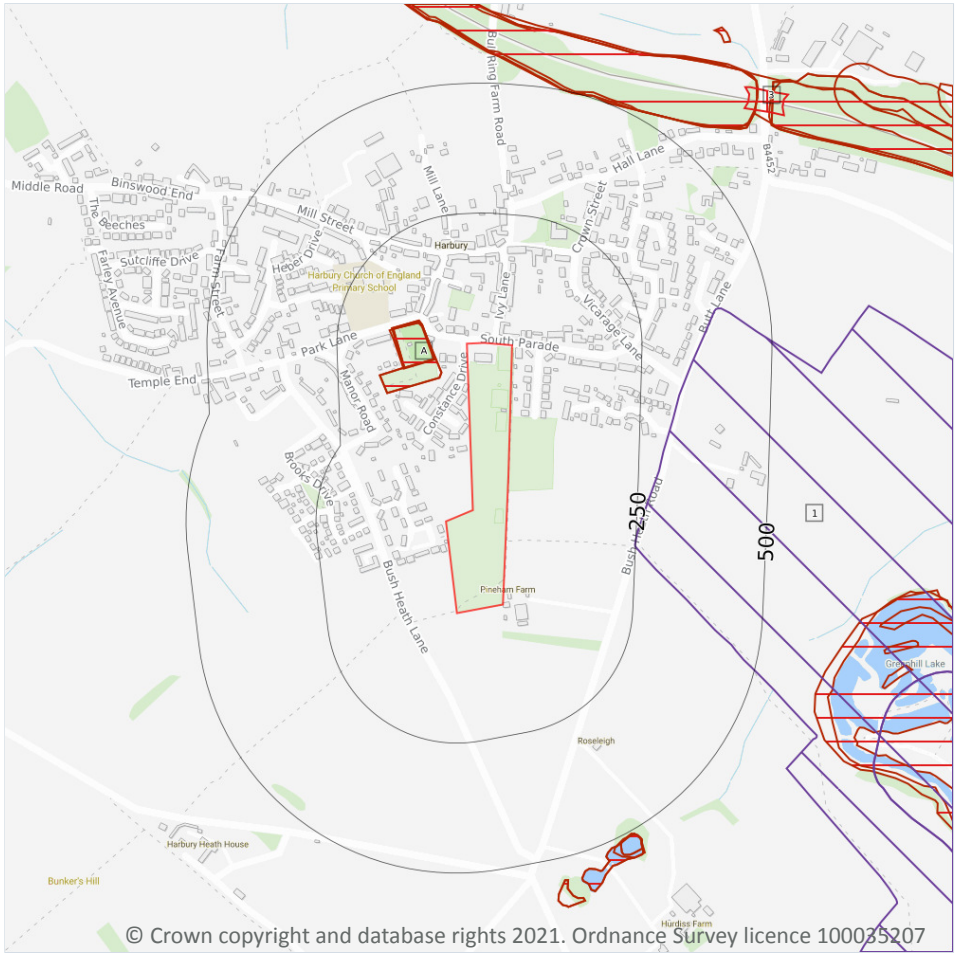
The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on **page 30**

Location	Hazard rating	Details
On site	**Very low**	**Soluble rocks are present within the ground. Few dissolution features are likely to be present. Potential for difficult ground conditions or localised subsidence are at a level where they need not be considered.**

This data is sourced from the British Geological Survey.

5 Mining, ground workings and natural cavities



5.1 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 Stantec UK Ltd.

5.2 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.

5.3 Surface ground workings

Records within 250m	5

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 32**

ID	Location	Land Use	Year of mapping	Mapping scale
A	51m W	Cemetery	1974	1:10000
A	51m W	Cemetery	1993	1:10000
A	63m W	Grave Yard	1885	1:10560
A	63m W	Cemetery	1904	1:10560
A	64m W	Cemetery	1954	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

5.4 Underground workings

Records within 1000m	1

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

Features are displayed on the Mining, ground workings and natural cavities map on **page 32**

ID	Location	Land Use	Year of mapping	Mapping scale
3	639m NE	Tunnel	1974	1:10000

This is data is sourced from Ordnance Survey/Groundsure.

5.5 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 32**

ID	Location	Site Name	Mineral	Type	Planning Status	Planning Status Date
1	249m E	Harbury Cement Works	Limestone	Surface mineral working	Valid	11/48

This data is sourced from the British Geological Survey.

