

**PMC CONSTRUCTION & DEVELOPMENT SERVICES
LIMITED**

INTERPRETIVE REPORT

on

SITE INVESTIGATION

at

MARY ROSE HOUSE

HAVANT

MARCH 2012

REPORT NO: 726543

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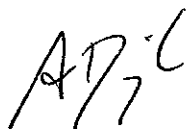
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1 INTRODUCTION

This investigation was carried out on the instructions of Rushby Brewster Associates Limited (the Engineer) on behalf of PMC Construction & Development Services Limited (the Client).

The purpose of the work was to investigate ground conditions, assess the contamination status of the site and provide information for the design of foundations for a residential development comprising flats and houses. The work included a Preliminary Risk Assessment, intrusive investigation, laboratory testing, a quantitative risk assessment and the preparation of a report.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and laboratory testing results, and it gives recommendations relating to foundation design, settlement, etc.

It presents an appraisal of geoenvironmental aspects such as soil contamination and gives recommendations on risk reduction. It should not be assumed that these would meet the requirements of the local authority, whose advice should be sought regarding planning permission. This report does not consider ecological impacts (e.g. bats) or botanical risks (e.g. Japanese Knotweed). It is recommended that these be considered as part of the assessment of development constraints for the site.

The ground investigation has been carried out using percussive window sampling techniques in general accordance with the recommendations of BS5930: 1999 *Code of Practice for Site Investigations*. Whilst every attempt is made to record full details of the strata encountered in the exploratory holes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks. The investigation has also been carried out in accordance with BS10175 *Investigation of Potentially Contaminated Sites: Code of Practice* (2011).

All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, and on the results of laboratory and field tests performed during the investigation. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those measured during the investigation.

All information, comments and opinions given in the desk study in this report are based on the information obtained. The information search cannot be exhaustive and there may be records that have not come to light. There may also be circumstances at the site that are not documented.

This report was prepared by Structural Soils Ltd for the sole and exclusive use of PMC Construction & Development Services Limited in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SITE DESCRIPTION

2.1 Location and Topography

The site is located on Woolston Road, Havant in the county of Hampshire (see Site Location Plan in Appendix A). The British National Grid Reference of the site is SU 704 087.

The site is approximately 65m by 60m in size (see Exploratory Hole Location Plan in Appendix A). Mary Rose House is located centrally in the site and measures approximately 30m by 20m, at the time of the investigation it was an NHS residential care home. The remainder of the site is largely landscaped garden areas, comprising grassed areas divided by asphalt footpaths, with several shrubs and trees. There is an asphalt car park in the eastern corner joining the access road, which leads from the adjacent NHS properties. The site is generally flat and level with the exception of the grassed area in the western corner, which is some 0.5m high than the rest of the site. No services were encountered during the investigation but they are assumed to be present between Woolston Road and Mary Rose House.

The site is bordered by housing to the southwest and northwest, Woolston Road to the northeast and NHS buildings to the southeast. The surrounding area is largely residential and the overall topography slopes gently to the southwest.

2.2 Geology

The British Geological Survey map (sheet 316, scale 1:50,000 published 1998) shows the site to be underlain by the Bognor Sand Member of the London Clay Formation, which is between 5m and 10m thick, and described as *glauconitic fine to medium grained sand*.

2.3 Hydrogeology

The Environment Agency (EA) website has classified the site's solid geology (Bognor Sand) as a Secondary 'A' Aquifer (variably permeable). 'Secondary' aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary 'A' Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The EA defines zones around groundwater abstractions used for public water supply as being Source Protection Zones (SPZ). The site does not lie within a currently defined SPZ.

The groundwater beneath the site is anticipated to lie at about 2.0m below ground level and is likely to be flowing to east towards a culverted stream.

2.4 Hydrology

The nearest surface water to the site is a stream lying approximately 185m to the northeast. Groundwater contained within the Bognor Sand is likely unlikely to be in potential continuity with this feature. Groundwater is estimated to be flowing in a easterly direction.

2.5 Preliminary Risk Assessment (Desk Study)

2.5.1 Site History from Ordnance Survey Maps

A search of Ordnance Survey maps was undertaken to establish the land-use history of the site and surroundings. Extracts of the maps that are discussed below can be found in Appendix H of this report. Unless otherwise stated, all quoted distances are measured from the site boundary that is marked on the maps.

TABLE 1: SUMMARY OF HISTORICAL MAP DATA			
Dates	Scale	Significant features, changes and developments:	
		On site	In surroundings [distance(m)]
1859-1868	1:10,560 & 1:2,500	- Site is part occupied by open fields E, and part by the grounds/gardens of a building W, relating to the adjacent Farm.	- Middle Park Farm 50m NE - Pond 20m E - Road 20m N - Stream 95m E - Brick and Tile Works 550m W
1895 - 1897	1:10,560 & 1:2,500	- No significant changes	- Brick and Tile Works no longer shown
1907 - 1939	1:10,560 & 1:2,500	- No significant changes	- No significant changes
1952	1:10,560 & 1:2,500	- No significant changes	- Earthworks associated with stream and marshy area 115m NE. - Pond 170m E
1957 - 1962	1:10,560 & 1:2,500	- No significant changes	- Residential development from 180m SW to E (Leigh Park) - Schools 420m S and 630m SE
1970 - 1977	1:10,000 & 1:1,250	- Building and grounds/gardens to E have been replaced by new large building 10m S. East part of site now occupied by grounds of new building.	- Woolston Road follows NE site boundary. - Housing from 20m N to E - Pond 20m E built over. - Pond 170m E not shown. - Earthworks and Weir 180m NW. - Work and Factory 800m SE
1991 - 1993	1:10,000 & 1:1,250	- Mary Rose House on site with associated gardens and parking areas.	- Building 10m S named Malmesbury Lawn (old peoples home)
2002	1:10,000	- No significant changes	- No significant changes

TABLE 1: SUMMARY OF HISTORICAL MAP DATA

Dates	Scale	Significant features, changes and developments:	
		On site	In surroundings [distance(m)]
2011	1:10,000 & 1:1,250	- No significant changes	- Open field adjacent W has been redeveloped as housing & school.

2.5.2 Summary of Site History

The earliest maps show the western part of the site to be part of an open field and the east part to be the grounds of a house. This remains unchanged until circa 1970 by which time the house has been replaced by a new building the grounds of which now occupy the site. By 1991 Mary Rose House has been constructed and the site has taken its current layout.

The surrounding area remains relatively undeveloped until circa 1957, from which point the area shows fairly continual development until the present. Middle Park Farm and associated pond is present adjacent to the site on the earliest map and remains until 1970 by which time it has been replaced by housing.

2.5.3 Environmental Data

Environmental features such as landfills, groundwater abstraction points, etc, are detailed in the GroundSure EnviroInsight report that can be found in Appendix H of this report. 'Notable' features in these data sets are listed below.

TABLE 2: SUMMARY OF SIGNIFICANT ENVIRONMENTAL DATA

Data Types Showing <u>Notable</u> Issues	No. of <u>Notable</u> Listings (or Yes/No) and Distance (m) from Site				Details of <u>Notable</u> Listings
	On site	0-250	250-500	>500	
ENVIRONMENTAL PERMITS, INCIDENTS & REGISTER					
EA Recorded Pollution Incidents		1			240m NE – 17/12/2002 contaminated water (firefighting run-off). Water impact: Category 3 Minor
LANDFILL					
EA & Landfill Data Historic and Non-Operational landfills				1	509m N – waste type: inert.
GEOLOGY					
Radon Affected Area	No	-	-	-	The property is not in a radon affected area, as less 1% of properties are above the action level. No radon protection measures are required for new homes.

TABLE 2: SUMMARY OF SIGNIFICANT ENVIRONMENTAL DATA					
Data Types Showing <u>Notable</u> Issues	No. of <u>Notable</u> Listings (or Yes/No) and Distance (m) from Site				Details of <u>Notable</u> Listings
	On site	0-250	250-500	>500	
GROUND WORKINGS					
Historical Surface and Underground Workings		3			22m NE – Pond, 110m NE – Unspecified pit, 161m E – Pond.
HYDROGEOLOGY & HYDROLOGY					
Surface Water Features		YES			Stream 185m NE
FLOODING					
EA Zone 2 or 3 Floodplains		YES	-	-	Zone 2 -32m SE Zone 3 – 44m E
CURRENT LAND USE					
Industrial Site Data		3			67m NE, 122m S, 235m SW – Substations.

2.5.4 Summary of Environmental Data

Historic ground workings comprising ponds are present within 250m of the site, the closest of which is 22m to the northeast.

Zone 2 and 3 floodplains lie 32m south and 44m E of the site respectively.

The site does not lie on an area affected by radon, as less than 1% of houses are above the action level; therefore no protective measures are necessary.

2.6 Outline Conceptual Model and Risk Assessment

2.6.1 General

This section of the report aims to identify land which could potentially be affected by contamination, such that it could affect the value or re-use of the land, or such that mitigation would be required for certain proposed end uses of the land.

The assessment also aims to identify land which would be regarded as 'contaminated land' under the terms of the Environmental Protection Act 1990, Part IIA. This act includes a stricter test for contaminated land than that outlined above. Land is considered to be contaminated if either:

- the land is causing significant harm to people, ecosystems or infrastructure; or
- there is a significant possibility that such harm could be caused; or
- pollution of controlled waters is being, or is likely to be, caused.

The following situations are defined as being where harm is to be regarded as significant:

- chronic or quite toxic effect, serious injury or death to humans;
- irreversible or other adverse harm to the ecological system;
- substantial damage to or failure of buildings;
- death of, or disease or other physical damage affecting, livestock or crops;
- pollution of controlled waters.

2.6.2 Risk Assessment Methodology

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: Preliminary, Generic Quantitative and Detailed Quantitative. An Outline Conceptual Model should be formed at the preliminary risk assessment stage. This identifies potentially complete (termed *possible*) pollutant linkages (source–pathway–receptor) and is used as the basis for design of the site investigation. The Outline Conceptual Model is updated as further information becomes available, for example as a result of the site investigation.

2.6.3 Potential Sources and Contaminants

The potential primary contaminants associated with the sources identified in the desk study are discussed in more detail below:

TABLE 3: POTENTIAL SOURCES AND CONTAMINANTS	
Potential Sources: On site	Likely contaminants
Made Ground	Heavy metals, asbestos, hydrocarbons
Potential Sources: Off site	Likely contaminants
Infilled Pond	Ground gases – Methane and carbon dioxide

2.6.4 Outline Conceptual Site Model

The information presented in previous sections has been used to compile an Outline Conceptual Model. The identified potential contaminants and potential receptors have been considered, along with any possible pathways that may link them.

The resulting pollutant linkages are considered on the following page:

TABLE 4: OUTLINE CONCEPTUAL MODEL

Potential Source	Potential Pathway	Potential Receptor	Potential Complete Linkage?	Comments (e.g. regarding pathways, impermeable strata, site upstream of source, etc)
Soil contaminants (including naturally occurring arsenic, lead, etc)	Ingestion/ Dermal Contact	Future on-site users (residents/commercial)	No	In areas of soft landscaping
		Construction workers	No	When handling soil during construction phase. **
		Maintenance workers	No	**
		Adjacent commercial/ residential land users	Yes	Potential for dust generation
	Permeation	Subsurface plastic water pipes	Yes	If pipes are laid in direct contact with soil.
	Leaching	Groundwater in Secondary A Aquifer	Yes	Leaching into the underlying minor aquifer
	Root uptake	Soft landscaping on-site (e.g. phytotoxicity)	Yes	Through areas of soft landscaping
Groundwater contaminants	Ingestion/ Dermal Contact	Future on-site users (residents/commercial)	No	Groundwater is anticipated to be a depth greater than that excavated for foundations or service installation.
		Adjacent commercial/ residential land users	No	
		Construction workers	No	
		Maintenance workers	No	
	Permeation	Subsurface plastic water pipes	No	As above.
	Lateral Groundwater migration	Groundwater in Secondary A Aquifer	No	
Vapours associated with soil and groundwater contaminants and/or bulk ground gases (e.g. asphyxiation, toxicity, explosion and fire)	Migration along backfill around services, more permeable strata inhalation/ explosion	Future on-site users (residents/commercial)	Yes	Ground gases could be present due to proximity of infilled pond.
		Construction/ Maintenance workers	No	This is not considered likely during the construction period.

** Assumes basic PPE is worn

2.6.5 Outline Risk Assessment Conclusions

The review of information and the construction of the Outline Conceptual Model highlights potential pollutant linkages. In order to investigate any unacceptable risk presented by these, intrusive investigation is recommended. An intrusive investigation will be able to provide further information on actual contaminants present and viable pathways to sensitive receptors.

2.7 Recommendations

Intrusive investigation is required to assess any significant contaminant sources, pathways and receptors.

The objectives of an investigation are to:

- Clarify the ‘Outline Contamination Conceptual Model’
- Clarify the Outline Risk Assessment
- Provide data for the design of any remedial works that may be required
- Benchmark the contamination status of the site

To achieve these objectives, an investigation was undertaken comprising window sample holes. The exploratory holes passed through all made ground and into underlying natural soils.

3 FIELDWORK

5 no. window sample holes (WS1 to WS5) and 1 no. dynamic probe (DP5) were completed between on 20 February 2012 at locations shown on the Exploratory Hole Location Plan in Appendix A.

In-situ testing comprising borehole soakaway infiltration tests (WS2 and WS5) were also undertaken.

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS5930: 1999 (2010 Amendment 2, which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1). Detailed descriptions, together with relevant comments, are given in the logs included in Appendix B.

3.1 Window Sampling and Dynamic Probing

The window sample exploratory holes were drilled using a tracked rig with chain driven drop weight. Steel sample tubes containing a plastic sample liner were used, and were 97mm diameter at the base of the inspection pit reducing in diameter with depth. The exploratory holes were between 2.90m and 4.00m deep.

Inspection pits were excavated by hand at the hole locations prior to the commencement of drilling.

Small disturbed and bulk soil samples were subsampled from the window samples at regular intervals.

Hand penetrometer tests were carried out at selected intervals on samples of intact cohesive soils, the results of which are included on the logs contained in Appendix B.

The dynamic probing was carried out by a tracked rig using the super heavy test set up complying with the DPSH-B apparatus of BS EN ISO 22476-2 (utilises a 63.5kg weight falling 0.75m driving a 50.5mm diameter cone). The probing was completed using a fixed anvil, and a disposable (lost) cone. The test results are contained in Appendix B.

The dynamic probing apparatus used was calibrated for efficiency; the calibration certificate for the apparatus is also included in Appendix B.

3.2 Chemical Contamination Sampling

Samples for contamination testing were taken from the window sample exploratory holes and were placed in appropriate containers that were supplied by the laboratory. Containers for volatiles testing of soil samples were filled to capacity. Any water sample containers (with preservatives where required) were filled to capacity to minimise volatilisation. All samples were then kept in cool boxes with ice packs and were transported to the laboratories under Chain of Custody documentation, as promptly as possible to maintain sample integrity.

3.3 Backfill, Monitoring Wells and Installations

On completion a 40mm diameter monitoring well was installed in WS1, the design having been decided by Structural Soils Ltd. The well details are shown on the exploratory hole log in Appendix B.

On completion all other exploratory holes were backfilled with arisings.

The client or site owner should ensure that the monitoring well (and its protective cover) is not damaged or covered until such time as information is no longer required from it. Extra costs would be incurred if it were necessary to reinstate a damaged well.

3.4 In-Situ Testing

The borehole soakaway tests were undertaken in WS2 and WS5. The test results are presented in tabular and graphical format in Appendix C.

3.5 Monitoring and Post Fieldwork Environmental Sampling

Gas concentrations and groundwater levels were recorded in the monitoring wells on 12 and 22 March and 2 April 2012. The results together with the temporal (weather) conditions are tabulated in Appendix G.

An infrared gas meter was used to measure concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂) in percentage by volume. Initial and steady state concentrations were recorded. A separate flow meter was used to measure borehole flow rates (initial and steady state) in litres per hour (l/hr). In addition the atmospheric pressure before and during monitoring, together with the weather conditions were recorded.

4 LABORATORY TESTING

Samples for potential geotechnical testing were returned to the company's laboratory in Bristol and those for potential contamination testing were sent to an accredited chemical testing laboratory. Geotechnical and contamination tests were scheduled by Structural Soils Ltd.

Geotechnical laboratory testing was generally carried out in accordance with BS1377: 1990, *Methods of Test for Soils for Civil Engineering Purposes*, Parts 1 to 8, unless indicated otherwise. Where non-standard procedures have been undertaken, this is recorded on the report sheet. The results are reported in tabular and/or graphical form and included as Appendix D of this report.

Contamination testing was carried out in accordance with MCERTs/UKAS standards. The results are reported in Appendix E of this report, along with the accreditation certificate for the laboratory.

4.1 Moisture Content

3 no. moisture content tests were undertaken using the oven-drying method in accordance with BS1377: Part 2: 1990. The results are tabulated in the Summary of Soil Classification Tests and below the Plasticity Chart (see Section 4.2, below).

4.2 Liquid Limit, Plastic Limit and Plasticity Index

3 no. liquid and plastic limit tests were performed in accordance with BS1377: Part 2: 1990. The results are plotted on the Plasticity Chart (in accordance with BS5930: 1999) and tabulated below the chart, and in the Summary of Soil Classification Tests.

4.3 Particle Size Distribution

1 no. particle size distribution test was undertaken by sedimentation analysis using the hydrometer method. All tests were in accordance with BS1377: Part 2: 1990. The results are represented graphically as a particle size distribution curve and in tabular format.

4.4 Chemical Analyses

5 no. soil samples were tested to determine their pH values and water soluble sulphate contents. The results are tabulated in the Summary of Chemical Analysis.

4.5 Contamination

No potential asbestos fibres, nor man-made materials that could potentially contain asbestos fibres, were observed during site works. Additionally, given that asbestos was not a 'contaminant of concern' for the site, no testing for asbestos was therefore undertaken on any soil samples.

4 no. soil samples were analysed for arsenic, cadmium, chromium (total), lead, mercury, selenium, copper, nickel, zinc, speciated polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (banded TPH), organic matter, soluble sulphate and pH (SSL Soil 1 suite).

5 GROUND CONDITIONS

5.1 General

The exploratory holes were logged by an engineer and the ground conditions encountered are detailed on the logs contained in Appendix B and are summarised below.

5.2 Made Ground/Topsoil

Topsoil was encountered in all exploratory holes to depths of up to 0.5m and largely comprised slightly gravelly clayey/silt sand. The gravel fraction was generally chert, however brick was encountered in WS2 and WS4 where the topsoil comprised made ground.

5.3 Superficial Deposits

Superficial deposits were present across the site up to 1.95m depth. In the southern part of the site (WS1, WS4 and WS5) they were present to between 0.95m and 1.10m and generally comprised slightly gravelly silty/clayey fine to medium sand, with thin sandy clay layers occurring in WS1 and WS4. Dynamic probe DP5 gave an equivalent SPT N value of 6 for the superficial sands.

In the northern part of the site (WS2 and WS3) they were proved to 1.95m depth and comprised firm to stiff slightly gravelly sandy silt/clay in locations. The gravel fraction across the site consisted of subrounded to rounded fine to coarse chert.

5.4 Bognor Sand Member

The Bognor Sand Member was encountered in all locations underlying the superficial deposits and was proved to a maximum depth of 4.0m. The material comprised orange brown and yellow brown silty fine sand, which passed into dark grey silty fine sand between 3.0m and 4.0m depth. Dynamic probe DP5 indicated the Bognor Sands are medium dense with an equivalent SPT N value of at least 10 below 1.2m depth.

5.5 Groundwater

Groundwater was encountered in all of the exploratory holes between 2.00m and 2.60m. The subsequent monitoring visits found groundwater in WS1 to standing at between 2.20m and 2.30m depth.

5.6 Indications of Contamination

There were no olfactory or visual indications of contamination in any of the exploratory holes.

6 DISCUSSION AND RECOMMENDATIONS

It is understood the proposed development will comprise a fifteen houses and a unit containing flats. The development includes garden areas where vegetables could be grown. A copy of the proposed development is contained in Appendix A.

6.1 Site Preparation and Excavation

The soils encountered at the site are considered suitable for excavation by standard mechanical plant such as a wheeled backhoe excavator. A hydraulic breaker will be required to break out any hard cover or buried foundations that remain following demolition of the existing building on site.

To reduce the costs of off-site disposal of demolition or excavated materials, and in the interests of sustainability, we would recommend that consideration be given to re-using any broken out hardstanding materials, underlying sub-base and also any demolition materials. There are several publications available regarding these principles.

Where trees are removed to facilitate construction, the root boles should be grubbed out to prevent re-growth. Any resulting voids from this operation should be backfilled with an acceptable, adequately compacted fill.

Our site works indicate that groundwater ingress into excavations to the recommended founding depths (or services excavations, etc) is unlikely. Groundwater has been recorded standing at 2.20m depth.

All excavations should be planned and due consideration should be given to providing temporary support or suitable battering. Excavations should be regularly inspected by a competent person to ensure continued safety. Further advice on the safety of excavations is given in *Health and Safety in Construction*. Excavations or below ground voids should be checked for the presence of harmful gases and vapours (e.g. hydrocarbons and solvents) prior to personnel entry.

6.2 Shrinkage and Swelling

Atterberg Limits tests performed on samples taken from the superficial deposits showed them to be of groups CL, borderline CI/CH and CH as defined in BS 5930:1999. After correction where necessary for their >0.425mm fraction, these samples show low to high volume change potentials with changes in moisture content, according to the criteria of NHBC Standards, Chapter 4.2 (2010) *Building Near Trees*.

Based on these results, it is recommended that a high volume change potential be assumed for the cohesive superficial deposits for design purposes.

6.3 Foundations

The investigation has shown that the ground conditions vary across the site. Therefore for the purposes of the foundation recommendations the site has been divided into two areas; the northern part of the site (the vicinity of WS2 and WS3), and the southern part of the site (the vicinity of WS1, WS4 and WS5).

Northern Section

In the northern part of the site foundations will be constructed on the superficial clay, therefore should be designed in accordance with the NHBC Standards, which recommend a minimum foundation depth of 1.0m for a soil of high volume change potential outside the zone of influence of trees (whether retained or removed). A significant number of trees are present on site therefore greater foundation depths will be required across all of the northern section and a compressible layer will be required on the side of foundations as a precaution against heave in accordance with NHBC Standards. The effects of possible future plantings should also be taken into account during design.

Conventional shallow strip or pad foundations can be constructed upon the superficial clays at a minimum depth of 1.0m, which should offer a net allowable bearing capacity of 120kN/m² for strip foundations up to 1.0m wide, and a net allowable bearing capacity of 140kN/m² for pad foundations up to 2.0m wide.

The total long term settlement of foundations exerting the above bearing pressures should not exceed 25mm. For example, a 1.0m wide strip foundation set at 1.0m depth exerting a foundation pressure of 120N/m² should be in the order of 20mm. This is based on an estimated coefficient of volume compressibility, m_v , of 0.17m²/MN, and a geological factor, μ_g , of 1.0.

Southern Section

In the southern part of the site foundations can be constructed on the granular superficial deposits or Bognor Sand. Due to the presence of a firm superficial clay layer in WS1 and WS4 around 0.70m depth we would recommend taking foundations down to the Bognor Sand encountered at 1.10m in WS1 and 0.95m in WS4. In WS5 no superficial clay was present therefore foundations

can be founded within the granular superficial deposits at a minimum depth of 0.45m or the Bognor Sands encountered at 1.05m depth.

The dynamic probe results from DP5 indicate that the granular superficial deposits are loose, with an equivalent N value of 6 being recorded, and the Bognor Sands are medium dense with an equivalent N value of at least 10. Therefore the granular superficial deposits should offer a conservative allowable bearing capacity of 120kN/m^2 , and the Bognor Sands should offer a conservative allowable bearing capacity of 200kN/m^2 .

The allowable bearing capacity in granular soils is defined as that likely to cause a maximum settlement of 25mm. This assumes a depth of granular soil beneath the foundation of at least twice the foundation width. For lower bearing pressures the settlements will be proportionally less.

6.4 Floor Slabs

Suspended floor slabs with a 150mm subfloor void (designed in accordance with NHBC guidelines) are recommended at the site because of the large number of trees to be removed and the low to high volume change potential of the cohesive soils.

6.5 Soakaway/SUDS Design

Drainage systems can be developed in line with the ideals of sustainable development. Surface water drainage methods that take account of such ideals are collectively referred to as *Sustainable Urban Drainage Systems* (SUDS). These systems are more sustainable than conventional drainage methods, because amongst other things they manage runoff flow rates, thereby reducing the impact of urbanisation on flooding and they also encourage natural groundwater recharge (where appropriate). Such systems include soakaways.

Borehole soakaway tests were undertaken at the base of WS2 and WS5, however due to the presence of groundwater in the base of the window sample holes it was not possible to calculate true infiltration coefficients.

In order to calculate a value from the results it has been assumed the holes were dry at the start of the test, this gives infiltration coefficients of 3.67×10^{-6} m/s for WS2, and 2.65×10^{-6} m/s for WS5. These values give an indication soakaways are unlikely to be suitable for the site, but this depends on a number of factors including their plan size and depth, the 'design storm' and the site area to be drained. It is recommended that full scale soakaway testing be undertaken during the

construction phase or when the site has been formally acquired in order better assess the suitability of the site for soakaways.

Values (factored in accordance CIRIA 156 (1996) *Infiltration Drainage – Manual of Good Practice*) can be used for design of soakaways in accordance with BRE Digest 365.

6.6 Protection of Buried Concrete

The site is classed as natural and groundwater is assumed to be static above about 2.0m depth and mobile below.

Soil pH values varying from 5.58 to 7.89 were recorded. From these results a ‘Characteristic Value’ of 6.06 is derived.

The water-soluble sulphate results range from <10mg/l to 32mg/l. The ‘Characteristic Value’ is therefore 29mg/l and this falls into Design Sulphate Class DS-1 in Table C1 BRE Special Digest 1 (SD1).

Therefore according to Table C1 the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1 where concrete could be contact with groundwater (e.g. below about 2.0m depth) and AC-1s if there is no risk of concrete being in contact with groundwater. The designer should utilise these classifications class in order to produce the concrete specification.

6.7 Radon

BRE Report 211 is the current guidance to the building industry and is referred to in the Building Regulations. The report applies to residential development. New residential buildings in certain areas may require basic or full radon protection. Basic protection consists of a radon-proof barrier across the ground floor. Full radon protection consists of a radon proof barrier across the ground floor supplemented by either a radon sump or a ventilated subfloor void.

For this site the BRE report indicates that no radon protection is necessary. This concurs with the findings of the desk study (see Section 2.4).

6.8 Contamination

6.8.1 Risk to Human Health

General

To determine whether contaminants are present at levels that may be deemed to pose a significant hazard to human health, measured contamination levels in soil at the site are

compared against derived guideline values ('Tier 2' soil screening), either directly or following statistical analysis. Where contaminants are present above the screening values it is probable that site-specific information will be required to further examine the potential risk of harm arising from such contamination.

The background to the assessment is contained in Appendix F and the findings are summarised in the following pages.

The proposed use of the site is housing and thus the residential with private gardens guidelines have been used to assess the results. Due to the limited number of samples tested we have compared the results directly to the GACs without the use of the statistics.

Results

There were no olfactory or visual indications of contamination in any of the holes.

Contaminants assessed against the GAC's are: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, Polycyclic Aromatic Hydrocarbons (PAH) & Total Petroleum Hydrocarbons (TPH).

All of the individual results were below the GAC/CLEA SGV's for a residential end-use.

Conclusions

The investigation has shown contaminant levels in the soil to be below the assessment criteria, which indicates that no risks to human health have been identified.

6.8.2 Risks to Plants (phytotoxicity)

General

Copper, nickel and zinc can inhibit plant growth. The GAC for this pollutant linkage (see Appendix F) have been taken from Department of the Environment Publication, *Code of Practice for Agricultural Use of Sewage Sludge*, 1996.

Results

The concentrations determined of these contaminants were below the stated guidelines.

Conclusions

The investigation has shown contaminant levels in the soil to be below the assessment criteria, which indicates that no risks to plants have been identified.

6.8.3 Risks to Water Supply Pipes (Non-Brownfield)

General

Given that the site is not brownfield and is unlikely to be at risk from organic contaminants, then testing was not required, nor undertaken, for water supply pipe assessment. Accordingly normal PE pipe materials should be suitable for the site, subject to acceptance by the local water company.

6.9 Ground Gases

General

In order to assess the significance of ground gases at the site, measured concentrations (by volume in air) and flow rates have been used to generate Gas Screening Values (GSVs). These have then been compared to the Revised Wilson and Card Classification presented within CIRIA Report 665 because the development is a mix of flats and houses. The generic 'Traffic Lights' as presented within the NHBC ground gases guide cannot be applied to the whole development due to the presence of the flats.

It is recommended that the gas risk should be assessed by the consideration of pathways to human receptors as follows:

- Gas entering the building through the substructure and building up to hazardous levels; and
- Subsequent householder exposure in garden areas, which can include outbuildings and extensions and where there may also be excavations for garden features.

Results

The following ground gas parameters have been recorded over the 3 no. gas monitoring rounds:

- A maximum 'initial' methane concentration of 0.0%;
- A maximum 'steady state' carbon dioxide concentration of 5.8%;
- A maximum 'initial' flow rate of 0.0 l/hr; and
- A maximum 'steady state' flow rate of 0.0 l/hr.

The worst case Gas Screening Values (GSV) for both methane and carbon dioxide have been calculated. In accordance with NHBC guidance (Ref 8.28) for methane the GVS is calculated using the peak concentration and flow and for carbon dioxide the residual concentrations and flow rates are used.

Conclusion

GSV's for methane and carbon dioxide have been calculated to be 0.0 l/hr and 0.0 l/hr respectively the site falls into 'Characteristic Situation' 1 (very low hazard) in Table 8.5 of CIRIA 665. However levels of carbon dioxide levels have been recorded over 5%, and due to the proximity of an infilled pond as a potential source of gas and the granular nature of the geology on site we recommend increasing this to 'Characteristic Situation' 2 (low hazard).

The type of building proposed is residential (non-managed) and for this Table 8.6 of CIRIA 665 indicates gas protection measures such as reinforced gas membrane and underfloor venting are implemented. All joints and penetrations should be sealed.

6.10 Contamination Conclusion

No contamination has been recorded at the site resulting in no complete pollutant linkages being identified.

It is therefore considered that the site is fit for the proposed end use without further assessment or remediation.

6.10.1 Unforeseen Risks During Development

Given the existence of made ground on the site it would be prudent to maintain vigilance during site clearance and construction, in case any areas of suspected contamination are encountered. If areas are found then a suitably qualified person should undertake appropriate sampling, testing and further risk assessment.

Site, landscape and maintenance workers should wear gloves, boots and overalls and wash their hands before eating, drinking and smoking. Excessive dust generation should be avoided.

6.11 Off-site Disposal of Surplus Soil

6.11.1 General

All excavated material and excess spoil must be classified for waste disposal purposes prior to disposal at landfill. Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all wastes must be classified as:

- ‘inert’, or
- ‘non-hazardous’, or
- ‘hazardous’.

The Environment Agency’s *Hazardous Waste (Technical Guidance WM2)* document outlines the methodology for classifying wastes.

Currently all wastes may require pre-treatment prior to disposal at landfill.

6.11.2 Initial Waste Characterisation

EnviroLab have produced an assessment tool that characterises contaminated waste soil by following the guidance within WM2. The ‘total solid testing’ results from this investigation have been run through this assessment tool to aid potential future off-site disposal of materials. This assessment produces an ‘initial’ characterisation of the waste which determines if it is hazardous or not (if it is ‘not’ hazardous, then it may be either inert (insoluble and inorganic) or non-hazardous. However, due to complications with the terminology of ‘inert waste’ it is best not to refer to it as such until after Waste Acceptance Criteria testing).

Any samples that are classed as hazardous will have light cells with bold text, in the respective sample columns (assuming results are in black & white, otherwise yellow cells on a colour copy). The results are summarised as follows:

All of the samples tested are classed as not being hazardous.

It is important to note that whilst we believe our in-house assessment tool to be an accurate interpretation of the requirements of WM2, thereby producing initial classifications in accordance with it, landfill operators often have their own assessment tools and can often come to a different conclusion. As a result, some landfill operators could even refuse to take apparently suitable waste.

7 SUMMARY

- 7.1 The site is located on Woolston Road, Havant, and at present is occupied by a Mary Rose House (a care home) and surrounding landscaped garden areas.
- 7.2 The desk study has revealed that the site was to the west in part open field, and to the east part of the grounds of Middle Park Farm until circa 1991 by which time Mary Rose House has been constructed and the site has taken its current layout. A pond is present adjacent to the site on the earliest map and remains until 1970 by which time it has been replaced by housing.
- 7.3 The site is to be redeveloped with housing and a unit containing flats with associated parking.
- 7.4 This investigation has revealed the site to be underlain by up to 0.5m of made ground, over superficial deposits, which are in turn underlain by the Bognor Sand.
- 7.5 The site lies on a secondary A Aquifer. Groundwater was encountered in all of the exploratory holes between 2.00m and 2.60m.
- 7.6 The soils encountered in the exploratory holes are generally suitable for excavation using standard mechanical plant. A hydraulic breaker will be required to break out any hard cover or buried foundations that remain following demolition of the existing building.
- 7.7 Atterberg Limits tests performed on samples taken from the superficial deposits showed them to be of groups CL, borderline CI/CH and CH as defined in BS 5930:1999 and based on these results, it is recommended that a high volume change potential be assumed for the cohesive superficial deposits for design purposes.
- 7.8 Foundations in the northern part of the site can be constructed upon the superficial clays at a minimum depth of 1.0m, which should offer a net allowable bearing capacity of 120kN/m^2 . Similarly foundations in the southern part of the site within the granular superficial deposits should offer a conservative allowable bearing capacity of 120kN/m^2 , and those in the Bognor Sands should offer a conservative allowable bearing capacity of 200kN/m^2 .

- 7.9 Suspended floor slabs with a 150mm subfloor void are recommended at the site because of the large number of trees to be removed and the low to high volume change potential of the cohesive soils.
- 7.10 According to Table C1 the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1 where concrete could be contact with groundwater (e.g. below about 2.0m depth) and AC-1s if there is no risk of concrete being in contact with groundwater.
- 7.11 Soakaway test results indicate soakaways are unlikely to be suitable for the site, but this depends on a number of factors including their plan size and depth, the 'design storm' and the site area to be drained. It is recommend that full scale soakaway testing be undertaken during the construction phase or when the site has been formally acquired in order better assess the suitability of the site for soakaways.
- 7.12 No contamination has been recorded at the site resulting in no complete pollutant linkages being identified. It is therefore considered that the site is fit for the proposed end use without further assessment or remediation.
- 7.13 Gas monitoring has indicated the site falls into 'Characteristic Situation' 2 (low hazard). Therefore gas protection measures such as reinforced gas membrane and underfloor venting should be implemented.
- 7.14 The 'Initial Waste Characterisation' shows that the samples tested are classed as not being hazardous.
- 7.15 We would recommend that the exploratory hole logs and the results of the Initial Waste Testing and Characterisation, (including the history of the site) be presented to the landfill(s) to which it is anticipated that the waste will be taken.

STRUCTURAL SOILS LIMITED


T Payne BSc (Hons)


A Cattell BSc PhD CGeol FGS

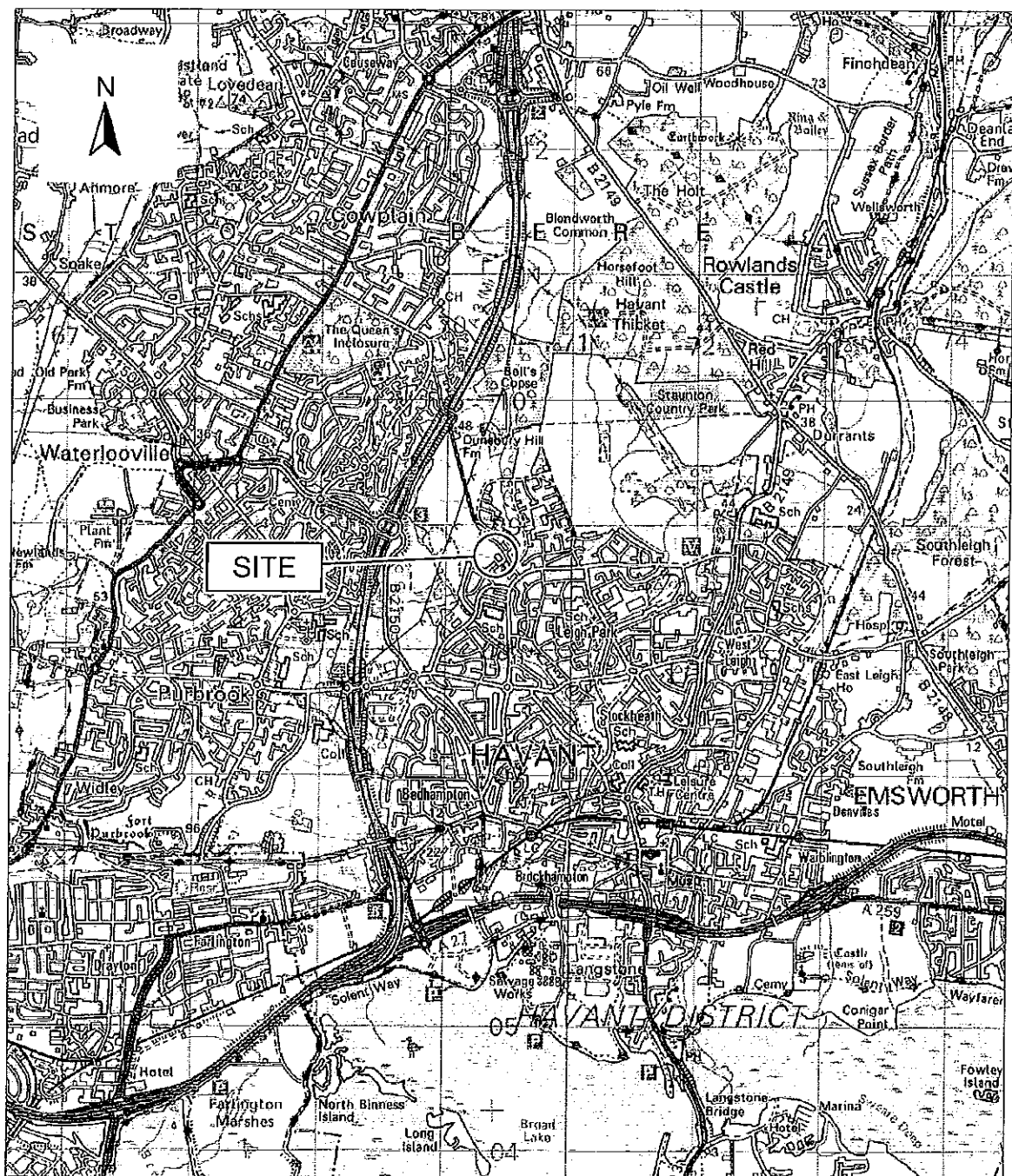
8 REFERENCES

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- 8.4 Environment Agency website, www.environment-agency.gov.uk
- 8.5 BS EN 1997-1:2004 *Eurocode 7 — Geotechnical design — Part 1: General rules*
- 8.6 BS EN 1997-2:2007 *Eurocode 7 — Geotechnical design — Part 2: Ground Investigation and testing*
- 8.7 BS EN ISO 22475-1:2006 *Geotechnical investigation and testing — Sampling by drilling and excavation and groundwater measurements — Part 1: Technical principles of execution*
- 8.8 BS EN ISO 14688-1:2002 *Geotechnical investigation and testing – Identification and classification of soil: Part 1: Identification and description*
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-
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- 8.30 Boyle, RA and Witherington, PJ (2007, Edition 04) 'Guidance On Evaluation Of Development Proposals On Sites Where Methane and Carbon Dioxide Are Present', NHBC
- 8.31 *Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Waste*, Environment Agency, WM2 Version 1.0, June 2003
- 8.32 Landfill (England & Wales) Regulations 2002

APPENDIX A

- (i) Site Location Plan
- (ii) Exploratory Hole Location Plan
- (iii) Proposed Development Layout Plan



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CLIENT

PMC Construction & Developments Services Ltd

PROJECT

Mary Rose House, Havant

TITLE

SITE LOCATION MAP

00	13.03.2012	-	JAH	TP	-	SITE LOCATION MAP			
REV.	DATE	DESCRIPTION	BY	CHD.	APR.				
DIMENSION		SCALE	ORIGIN SIZE			JOB NO.	GRID REFERENCE	DRAWING STATUS	FIGURE
m		1:50,000	A4			726543	SU 704 087	-	1

NOTE



MARY ROSE HAVANT

PROPOSED SITE PLAN

1:200

APPENDIX B

- (i) Key to Exploratory Hole Logs
- (ii) Window Sample Logs
- (iii) Dynamic Probe Log



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Contract Reference: **726543**

KEY TO EXPLORATORY POSITION LOGS - SUMMARY OF ABBREVIATIONS

SAMPLING

Sample type codes

AMAL	=	Amalgamated sample.
B	=	Bulk disturbed sample.
D	=	Small Disturbed sample.
ES	=	Soil sample for environmental testing.

IN-SITU TESTING

HP	=	Hand Penetrometer Test. Value given as shear strength c_u , in kPa.
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ADDITIONAL NOTES

1. All soil and rock descriptions and legends in general accordance with BS EN ISO 14688-1, 14688-2, 14689-1, and BS5930:1999 including Amendment 2 (2010).
2. Material types divided by a broken line (---) indicates an unclear boundary.
3. The data on any sheet within the report showing the AGS icon is available in the AGS format.

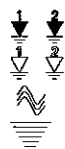


STRUCTURAL SOILS

Contract Reference: 726543

KEY TO EXPLORATORY POSITION LOGS - SUMMARY OF GRAPHIC SYMBOLS

WATER COLUMN SYMBOLS



First water strike, second water strike etc.

Standing water level following first strike, standing water level following second strike etc.



Seepage.

Standing water level recorded at documented date.

MATERIAL GRAPHIC LEGENDS



Gravelly
clayey
SAND



Clayey
SAND



MADE
GROUND



Sandy
CLAY



Gravelly
sandy
CLAY



Sandy
gravelly
CLAY



Sandy
SILT



Topsoil



Silty
gravelly
SAND



Silty
SAND

INSTRUMENTATION SYMBOLS



Backfill



Bentonite
seal



Concrete



Gravel
filter



Stopcock
cover



Plain pipe



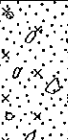
Slotted
pipe



STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Window Sample: WS1	
Contract Ref: 726543	Date: 20.02.12	Ground Level (°): ---	Co-ordinates: ---	Sheet: 1 of 1	

Progress	Samples / Tests				Water Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results				
↑ 1.00 - 2.00 (87mm dia) 100% rec ↓ ↑ 2.00 - 3.00 (77mm dia) 95% rec ↓						Grass over TOPSOIL of dark brown slightly gravelly clayey SAND. Gravel is subrounded to rounded fine to coarse chert.	(0.30)	
	0.30-0.70	2	B	$c_u=50/60/65$		Brown and yellow brown slightly gravelly silty fine to medium SAND. Gravel is subrounded to rounded fine to coarse chert. (Superficial Deposits)	0.30	
	0.50	1	ES			(0.50)		
	0.50-0.70	2	B					
	0.80	3	HP			Firm yellow brown and orange brown sandy CLAY. (Superficial Deposits)	0.80	
	0.90		D	(0.30)				
	1.00	HP	$c_u=50$	1.10				
	1.20-2.00	4	D	Orange brown and yellow brown silty fine to medium SAND. (Bognor Sand Member)	(0.90)			
	2.10-2.90	5	D	Orange brown silty fine SAND. (Bognor Sand Member)	2.00			
	3.10-3.60	6	D		(1.75)			
				Dark grey silty fine SAND. (Bognor Sand Member)	3.75			
				Window sample hole terminated at 4.00 m depth.	4.00			

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
						1. Inspection pit hand dug to 1.00m depth. 2. Stratum damp from 2.20m depth. 3. 40mm diameter monitoring well installed on completion to 3.8m depth (response zone 0.8 to 3.8m).
All dimensions in metres						Scale: 1:25
Method Used: Tracked window sampling	Plant Used: Archway Competitor		Drilled By: RD	Logged By: TPayne	Checked By:	



STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Window Sample: WS2
Contract Ref: 726543	Date: 20.02.12	Ground Level (): ---	Co-ordinates: ---	Sheet: 1 of 1

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.20	1	ES				MADE GROUND: Grass over TOPSOIL of dark brown slightly gravelly clayey SAND. Gravel is subangular to rounded fine to coarse chert and occasional brick.	(0.30)	
	0.50	2	HP	$c_u=90/100/90$			Stiff orange brown and light grey brown sandy CLAY. (Superficial Deposits)	(0.80)	
	0.60		D						
	0.90		HP	$c_u=85/80/75$			Firm orange brown and light grey brown slightly gravelly sandy CLAY. Gravel is subrounded to rounded fine to medium chert. (Superficial Deposits)	(0.55)	
	1.00-1.20	3	D						
	1.10-1.20	3	D						
	1.10		HP	$c_u=75$					
	1.30		HP	$c_u=60$					
	1.50		HP	$c_u=65$			Firm orange brown and light grey brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse chert. (Superficial Deposits)	(0.30)	
	1.70-1.90	4	D	$c_u=60$					
	1.70		HP				Orange brown and brown slightly silty fine to medium SAND. (Bognor Sand Member)	(1.20)	
	2.00-2.50	5	D						
	2.50-3.00	6	D						
	3.20-4.00	7	D				Dark grey silty fine SAND. (Bognor Sand Member)	(0.85)	
	3.80-4.00	7	D						
							Window sample hole terminated at 4.00 m depth.		

