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Desk Study & Preliminary Site Assessment Report

Desk Studies | Risk Assessments | Site Investigations | Geotechnical | Contamination Investigations | Remediation Design and Validation

Site: St Michael's Convent, Richmond

Client: Beechcroft Developments Ltd

Report Date: 8 August 2016

Project Reference: A2392(A)

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A INTRODUCTION

1 Site Location

The site is located on the eastern outskirts of Ham (near Richmond-upon-Thames), the approximate National Grid Reference of the site is TQ 177 722.

2 Proposed Construction

It is proposed to demolish some of the current structures, refurbish/extend the existing building and construct some new buildings within the grounds, to comprise a total of 28 residential units with communal gardens. For the purposes of the initial contamination assessment the proposed development land use is classified as Public Open Space (Residential) - CLEA model1/ C4SL report[2].

3 Investigation Brief

In accordance with the Client's instructions, and our quotation, the following was included in our brief for this preliminary investigation:

- Phase 1 Desk Study including walkover survey, Historical Ordnance Survey maps and environmental database searches.
- 7 No. boreholes drilled to 3-4m (bgl) using a mini-tracked windowless sampler rig, with in-situ testing and sampling.
- Limited chemical and geotechnical laboratory testing.

4 Scope

This assessment gives only a brief account of ground conditions, possible problems which may be encountered and likely foundation type based on a visual assessment of ground conditions and limited laboratory testing. It is not a fully comprehensive site investigation report and it is anticipated that further work including geotechnical and chemical laboratory testing will be carried out. It is not an engineering design document and should any information be used it should be noted that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the final design. It is impossible to categorically define the extent of any contamination on site at this preliminary stage, due to the discrete number of sampling locations. The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

As with any site there may be differences in soil conditions between exploratory hole positions.

The work and the assessment report are prepared specifically for Beechcroft Developments Ltd and their appointed Engineers. Southern Testing Laboratories Limited owes no duty of care and skill to other parties.

[1] Environment Agency Publication SC050021/SR3 'Updated technical background to the CLEA Model' (2009).
[2] SP1010 Development of Category 4 Screening Levels DEFRA (2014)

The recommendations may not be appropriate to alternative development schemes.

The findings and opinions conveyed via this assessment are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

B DESK STUDY & WALKOVER SURVEY

5 Desk Study

A desk study has been carried out. Reference has been made to the following information sources.

- Geological Maps
- Hydrogeological/Groundwater Vulnerability maps
- Aerial Photographs
- Historical Ordnance Survey Maps
- Environmental Databases
- Brief Local Authority planning search
- Environment Agency website
- Bomb Maps
- BRE Radon Atlas[3]

The environmental databases search report compiled for this desk study contains site-specific environmental data drawn from data sets that comprise publicly available information together with data from third parties, some of which is under review. Accordingly, Southern Testing Laboratories Limited does not warrant its accuracy, reliability or completeness.

The full report is included in Appendix E, a summary of the salient features is included in the following sections of this report.

5.1 Geology

The British Geological Survey map of the area (No. 270 – South London) indicates that the site geology consists of sands and gravels of superficial deposits of Kempton Park Gravel over London Clay.

Kempton Park Gravel Formation

The Kempton Park sands and gravels are one of a series of locally named deposits derived from the river gravels of a prehistoric River Thames. In addition to sand and silt, the formation often contains organic clay, tufa and peat. Gravel clasts can comprise of flint, vein quartz and chert.

London Clay

London Clay is a well known, stiff, fissured blue-grey clay which weathers to a brown colour near the surface. In places it contains thin claystone bands and crystals of calcium sulphate (selenite) are common. The long term stable angle for slopes is about 7° for grassed or cleared slopes and a few degrees more for wooded slopes. The NHBC classification is generally High Volume Change Potential.

[3] BR 211 (2007) 'Radon: guidance on protective measures for new buildings'

5.2 Hydrology and Hydrogeology

Data from the Environment Agency and other information relating to controlled waters is summarised below.

Data		Remarks	Possible Hazard to/from Site (Y/N)
Aquifer Designation	Superficial Deposits	The Kempton Park Gravels are classified as a *Secondary A Aquifer*.	Y
	Bedrock	The London Clay formation is classified as an *Unproductive Strata*.	N
Groundwater Vulnerability		The soils underlying the site are classified as a *Minor Aquifer*. Most urban areas (including the subject site) are given a default *High Vulnerability* classification as there is little actual data.	Y
Abstractions		The only groundwater abstraction licenses listed within 1km of the site are for golf course irrigation purposes (approx. 0.4-0.7km to the northeast).	N
Source Protection Zones		The site does not lie within a groundwater Source Protection Zone (SPZ).	N
Surface Water Features		The nearest obvious surface watercourse is the River Thames, which is located approximately 1km to the southwest of the site.	N
Fluvial Flood Risk		Based on the Environment Agency mapping (Nov 2015), the site is not shown to lie within an area at risk of flooding due to rivers.	N
Surface Water Flood Risk		Based on the Environment Agency mapping (Nov 2015), the majority of the site is shown to be *Very Low Risk* with regard to indicative surface water flooding, although there are occasional areas shown as *Low Risk*.	Y
Reservoir Flood Risk		Based on the Environment Agency mapping (Nov 2015), the site is not shown to lie within an area at risk of flooding due to reservoirs.	N
Discharge Consents		There are no Discharge Consents listed within 250m of the site.	N

5.3 Historical Map Search

Copy extracts of historical Ordnance Survey plans dating from 1868 were obtained and are presented in Appendix D. The chronology of building development on the site is discussed in the Heritage Statement accompanying the planning application for this site, to which the reader is referred.

5.4 Environmental Databases

	Distance (m)	Direction	Details	Possible Hazard to site (Y/N)
Historical Industrial Land Uses	-	-	There are no potentially contaminative past land uses listed within 250m of the site.	N
Current Industrial Land Uses	202	W	Within 250m there are only 2 No. *Contemporary Trade Directory Entries*, both of which relate to carpet/rug manufacture.	N
Current and Historical Landfills	-	-	There are no past or present landfill sites listed within 250m of the site.	N
Fuel Sites	-	-	There are no *Fuel Station Entries* listed within 250m of the site.	N
Pollution Incidents	175	NW	There is 1 No. *Pollution Incident to Controlled Waters* recorded within 250m. Category 3 (minor incident), release of oils into unknown receiving water (Feb 1999).	N
Hazardous Substances Consents	-	-	There are no *Hazardous Substance Consents* listed within 250m of the site.	N

5.5 Geological Hazards and Mining Activities

Data from various sources relating to potential geological hazards at the site are summarized below. The Hazard Potentials listed for the BGS data are as presented in the Envirocheck report, derived from various generic BGS sources, which are not considered as site-specific. It is important that this information is considered in context of the actual site topography, ground conditions encountered during future investigation, and development proposals.

Data Source	Hazard	Hazard Potential to Site	Remarks
BGS	Potential for Collapsible Ground Stability Hazard	Very Low	
	Potential for Compressible Ground Stability Hazard	Negligible	
	Potential for Ground Dissolution Stability Hazard	Negligible	
	Potential for Landslide Ground Stability Hazard	Very Low	
	Potential for Running Sand Ground Stability Hazard	Very Low	Given the mapped presence of terrace deposits over London Clay, there is the potential for a relatively high water table, therefore, a *Low* to *Moderate* risk

Data Source	Hazard	Hazard Potential to Site	Remarks
			is considered more appropriate.
	Potential for Swelling or Shrinking Clay Ground Stability Hazard	Moderate	Hazard may be dependant on the thickness of overlying terrace gravel deposits.
	Shallow Mining Hazard	Negligible	
ARUP	Mining Instability	There are no records within 2km of the site.	
CSS/KURG*	Underground openings	Within 2km there is only one record in our own underground workings database, which is a well located approximately 1.7km to the northeast.	
PBA	Natural & Mining Cavities	There are no records within 2km of the site.	

**Chelsea Speleological Society/ Kent Underground Research Group*

5.6 Radon Risk

With reference to BRE guidance, no radon protection is required on this site.

5.7 Other Sources

Whilst an Unexploded Ordnance desk study/risk assessment was outside of the scope of this investigation, by way of comment and based on publicly available online bomb mapping only, scattered bombs are shown to have struck the local area during the Second World War, although none are indicated to be within the subject site.

A brief search of planning records on the London Borough of Richmond-upon-Thames website, indicates relatively few historic applications for the subject site, the majority of which relate to minor building work or tree works.

6 Walkover Survey

A walkover survey was carried out on 19th October 2015, at the time of the investigation.

6.1 General Description and Boundaries

The site, which is roughly rectangular in shape and extends to approximately 175×95m, currently comprises a convent set within extensive grounds. To the north and east are residential properties, to the south is a park/common and to the west are residential properties, a school and playing fields.

In the northwest of the site there is a small area of deposited garden waste, occasional discarded timber furniture and a very small area which has possibly been used for bonfires.

6.2 Topography and Drainage

The site is relatively flat and level, with only a gradual fall of approximately 1m from the south to the north. Similarly, the local topography is predominantly flat and level.

6.3 Vegetation

Large areas of the site are grassed, with numerous shrubs, bushes and hedges. There are also numerous mature trees across the site, most notably in the northern half where tree types include Oak, Ash, Beech, Cherry, Sycamore, Chestnut, Silver Birch and fruit trees.

6.4 Buildings and Land Use on Site and Nearby

The site is located in a predominantly residential area, with areas of playing fields and park/ common land.

The main building in the south of the site comprises a 2-3 storey brick-built structure with some later 2-storey extensions. Within the grounds there are occasional timber sheds/workshops, brick outbuildings and glasshouses.

Based on a brief external inspection of the existing main building, there were no signs of significant structural movement, which can sometimes be an indication of poor ground conditions.

6.5 Photographs

A series of photographs showing the site at the time of the walkover/investigation is included in Appendix B.

C PRELIMINARY CONCEPTUAL MODEL

7 Introduction

In the context of this report, the conceptual model summarises the potential pollutant linkages identified for the site and forms the basis of the risk assessment for the site. The preliminary model comprises the potential sources of contamination, receptors that could be harmed and exposure pathways identified from the desk study and walkover survey. These potential linkages form the basis upon which the investigation is designed and reported.

8 Potential Sources of Contamination

On the basis of the available historical mapping, the site appears to have only been used as an orphanage/convent, with extensive grounds. Therefore, no significant potential sources of on site contamination have been identified. There is a risk that some made ground soils may be present due to occasional development/redevelopment within the site.

Similarly, no significant potential off site sources of contamination have been identified.

8.1 On Site Sources

Source	Potential Contaminants
Made Ground (due to former development)	Unknown composition but made ground can typically include Heavy Metals, Polyaromatic Hydrocarbons (PAHs) and Asbestos.

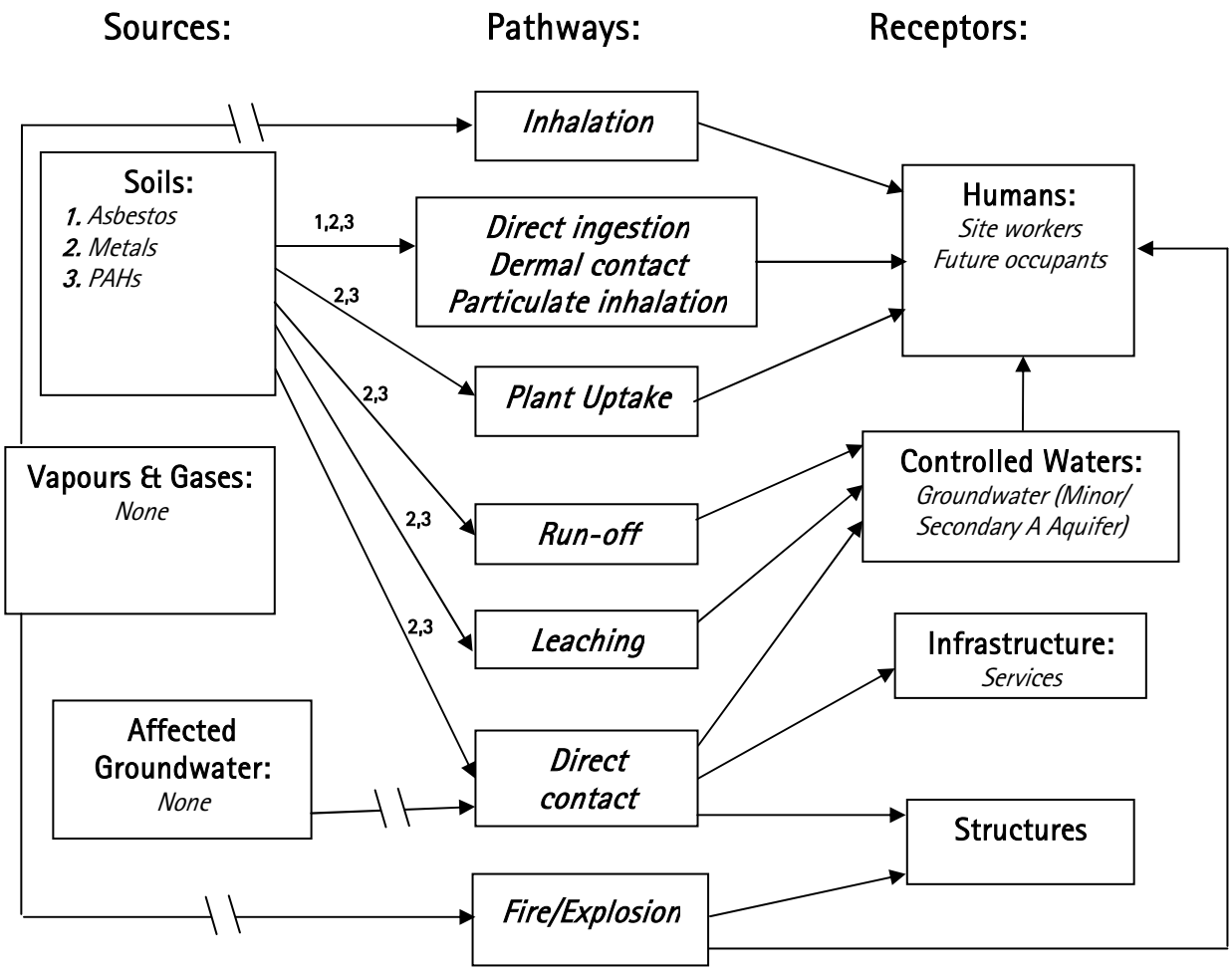
It is considered possible that, at some point in the past, fuel (eg. heating oil) may have been stored on site, however, the location(s) of any such facilities have not been determined.

8.2 Off Site Sources

No significant potential sources of off-site contamination were indentified.

9 Pollutant Linkages and Model Summary

The following diagram shows the potential pollutant linkages identified for the site and summarises the preliminary conceptual model:



\ \ Denotes potential pollutant linkage not complete

D FIELDWORK

10 Soils as Found

Depth	Soil Type	Description
GL – 0.2/0.5m	TOPSOIL/ MADE GROUND	Brown, friable, CLAY/SILT, with occasional flint gravel, ash/ cinders and very occasional brick fragments.
- 0.8/1.2m	Silty CLAY	Medium to high strength, silty CLAY, with occasional flint gravel. *(Occasionally very high strength/desiccated)*
- 3.0/4.0m	SAND/GRAVEL	Medium dense to dense, orange brown, fine to coarse SAND and fine to coarse, sub-rounded to angular flint GRAVEL. *(Occasionally becoming loose to medium dense below 2.5/3.0m)*
-4.0m	CLAY *(WS1 & WS7 only)*	Medium to high strength, grey CLAY. *(London Clay)*

E PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

11 Swelling and Shrinkage

Atterberg Limit tests were carried out on three samples of the shallow silty clay soils. The plasticity indices are in the range 22-27% and the samples are classified as being CI/CH (clays of intermediate and high plasticity). These results all fall within the NHBC **Medium** Volume Change Potential (VCP) classification.

The sand/gravel soils underlying the silty clay, will be negligible in terms of swelling/shrinkage, therefore, no deepening due to the influence of trees will be required for foundations placed within these materials. The London Clay soils which underlie the sand/gravel at depth (3.5m+) are likely to fall within the NHBC High VCP classification, however, these soils are not anticipated to affect shallow foundations placed within the upper sand/gravel layer.

12 Groundwater

Groundwater was encountered in all seven of the exploratory holes as follows:

Hole ID	Water Strikes
WS1	SWL = 2.47m (bgl) after 1 hour
WS2	SWL = 2.90m (bgl) after 15 mins
WS3	SWL = 2.65m (bgl) after 30 mins
WS4	SWL = 2.50m (bgl) after 30 mins
WS5	SWL = 2.60m (bgl) after 15 mins
WS6	SWL = 2.42m (bgl) after 15 mins
WS7	SWL = 3.05m (bgl) after 15 mins

Groundwater levels vary considerably from season to season and year to year, often rising close to the ground surface in wet or winter weather, and falling in periods of drought. Long-term monitoring from boreholes or standpipes is required to assess the groundwater regime and this was outside of the scope of this investigation.

It should be noted that the site investigation was carried out early in the autumn/winter period, therefore, it is likely that groundwater levels will be higher during wetter periods and/or towards the end of the winter months, which could have implications for deeper excavations (drain runs etc.).