5.6 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.

5.7 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 Stantec UK Ltd.

5.8 JPB mining areas

Records on site	0

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

This data is sourced from Johnson Poole and Bloomer.

5.9 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.

5.10 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.

5.11 Gypsum areas

Records on site	0

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

5.12 Tin mining

Records on site	0

Generalised areas that may be affected by historical tin mining.

This data is sourced from Mining Searches UK.

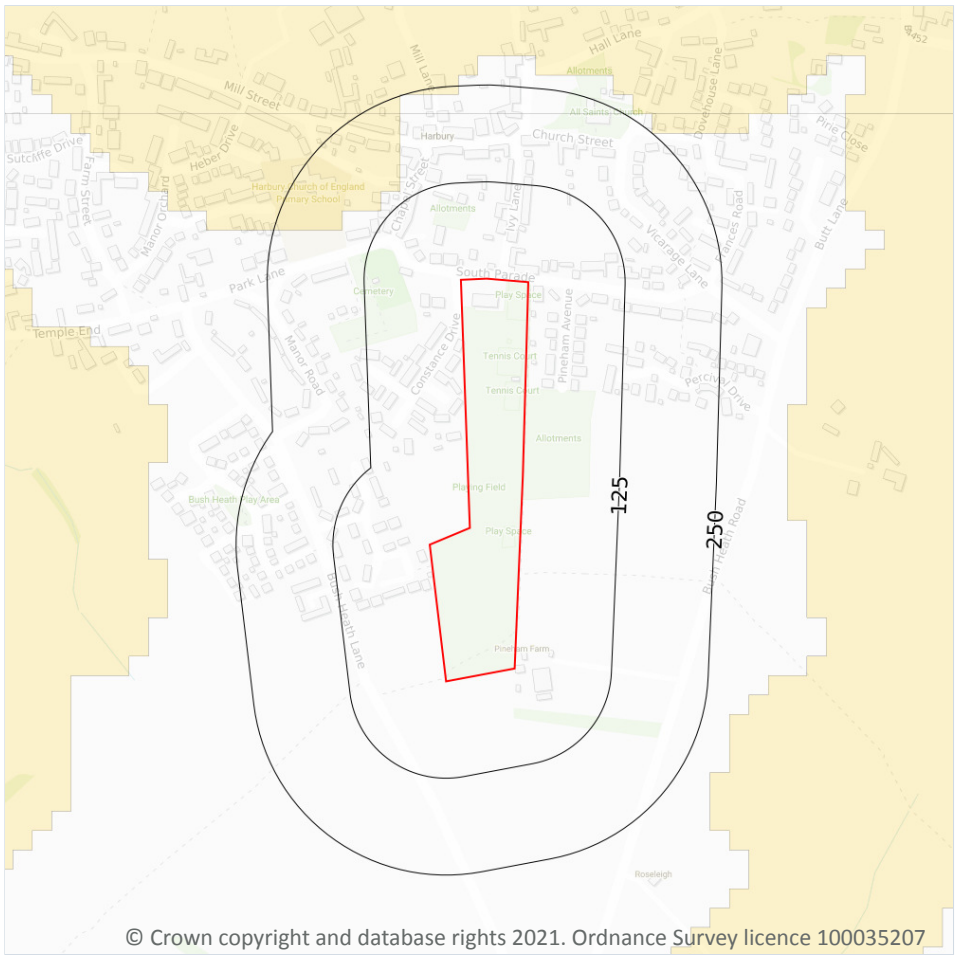
5.13 Clay mining

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).

6 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%

6.1 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 36**

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.

7 Soil chemistry

7.1 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**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**40 - 60 mg/kg**	**15 - 30 mg/kg**
On site	**15 mg/kg**	**No data**	**100 mg/kg**	**60 mg/kg**	**1.8 mg/kg**	**40 - 60 mg/kg**	**15 - 30 mg/kg**

This data is sourced from the British Geological Survey.

7.2 BGS Estimated Urban Soil Chemistry

Records within 50m	0

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).

This data is sourced from the British Geological Survey.

7.3 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.

8 Railway infrastructure and projects

8.1 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.

8.2 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.

8.3 Railway tunnels

Records within 250m	0

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

8.4 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.

8.5 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.

8.6 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.

8.7 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.

8.8 Crossrail 1

Records within 500m	0

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.

This data is sourced from publicly available information by Groundsure.

8.9 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.

8.10 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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