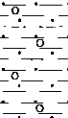
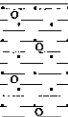
Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)		
20/02/12		4.00	-		2.25	1. Inspection pit hand dug to 1.00m depth. 2. Stratum saturated from 2.00m depth. 3. Groundwater standing at 2.25m depth after drilling. 4. Hole collapsed to 2.50m depth. 5. Soakaway test performed in base of hole. 6. Hole backfilled with arisings on completion.	
All dimensions in metres						Scale:	1:25
Method Used:	Tracked window sampling		Plant Used:	Archway Competitor		Drilled By:	RD
						Logged By:	TPayne
						Checked By:	
							AGS



STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Window Sample: WS3	
Contract Ref: 726543	Date: 20.02.12	Ground Level (): ---	Co-ordinates: ---	Sheet: 1 of 1	

Progress		Samples / Tests			Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend	
Window Run	Depth	No	Type	Results						
1.00 - 2.00 (77mm dia) 100% rec 2.00 - 3.00 (57mm dia) 75% rec 3.00 - 4.00 (47mm dia) 80% rec	0.30	1	ES	$c_u=55/50/50$		Grass over TOPSOIL of dark brown slightly gravelly very silty SAND. Gravel is subrounded to rounded fine to medium chert.	0.25			
	0.50	2	D			Firm dark brown and orange brown slightly gravelly sandy SILT. Gravel is subrounded to rounded fine to coarse chert. (Superficial Deposits)	(0.80)			
	0.50		HP							
	0.60	2	D							
	1.00		HP	$c_u=40/50/45$			Stiff orange brown and light grey brown slightly gravelly slightly sandy CLAY. Gravel is subrounded to rounded fine to medium chert. (Superficial Deposits)	1.05		
	1.10-1.20	3	D	$c_u=100$		(0.45)				
	1.10		HP					$c_u=85$		
	1.20		HP					$c_u=70$		
	1.30		HP					$c_u=75$		
	1.40		HP			1.50				
	1.50-1.80	4	D	$c_u=65$		(0.45)				
	1.60		HP							
	1.80		HP	$c_u=60$		1.95				
	2.00-3.00	5	D			(1.95)				
	3.00-3.80	6	D							
	3.90-4.00	7	D					Dark grey silty fine SAND. (Bognor Sand Member)	3.90	
								Window sample hole terminated at 4.00 m depth.	4.00	

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
20/02/12		4.00	-		2.64	1. Inspection pit hand dug to 1.00m depth. 2. Groundwater standing at 2.64m depth after drilling. 3. Hole collapsed to 2.71m depth. 4. Hole backfilled with arisings on completion.
All dimensions in metres						Scale: 1:25
Method Used: Tracked window sampling	Plant Used: Archway Competitor	Drilled By: RD	Logged By: TPayne	Checked By: AD	AGS	



STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Window Sample: WS4
Contract Ref: 726543	Date: 20.02.12	Ground Level (): ---	Co-ordinates: ---	Sheet: 1 of 1

Progress		Samples / Tests			Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend	
Window Run	Depth	No	Type	Results						
	0.30	1	ES	$c_u=45$			MADE GROUND: Grass over TOPSOIL of dark brown slightly gravelly silty SAND. Gravel is subangular to rounded fine to coarse chert, brick and charcoal.	(0.50)		
	0.30	2	D				Brown and orange brown gravelly clayey SAND. Gravel is subrounded to rounded fine to coarse chert. (Superficial Deposits)	0.50		
	0.50-0.70	3	D					0.75		
	0.75-0.95	4	D				Firm orange brown and brown sandy CLAY. (Superficial Deposits)	0.95		
	0.80	4	HP				Orange brown and light grey brown clayey fine SAND. (Bognor Sand Member)	(1.35)		
	1.00-1.50	5	D							
	1.50-2.00	6	D				Orange brown silty fine SAND. (Bognor Sand Member)	2.30		
	2.20-2.80	7	D							
	2.00-3.00	8	D				Dark grey silty fine SAND. (Bognor Sand Member)	(1.25)		
	3.00-3.50	8	D					3.55		
3.60-4.00	9	D	Window sample hole terminated at 4.00 m depth.				(0.45)			
				4.00						

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
20/02/12		4.00	-		2.33	1. Inspection pit hand dug to 1.00m depth. 2. Stratum saturated from 2.30m depth. 3. Groundwater standing at 2.33m depth after drilling. 4. Hole collapsed to 2.40m depth. 5. Hole backfilled with arisings on completion.
All dimensions in metres						Scale: 1:25
Method Used: Tracked window sampling	Plant Used: Archway Competitor		Drilled By: RD	Logged By: TPayne	Checked By:	



STRUCTURAL SOILS

WINDOW SAMPLE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Window Sample: WS5
Contract Ref: 726543	Date: 20.02.12	Ground Level (): ---	Co-ordinates: ---	Sheet: 1 of 1

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.50 - 1.00 (97mm dia) 100% rec 1.00 - 2.00 (77mm dia) 85% rec 2.00 - 2.90 (57mm dia) 80% rec	0.20	1	ES			Grass over TOPSOIL of dark brown slightly gravelly sandy SILT. Gravel is subrounded to rounded fine to medium chert.	(0.35)		
	0.40-0.60	2	D			Brown and grey silty gravelly SAND. Gravel is subrounded to rounded fine to coarse chert. (Superficial Deposits)	0.35 0.60		
	0.70-1.00	3	D			Brown and orange brown clayey fine to medium SAND. (Superficial Deposits)	(0.45)		
	1.10-1.50	4	D			Orange brown and light brown slightly silty fine SAND. (Bognor Sand Member)	1.05		
	1.50-2.00	5	D			... dark brown staining from 2.40 to 2.60m depth.	(1.85)		
	2.00-2.50	6	D						
	2.50-2.90	7	D						
						Window sample hole refused at 2.90 m depth.	2.90		

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
20/02/12		2.90	-		2.02	1. Inspection pit hand dug to 1.00m depth. 2. Stratum damp from 1.50m depth. 3. Stratum saturated from 2.00m depth. 4. Groundwater standing at 2.02m depth after drilling. 5. Hole collapsed to 2.28m depth. 6. Soakaway test performed in base of hole. 7. Hole backfilled with arisings on completion.
All dimensions in metres						Scale: 1:25
Method Used: Tracked window sampling	Plant Used: Archway Competitor	Drilled By: RD	Logged By: TPayne	Checked By:		



STRUCTURAL SOILS

DRAFT DYNAMIC PROBE LOG

Contract: Mary Rose House, Havant		Client: PMC Construction		Probe ref: DP5	
Contract Ref: 726543	Date: 20.02.12	Ground Level (): ---	Co-ordinates: ---	Sheet: 1 of 1	

DEPTH (m)	READING (Blows/100mm)	DIAGRAM (N100 VALUES)	TORQUE ON RODS (Nm)	REMARKS
0	0			
0.5	0 1 2 3			
1.0	3 1 2 2 2			
1.5	1 1 2 4 4			
2.0	6 8 9 9 8			
2.0		Dynamic probe hole terminated at 2.00m depth.		
2.5				
3.0				
3.5				
4.0				
4.5				

General Remarks

Equipment conforms to DPSII apparatus in BS 1377:1990 Part 9

All dimensions in metres	Method:	Tested By:	Checked By:
Scale 1:25	BS1377 - DPSH	RDavenport	

APPENDIX C

- (i) Dynamic Probe Calibration Records
- (ii) Soakaway Test Results

SPT Calibration Report

Hammer Energy Measurement Report

Type of Hammer: Dart
Client: STRUCTURAL SOILS
Test No: EQU550
Test Depth (m): 7.00
Date of Test: 22/09/2011
Valid until: 22/09/2012
Hammer ID: 12

Mass of the hammer $m = 63.5\text{kg}$
Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter $d_r = 0.052\text{m}$
Length of the instrumented rod 0.558m
Area $A = 11.61\text{cm}^2$
Modulus $E_s = 206843\text{MPa}$

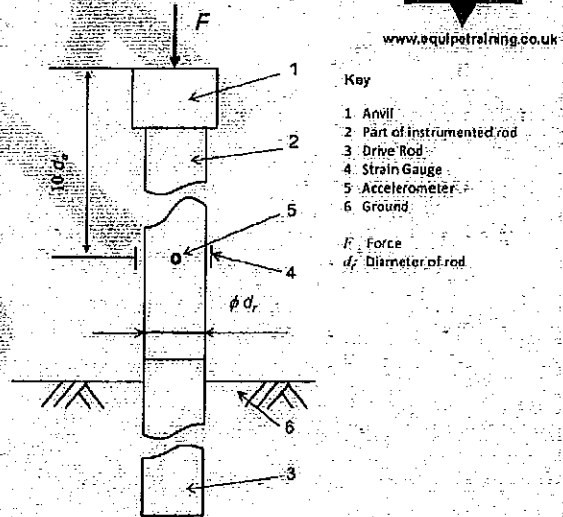
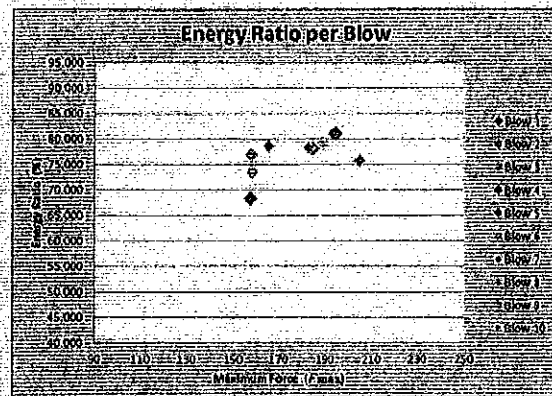
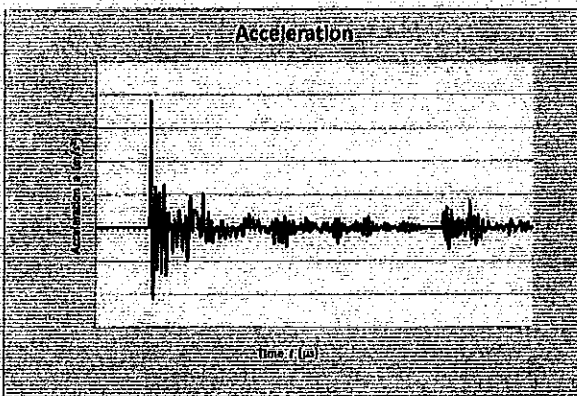
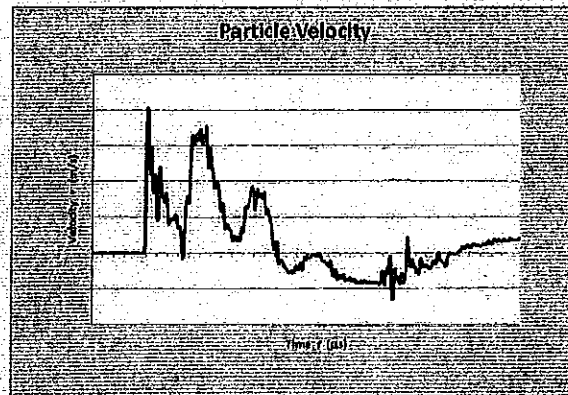
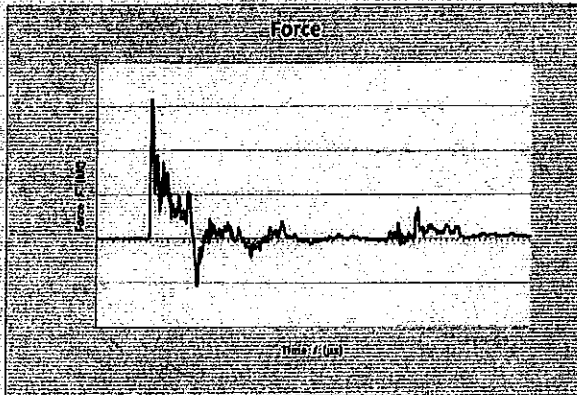


Fig. B.1 and B.2 BS EN ISO 22476-3: 2005



Observations:
1.

$E_{\text{meas}} = 0.359\text{ kN-m}$

$E_{\text{theor}} = 0.473\text{ kN-m}$

Equipe SPT Analyzer Operators:

JML

Prepared by:

h Spies

Checked by:

K Howell

Date

29/09/2011

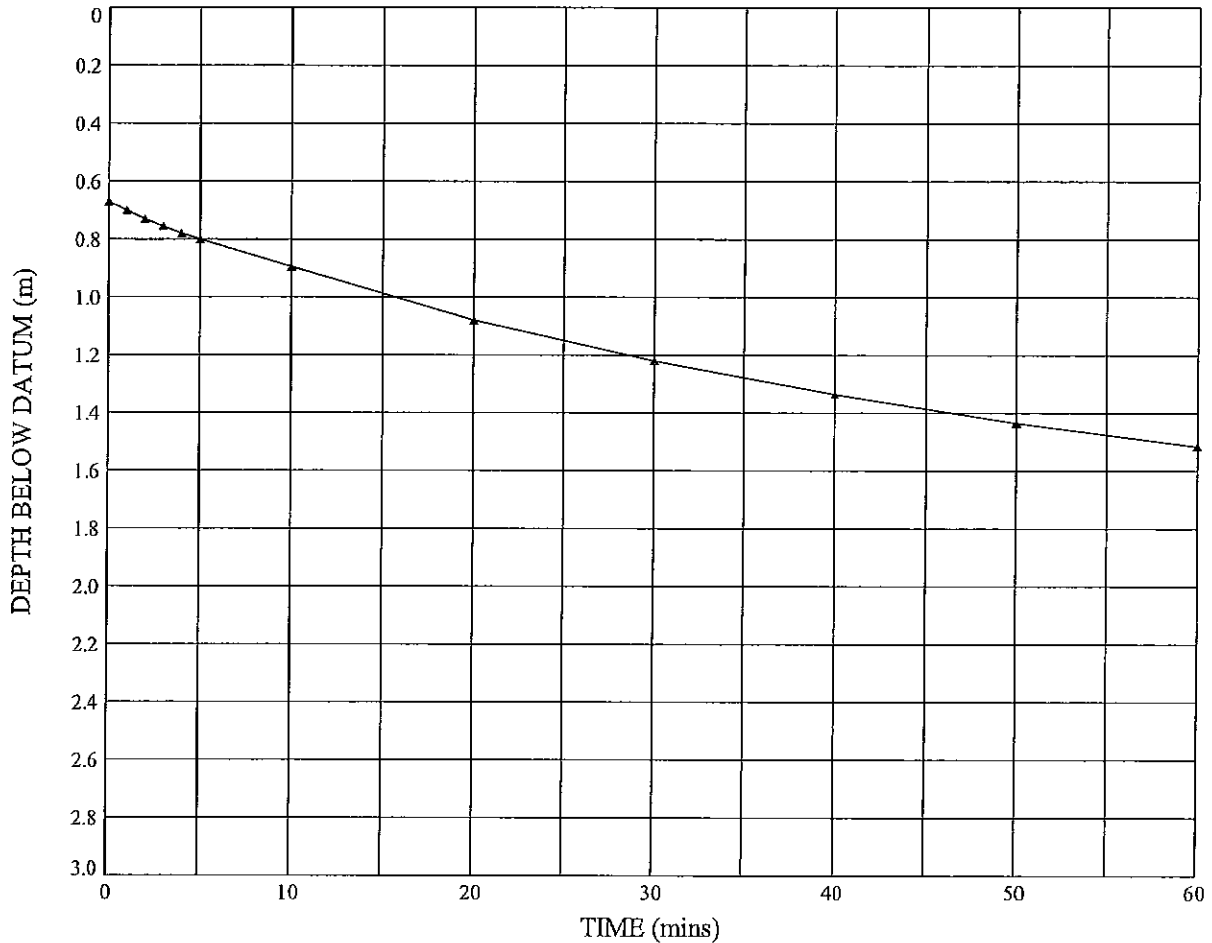
BOREHOLE SOAKAWAY TEST

Test position: WS2

Ground Level (): ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth, D_e = 1.83 m

Effective storage volume, V_{p75-25} = 0.006083 m³

Surface area, a_{p50} = 0.271107 m²

Time, t_{p75-25} = 6115 secs

Infiltration coefficient, f = 3.67×10^{-6} m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation. For calculation purposes window sample hole is assumed to be dry at start of test.

Test hole details:

Hole depth at start of test: 2.50m

Window sample hole
(average diameter used): 92mm

Legend:

▲ Test 1 (20/02/2012)



STRUCTURAL SOILS
The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By

Date

Checked By

Date

JSR

28/03/12

Contract:

Mary Rose House, Havant

Contract Ref:

726543

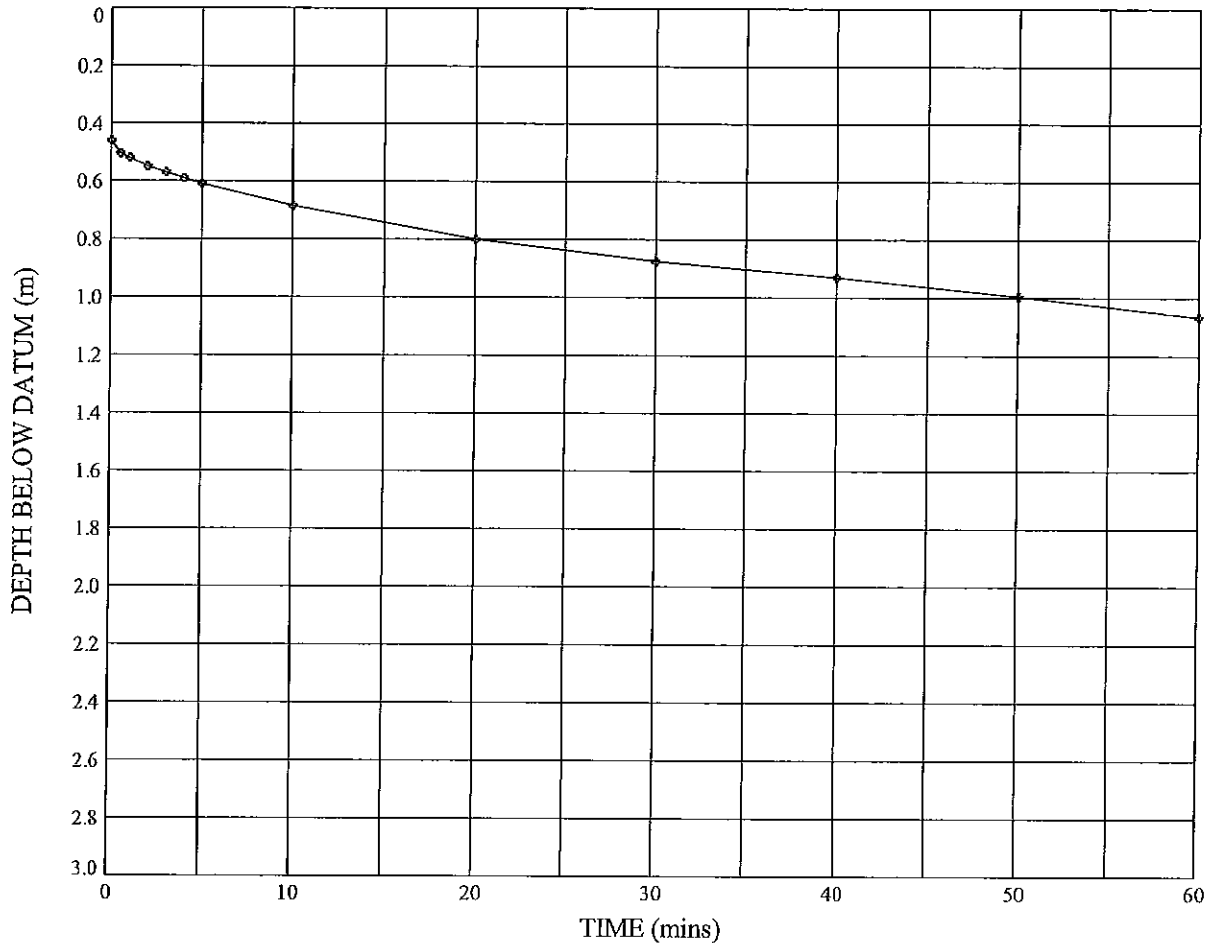
BOREHOLE SOAKAWAY TEST

Test position: WS5

Ground Level (): ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth, D_e = 1.82 m

Effective storage volume, V_{p75-25} = 0.005164 m³

Surface area, a_{p50} = 0.248677 m²

Time, t_{p75-25} = 7835 secs

Infiltration coefficient, f = 2.65×10^{-6} m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation. For calculation purposes window sample hole is assumed to be dry at start of test.

Test hole details:

Hole depth at start of test: 2.28m

Window sample hole
(average diameter used): 85mm

Legend:

⊗ Test 1 (20/02/2012)



STRUCTURAL SOILS
The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By

Date

Checked By

Date

90%

28/03/12

Contract:

Mary Rose House, Havant

Contract Ref:

726543

APPENDIX D

- (i) Geotechnical Laboratory Test Verification Sheet
- (ii) Geotechnical Laboratory Test Results

TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

CHECKING STATUS: **CHECKED**

In accordance with Structural Soils Ltd Laboratory Quality Assurance Manual, Issue 6, January 2010 all results sheets and summaries of results issued by the laboratory are checked by an approved signatory. This check will also involve checking of at least 10% of calculations for each test type to ensure that data has been correctly entered into the computer and calculated. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Assurance Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **26/03/2012 12:07:46**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
David Trowbridge (Laboratory Manager)



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Contract:

Mary Rose House, Havant

Job No:

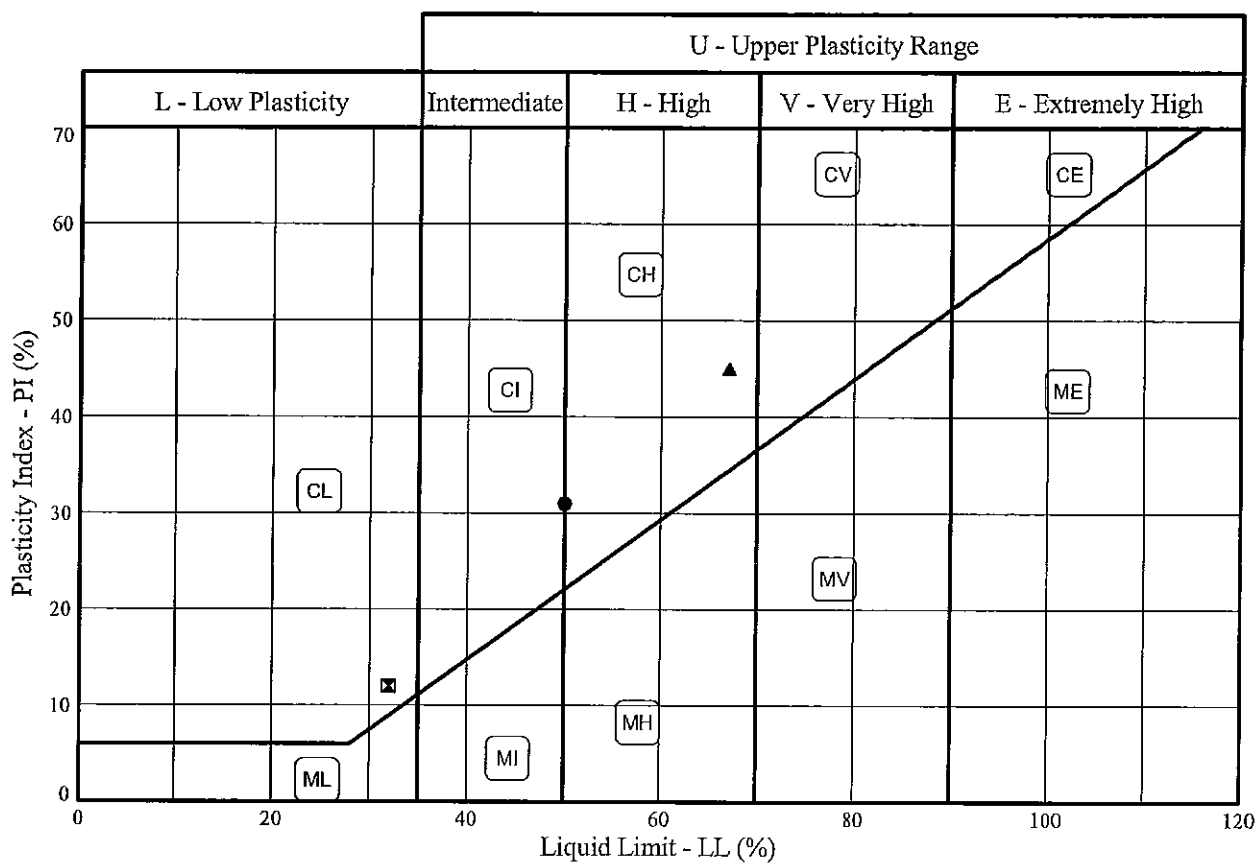
726543



PLASTICITY CHART - PI Vs LL

In accordance with clause 42.3 of BS5930:1981

Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425um %
Exploratory Position ID	Sample	Depth (m)								
●	WS2	2D	0.60	3.2/4.4/5.3/5.4	4.2.3	23	50	19	31	98
☒	WS3	2D	0.60	3.2/4.4/5.3/5.4	4.2.4	22	32	20	12	94
▲	WS3	3D	1.10	3.2/4.4/5.3/5.4	4.2.3	27	67	22	45	100
		</								

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Conc Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non standard test, NP = Non plastic.

Approved Signatories: D. TROWBRIDGE A. FROST M. STOKES S. HANDCOCK



STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By

A.S. Frost

ALAN FROST

Date

25/03/12

Contract

Mary Rose House, Havant

Contract Ref:

726543



In accordance with clauses 3.2, 4.3, 4.4, 5.3, 5.4, 7.2, 8.2, 8.3 of BS1377:Part 2:1990

Mary Rose House, Havant

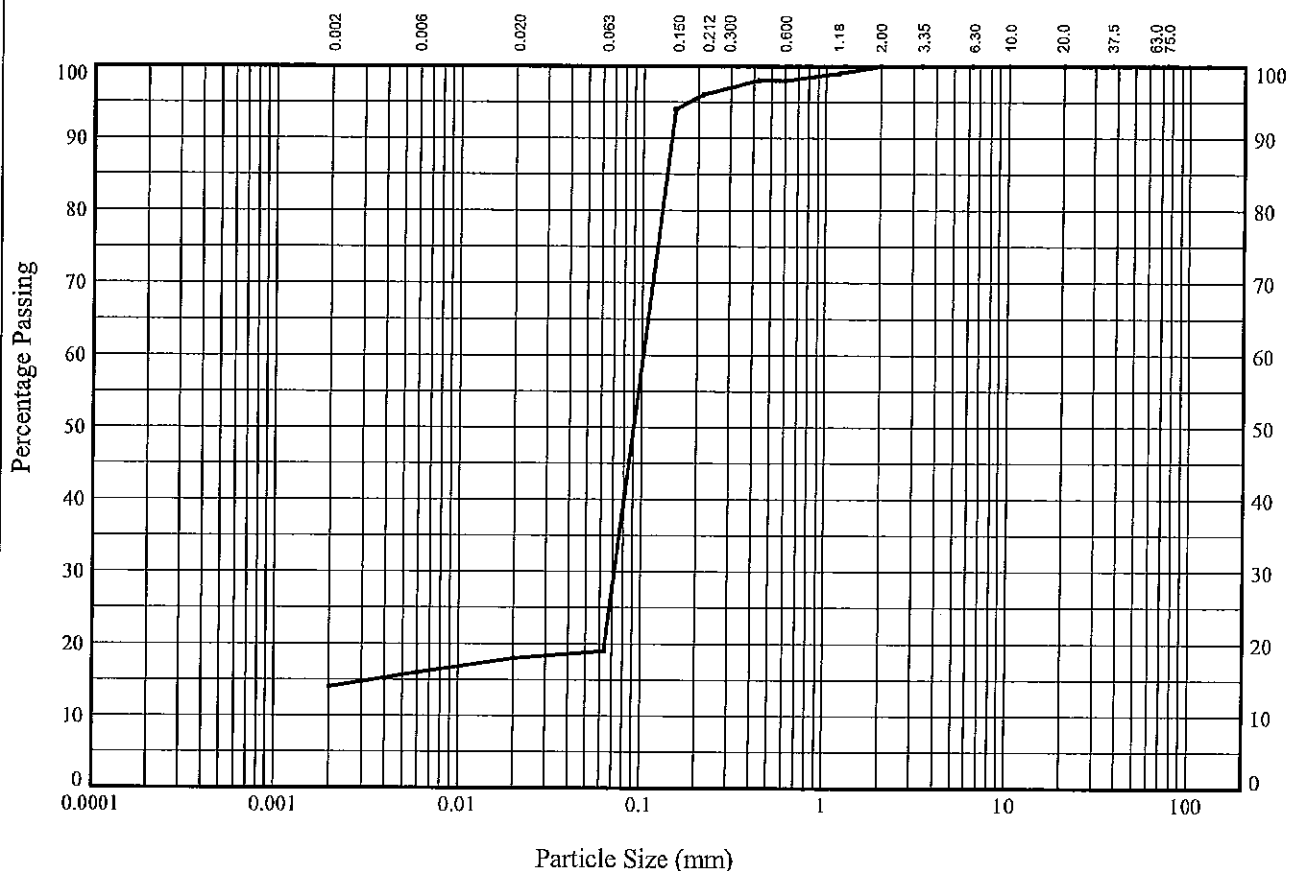
726543



PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9,2,9.5 of BS1377:Part 2:1990

Window Sample : **WS4** Sample Ref: Sample Type: **AMAL** Depth (m): **1.00**
 Amalgamation comprises: WS4, Depth:1.00, Ref:5, Type:D + WS4, Depth:1.50, Ref:6, Type:D



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	100
10.0	100
6.30	100
3.35	100
2.00	100
1.18	99
0.600	98
0.425	98
0.212	96
0.150	94
0.063	19

Particle Diameter	Percentage Passing
0.02	18
0.006	16
0.002	14

Soil Fraction	Sieve Percentage
GRAVEL	0
SAND	81
SILT	5
CLAY	14

Soil Description:
Grey mottled brown clayey SAND

Approved Signatories: D. TROWBRIDGE A. FROST M. STOKES S. HANDBECK



STRUCTURAL SOILS
 1a Princess Street
 Bedminster
 Bristol
 BS3 4AG

Compiled By		Date
A. J. Frost		25/03/12
Contract		Contract Ref:
Mary Rose House, Havant		726543



SUMMARY OF CHEMICAL ANALYSES

[illegible]

NOTES:- All chemical tests were undertaken by Envirolab.

Approved Signatories: D. TROWERIDGE A. FROST M. STOKES S. HANDCOCK

Contract Ref:

Date _____

25.03.12

726543

Mary Rose House, Havant

Contract:

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG



GINT_LIBRARY_V8_04.GLB : L - SUMMARY OF CHEMICAL ANALYSES - 726543 MARY ROSE HOUSE HAVANT.GPJ | 25/03/12 08:15 | AF



APPENDIX E

- (i) Contamination Laboratory Test Results
- (ii) Initial Waste Characterisation (Haswaste)
- (iii) Laboratory UKAS Accreditation Certificate

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 12/00842
Issue Number: 1 **Date:** 05 March, 2012

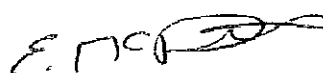
Client: Structural Soils Bristol
The Old School House
Stillhouse Lane
Bedminster
Bristol
UK
BS3 4EB

Project Manager: SSL Enviro / Tom Payne
Project Name: Mary Road House, Havant
Project Ref: 726543
Order No: Not specified
Date Samples Received: 23/02/12
Date Instructions Received: 23/02/12
Date Analysis Completed: 05/03/12

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Liz McDermott
Project Coordinator

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 inert stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample bases. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

Subscript "A" indicates analysis performed on the sample as received, "D" indicates analysis performed on dried & crushed sample. All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts. Superscript "M" indicates method accredited to MCERTS.

Predominant Matrix Codes - 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER. Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our MCERTS accreditation. Secondary Matrix Codes - A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis. NDP indicates No Determination Possible. NAD indicates No Asbestos. Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

Envirolab Job Number: 12/00842

Client Project Name: Mary Road House, Havant

Client Project Ref: 726543

Lab Sample ID	12/00842/1	12/00842/2	12/00842/3	12/00842/4					Units	Method ref
Client Sample No	1	1	1	1						
Client Sample ID	WS1	WS2	WS3	WS5						
Depth to Top	0.50	0.20	0.30	0.20						
Depth To Bottom										
Date Sampled	20-Feb-12	20-Feb-12	20-Feb-12	20-Feb-12						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AE	5AE	5E	5AE						
pH _D ^{M#}	7.41	7.46	6.53	5.58					pH	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	<0.01	<0.01	0.02	<0.01					g/l	A-T-026s
Organic matter _D [#]	1.9	2.0	1.6	1.6					% w/w	A-T-032 OM
Arsenic _D ^{M#}	6	6	7	2					mg/kg	A-T-024
Cadmium _D ^{M#}	1.1	1.0	1.6	0.6					mg/kg	A-T-024
Copper _D ^{M#}	8	8	8	4					mg/kg	A-T-024
Chromium _D ^{M#}	16	20	21	14					mg/kg	A-T-024
Lead _D ^{M#}	27	28	23	15					mg/kg	A-T-024
Mercury _D	<0.17	0.17	<0.17	<0.17					mg/kg	A-T-024
Nickel _D ^{M#}	5	7	8	4					mg/kg	A-T-024
Selenium _D ^{M#}	<1	<1	1	<1					mg/kg	A-T-024
Zinc _D ^{M#}	46	65	48	24					mg/kg	A-T-024

Envirolab Job Number: 12/00842

Client Project Name: Mary Road House, Havant

Client Project Ref: 726543

Lab Sample ID	12/00842/1	12/00842/2	12/00842/3	12/00842/4					Units	Method ref
Client Sample No	1	1	1	1						
Client Sample ID	WS1	WS2	WS3	WS5						
Depth to Top	0.50	0.20	0.30	0.20						
Depth To Bottom										
Date Sampled	20-Feb-12	20-Feb-12	20-Feb-12	20-Feb-12						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AE	5AE	5E	5AE						
PAH 16										
Acenaphthene _A ^{MS}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Acenaphthylene _A ^{MS}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Anthracene _A [#]	<0.01	0.02	<0.01	<0.01					mg/kg	A-T-019s
Benzo(a)anthracene _A ^{MS}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Benzo(a)pyrene _A ^{MS}	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Benzo(b)fluoranthene _A	0.02	0.02	0.01	<0.01					mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{MS}	<0.01	0.02	0.01	<0.01					mg/kg	A-T-019s
Benzo(k)fluoranthene _A	<0.01	0.01	<0.01	<0.01					mg/kg	A-T-019s
Chrysene _A ^{MS}	0.03	0.03	0.04	0.03					mg/kg	A-T-019s
Dibenzo(ah)anthracene _A	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Fluoranthene _A ^{MS}	0.07	0.05	0.05	<0.01					mg/kg	A-T-019s
Fluorene _A ^{MS}	<0.01	0.01	<0.01	<0.01					mg/kg	A-T-019s
Indeno(123-cd)pyrene _A [#]	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Naphthalene _A ^{MS}	<0.01	0.03	0.02	<0.01					mg/kg	A-T-019s
Phenanthrene _A ^{MS}	0.01	0.05	0.02	<0.01					mg/kg	A-T-019s
Pyrene _A ^{MS}	0.06	0.04	0.05	0.02					mg/kg	A-T-019s
Total PAH _A	0.20	0.31	0.21	0.06					mg/kg	A-T-019s
TPH Banded 2										
>C6-C10 _A [#]	<10	<10	<10	<10					mg/kg	A-T-007s
>C10-C25 _A [#]	<10	<10	<10	<10					mg/kg	A-T-007s
>C25-C40 _A [#]	<10	<10	<10	<10					mg/kg	A-T-007s

SUMMARY OF CONTAMINATION ANALYSIS: SOIL

	Guidelines for Residential with Private Gardens (mg/kg)					
	SOM 1%		SOM 2.5%		SOM 6%	
Arsenic	32		32		32	
Cadmium	10		10		10	
Chromium (total)	3,000		3,000		3,000	
Chromium (hexavalent)	4.3		4.3		4.3	
Copper	2,300		2,300		2,300	
Mercury	0.17 170 7.4	Elemental Mercury (Hg ⁰) Inorganic Mercury (Hg ²⁺) Methyl Mercury (Hg ¹⁺)	0.42 170 9.6	Elemental Mercury (Hg ⁰) Inorganic Mercury (Hg ²⁺) Methyl Mercury (Hg ¹⁺)	1.0 170 11	Elemental Mercury (Hg ⁰) Inorganic Mercury (Hg ²⁺) Methyl Mercury (Hg ¹⁺)
Nickel	130		130		130	
Lead	300		300		300	
Selenium	350		350		350	
Zinc	3,800		3,800		3,800	
PAHs						
Acenaphthene	210		480		1,000	
Acenaphthylene	170		400		850	
Anthracene	2,300		4,900		9,200	
Benzo (a) anthracene	3.1		4.7		5.9	
Benzo (a) pyrene	0.83		0.94		1.0	
Benzo (b) fluoranthene	5.6		6.5		7.0	
Benzo (g,h,i) perylene	44		46		47	
Benzo (k) fluoranthene	8.5		9.6		10	
Chrysene	6.0		8.0		9.3	
Dibenzo (a,h) anthracene	0.76		0.86		0.90	
Fluoranthene	260		460		670	
Fluorene	160		380		780	
Indeno (1,2,3-cd) pyrene	3.2		3.8		4.2	
Naphthalene	1.5		3.7		8.7	
Phenanthrene	92		200		380	
Pyrene	560		1,000		1,600	
PETROLEUM HYDROCARBONS						
MTBE	1.8		3.7		7.4	
Benzene	0.079		0.157		0.33	
Toluene	120		270		610	
Ethyl Benzene	65		154		350	
Xylene (m)	44		103		240	
Xylene (p)	42		98		230	
Xylene (o)	45		106		250	
Aliphatics EC5-EC6	30		55		110	
Aliphatics >EC6-EC8	73		160		370	
Aliphatics >EC8-EC10	19		46		110	
Aliphatics >EC10-EC12	93 (48)		230 (118)		540 (283)	
Aliphatics >EC12-EC16	744 (24)		1,700 (59)		3,000 (142)	
Aliphatics >EC16-EC35	45,100 (8.48)		64,000 (21)		76,000	
Aliphatics >EC35-EC44	45,100 (8.48)		64,000 (21)		76,000	
Aromatics EC5-EC7	Use benzene and toluene results to assess these bands					
Aromatics >EC7-EC8						
Aromatics >EC8-EC9 (styrene)	130		316		700	
Aromatics >EC9-EC10	27		65		150	
Aromatics >EC10-EC12	69		160		346	
Aromatics >EC12-EC16	140		310		593	
Aromatics >EC16-EC21	250		480		770	
Aromatics >EC21-EC35	890		1,100		1,230	
Aromatics >EC35-EC44	890		1,100		1,230	
PETROLEUM HYDROCARBONS						
TPH EC6-EC10	19		46		110	
TPH EC10-EC25	69		160		346	
TPH EC25-EC40	890		1,100		1,230	

() = Substitution limits

EC: equivalent carbon

GACs given assume 1% SOM for metals and 2.5% SOM for hydrocarbons

SOM: Soil organic matter

Hydrocarbon GACs assume free phase contamination is not present.

United Kingdom Accreditation Service

ACCREDITATION CERTIFICATE



TESTING LABORATORY
No. 1247

Envirolab

is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005
General Requirements for the competence of testing and calibration laboratories.

This accreditation demonstrates technical competence for a defined scope as detailed in and at the locations specified in the schedule to this certificate, and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).

The schedule to this certificate is an essential accreditation document and from time to time may be revised and reissued by the United Kingdom Accreditation Service. The most recent issue of the schedule of accreditation, which bears the same accreditation number as this certificate, is available from the UKAS website www.ukas.org.

This accreditation is subject to continuing conformity with United Kingdom Accreditation Service requirements. The absence of a schedule on the UKAS website indicates that the accreditation is no longer in force.

Accreditation Manager, United Kingdom Accreditation Service

Initial Accreditation date
02 December 1992

This certificate issued on
11 August 2006

The Department of Trade and Industry (DTI) has entered into a memorandum of understanding with the United Kingdom Accreditation Service (UKAS) through which UKAS is recognised as the national body responsible for assessing and accrediting the competence of organisations in the fields of calibration, testing, inspection and certification of systems, products and persons

APPENDIX F

- (i) Soil Guideline Value Derivation
- (ii) RSK Group Generic Assessment Criteria (GAC)
- (iii) UKWIR Guidelines
- (iv) Risk Assessment Methodology

Soil Guideline Value Derivation

The Soil Guideline Values (SGVs) derived from the CLEA model and published by DEFRA provide initial screening criteria to establish whether sources of contamination are significant. These can then be compared with the site-specific analytical data to establish whether the hazards have the potential to cause unacceptable health risks.

In August 2008 the Environment Agency and the Department of Environment, Food and Rural Affairs (Defra) withdrew Contaminated Land Reports CLR7 to CLR10, together with the previously published Soil Guideline Values (SGVs) and CLEA UK software. In September 2009 version 1.06 of the CLEA model was issued and in May 2010 RSK released screening values (Generic Assessment Criteria (GAC)) derived in accordance with this model. RSK Group Plc has followed the same approach as CLEA to derive GAC for relevant contaminants for which SGVs are as yet not published. The rationale behind the derivation of these values.

The CLEA system also introduces some statistical testing of the test results. In principle, the mean (average) of the results for a given contaminant could be compared with the SGV. However, the measured mean could differ significantly from the true mean if only a limited number of results were available. Therefore in the mean value test, the value below which the true mean value for the site lies (US_{95}), is calculated at the 95% confidence limit. Therefore if the US_{95} is below the SGV then there is 95% confidence that the true mean is below the SGV and that there is no significant risk to health. If the mean value exceeds the SGV then this may indicate a requirement for remediation or further investigation.

If the mean value lies below the SGV, then remediation is not likely to be required. This may be the case even if some individual results exceed the SGV, as long as the elevated results fall within the same sample population, as discussed below. There is also a maximum value test and this determines whether individual results which exceed a SGV fall within the range that can be expected from the sample population, or whether they are indicative of an area of greater contaminant concentrations (e.g. a hotspot). In this latter case such elevated results are called "outliers" and such outliers may indicate a requirement for remediation or further investigation.