13 Soakage Potential

Although soakage testing was outside of the scope of this investigation, by way of comment, whilst soakaways may be feasible within the sand/gravel, the presence of groundwater at soakaway depth, particularly in winter months, will limit their storage capacity.

Given that the sand/gravel is classified as a Secondary Aquifer, the Environment Agency should be contacted if such drainage is proposed and there may be some restrictions on the use of soakaways (ie. the inclusion of an unsaturated zone, or limit to roof drainage only etc.).

14 Sulphates

The recorded pH values of six samples of the natural silty clay and sand/gravel soil are in the range 5.2-7.0 (mean 6.1). The Design Sulphate Class is DS-1 and groundwater should be assumed to be mobile, therefore, the ACEC site classification is AC-1.

Should any concrete be placed within the London Clay at depth (3.5m+) it is recommended that a higher classification (DS-2/DS-3) is adopted, together with an ACEC classification of AC-2/AC-3.

15 Foundations & Bearing Capacity

On the basis of the preliminary investigation carried out to date, shallow traditional strip, trench fill or pad footings will be acceptable, with an allowable bearing capacity of 175kPa for foundations placed within the natural sand/gravel soils (ie. penetrating any superficial made ground soils).

At this stage it is recommended that all foundations are deepened through the silty clays and placed within the natural sand/gravel. Therefore, foundation deepening in accordance with NHBC Volume Change Potential will not be required. Some deepening may be required over the footprints of the existing buildings (ie. following demolition and ground disturbance caused by excavation of existing below ground footings etc.). Where deep foundations are required, some allowance for dewatering should be made.

16 Floor Slabs

Suspended ground floor slabs will be required where made ground depths are greater than 600mm or where foundations greater than 1.5m are required due to the presence of trees, outside of these areas either ground bearing or suspended floor slabs will be acceptable.

17 Excavations

Excavations on site should be manageable using conventional plant. However, it should be noted that the sand/gravel soils were unstable and collapsed in the majority of the trial holes below the groundwater level. This may require any deeper excavations, such as for drainage runs, to be fully supported, particularly if the groundwater level rises and appropriate dewatering measures may be necessary.

F PRELIMINARY ENVIRONMENTAL RECOMMENDATIONS

18 Soil Contamination

The number of sample locations was limited and aimed to provide general coverage of the site and an initial assessment of the soils.

Access was slightly restricted due to the presence of buildings and underground services.

Based on the potential contamination identified in the preliminary conceptual model and observations made on site, the following tests were selected.

Test Suite	Number of Samples	Soil Tested
STL Key Contaminant Suite	3 4	Topsoil Made Ground
Asbestos Identification	3 4	Topsoil Made Ground

The test results are presented in full in Appendix C.

The results have been compared to screening levels, which are based on current industry guidance. The derivation of the various screening levels adopted is discussed in the appended Analytical Framework. These screening values are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

Soil Type: Topsoil

Contaminants	Units	No of Samples Tested	Range	Sample Mean	Open Space (Residential) Tier 1 Screening Value
Arsenic (As)	mg/kg	3	21 – 27	24	79
Cadmium (Cd)	mg/kg	3	0.1 – 0.5	0.27	120
Total Chromium (Cr)	mg/kg	3	23 – 30	27	/
Hexavalent Chromium (CrVI)	mg/kg	3	<1.0	1.0	7.7
Lead (Pb)	mg/kg	3	180 – 320	230	630
Mercury (Hg)	mg/kg	3	<1.0 – 1.8	1.3	40
Selenium (Se)	mg/kg	3	<3.0	3.0	1100

Contaminants	Units	No of Samples Tested	Range	Sample Mean	Open Space (Residential) Tier 1 Screening Value
Nickel (Ni)	mg/kg	3	16 – 22	20	230
Copper (Cu)	mg/kg	3	39 – 63	53	12,000
Zinc (Zn)	mg/kg	3	66 – 180	114	81,000
Phenol	mg/kg	3	<1.0	1.0	440 – 1300
Benzo(a)pyrene	mg/kg	3	0.1 – 0.3	0.23	4.9
Naphthalene	mg/kg	3	<0.1	0.1	77-430*
Total Cyanide (CN)	mg/kg	3	<1.0	1.0	/
Acidity (pH value)	Units	3	5.4 – 7.1	6.3	/
Soil Organic Matter	%	3	4.0 – 6.9	5.1	/

** Open Space levels calculated on the basis of the exposure modelling developed in the C4SL research.*

The concentrations of the various contaminants are low for the soils analysed and there are no exceedences of the screening values. This concurs with the visual and olfactory evidence.

Soil Type: Made Ground

Contaminants	Units	No of Samples Tested	Range	Sample Mean	Open Space (Residential) Tier 1 Screening Value
Arsenic (As)	mg/kg	4	23 – 30	26	79
Cadmium (Cd)	mg/kg	4	0.2 – 0.6	0.33	120
Total Chromium (Cr)	mg/kg	4	26 – 27	26	/
Hexavalent Chromium (CrVI)	mg/kg	4	<1.0	1.0	7.7
Lead (Pb)	mg/kg	4	320 – **850**	493	630
Mercury (Hg)	mg/kg	4	<1.0 – 2.3	1.3	40
Selenium (Se)	mg/kg	4	<3.0	3.0	1100
Nickel (Ni)	mg/kg	4	21 – 27	24	230
Copper (Cu)	mg/kg	4	37 – 99	63	12,000
Zinc (Zn)	mg/kg	4	91 – 250	145	81,000
Phenol	mg/kg	4	<1.0	1.0	440 – 1300
Benzo(a)pyrene	mg/kg	4	<0.1 – 0.3	0.15	4.9
Naphthalene	mg/kg	4	<0.1	0.1	77-430*
Total Cyanide (CN)	mg/kg	4	<1.0	1.0	/
Acidity (pH value)	Units	4	6.0 - 7.6	7.0	/
Soil Organic Matter	%	4	6.0 – 9.7	8.3	/

** Open Space levels calculated on the basis of the exposure modelling developed in the C4SL research.*

With the exception of a single Lead concentration, the concentrations of the various contaminants are low for the soils analysed and there are no further exceedences of the screening values.

This concurs with the visual and olfactory evidence. A slightly elevated concentration of Lead (850mg/kg) was measured in one made ground sample (WS7 at 0.15m) compared to the tier 1 screening value of 630mg/kg.

18.1 Asbestos Screening

No asbestos containing materials were detected in the samples analysed and none were observed in the exploratory holes. However, it should be noted that the exploratory holes are of small diameter and the samples obtained may not reflect the full composition of the soils on the site. Therefore, there is always the potential for pockets of asbestos or for asbestos containing materials to be present, which have not been detected in the sampling.

19 Land Gas

No suspect materials were noted on site, and the desk study information obtained to date does not indicate significant local on site or off site risks. On this basis, land gas issues are not expected to affect the proposed development.

20 Conclusions and Recommendations Regarding Environmental Issues

In summary, on the basis of the limited investigation and testing to date, the topsoil and made ground soils are largely considered to be suitable to remain on site. Some further investigation is recommended, both to increase coverage of the site and further assess the extent of the slightly elevated Lead concentration measured within the soil sample obtained from borehole WS7.

The chemical analysis appended will provide information to assist in classifying any soils to be removed from site to landfill as part of the groundworks.

The developer, as the waste producer, will ultimately be responsible for the material removed from site. The contents of this report should be forwarded to tip operators for their own assessment, to confirm classification of the soils for off site disposal, and whether they can accept the material. Waste Acceptance Criteria (WAC) testing may be requested for confirmation of the material's classification.

As with any site, a careful watch for potentially contaminated soils should be made at the construction stage and any such soils encountered should be sampled, tested and dealt with appropriately. This could include any contamination (if present) arising from any former bulk fuel storage within the site.

S F Pratt MSc CGeol
(Countersigned)

C Lennard BEng
(Signed)

For and on behalf of Southern Testing Laboratories Limited

Analytical Framework

There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.

The CLEA model[4] provides a methodology for quantitative assessment of the long-term risks posed to human health by exposure to contaminated soils. Toxicological data is used to calculate a Soil Guideline Value (SGV) for an individual contaminant, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.

The CLEA model and associated guidance was updated through 2009. A new model has been released and new TOX and SGV reports are to be published. New SGVs are used where appropriate.

In the absence of any published SGVs for certain substances, Southern Testing have derived or adopted Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH[5] S4UL's and CL:AIRE[6] generic assessment criteria. In addition, in March 2014, DEFRA[7] published the results of a research programme to develop screening values to assist decision making under Part 2A of the Environmental Protection Act. Category 4 screening levels were published for 6 substances, with reference to human health risk only. This guidance includes revisions of the CLEA exposure parameters, presenting parameters for public open space land use scenarios, and also of the toxicological approach. The screening levels represent a low risk scenario, based on a 'Low Level of Toxicological Concern' rather than the 'Minimal Risk' of CLEA, and the analytical results of this investigation may be considered relative to these levels.

The values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

Site-specific assessments are undertaken wherever possible and/or applicable.

CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.

The results of any groundwater analyses are compared to relevant quality criteria, e.g. EQS or DWS.

Ground gases are assessed in accordance with the guidance given in CIRIA report C665.

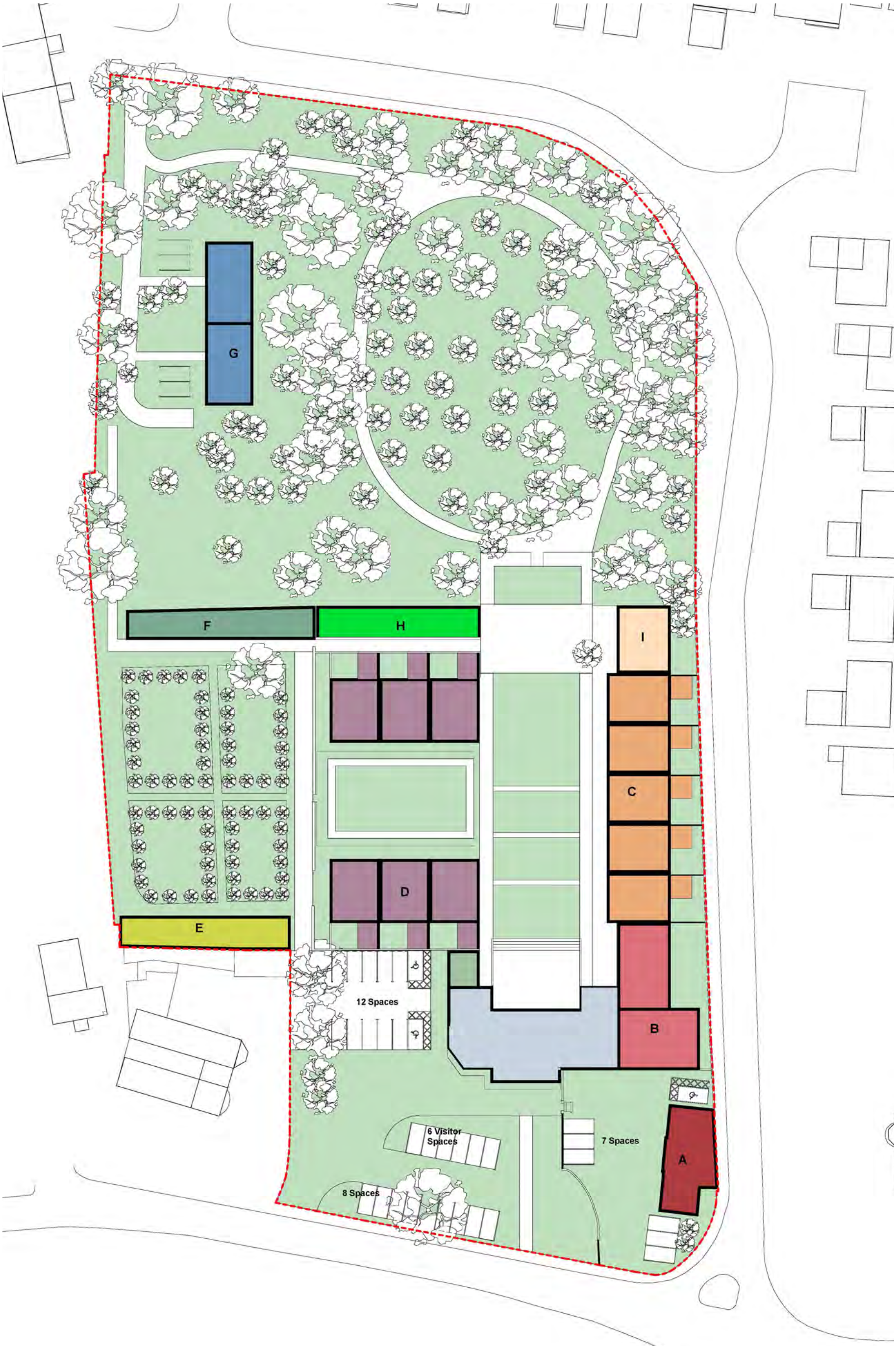
[4] Environment Agency Publication SC050021/SR3 'Updated technical background to the CLEA Model' (2009).
[5] The LQM/CIEH S4ULs for Human Health Risk Assessment. (2014).
[6] The EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment (2009).
[7] SP1010 Development of Category 4 Screening Levels foe Assessment of Land Affected by Contamination. DEFRA, 2014.

GENERAL GUIDANCE FOR USE OF ASSESSMENT REPORT

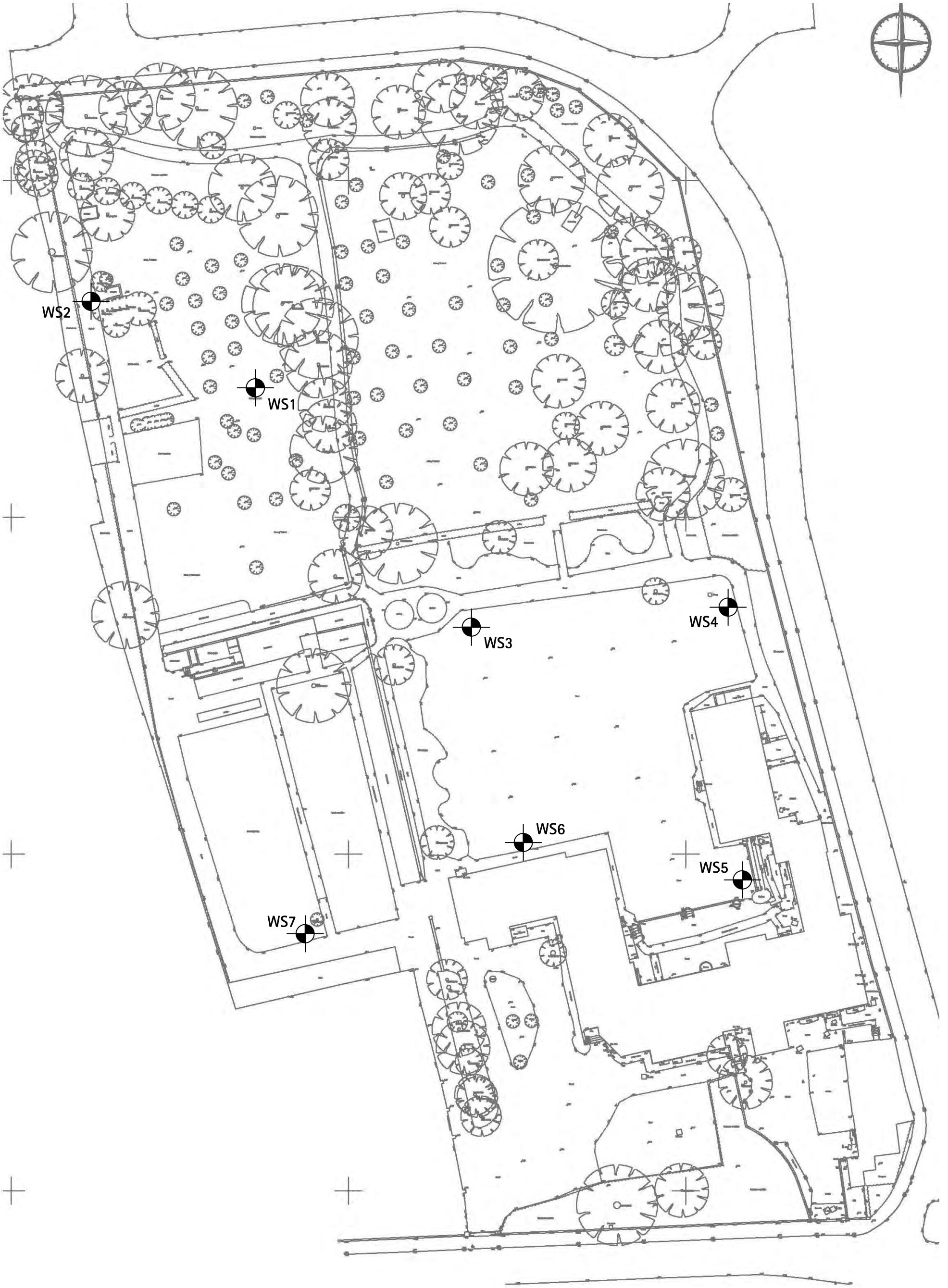
The assessment report is written on the basis of a visual examination of the site and soils found. Generally the frequency/density of trial holes is less than would be required for detailed design. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore specific testing is required in order to accurately predict many of the elements considered herein. Such testing is outside the scope of this preliminary report. The following comments are made with reference to the report sections:

