



Phase I & II Geo-Environmental Assessment

Land adjacent to 4 Swapcoat Lane

Long Sutton
Lincolnshire
PE12 9HD

Prepared for:

Mr. Robert Spenceley
D & R Property Services Ltd.
C/O 5 The Wentworths
Long Sutton
Lincolnshire
PE12 9RT

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LAND ADJACENT TO 4 SWAPCOAT LANE, LONG SUTTON

NON TECHNICAL SUMMARY

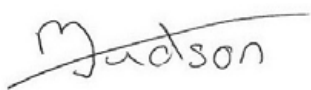
This report presents the findings of a combined Phase I Desk Study and Phase II Intrusive Investigation undertaken to determine ground conditions and establish if there are any environmental risks associated with the site and its development. Pertinent findings and conclusions may be summarised as follows:

- The site is currently undeveloped and has most recently been used as a motorcycle workshop, which subsequently burnt down. Development proposals include construction of three residential properties.
- The site does not lie in an area of high environmental sensitivity given the underlying clay geology and the absence of any nearby surface water features. However, potential risks have been identified associated with the quality and nature of shallow soils present across the site given the presence of fill material (made ground) and the site's former use.
- Site investigation work included the excavation of five boreholes across the area and ground conditions were found to comprise a layer of made ground with bricks, tarmac and factory clinker, overlying natural soils.
- Whilst no significant contamination likely to be associated with the former use of the site as a motorcycle workshop was identified, elevated concentrations of contaminants were identified associated with shallow made ground which would not be considered suitable for usage within domestic garden areas. On this basis, it is recommended that a cover system comprising **460mm** of clean imported topsoil is used within any proposed domestic garden or landscaped areas.
- It is recommended that a copy of this report be provided to the Environmental Health Department of South Holland District Council for inclusion in their land quality records and to support any future planning application.

The above points represent a simplified summary of the findings of this assessment and should not form the basis for key decisions for the proposed development. A thorough review of the details is contained within the following report, or alternatively get in touch and we'll talk you through it.



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Title:	Phase I & II Geo-Environmental Assessment Land adjacent to 4 Swapcoat Lane, Long Sutton	
Client:	D & R Property Services Ltd.	
Date:	7 th October 2015	
EPS Contact Details:	7B Caxton House Broad Street Cambourne Cambridge CB23 6JN	T: 01954 710666 F: 01954 710677 E: info@epstrategies.co.uk W: www.epstrategies.co.uk
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Author:	Reviewed:	Authorised:
		
Michael Judson	Rob Allen	Will Evans
Consultant	Principal Consultant	Director

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Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

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1 INTRODUCTION

In September 2015, Environmental Protection Strategies Ltd (EPS) was commissioned by D & R Property Services Ltd. to complete a Phase I and II Geo-Environmental Assessment at Land adjacent to 4 Swapcoat Lane, Long Sutton, Lincolnshire, PE12 9HD (the 'site'); see Figure 1.

The work was commissioned in order to fulfil planning requirements for the erection of three residential dwellings with associated parking and domestic garden areas.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study and subsequent Phase II Intrusive Investigation undertaken.

1.1 Background

A Desk Study comprises the first stage of any geo-environmental assessment, the purpose of which is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose an environmental or geological risk to site users, the surrounding environment or proposed development, either at present or in the future.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

Source	The location from which an environmentally hazardous / contaminative substance is, (or was,) derived.
Receptor	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.
Pathway	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health, resulting in the need for a Phase II investigation.

1.2 Objectives

The objectives of this investigation were as follows:

- To compile a Conceptual Site Model (CSM) and undertake a Preliminary Risk Assessment to evaluate the potential risks the site may pose to human and environmental receptors, both currently and in future.
- To investigate potential contaminant linkages identified through the CSM by means of investigating shallow soils.
- To determine the potential risks posed by the site and make recommendations for further work that may be required, to ensure suitability for use and safe development in accordance with the *Model Procedures for the Management of Land Contamination - Contaminated Land Report 11* and the *National Planning Policy Framework*.



1.3 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRA's 'Contaminated Land Statutory Guidance' (2012) and BS10175 (2011)—'Investigation of Potentially Contaminated Sites', the following tasks were undertaken:

Desk Study:

- Collection of site records.
- Study of existing geological, hydrogeological and historic maps of the area.
- Consultation of environmental databases.
- Review of proposed development plans.
- Development of conceptual model and preliminary risk assessment.

Intrusive Investigation:

- Site walkover, inspection of any visual evidence of contamination at the site, obtaining photographic records.
- Health and safety briefing / site supervision.
- Drilling of five boreholes to a maximum depth of 1.2m below ground level, using a hand-held pneumatic window sampler.
- Continual logging of ground conditions including inspection of samples for visual and olfactory contamination, and laboratory analysis of selected soil samples.

Reporting:

- Data collection and interpretation.
- Reporting.

The findings of these investigations and their conclusions are presented in the following sections.

1.4 Limitations and Constraints

The purpose of this report is to present the findings of a soil sampling investigation conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site. Where outlined in our report, we have examined the ground beneath a site by constructing a number of boreholes and / or trial pits to recover soil and / or groundwater samples. The locations of these excavations and sampling points are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the ground conditions encountered may differ to those encountered during the investigation.



No visible evidence of Japanese Knotweed was identified during the site walkover, however this plant can be difficult to identify in the early stages of growth and therefore it is not always possible to identify its presence at certain times of the year. For this reason EPS cannot confirm that Japanese Knotweed rhizomes do not exist and it is recommended that if it is suspected that this species, or other similarly invasive plants are present at the site, a specialist contractor should be commissioned to make a detailed assessment.