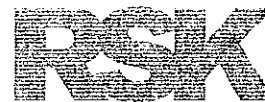
Generic assessment criteria for human health: residential scenario – private gardens

The human health generic assessment criteria (GAC) have been developed during a period of regulatory review and updating of the Contaminated Land Exposure Assessment (CLEA) project. Therefore, the Environment Agency (EA) is in the process of publishing updated reports relating to the CLEA project and the GAC presented in this document may change to reflect these updates. This issue was prepared following the publication of soil guideline value (SGV) reports and associated publications⁽¹⁾ for mercury, selenium, benzene, toluene, ethylbenzene and xylene in March 2009, arsenic and nickel in May 2009, cadmium and phenol in June 2009, dioxins, furans and dioxin-like polychlorinated biphenyls (PCBs) in September 2009. It was also produced following publication of GAC by LQM⁽⁶⁾. Where available, the published soil guideline values (SGV)⁽¹⁾ were used as the GAC. The GAC for lead is discussed separately below owing to it not being derived using the same approach as other compounds.

Lead GAC derivation

The Environment Agency SGV and Tox reports for lead were withdrawn in 2009. In addition, the provisional tolerable weekly intake data published in the Netherlands were withdrawn in 2010 owing to concerns that they were not suitably protective of human health. The withdrawn SGVs were based on a target blood lead concentration of 10µg/dl. In the absence of current guidelines many consultants continue to use the withdrawn SGV. However, as this is not considered sufficiently protective of human health, after attendance at the SOBRA summer workshop June 2011, RSK has revised its GAC and is currently undertaking a review of recent toxicological developments that will be used to refine this GAC further in the coming months. In the meantime, RSK has undertaken sensitivity analysis using the Society of Environmental Geochemistry and Health (SEGH) equation and the CLEA model to produce an interim GAC value. The results are summarised below:

- Using CLEA with the former provisional tolerable weekly intake (PTWI) (25 µg/kg bw), assuming 100% lead is bioavailable, produces a GAC of 212 mg/kg
- Using CLEA with the former PTWI, assuming 50% lead is bioavailable, produces a GAC of 478 mg/kg
- Using the SEGH equation amended for a blood target concentration of 5.6 µg/dl (equal to the LOAEL for IQ defects) gives a negative GAC number unless other factors such as child background blood concentration or delta are amended. Without undertaking further research into these numbers, RSK can present sensitivity analysis to demonstrate the sensitivity of these input parameters but cannot justify one parameter over another. The results are:
 - GAC between 39mg/kg and 99mg/kg if the value of delta (the slope or response of blood Pb versus soil and dust Pb relationship) only is amended from 5 to 2µg/dl/1000µg/g. The value of 2 was chosen as it is within the reasonable range quoted in the former SGV report
 - GAC between 244mg/kg and 610mg/kg if the geometric mean of blood lead concentration in young children is reduced from 3.4µg/dl to 2µg/dl. This decrease has been simulated on the basis that blood concentrations are likely to decrease over time across the UK owing to a ban on lead in petrol, lead within paint used internally and water pipe replacement. This decrease is considered reasonable as the site is a new development



so lead-based paints will not be used internally and lead water supply pipelines will be absent.

Therefore, given the results above RSK proposes to use a GAC of **300mg/kg** for a residential end use. This value is broadly in the middle of the range of sensitivity modelling results quoted above when background mean blood lead concentrations in children are reduced to reflect a new development. The value is also broadly in the middle of the range of sensitivity modelling results for a range of bioavailability of lead between 50% and 100%. This number is considered reasonably protective of human health while being practical for use.

GAC derivation for other metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using CLEA v1.06 and the supporting UK guidance⁽¹⁻⁶⁾. Groundwater assessment criteria (GrAC) protective of human health via the inhalation pathway were derived using the RBCA 1.3b model. RSK has updated the inputs within RBCA to reflect the UK guidance⁽¹⁻⁵⁾. The SAC and GrAC collectively are termed GAC.

Conceptual model

In accordance with EA Science Report SC050221/SR3⁽³⁾, the residential with private garden scenario considers risks to a female child between the ages of 0 and 6 years old. In accordance with Box 3.1, SR3⁽³⁾, the pathways considered for production of the SAC in the residential with gardens scenario are:

- direct soil and dust ingestion;
- consumption of home-grown produce;
- consumption of soil attached to home-grown produce;
- dermal contact with soil and indoor dust, and
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

The pathway considered in production of the GrAC is the volatilisation of compounds from groundwater and subsequent vapour inhalation by residents while indoors. Figure 2 illustrates this linkage. Although the outdoor air inhalation pathway is also valid, this contributes little to the overall risks owing to the dilution in outdoor air. Within RBCA, the solubility limit of the determinant restricts the extent of volatilisation, which in turn drives the indoor air inhalation pathway. While the same restriction is not built into the CLEA model, the CLEA model output cells are flagged red where the soil saturation limit has been exceeded.

An assumption used in the CLEA model is that of simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁴⁾. The upper boundaries of this partitioning are represented by the aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous-based or the vapour based

saturation limits. Where model output cells are flagged red the soil or vapour saturation limit has been exceeded and further consideration of the SAC to be used within the assessment is required. One approach that could be adopted is to use the 'modelled' solubility saturation limit or vapour saturation limit of the compound as the SAC. However, as stated within the CLEA handbook⁽⁴⁾ this is likely to not be practical in many cases because of the very low limits and, in any case, is highly conservative. Unless free-phase product is present, concentrations of the chemical are unlikely to be present at sufficient concentration to result in an exceedance of the health criteria value (HCV).

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH⁽⁶⁾ whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limit given in brackets. Therefore, when using the SAC to screen laboratory analysis the assessor should take note if a given SAC has a corresponding solubility or vapour saturation limit (in brackets), and subsequently incorporate this piece of information within the screening analytical discussion. If further assessment is required following this process then an additional approach can be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁴⁾, which explains how to calculate an effective assessment criterion manually.

Input selection

Chemical data was obtained from EA Report SC050021/SR7⁽⁵⁾ and the health criteria values (HCV) from the UK TOX⁽¹⁾ reports where available. For SAC for total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH), toxicological and chemical specific parameters were obtained from the LQM/CIEH report⁽⁶⁾. Similarly, toxicological and specific chemical parameters for the volatile organic compound 1,2,4-trimethylbenzene were obtained from EIC/AGS/CL:AIRE⁽⁷⁾.

For total petroleum hydrocarbons (TPH), aromatic hydrocarbons C₅-C₈ were not modelled since benzene and toluene are being modelled separately. The aromatic C₈-C₉ hydrocarbon fraction comprises ethylbenzene, xylene and styrene. Since ethylbenzene and xylene are being modelled separately, the physical, chemical and toxicological data for this band has been taken from styrene.

Owing to the lack of UK-specific data, default information in the RBCA model was used to evaluate methyl tertiary butyl ether (MTBE). No published UK data was available for 1,3,5-trimethylbenzene, so information was obtained from the US EPA as in the RBCA model. RBCA uses toxicity data for the inhalation pathway in different units to the CLEA model and cannot consider separately the mean daily intake (MDI), occupancy periods or breathing rates. Therefore, the HCV in RBCA was amended to take account of:

- amendments to the MDI using Table 3.4 of SR2⁽²⁾
- a child weighing 13.3kg (average of 0–6 year old female in accordance with Table 4.6 of SR3⁽³⁾) and breathing 11.85m³ (average daily inhalation rate for a 0–6-year old female in accordance with Table 4.14 of SR3⁽³⁾)



1. The 50% rule (for petroleum hydrocarbons, trimethylbenzenes and MTBE)⁽²⁾ where MDI data is not available but background exposure is considered important in the overall exposure.

Physical parameters

For the residential with private gardens scenario, the CLEA default building is a small two-storey terrace house with concrete ground-bearing slab. The house is assumed to have a 100m² private garden consisting of lawn, flowerbeds and incorporating a 20m² plot for growing fruit and vegetables consumed by the residents. SR3⁽³⁾ notes this residential building type to be the most conservative in terms of protection from vapour intrusion. The building parameters are outlined in Table 5.

The parameters for a sandy loam soil type were used in line with SR3⁽³⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this parameter, RSK has produced an additional set of SAC for an SOM of 1% and 2.5%. For the GrAC, the depth to groundwater was taken as 2.5m based on RSK's experience of assessing the volatilisation pathway from groundwater.

GAC

The SAC were produced using the input parameters in Tables 1 to 5 and the GrAC using input parameters in Table 6. The final selected GAC are presented by pathway in Table 7 and the combined GAC in Table 8.

Figure 1: Conceptual model for CLEA residential scenario – private gardens

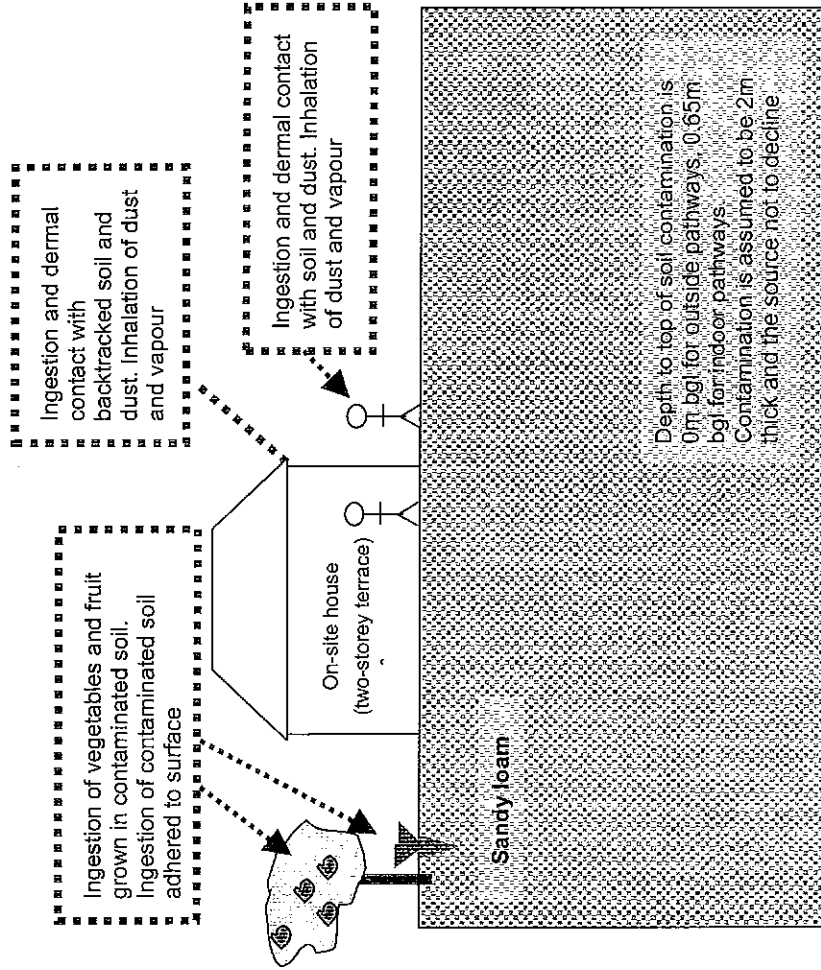


Table 1: Exposure assessment parameters for residential scenario - private gardens – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, report SC050021/SR3 ⁽³⁾
Building	Small terraced house	Key generic assumption given in Box 3.1, report SC050021/SR3. Two storey small terraced house chosen as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, report SC050021/SR3) ⁽³⁾
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, From Table 3.1, report SC050021/SR3) ⁽³⁾
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged zero to six. From Box 3.1, report SC050021/SR3 ⁽³⁾
End AC (age class)	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽⁶⁾
pH	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
	7	Model default

Table 2: Residential with private gardens –home-grown produce data for CLEA model

Name	Consumption rate (g FW kg ⁻¹ BW day ⁻¹) by age class						Dry weight conversion factor	Home-grown fraction (average)	Home-grown fraction (high end)	Soil loading factor	Preparation correction factor
	1	2	3	4	5	6	g DW g ⁻¹ FW	-	-	g g ⁻¹ DW	-
Green vegetables	7.12	6.85	6.85	6.85	3.74	3.74	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.69	3.30	3.30	3.30	1.77	1.77	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16.03	5.46	5.46	5.46	3.38	3.38	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.96	3.96	3.96	1.85	1.85	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.54	0.54	0.54	0.16	0.16	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	11.96	11.96	11.96	4.26	4.26	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 4.17, SR3 ⁽³⁾						Table 6.3, SR3 ⁽³⁾	Table 4.19, SR3 ⁽³⁾		Table 6.3, SR3 ⁽³⁾	

Table 3: Residential with private gardens – land use data for CLEA model

Parameter	Unit	Age class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr ⁻¹	180	365	365	365	365	365
EF (consumption of home-grown produce)	day yr ⁻¹	180	365	365	365	365	365
EF (skin contact, indoor)	day yr ⁻¹	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr ⁻¹	180	365	365	365	365	365
EF (inhalation of dust and vapour, indoor)	day yr ⁻¹	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr ⁻¹	365	365	365	365	365	365
Justification		Table 3.1, SR3 ⁽³⁾					
Occupancy period (indoor)	hr day ⁻¹	23	23	23	23	19	19
Occupancy period (outdoor)	hr day ⁻¹	1	1	1	1	1	1
Justification		Table 3.2, SR3 ⁽³⁾					
Soil to skin adherence factor (indoor)	mg cm ⁻² day ⁻¹	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02
Soil to skin adherence factor (outdoor)	mg cm ⁻² day ⁻¹	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Justification		Table 8.1, SR3 ⁽³⁾					
Soil and dust ingestion rate	g day ⁻¹	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01
Justification		Table 6.2, SR3 ⁽³⁾					

Of note, for **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} – are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not only in childhood but averaged over a longer time period. See the Environment Agency Science report: SC05002 / TOX 3 ⁽¹⁾ and Science Report SC050021/Cadmium SGV ⁽¹⁾ for more information.

Table 4: Residential with private gardens – receptor data for CLEA model

Parameter	Unit	Age Class						Justification
		1	2	3	4	5	6	
Body weight	kg	5.6	9.8	12.7	15.1	16.9	19.7	Table 4.6, SR3 ⁽³⁾
Body height	m	0.7	0.8	0.9	0.9	1	1.1	
Inhalation rate	m ³ day ⁻¹	8.5	13.3	12.7	12.2	12.2	12.2	Table 4.14, SR3 ⁽³⁾
Max exposed skin fraction (indoor)	m ² m ⁻²	0.32	0.33	0.32	0.35	0.35	0.33	Table 4.8, SR3 ⁽³⁾
Max exposed skin fraction (outdoor)	m ² m ⁻²	0.26	0.26	0.25	0.28	0.28	0.26	

See cadmium note as per Table 3 above.

Table 5: Residential with private gardens – soil and building inputs for CLEA model

Parameter	Unit	Value	Justification
Soil properties for sandy loam			
Porosity, total	cm ³ cm ⁻³	0.53	Default soil type is sandy loam, Section 4.3.1, SR3 ⁽³⁾ Parameters for sandy loam from Table 4.4, SR3 ⁽³⁾
Porosity, air filled	cm ³ cm ⁻³	0.20	
Porosity, water filled	cm ³ cm ⁻³	0.33	
Residual soil water content	cm ³ cm ⁻³	0.12	
Saturated hydraulic conductivity	cm s ⁻¹	3.56E-03	
van Genuchten shape parameter (<i>m</i>)	-	3.20E-01	
Bulk density	g cm ⁻³	1.21	
Threshold value of wind speed at 10m	m s ⁻¹	7.20	Default value taken from Section 9.2.2, SR3 ⁽³⁾
Empirical function (<i>F_x</i>) for dust model	-	1.22	Value taken from Section 9.2.2, SR3 ⁽³⁾
Ambient soil temperature	K	283	Annual average soil temperature representative of UK surface soils. Section 4.3.1, SR3 ⁽³⁾
Air dispersion model			
Mean annual wind speed (10m)	m s ⁻¹	5.00	Default value taken from Section 9.2.2, SR3 ⁽³⁾
Air dispersion factor at height of 0.8m	g m ⁻² s ⁻¹ per kg m ⁻³	2400	Values for a 0.01 ha site, appropriate to a residential land use in Newcastle (most representative city for UK). (from Table 9.1, SR3 ⁽³⁾) Assumed child of 6 is not tall enough to reach 1.6m
Air dispersion factor at height of 1.6m	g m ⁻² s ⁻¹ per kg m ⁻³	0	
Fraction of site with hard or vegetative cover	m ² m ⁻²	0.75	Section 3.2.6, SR3 ⁽³⁾ based on residential land use

Parameter	Unit	Value	Justification
Building properties for small terrace house with ground-bearing floor slab			
Building footprint	m ²	28	From Table 3.3 and 4.21, SR3 ⁽³⁾
Living space air exchange rate	hr ⁻¹	0.50	
Living space height (above ground)	m	4.8	
Living space height (below ground)	m	0.0	Assumed no basement
Pressure difference (soil to enclosed space)	Pa	3.1	From Table 3.3, SR3 ⁽³⁾
Foundation thickness	m	0.15	
Floor crack area	cm ²	423	
Dust loading factor	µg m ⁻³	50	Default value for a residential site taken from Section 9.3, SR3 ⁽³⁾
Vapour model			
Default soil gas ingress rate	cm ³ s ⁻¹	25	Generic flow rate, Section 10.3, SR3 ⁽³⁾
Depth to top of source (beneath building)	cm	50	Section 3.2.6, SR3 ⁽³⁾ states source is 50cm below building or 65cm below ground surface
Depth to top of source (no building)	cm	0	Section 10.2, SR3 ⁽³⁾ assumes impact from 0m to 1m for outdoor inhalation pathway
Thickness of contaminant layer	cm	200	Model default for indoor air, Section 4.9, SR4 ⁽⁴⁾
Time average period for surface emissions	years	6	Time period of a 0 to 6 year old, Box 3.5, SR3 ⁽³⁾
User-defined effective air permeability	cm ²	3.05E-08	Calculated for sandy loam using equations in Appendix 1, SR3 ⁽³⁾

Figure 2: GrAC conceptual model for RBCA residential with private gardens scenario

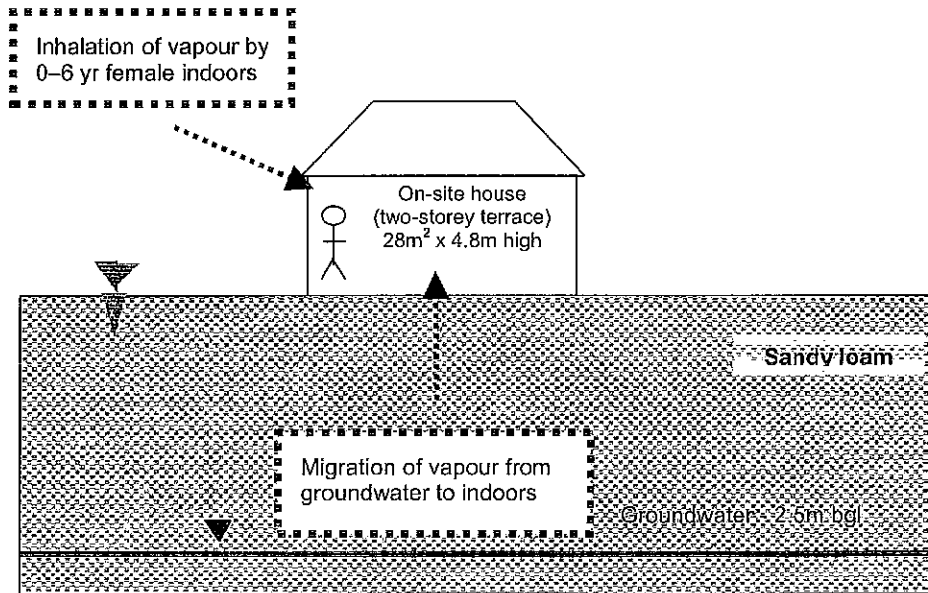
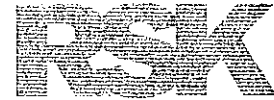
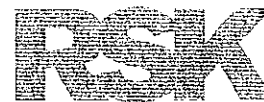


Table 6: Residential with private gardens – RBCA inputs

Parameter	Unit	Value	Justification
Receptor			
Averaging time	Years	6	From Box 3.1, SR3 ⁽³⁾
Receptor weight	kg	13.3	Average of CLEA 0–6 year old female data, Table 4.6, SR3 ⁽³⁾
Exposure duration	Years	6	From Box 3.1, report, SR3 ⁽³⁾
Exposure frequency	Days/yr	350	Weighted using occupancy period of 23 hours per day for 365 days of the year
Soil type – sandy loam			
Total porosity	-	0.53	CLEA value for sandy loam. Parameters for sandy loam from Table 4.4, SR3 ⁽³⁾
Volumetric water content	-	0.33	
Volumetric air content	-	0.20	
Dry bulk density	g cm ⁻³	1.21	
Vertical hydraulic conductivity	cm s ⁻¹	3.56E-3	CLEA value for saturated conductivity of sandy loam, Table 4.4, SR3 ⁽³⁾
Vapour permeability	m ²	3.05E-12	Calculated for sandy loam using equations in Appendix 1, SR3 ⁽³⁾
Capillary zone thickness	m	0.1	Professional judgement



Parameter	Unit	Value	Justification
Fraction organic carbon	%	(i) 0.0348	Representative of sandy loam according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽⁸⁾
		(ii) 0.0058	To provide SAC for sites where SOM < 6% as often observed by RSK
Building			
Building volume/area ratio	m	4.8	Table 3.3, SR3 ⁽³⁾
Foundation area	m ²	28	
Foundation perimeter	m	22	Calculated assuming building measures 7m x 4m to give 28m ² foundation area
Building air exchange rate	d ⁻¹	12	Table 3.3, SR3 ⁽³⁾
Depth to bottom of foundation slab	m	0.15	
Foundation thickness	m	0.15	
Foundation crack fraction	-	0.0151	Calculated from floor crack area of 423 cm ² and building footprint of 28m ² in Table 4.21, SR3 ⁽³⁾
Volumetric water content of cracks	-	0.33	Assumed equal to underlying soil type in assumption that cracks become filled with soil over time. Parameters for sandy loam from Table 4.4, SR3 ⁽³⁾
Volumetric air content of cracks	-	0.2	
Indoor/outdoor differential pressure	Pa	3.1	From Table 3.3, SR3 ⁽³⁾



References

1. Environment Agency (2009), 'Science Report SC050021/benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, mercury SGV, selenium SGV, nickel SGV, arsenic SGV, cadmium SGV, phenol SGV, dioxins, furans and dioxin like PCBs SGVs', 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin- like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin- like PCBs', March 2009, May 2009 and September 2009.
2. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2*, January (Bristol: Environment Agency).
3. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).
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5. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).
6. Chartered Institute for Environmental Health and Land Quality Management (2009), 'The LQM/CIEH Generic Assessment Criteria for Human Health', second edition.
7. CL:AIRE (2009), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).
8. Changes made to the CLEA framework documents after the three-month evaluation period in 2008, released January 2009 by the Environment Agency.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS

Table 7
Human Health Generic Assessment Criteria by Pathway for Residential Scenario - Private Gardens

Compound	Notes	GrAC (mg/l)	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)			SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)			Soil Saturation Limit (mg/kg)
			Oral	Inhalation	Combined	Oral	Inhalation	Combined	Oral	Inhalation	Combined	Oral	Inhalation	Combined	
Metals															
Arsenic	(b)(6)	-	1.32E-01	1.85E-02	-	NR	NR	NR	1.32E-01	1.85E-02	-	NR	NR	NR	
Cadmium	(b)	-	1.42E-01	1.85E-02	-	NR	NR	NR	1.42E-01	1.85E-02	-	NR	NR	NR	
Chromium (III) - oxide	(b)	-	1.84E-04	3.95E-03	1.28E-03	NR	NR	NR	1.84E-04	3.95E-03	1.28E-03	NR	NR	NR	
Chromium (VI) - hexavalent	(b)	-	1.02E-01	4.25E-03	5.21E-03	NR	NR	NR	1.02E-01	4.25E-03	5.21E-03	NR	NR	NR	
Copper	(b)	-	1.02E-01	1.04E-03	1.23E-03	NR	NR	NR	1.02E-01	1.04E-03	1.23E-03	NR	NR	NR	
Lead	(a)	-	3.00E-02	-	-	NR	NR	NR	3.00E-02	-	-	NR	NR	NR	
Elemental Mercury (Hg ⁰)	(b)(6)	9.40E-03	-	1.70E-03	-	-	4.31E-00	NR	-	1.70E-03	-	-	2.50E-01	NR	
Inorganic Mercury (Hg ²⁺)	(b)	-	1.18E-02	2.55E-03	1.74E-02	NR	NR	NR	1.18E-02	2.55E-03	1.74E-02	NR	NR	NR	
Methyl Mercury (Hg ⁺)	(b)	2.00E-01	1.18E-02	1.59E-01	1.74E-02	7.33E-01	7.33E-01	7.33E-01	1.18E-02	1.59E-01	1.74E-02	1.42E-02	NR	NR	
Nickel	(b)(6)	-	1.53E-02	1.27E-02	-	NR	NR	NR	1.53E-02	1.27E-02	-	NR	NR	NR	
Selenium	(b)(6)	-	1.34E-02	-	-	NR	NR	NR	1.34E-02	-	-	NR	NR	NR	
Zinc	(c)	-	1.37E-03	1.25E-07	-	NR	NR	NR	1.37E-03	1.25E-07	-	NR	NR	NR	
Cyanide	(c)	-	1.66E-01	1.37E-01	1.36E-01	NR	NR	NR	1.66E-01	1.37E-01	1.36E-01	NR	NR	NR	
Volatile Organic Compounds															
Benzene	(b)	7.20E-03	1.12E-01	2.69E-03	7.99E-02	1.22E-03	2.69E-03	1.22E-03	1.12E-01	2.69E-03	7.99E-02	2.28E-03	2.69E-03	4.71E-03	
Toluene	(b)	1.90E-03	1.42E-02	1.56E-02	1.19E-02	8.80E-02	1.56E-02	1.19E-02	1.42E-02	1.56E-02	1.19E-02	1.52E-03	1.56E-02	4.30E-03	
Ethylbenzene	(b)	2.60E-02	1.46E-02	1.70E-02	1.52E-02	5.18E-02	1.70E-02	1.52E-02	2.91E-02	1.70E-02	1.52E-02	1.22E-03	1.70E-02	2.84E-03	
Xylene - m	(b)	8.40E-01	1.20E-02	1.36E-01	1.43E-01	5.28E-02	1.36E-01	1.43E-01	4.30E-02	1.36E-01	1.43E-01	1.47E-03	1.36E-01	3.48E-03	
Xylene - o	(b)	1.00E-02	1.15E-02	1.50E-01	1.63E-01	4.78E-02	1.50E-01	1.63E-01	4.30E-02	1.50E-01	1.63E-01	1.12E-03	1.50E-01	2.52E-03	
Xylene - p	(b)	8.70E-01	1.19E-02	1.54E-01	1.61E-01	5.76E-02	1.54E-01	1.61E-01	4.30E-02	1.54E-01	1.61E-01	1.35E-03	1.54E-01	3.17E-03	
Total xylene	(b)	8.40E-01	1.20E-02	1.36E-01	1.43E-01	5.28E-02	1.36E-01	1.43E-01	4.30E-02	1.36E-01	1.43E-01	1.47E-03	1.36E-01	3.48E-03	
Methyl Ethyl ether	(b)	2.20E-03	1.42E-02	1.56E-02	1.19E-02	1.59E-04	1.56E-02	1.19E-02	2.16E-04	1.56E-02	1.19E-02	2.16E-04	1.56E-02	3.34E-04	
Trichloroethene	(b)	1.80E-03	1.28E-02	1.44E-02	1.08E-02	1.54E-03	1.44E-02	1.08E-02	2.16E-04	1.44E-02	1.08E-02	1.47E-03	1.44E-02	7.14E-03	
Tetrachloroethene	(b)	3.60E-03	1.28E-02	1.44E-02	1.08E-02	4.24E-02	1.44E-02	1.08E-02	9.51E-02	1.44E-02	1.08E-02	1.47E-03	1.44E-02	2.18E-03	
1,1,1-Trichloroethane	(b)	1.10E-01	1.32E-02	1.83E-03	1.52E-03	1.43E-03	1.83E-03	1.52E-03	2.92E-03	1.83E-03	1.52E-03	2.92E-03	1.83E-03	6.39E-03	
1,1,1,2-Tetrachloroethane	(b)	1.40E-01	1.19E-02	1.68E-03	1.37E-03	2.60E-03	1.68E-03	1.37E-03	6.02E-03	1.68E-03	1.37E-03	6.02E-03	1.68E-03	1.40E-04	
1,1,2,2-Tetrachloroethane	(b)	1.40E-01	1.19E-02	1.68E-03	1.37E-03	2.60E-03	1.68E-03	1.37E-03	6.02E-03	1.68E-03	1.37E-03	6.02E-03	1.68E-03	1.40E-04	
Carbon Tetrachloride	(b)	5.00E-02	1.05E-02	1.41E-02	1.03E-02	1.52E-03	1.41E-02	1.03E-02	3.32E-03	1.41E-02	1.03E-02	3.32E-03	1.41E-02	1.20E-04	
1,2-Dichloroethane	(b)	3.00E-01	1.10E-02	1.64E-03	1.34E-03	3.41E-03	1.64E-03	1.34E-03	4.91E-03	1.64E-03	1.34E-03	4.91E-03	1.64E-03	7.54E-03	
Vinyl Chloride	(b)	1.80E-02	1.16E-02	1.53E-04	1.73E-04	1.36E-03	1.53E-04	1.73E-04	1.76E-03	1.53E-04	1.73E-04	1.76E-03	1.53E-04	2.69E-03	
1,2,4-Trimethylbenzene	(b)	7.00E-02	1.35E-01	1.48E-01	1.45E-01	5.57E-02	1.48E-01	1.45E-01	1.38E-03	1.48E-01	1.45E-01	1.38E-03	1.48E-01	3.29E-03	
1,3,5-Trimethylbenzene	(b)	4.70E-02	1.45E-01	1.48E-01	1.45E-01	9.47E-01	1.48E-01	1.45E-01	2.28E-02	1.48E-01	1.45E-01	2.28E-02	1.48E-01	5.33E-02	
Semi-Volatile Organic Compounds															
Acenaphthene	(b)	3.20E-03	1.21E-02	3.45E-03	2.05E-02	5.70E-01	3.45E-03	2.05E-02	1.41E-02	3.45E-03	2.05E-02	1.41E-02	3.45E-03	3.38E-02	
Acenaphthylene	(b)	4.20E-03	1.78E-02	3.27E-03	1.69E-02	8.61E-01	3.27E-03	1.69E-02	2.12E-02	3.27E-03	1.69E-02	2.12E-02	3.27E-03	5.08E-02	
Anthracene	(b)	2.30E-03	2.14E-03	1.08E-05	2.26E-03	1.17E-00	1.08E-05	2.26E-03	2.91E-00	1.08E-05	2.26E-03	2.91E-00	1.08E-05	6.90E-00	
Benzo(a)anthracene	(b)	3.30E-03	7.00E-04	5.55E-07	3.10E-06	1.71E-00	5.55E-07	3.10E-06	4.28E-00	5.55E-07	3.10E-06	4.28E-00	5.55E-07	1.02E-01	
Benzo(b)fluoranthene	(b)	2.70E-03	8.06E-04	1.78E-01	5.66E-00	1.22E-00	1.78E-01	5.66E-00	3.04E-00	1.78E-01	5.66E-00	3.04E-00	1.78E-01	7.28E-00	
Benzo(k)fluoranthene	(b)	2.80E-04	6.68E-01	1.27E-02	4.39E-01	1.54E-02	1.27E-02	4.39E-01	3.80E-02	1.27E-02	4.39E-01	3.80E-02	1.27E-02	9.23E-02	
Benzo(g)huanthene	(b)	3.00E-04	1.28E-01	2.86E-01	8.51E-00	6.97E-01	2.86E-01	8.51E-00	1.72E-00	2.86E-01	8.51E-00	1.72E-00	2.86E-01	4.12E-00	
Chrysene	(b)	2.00E-03	1.78E-03	8.76E-03	5.00E-00	4.49E-01	8.76E-03	5.00E-00	1.10E-00	8.76E-03	5.00E-00	1.10E-00	8.76E-03	2.64E-00	
Fluorene	(b)	2.00E-04	1.19E-03	2.13E-00	7.82E-01	3.95E-03	2.13E-00	7.82E-01	9.82E-03	2.13E-00	7.82E-01	9.82E-03	2.13E-00	2.38E-02	
Fluoranthene	(b)	2.30E-04	1.70E-02	2.89E-04	1.63E-02	1.89E-01	1.70E-02	1.63E-02	6.74E-01	1.70E-02	1.63E-02	6.74E-01	1.70E-02	1.13E-02	
Fluorene	(b)	1.90E-01	1.70E-02	4.35E-03	1.63E-02	3.09E-01	1.63E-02	3.09E-01	7.68E-01	1.63E-02	3.09E-01	7.68E-01	1.63E-02	1.83E-02	
Indeno(1,2,3-cd)pyrene	(b)	2.00E-04	4.58E-01	1.04E-01	3.18E-00	8.13E-02	1.04E-01	3.18E-00	7.68E-01	1.04E-01	3.18E-00	7.68E-01	1.04E-01	3.68E-01	
Phenanthrene	(b)	5.00E-01	9.35E-01	5.04E-03	9.18E-01	3.60E-01	5.04E-03	9.18E-01	1.50E-01	5.04E-03	9.18E-01	1.50E-01	5.04E-03	3.68E-01	
Pyrene	(b)	3.0E-01	5.69E-02	6.18E-04	5.63E-02	2.20E-00	6.18E-04	5.63E-02	5.49E-00	6.18E-04	5.63E-02	5.49E-00	6.18E-04	1.32E-01	
Benzo(a)pyrene	(b)	3.0E-03	1.21E-00	2.92E-03	1.92E-03	9.11E-01	2.92E-03	1.92E-03	2.28E-00	2.92E-03	1.92E-03	2.28E-00	2.92E-03	5.40E-00	
Naphthalene	(b)	1.30E-04	1.12E-01	1.44E-00	1.54E-03	7.64E-01	1.44E-00	1.54E-03	1.33E-02	1.44E-00	1.54E-03	1.33E-02	1.44E-00	4.32E-02	
Phenol	(b)	-	1.45E-02	1.31E-02	1.14E-02	4.18E-04	1.31E-02	1.14E-02	8.13E-04	1.31E-02	1.14E-02	8.13E-04	1.31E-02	1.74E-05	

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS

Table 7
Human Health Generic Assessment Criteria by Pathway for Residential Scenario - Private Gardens

Compound	Notes	GrAC (mg/l)	SAC Appropriate to Pathway SOM 1% (mg/kg)		Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.6% (mg/kg)		Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)		Soil Saturation Limit (mg/kg)		
			Oral	Inhalation		Combined	Oral		Inhalation	Combined		Oral	Inhalation
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons >EC ₁₅ -EC ₃		1.00E+01	4.73E+03	12.38E+01	2.97E+01	3.04E+02	1.08E+04	1.15E+01	1.15E+01	5.58E+02	2.35E+04	1.11E+02	1.15E+03
Aliphatic hydrocarbons >EC ₉ -EC ₃		5.00E+00	4.43E+04	7.27E+01	1.02E+01	1.44E+02	3.27E+04	1.67E+01	1.67E+01	3.23E+02	8.38E+04	1.37E+02	7.38E+02
Aliphatic hydrocarbons >EC ₃ -EC ₀		2.30E+01	1.46E+03	1.11E+01	1.88E+01	7.77E+01	2.44E+03	1.46E+01	1.46E+01	1.90E+02	3.35E+03	1.09E+02	4.51E+02
Aliphatic hydrocarbons >EC ₀ -EC ₀		3.40E+00	1.52E+03	9.94E+01	9.28E+01	4.79E+01	4.01E+03	2.32E+02	2.32E+02	1.18E+02	4.44E+03	5.57E+02	2.83E+02
Aliphatic hydrocarbons >EC ₁₅ -EC ₀		1.70E+04	4.07E+03	7.02E+02	7.44E+02	2.37E+01	4.40E+03	1.95E+03	1.95E+03	5.91E+01	4.41E+03	4.68E+03	1.42E+00
Aliphatic hydrocarbons >EC ₁₅ -EC ₄	(c)	-	4.51E+04	-	-	8.49E+00	6.38E+04	-	-	2.12E+01	7.61E+04	-	5.09E+01
Aliphatic hydrocarbons >EC ₁₅ -EC ₄	(c)	-	4.51E+04	-	-	8.49E+00	6.38E+04	-	-	2.12E+01	7.61E+04	-	5.09E+01
Aromatic hydrocarbons >EC ₁₅ -EC ₄ (styrene)		7.40E+00	1.16E+02	2.55E+02	1.13E+02	6.20E+02	3.92E+02	1.67E+02	1.67E+02	1.52E+03	8.50E+02	1.19E+02	3.61E+03
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀		7.40E+00	1.16E+02	2.55E+02	1.13E+02	6.20E+02	3.92E+02	1.67E+02	1.67E+02	1.52E+03	8.50E+02	1.19E+02	3.61E+03
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀		2.50E+01	1.79E+01	1.32E+02	1.32E+02	6.13E+02	1.31E+02	1.16E+01	1.16E+01	1.50E+03	2.84E+02	1.15E+02	3.68E+02
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀		5.00E+00	1.14E+02	1.32E+02	1.32E+02	3.64E+02	1.88E+02	1.48E+02	1.48E+02	8.99E+02	2.87E+02	1.10E+02	2.18E+03
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀	(c)	-	1.247E+02	2.00E+03	3.86E+02	1.99E+02	3.13E+02	4.96E+03	4.96E+03	4.19E+02	1.60E+02	1.18E+04	1.00E+03
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀	(c)	-	2.47E+02	-	-	5.37E+01	4.82E+02	-	-	1.34E+02	7.66E+02	-	3.21E+02
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀	(c)	-	8.89E+02	-	-	4.83E+00	4.11E+03	-	-	1.21E+01	1.22E+03	-	2.90E+01
Aromatic hydrocarbons >EC ₁₅ -EC ₁₀	(c)	-	8.89E+02	-	-	4.83E+00	4.11E+03	-	-	1.21E+01	1.22E+03	-	2.90E+01

Notes:

- (*) Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.
 NR - the compound is not volatile and therefore a soil saturation limit not calculated within CLEA
 EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances since the contribution of the indoor and outdoor vapour pathway to total exposure is >10%. This shading has also been used for the RBCA output where the theoretical solubility limit has been exceeded. The SAC has been set as the model calculated SAC with the saturation limits shown in brackets.
Calculated SAC exceeds soil saturation limit but will not affect the SSV significantly since the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
Calculated SAC does not exceed the soil saturation limit.

For consistency where the theoretical solubility limit within RBCA has been exceeded in production of the GRAC, these cells have also been hatched red.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.
 SAC for TPH fractions, polycyclic aromatic hydrocarbons, MTBE, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3

- (a) Sensitivity analysis undertaken on SECH equation and CLEA model, considered reasonable in absence of UK specific data
 (b) GRAC taken from the Environment Agency SGV reports published 2009.
 (c) SAC for selenium, aliphatic and aromatic hydrocarbons >EC15 does not include inhalation pathway owing to absence of toxicity data. SAC for arsenic is only based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The same approach has been adopted for zinc.
 (d) SAC for elemental mercury, chromium VI and nickel is based on the inhalation pathway only owing to an absence of toxicity for elemental mercury, in accordance with the SGV report for nickel and LQM report for chromium VI.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS



Table 8
Human Health Generic Assessment Criteria for Residential Scenario - Private Gardens

Compound	GrAC for Groundwater (mg/l)	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals				
Arsenic	-	32	32	32
Cadmium	-	10	10	10
Chromium (III) - oxide	-	3,000	3,000	3,000
Chromium (VI) - hexavalent	-	4.3	4.3	4.3
Copper	-	2,300	2,300	2,300
Lead	-	300	300	300
Elemental Mercury (Hg ⁰)	0.009	0.17	0.42	1.0
Inorganic Mercury (Hg ²⁺)	-	170	170	170
Methyl Mercury (Hg ⁴⁺)	20	7.4	9.6	11
Nickel	-	130	130	130
Selenium	-	350	350	350
Zinc	-	3,800	3,800	3,800
Cyanide	-	3.7	3.7	3.7
Volatile Organic Compounds				
Benzene	7	0.079	0.157	0.33
Toluene	1,900	120	270	610
Ethylbenzene	260	65	154	350
Xylene - m	100	44	103	240
Xylene - o	87	45	106	250
Xylene - p	84	42	98	230
Total xylene	84	44	103	240
Methyl tertiary butyl ether (MTBE)	2,200	1.8	3.7	7.4
Trichloroethene	1.8	0.11	0.2	0.49
Tetrachloroethene	3.6	0.94	2.1	4.6
1,1,1-Trichloroethane	26	6.2	12.7	28
1,1,1,2-Tetrachloroethane	14	0.89	2.1	4.8
1,1,2,2-Tetrachloroethane	14	1.4	2.87	6.3
Carbon Tetrachloride	0.056	0.018	0.039	0.089
1,2-Dichloroethane	0.30	0.0053	0.0080	0.014
Vinyl Chloride	0.019	0.00047	0.0006	0.001
1,2,4-Trimethylbenzene	0.075	0.35	0.85	2.1
1,3,5-Trimethylbenzene	0.047	0.46	1.1	2.5
Semi-Volatile Organic Compounds				
Acenaphthene	3.2	210	480	1,000
Acenaphthylene	4.2	170	400	850
Anthracene	0.0021	2,300	4,900	9,200
Benzo(a)anthracene	0.0038	3.1	4.7	5.9
Benzo(b)fluoranthene	0.0020	5.6	6.5	7.0
Benzo(g,h,i)perylene	0.00026	44	46	47
Benzo(k)fluoranthene	0.00080	8.5	9.6	10
Chrysene	0.0020	6.0	8.0	9.3
Dibenz(a,h)anthracene	0.00060	0.76	0.86	0.90
Fluoranthene	0.23	260	460	670
Fluorene	1.9	160	380	780
Indeno(1,2,3-cd)pyrene	0.0002	3.2	3.8	4.2
Phenanthrene	0.53	92	200	380
Pyrene	0.13	580	1,000	1,600
Benzo(a)pyrene	0.0035	0.83	0.94	1.0
Naphthalene	19	1.5	3.7	8.7
Phenol	-	180	290	420
Total Petroleum Hydrocarbons				
Aliphatic hydrocarbons EC ₅ -EC ₆	10	30	55	110
Aliphatic hydrocarbons > EC ₇ -EC ₉	5.4	73	160	370
Aliphatic hydrocarbons > EC ₁₀ -EC ₁₀	0.23	19	46	110
Aliphatic hydrocarbons > EC ₁₁ -EC ₁₂	0.034	93 (48)	230 (118)	540 (283)
Aliphatic hydrocarbons > EC ₁₃ -EC ₁₅	0.00076	744 (24)	1,700 (59)	3,000 (142)
Aliphatic hydrocarbons > EC ₁₆ -EC ₃₅	-	45,100 (8.48)	64,000 (21)	76,000
Aliphatic hydrocarbons > EC ₃₅ -EC ₄₄	-	45,100 (8.48)	64,000 (21)	76,000
Aromatic hydrocarbons > EC ₈ -EC ₉ (styrene)	7.4	130	316	700
Aromatic hydrocarbons > EC ₉ -EC ₁₀	7.4	27	65	150
Aromatic hydrocarbons > EC ₁₀ -EC ₁₂	25	69	160	346
Aromatic hydrocarbons > EC ₁₂ -EC ₁₅	5.6	140	310	593
Aromatic hydrocarbons > EC ₁₅ -EC ₂₁	-	250	480	770
Aromatic hydrocarbons > EC ₂₁ -EC ₃₅	-	890	1,100	1,230
Aromatic hydrocarbons > EC ₃₅ -EC ₄₄	-	890	1,100	1,230

Notes:

- Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

EC - equivalent carbon, GrAC - groundwater assessment criteria, SAC - soil assessment criteria.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, polycyclic aromatic hydrocarbons, MTBE, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SFG.