Environmental Database	An environmental database report is included. This provides site specific searches of a number of databases owned by others (e.g. Environment Agency), which are by nature limited in content and quality.
Groundwater Protection Zones	The comments made in this section are based purely on interrogation of the Environment Agency website on the date shown. Confirmation should be sought from the relevant Regional Office of the Environment Agency. Groundwater source protection zones provide an indication of the risk to groundwater supplied from potential pollutants. Three zones are usually refined (inner, outer, and total catchment) which are based on the travel times from any point below the water table to the source (eg a spring, well or borehole).
Underground Workings	Relates to interrogation of our own database of underground workings (which itself is largely based on data from the Chelsea Speleological Society), together with information on the mapped geology, and the contents of the Environmental Database. The search cannot therefore be classed as exhaustive.
Flood Risk	The comments made in this section are based purely on interrogation of the Environment Agency website on the date shown. Confirmation should be sought from the relevant Regional Office of the Environment Agency. The indicative flood plain maps published on the website indicate where flooding from rivers, stream, watercourses or the sea is possible.
Swelling and Shrinkage	Refers to ground movement caused by clay soils drying out in summer or wetting in winter, particularly near trees. Reference should be made to current NHBC Standards Chapter 4.2.
Groundwater	Assessment is based on the actual groundwater conditions encountered and these should not be taken as equilibrium levels. Groundwater levels may vary considerately from season to season and year to year. Long-term monitoring would be required to accurately assess the groundwater regime. The absence of water level observations does not necessarily indicate that water is not present.
Soakage Potential	The Environment Agency must be consulted regarding the use of soakaways on site. Specific field tests will be required for detailed design
Bearing Capacity	May be assessed as good, average or poor. Where a value is given, this should be regarded as guidance only and not as a design value
Settlement	May be assessed as low, average or high. The assessments are based on the proposed construction or, where none is given, on two-storey housing. High settlement would generally indicate that the soils are unsuitable for supporting structural loads
Floor Slabs	Generally assessed as suspended or ground bearing with reasons given.
Landslip	May be assessed as low, moderate or high risk. Landslip issues are extremely complex and would require specific testing and risk assessment for design.
Roads	The most important element of any road construction is drainage, to which careful attention should be paid. It is noted that road subgrades can soften rapidly if allowed to become wet during construction. This softening can give rise to substantial increases in costs. Where a value is given, this should be regarded as guidance only and not as a design value.
Soil Contamination	General comments are given based on the findings of the desk study, walkover survey, soils found and possibly limited test results. In most cases further detailed investigation including testing and risk assessment will be required for design.
Groundwater Contamination	General comments are given based on the findings of the desk study, walkover survey, observations in exploratory holes and possibly limited test results. In some cases further detailed investigation including testing and risk assessment will be required for design.
Land Gas	General comments are based on the findings of the desk study, walkover survey, soils found, long term monitoring would be required to confirm.
Radon	An assessment is made on the basis of the BRE Publication Radon-Guidance on protective measures for new dwellings (BR211-2007) to which the reader is referred.

APPENDIX A – TRIAL HOLE LOGS & SITE LOCATION PLAN



Site: St Michael's Convent, Richmond		STL: A2392	Fig No: 1A
Date: 8 August 2016		Proposed Site Layout (not to scale)	
Southern Testing	Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN	ST Consult	



NB: Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned

Site: St Michael's Convent, Richmond	STL: A2392	Fig No: 2
Date: 19 October 2015	Site Investigation Plan (not to scale)	

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

ST Consult

Southern Testing ST Consult

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Start - End Date	Project ID:	Hole Type:	WS1
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole collapsed to 2.6m upon completion. 2. SWL = 2.47m after 60 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.15	ES			(0.25)		0.25	Brown, friable, CLAY/SILT, with frequent rootlets, occasional flint gravel and very occasional ash/ cinders (TOPSOIL).
		0.50	D						Very high strength, orange brown, desiccated, silty CLAY, with occasional occasional rootlets.
		0.50	HP	UCS(kPa)=600+		(0.85)			
		1.00	D						*[0.9-1.1m: Becoming slightly sandy and gravelly]*
		1.00	HP	UCS(kPa)=600+					
		1.00	SPT	N=52 (9,12/10,10,15,17)				1.10	Dense to very dense, brown and brown orange, slightly clayey, fine to coarse SAND and fine to coarse, sub-rounded to angular, flint GRAVEL.
		1.60	D						
		2.00	SPT	N=34 (7,9/9,9,9,7)					
	▼					(2.40)			*[2.3-3.5m: Soils becoming wet and less gravelly]*
		2.70	D						
									[2.9-3.5m: With occasional soft clay patches]
		3.00	SPT	N=7 (1,3/2,3,1,1)					*[3.0-3.5m: Soils becoming loose to medium dense]*
								3.50	High strength, grey, CLAY.
						(0.50)			
		4.00	D					4.00	End of borehole at 4.00m
		4.00	HP	UCS(kPa)=200.0					

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								2.47						

Southern Testing ST Consult	Start - End Date	Project ID:	Hole Type:	WS2
www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020	19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole remained open to 3.0m upon completion. 2. SWL = 2.90m after 15 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		Depth (m bgl)	Type	Results					
		0.10	ES			(0.20)			Grey brown, friable, CLAY/SILT, with frequent brick fragments, flint gravel and roots/rootlets (MADE GROUND).
		0.20	ES					0.20	Very high strength, orange brown, desiccated, silty CLAY.
		0.50	D						
		0.50	HP	UCS(kPa)=600+		(0.90)			
									[0.9-1.1m: Becoming gravelly]
		1.00	D						
		1.00	HP	UCS(kPa)=600+					
		1.00	SPT	N=62 (3,5/13,16,17,16)				1.10	Very dense, brown orange and dark brown, very sandy, fine to coarse, sub-rounded to angular, flint GRAVEL.
						(0.30)		1.40	Dense, brown orange and dark brown, gravelly, fine to coarse SAND.
		1.70	D						
		2.00	SPT	N=54 (4,14/16,14,12,12)		(1.60)			
									[2.7-3.0m: Becoming brown]
	▼	2.90	D						
		3.00	SPT	N=32 (1,5/7,9,8,8)				3.00	End of borehole at 3.00m

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								2.90						

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Start - End Date	Project ID:	Hole Type:	WS3
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole collapsed to 2.85m upon completion. 2. SWL = 2.65m after 30 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.10	ES			(0.30)			Light brown, friable, CLAY/SILT, with frequent rootlets and occasional flint gravel (TOPSOIL).
								0.30	
		0.50	D						High to very high strength, brown and orange brown, silty CLAY, with occasional flint gravel.
		0.50	HP	UCS(kPa)=320.0					
						(0.90)			
		0.90	D						
		0.90	HP	UCS(kPa)=350.0					
		0.90	SPT	N=37 (4,4/8,10,9,10)					*[1.0-1.2m: Gravel becoming frequent]*
								1.20	
									Dense, orange brown, fine to coarse SAND and fine to medium, sub-rounded to angular flint GRAVEL.
		1.50	D						
									[1.7-3.0m: Gravel becoming fine to coarse]
		1.90	SPT	N=47 (6,11/11,13,12,11)					
						(1.80)			
	▼								*[2.5-3.0m: Soils becoming loose to medium dense]*
		2.70	D						
									[Soils wet below approx. 2.8m]
		2.90	SPT	N=12 (1,2/3,4,3,2)					
								3.00	End of borehole at 3.00m

1 2 3 4

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								2.65						

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Start - End Date	Project ID:	Hole Type:	WS4
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole collapsed to 2.7m upon completion. 2. SWL = 2.5m after 30 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.15	ES			(0.50)			Brown, CLAY/SILT, with frequent rootlets, occasional flint gravel, very occasional ash/cinders and brick fragments (MADE GROUND).
		0.40	D						
		0.40	HP	UCS(kPa)=220.0				0.50	
						(0.60)			High strength, brown and orange brown, silty CLAY, with occasional flint gravel.
		0.90	D						
		0.90	HP	UCS(kPa)=600+					*[0.9-1.1m: Becoming very high strength and very gravelly]*
		0.90	SPT	N=31 (3,8/8,8,8,7)				1.10	
		1.30	D						Dense, orange brown, fine to coarse SAND and fine to coarse, sub-rounded to angular flint GRAVEL.
									[1.1-1.4m: Slightly clayey and brown/orange brown]
									[1.5-1.6m: Lens of fine to medium SAND]
		1.90	SPT	N=38 (4,7/9,9,10,10)		(1.90)			
		2.30	D						
	▼							3.00	End of borehole at 3.00m

1 2 3 4

Hole Details: Depth (m bgl)	Hole Details: Dia. (mm)	Casing Details: Depth (m bgl)	Casing Details: Dia. (mm)	Water Strike (m bgl): Date	Depth	Casing	Sealed	Readings (m bgl): Rose to:	Time (min)	Remarks	Standing/Chiselling (m bgl): From	To	Time	Remarks
								2.50						

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Start - End Date	Project ID:	Hole Type:	WS5
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole collapsed to 3.0m upon completion. 2. SWL = 2.6m after 15 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.20	ES			(0.50)			Orange brown and grey brown, CLAY/SILT, with occasional rootlets, flint gravel and ash/cinders (MADE GROUND).
									[0.3-0.5m: Becoming a silty CLAY]
								0.50	
		0.60	ES			(0.30)			Medium strength, orange brown, sandy CLAY, with frequent, fine to medium, sub-rounded to angular flint gravel.
		0.60	HP	UCS(kPa)=130.0					
								0.80	
		1.00	SPT	N=35 (3,6/9,8,9,9)		(0.60)			Dense, orange brown, fine to coarse SAND and fine to coarse, sub-rounded to angular, flint GRAVEL.
								1.40	
		1.60	D			(0.50)			Yellow brown, fine to coarse SAND, with very occasional flint gravel.
								1.90	
		2.00	SPT	N=39 (5,11/11,11,8,9)					Dense, brown, fine to coarse SAND and fine to coarse, rounded to sub-angular, flint GRAVEL.
		2.30	D						
	▼								
		3.00	SPT	N=15 (1,2/3,5,3,4)		(2.10)			*[3.0-4.0m: Soils becoming medium dense]*
		3.60	D						
								4.00	End of borehole at 4.00m

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								2.60						

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Start - End Date	Project ID:	Hole Type:	WS6
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole remained open to 3.0m upon completion. 2. SWL = 2.42m after 15 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.15	ES			(0.30)		0.30	Grey brown, friable, clayey SILT, with frequent rootlets, occasional flint gravel and very occasional brick fragments (TOPSOIL).
		0.60	D			(0.60)			Medium to high strength, orange brown, silty CLAY.
		0.60	HP	UCS(kPa)=160.0					
									[0.8-0.9m: With occsaional flint gravel]
								0.90	
		1.00	D						Dense, brown orange, fine to coarse SAND and fine to coarse, sub-rounded to angular flint GRAVEL.
		1.00	SPT	N=38 (3,7/7,9,10,12)					
		1.90	D						
		2.00	SPT	N=44 (4,10/10,10,12,12)		(2.10)			
	▼								*[2.5-3.0m: Soils becoming loose to medium dense and wet]*
		2.90	D						
		3.00	SPT	N=14 (3,4/3,4,4,3)				3.00	End of borehole at 3.00m

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								2.42						

Southern Testing ST Consult

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Start - End Date	Project ID:	Hole Type:	WS7
19/10/2015	A2392	WLS	Sheet 1 of 1

Project Name:	St Michael's Convent, Richmond	Remarks:	Co-ordinates:	Level:	Logger:
					CL
Location:	Ham Common, Richmond	1. Borehole collapsed to 3.3m upon completion. 2. SWL = 3.05m after 15 mins.			
Client:	Beechcroft Developments Ltd				

Backfill	Water Strikes	Samples and Insitu Testing: Depth (m bgl)	Type	Results	Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description
		0.15	ES			(0.40)			Grey brown, friable, clayey SILT, with occasional rootlets, brick fragments and ash/cinders (MADE GROUND).
								0.40	Very high strength, brown orange, silty CLAY.
		0.60	D			(0.80)			
		1.00	D						*[1.0-1.2m: With occsaional flint gravel]*
		1.00	HP	UCS(kPa)=450.0					
		1.00	SPT	N=9 (1,2/3,2,2,2)				1.20	Loose to medium dense, orange brown and yellow brown, fine to medium SAND, with occasional flint gravel.
		1.50	D			(1.00)			*[1.8-2.2m: Gravel becoming frequent]*
		2.00	SPT	N=56 (3,5/9,13,15,19)				2.20	Medium dense to dense, orange/reddish brown, fine to coarse SAND and fine to medium, sub-rounded to angular flint GRAVEL.
		2.60	D						*[Soils wet below approx. 2.5m]*
	▼	3.00	SPT	N=29 (4,5/8,8,7,6)		(1.40)			
								3.60	Medium to high strength, grey, CLAY.
		4.00	D			(0.40)			
		4.00	HP	UCS(kPa)=150.0				4.00	End of borehole at 4.00m

Hole Details		Casing Details		Water Strike (m bgl)				Readings (m bgl)			Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth	Casing	Sealed	Rose to:	Time (min)	Remarks	From	To	Time	Remarks
								3.05						

APPENDIX B – PHOTOGRAPHS

Photo 1 – View of existing building from the SW site corner (looking NE)

Photo 2 – View of existing building from site centre (looking SE)

Photo 3 – View of eastern elevation of existing building (looking S)

Photo 4 – Building in the SE corner of the site (looking SE)

Photo 5 – Workshops/sheds in the SW site corner (looking SW)

Photo 6 – View across the gardens from the centre-E (looking W)

Photo 7 – Path running along the W boundary in the N (looking S)

Photo 8 – View of the grounds in the centre-N (looking SE)

Photo 9 – View of the grounds in the centre of the site (looking E)

Photo 10 – View of the grounds in the centre-N (looking NW)

Photo 11 – View of the grounds in the centre-E (looking S)

Photo 12 – Garden waste and rubbish in the NW (looking NW)

Photo 13 – View of the grounds in the centre-W (looking N)

Photo 14 – View of the grounds in the centre-W (looking S)

APPENDIX C – LABORATORY TEST RESULTS

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Atterberg and Moisture Content Summary

To BS1377-2:1990(2003) cl.3.2, 3.3, 4.2, 4.3

AGS

Project Name		*St Michael's Convent (Richmond)*					**Project Number**		*A2392*		
Client		*Beechcroft Developments*			**PE**	*CL*	**Date Issued**		*27-Oct-15*		
Location	Depth m	Sample Type	Visual Description	Comments	Natural MC %	Liquid Limit %	Plastic Limit %	Plasticity Index	Classi-fication	Passing 425 micron %	
WS1	1.00	D	*Hard extremely high strength brown gravelly sandy CLAY. Gravel consists of fine to coarse angular to subrounded flint.*	*Sieve Prep*	*12*	*46*	*23*	*23*	*CI*	*70*	
WS3	0.90	D	*Orange brown gravelly sandy CLAY. Gravel consists of fine to coarse angular to subrounded flint.*	*Sieve Prep*	*17*	*51*	*29*	*22*	*MH*	*63*	
WS4	0.90	D	*Very stiff extremely high strength slightly gravelly slightly sandy CLAY. Gravel consists of fine to medium subangular flint.*	*Sieve Prep*	*18*	*52*	*25*	*27*	*CH*	*84*	