The SAC has been set as the model calculated SAC with the saturation limit shown in brackets.
For consistency where the GrAC exceeds the solubility limit, GrAC has been set at the solubility limit. The GrAC is conservative since concentrations of the chemical are very unlikely to be at sufficient concentration to result in an exceedance of the health criteria value at the point of exposure (i.e. indoor air) provided free-phase product is absent.

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS



This appendix presents the generic assessment criteria (GAC) that RSK considers are suitable for assessing risks to vegetation via the uptake of phytotoxic determinants through plant roots

Copper and zinc can inhibit plant growth but are not normally hazardous to human health. The GAC for this pollutant linkage have been taken from Department of the Environment (1996) publication, *Code of Practice for Agricultural Use of Sewage Sludge*. The GAC for the phytotoxic determinants are presented in Table A1. The table also includes nickel as this is also phytotoxic. Please note that the human health GAC's may not be suitably protective of the phytotoxic effects pathway depending on the soil pH.

Generic assessment criteria for phytotoxic determinants

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH > 7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110

UKWIR Guidelines

A range of pipe materials are available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the *Water Supply (Water Fittings) Regulations 1999* in England and Wales, the *Byelaws 2000* in Scotland and the *Northern Ireland Water Regulations*. The regulations include a requirement to use only suitable materials when laying water pipes, and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to potable water supply by permeating plastic water supply pipes. To fulfil their statutory obligations, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that a remedial strategy is proposed that will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or in specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies.

The focus of the UKWIR project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was also to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipes failing prematurely due to the presence of contamination.

Report 10/WM/03/21 concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for PE and PVC pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

Risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GACs for this linkage and are reproduced in the table on the following page.

Since water supply pipes are typically laid at a minimum depth of 750mm below finished ground levels, sample results from depths between 0.5m and 1.5m below finished ground level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used provided that they are considered representative of the strata within those depths. Report 10/WM/03/21 also specifies that sampling should characterise the ground conditions to a minimum of 0.5m below the proposed depth of the pipe and to 15m either side of it.

It should be noted that the assessment provided in this report is a guide only and the method of assessment and recommendations should be checked with the relevant water supply company.

Where a water main and/or service pipe is to be laid close to fuel or chemical storage tanks (e.g. petrol filling stations) then the local water company may require the pipe materials laid within a designated distance of the facility to take account of future contamination risk.

Generic assessment criteria (GAC) for water supply pipes

		Pipe material	
		GAC (mg/kg)	
	Parameter group	PE	PVC
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC	0.5#	0.125#
1a	• BTEX + MTBE	0.1	0.03
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C ₅ -C ₁₀)	2##	1.4##
2e	• Phenols	2	0.4
2f	• Cresols and chlorinated phenols	2	0.04
3	Mineral oil C ₁₁ -C ₂₀	10	Suitable
4	Mineral oil C ₂₁ -C ₄₀	500	Suitable
5	Corrosive (conductivity, redox and pH)	Suitable	Suitable
Further parameters identified as relevant following site investigation			
2a	Ethers	0.5	1
2b	Nitrobenzene	0.5	0.4
2c	Ketones	0.5	0.02
2d	Aldehydes	0.5	0.02
6	Amines	Not suitable	Suitable

Notes: where indicated as 'suitable', the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR.

#: Total VOC result minus BTEX and MTBE results

##: Total SVOC result minus total phenols/cresols/chlorinated phenols results

Risk Assessment Methodology

Risk is a combination of the 'likelihood' of an event occurring and the magnitude of its 'consequences'. Therefore, in order to assess risk, both the likelihood and the consequences of an event must be taken into account. RSK Group Plc has adopted guidance provided in CIRIA C552 for use in the production of risk assessments.

The likelihood of an event can be classified on a four point system using the following terms and definitions based on CIRIA C552:

Highly likely: The event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution;

Likely: It is probable that an event will occur, or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term;

Low likelihood: Circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term;

Unlikely: Circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

Severe: Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);

Medium: Chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);

Mild: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment; and

Minor: Harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned the table below.

RISK CLASSIFICATION SYSTEM (CIRIA 552)					
		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

APPENDIX G

(i) Gas/Groundwater Monitoring Results

IN-SITU GAS MONITORING RESULTS

[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	-	Falling	1030	1030	Dipmeter + GA2000 + Weather: Fine. + Ground: Damp + Wind: None
Round 2	Rising	Constant	1024	1024	Dipmeter + GA2000 + Weather: Fine. + Ground: Dry + Wind: Light
Round 3	Falling	Constant	1007	1007	Dipmeter + GA2000 + Weather: Fine. + Ground: Dry + Wind: Strong

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Drilled Depth (mbgl)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)
WS1	1	40	1	---	3.85	0.80 to 3.80	12/03/2012 14:20:00	1030	1030	0.0 ₀	2.20	-	-	-	-
WS1	1	40	1	---	---	0.80 to 3.80	30 secs	-	-	0.0 _{SS}	-	-	-	-	-
WS1	1	40	1	---	---	0.80 to 3.80	60 secs	-	-	-	-	0.1	0.0	19.9	-
WS1	1	40	1	---	---	0.80 to 3.80	15 secs	-	-	-	-	1.0	0.0	19.0	-
WS1	1	40	1	---	---	0.80 to 3.80	30 secs	-	-	-	-	1.3	0.0	18.6	-
WS1	1	40	1	---	---	0.80 to 3.80	60 secs	-	-	-	-	1.6	0.0	18.1	-
WS1	1	40	1	---	---	0.80 to 3.80	90 secs	-	-	-	-	1.7	0.0	17.9	-
WS1	1	40	1	---	---	0.80 to 3.80	120 secs	-	-	-	-	1.9	0.0	17.6	-
WS1	1	40	2	---	3.85	0.80 to 3.80	22/03/2012 10:30:00	1024	1024	0.0 ₀	2.25	-	-	-	-
WS1	1	40	2	---	---	0.80 to 3.80	30 secs	-	-	0.0 _{SS}	-	-	-	-	-
WS1	1	40	2	---	---	0.80 to 3.80	60 secs	-	-	-	-	0.1	0.0	20.6	-
WS1	1	40	2	---	---	0.80 to 3.80	15 secs	-	-	-	-	1.5	0.0	19.5	-
WS1	1	40	2	---	---	0.80 to 3.80	30 secs	-	-	-	-	1.8	0.0	18.9	-
WS1	1	40	2	---	---	0.80 to 3.80	60 secs	-	-	-	-	2.4	0.0	18.3	-
WS1	1	40	2	---	---	0.80 to 3.80	90 secs	-	-	-	-	2.8	0.0	17.7	-
WS1	1	40	2	---	---	0.80 to 3.80	120 secs	-	-	-	-	3.3	0.0	17.2	-
WS1	1	40	2	---	---	0.80 to 3.80	180 secs	-	-	-	-	3.5	0.0	16.9	-
WS1	1	40	3	---	3.85	0.80 to 3.80	02/04/2012 11:52:00	1007	1007	0.0 ₀	2.30	-	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

 STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Contract: <i>[Signature]</i>	Corrupted By <i>[Signature]</i>	Date 03/04/12	Checked By AD	Date 4/4/12	Contract Ref: 726543
	Mary Rose House, Havant					

Page: 1 of 2

AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe diameter (mm)	Monitoring Round	Drilled Depth (mbgl)	Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% vol)	Methane (% vol)	Oxygen (% vol)	LEL (%)
WS1	1 40	3	---	---	0.80 to 3.80	30 secs	-	-	0.0 _(SS)	-	-	-	-	-
WS1	1 40	3	---	---	0.80 to 3.80	60 secs	-	-	-	-	0.0	0.0	20.5	0.0
WS1	1 40	3	---	---	0.80 to 3.80	15 secs	-	-	-	-	2.6	0.0	18.9	0.0
WS1	1 40	3	---	---	0.80 to 3.80	30 secs	-	-	-	-	3.4	0.0	17.7	0.0
WS1	1 40	3	---	---	0.80 to 3.80	60 secs	-	-	-	-	4.6	0.0	16.4	0.0
WS1	1 40	3	---	---	0.80 to 3.80	90 secs	-	-	-	-	5.7	0.0	15.2	0.0
WS1	1 40	3	---	---	0.80 to 3.80	120 secs	-	-	-	-	5.8	0.0	15.1	0.0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

 STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Compiled By 	Date 03/04/12	Checked By AD	Date 4/4/12.	Contract Ref: 726543
	Contract: Mary Rose House, Havant				Page: 2 of 2

APPENDIX H

- (i) GroundSure GeoInsight Report
- (ii) GroundSure EnviroInsight Report
- (iii) Historical Mapping

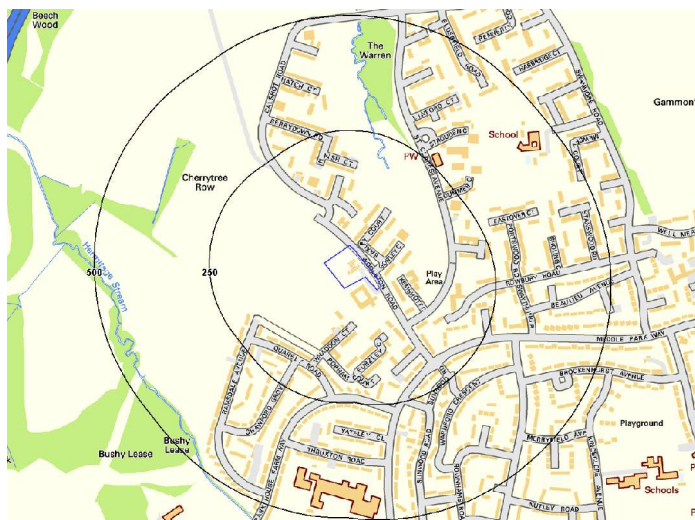
GroundSure GeoInsight

Address: Mary Rose House,Havant,PO9 4JN

Date: Feb 17, 2012

Report Reference: EMS-154229_223221

Your Reference: EMS_154229_223221



Brought to you by emapsite

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Aerial Photograph of Study Site



Site Name: Mary Rose House,Havant,PO9 4JN
Grid Reference: 470416,108787
Size of Site: 0.56 ha

Aerial photography supplied by Getmapping PLC.
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Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow Mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and GroundSure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary
1. Geology	Description
1.1 Artificial Ground,	
1.1.1 Is there any Artificial Ground /Made Ground present beneath the study site?*	No
1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary?	No
1.2 Superficial Geology & Landslips	
1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	No
1.2.2 Are there any records relating to permeability of superficial geology within the study site* boundary?	No
1.2.3 Are there any records of landslip within 500m of the study site boundary?	No
1.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No
1.3 Bedrock, Solid Geology & Faults	
1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
1.3.2 Are there any records relating to permeability of bedrock within the study site* boundary?	Yes
1.3.3 Are there any records of faults within 500m of the study site boundary?	No
1.3.4 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level
1.3.5 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary

* This includes an automatically generated 50m buffer zone around the site

Source:Scale 1:50,000 BGS Sheet No:316

2. Ground Workings	on-site	0-50	51-250	251-500	501-1000
2.1 Historical Surface Ground Working Features from Small Scale Mapping	0	1	2	-	-
2.2 Historical Underground Workings Features from Small Scale Mapping	0	0	0	0	0
2.3 Current Ground Workings	0	0	0	0	0

3. Mining, Extraction & Natural Cavities	on-site	0-50	51-250	251-500	501-1000
3.1 Historical Mining	0	0	0	0	0
3.2 Coal Mining	0	0	0	0	0
3.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
3.4 Non-Coal Mining*	0	0	0	0	0
3.5 Non-Coal Mining Cavities	0	0	0	0	0
3.6 Natural Cavities	0	0	0	0	0
3.7 Brine Extraction	0	0	0	0	0
3.8 Gypsum Extraction	0	0	0	0	0
3.9 Tin Mining	0	0	0	0	0
3.10 Clay Mining	0	0	0	0	0

*This includes an automatically generated 50m buffer zone around the site

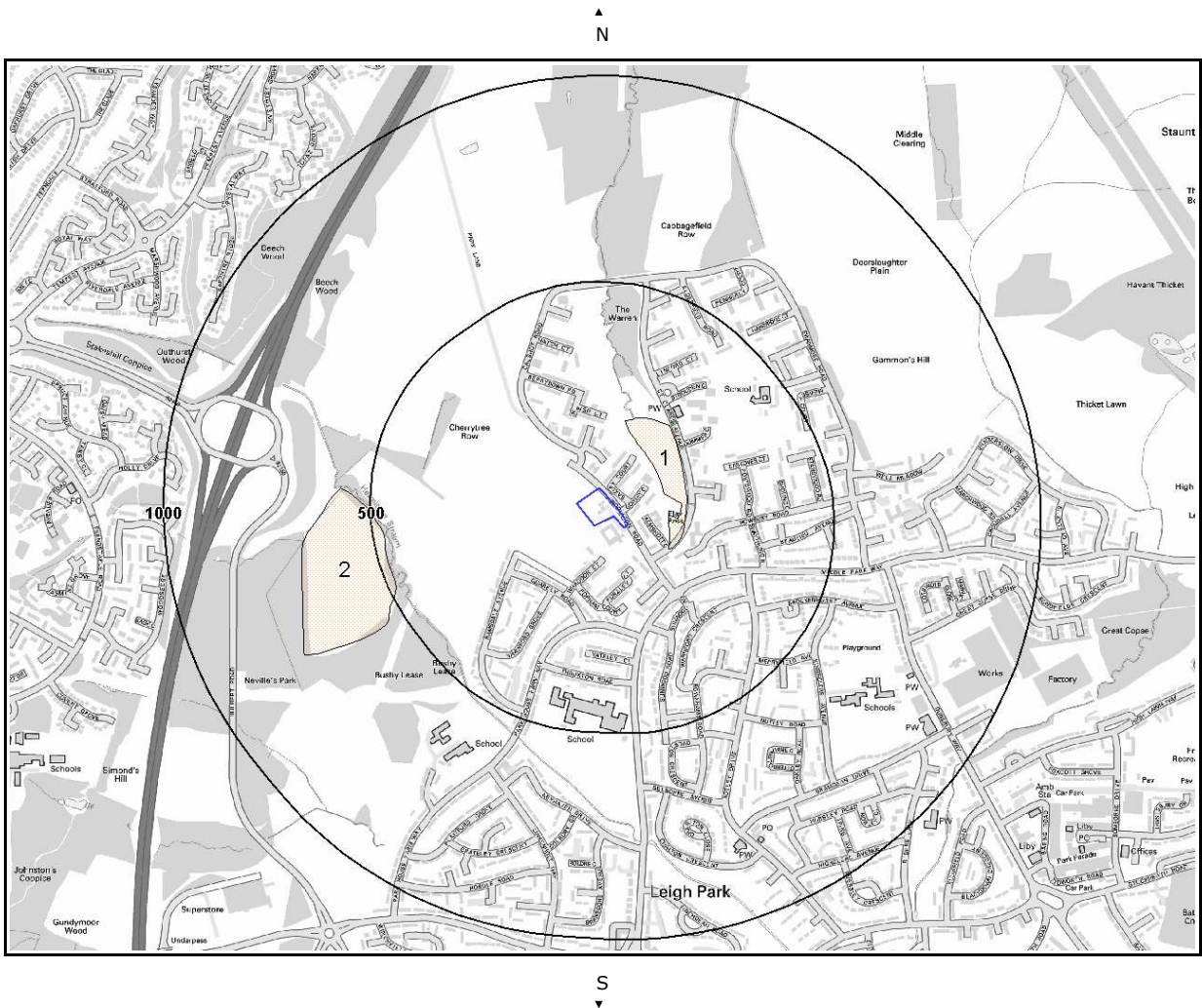
4. Natural Ground Subsidence	on-site*	0-50	51-250	251-500	501-1000
4.1 Shrink-Swell Clay	Negligible	-	-	-	-
4.2 Landslides	Very Low	-	-	-	-
4.3 Ground Dissolution of Soluble Rocks	Negligible	-	-	-	-
4.4 Compressible Deposits	Negligible	-	-	-	-
4.5 Collapsible Deposits	Very Low	-	-	-	-
4.6 Running Sand	Low	-	-	-	-

* This includes an automatically generated 50m buffer zone around the site

5. Borehole Records	on-site	0-50	51-250	251-500	501-1000
5.1 BGS Recorded Boreholes	0	0	0	-	-

6. Estimated Background Soil Chemistry	on-site	0-50	51-250	251-500	501-1000
6.1 Records of Background Soil Chemistry	1	0	0	-	-

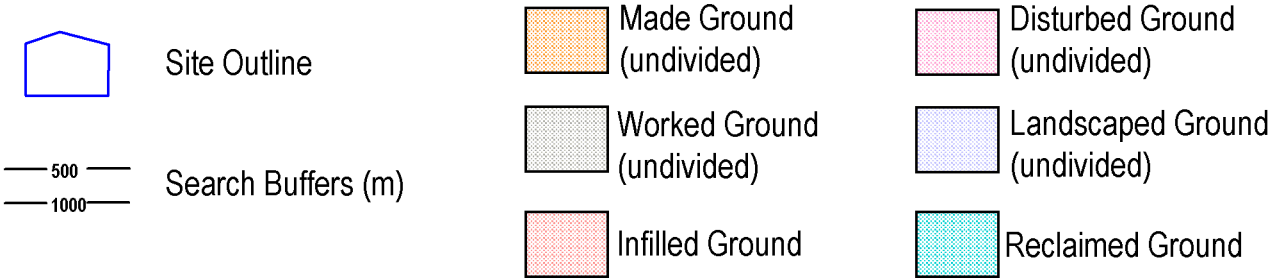
1.1 Artificial Ground Map



Artificial Ground Legend

Enabled by Ordnance Survey

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Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:316

1.1.1 Artificial/Made Ground

Are there any records of Artificial/Made Ground within 500m of the study site boundary? **Yes**

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	100.0	E	MGR-MGRD	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
2	474.0	W	MGR-MGRD	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

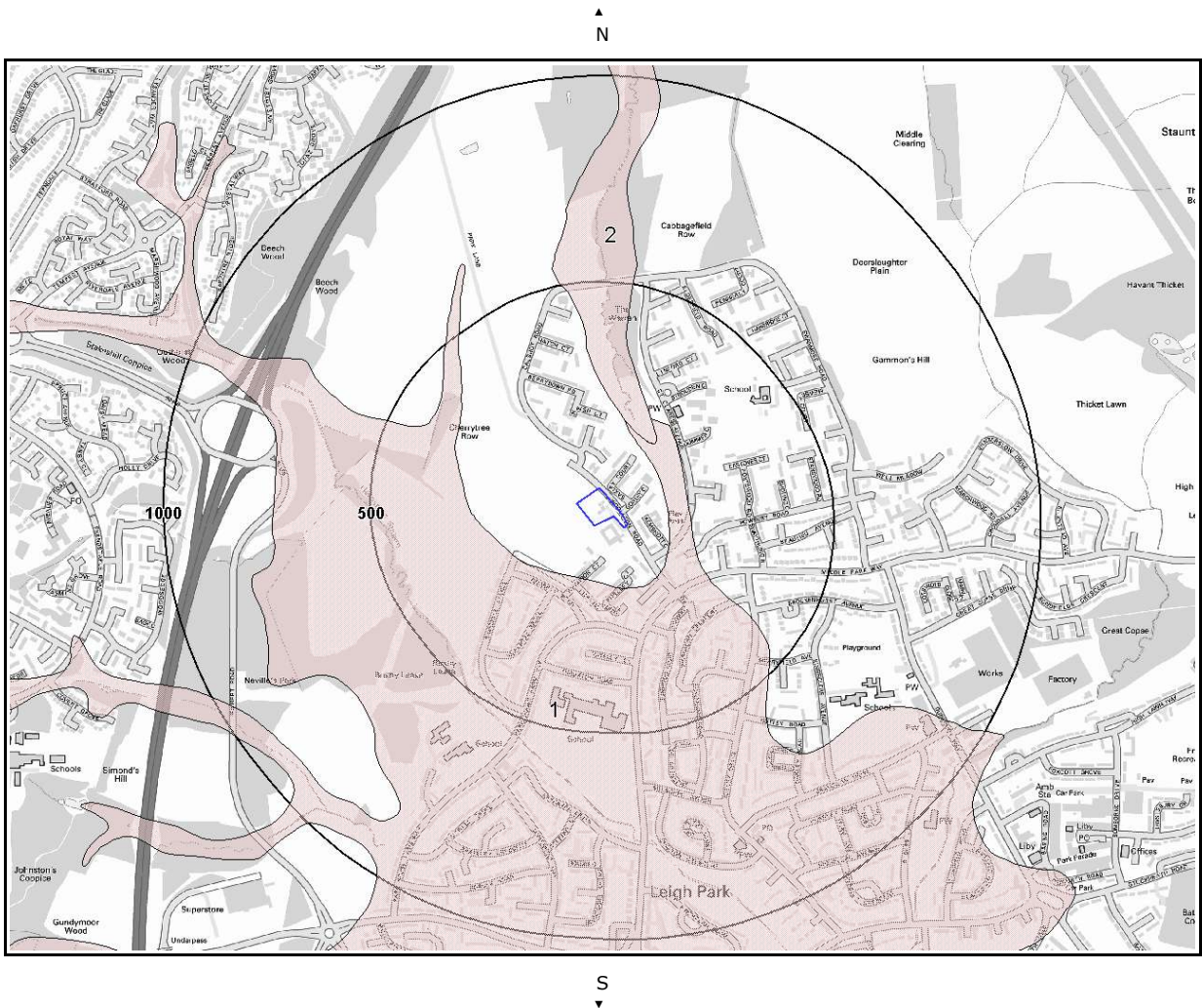
1.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site* boundary? **No**

Database searched and no data found.

* This includes an automatically generated 50m buffer zone around the site.

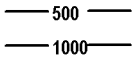
1.2 Superficial Deposits and Landslips Map



Superficial and Landslips Legend



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-  Site Outline
-  Search Buffers (m)
 - 500
 - 1000

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.2 Superficial Deposits and Landslips

1.2.1 Superficial Deposits/Drift Geology

Are there any records of Superficial Deposits/Drift Geology within 500m of the study site boundary? Yes

ID	Distance (m)	Direction	Lex Code	Description	Rock Description
1	100.0	E	HEAD-CSSG	HEAD	CLAY, SILT, SAND AND GRAVEL
2	159.0	NE	HEAD-CSSG	HEAD	CLAY, SILT, SAND AND GRAVEL

1.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site* boundary? No

Database searched and no data found.

1.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

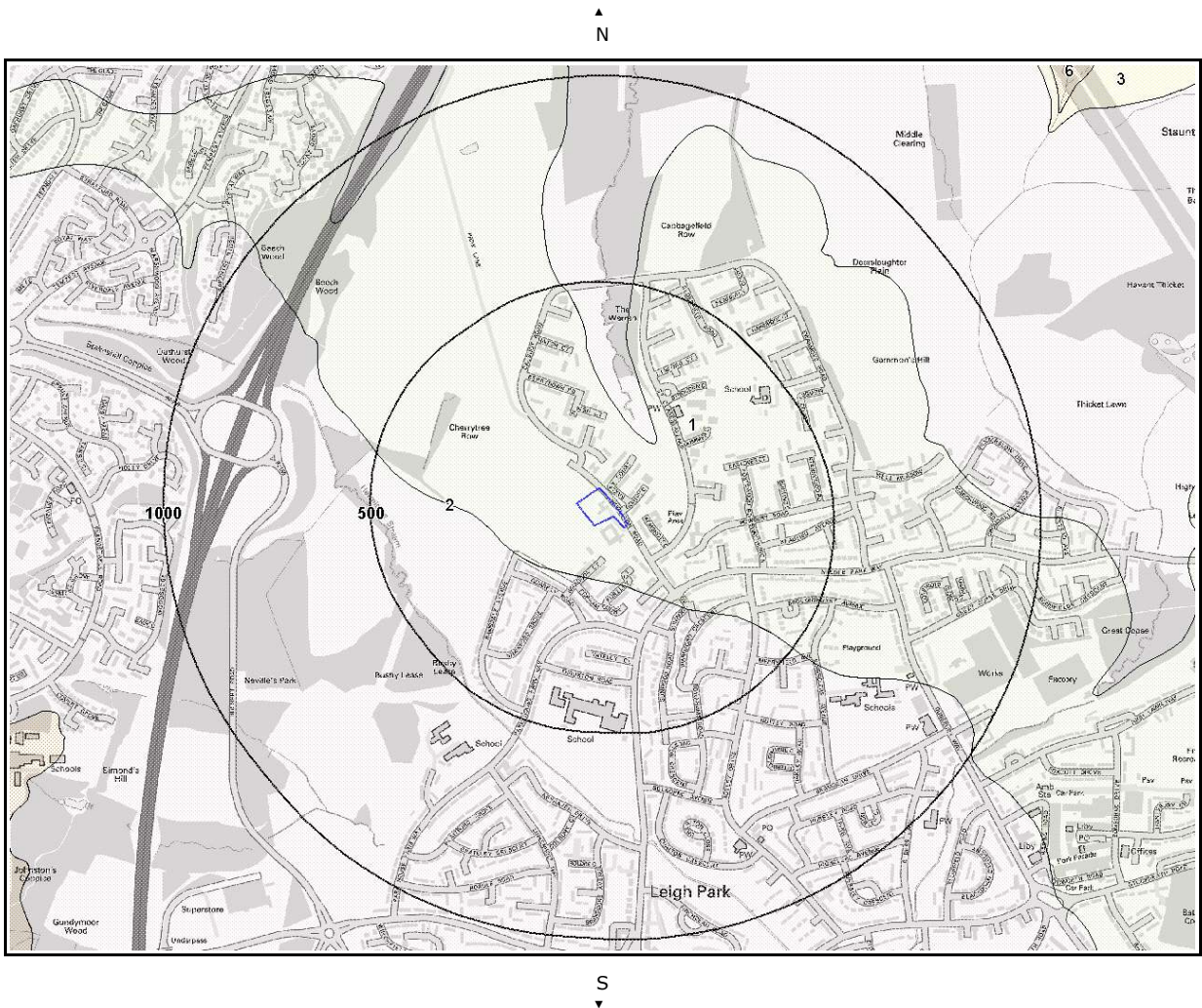
1.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site* boundary? No

Database searched and no data found.

*This includes an automatically generated 50m buffer zone around the site.

1.3 Bedrock and Faults Map



Bedrock & Faults Deposits Legend



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-  Site Outline
-  500
-  1000
- Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:316

1.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance (m)	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	BOSA-SAND	Bognor Sand Member - Sand	Eocene
2	127.0	S	LC-CLSS	London Clay Formation - Clay, Silt And Sand	Eocene

1.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site* boundary? **Yes**

Distance (m)	Direction	Flow type	Maximum Permeability	Minimum Permeability
0.0	On Site	Intergranular	High	High

1.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? **No**

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3.4 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?

The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level

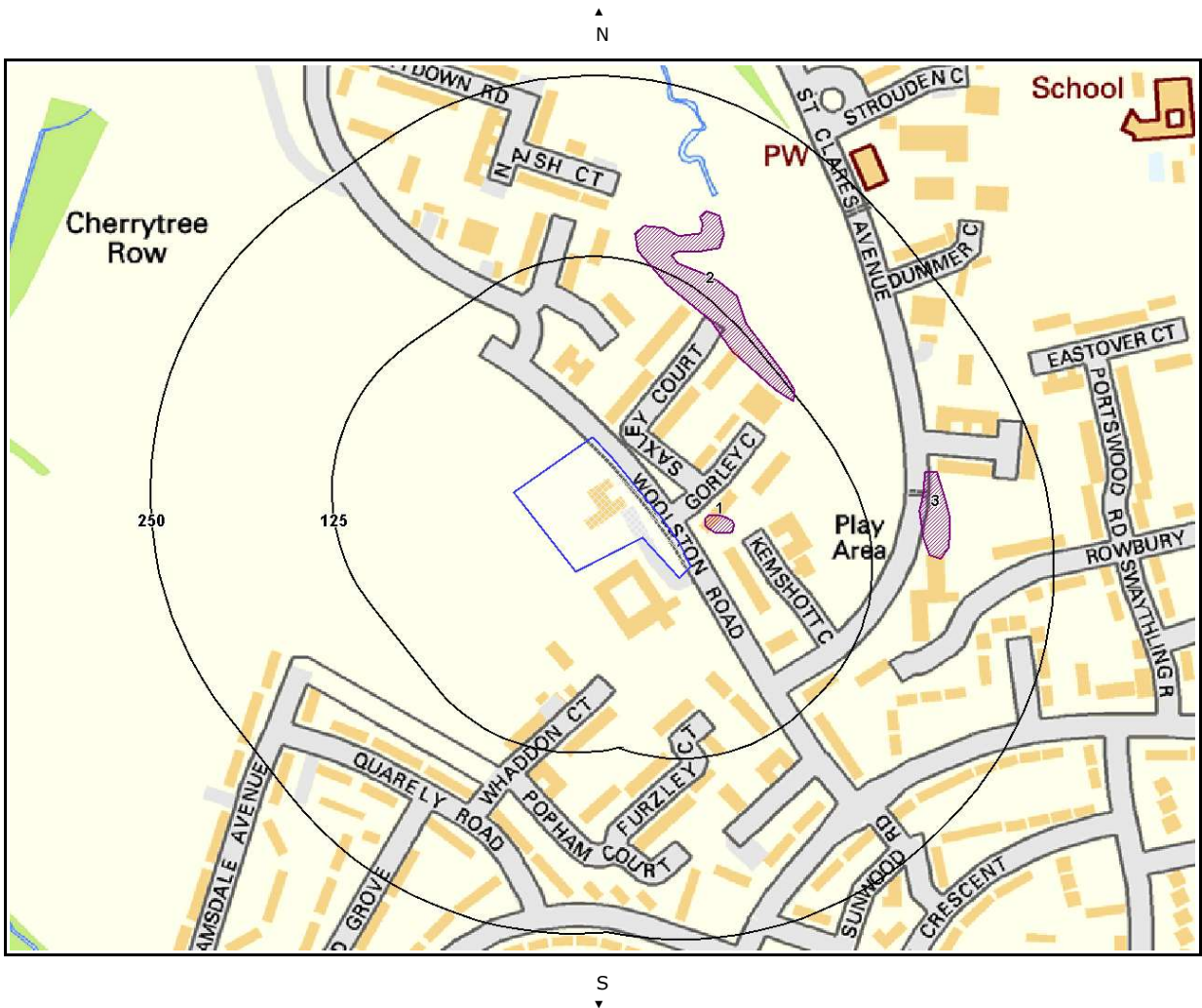
1.3.5 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?

No radon protective measures are necessary

* This includes an automatically generated 50m buffer zone around the site.

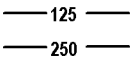
2. Ground Workings Map



Ground Workings Legend



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- | | | | |
|---|--------------------|---|----------------------------------|
|  | Site Outline |  | Historic Surface Ground Workings |
|  | Search Buffers (m) |  | Historic Underground Workings |
| | |  | Current Ground Workings |

2. Ground Workings

2.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on GroundSure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping.

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? **Yes**

The following Historical Surface Ground Working Features are provided by GroundSure:

ID	Distance (m)	Direction	NGR	Use	Date
1	22.0	NE	470501,108777	Pond	1930
2	110.0	NE	470498,108928	Unspecified Pit	1957
3	161.0	E	470649,108783	Pond	1957

2.2 Historical Underground Workings Features derived from Historical Mapping

This data is derived from the GroundSure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? **No**

Database searched and no data found.

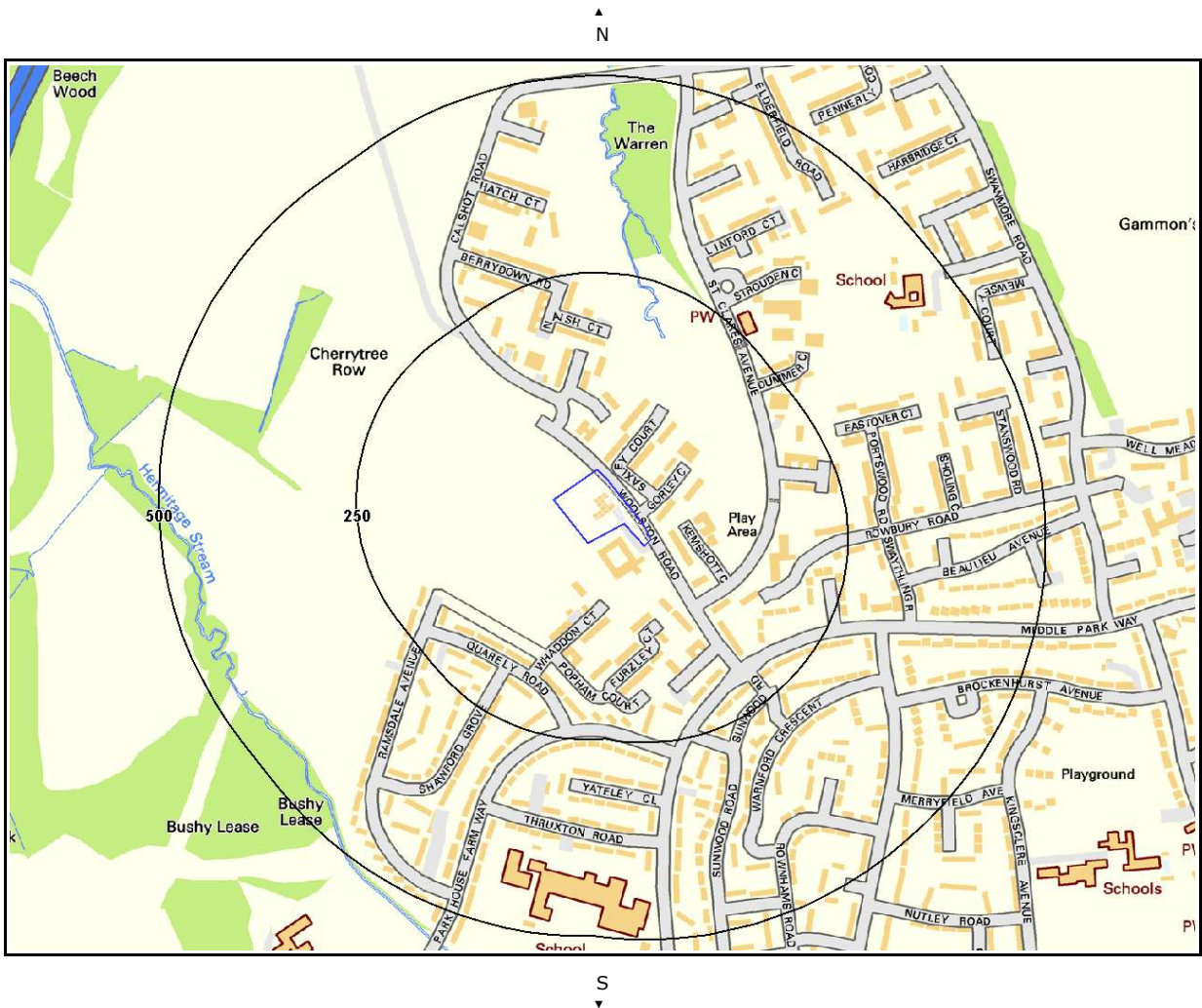
2.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? **No**

Database searched and no data found.

3. Mining, Extraction & Natural Cavities Map



Mining, Extraction & Natural Cavities
Legend

Enabled by
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3. Mining, Extraction & Natural Cavities

3.1 Historical Mining

This dataset is derived from GroundSure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary?

No

The following information provided by JPB is not represented on Mapping:

Database searched. No results found.

3.4 Non – Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.5 Non – Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary?

No

Report Reference: [EMS-154229_223221](#)

Database searched and no data found.

3.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary?

No

Database searched and no data found.

3.7 Brine Extraction

This dataset provides information from the Brine Compensation Board which has been discontinued and is now covered by the Coal Authority.

Are there any Brine Extraction areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level. More detailed information on potential Tin Mining may be found in Section 3.4 – Non-Coal Mining Hazards.

Are there any Tin Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

3.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

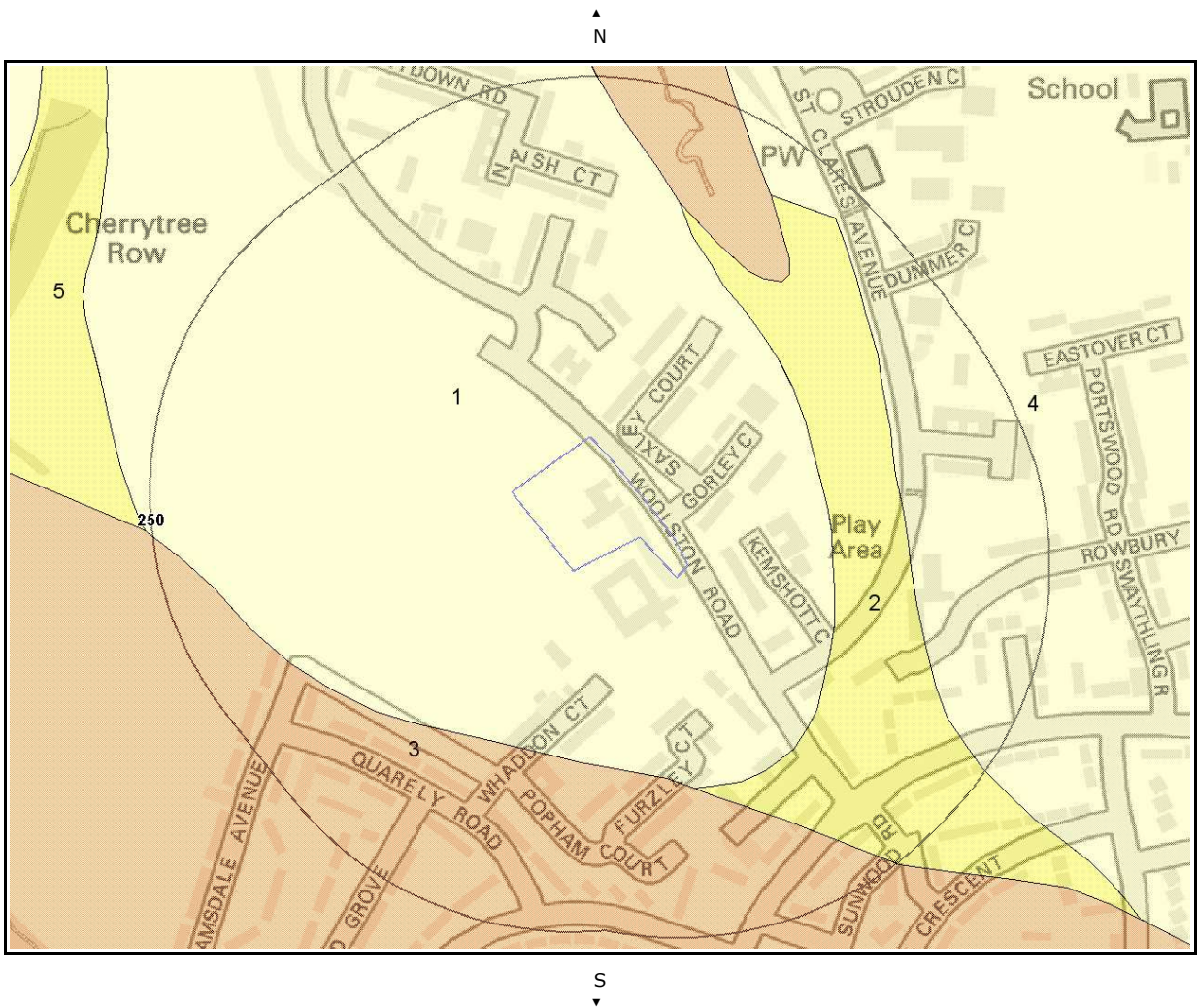
Are there any Clay Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