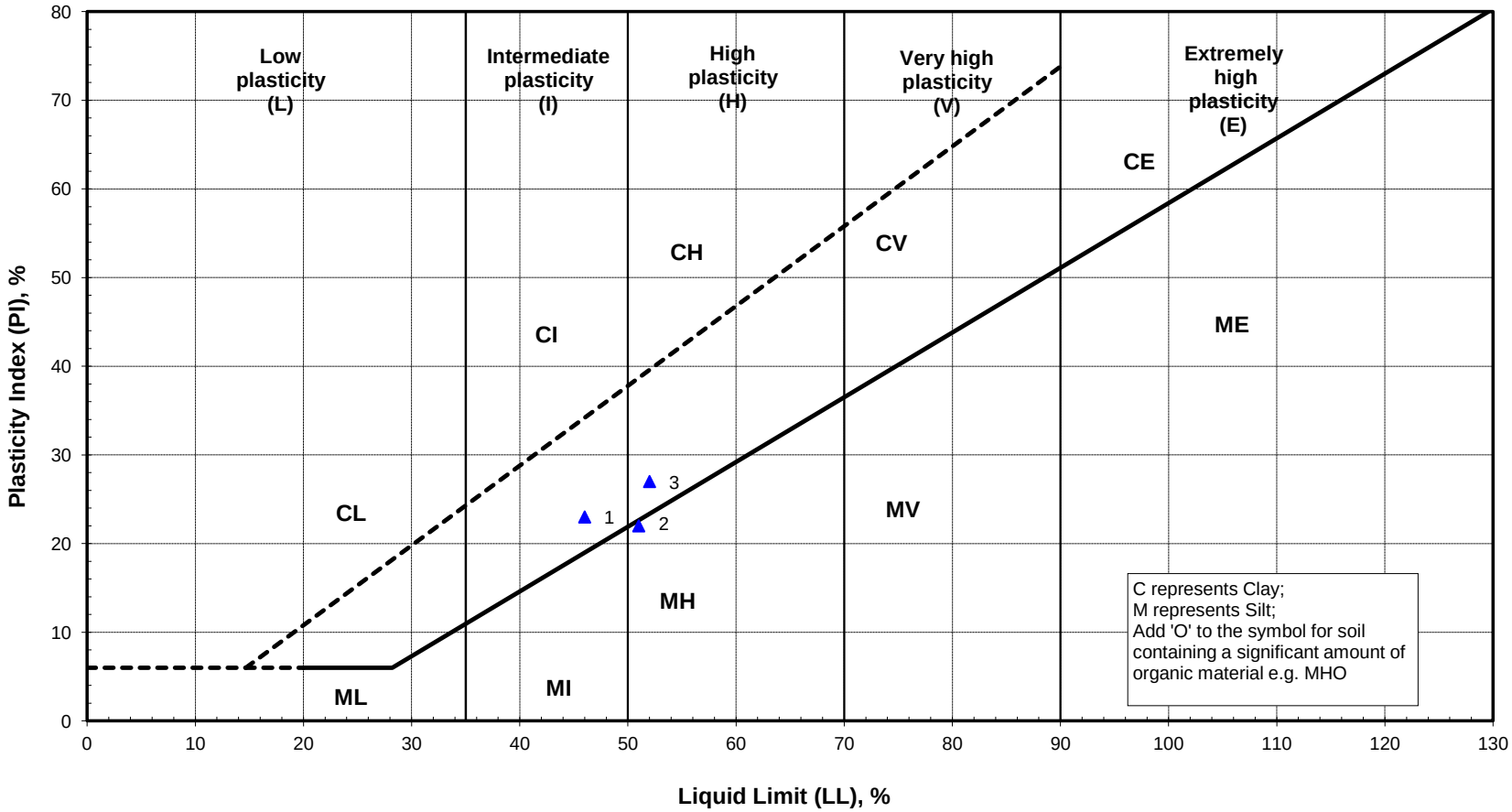
Jun 13

Plasticity Chart for Atterberg Limit Tests

Project Name	*St Michael's Convent (Richmond)*			**Project Number**	*A2392*
Client Name	*Beechcroft Developments*	**PE**	*CL*	**Date Issued**	*27-Oct-15*

Key

No.	TH No.	Depth
1	WS1	1.00
2	WS3	0.90
3	WS4	0.90



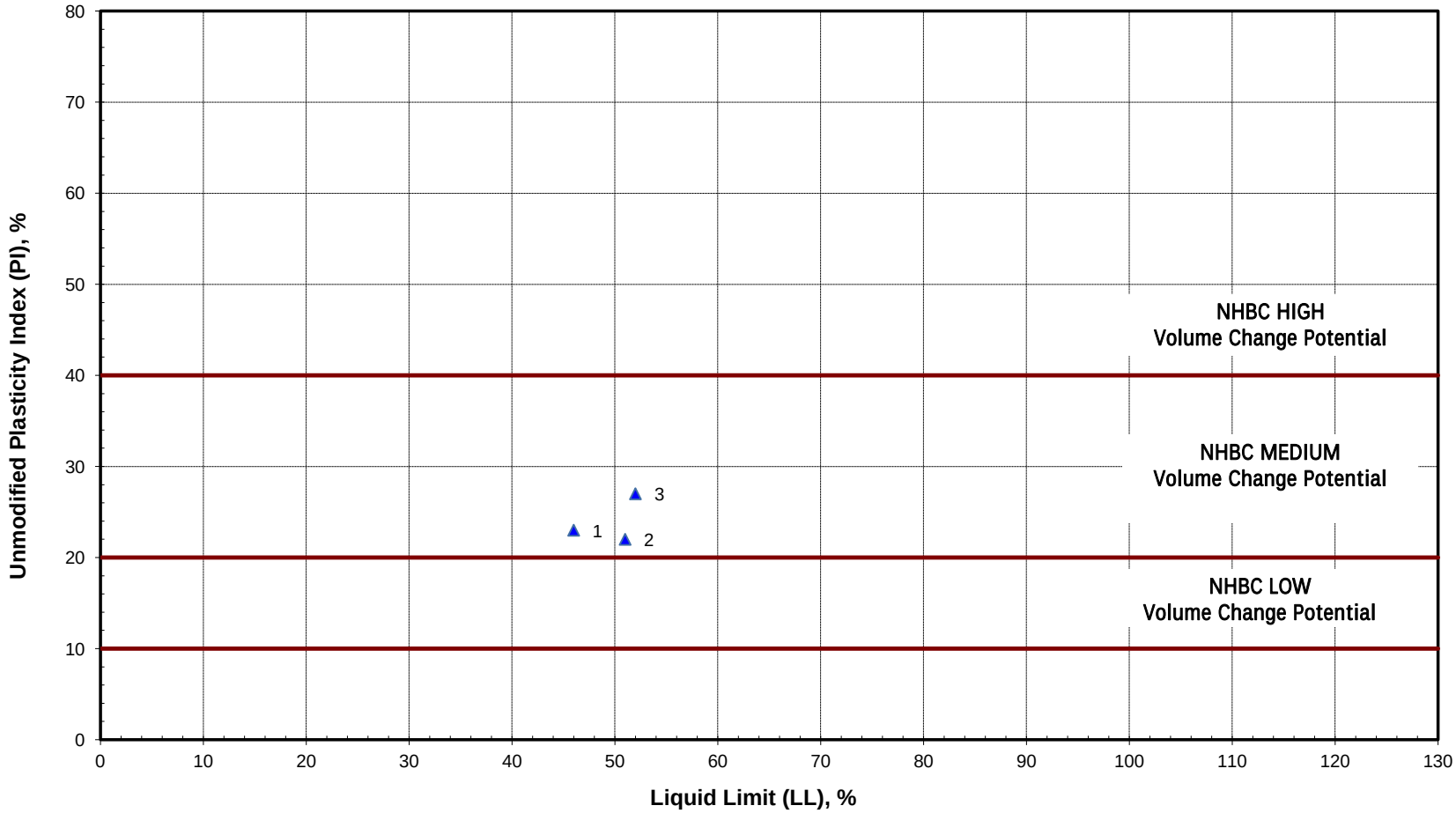
Liquid Limit		**Plastic Limit**		**Plasticity Index**	
Maximum Value	52	Maximum Value	29	Maximum Value	27
Minimum Value	46	Minimum Value	23	Minimum Value	22
Average Value	50	Average Value	26	Average Value	24

NHBC Classification for Volume Change Potential

Project Name	*St Michael's Convent (Richmond)*			**Project Number**	*A2392*
Client Name	*Beechcroft Developments*	**PE**	*CL*	**Date Issued**	*27-Oct-15*

Key

No.	TH No.	Depth
1	WS1	1.00
2	WS3	0.90
3	WS4	0.90



Liquid Limit		**Plastic Limit**		**Unmodified Plasticity Index**	
Maximum Value	52	Maximum Value	29	Maximum Value	27
Minimum Value	46	Minimum Value	23	Minimum Value	22
Average Value	50	Average Value	26	Average Value	24

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CHEMICAL & ELECTROCHEMICAL TESTING SUMMARY

To BS1377-3:1990(2003) cl 5.6 & 9.5

AGS

Project Name	St Michael's Convent (Richmond)					Project Number	A2392
Client	Beechcroft Developments			PE	*CL*	Date Issued	*27-Oct-15*

TH No.	Depth m	Sample Type	Visual Description	Comments	Passing 2mm %	pH Value	Soil Sulphate 2:1 Water Extract		Groundwater Sulphate	
							g/l SO_3	BRE mg/l SO_4	g/l SO_3	BRE mg/l SO_4
WS1	2.70	D	Brown very gravelly SAND. Gravel consists of fine to coarse subangular flint.		69.1	7.0	0.01	10		
WS2	1.00	D	Hard extremely high strength dark brown slightly sandy CLAY.		100.0	6.2	0.02	19		
WS4	1.30	D	Dark brown gravelly SAND. Gravel consists of fine to coarse angular to subrounded flint.		46.7	5.9	0.02	19		
WS5	0.60	ES	Dark brown very gravelly CLAY. Gravel consists of fine to coarse subangular to subrounded flint.		24.2	5.2	0.02	19		
WS6	1.90	D	Orange brown very gravelly SAND. Gravel consists of fine to coarse angular to subrounded flint.		45.4	5.7	0.02	19		
WS7	1.00	D	Stiff very high strength dark brown sandy CLAY.		100.0	6.8	0.01	10		

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PARTICLE SIZE DISTRIBUTION REPORT

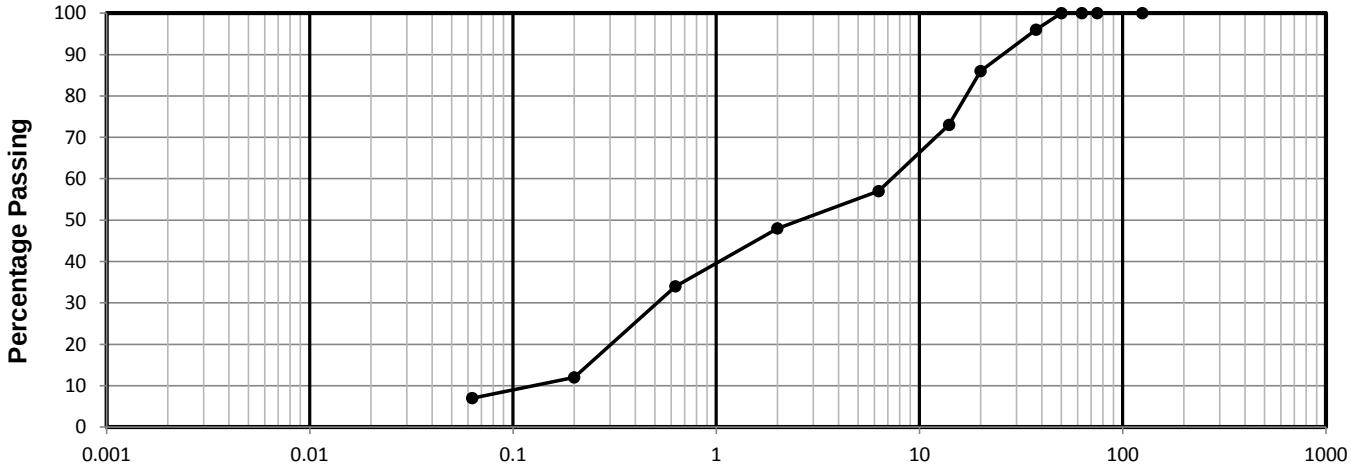
To BS1377-2:1990(2003) cl. 9.2-9.5

AGS

Project Name	*St Michael's Convent (Richmond)*			**Project Number**	*A2392*
Client Name	*Beechcroft Developments*	**PE**	*CL*	**Date Issued**	*27-Oct-15*

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	96
20mm	86
14mm	73
6.3mm	57
2mm	48
630µm	34
200µm	12
63µm	7

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
	7			41			52			0

Visual Description of Sample:

Brown very sandy GRAVEL. Gravel consists of fine to coarse angular flint.

Particle Density (Assumed) Mg/m³	**2.65**

Coefficient of Uniformity	**58.1**

Test Methods:

Wet & Dry Grading BS1377-2: 1990(2003) cl.9.2 & 9.3

Location	WS1
Depth (m)	1.60
Sample Type	D

Comments:

Tested By	STL Lab
Checked By	AnnaS

Southern Testing | ST Consult

PARTICLE SIZE DISTRIBUTION REPORT

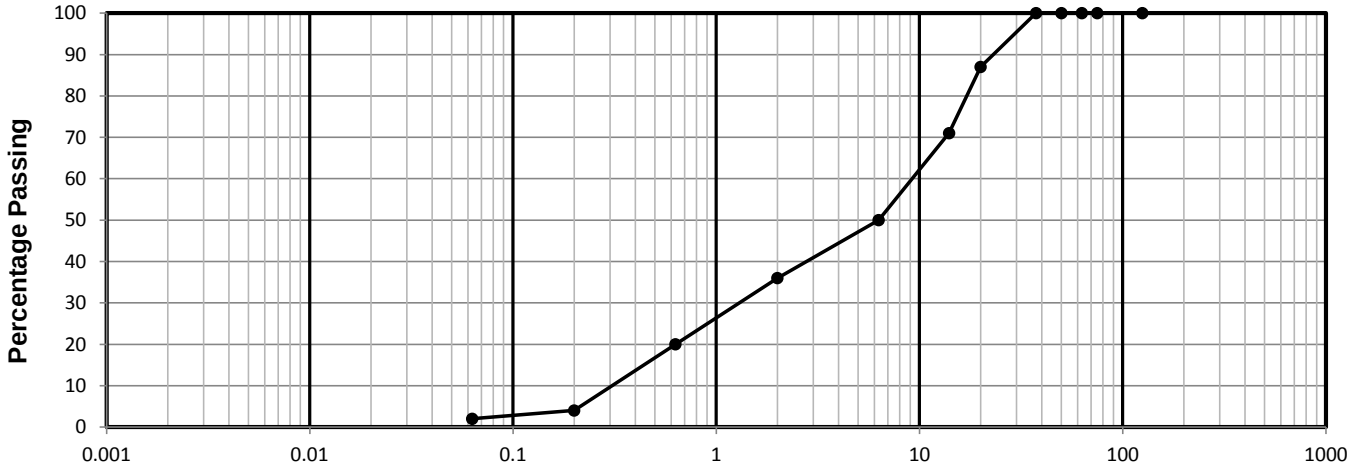
To BS1377-2:1990(2003) cl. 9.2-9.5

AGS

Project Name	*St Michael's Convent (Richmond)*			**Project Number**	*A2392*
Client Name	*Beechcroft Developments*	**PE**	*CL*	**Date Issued**	*27-Oct-15*

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
20mm	87
14mm	71
6.3mm	50
2mm	36
630µm	20
200µm	4
63µm	2

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
	2			35			64			0

Visual Description of Sample:

Brown very sandy GRAVEL. Gravel consists of fine to coarse angular flint and quartzite.

Particle Density (Assumed) Mg/m³	**2.65**
Coefficient of Uniformity	**30**

Test Methods:

Wet & Dry Grading BS1377-2: 1990(2003) cl.9.2 & 9.3

Location	WS3
Depth (m)	2.70
Sample Type	D

Comments:

Tested By	STL Lab
Checked By	AnnaS

Southern Testing | ST Consult

PARTICLE SIZE DISTRIBUTION REPORT

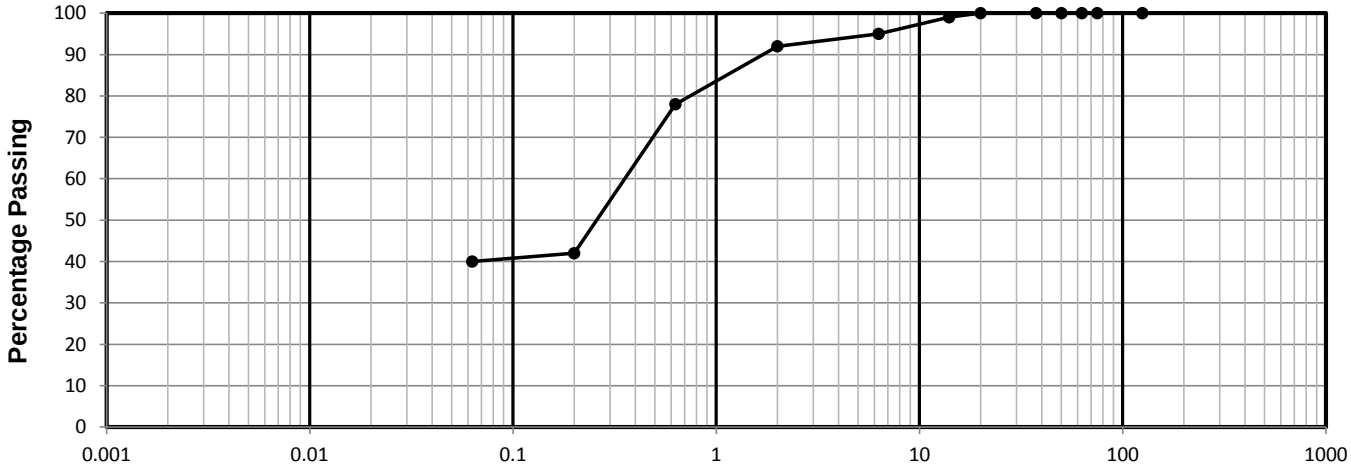
To BS1377-2:1990(2003) cl. 9.2-9.5

AGS

Project Name	*St Michael's Convent (Richmond)*			**Project Number**	*A2392*
Client Name	*Beechcroft Developments*	**PE**	*CL*	**Date Issued**	*27-Oct-15*

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
20mm	100
14mm	99
6.3mm	95
2mm	92
630µm	78
200µm	42
63µm	40

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
40				52			8			0

Visual Description of Sample:

Orange brown slightly gravelly SAND. Gravel consists of fine to medium angular to subrounded flint and sandstone.