4. Natural Ground Subsidence

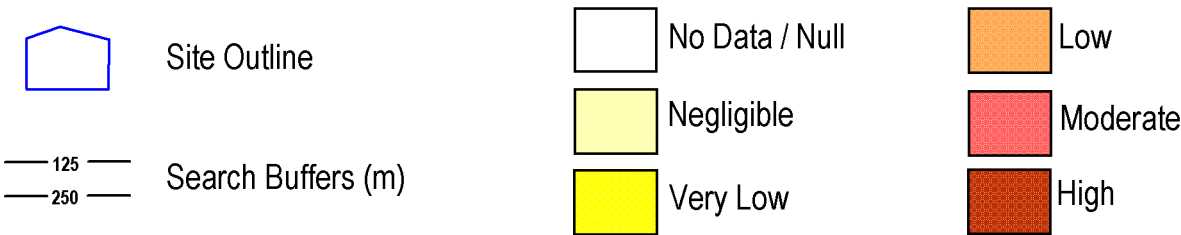
4.1 Shrink-Swell Clay Map



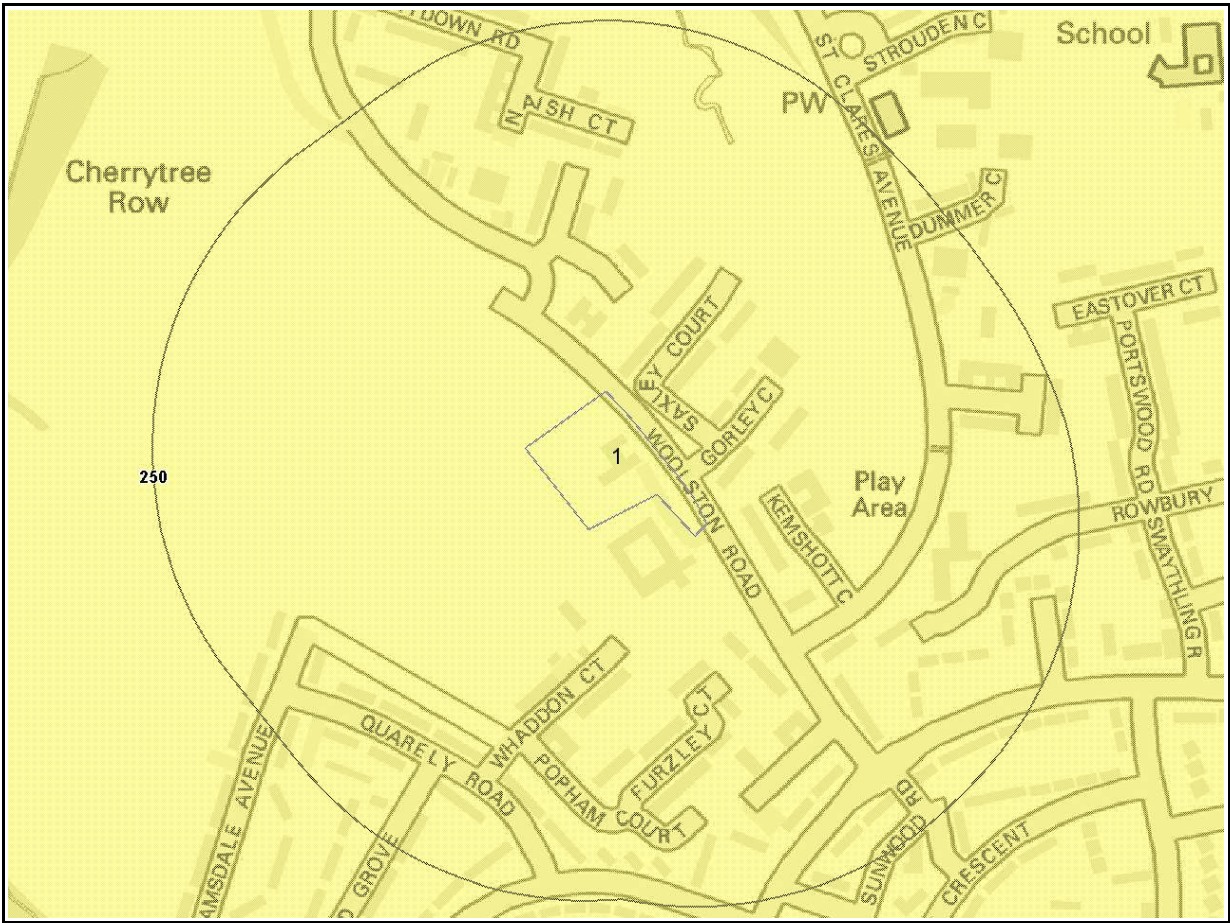
Shrink-Swell Clay Legend



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4.2 Landslides Map



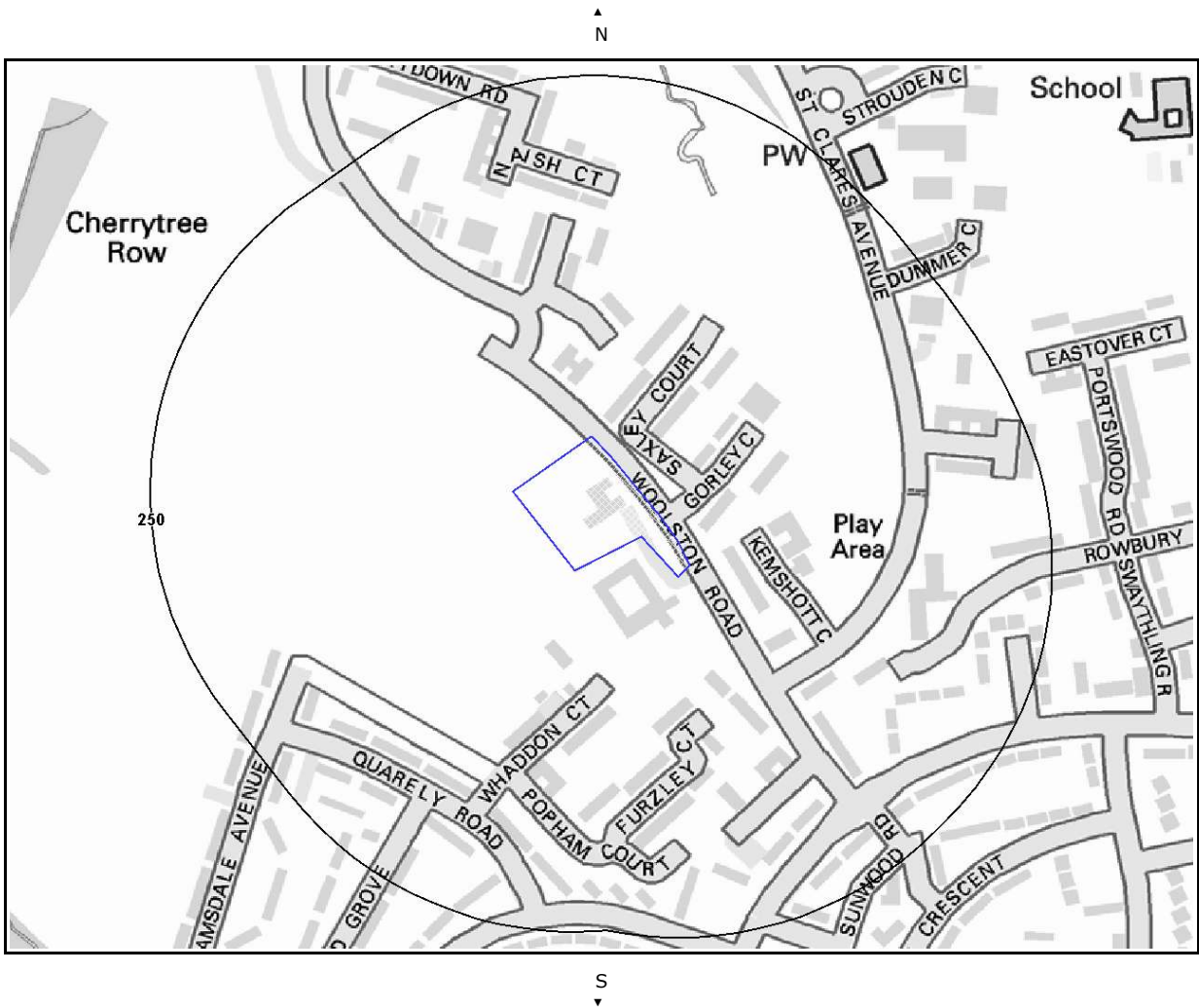
Landslides Legend



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	Site Outline		No Data / Null		Low
	Search Buffers (m)		Negligible		Moderate
			Very Low		High

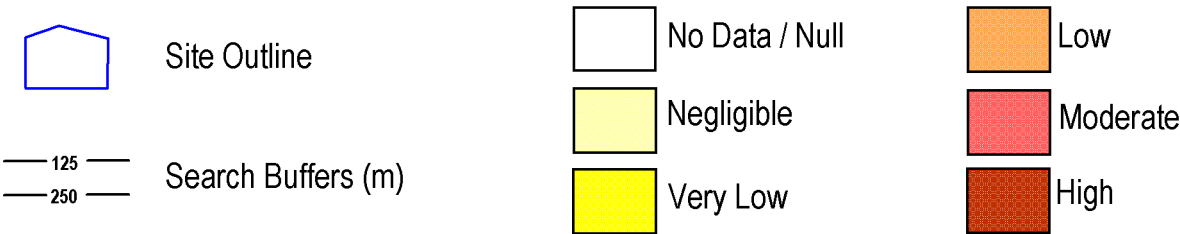
4.3 Ground Dissolution Soluble Rocks Map



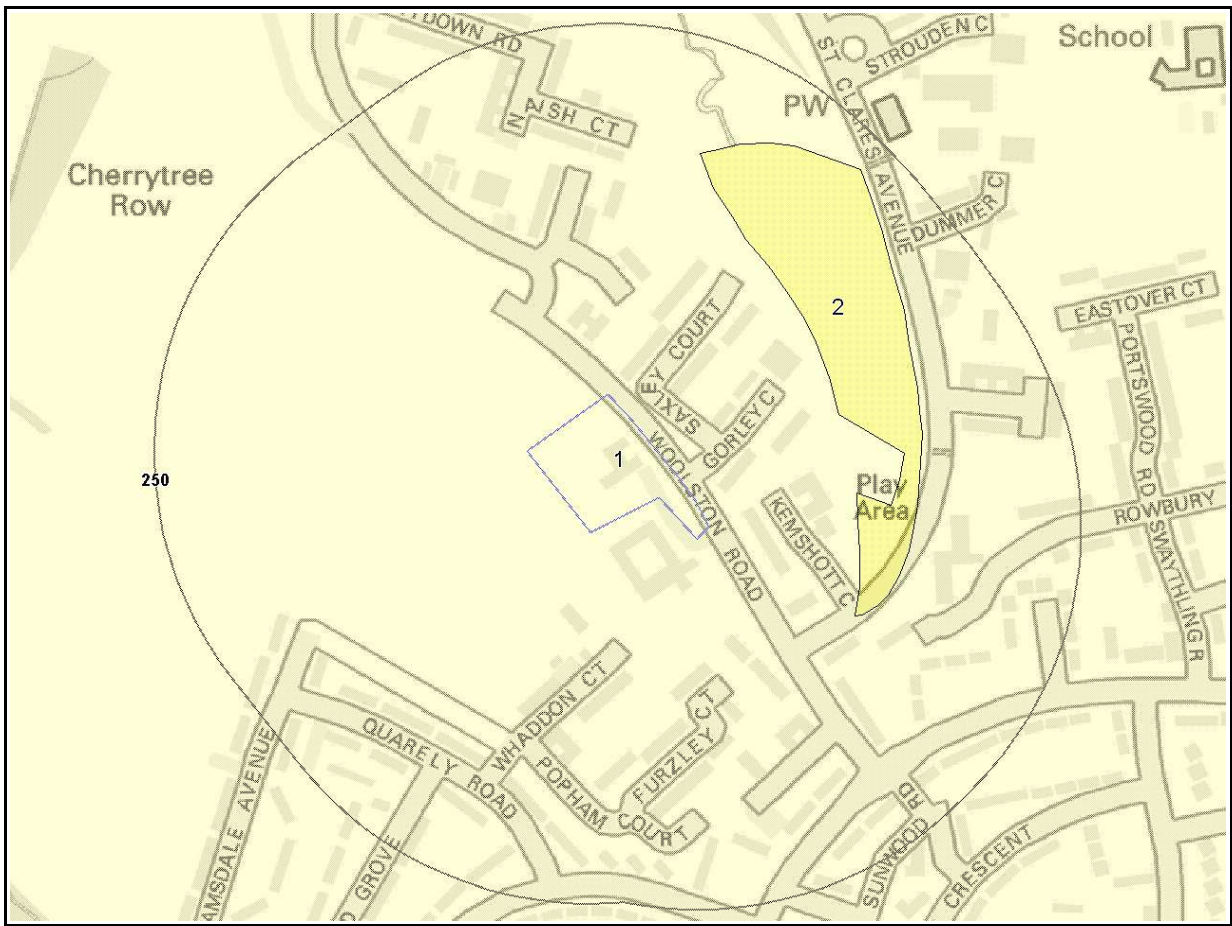
Ground Dissolution Soluble Rocks
Legend



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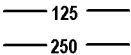
4.4 Compressible Deposits Map



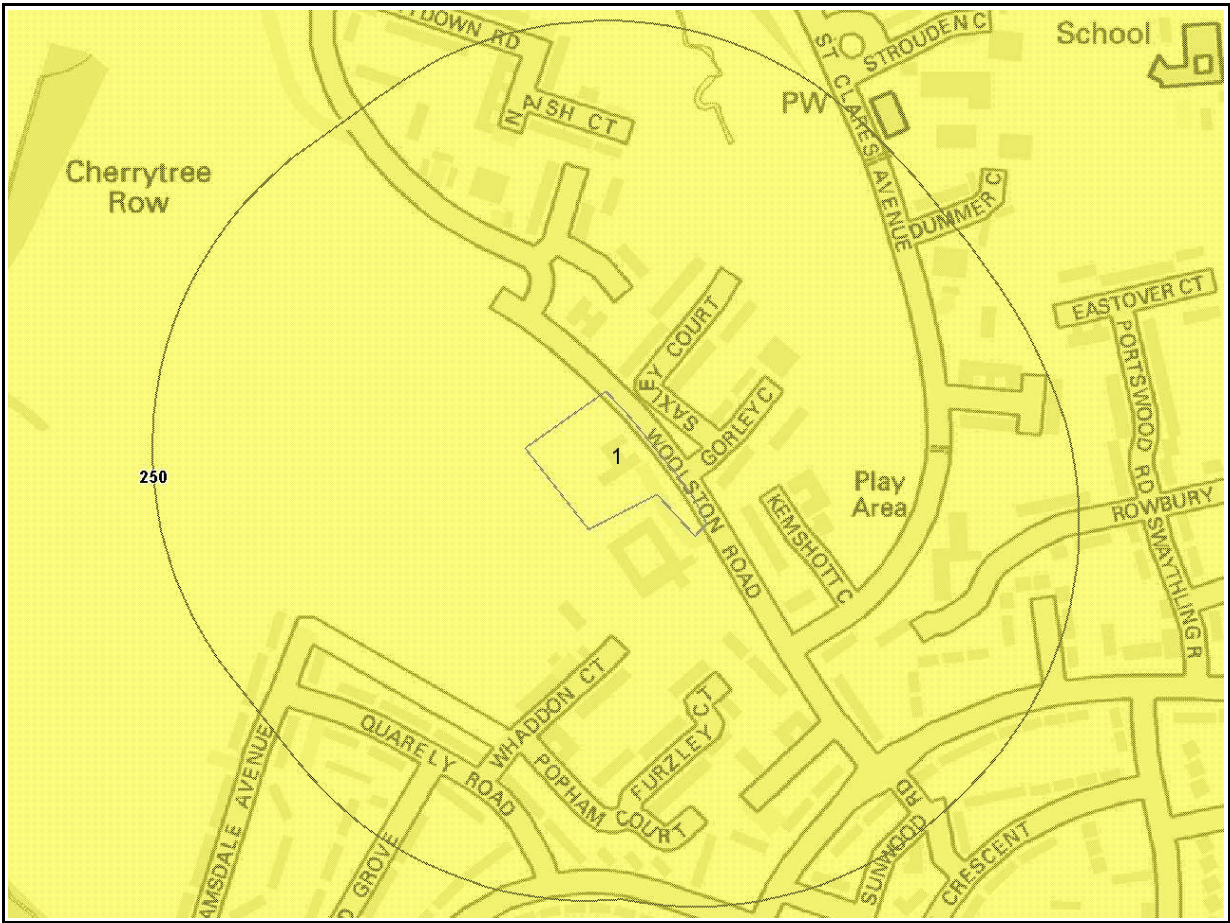
Compressible Deposits Legend



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	Site Outline		No Data / Null		Low
	Search Buffers (m)		Negligible		Moderate
			Very Low		High

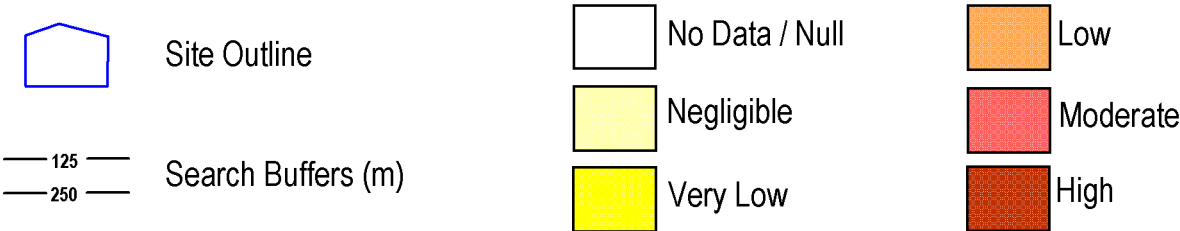
4.5 Collapsible Deposits Map



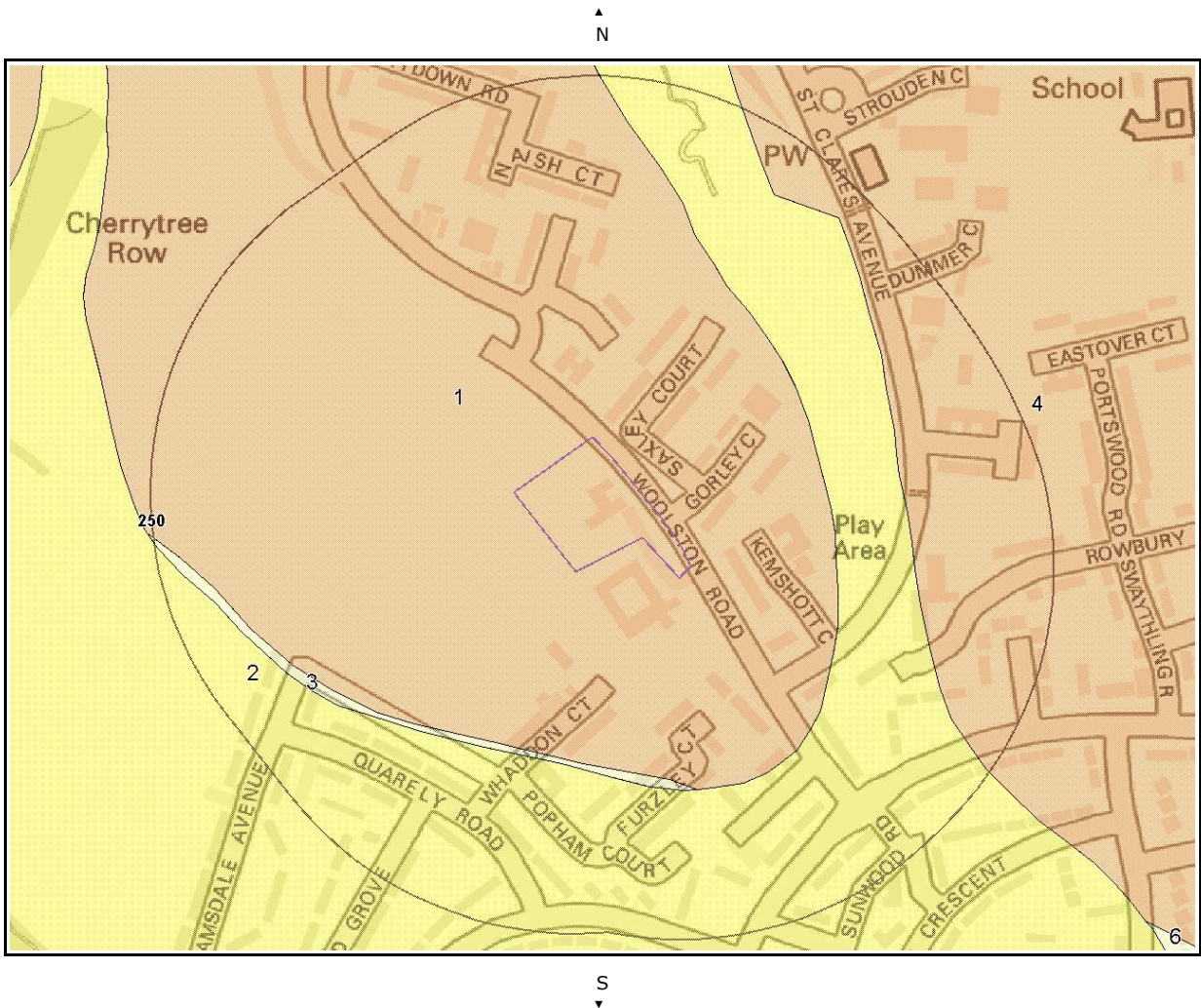
Collapsible Deposits Legend



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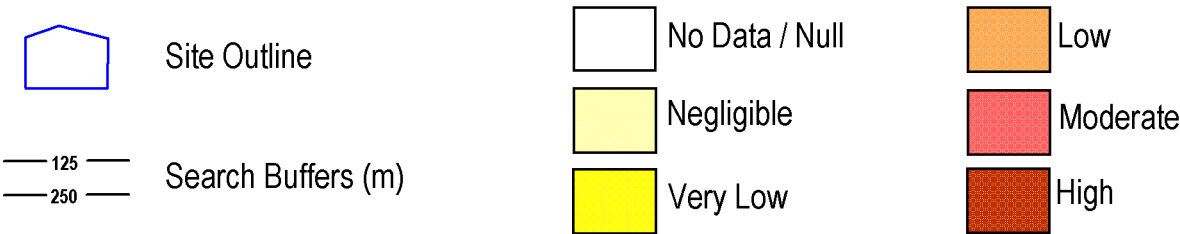
4.6 Running Sand Map



Running Sand Legend



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4. Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site* boundary? **Low**

4.1 Shrink – Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

4.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

4.3 Ground Dissolution of Soluble Rocks

The following Soluble Rocks information provided by the British Geological Survey:

Distance (m)*	Direction	Hazard Rating	Details
0.0	On site	Null-Negligible	Soluble rocks are not present in the search area. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

4.4 Compressible Deposits

The following Compressible Ground information provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

*This includes an automatically generated 50m buffer zone around the study site boundary.

Report Reference: [EMS-154229_223221](#)

4.5 Collapsible Deposits

The following Collapsible Rocks information is provided by the British Geological Survey:

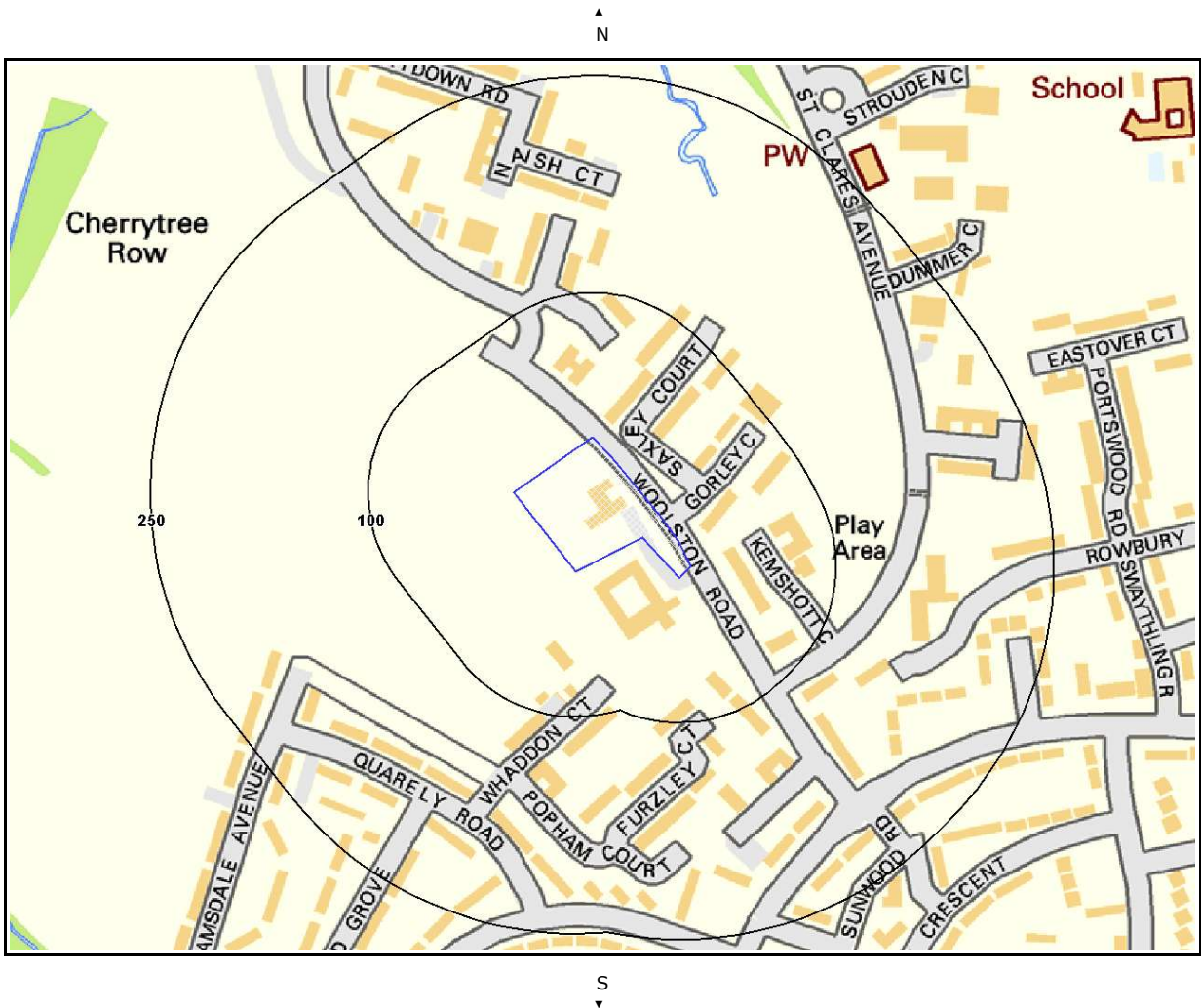
ID	Distance (m) *	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

4.6 Running Sands

The following Running Sands information is provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

5. Borehole Records Map



Borehole Records Legend



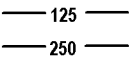
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Site Outline



Borehole Locations



Search Buffers (m)

5. Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: **0**

Database searched and no data found.

6. Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary:

1

For further information on how this data is calculated and limitations upon its use, please see the GroundSure GeoInsight User Guide, available on request.

Distance (m)*	Direction	Sample Type	Estimated Geometric Mean Soil Concentrations (mg/kg)				
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<150 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

7. Contacts

EmapSite

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sales@emapsite.com



British Geological Survey Enquiries

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Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries



British Gypsum

British Gypsum Ltd, East Leake, Loughborough, Leicestershire, LE12 6HX
Tel: www.british-gypsum.com



The Coal Authority

200 Lichfield Lane, Mansfield, Notts NG18 4RG
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DX 716176 Mansfield 5 www.coal.gov.uk



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Acknowledgements

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This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these conditions unless the context otherwise requires:

"Beneficiary" means the Client or the customer of the Client for whom the Client has procured the Services.

"Commercial" means any building which is not Residential.

"Commission" means an order for Consultancy Services submitted by a Client.

"Consultancy Services" mean consultancy services provided by GroundSure including, without limitation, carrying out interpretation of third party and in-house environmental data, provision of environmental consultancy advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the performance of the Services which arises upon GroundSure's acceptance of an Order or Commission and which shall incorporate these conditions, the relevant GroundSure User Guide, proposal by GroundSure and the content of any subsequent report, and any agreed amendments in accordance with clause 11.

"Client" means the party that submits an Order or Commission.

"Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Report" means reports comprising factual data with no professional interpretation in respect of the level of likely risk and/or liability available from GroundSure.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028 and whose registered office is at Greater London House, Hampstead Road, London NW1 7EJ.

"GroundSure Materials" means all materials prepared by GroundSure as a result of the provision of the Services, including but not limited to Data Reports, Mapping and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, service marks, moral rights, data protection rights, know-how, trade mark or any other intellectual property rights.

"Mapping" an historical map or a combination of historical maps of various ages, time periods and scales available from GroundSure.

"Order" means an order form submitted by the Client requiring Services from GroundSure in respect of a specified Site.

"Order Website" means online platform via which Orders may be placed.

"Report" means a Risk Screening Report or Data Report for commercial or residential property available from GroundSure relating to the Site prepared in accordance with the specifications set out in the relevant User Guide.

"Residential" means any building used as or suitable for use as an individual dwelling.

"Risk Screening Report" means one of GroundSure's risk screening reports, comprising factual data with interpretation in respect of the level of likely risk and/or liability, excluding **"Consultancy Services"**.

"Services" means the provision of any Report, Mapping or Consultancy Services which GroundSure has agreed to carry out for the Client/Beneficiary on these terms and conditions in respect of the Site.

"Site" means the landsite in respect of which GroundSure provides the Services.

"Third Party Content" means any data, database or other information contained in a Report or Mapping which is provided to GroundSure by a Data Provider.

"User Guide" means the relevant current version of the user guide, available upon request from GroundSure.

2 Scope of Services

2.1 GroundSure agrees to carry out the Services in accordance with the Contract and to the extent set out therein.

2.2 GroundSure shall exercise all the reasonable skill, care and diligence to be expected of experienced environmental consultants in the performance of the Services.

2.3 The Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in the Contract.

2.4 Terms and conditions appearing on a Client's order form, printed stationery or other communication, including invoices, to GroundSure, its employees, servants, agents or other representatives or any terms implied by custom, practice or course of dealing shall be of no effect and these terms and conditions shall prevail over all others.

2.5 If a Client/Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to procure such insurance, but makes no warranty that such insurance shall be available from insurers or offered on reasonable terms. GroundSure does not endorse or recommend any particular insurance product, policy or insurer. Any insurance purchased shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. The Client/Beneficiary should take independent advice to ensure that the insurance policy requested and/or offered is suitable for its requirements.

2.6 GroundSure's quotations/proposals are valid for a period of 30 days only. GroundSure reserves the right to withdraw any quotation at any time before GroundSure accepts an Order or Commission. GroundSure's acceptance of an Order or Commission shall be effective only where such acceptance is in writing and signed by GroundSure's authorised representative or where accepted via GroundSure's Order Website.

3 The Client's obligations

3.1 The Client shall ensure the Beneficiary complies with and is bound by the terms and conditions set out in the Contract and shall provide that GroundSure may in its own right enforce such terms and conditions against the Beneficiary pursuant to the Contracts (Rights of Third parties) Act 1999. The Client shall be liable for all breaches of the Contract by the Beneficiary as if they were breaches by the Client. The Client shall be solely responsible for ensuring that the Report/Mapping ordered is appropriate and suitable for the Beneficiary's needs.

3.2 The Client shall (or shall procure that the Beneficiary shall) supply to GroundSure as soon as practicable and without charge all information necessary and accurate relevant data including any specific and/or unusual environmental information relating to the Site known to the Client/Beneficiary which may pertain to the Services and shall give such assistance as GroundSure shall reasonably require in the performance of the Services (including, without limitation, access to a Site, facilities and equipment as agreed in the Contract).

3.3 Where Client/Beneficiary approval or decision is required, such approval or decision shall be given or procured in reasonable time as not to delay or disrupt the performance of any other part of the Services.

3.4 The Client shall not and shall not knowingly permit the Beneficiary to, save as expressly permitted by these terms and conditions, re-sell, alter, add to, amend or use out of context the content of any Report, Mapping or, in respect of any Services, information given by GroundSure. For the avoidance of doubt, the Client and Beneficiary may make the Report, Mapping or GroundSure's findings available to a third party who is considering acquiring the whole or part of the Site, or providing funding in relation to the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.5 The Client is responsible for maintaining the confidentiality of its user name and password if using GroundSure's internet ordering service and accepts responsibility for all activity that occurs under such account and password.

4 Reliance

4.1 Upon full payment of all relevant fees and subject to the provisions of these terms and conditions, the Client and Beneficiary are granted an irrevocable royalty-free licence to access the information contained in a Report, Mapping or in a report prepared by GroundSure in respect of or arising out of Consultancy Services. The Services may only be used for the benefit of the Client and those persons listed in clauses 4.2 and 4.3.

4.2 In relation to Data Reports, Mapping and Risk Screening Reports, the Client shall be entitled to make Reports available to (i) the Beneficiary, (ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate), (iv) the first purchaser or first tenant of the Site (v) the professional advisers and lenders of the first purchaser or tenant of the Site. Accordingly GroundSure shall have the same duties and obligations to those persons in respect of the Services as it has to the Client and those persons shall have the benefit of any of the Client's rights under the Contract as if those persons were parties to the Contract. For the avoidance of doubt, the limitations of GroundSure's liability as set out in clauses 7 and 11.6 shall apply.

4.3 In relation to Consultancy Services, reliance shall be limited to the Client, Beneficiary and named parties on the Report.

4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise agreed in writing with GroundSure, any other party considering the information supplied by GroundSure as part of the Services, including (but not limited to) insurance underwriters, does so at their own risk and GroundSure has no legal obligations to such party unless otherwise agreed in writing.

4.5 The Client shall not and shall not knowingly permit any person (including the Beneficiary) who is provided with a copy of any Report, (except as permitted herein or by separate agreement with GroundSure) to: (a) remove, suppress or modify any trade mark, copyright or other proprietary marking from the Report or Mapping; (b) create any product which is derived directly or indirectly from the data contained in the Report or Mapping; (c) combine the Report or Mapping with, or incorporate the Report or Mapping into any other information data or service; or (d) re-format or otherwise change (whether by modification, addition or enhancement) data or images contained in the Report or Mapping.

4.6 Notwithstanding clause 4.5, if the Client acts in a professional capacity, it may make reasonable use of a Report and/or findings made as a result of Consultancy Services to advise Beneficiaries. However, GroundSure shall have no liability in respect of any opinion or report given to such Beneficiaries by the Client or a third party.

5 Fees and Disbursements

5.1 GroundSure shall charge the Client fees at the rate and frequency specified in the Contract together, in the case of Consultancy Services, with all proper disbursements incurred by GroundSure in performing the Services. For the avoidance of doubt, the fees payable for the Services are as set out in GroundSure's written proposal, Order Website or Order acknowledgement form. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services.

5.2 Unless GroundSure requires prepayment, the Client shall promptly pay all fees disbursements and other monies due to GroundSure in full without deduction, counterclaim or set off together with such value added tax or other tax as may be required within 30 days from the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("**Payment Date**"). GroundSure reserves the right to charge interest which shall accrue on a daily basis from 30 days after the date of Payment Date until the date of payment (whether before or after judgment) at the rate of five per cent per annum above the Bank of England base rate from time to time.

5.3 In the event that the Client disputes the amount payable in respect of GroundSure's invoice it shall notify GroundSure no later than 28 days after the date thereof that it is in dispute. In default of such notification the Client shall be deemed to have agreed the amount thereof. As soon as reasonably practicable following receipt of a notification in respect of any disputed invoice, a member of the management team at GroundSure shall contact the Client and the parties shall use all reasonable endeavours to resolve the dispute.

6 Intellectual Property and Confidentiality

6.1 Subject to the provisions of clause 4.1, the Client and the Beneficiary hereby acknowledge that all Intellectual Property in the Services and Content are and shall remain owned by either GroundSure or the Data Providers and nothing in these terms purports to transfer or assign any rights to the Client or the Beneficiary in respect of the Intellectual Property.

6.2 The Client shall acknowledge the ownership of the **Third Party Content** where such **Third Party Content** is incorporated or used in the Client's own documents, reports, systems or services whether or not these are supplied to a third party.

6.3 Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client acknowledges that the proprietary rights subsisting in copyright, database rights and any other intellectual property rights in respect of any data and information contained in any Report are and shall remain (subject to clause 11.1) the property of GroundSure and/or any third party that has supplied data or information used to create a Report, and that these conditions do not purport to grant, assign or transfer any such rights in respect thereof to a Client and/or a Beneficiary.

6.5 The Client shall (and shall procure that any recipients of the Report as permitted under clause 4.2 shall):

- (i) not remove, suppress or modify any trademark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

- (ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
 - (iii) not create any product or report which is derived directly or indirectly from the data contained in the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
 - (iv) not combine the Services with or incorporate such Services into any other information data or service; and
 - (v) not reformat or otherwise change (whether by modification, addition or enhancement), data contained in the Services (save that those acting in a professional capacity to the Beneficiary shall not be in breach of this clause 6.5(v) where such reformatting is in the normal course of providing advice based upon the Services), in each case of parts (iii) to (v) inclusive, whether or not such product or report is produced for commercial profit or not.
- 6.6 The Client and/or Beneficiary shall and shall procure that any party to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.
- 6.8 Save as otherwise set out in these terms and conditions, any information provided by one party ("**Disclosing Party**") to the other party ("**Receiving Party**") shall be treated as confidential and only used for the purposes of these terms and conditions, except in so far as the Receiving Party is authorised by the Disclosing Party to provide such information in whole or in part to a third party.

7 Liability

THE CLIENT'S ATTENTION IS DRAWN TO THIS PROVISION

- 7.1 Subject to the provisions of this clause 7, GroundSure shall be liable to the Beneficiary only in relation to any direct losses or damages caused by any negligent act or omission of GroundSure in preparing the GroundSure Materials and provided that the Beneficiary has used all reasonable endeavours to mitigate any such losses.
- 7.2 GroundSure shall not be liable for any other losses or damages incurred by the Beneficiary, including but not limited to:
- (i) loss of profit, revenue, business or goodwill, losses relating to business interruption, loss of anticipated savings, loss of or corruption to data or for any special, indirect or consequential loss or damage which arise out of or in connection with the GroundSure Materials or otherwise in relation to a Contract;
 - (ii) any losses or damages that arise as a result of the use of all or part of the GroundSure Materials in breach of these terms and conditions or contrary to the terms of the relevant User Guide;
 - (iii) any losses or damages that arise as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such part is based on any Third Party Content or any reasonable interpretation of Third Party Content. The Client accepts, and shall procure that any other Beneficiary shall accept, that it has no claim or recourse to any Data Provider in relation to Third Party Content; and/or
 - (iv) any loss or damage to a Client's computer, software, modem, telephone or other property caused by a delay or loss of use of GroundSure's internet ordering service.
- 7.3 GroundSure's total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise, arising in connection with the GroundSure Materials or otherwise in relation to the Contract shall be limited to £10 million in total (i) for any one claim or (ii) for a series of connected claims brought by one or more parties.
- 7.4 For the duration of the liability periods set out in clauses 7.5 and 7.6 below, GroundSure shall maintain professional indemnity insurance in respect of its liability under these terms and conditions provided such insurance is readily available at commercially viable rates. GroundSure shall produce evidence of such insurance if reasonably requested by the Client. A level of cover greater than GroundSure's current level of cover may be available upon request and agreement with the Client.
- 7.5 Any claim under the Contract in relation to Data Reports, Mapping and Risk Screening Reports, must be brought within six years from the date when the Beneficiary became aware that it may have a claim and in no event may a claim be brought twelve years or more after completion of such a Contract. For the avoidance of doubt, any claim in respect of which proceedings are notified to GroundSure in writing prior to the expiry of the time periods referred to in this clause 7.5 shall survive the expiry of those time periods provided the claim is actually commenced within six months of notification.
- 7.6 Any claim under the Contract in relation to Consultancy Services, must be brought within six years from the date the Consultancy Services were completed.
- 7.7 he Client accepts and shall procure that any other Beneficiary shall accept that it has no claim or recourse to any Data Provider or to GroundSure in respect of the acts or omissions of any Data Provider and/or any Third Party Content provided by a Data Provider.
- 7.8 Nothing in these terms and conditions:
- (i) excludes or limits the liability of GroundSure for death or personal injury caused by GroundSure's negligence, or for fraudulent misrepresentation; or
 - (ii) shall affect the statutory rights of a consumer under the applicable legislation.

8 GroundSure right to suspend or terminate

- 8.1 In the event that GroundSure reasonably believes that the Client or Beneficiary as applicable has not provided the information or assistance required to enable the proper performance of the Services, GroundSure shall be entitled on fourteen days written notice to suspend all further performance of the Services until such time as any such deficiency has been made good.
- 8.2 GroundSure may additionally terminate the Contract immediately on written notice in the event that:
- (i) the Client shall fail to pay any sum due to GroundSure within 28 days of the Payment Date; or
 - (ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an Administration Order made against it or if a Receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
 - (iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
 - (iv) the Client or the Beneficiary breaches any material term of the Contract (including, but not limited to, the obligations in clause 4) incapable of remedy or if remediable, is not remedied within 14 days of notice of the breach.

9 Client's Right to Terminate and Suspend

- 9.1 Subject to clause 10.2, the Client may at any time after commencement of the Services by notice in writing to GroundSure require GroundSure to terminate or suspend immediately performance of all or any of the Services.
- 9.2 The Client waives all and any right of cancellation it may have under the Consumer Protection (Distance Selling) Regulations 2000 (as amended) in respect of the Order of a Report/Mapping. This does not affect the Beneficiary's statutory rights.

10 Consequences of Withdrawal, Termination or Suspension

- 10.1 Upon termination or any suspension of the Services, GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client/Beneficiary any property of the Client/ Beneficiary in GroundSure's possession or control.
- 10.2 In the event of termination/suspension of the Contract under clauses 8 or 9, the Client shall pay to GroundSure all and any fees payable in respect of the performance of the Services up to the date of termination/suspension. In respect of any Consultancy Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination/suspension of the Contract.

11 General

- 11.1 The mapping contained in the Services is protected by Crown copyright and must not be used for any purpose outside the context of the Services or as specifically provided in these terms.
- 11.2 GroundSure reserves the right to amend these terms and conditions. No variation to these terms shall be valid unless signed by an authorised representative of GroundSure.
- 11.3 No failure on the part of GroundSure to exercise and no delay in exercising, any right, power or provision under these terms and conditions shall operate as a waiver thereof.
- 11.4 Save as expressly provided in clauses 4.2, 4.3, 6.3 and 11.5, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
- 11.5 The Secretary of State for Communities and Local Government acting through Ordnance Survey may enforce breach of clause 6.1 of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
- 11.6 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
- (i) the Client or Beneficiary's failure to provide facilities, access or information;
 - (ii) fire, storm, flood, tempest or epidemic;
 - (iii) Acts of God or the public enemy;
 - (iv) riot, civil commotion or war;
 - (v) strikes, labour disputes or industrial action;
 - (vi) acts or regulations of any governmental or other agency;
 - (vii) suspension or delay of services at public registries by Data Providers; or
 - (viii) changes in law.
- 11.7 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
- 11.8 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email and on the second working day after the day of posting if sent by first class post.
- 11.9 The Contract constitutes the entire contract between the parties and shall supersede all previous arrangements between the parties.
- 11.10 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
- 11.11 These terms and conditions shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with these terms and conditions shall be subject to the exclusive jurisdiction of the English courts.
- 11.12 If the Client or Beneficiary has a complaint about the Services, notice can be given in any format eg writing, phone, email to the Compliance Officer at GroundSure who will respond in a timely manner.

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GroundSure EnviroInsight

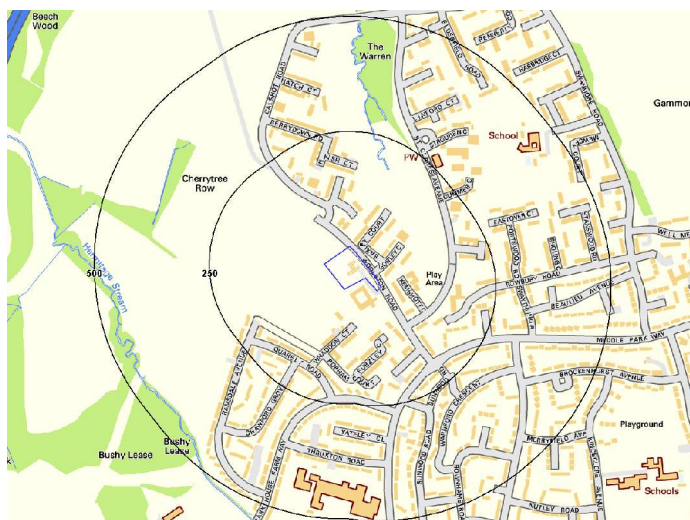
Address: Mary Rose House, Havant, PO9 4JN

Date: Feb 17, 2012

GroundSure Reference: EMS-154229_223222

Your Reference: EMS_154229_223222

Client: EmapSite



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emapsite™

Aerial Photograph of Study Site



Aerial photography supplied by Getmapping PLC.
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Site Name: Mary Rose House, Havant, PO9 4JN
Grid Reference: 470416, 108787
Size of Site: 0.56 ha

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary					
1. Environmental Permits, Incidents and Registers	on-site	0-50	51-250	251-500	501-1000	1000-1500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations						
Records of historic IPC Authorisations	0	0	0	0	-	-
Records of Part A(1) and IPPC Authorised Activities	0	0	0	0	-	-
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0	-	-
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0	-	-
Records of List 1 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of List 2 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0	-	-
Records of Licensed Discharge Consents	0	0	0	0	-	-
Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0		
1.2 Records of COMAH and NIHHS sites	0	0	0	0	-	-
1.3 Environment Agency Recorded Pollution Incidents						
National Incidents Recording System, List 2	0	0	1	-	-	-
National Incidents Recording System, List 1	0	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990	0	0	0	0	-	-
2. Landfill and Other Waste Sites	on-site	0-50	51-250	251-500	501-1000	1000-1500
2.1 Landfill Sites						
Environment Agency Registered Landfill Sites	0	0	0	0	0	-
Landfill Data – Operational Landfill Sites	0	0	0	0	0	-
Environment Agency Historic Landfill Sites	0	0	0	0	1	0
Landfill Data – Non-Operational Landfill Sites	0	0	0	0	0	-
BGS/DoE Landfill Site Survey	0	0	0	0	0	0
GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency Licensed Waste Sites	0	0	0	0	0	0

3. Current Land Uses	on-site	0-50	51-250	251-500	501-1000	1000-1500
3.1 Current Industrial Sites Data	0	0	3	-	-	-
3.2 Records of Petrol and Fuel Sites	0	0	0	0	-	-
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0	-	-

4. Geology	Description
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site? *	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site? *	No
4.3 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
Source: Scale: 1:50,000 BGS Sheet 316	

* This includes an automatically generated 50m buffer zone around the site.