Particle Density (Assumed) Mg/m³	**2.65**
Coefficient of Uniformity	**>5.63**

Test Methods:

Wet & Dry Grading BS1377-2: 1990(2003) cl.9.2 & 9.3

Location	WS5
Depth (m)	1.60
Sample Type	D

Comments:

Tested By	STL Lab
Checked By	AnnaS

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

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Estate
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Essex
CM7 2RT
Tel : 01376 560120
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Report Number: 520532-1

Date of Report: 03-Nov-2015

Customer: Southern Testing Laboratories
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

Customer Contact: Mr Chris Lennard

Customer Job Reference: A2392
Customer Purchase Order: A2392_1 Chris
Customer Site Reference: St Michaels Convent (Richmond)
Date Job Received at SAL: 27-Oct-2015
Date Analysis Started: 28-Oct-2015
Date Analysis Completed: 03-Nov-2015

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

1549

Report checked
and authorised by :
Chelsea Entwistle
Project Management

Issued by :
Chelsea Entwistle
Project Management

SAL Reference: 520532
Project Site: St Michaels Convent (Richmond)
Customer Reference: A2392

Soil Analysed as Soil
STL Key Contamintion Suite

				SAL Reference	**520532 001**	**520532 002**	**520532 004**	**520532 005**	**520532 006**
				Customer Sample Reference	**WS1 @ 0.15m**	**WS2 @ 0.1m**	**WS3 @ 0.10m**	**WS4 @ 0.15m**	**WS5 @ 0.20m**
				Date Sampled	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**
				Type	**Topsoil**	**Topsoil**	**Topsoil**	**Topsoil**	**Topsoil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T257	A40	2	mg/kg	**27**	**23**	**21**	**26**	**24**
Cadmium	T257	A40	0.1	mg/kg	**0.5**	**0.3**	**0.1**	**0.2**	**0.2**
Chromium	T257	A40	0.5	mg/kg	**23**	**26**	**30**	**26**	**26**
Copper	T257	A40	2	mg/kg	**39**	**37**	**56**	**99**	**58**
Lead	T257	A40	2	mg/kg	**320**	**320**	**180**	**380**	**420**
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0	**1.8**	**2.3**	<1.0
Nickel	T257	A40	0.5	mg/kg	**22**	**24**	**16**	**21**	**25**
Selenium	T257	A40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T257	A40	2	mg/kg	**180**	**140**	**66**	**91**	**97**
Asbestos ID	T27	A40			Asbestos not detected	Asbestos not detected	Asbestos not detected	Asbestos not detected	Asbestos not detected
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Fraction Organic Carbon - F(oc)	T21	A40	1	%	<1	<1	<1	<1	<1
pH	T7	A40			**6.4**	**7.6**	**5.4**	**6.0**	**7.0**
Soil Organic Matter	T287	A40	0.1	%	**6.9**	**6.0**	**4.0**	**9.3**	**9.7**
(Water Soluble) SO4-- expressed as SO4	T242	A40	0.01	g/l	**0.01**	**0.03**	**0.01**	**0.01**	<0.01
Sulphide	T4	A40	10	mg/kg	<10	<10	<10	<10	<10
Cyanide(Total)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Phenols(Mono)	T221	AR	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Moisture @105C	T162	AR	0.1	%	**15**	**11**	**8.5**	**14**	**15**
Retained on 2mm	T2	A40	0.1	%	**17.4**	**22.6**	**17.8**	**8.3**	**14.0**

SAL Reference: 520532
Project Site: St Michaels Convent (Richmond)
Customer Reference: A2392

Soil Analysed as Soil
STL Key Contamintion Suite

				SAL Reference	**520532 007**	**520532 008**
				Customer Sample Reference	**WS6 @ 0.15m**	**WS7 @ 0.15m**
				Date Sampled	**19-OCT-2015**	**19-OCT-2015**
				Type	**Topsoil**	**Topsoil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Arsenic	T257	A40	2	mg/kg	**25**	**30**
Cadmium	T257	A40	0.1	mg/kg	**0.2**	**0.6**
Chromium	T257	A40	0.5	mg/kg	**28**	**27**
Copper	T257	A40	2	mg/kg	**63**	**58**
Lead	T257	A40	2	mg/kg	**190**	**850**
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0
Nickel	T257	A40	0.5	mg/kg	**21**	**27**
Selenium	T257	A40	3	mg/kg	<3	<3
Zinc	T257	A40	2	mg/kg	**97**	**250**
Asbestos ID	T27	A40			Asbestos not detected	Asbestos not detected
Chromium VI	T6	A40	1	mg/kg	<1	<1
Fraction Organic Carbon - F(oc)	T21	A40	1	%	<1	<1
pH	T7	A40			**7.1**	**7.2**
Soil Organic Matter	T287	A40	0.1	%	**4.3**	**8.1**
(Water Soluble) SO4-- expressed as SO4	T242	A40	0.01	g/l	<0.01	**0.01**
Sulphide	T4	A40	10	mg/kg	<10	<10
Cyanide(Total)	T4	AR	1	mg/kg	<1	<1
Phenols(Mono)	T221	AR	1.0	mg/kg	<1.0	<1.0
Moisture @105C	T162	AR	0.1	%	**16**	**15**
Retained on 2mm	T2	A40	0.1	%	**19.2**	**20.8**

SAL Reference: 520532
Project Site: St Michaels Convent (Richmond)
Customer Reference: A2392

Soil Analysed as Soil
Total and Speciated USEPA16 PAH (SE) (MCERTS)

				SAL Reference	**520532 001**	**520532 002**	**520532 004**	**520532 005**	**520532 006**
				Customer Sample Reference	**WS1 @ 0.15m**	**WS2 @ 0.1m**	**WS3 @ 0.10m**	**WS4 @ 0.15m**	**WS5 @ 0.20m**
				Date Sampled	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**	**19-OCT-2015**
				Type	**Topsoil**	**Topsoil**	**Topsoil**	**Topsoil**	**Topsoil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	**0.2**	**0.1**	<0.1	**0.2**	**0.2**
Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	**0.6**	**0.3**	**0.3**	**0.2**	<0.1
Pyrene	T16	AR	0.1	mg/kg	**0.6**	**0.2**	**0.2**	**0.2**	<0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	**0.3**	**0.1**	**0.2**	**0.1**	<0.1
Chrysene	T16	AR	0.1	mg/kg	**0.4**	**0.2**	**0.2**	**0.2**	<0.1
Benzo(b)fluoranthene	T16	AR	0.1	mg/kg	**0.3**	**0.1**	**0.2**	**0.1**	<0.1
Benzo(k)fluoranthene	T16	AR	0.1	mg/kg	**0.3**	**0.1**	**0.2**	<0.1	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	**0.3**	**0.1**	**0.1**	<0.1	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
PAH(total)	T16	AR	0.1	mg/kg	**3.4**	**1.3**	**1.3**	**1.0**	**0.2**

SAL Reference: 520532
Project Site: St Michaels Convent (Richmond)
Customer Reference: A2392

Soil Analysed as Soil
Total and Speciated USEPA16 PAH (SE) (MCERTS)

				SAL Reference	**520532 007**	**520532 008**
				Customer Sample Reference	**WS6 @ 0.15m**	**WS7 @ 0.15m**
				Date Sampled	**19-OCT-2015**	**19-OCT-2015**
				Type	**Topsoil**	**Topsoil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Naphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	**0.3**	**0.3**
Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	**0.8**	**0.7**
Pyrene	T16	AR	0.1	mg/kg	**0.7**	**0.6**
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	**0.4**	**0.4**
Chrysene	T16	AR	0.1	mg/kg	**0.5**	**0.4**
Benzo(b)fluoranthene	T16	AR	0.1	mg/kg	**0.4**	**0.4**
Benzo(k)fluoranthene	T16	AR	0.1	mg/kg	**0.3**	**0.3**
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	**0.3**	**0.3**
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	**0.2**	**0.2**
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	**0.2**	**0.2**
PAH(total)	T16	AR	0.1	mg/kg	**4.1**	**3.6**

Index to symbols used in 520532-1

Value	Description
AR	As Received
A40	Assisted dried < 40C
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited

N	Analysis is not UKAS accredited

Notes

Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis
Asbestos subcontracted to REC Limited
Retained on 2mm is removed before analysis

Method Index

Value	Description
T162	Grav (1 Dec) (105 C)
T221	Colorimetry (CE)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T21	OX/IR
T7	Probe
T287	Calc TOC/0.58
T6	ICP/OES
T4	Colorimetry
T245	ICP/OES(Aqua Regia Extraction)
T16	GC/MS
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T2	Grav
T27	PLM

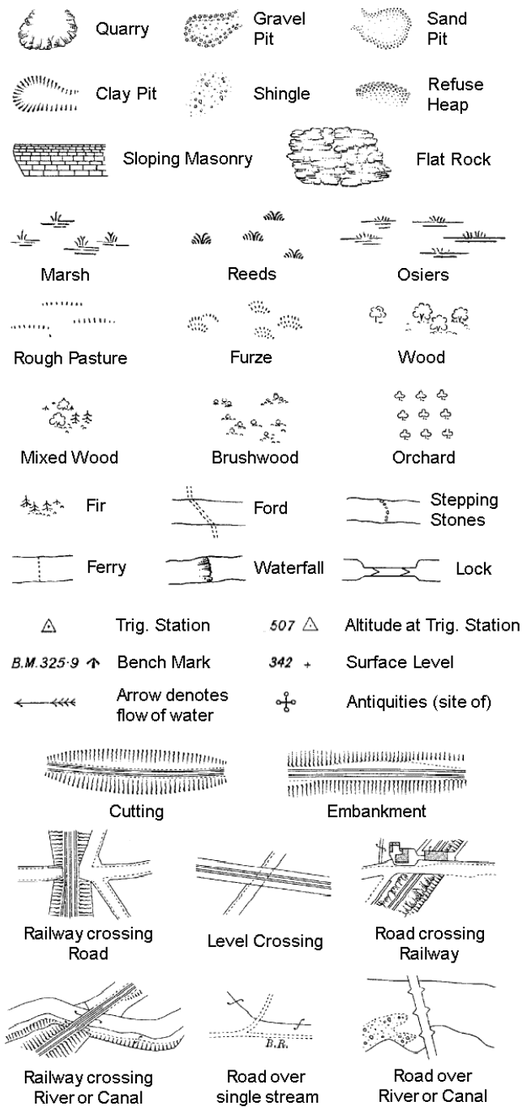
Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T257	A40	2	mg/kg	M	001-002,004-008
Cadmium	T257	A40	0.1	mg/kg	M	001-002,004-008
Chromium	T257	A40	0.5	mg/kg	M	001-002,004-008
Copper	T257	A40	2	mg/kg	M	001-002,004-008
Lead	T257	A40	2	mg/kg	M	001-002,004-008
Mercury	T245	A40	1.0	mg/kg	U	001-002,004-008
Nickel	T257	A40	0.5	mg/kg	M	001-002,004-008
Selenium	T257	A40	3	mg/kg	U	001-002,004-008
Zinc	T257	A40	2	mg/kg	M	001-002,004-008
Asbestos ID	T27	A40			SU	001-002,004-008
Chromium VI	T6	A40	1	mg/kg	N	001-002,004-008
Fraction Organic Carbon - F(oc)	T21	A40	1	%	N	001-002,004-008
pH	T7	A40			M	001-002,004-008
Soil Organic Matter	T287	A40	0.1	%	N	001-002,004-008
(Water Soluble) SO4-- expressed as SO4	T242	A40	0.01	g/l	M	001-002,004-008
Sulphide	T4	A40	10	mg/kg	N	001-002,004-008
Cyanide(Total)	T4	AR	1	mg/kg	M	001-002,004-008
Phenols(Mono)	T221	AR	1.0	mg/kg	M	001-002,004-008
Moisture @105C	T162	AR	0.1	%	N	001-002,004-008
Retained on 2mm	T2	A40	0.1	%	N	001-002,004-008
Naphthalene	T16	AR	0.1	mg/kg	U	001-002,004-008
Acenaphthylene	T16	AR	0.1	mg/kg	U	001-002,004-008
Acenaphthene	T16	AR	0.1	mg/kg	M	001-002,004-008
Fluorene	T16	AR	0.1	mg/kg	M	001-002,004-008
Phenanthrene	T16	AR	0.1	mg/kg	U	001-002,004-008
Anthracene	T16	AR	0.1	mg/kg	M	001-002,004-008
Fluoranthene	T16	AR	0.1	mg/kg	N	001-002,004-008
Pyrene	T16	AR	0.1	mg/kg	N	001-002,004-008
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	M	001-002,004-008
Chrysene	T16	AR	0.1	mg/kg	M	001-002,004-008
Benzo(b)fluoranthene	T16	AR	0.1	mg/kg	U	001-002,004-008
Benzo(k)fluoranthene	T16	AR	0.1	mg/kg	N	001-002,004-008
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	M	001-002,004-008
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	M	001-002,004-008
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	M	001-002,004-008
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	M	001-002,004-008
PAH(total)	T16	AR	0.1	mg/kg	U	001-002,004-008

APPENDIX D – HISTORICAL OS MAPS

Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)

County & Civil Parish Boundary

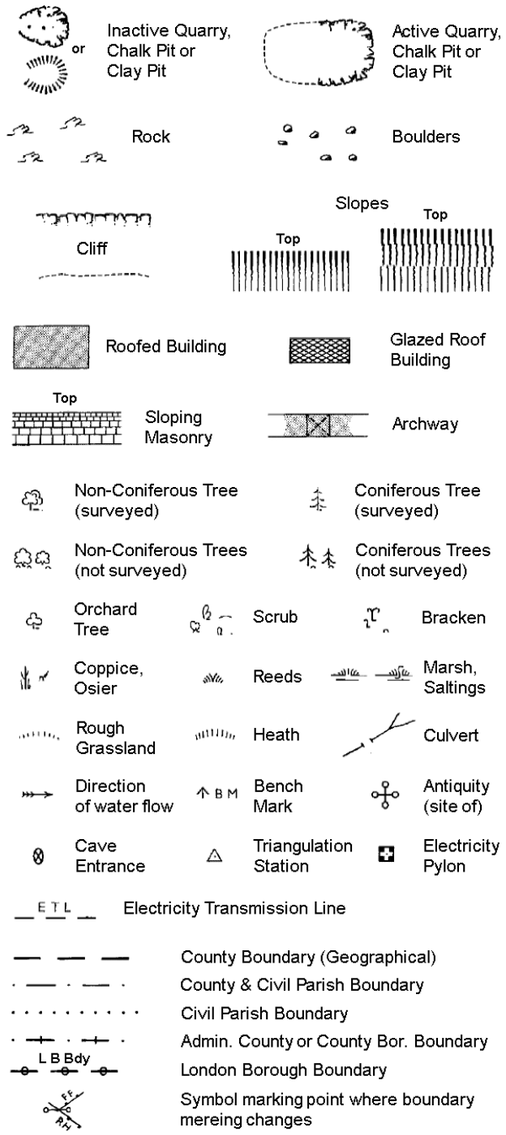
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

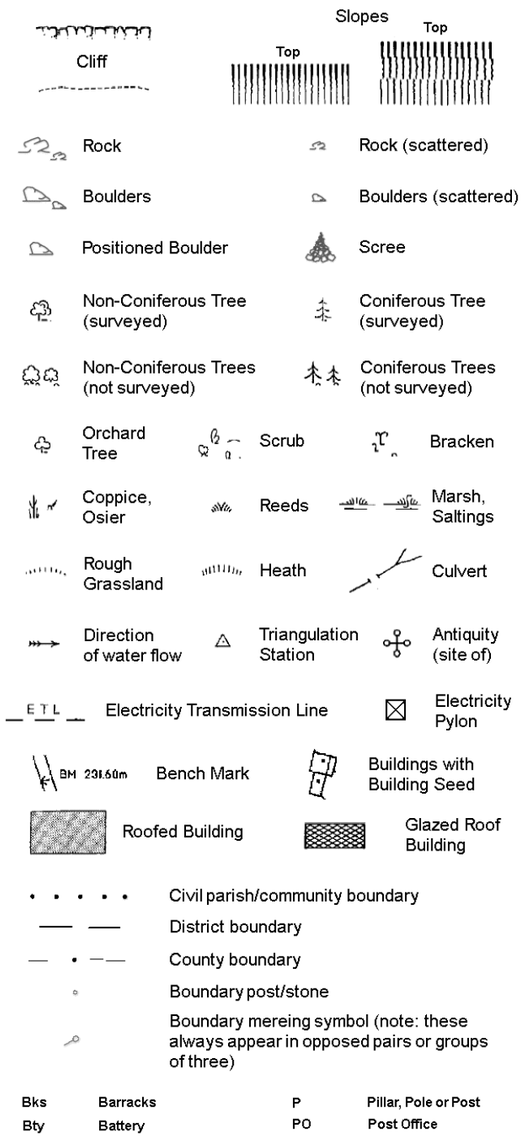
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

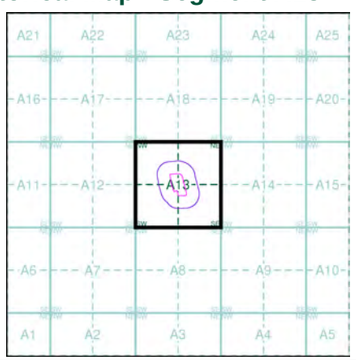
Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

Southern Testing
Environmental & Geotechnical

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Middlesex	1:2,500	1865 - 1880	2
Surrey	1:2,500	1868 - 1878	3
Surrey	1:2,500	1868	4
Surrey	1:2,500	1894	5
Middlesex	1:2,500	1896	6
London	1:2,500	1896	7
Surrey	1:2,500	1897	8
Surrey	1:2,500	1913	9
Middlesex	1:2,500	1914 - 1915	10
Middlesex	1:2,500	1934	11
Surrey	1:2,500	1934 - 1935	12
Historical Aerial Photography	1:1,250	1946 - 1947	13
Ordnance Survey Plan	1:1,250	1959	14
Additional SIMs	1:1,250	1959 - 1979	15
Ordnance Survey Plan	1:2,500	1960	16
Additional SIMs	1:2,500	1960	17
Ordnance Survey Plan	1:1,250	1969 - 1974	18
Ordnance Survey Plan	1:2,500	1971	19
Supply of Unpublished Survey Information	1:1,250	1973	20
Supply of Unpublished Survey Information	1:1,250	1975	21
Additional SIMs	1:1,250	1982 - 1983	22
Large-Scale National Grid Data	1:1,250	1991	23
Large-Scale National Grid Data	1:1,250	1992 - 1995	24
Large-Scale National Grid Data	1:1,250	1996	25

Historical Map - Segment A13



Order Details

Order Number:	73071210_1_1
Customer Ref:	A2392 Richmond
National Grid Reference:	517720, 172230
Slice:	A
Site Area (Ha):	1.55
Search Buffer (m):	100

Site Details

St. Michaels Convent, 56 Ham Common, RICHMOND, Surrey, TW10 7JH

Landmark Information Group

Tel: 0844 844 9952
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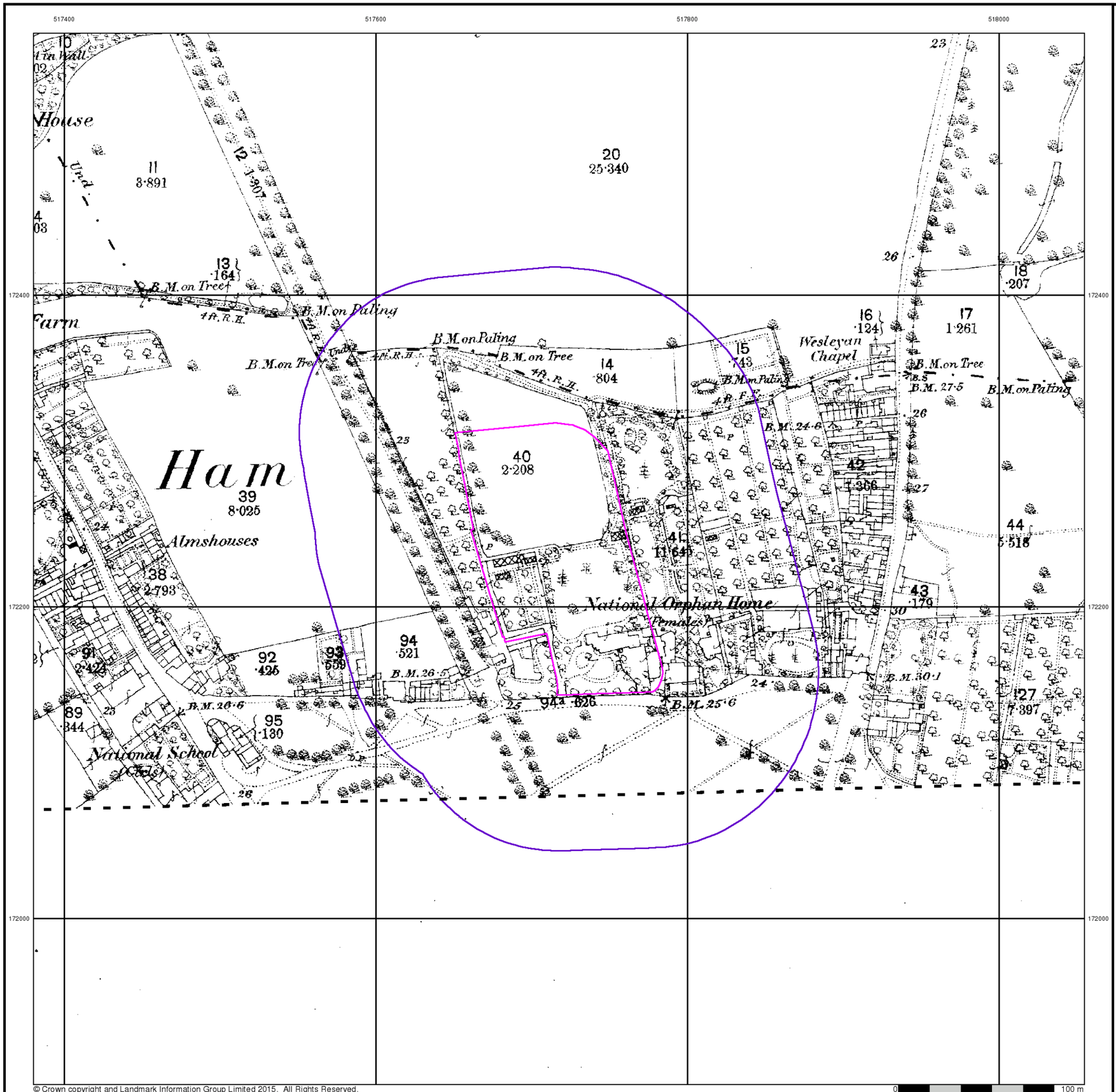


Southern Testing
Environmental & Geotechnical

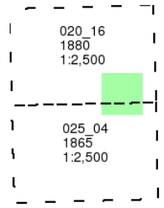
Middlesex

Published 1865 - 1880

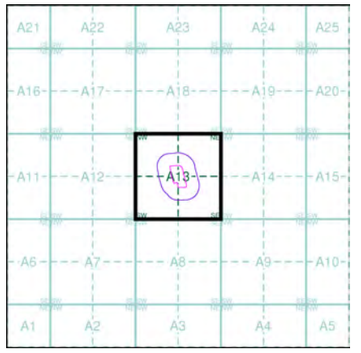
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	73071210_1_1
Customer Ref:	A2392 Richmond
National Grid Reference:	517720, 172230
Slice:	A
Site Area (Ha):	1.55
Search Buffer (m):	100

Site Details

St. Michaels Convent, 56 Ham Common, RICHMOND, Surrey, TW10 7JH

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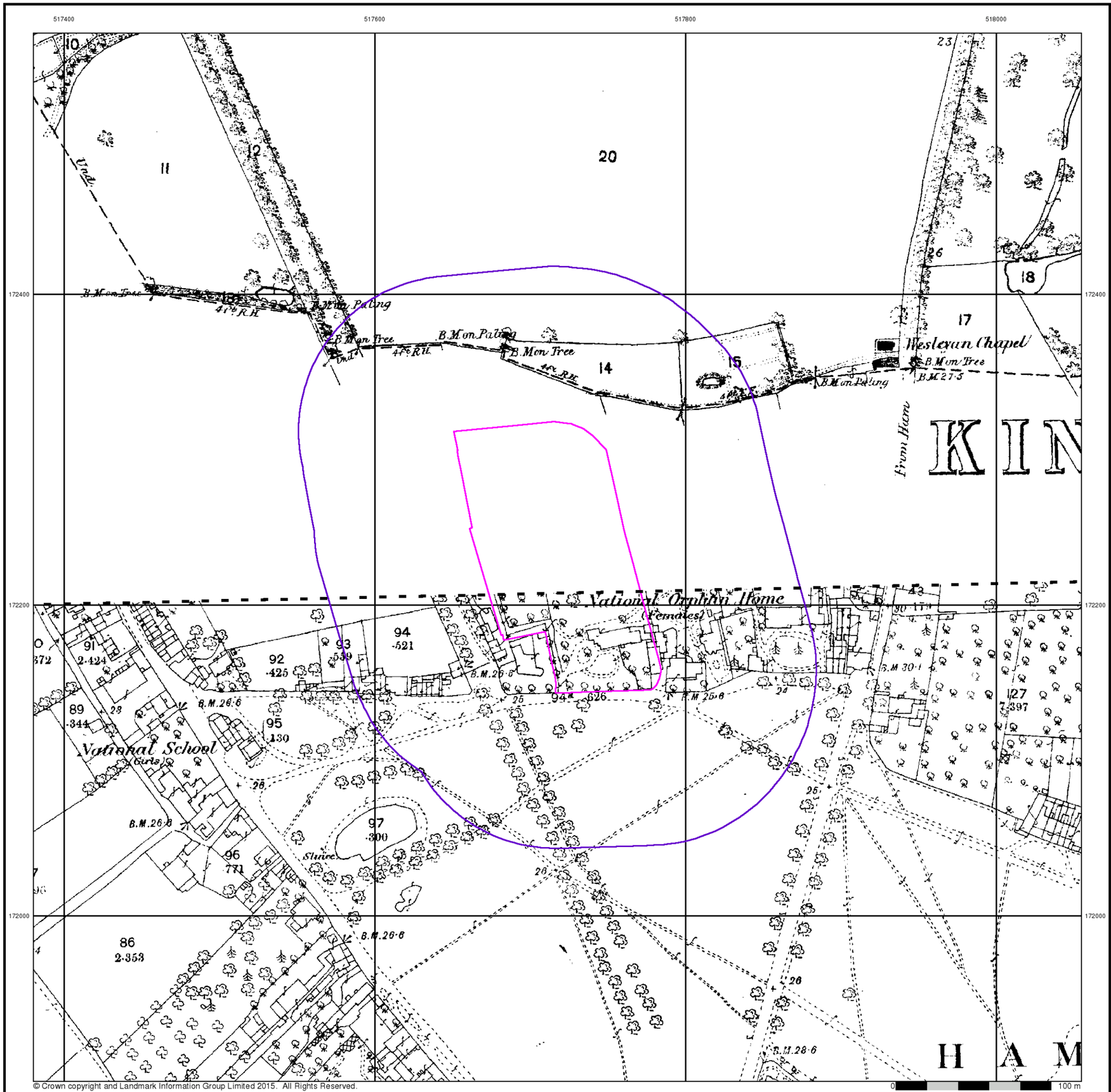


Southern Testing
Environmental & Geotechnical

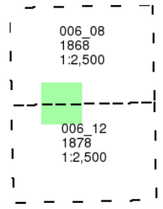
Surrey

Published 1868 - 1878

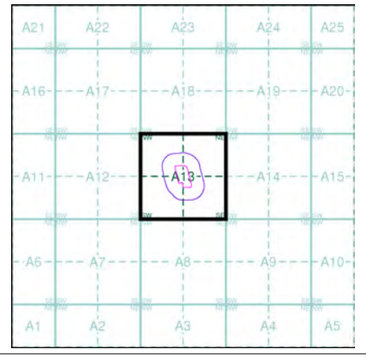
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	73071210_1_1
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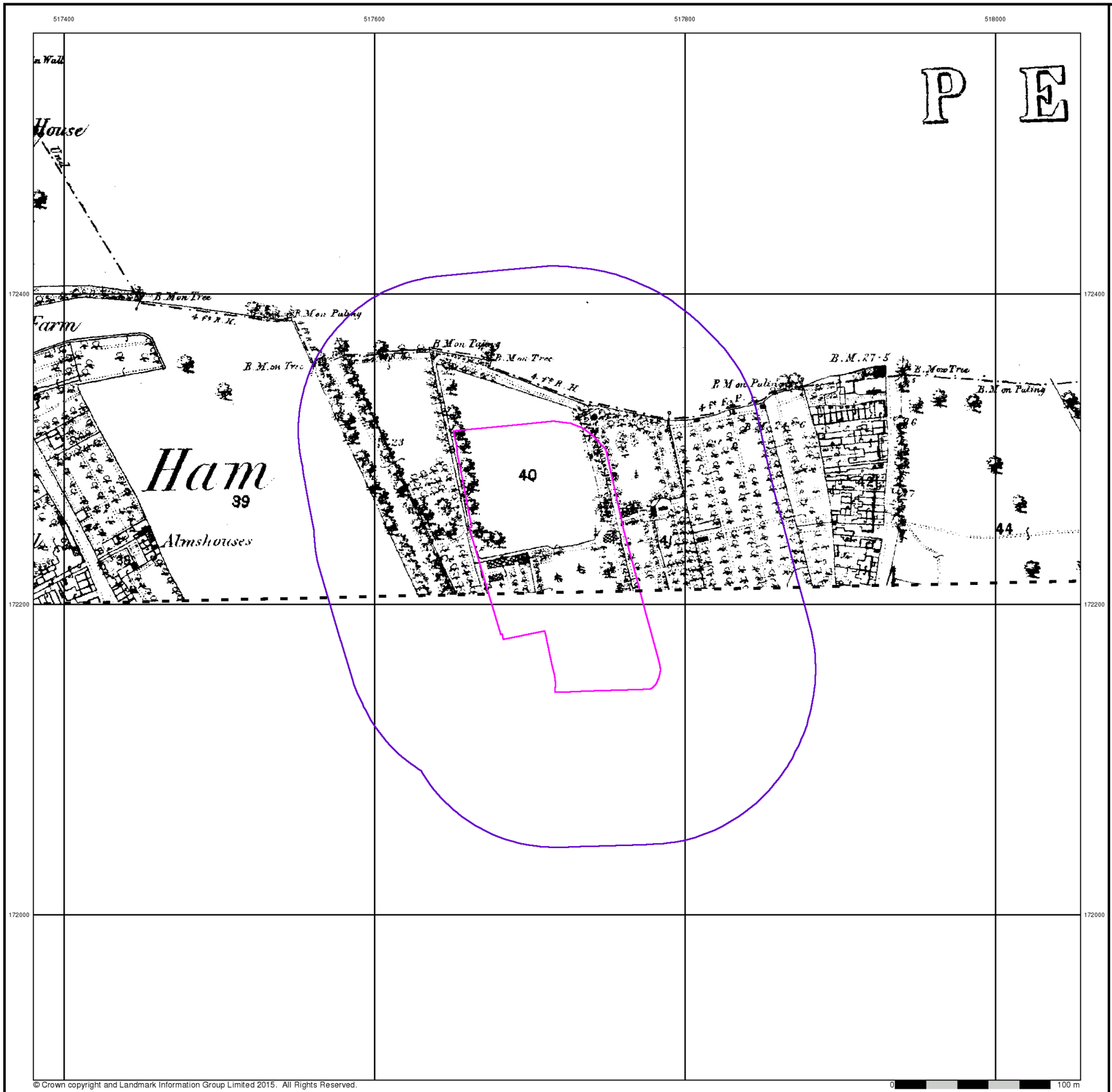

Southern Testing
Environmental & Geotechnical

Surrey

Published 1868

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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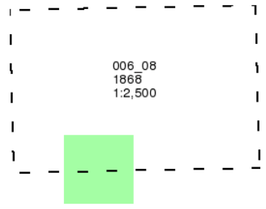
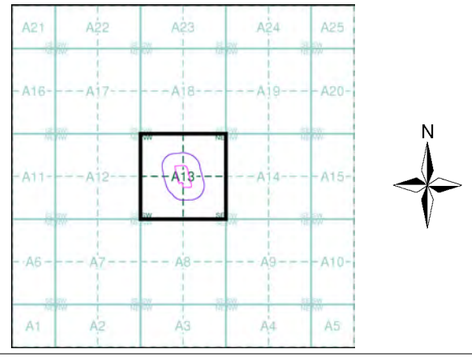