5. Hydrogeology and Hydrology	on-site	0-50	51-250	251-500	501-1000	1001-2000
5.1 Are there any records of Productive Strata in the Superficial Geology within 500m of the study site?				Yes		
5.2 Are there any records of Productive Strata in the Bedrock Geology within 500m of the study site?				Yes		
5.3 Groundwater Abstraction Licences (within 1000m of the study site).	0	0	0	0	0	-
5.4 Surface Water Abstraction Licences (within 1000m of the study site).	0	0	0	0	0	-
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	0
5.6 Are there any Source Protection Zones within 500m of the study site?					No	
5.7 River Quality						
Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	No
5.8 Detailed River Network entries within 500m of the site	0	0	6	8	-	-
5.9 Surface water features within 250m of the study site	No	No	Yes	-	-	-

6. Flooding	
6.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	Yes
6.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	Yes
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	High
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low

7. Designated Environmentally Sensitive Sites	on-site	0-50	51-250	251-500	501-1000	1001-1500
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	-	-
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	-	-

7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	-	-
7.3 Records of Local Nature Reserves (LNR)	0	0	0	0	-	-
7.4 Records of Special Areas of Conservation (SAC)	0	0	0	0	-	-
7.5 Records of Special Protection Areas (SPA)	0	0	0	0	-	-
7.6 Records of Ramsar sites	0	0	0	0	-	-
7.7 Records of World Heritage Sites	0	0	0	0	-	-
7.8 Records of Environmentally Sensitive Areas	0	0	0	0	-	-
7.9 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	-	-
7.10 Records of National Parks	0	0	0	0	-	-
7.11 Records of Nitrate Sensitive Areas	0	0	0	0	-	-
7.12 Records of Nitrate Vulnerable Zones	0	0	0	0	-	-

8. Natural Hazards

8.1 What is the maximum risk of natural ground subsidence? Low

9. Mining

9.1 Are there any coal mining areas within 75m of the study site? No

9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site? Negligible

9.3 Are there any brine affected areas within 75m of the study site? No

Using this Report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client. The document contains the following sections:

1. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

2. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

3. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure underground oil and gas pipelines.

4. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

5. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

6. Flooding

Provides information on surface water flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

7. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites. These searches are conducted using radii of up to 500m.

8. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence.

9. Mining

Provides information on areas of coal and shallow mining.

10. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, GroundSure provide a free Technical Helpline (08444 159000) for further information and guidance.

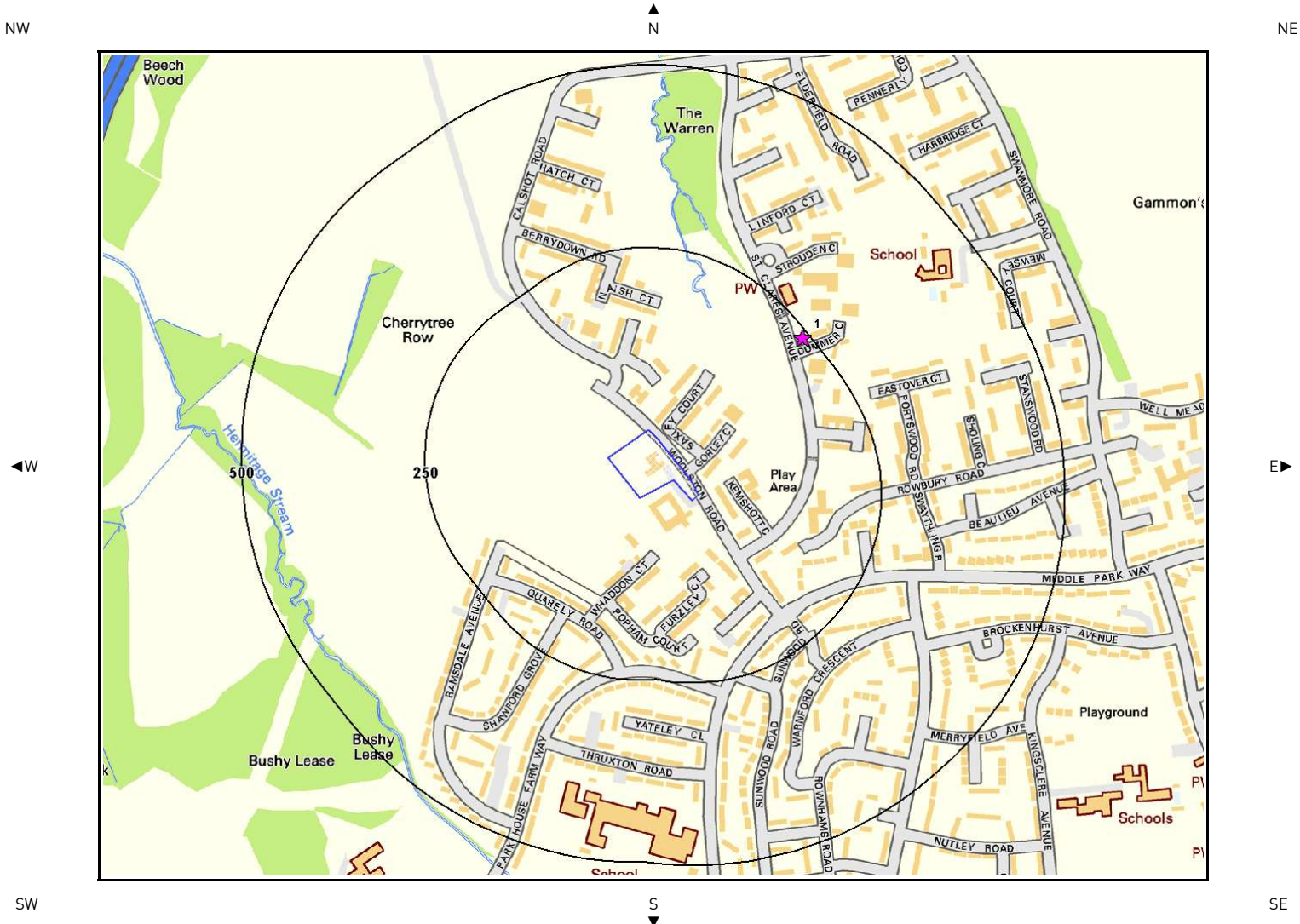
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Environmental Permits, Incidents and Registers Map



Authorisations, Incidents and Registers Legend

Enabled by
Ordnance Survey

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- | | | |
|---|--|--|
|  Site Outline |  Recorded Pollution Incident |  RAS 3 & 4 Authorisations |
|  Dangerous Substances (List 1) |  Part A(1) Authorised Processes and Historic IPC Authorisations | |
|  Dangerous Substances (List 2) |  Part A(2) and Part B Authorised Processes | |
|  Water Industry Referrals |  COMAH / NIHHS Sites | |
|  Licenced Discharge Consents |  Sites Determined as Contaminated Land | |
|  Red List Discharge Consents |  Hazardous Substance Consents and Enforcements | |

1.Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

Records of historic IPC Authorisations within 500m of the study site: **0**

Database searched and no data found.

Records of Part A(1) and IPPC Authorised Activities within 500m of the study site: **0**

Database searched and no data found.

Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: **0**

Database searched and no data found.

Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site: **0**

Database searched and no data found.

Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site: **0**

Database searched and no data found.

Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site: **0**

Database searched and no data found.

Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: **0**

Database searched and no data found.

Records of Category 3 or 4 Radioactive Substance Licences within 500m of the study site: **0**

Database searched and no data found.

Records of Licensed Discharge Consents within 500m of the study site: **0**

Database searched and no data found.

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Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site: 0

Database searched and no data found.

1.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 0

Database searched and no data found.

1.3 Environment Agency Recorded Pollution Incidents

Records of National Incidents Recording System, List 2 within 250m of the study site: 1

The following NIRS List 2 records are represented as points on the Authorisations, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details
1	240.0	NE	470623, 108963	Incident Date: 17/12/2002 Incident Identification: 126525 Pollutant: Contaminated Water Pollutant Description: Firefighting Run-Off Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)

Records of National Incidents Recording System, List 1 within 250m of the study site: 0

Database searched and no data found.

1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

2. Landfill and Other Waste Sites

2.1 Landfill Sites

Records from Environment Agency landfill data within 1000m of the study site: **0**

Database searched and no data found.

Records of operational landfill sites sourced from Landmark within 1000m of the study site: **0**

Database searched and no data found.

Records of Environment Agency historic landfill sites within 1500m of the study site: **1**

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance	Direction	NGR	Details	
1	509.0	N	470200, 109600	Site Address: Dunsbury Hill Farm, Cowplain, Hampshire Waste Licence: Yes Site Reference: 13/3, FHA17 Waste Type: Inert, Regis Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: Haredon House, London Road, North Cheam, Sutton, Surrey Operator: -

Records of non-operational landfill sites sourced from Landmark within 1000m of the study site: **0**

Database searched and no data found.

Records of BGS/DoE non-operational landfill sites within 1500m of the study site: **0**

Database searched and no data found.

Records of Local Authority landfill sites within 1500m of the study site: **0**

Database searched and no data found.

2.2 Other Waste Sites

Records of operational waste treatment, transfer or disposal sites within 500m of the study site: **0**

Database searched and no data found.

Records of non-operational waste treatment, transfer or disposal sites within 500m of the study site: **0**

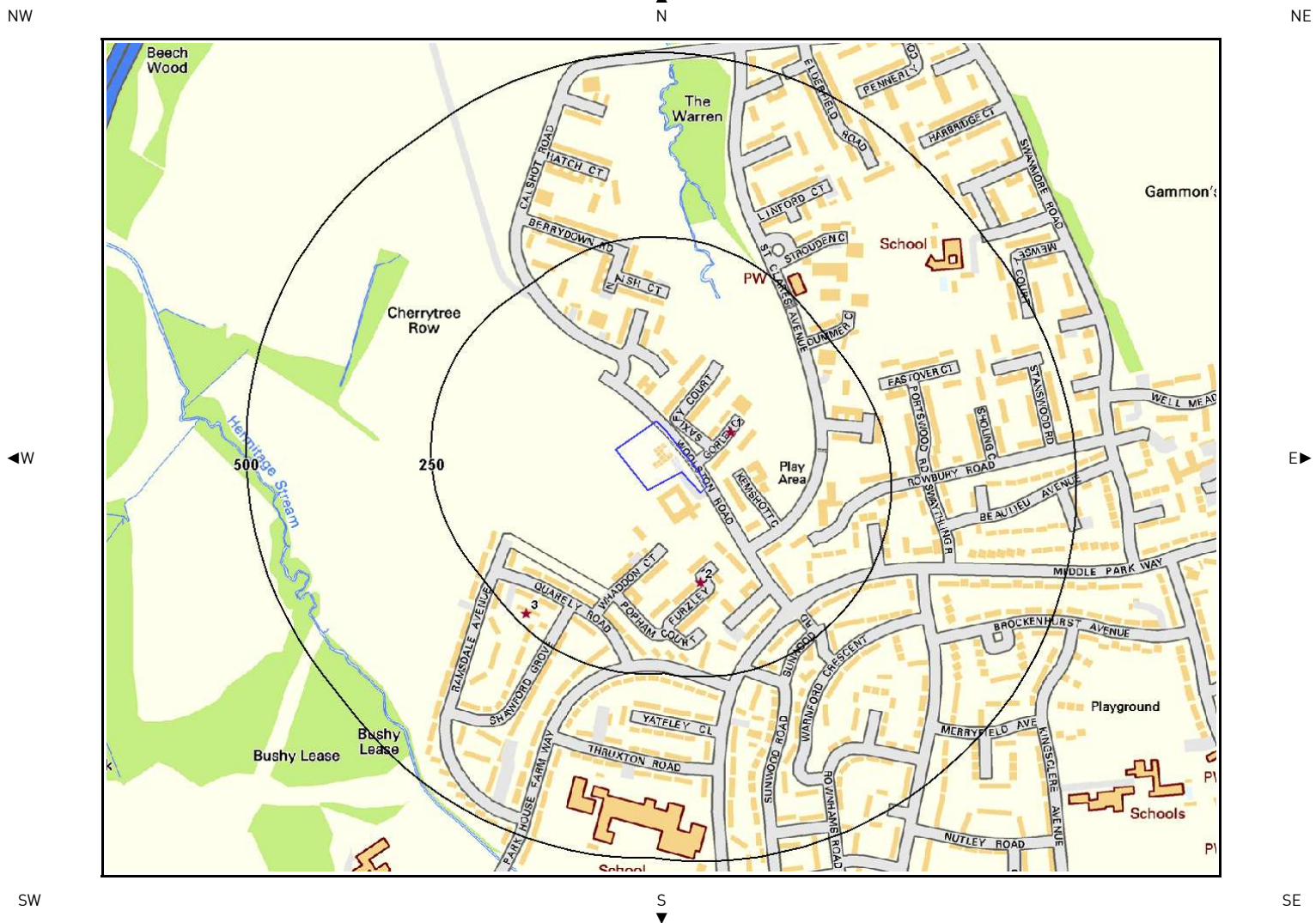
Database searched and no data found.

Records of Environment Agency licensed waste sites within 1500m of the study site: **0**

Report Reference: [EMS-154229_223222](#)

Database searched and no data found.

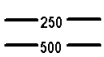
3. Current Land Use Map



Current Land Use Legend



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-  Site Outline
-  Current Industrial Sites
-  Petrol & Fuel Sites
-  Underground High Pressure Oil & Fuel Pipelines
-  Search Buffers (m)
 - 250
 - 500

3. Current Land Uses

3.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site:

3

The following records are represented as points on the Current Land Uses map.

ID	Distance	Direction	Company	Address	Activity	Category
1	67.0	NE	Electricity Sub Station	PO9	Electrical Features	Infrastructure and Facilities
2	122.0	S	Electricity Sub Station	PO9	Electrical Features	Infrastructure and Facilities
3	235.0	SW	Electricity Sub Station	PO9	Electrical Features	Infrastructure and Facilities

3.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site:

0

Database searched and no data found.

3.3 Underground High Pressure Oil and Gas Pipelines

Records of high pressure underground pipelines within 500m of the study site:

0

Database searched and no data found.

4. Geology

4.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.2 Superficial Ground and Drift Geology

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.3 Bedrock and Solid Geology

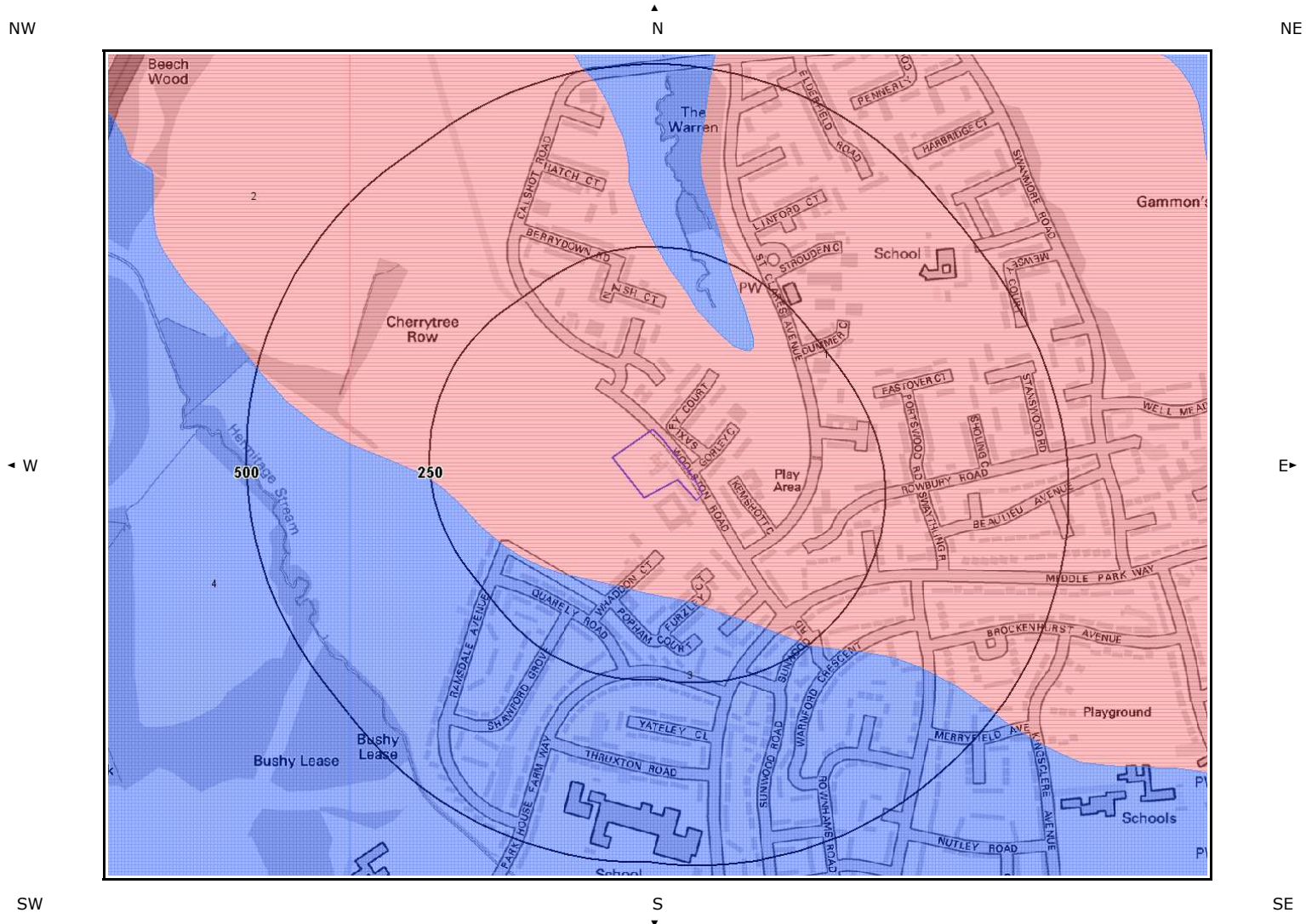
The database has been searched on site, including a 50m buffer.

LEX Code	Description	Rock Type
BOSA-SAND	BOGNOR SAND MEMBER	SAND

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

For more detailed geological and ground stability data please refer to the "GroundSure GeoInsight". Available from our website.

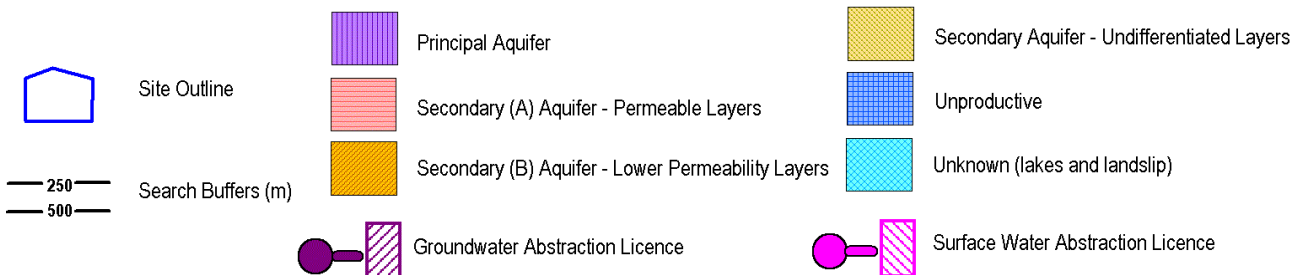
5b. Hydrogeology - Aquifer Within Bedrock Geology and Abstraction Licenses



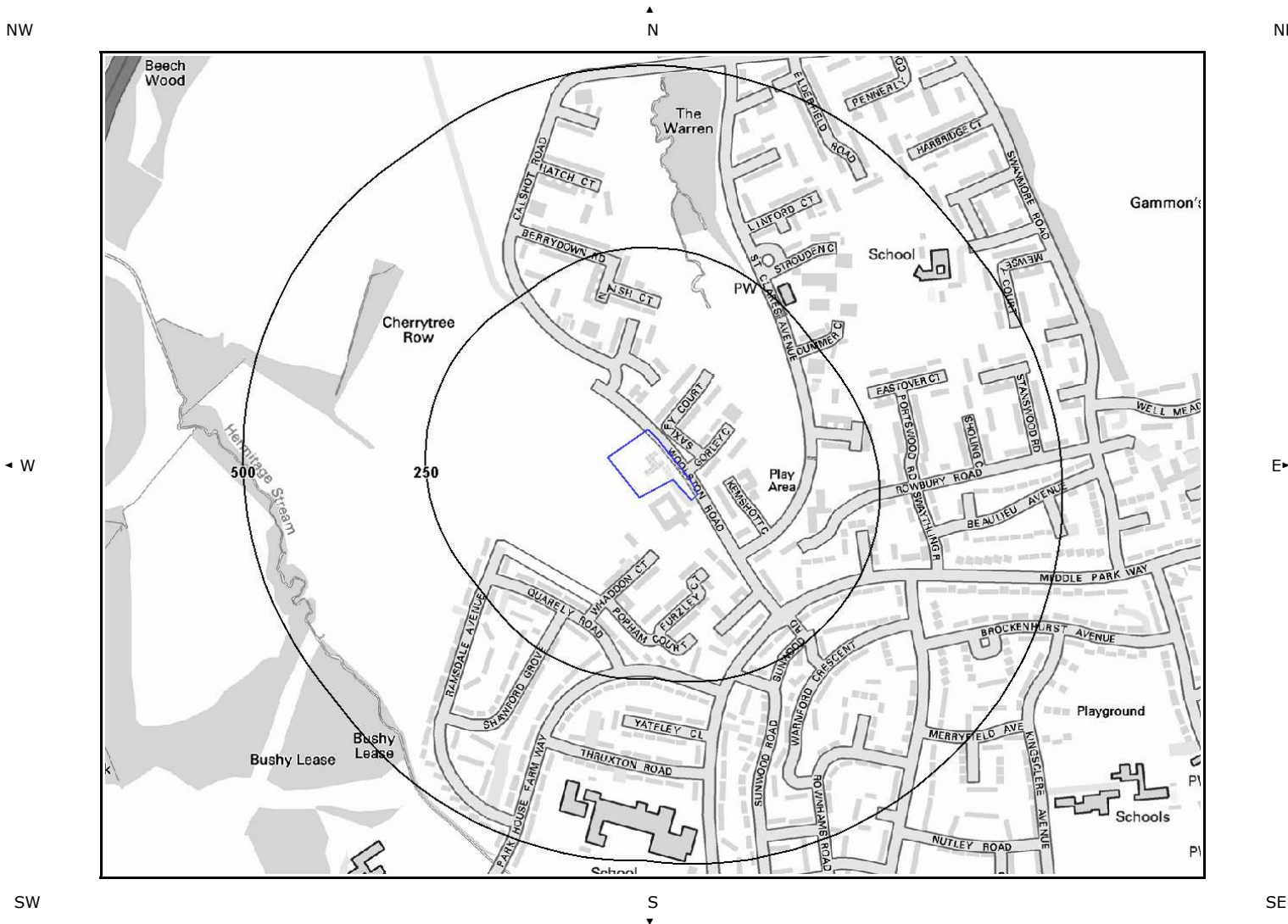
Aquifer Within Bedrock Geology Legend



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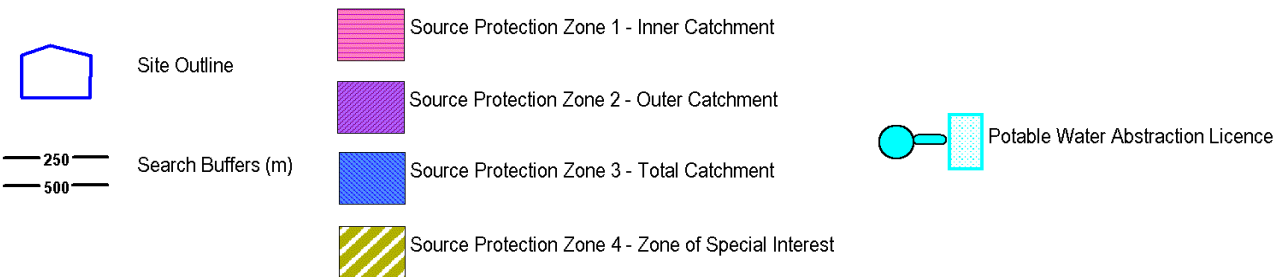
5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



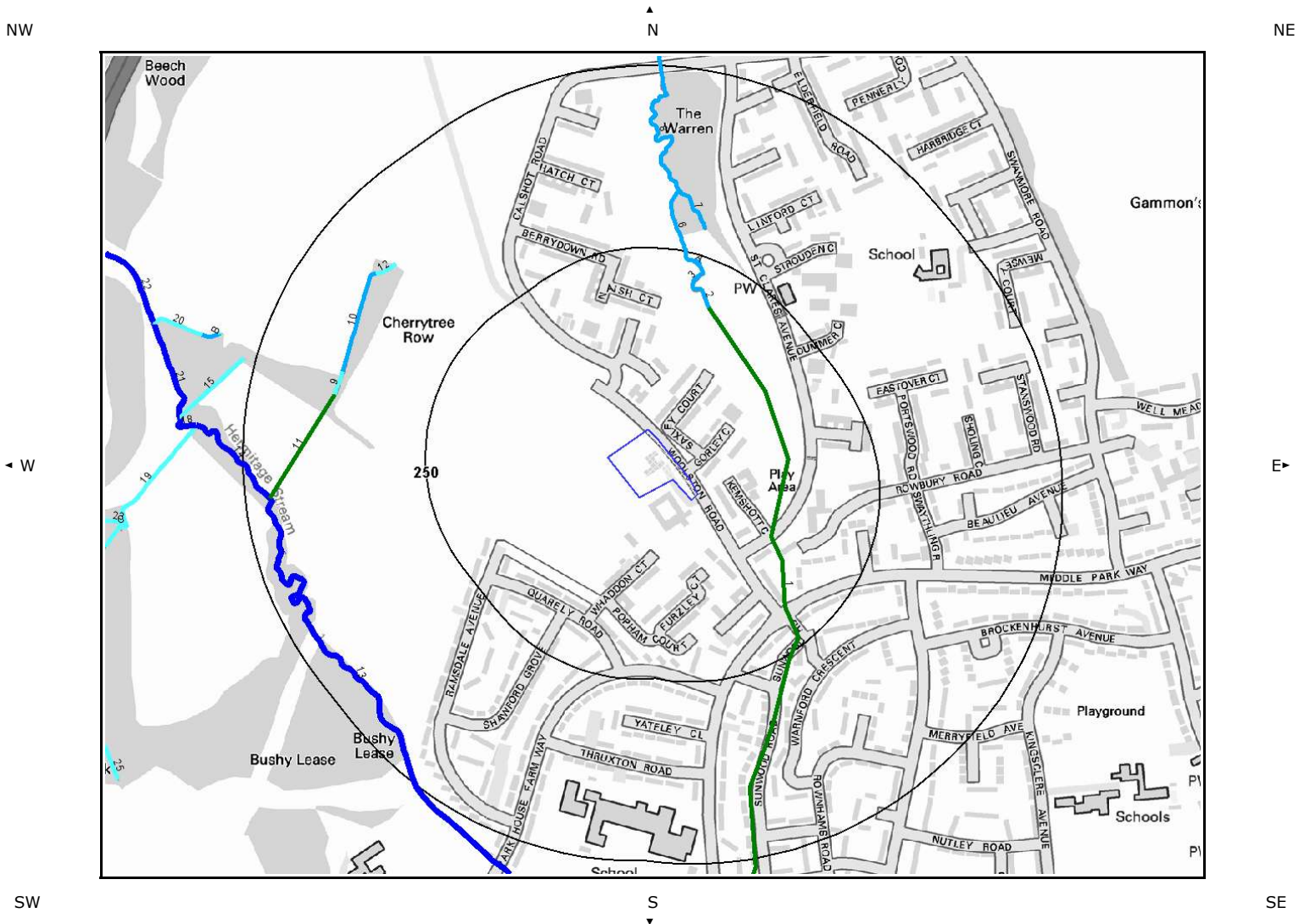
SPZ and Potable Water Abstraction Licenses Legend



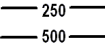
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5d. Hydrology – Detailed River Network and River Quality



Hydrology Legend

- | | | | | | |
|---|--------------------|---|---------------------------------------|---|-------------------------------------|
|  | Site Outline |  | Primary River |  | Canal |
|  | Search Buffers (m) |  | Secondary River |  | Canal Tunnel |
| | |  | Tertiary River |  | Extended Culvert (greater than 50m) |
| | |  | Lake/Reservoir |  | D/S of High Water Mark |
| | |  | Underground River (inferred) |  | D/S seaward extension |
| | |  | General Quality Assessment: Chemistry |  | General Quality Assessment: Biology |



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5. Hydrogeology and Hydrology

5.1 Aquifer within Superficial Deposits

Are there records of productive strata within the superficial geology at or in proximity to the property?

Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (5a):

ID	Distance [m]	Direction	Designation	Description
1	100.0	E	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
2	359.0	W	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

5.2 Aquifer within Bedrock Deposits

Are there records of productive strata within the bedrock geology at or in proximity to the property? **Yes**

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (5b):

ID	Distance [m]	Direction	Designation	Description
1	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
3	127.0	S	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	359.0	W	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	359.0	W	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

5.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 1000m of the study site?

No

Database searched and no data found.

5.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 1000m of the study site?

No

Database searched and no data found.

5.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site?

No

Database searched and no data found.

5.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site?

No

Database searched and no data found.

5.7 River Quality

Is there any Environment Agency information on river quality within 1500m of the study site?

No

Biological Quality:

Database searched and no data found.

Chemical Quality:

Database searched and no data found.

5.8 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site?

Yes

The following Detailed River Network records are represented on the Hydrology Map (5d):

ID	Distance	Direction	Details	
1	111.0	E	River Name: - Water Course Name: Park Lane Stream Welsh River Name: - Alternative Name: -	River Type: Extended Culvert (greater than 50m) Catchment: - Drain: NO Main River Status: Currently Undefined
2	188.0	NE	River Name: - Water Course Name: Park Lane Stream Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined

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3	203.0	N	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined
4A	236.0	N	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined
5A	236.0	N	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined
6	240.0	N	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined
7	287.0	N	River Name: Drain Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: YES Main River Status: Currently Undefined
8	332.0	N	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: NO Main River Status: Currently Undefined
9	381.0	W	River Name: Drain Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Catchment: - Drain: YES Main River Status: Currently Undefined
10	381.0	W	River Name: Drain Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Catchment: - Drain: YES Main River Status: Currently Undefined
11	384.0	W	River Name: - Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Extended Culvert (greater than 50m) Catchment: - Drain: NO Main River Status: Currently Undefined
12	394.0	NW	River Name: Drain Water Course Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Catchment: - Drain: YES Main River Status: Currently Undefined
13	450.0	W	River Name: Hermitage Stream Water Course Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Catchment: - Drain: NO Main River Status: Currently Undefined
14	466.0	W	River Name: Hermitage Water Course Name: Hermitage Stream Welsh River Name: - Alternative Name: -	River Type: Primary River Catchment: - Drain: NO Main River Status: Currently Undefined

5.9 Surface Water Features

Are there any surface water features within 250m of the study site?

Yes

The following surface water records are not represented on mapping:

Distance to Surface Water (m)	on-site	0-50	51-250
Surface water features within 250m of the study site	No	No	Yes

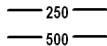
6. Environment Agency Flood Map



Environment Agency Flood Legend



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-  Site Outline
-  Search Buffers (m)
-  Zone 2 Floodplain
-  Zone 3 Floodplain
-  Flood Storage Area
-  Area Benefiting from Flood Defences
-  Flood Defences

6. Flooding

6.1 Zone 2 Flooding

Zone 2 floodplain estimates the annual probability of flooding as one in one thousand (0.1%) or greater from rivers and the sea but less than 1% from rivers or 0.5% from the sea. Alternatively, where information is available they may show the highest known flood level.

Is the site within 250m of an Environment Agency indicative Zone 2 floodplain?

Yes

The following floodplain records are represented as green shading on the Flood Map:

ID	Distance	Direction	Update	Type
1B	32.0	SE	01-Nov-2011	Zone 2 - (Fluvial Models)

6.2 Zone 3 Flooding

Zone 3 estimates the annual probability of flooding as one in one hundred (1%) or greater from rivers and a one in two hundred (0.5%) or greater from the sea. Alternatively, where information is available they may show the highest known flood level.

Is the site within 250m of an Environment Agency indicative Zone 3 floodplain?

Yes

The following floodplain records are represented as blue shading on the Flood Map:

ID	Distance	Direction	Update	Type
16B	44.0	E	01-Nov-2011	Zone 3 - (Fluvial Models)

6.3 Flood Defences

Are there any Flood Defences within 250m of the study site?

No

6.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site?

No

6.5 Areas used for Flood Storage

Are there any areas used for Flood Storage within 250m of the study site?

No

6.6 Groundwater Flooding Susceptibility Areas

Are there any British Geological Survey groundwater flooding susceptibility flood areas within 50m of the boundary of the study site?

Yes

Report Reference: EMS-154229_223222

What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

High

6.7 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result?

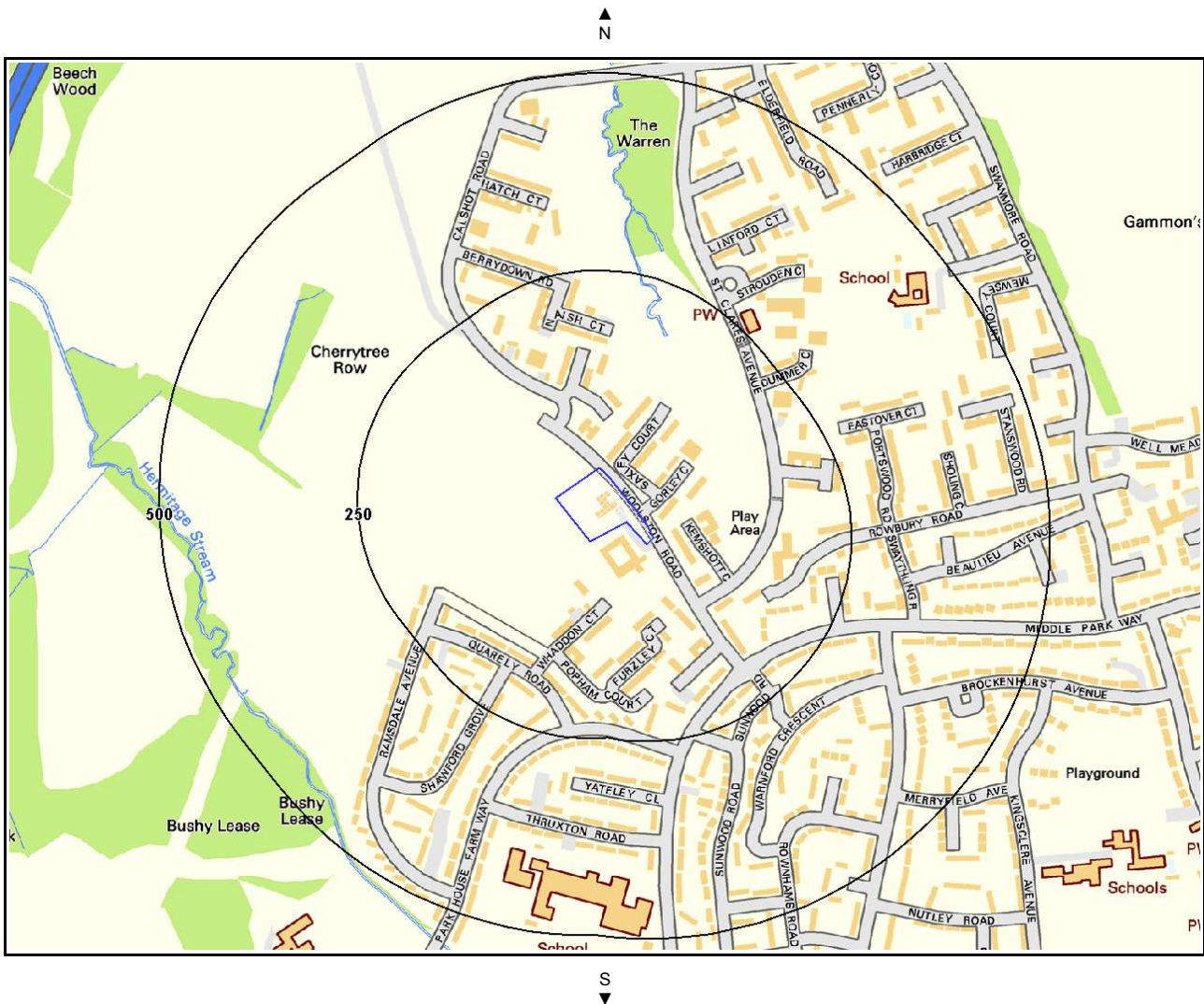
Low

Notes:

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The **confidence rating** is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

7.Designated Environmentally Sensitive Sites Map



Designated Environmentally Sensitive Sites Legend

Enabled by Ordnance Survey

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	Site Outline		SAC		SSSI		NNR		World Heritage Sites
	250		SPA		Ramsar		LNR		Environmentally Sensitive Areas
	500		Areas of Outstanding Natural Beauty		Nitrate Sensitive Areas		National Parks		

7. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 500m of the study site? **No**

Records of Sites of Special Scientific Interest (SSSI) within 500m of the study site: **0**

Database searched and no data found.

Records of National Nature Reserves (NNR) within 500m of the study site: **0**

Database searched and no data found.

Records of Special Areas of Conservation (SAC) within 500m of the study site: **0**

Database searched and no data found.

Records of Special Protection Areas (SPA) within 500m of the study site: **0**

Database searched and no data found.

Records of Ramsar sites within 500m of the study site: **0**

Database searched and no data found.

Records of Local Nature Reserves (LNR) within 500m of the study site: **0**

Database searched and no data found.

Records of World Heritage Sites within 500m of the study site: **0**

Database searched and no data found.

Records of Environmentally Sensitive Areas within 500m of the study site: **0**

Database searched and no data found.

Records of Areas of Outstanding Natural Beauty (AONB) within 500m of the study site: **0**

Database searched and no data found.

Records of National Parks (NP) within 500m of the study site: **0**

Database searched and no data found.

Records of Nitrate Sensitive Areas within 500m of the study site:	0
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Database searched and no data found.

Records of Nitrate Vulnerable Zones within 500m of the study site:	0
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Database searched and no data found.

8. Natural Hazards Findings

8.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a GroundSure GeoInsight, available from our website. The following information has been found:

8.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? **Negligible**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

8.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? **Very Low**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

8.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? **Null - Negligible**

Soluble rocks are not present in the search area. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

8.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? **Negligible**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

8.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site?

Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard

Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

8.1.6 Running Sand

What is the maximum Running Sand* hazard rating identified on the study site?

Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard

Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

* This indicates an automatically generated 50m buffer and site.

9. Mining

9.1 Coal Mining

Are there any coal mining areas within 75m of the study site?

No

Database searched and no data found.

9.2 Shallow Mining

What is the subsidence hazard relating to shallow mining on-site*?

Negligible

*Please note this data is searched with a 150m buffer.

9.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site?

No

Database searched and no data found.

10. Contacts

EmapSite

Telephone: 0118 9736883
sales@emapsite.com



British Geological Survey (England & Wales)

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143. Fax: 0115 936 3276. Email:
enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological
enquiries



Environment Agency

National Customer Contact Centre
PO Box 544
Rotherham
S60 1BY
Tel: 08708 506 506
Web: www.environment-agency.gov.uk
Email: enquiries@environment-agency.gov.uk



Health Protection Agency

Chilton, Didcot, Oxon, OX11 0RQ
Tel: 01235 822622 www.hpa.org.uk/radiation
Radon measures and general radon information and
guidance



The Coal Authority

200 Lichfield Lane, Mansfield, Notts NG18 4RG
Tel: 0845 762 6848. DX 716176 Mansfield 5
www.coal-authority.co.uk
Coal mining reports and related enquiries



Ordnance Survey

Romsey Road
Southampton SO16 4GU
Tel: 08456 050505



Local Authority

Authority: Havant Borough Council
Phone: 023 9247 4174
Web: www.havant.gov.uk
Address: Civic Centre Road, Havant, Hampshire, PO9 2AX

Get Mapping PLC

Virginia Villas, High Street, Hartley Witney, Hampshire RG27
8NW
Tel: 01252 845444



Acknowledgements

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This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these conditions unless the context otherwise requires:

"Beneficiary" means the Client or the customer of the Client for whom the Client has procured the Services.

"Commercial" means any building which is not Residential.

"Commission" means an order for Consultancy Services submitted by a Client.

"Consultancy Services" mean consultancy services provided by GroundSure including, without limitation, carrying out interpretation of third party and in-house environmental data, provision of environmental consultancy advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the performance of the Services which arises upon GroundSure's acceptance of an Order or Commission and which shall incorporate these conditions, the relevant GroundSure User Guide, proposal by GroundSure and the content of any subsequent report, and any agreed amendments in accordance with clause 11.

"Client" means the party that submits an Order or Commission.

"Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Report" means reports comprising factual data with no professional interpretation in respect of the level of likely risk and/or liability available from GroundSure.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028 and whose registered office is at Greater London House, Hampstead Road, London NW1 7EJ.

"GroundSure Materials" means all materials prepared by GroundSure as a result of the provision of the Services, including but not limited to Data Reports, Mapping and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, service marks, moral rights, data protection rights, know-how, trade mark or any other intellectual property rights.

"Mapping" an historical map or a combination of historical maps of various ages, time periods and scales available from GroundSure.

"Order" means an order form submitted by the Client requiring Services from GroundSure in respect of a specified Site.

"Order Website" means online platform via which Orders may be placed.

"Report" means a Risk Screening Report or Data Report for commercial or residential property available from GroundSure relating to the Site prepared in accordance with the specifications set out in the relevant User Guide.

"Residential" means any building used as or suitable for use as an individual dwelling.

"Risk Screening Report" means one of GroundSure's risk screening reports, comprising factual data with interpretation in respect of the level of likely risk and/or liability, excluding **"Consultancy Services"**.

"Services" means the provision of any Report, Mapping or Consultancy Services which GroundSure has agreed to carry out for the Client/Beneficiary on these terms and conditions in respect of the Site.

"Site" means the landsite in respect of which GroundSure provides the Services.

"Third Party Content" means any data, database or other information contained in a Report or Mapping which is provided to GroundSure by a Data Provider.

"User Guide" means the relevant current version of the user guide, available upon request from GroundSure.

2 Scope of Services

2.1 GroundSure agrees to carry out the Services in accordance with the Contract and to the extent set out therein.

2.2 GroundSure shall exercise all the reasonable skill, care and diligence to be expected of experienced environmental consultants in the performance of the Services.

2.3 The Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in the Contract.

2.4 Terms and conditions appearing on a Client's order form, printed stationery or other communication, including invoices, to GroundSure, its employees, servants, agents or other representatives or any terms implied by custom, practice or course of dealing shall be of no effect and these terms and conditions shall prevail over all others.

2.5 If a Client/Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to procure such insurance, but makes no warranty that such insurance shall be available from insurers or offered on reasonable terms. GroundSure does not endorse or recommend any particular insurance product, policy or insurer. Any insurance purchased shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. The Client/Beneficiary should take independent advice to ensure that the insurance policy requested and/or offered is suitable for its requirements.

2.6 GroundSure's quotations/proposals are valid for a period of 30 days only. GroundSure reserves the right to withdraw any quotation at any time before GroundSure accepts an Order or Commission. GroundSure's acceptance of an Order or Commission shall be effective only where such acceptance is in writing and signed by GroundSure's authorised representative or where accepted via GroundSure's Order Website.

3 The Client's obligations

3.1 The Client shall ensure the Beneficiary complies with and is bound by the terms and conditions set out in the Contract and shall provide that GroundSure may in its own right enforce such terms and conditions against the Beneficiary pursuant to the Contracts (Rights of Third Parties) Act 1999. The Client shall be liable for all breaches of the Contract by the Beneficiary as if they were breaches by the Client. The Client shall be solely responsible for ensuring that the Report/Mapping ordered is appropriate and suitable for the Beneficiary's needs.

3.2 The Client shall (or shall procure that the Beneficiary shall) supply to GroundSure as soon as practicable and without charge all information necessary and accurate relevant data including any specific and/or unusual environmental information relating to the Site known to the Client/Beneficiary which may pertain to the Services and shall give such assistance as GroundSure shall reasonably require in the performance of the Services (including, without limitation, access to a Site, facilities and equipment as agreed in the Contract).

3.3 Where Client/Beneficiary approval or decision is required, such approval or decision shall be given or procured in reasonable time as not to delay or disrupt the performance of any other part of the Services.

3.4 The Client shall not and shall not knowingly permit the Beneficiary to, save as expressly permitted by these terms and conditions, re-sell, alter, add to, amend or use out of context the content of any Report, Mapping or, in respect of any Services, information given by GroundSure. For the avoidance of doubt, the Client and Beneficiary may make the Report, Mapping or GroundSure's findings available to a third party who is considering acquiring the whole or part of the Site, or providing funding in relation to the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.5 The Client is responsible for maintaining the confidentiality of its user name and password if using GroundSure's internet ordering service and accepts responsibility for all activity that occurs under such account and password.