Historical Map - Segment A13



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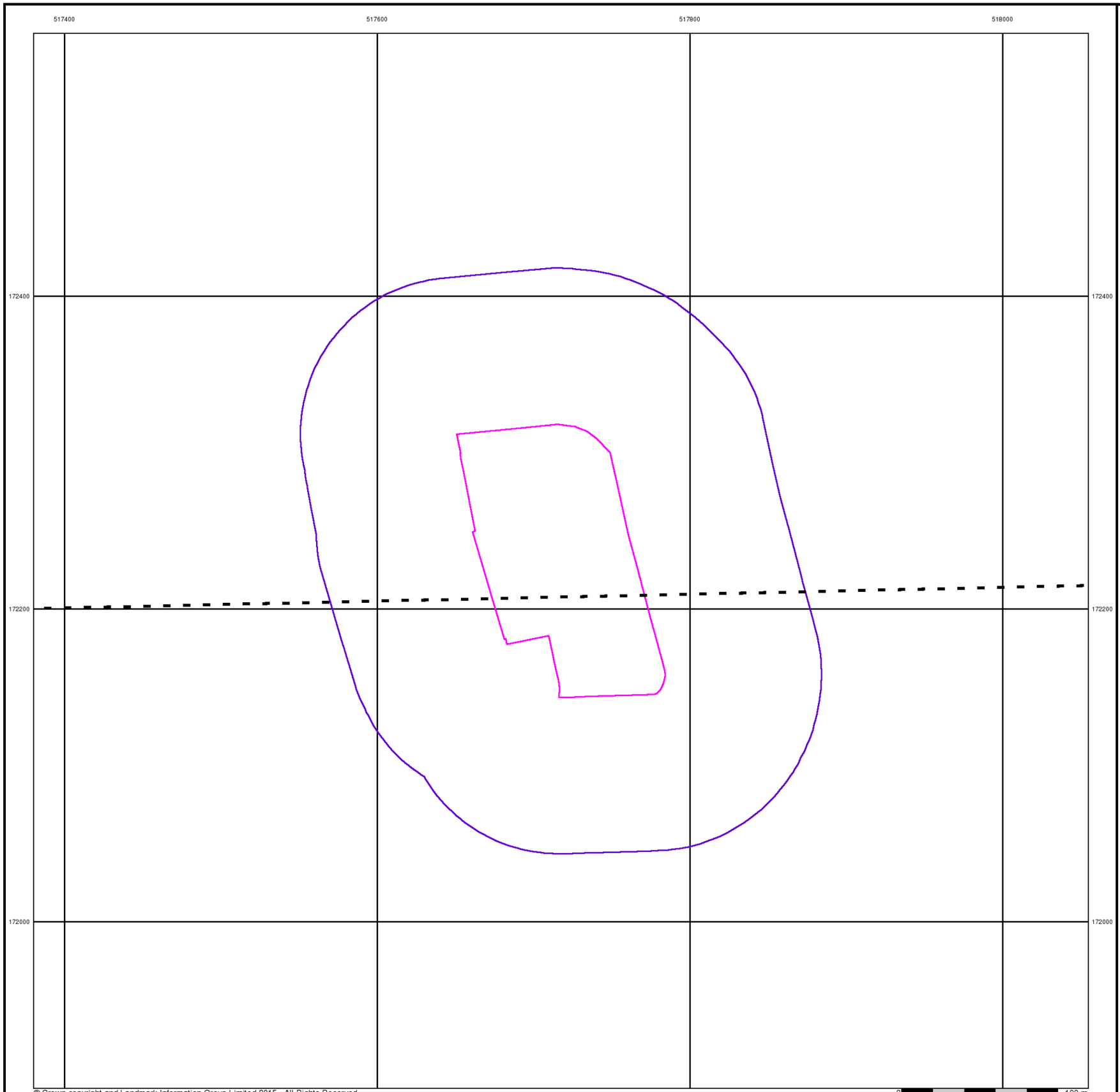

Southern Testing
Environmental & Geotechnical

Surrey

Published 1894

Source map scale - 1:2,500

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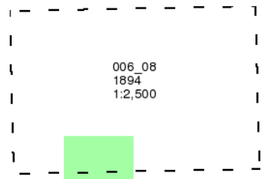
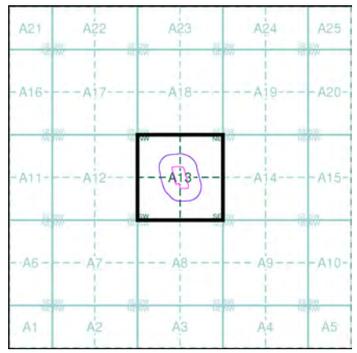


Historical Map - Segment A13



Order Details

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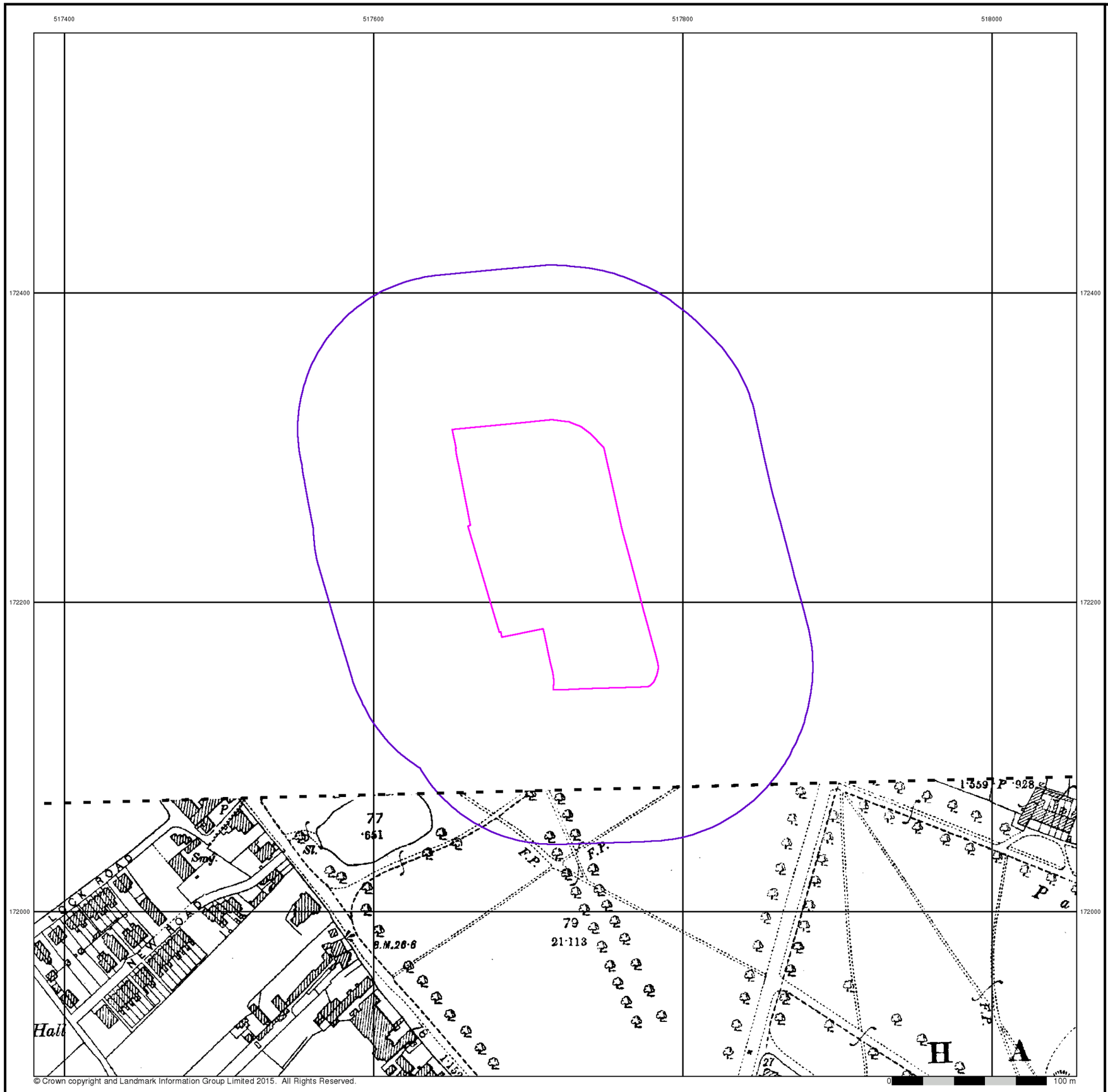

Southern Testing
Environmental & Geotechnical

Middlesex

Published 1896

Source map scale - 1:2,500

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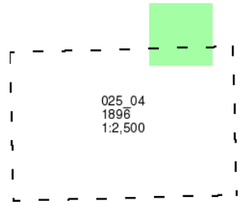
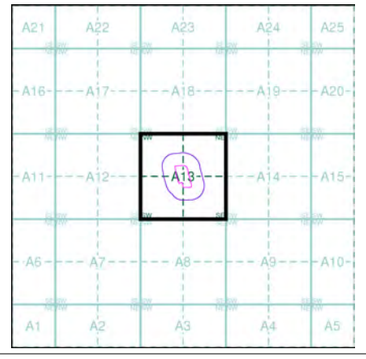


Historical Map - Segment A13



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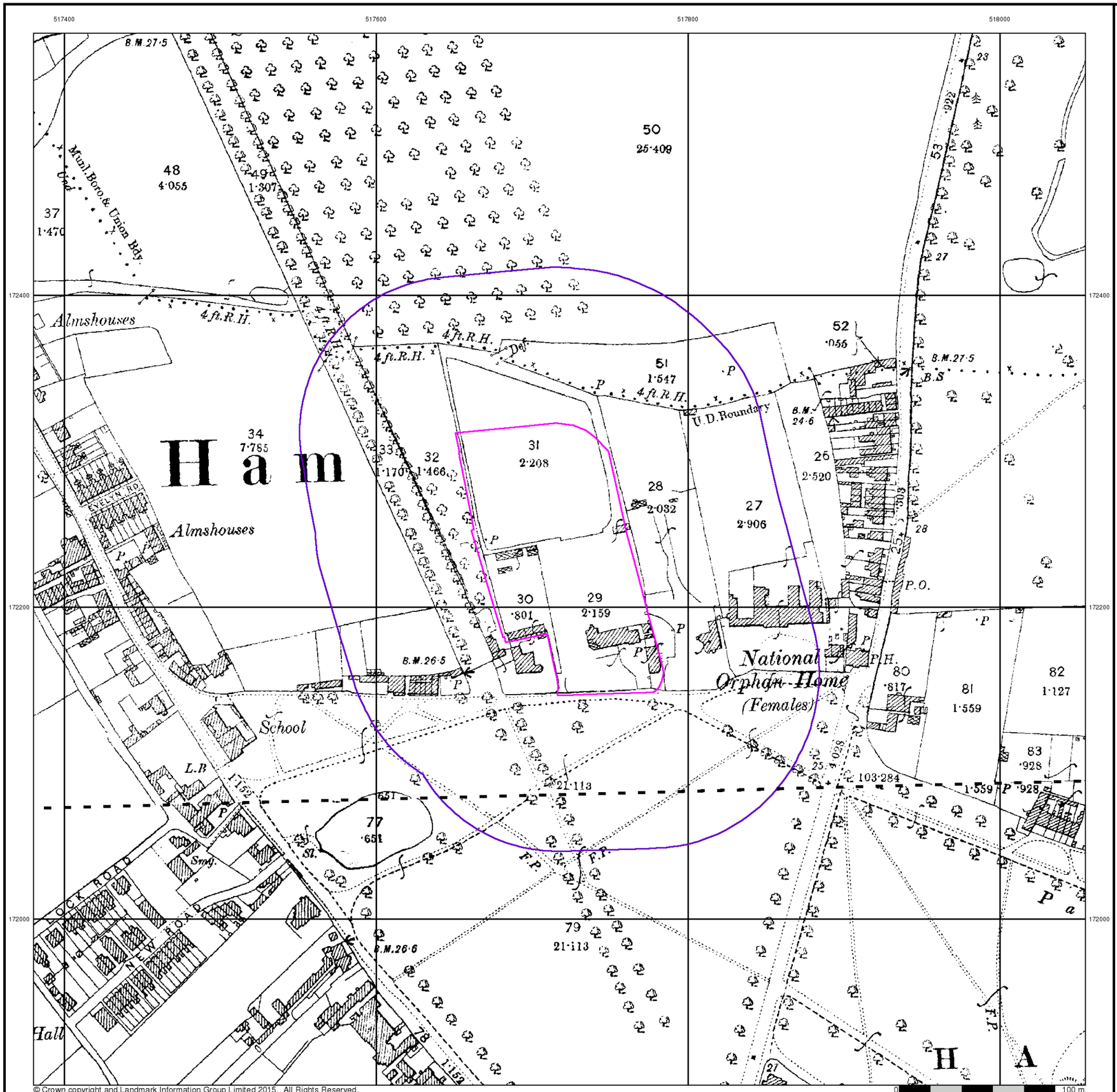

Southern Testing
Environmental & Geotechnical

London

Published 1896

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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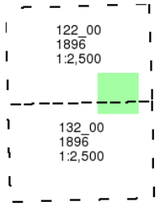
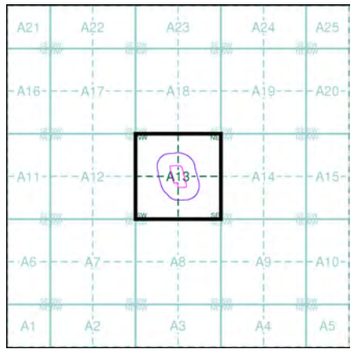


Historical Map - Segment A13



Order Details

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Site Details

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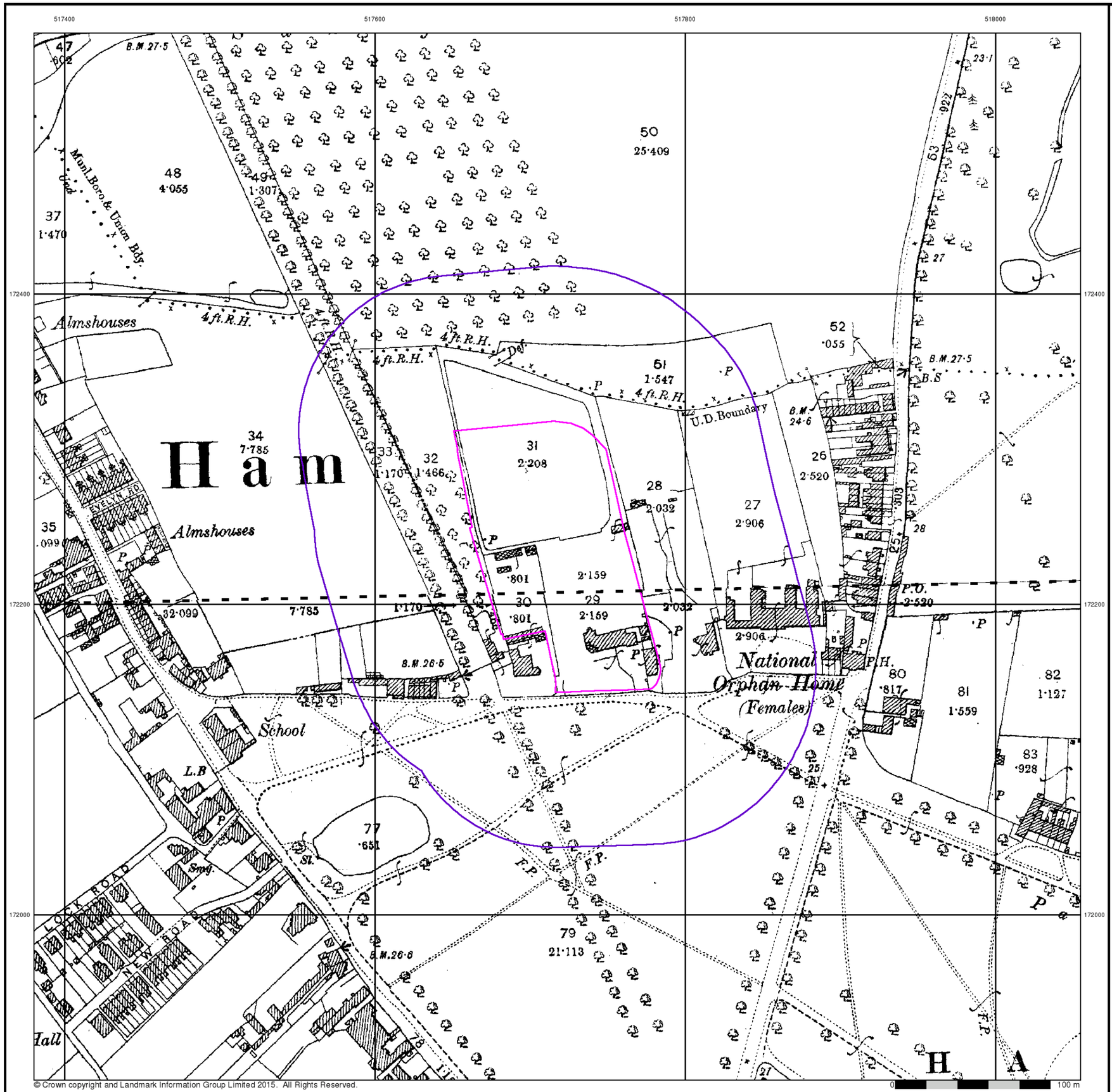

Southern Testing
Environmental & Geotechnical

Surrey

Published 1897

Source map scale - 1:2,500

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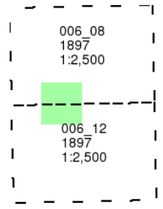
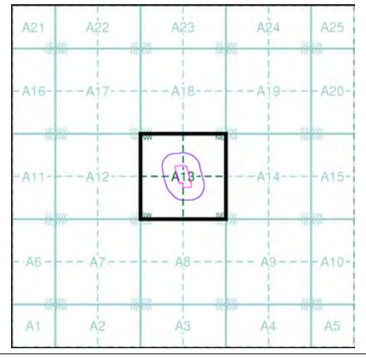


Historical Map - Segment A13



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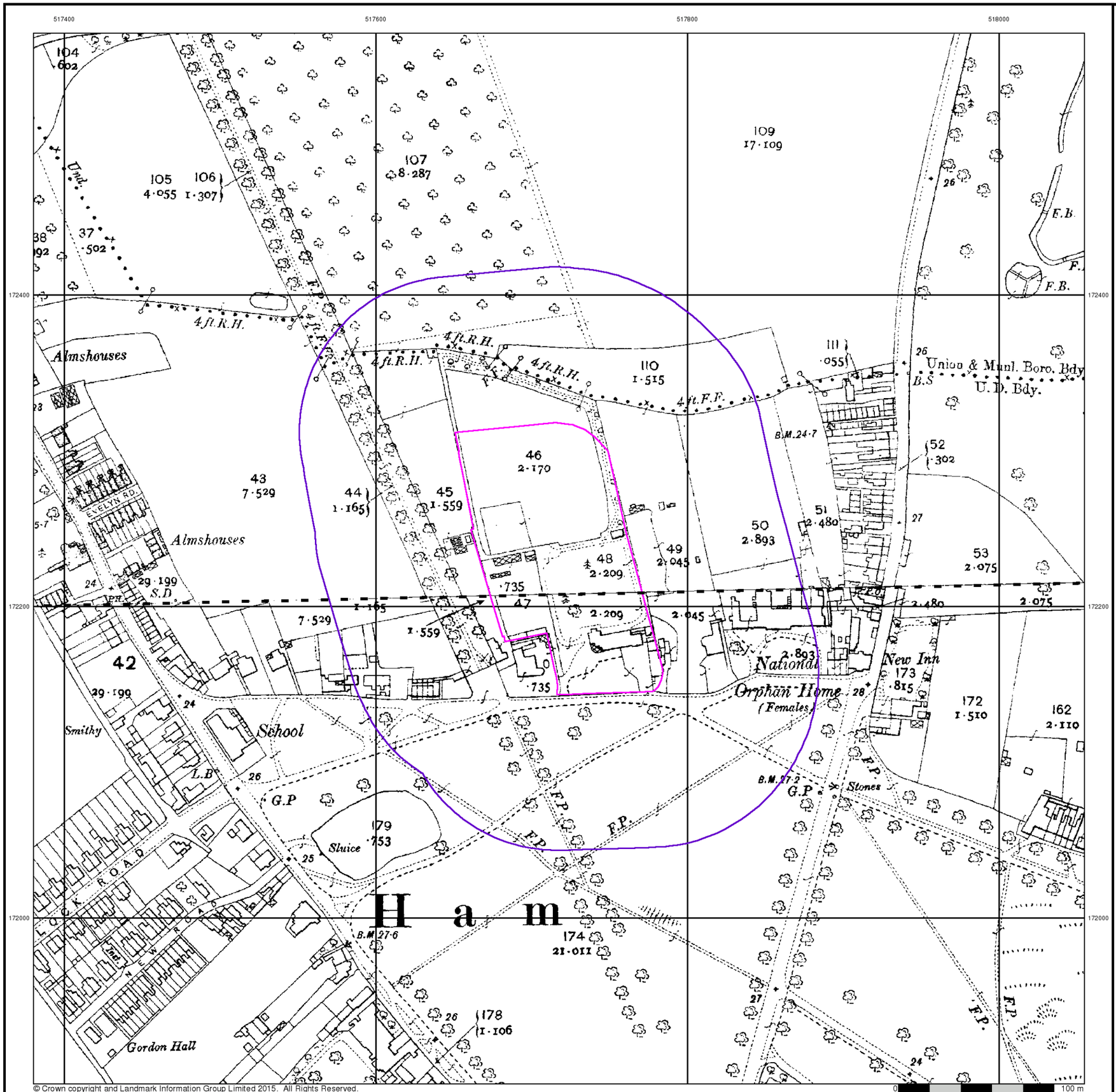

0 100 m

Southern Testing
Environmental & Geotechnical

Surrey

Published 1913

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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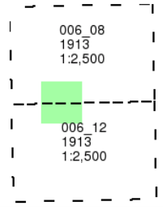
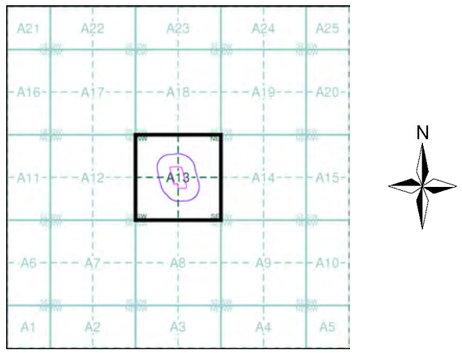


Historical Map - Segment A13



Order Details

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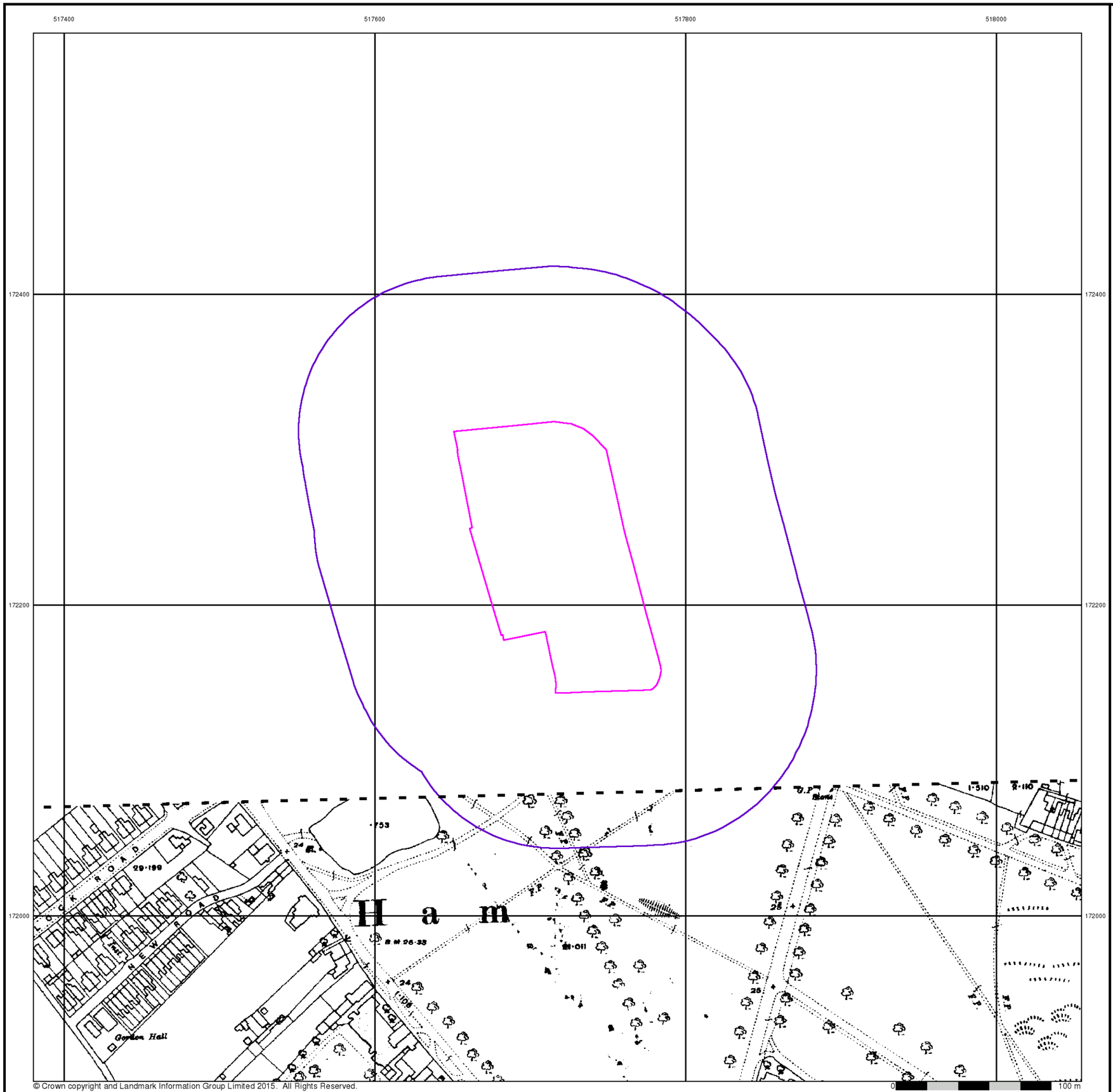

Southern Testing
Environmental & Geotechnical

Middlesex

Published 1914 - 1915

Source map scale - 1:2,500

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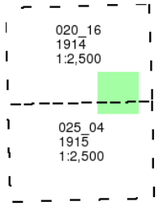
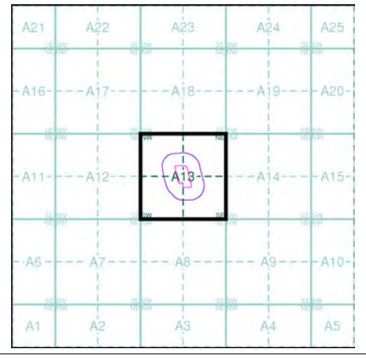


Historical Map - Segment A13



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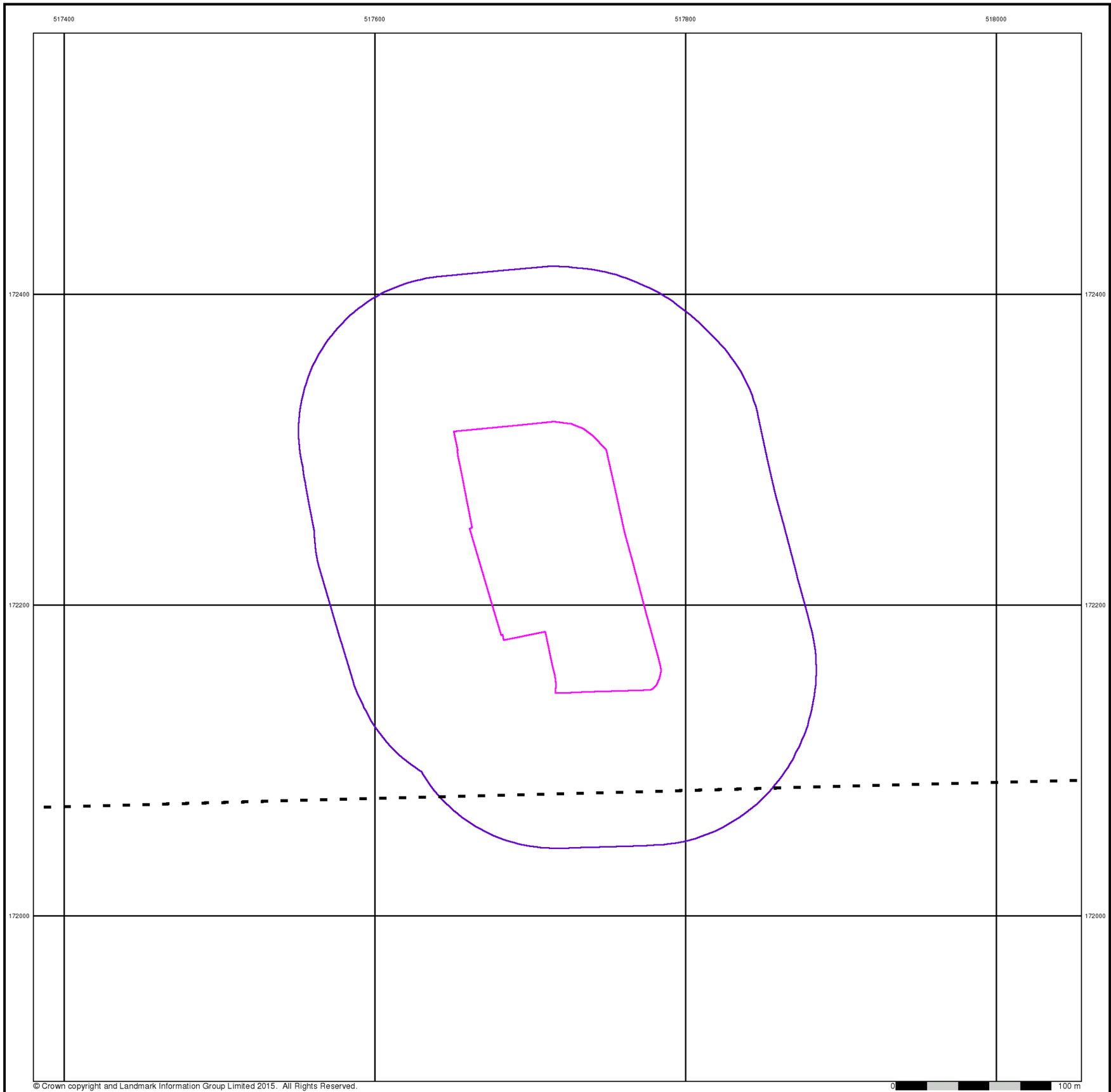

0 100 m

Southern Testing
Environmental & Geotechnical

Middlesex

Published 1934

Source map scale - 1:2,500

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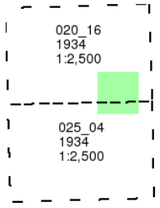
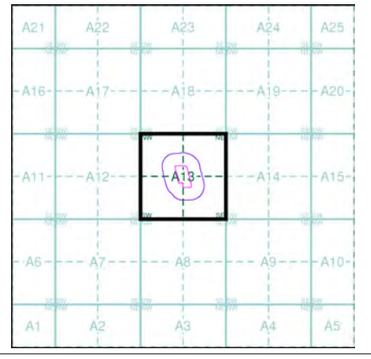


Historical Map - Segment A13



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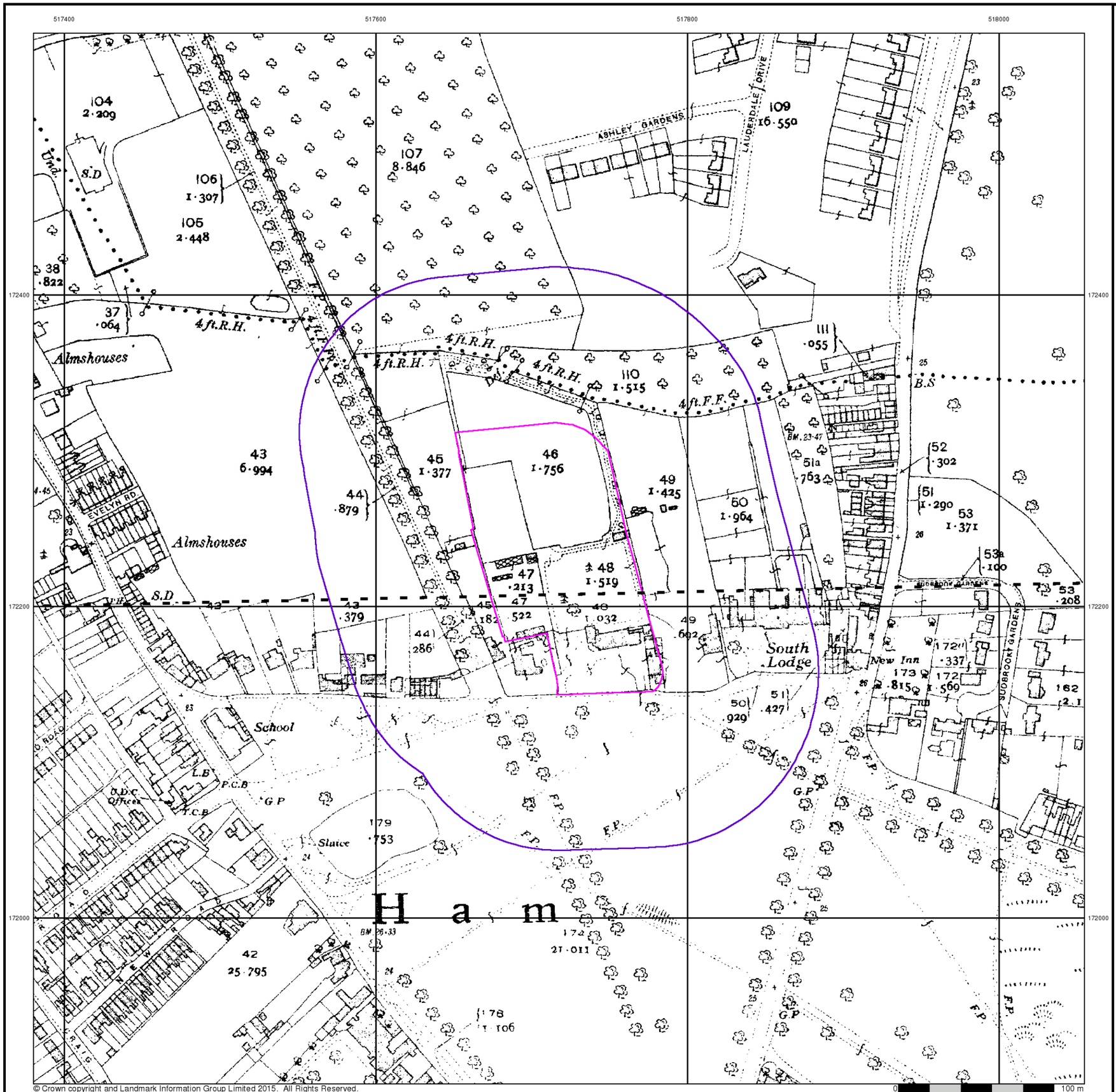

Southern Testing
Environmental & Geotechnical

Surrey

Published 1934 - 1935

Source map scale - 1:2,500

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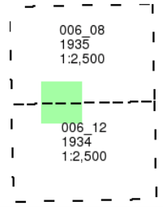
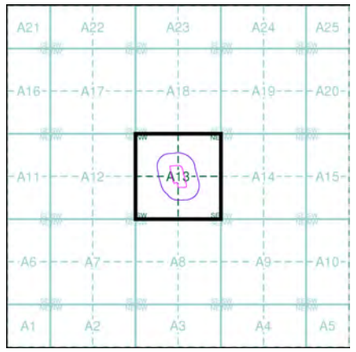


Historical Map - Segment A13



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