4 Reliance

4.1 Upon full payment of all relevant fees and subject to the provisions of these terms and conditions, the Client and Beneficiary are granted an irrevocable royalty-free licence to access the information contained in a Report, Mapping or in a report prepared by GroundSure in respect of or arising out of Consultancy Services. The Services may only be used for the benefit of the Client and those persons listed in clauses 4.2 and 4.3.

4.2 In relation to Data Reports, Mapping and Risk Screening Reports, the Client shall be entitled to make Reports available to (i) the Beneficiary, (ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate), (iv) the first purchaser or first tenant of the Site (v) the professional advisers and lenders of the first purchaser or tenant of the Site. Accordingly GroundSure shall have the same duties and obligations to those persons in respect of the Services as it has to the Client and those persons shall have the benefit of any of the Client's rights under the Contract as if those persons were parties to the Contract. For the avoidance of doubt, the limitations of GroundSure's liability as set out in clauses 7 and 11.6 shall apply.

4.3 In relation to Consultancy Services, reliance shall be limited to the Client, Beneficiary and named parties on the Report.

4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise agreed in writing with GroundSure, any other party considering the information supplied by GroundSure as part of the Services, including (but not limited to) insurance underwriters, does so at their own risk and GroundSure has no legal obligations to such party unless otherwise agreed in writing.

4.5 The Client shall not and shall not knowingly permit any person (including the Beneficiary) who is provided with a copy of any Report, (except as permitted herein or by separate agreement with GroundSure) to: (a) remove, suppress or modify any trade mark, copyright or other proprietary marking from the Report or Mapping; (b) create any product which is derived directly or indirectly from the data contained in the Report or Mapping; (c) combine the Report or Mapping with, or incorporate the Report or Mapping into any other information data or service; or (d) re-format or otherwise change (whether by modification, addition or enhancement) data or images contained in the Report or Mapping.

4.6 Notwithstanding clause 4.5, if the Client acts in a professional capacity, it may make reasonable use of a Report and/or findings made as a result of Consultancy Services to advise Beneficiaries. However, GroundSure shall have no liability in respect of any opinion or report given to such Beneficiaries by the Client or a third party.

5 Fees and Disbursements

5.1 GroundSure shall charge the Client fees at the rate and frequency specified in the Contract together, in the case of Consultancy Services, with all proper disbursements incurred by GroundSure in performing the Services. For the avoidance of doubt, the fees payable for the Services are as set out in GroundSure's written proposal, Order Website or Order acknowledgement form. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services.

5.2 Unless GroundSure requires prepayment, the Client shall promptly pay all fees disbursements and other monies due to GroundSure in full without deduction, counterclaim or set off together with such value added tax or other tax as may be required within 30 days from the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("**Payment Date**"). GroundSure reserves the right to charge interest which shall accrue on a daily basis from 30 days after the date of Payment Date until the date of payment (whether before or after judgment) at the rate of five per cent per annum above the Bank of England base rate from time to time.

5.3 In the event that the Client disputes the amount payable in respect of GroundSure's invoice it shall notify GroundSure no later than 28 days after the date thereof that it is in dispute. In default of such notification the Client shall be deemed to have agreed the amount thereof. As soon as reasonably practicable following receipt of a notification in respect of any disputed invoice, a member of the management team at GroundSure shall contact the Client and the parties shall use all reasonable endeavours to resolve the dispute.

6 Intellectual Property and Confidentiality

6.1 Subject to the provisions of clause 4.1, the Client and the Beneficiary hereby acknowledge that all Intellectual Property in the Services and Content are and shall remain owned by either GroundSure or the Data Providers and nothing in these terms purports to transfer or assign any rights to the Client or the Beneficiary in respect of the Intellectual Property.

6.2 The Client shall acknowledge the ownership of the **Third Party Content** where such **Third Party Content** is incorporated or used in the Client's own documents, reports, systems or services whether or not these are supplied to a third party.

6.3 Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client acknowledges that the proprietary rights subsisting in copyright, database rights and any other intellectual property rights in respect of any data and information contained in any Report are and shall remain (subject to clause 11.1) the property of GroundSure and/or any third party that has supplied data or information used to create a Report, and that these conditions do not purport to grant, assign or transfer any such rights in respect thereof to a Client and/or a Beneficiary.

6.5 The Client shall (and shall procure that any recipients of the Report as permitted under clause 4.2 shall):

(i) not remove, suppress or modify any trademark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;

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- (iii) not create any product or report which is derived directly or indirectly from the data contained in the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
 - (iv) not combine the Services with or incorporate such Services into any other information data or service; and
 - (v) not reformat or otherwise change (whether by modification, addition or enhancement), data contained in the Services (save that those acting in a professional capacity to the Beneficiary shall not be in breach of this clause 6.5(v) where such reformatting is in the normal course of providing advice based upon the Services), in each case of parts (iii) to (v) inclusive, whether or not such product or report is produced for commercial profit or not.
- 6.6 The Client and/or Beneficiary shall and shall procure that any party to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.
- 6.8 Save as otherwise set out in these terms and conditions, any information provided by one party ("**Disclosing Party**") to the other party ("**Receiving Party**") shall be treated as confidential and only used for the purposes of these terms and conditions, except in so far as the Receiving Party is authorised by the Disclosing Party to provide such information in whole or in part to a third party.

7 Liability

THE CLIENT'S ATTENTION IS DRAWN TO THIS PROVISION

- 7.1 Subject to the provisions of this clause 7, GroundSure shall be liable to the Beneficiary only in relation to any direct losses or damages caused by any negligent act or omission of GroundSure in preparing the GroundSure Materials and provided that the Beneficiary has used all reasonable endeavours to mitigate any such losses.
- 7.2 GroundSure shall not be liable for any other losses or damages incurred by the Beneficiary, including but not limited to:
- (i) loss of profit, revenue, business or goodwill, losses relating to business interruption, loss of anticipated savings, loss of or corruption to data or for any special, indirect or consequential loss or damage which arise out of or in connection with the GroundSure Materials or otherwise in relation to a Contract;
 - (ii) any losses or damages that arise as a result of the use of all or part of the GroundSure Materials in breach of these terms and conditions or contrary to the terms of the relevant User Guide;
 - (iii) any losses or damages that arise as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such part is based on any Third Party Content or any reasonable interpretation of Third Party Content. The Client accepts, and shall procure that any other Beneficiary shall accept, that it has no claim or recourse to any Data Provider in relation to Third Party Content; and/or
 - (iv) any loss or damage to a Client's computer, software, modem, telephone or other property caused by a delay or loss of use of GroundSure's internet ordering service.
- 7.3 GroundSure's total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise, arising in connection with the GroundSure Materials or otherwise in relation to the Contract shall be limited to £10 million in total (i) for any one claim or (ii) for a series of connected claims brought by one or more parties.
- 7.4 For the duration of the liability periods set out in clauses 7.5 and 7.6 below, GroundSure shall maintain professional indemnity insurance in respect of its liability under these terms and conditions provided such insurance is readily available at commercially viable rates. GroundSure shall produce evidence of such insurance if reasonably requested by the Client. A level of cover greater than GroundSure's current level of cover may be available upon request and agreement with the Client.
- 7.5 Any claim under the Contract in relation to Data Reports, Mapping and Risk Screening Reports, must be brought within six years from the date when the Beneficiary became aware that it may have a claim and in no event may a claim be brought twelve years or more after completion of such a Contract. For the avoidance of doubt, any claim in respect of which proceedings are notified to GroundSure in writing prior to the expiry of the time periods referred to in this clause 7.5 shall survive the expiry of those time periods provided the claim is actually commenced within six months of notification.
- 7.6 Any claim under the Contract in relation to Consultancy Services, must be brought within six years from the date the Consultancy Services were completed.
- 7.7 The Client accepts and shall procure that any other Beneficiary shall accept that it has no claim or recourse to any Data Provider or to GroundSure in respect of the acts or omissions of any Data Provider and/or any Third Party Content provided by a Data Provider.
- 7.8 Nothing in these terms and conditions:
- (i) excludes or limits the liability of GroundSure for death or personal injury caused by GroundSure's negligence, or for fraudulent misrepresentation; or
 - (ii) shall affect the statutory rights of a consumer under the applicable legislation.

8 GroundSure right to suspend or terminate

- 8.1 In the event that GroundSure reasonably believes that the Client or Beneficiary as applicable has not provided the information or assistance required to enable the proper performance of the Services, GroundSure shall be entitled on fourteen days written notice to suspend all further performance of the Services until such time as any such deficiency has been made good.
- 8.2 GroundSure may additionally terminate the Contract immediately on written notice in the event that:
- (i) the Client shall fail to pay any sum due to GroundSure within 28 days of the Payment Date; or
 - (ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an Administration Order made against it or if a Receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
 - (iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
 - (iv) the Client or the Beneficiary breaches any material term of the Contract (including, but not limited to, the obligations in clause 4) incapable of remedy or if remediable, is not remedied within 14 days of notice of the breach.

9 Client's Right to Terminate and Suspend

- 9.1 Subject to clause 10.2, the Client may at any time after commencement of the Services by notice in writing to GroundSure require GroundSure to terminate or suspend immediately performance of all or any of the Services.
- 9.2 The Client waives all and any right of cancellation it may have under the Consumer Protection (Distance Selling) Regulations 2000 (as amended) in respect of the Order of a Report/Mapping. This does not affect the Beneficiary's statutory rights.

10 Consequences of Withdrawal, Termination or Suspension

- 10.1 Upon termination or any suspension of the Services, GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client/Beneficiary any property of the Client/ Beneficiary in GroundSure's possession or control.
- 10.2 In the event of termination/suspension of the Contract under clauses 8 or 9, the Client shall pay to GroundSure all and any fees payable in respect of the performance of the Services up to the date of termination/suspension. In respect of any Consultancy Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination/suspension of the Contract.

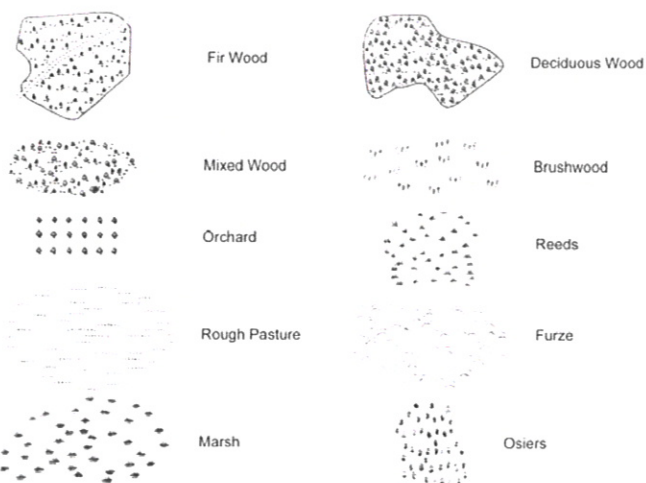
11 General

- 11.1 The mapping contained in the Services is protected by Crown copyright and must not be used for any purpose outside the context of the Services or as specifically provided in these terms.
- 11.2 GroundSure reserves the right to amend these terms and conditions. No variation to these terms shall be valid unless signed by an authorised representative of GroundSure.
- 11.3 No failure on the part of GroundSure to exercise and no delay in exercising, any right, power or provision under these terms and conditions shall operate as a waiver thereof.
- 11.4 Save as expressly provided in clauses 4.2, 4.3, 6.3 and 11.5, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
- 11.5 The Secretary of State for Communities and Local Government acting through Ordnance Survey may enforce breach of clause 6.1 of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
- 11.6 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
- (i) the Client or Beneficiary's failure to provide facilities, access or information;
 - (ii) fire, storm, flood, tempest or epidemic;
 - (iii) Acts of God or the public enemy;
 - (iv) riot, civil commotion or war;
 - (v) strikes, labour disputes or industrial action;
 - (vi) acts or regulations of any governmental or other agency;
 - (vii) suspension or delay of services at public registries by Data Providers; or
 - (viii) changes in law.
- 11.7 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
- 11.8 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email and on the second working day after the day of posting if sent by first class post.
- 11.9 The Contract constitutes the entire contract between the parties and shall supersede all previous arrangements between the parties.
- 11.10 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
- 11.11 These terms and conditions shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with these terms and conditions shall be subject to the exclusive jurisdiction of the English courts.
- 11.12 If the Client or Beneficiary has a complaint about the Services, notice can be given in any format eg writing, phone, email to the Compliance Officer at GroundSure who will respond in a timely manner.

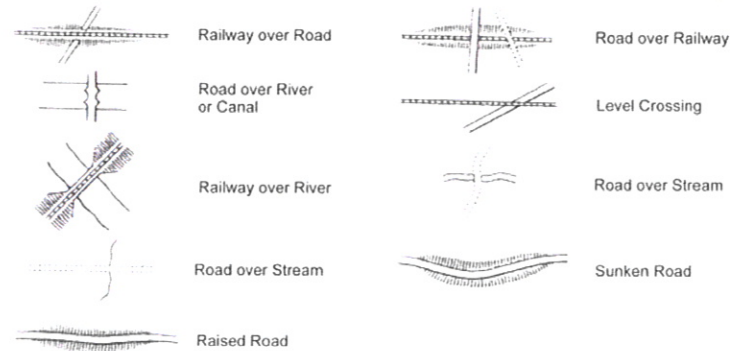
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County Series 1:10,560 scale

VEGETATION



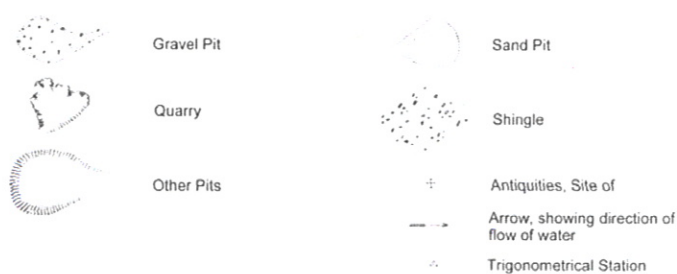
ROADS



RAILWAYS



GENERAL FEATURES



BOUNDARIES



National Grid 1:10,000 scale

HEIGHTS (METRES)

Values are given in metres above mean sea level at Newlyn

Surface heights determined by ground survey or air survey

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

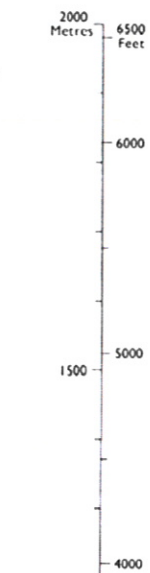
Contours are at 5 metres vertical interval

ROCK FEATURES



CONVERSION SCALE

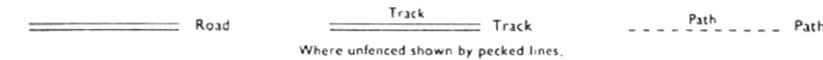
Metres - Feet



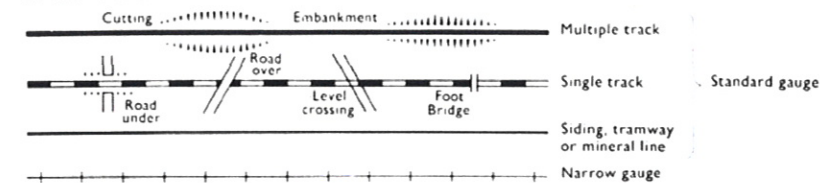
ABBREVIATIONS

BP, BS	Boundary Post or Stone	PO	Post Office
Ch	Church	PC	Public Convenience
CH	Club House	PH	Public House
F Sta	Fire Station	S	Stone
FB	Foot Bridge	Spr	Spring
Fn	Fountain	TCB	Telephone Call Box
GP	Guide Post	TCP	Telephone Call Post
MP, MS	Mile Post or Stone	TH	Town Hall
P	Pole or Post	W	Well
Pol Sta	Police Station	Y	Youth hostel

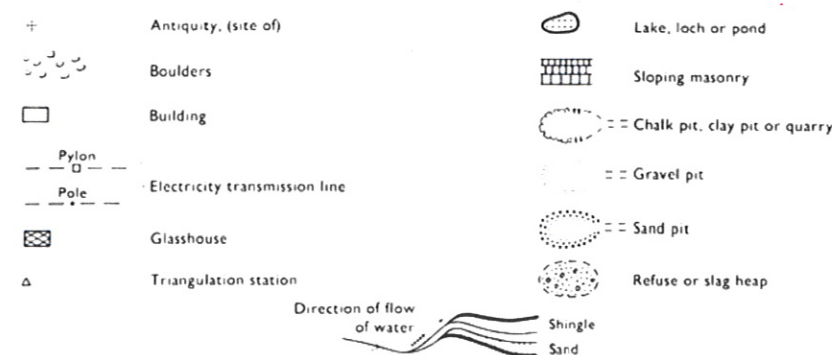
ROADS



RAILWAYS



GENERAL FEATURES



VEGETATION



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



Historical Map Pack Legend

County Series & National Grid

1:10,560 scale & 1:10,000 scale

Information present on these legends is sourced from the same Ordnance Survey mapping as the maps used in this product.

If you have a query regarding any of the maps provided please contact GroundSure's technical helpline. We will endeavour to answer any queries you may have.

Technical Helpline

Tel:01273 819 700

maps&data@groundsure.com

www.groundsure.com

County Series 1:2,500 scale

National Grid 1:2,500 / 1:1,250 scale



GroundSure

**Historical Map Pack
Legend**

County Series

1:1,250 scale



County Series & National Grid

1:2,500 scale

Information present on these legends is sourced from the same Ordnance Survey mapping as the maps used in this product.

If you have a query regarding any of the maps provided within this map pack, please contact GroundSure's technical helpline. We will endeavour to answer any queries you may have.

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GENERAL FEATURES

Wood Marsh Reeds

Fir Mixed Wood Brush Wood Osiers

Orchard Bush Rough Pasture Furze

Ford Stepping Stones Ferry Sloping Masonry Flat Rock

Lock Waterfall Quarry Sand Pit Refuse Heap Clay Pit

Shingle Gravel Pit

▲ Trigonometrical Station
 507 △ Altitude at Trigonometrical Station
 B M 325 9 ↑ Bench Mark
 342 + Surface Level
 △ Permanent Traverse Station
 + Antiquities (site of)
 → Arrow denotes flow of water

Sl Sluice
 Tr Trough
 Sp Spring
 W Well
 M R Mooring Ring
 M P Mooring Post
 B S Boundary Stone
 B F Boundary Post

ROADS

A simple line drawing showing a road crossing a single stream. The road is represented by two parallel lines, and the stream is a single line passing underneath.

Road over single stream

A line drawing showing a road crossing a railway. The road is a single line crossing over the railway tracks, which are represented by two parallel lines with cross-ticks.

Road crossing railway

A line drawing showing a road crossing a river or canal. The road is a single line crossing over the water body, which is represented by a wavy line.

Road over River or Canal

RAILWAYS

A line drawing showing a railway crossing a river or canal. The railway tracks, represented by two parallel lines with cross-ticks, cross over the water body, which is a wavy line.

Railway crossing River or Canal

A line drawing showing a railway crossing a road. The railway tracks, represented by two parallel lines with cross-ticks, cross over the road, which is a single line.

Railway crossing Road

A line drawing showing a level crossing. A road, represented by a single line, crosses over railway tracks, which are represented by two parallel lines with cross-ticks.

Level Crossing

A line drawing showing an embankment. A railway track, represented by two parallel lines with cross-ticks, is elevated on a raised structure.

Embankment

A line drawing showing a cutting. A railway track, represented by two parallel lines with cross-ticks, is shown in a deep excavation or cut through the ground.

Cutting

ABBREVIATIONS

	Trigonometrical Station
507	Altitude at Trigonometrical Station
B M 325 9	Bench Mark
342	Surface Level
	Permanent Traverse Station
	Antiquities (site of)
	Arrow denotes flow of water

<i>Sl</i>	Sluice
<i>Tr</i>	Trough
<i>Sp.</i>	Spring
<i>W</i>	Well
<i>M.R</i>	Mooring Ring
<i>M.P</i>	Mooring Post
<i>B.S</i>	Boundary Stone
<i>B.P</i>	Boundary Post

ABBREVIATIONS

BH	Beer House
BM	Bench Mark
BP	Boundary Post
BS	Boundary Stone
C	Crane
CH	Club House
Chy	Chimney
Cn	Capstan
Dfn	Drinking Fountain
Dk	Dock
EIP	Electricity Pillar or Post
ETL	Electricity Transmission Line
FA	Fire Alarm
FAP	Fire Alarm Pillar
FAB	Filter Bed, Foot Bridge
FBM	Fundamental Bench Mark
FS	Frazzled

F Sta	Fire Station
GP	Guide Post
GVC	Gas Valve Compound
H	Hydrant or Hydraulic
ha	Hectares
LB	Letter Box
LB Sta	Lifboat Station
LC	Level Crossing
LG	Loading Gauge
LHo	Lighthouse
LTw	Lighting Tower
m	Metres
MHW	Mean High Water
MHWS	Mean High Water Springs
MLW	Mean Low Water
MLWS	Mean Low Water Springs
MP	Mile or Mooring Post

MPU	Mail Pick up
MS	Mill Stone
NT	National Trust
NTL	Normal Tidal Limit
NTS	National Trust for Scotland
P	Pillar, Pole or Post
PC	Public Convenience
PCB	Police Call Box
PH	Public House
PO	Post Office
Pd	Pump
PTP	Police Telephone Pillar
Resr	Reservoir
KM	Road House
rp	Revision Point
S	Stone
SB	Signal Box

SL	Signal Light
Sl	Sluice
SP	Signal Post
Spr	Spring
SS	Signal Station
T C B	Telephone Call Box
T C P	Telephone Call Post
Tk	Tank or Track
Tr	Trough
ts	Traverse Station
W	Well
WB	Weighbridge
Wd Pp	Wind Pump
Wks	Works
Wr Pt	Water Point
Wr T	Water Tap

GroundSure's technical team is on hand to help you with your
endeavour to answer the question: "What's below?"

Technical Helpline
Tel: 01273 819 700
maps&data@groundsure.co.uk

GENERAL FEATURES

BOUNDARIES

England & Wales

— — — — — County Boundary (geographical)

· · · · · County & Civil Parish Boundary coterminous

— + — + — Admin County or County Borough Boundary

— ○ — ○ — London Borough Boundary

M.B. Bdy. U.D. Bdy. R.D. Bdy. County District Boundaries based on civil parish

England, Wales & Scotland	
.....	Civil Parish Boundary
Boro (or Burgh) Const & Ward Bdy	Partly & Ward Boundaries
Co Const Bdy	based on civil parish
Boro (or Burgh) Const & Ward Bdy	Partly & Ward Boundaries
Co Const Bdy	not based on civil parish

Scotland	
-----*	County Boundary (geographical)
-----†	" " " " " "
-----*	County Council Boundary
-----†	" " " " " "
-----*	County of the City Boundary
-----†	" " " " " "
-----*	Burgh Boundary
-----†	" " " " " "
-----*	District Council Boundary
-----†	" " " " " "

* Not with parish † Coincident with parish

Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

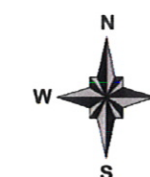
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1859

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1859
Revised 1859
Edition NA
Copyright NA
Levelled NA

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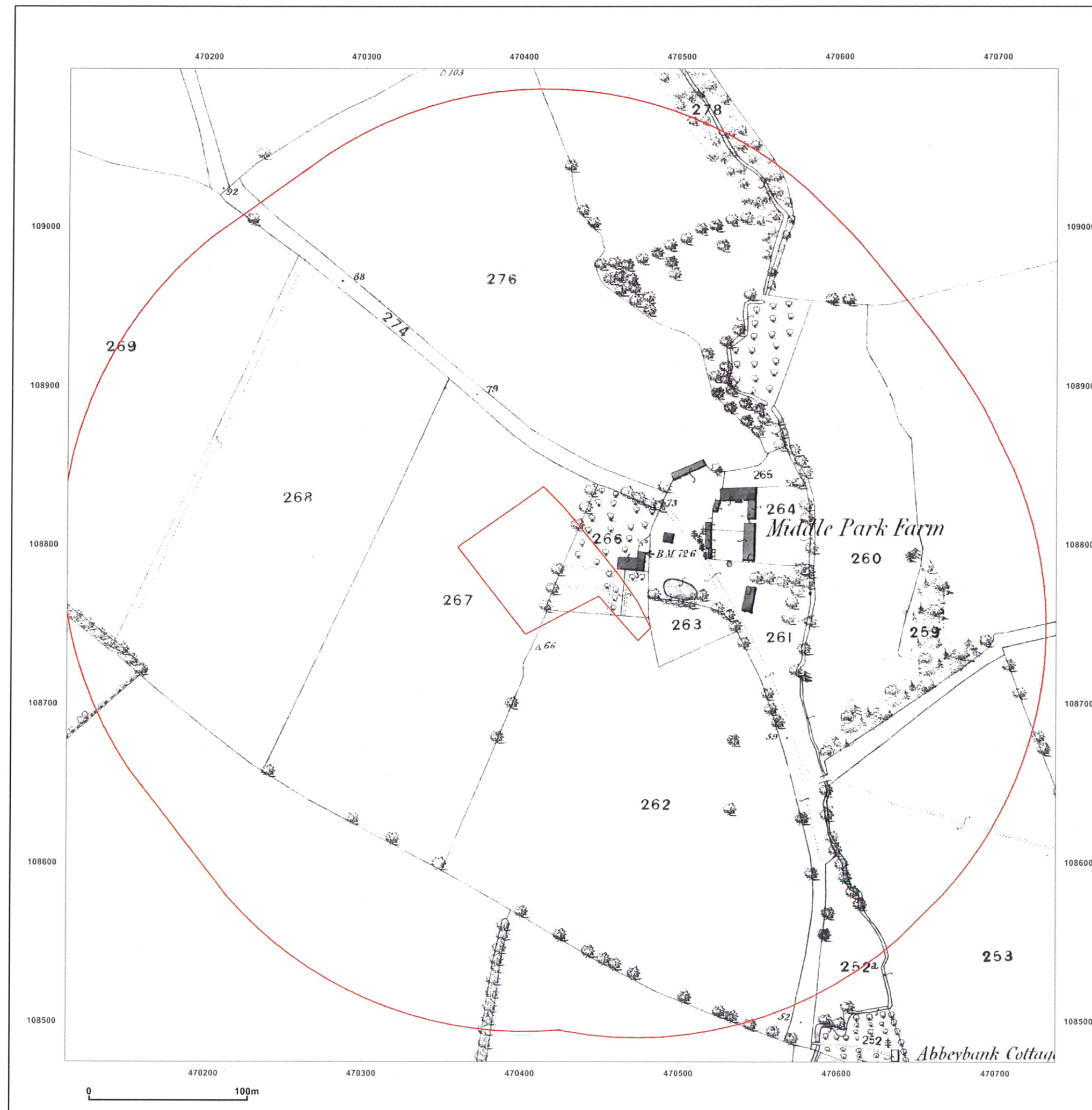


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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1868

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1868
Revised 1868
Edition NA
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4JN

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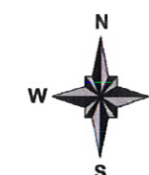
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1895

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1865
Revised 1895
Edition NA
Copyright NA
Levelled NA

Surveyed 1867
Revised 1895
Edition NA
Copyright NA
Levelled NA

Surveyed 1867
Revised 1895
Edition NA
Copyright NA
Levelled NA

Surveyed 1872
Revised 1895
Edition NA
Copyright NA
Levelled NA



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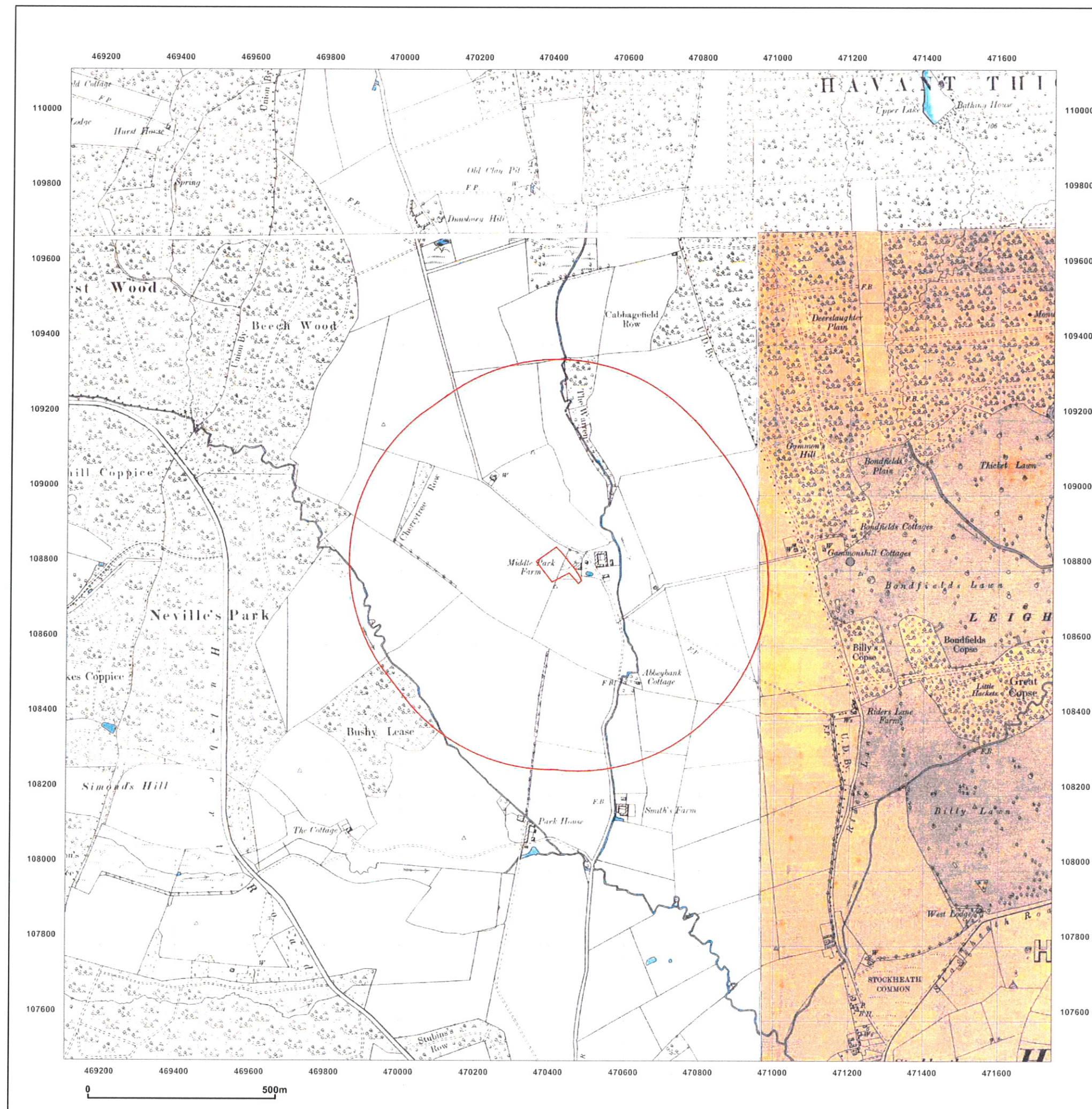


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Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1897

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1897
Revised 1897
Edition NA
Copyright NA
Levelled NA



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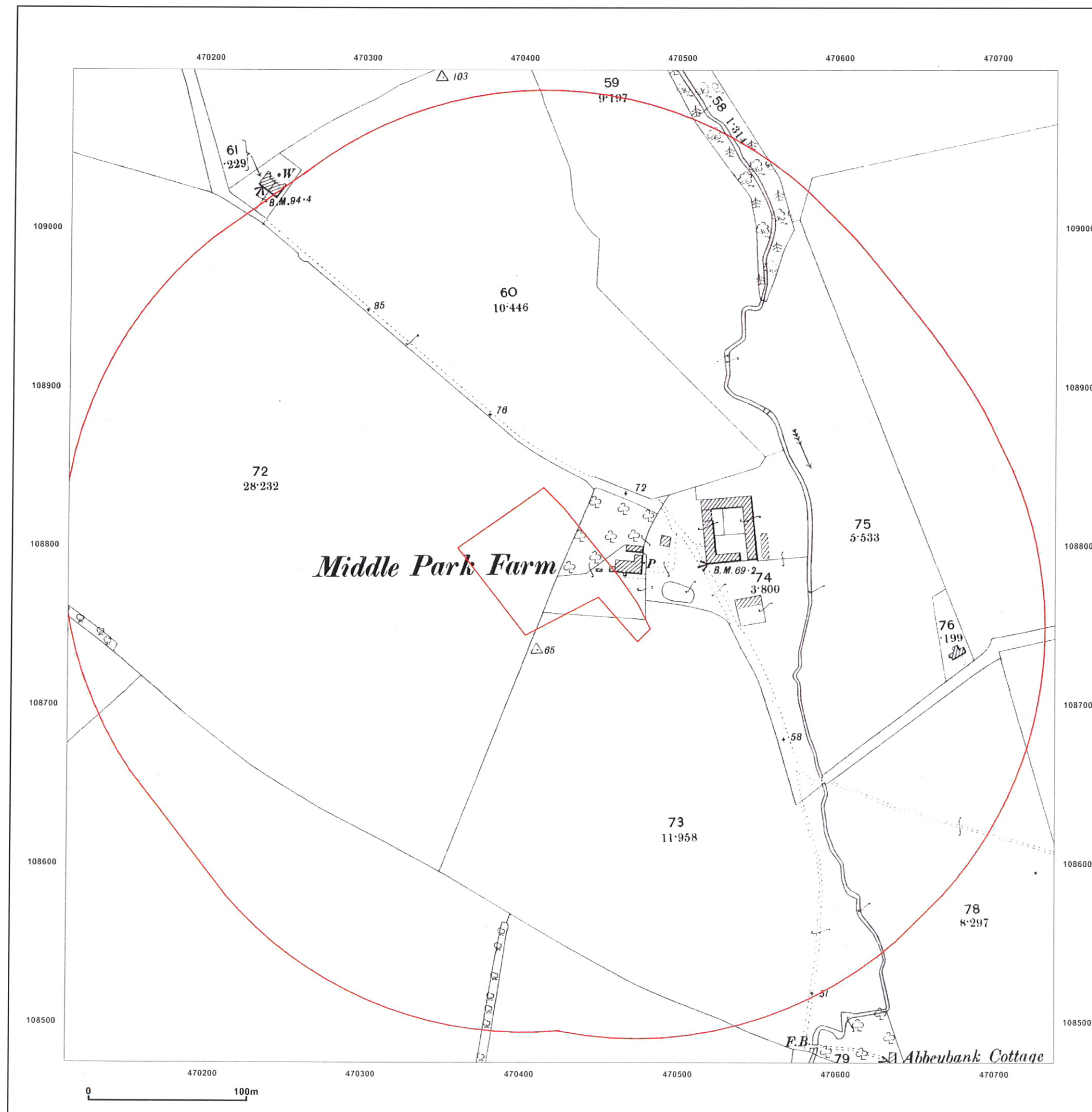


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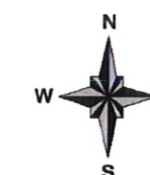
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1907

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Printed at: 1:10,560

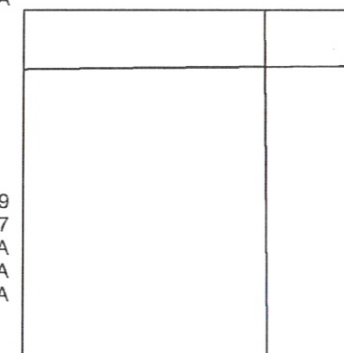


Surveyed 1865
Revised 1907
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1907
Edition NA
Copyright NA
Levelled NA

Surveyed 1859
Revised 1907
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1907
Edition NA
Copyright NA
Levelled NA



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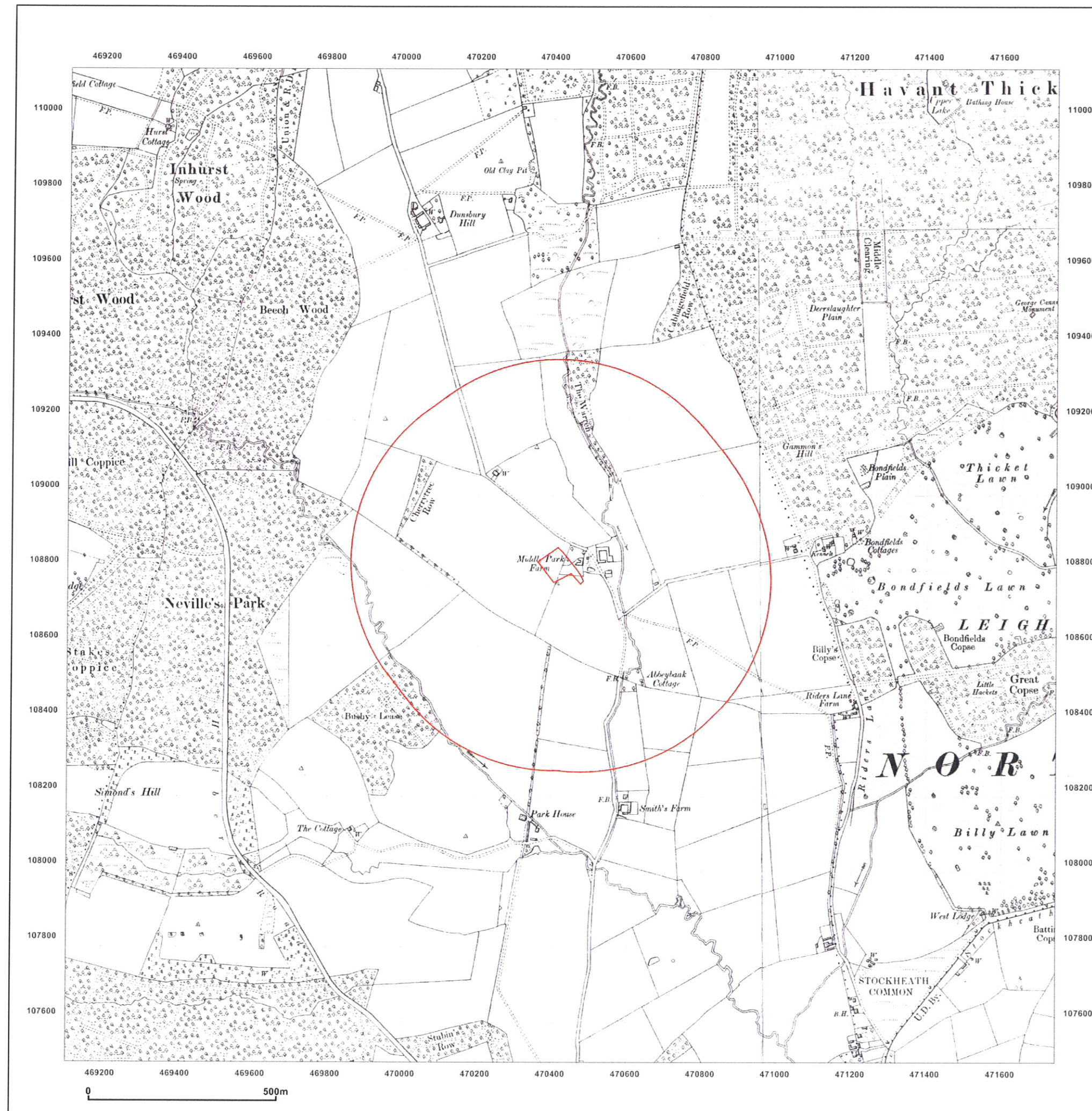


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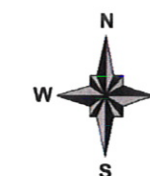
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Map Name: County Series

Map date: 1908

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1908
Revised 1908
Edition NA
Copyright NA
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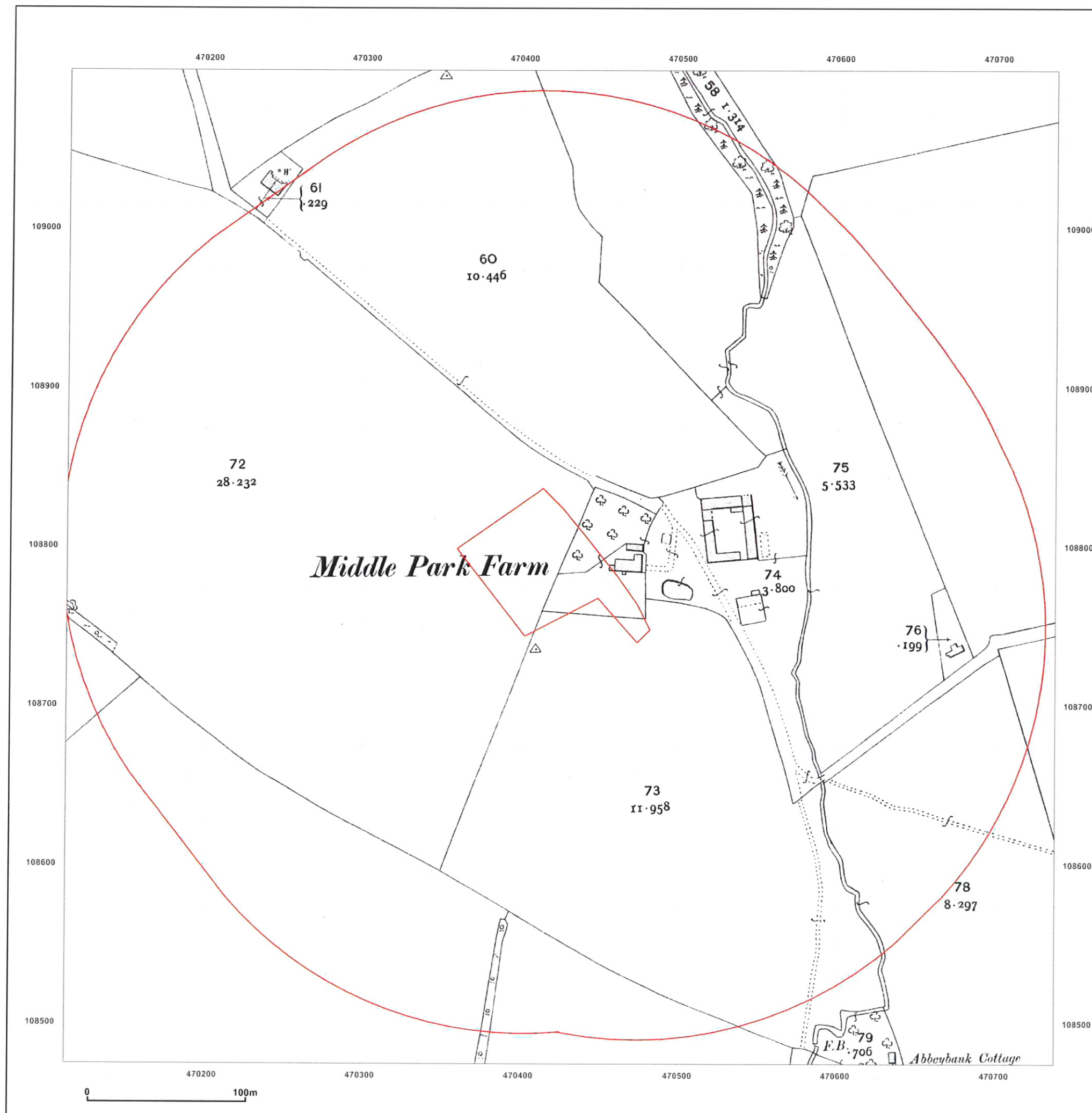


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Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1930-1932

Scale: 1:10,560

Printed at: 1:10,560

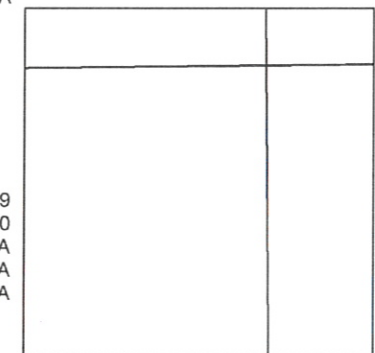


Surveyed 1865
Revised 1865
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1931
Edition NA
Copyright NA
Levelled NA

Surveyed 1859
Revised 1930
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1931
Edition NA
Copyright NA
Levelled NA



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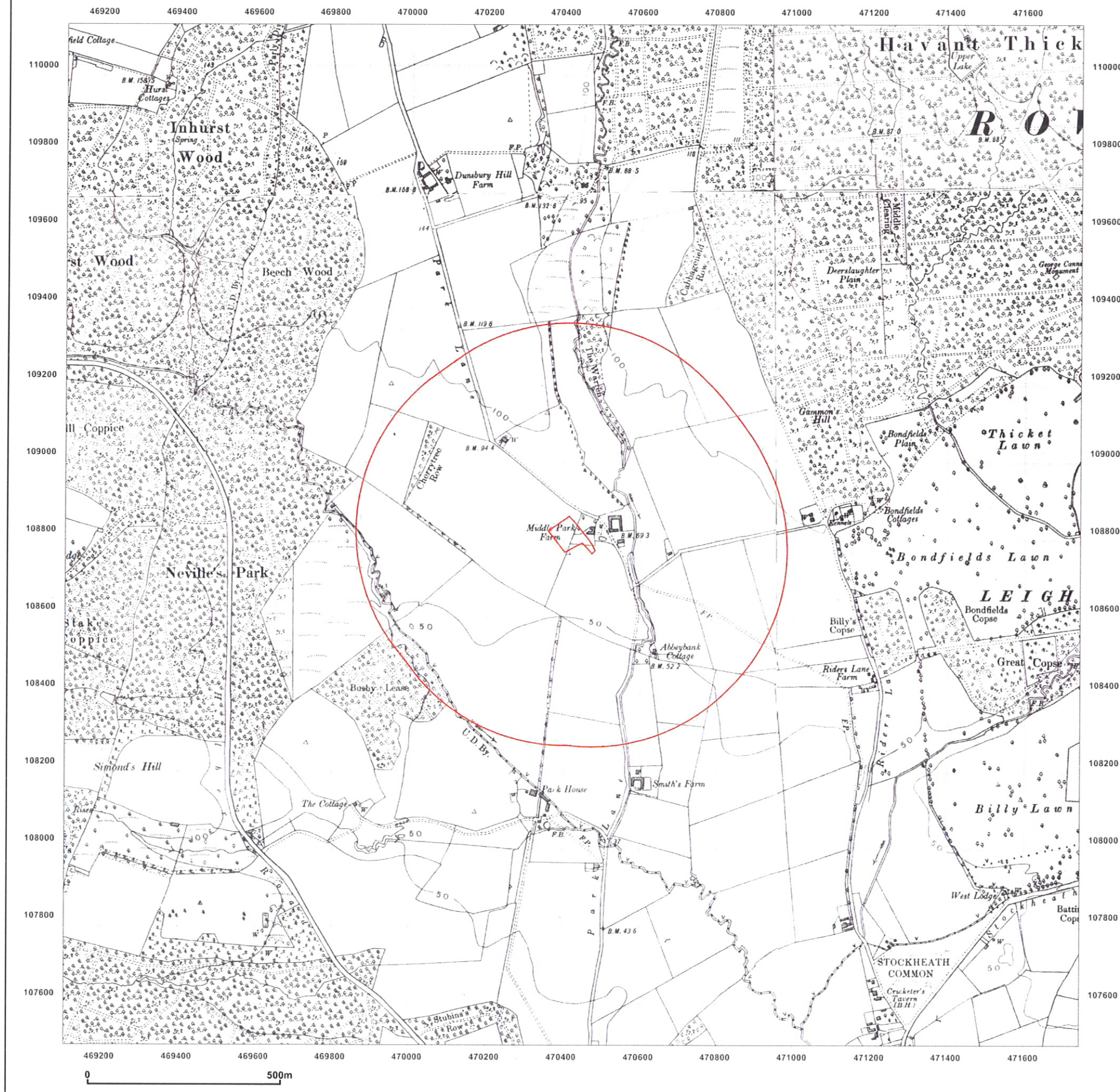


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Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1932

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1932
Revised 1932
Edition NA
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Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1859
Revised 1938
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1938
Edition NA
Copyright NA
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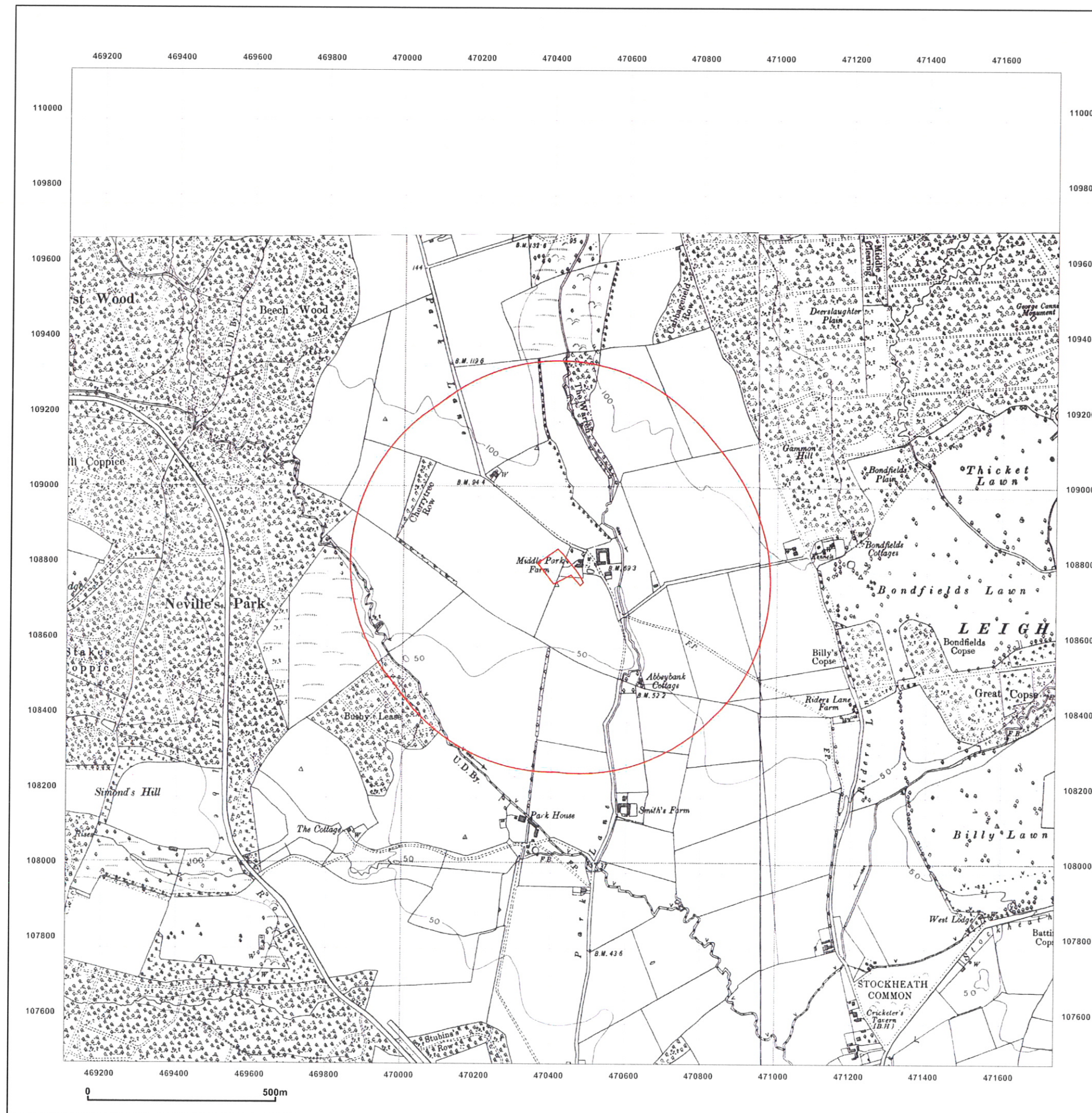


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4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: County Series

Map date: 1939

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1939
Revised 1939
Edition NA
Copyright NA
Levelled NA



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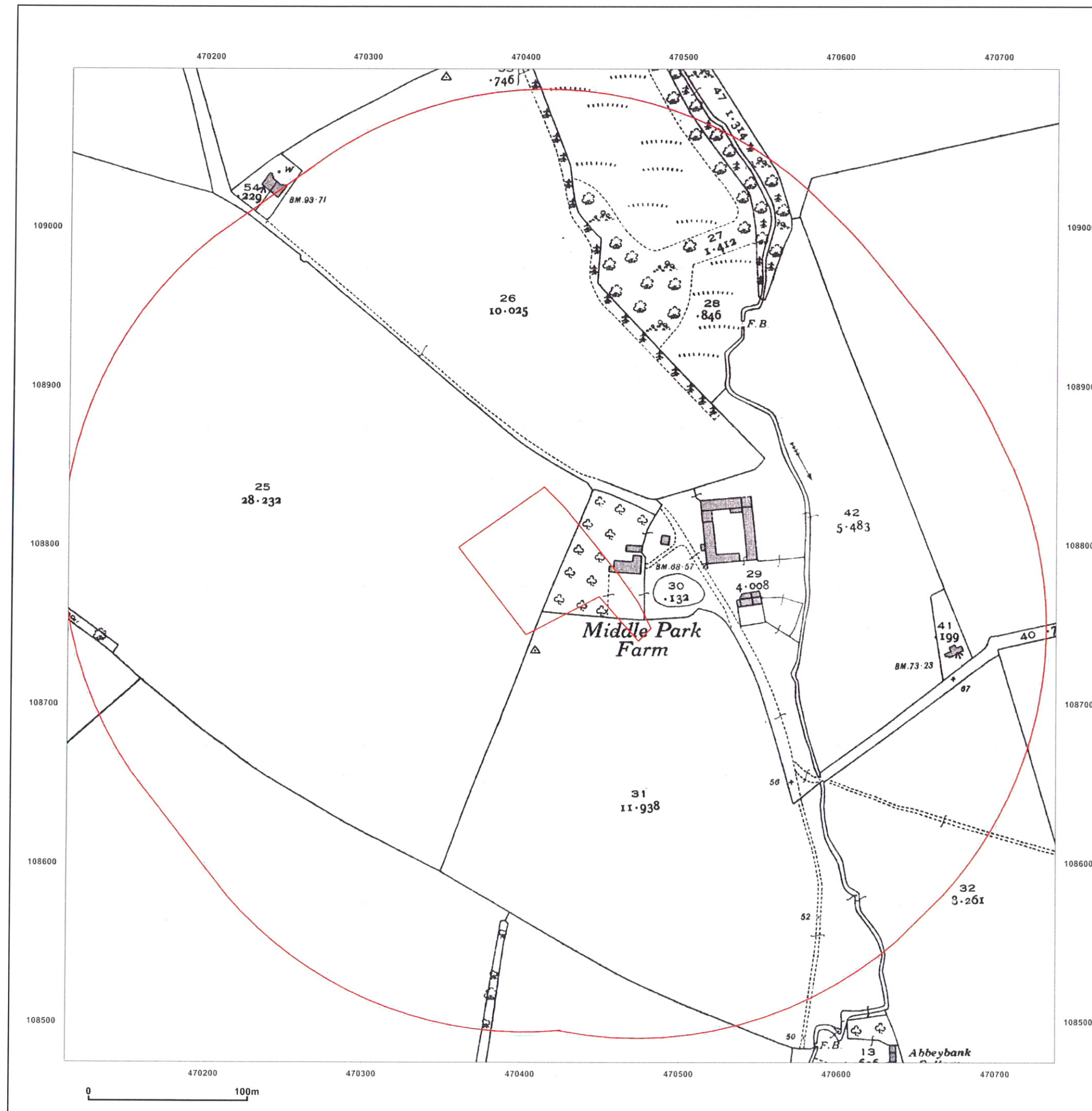


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Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1952

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1952
Revised 1952
Edition N/A
Copyright N/A
Levelled 1942



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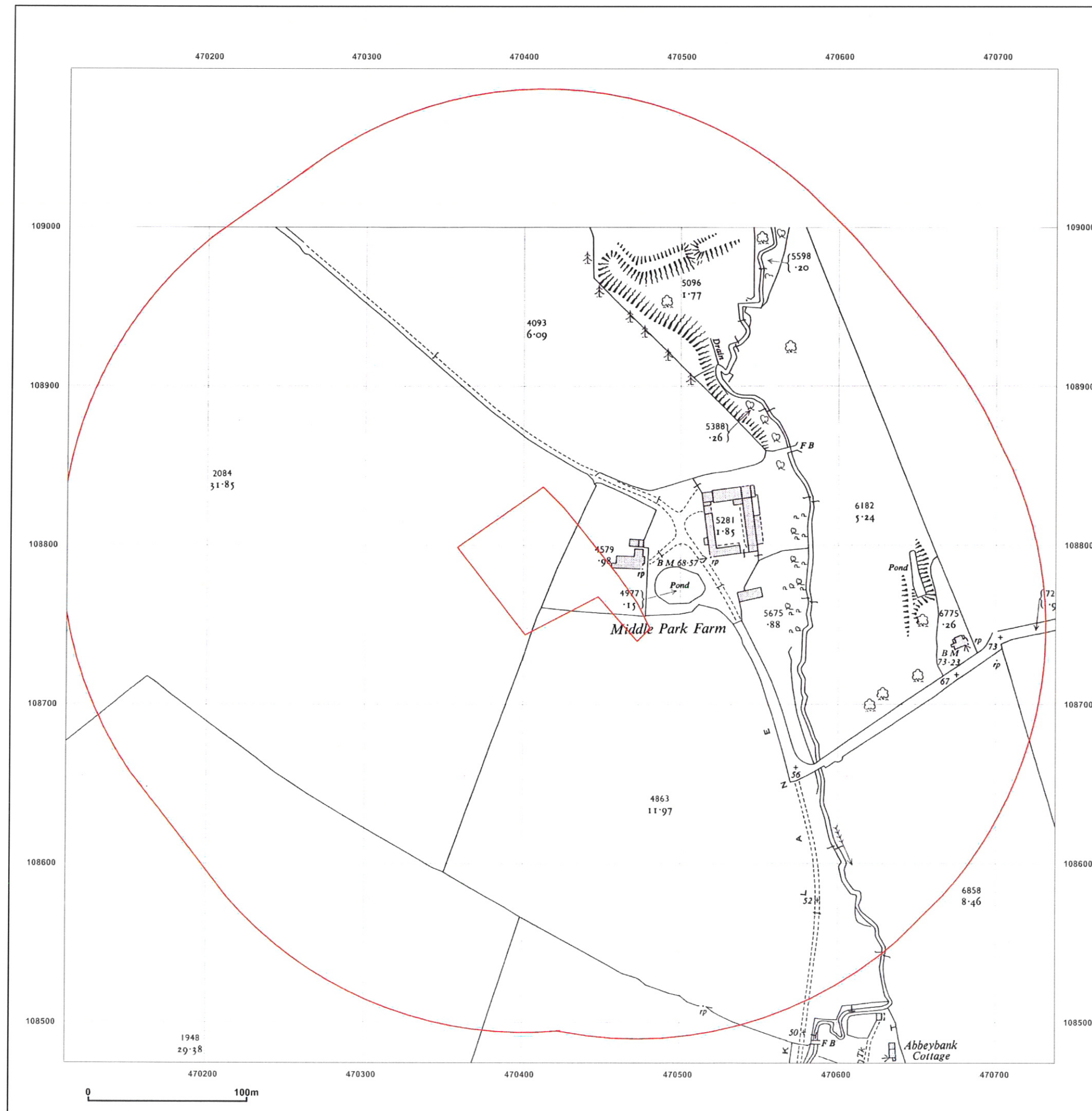


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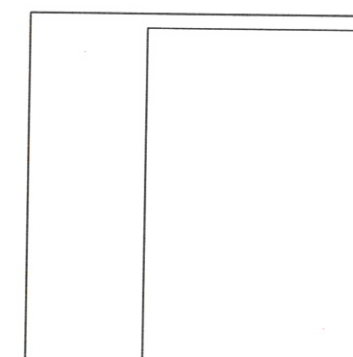
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Grid Ref: 470425, 108787

Map Name: Provisional

Map date: 1957

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1873
Revised 1957
Edition NA
Copyright NA
Levelled NA



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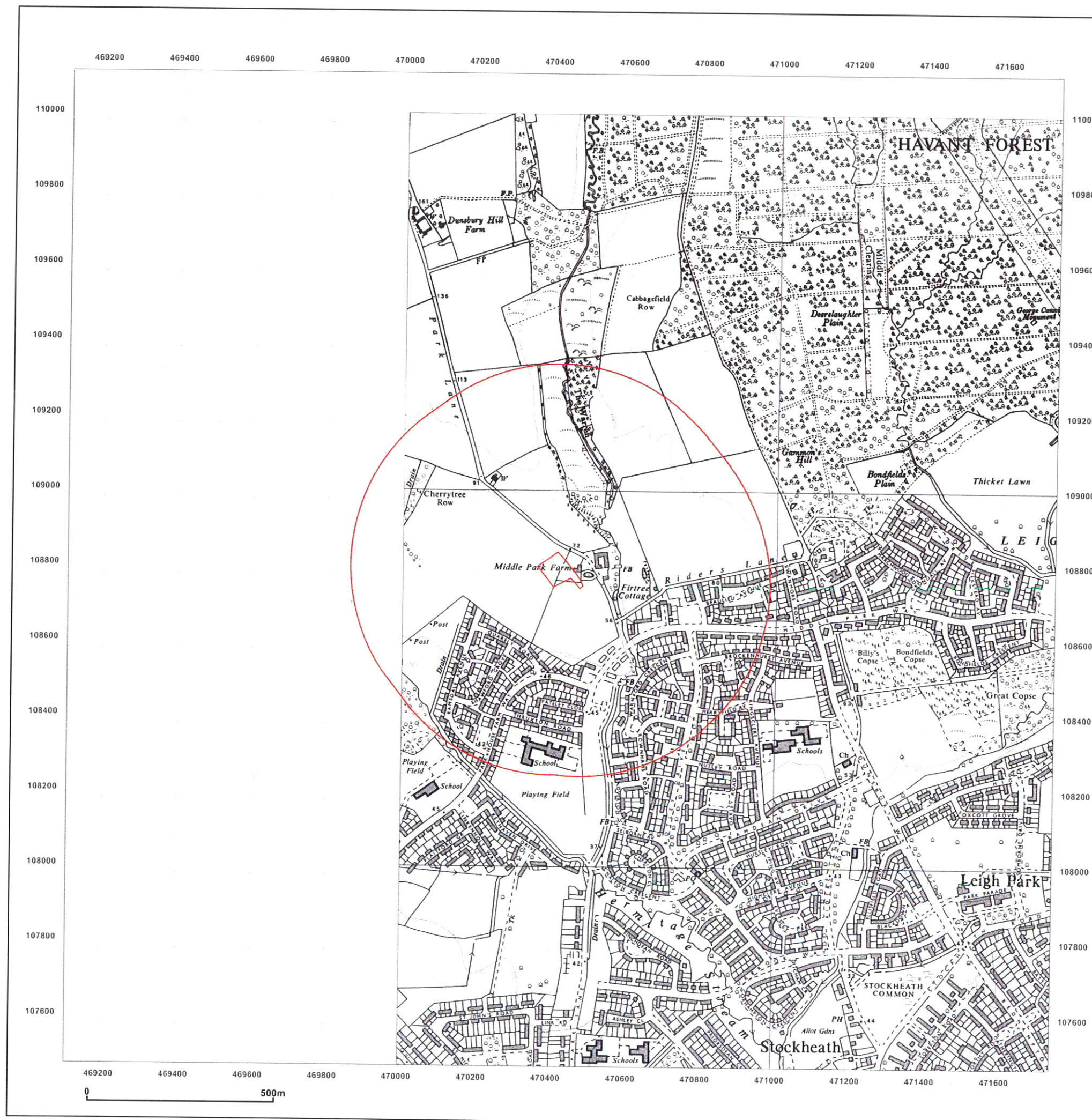


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Site Details:

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Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

Grid Ref: 470425, 108787

Map Name: Provisional

Map date: 1957-1959

Scale: 1:10,560

Printed at: 1:10,560

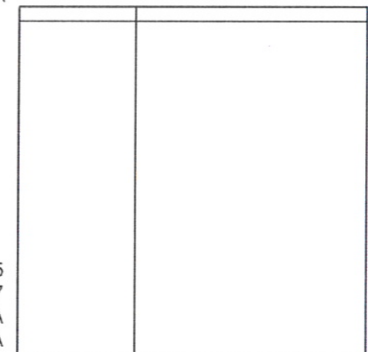


Surveyed 1959
Revised 1959
Edition NA
Copyright NA
Levelled NA

Surveyed 1957
Revised 1957
Edition NA
Copyright NA
Levelled NA

Surveyed 1865
Revised 1957
Edition NA
Copyright NA
Levelled NA

Surveyed 1873
Revised 1957
Edition NA
Copyright NA
Levelled NA



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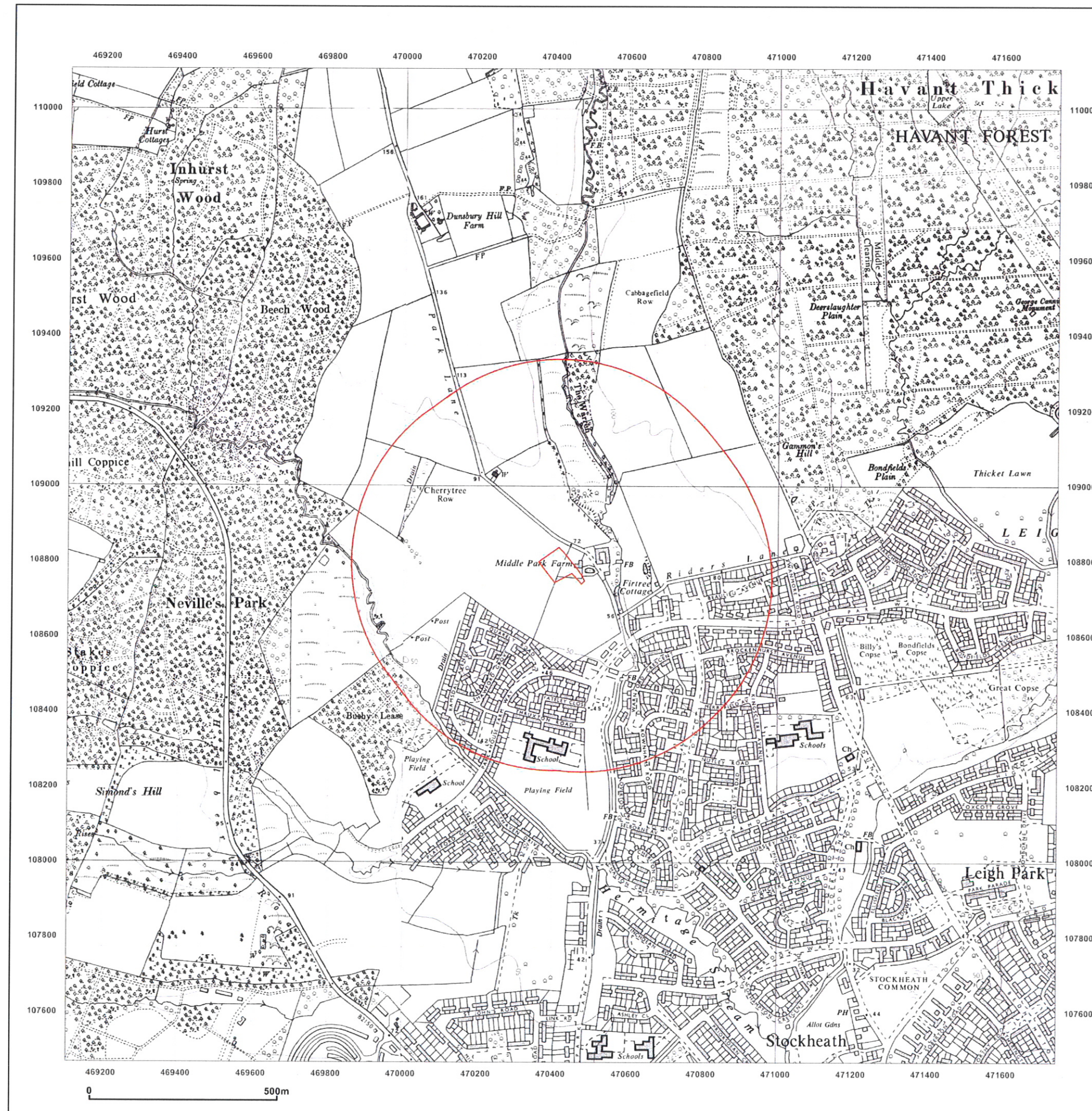


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Site Details:

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4JN

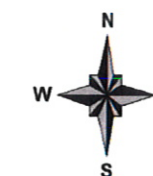
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Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1957-1961

Scale: 1:1,250

Printed at: 1:2,500



Surveyed 1961
Revised 1961
Edition N/A
Copyright 1961
Levelled 1958

Surveyed 1957
Revised 1957
Edition N/A
Copyright N/A
Levelled 1942

Surveyed 1961
Revised 1961
Edition N/A
Copyright 1961
Levelled 1958

Surveyed 1957
Revised 1957
Edition N/A
Copyright N/A
Levelled 1942



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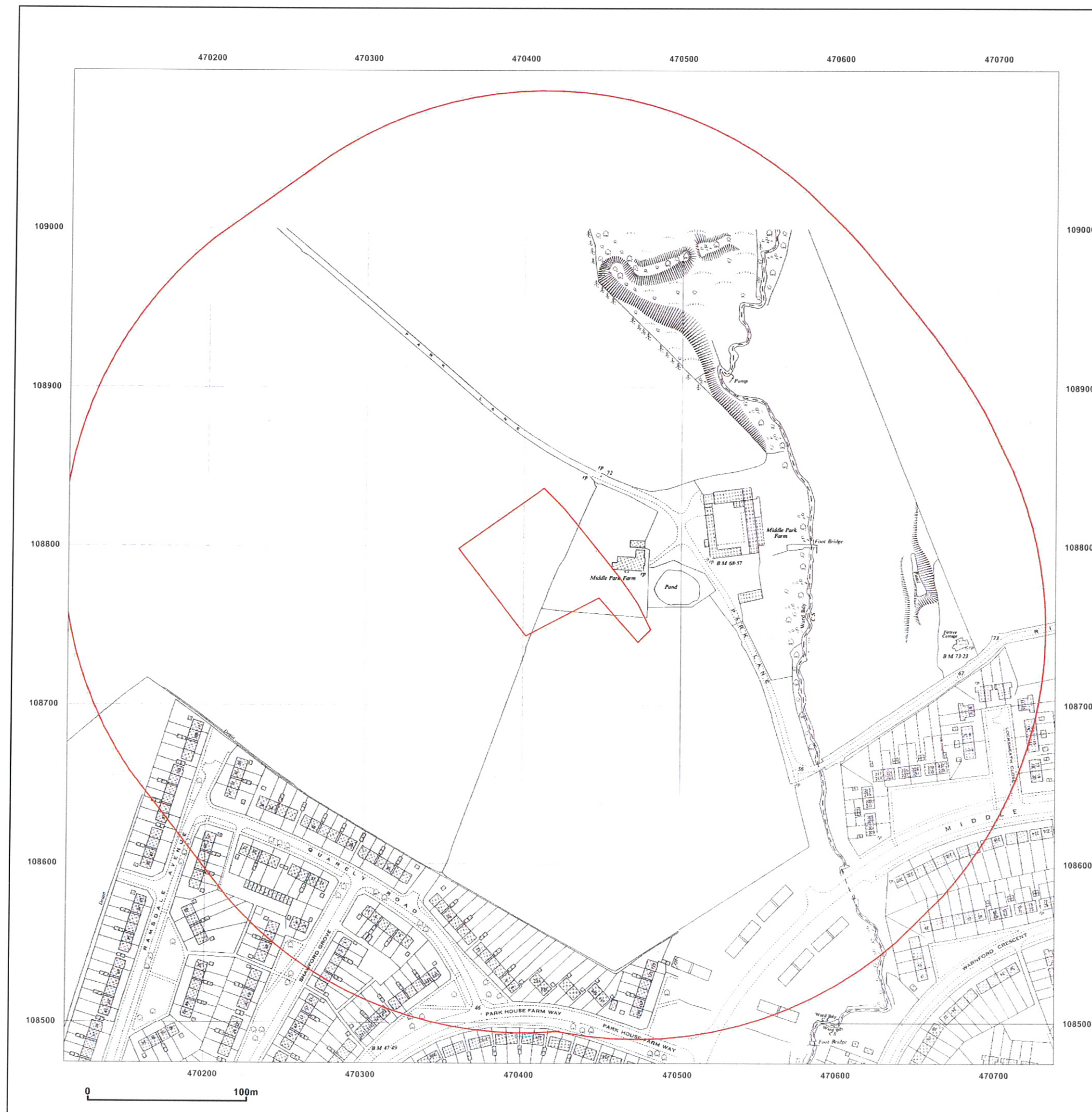


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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1962

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1962
Revised 1962
Edition 1964
Copyright 1964
Levelled 1958



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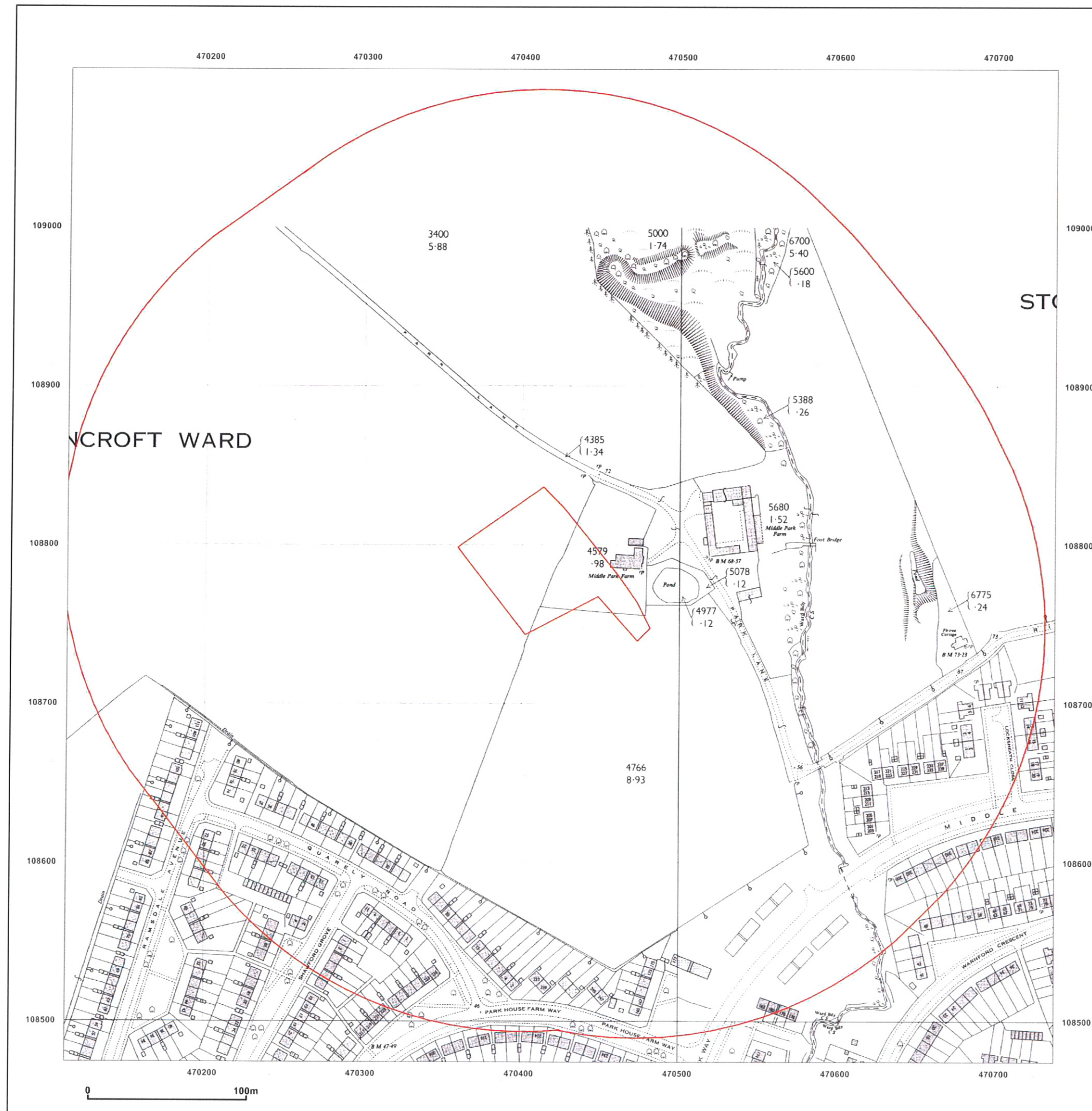


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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1970-1973

Scale: 1:1,250

Printed at: 1:2,500



Surveyed 1970
Revised 1970
Edition N/A
Copyright 1971
Levelled 1958

Surveyed 1970
Revised 1970
Edition N/A
Copyright 1971
Levelled 1958

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

Surveyed 1957
Revised 1970
Edition N/A
Copyright 1970
Levelled 1958

Surveyed 1961
Revised 1973
Edition N/A
Copyright 1973
Levelled 1958



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Site Details:

Mary Rose House, Havant, PO9 4JN

Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

Grid Ref: 470425, 108787

Map Name: National Grid

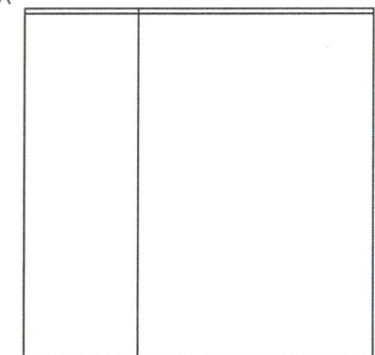
Map date: 1973-1977

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1973
Revised 1977
Edition NA
Copyright NA
Levelled NA



Surveyed 1973
Revised 1973
Edition NA
Copyright NA
Levelled NA



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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1980

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1980
Revised 1980
Edition NA
Copyright NA
Levelled NA

Surveyed 1980
Revised 1980
Edition NA
Copyright NA
Levelled NA



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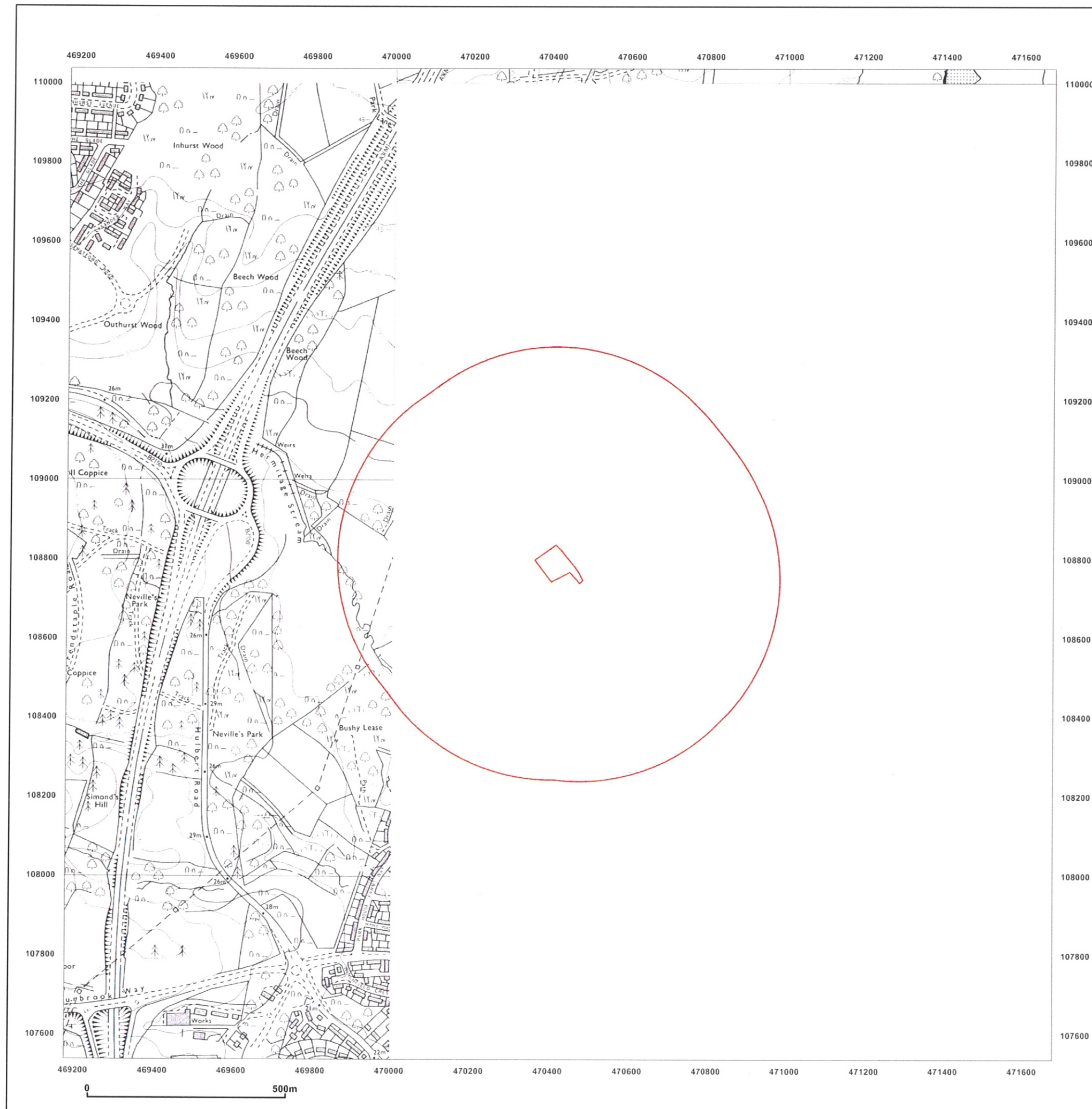


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Site Details:

Mary Rose House, Havant, PO9 4JN

Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1991-1992

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1990
Revised 1992
Edition NA
Copyright NA
Levelled NA

Surveyed 1989
Revised 1991
Edition NA
Copyright NA
Levelled NA

Surveyed 1988
Revised 1991
Edition NA
Copyright NA
Levelled NA

Surveyed 1989
Revised 1991
Edition NA
Copyright NA
Levelled NA



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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,500



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

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

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Revised 1993
Edition N/A
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Levelled N/A

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

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Site Details:

Mary Rose House, Havant, PO9
4JN

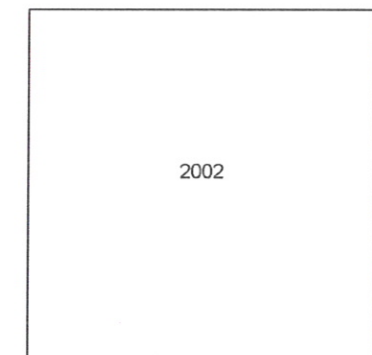
Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: 1:10,000 Raster

Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000



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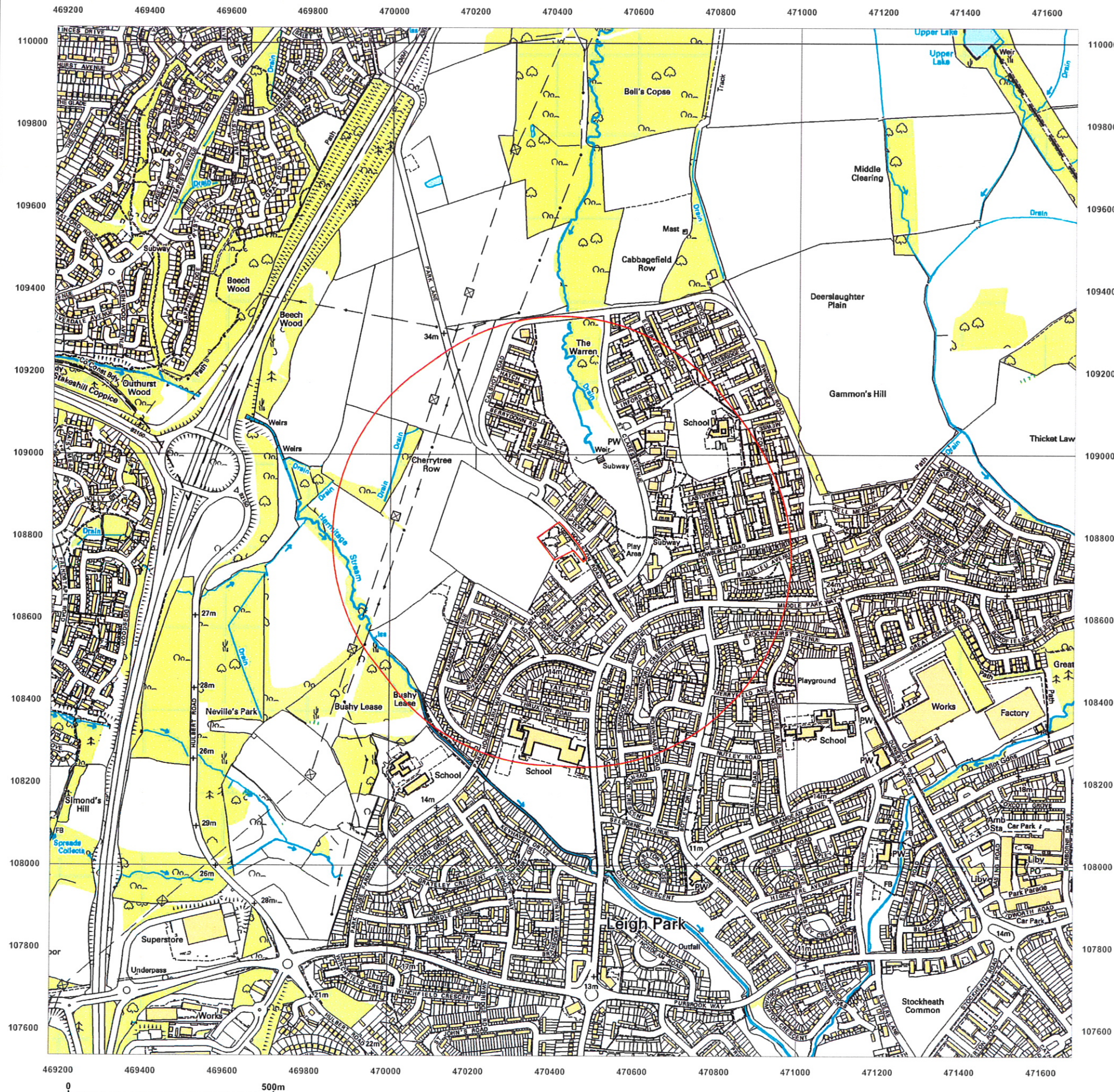
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Site Details:

Mary Rose House, Havant, PO9
4JN

Client Ref: EMS_154229_223220

Report Ref: EMS-154229_223220

Grid Ref: 470425, 108787

Map Name: MasterMap

Map date: 2011

Scale: 1:2,500

Printed at: 1:2,500



2011



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Site Details:

Mary Rose House, Havant, PO9
4JN

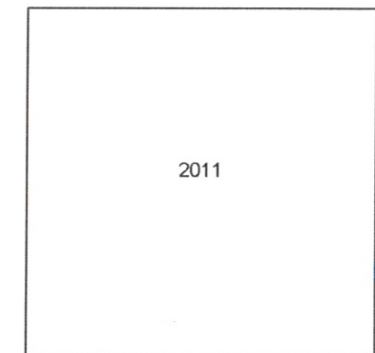
Client Ref: EMS_154229_223220
Report Ref: EMS-154229_223220
Grid Ref: 470425, 108787

Map Name: National Grid

Map date: 2011

Scale: 1:10,000

Printed at: 1:10,000



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