Whilst it is recognised that information contained within this report may assist relevant and suitably qualified professionals, this report does not provide a geotechnical appraisal of ground conditions with respect to suitability of foundations or future structures nor does it intend to identify a need for any associated geotechnical ground improvement works.

The investigation was carried out to assess the significance of contamination resulting from the use of the site as identified in this report. Unless EPS has otherwise indicated, no assessment of potential impact of any other previous uses has been made.

2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

2.1 Site & Location Description

Detail	Description
Location	The site is located to the west of Swapcoat Lane, in Long Sutton, Lincolnshire.
Grid Reference	NGR 542919, 323122
Topographic Elevation	The site has an approximate topographic elevation of 5m Above Ordnance Datum (AOD).
Topographic Gradient	Local topography falls moderately to the southwest.
Description of Site	A site walkover was undertaken on the 15th September 2015 and the site was noted to comprise an irregular shaped piece of unused land, with access obtained via Swapcoat Lane. The site is predominantly covered in hardstanding with some areas of open ground. Various debris including metal objects and plastic was also noted scattered around the site. The site is partially overgrown with vegetation comprising small-medium sized trees and bushes, as well as weeds and nettles scattered across the site and lining the site boundaries.
Surrounding Land Use	Immediate surrounding land use comprises a mixture of commercial and residential usage. Adjacent to the west lies Long Sutton County Primary School, whilst adjacent in all other directions are residential properties. Exchange garage lies approximately 80m to the east.

A plan showing the site location is provided as Figure 1, the current site layout is detailed on Figure 2 and an aerial photograph is included as Figure 3. Selected site photographs are included as Appendix A, an indicative proposed development plan as Appendix B and relevant extracts of a Landmark Envirocheck report are included as Appendix C.

2.2 Environmental Setting

Detail	Description
Geology	Geological maps of the area show that ground conditions comprise superficial Tidal Flat Deposits overlying bedrock geology of the Ampthill Clay Formation. Information on the site's geological context is included as Appendix D.

Detail	Description																
British Geological Survey (BGS)	An historic borehole log was acquired from the British Geological Survey (BGS) for a location approximately 1km west of the site and reports a thin layer of topsoil overlying brown sandy clay and then greyish-brown becoming grey silty clay to a depth of 4.50m bgl. Grey silty fine-medium sand is present below this to the base of the borehole at 5.50m bgl. Groundwater was measured at a rest level of 0.70m bgl. A copy of the historic borehole log is included within Appendix D.																
Geological Hazards	<table> <tr> <th>Hazard</th><th>On Site Risk</th></tr> <tr> <td>Mining</td><td>Might not be affected / No Hazard</td></tr> <tr> <td>Collapsible Ground</td><td>No Hazard</td></tr> <tr> <td>Compressible Ground</td><td>Moderate</td></tr> <tr> <td>Ground Dissolution</td><td>No Hazard</td></tr> <tr> <td>Running Sand</td><td>Moderate</td></tr> <tr> <td>Landslide</td><td>Very low</td></tr> <tr> <td>Shrinking / Swelling Clay</td><td>Low</td></tr> </table>	Hazard	On Site Risk	Mining	Might not be affected / No Hazard	Collapsible Ground	No Hazard	Compressible Ground	Moderate	Ground Dissolution	No Hazard	Running Sand	Moderate	Landslide	Very low	Shrinking / Swelling Clay	Low
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Radon	The BGS and Health Protection Agency (HPA) report entitled ' <i>Indicative Atlas of Radon in England and Wales</i> ' (November 2007) shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. The joint Building Research Establishment Ltd (BRE) report entitled: ' <i>Radon: Guidance on Protective Measures for New Buildings - 2007</i> ' reports that the site does not lie within an area where basic radon protection methods will need to be employed.																
Hydrogeology	Groundwater vulnerability maps for the area indicate that both the superficial deposits and underlying bedrock are classified as unproductive strata. The site does not lie within a Source Protection Zone (SPZ) for nearby groundwater abstraction. Groundwater vulnerability maps are included as Appendix E.																
Hydrology	The nearest surface water feature lies roughly 195m northeast and appears to comprise a small unnamed drain or pond. A number of other small drains / streams are located in the surrounding area. Review of the Environment Agency (EA) flood zone map for the area indicates that the site lies within Flood Zone 3, which is defined as having a high risk of flooding from rivers or the sea. It is likely under these circumstances that the EA will require a Flood Risk Assessment for the site, unless one has already been undertaken. One water abstraction is located approximately 965m to the east. Operated by C R Hovell, water is abstracted for spray irrigation at a rate of 22730m³/year from a catchpit, catchment tank or collecting tank. Three discharge consents are recorded within 500m, the closest of which lies approximately 260m south and pertains to the release of an unknown material onto land between November 1975 and August 1997. It was operated by the Long Sutton Royal British Legion Club.																

Detail	Description		
Landfill & Waste	The EA public database does not list any active or historic landfill sites within 1km. A registered waste treatment or disposal site is located 20m southeast of the site. Owned by C J Bradford, the site is categorised as a scrapyard and has been in use since March 1993. Authorised waste includes motorcycles, bodies and parts.		
Licensed Industrial Activity	No industrial sites licensed by the EA are reported in the surrounding area. Three sites licensed by the local authority are reported within 1km of the site. These include petrol filling stations around 380m south and 850m southeast and a facility for packing and the use of cement around 810m southeast.		
Industrial Land Use	The Envirocheck report lists a number of industrial land uses in the area, which are summarised below.		
	Land Use	Distance & Direction	Status
	Garage Services	81m E	Active
	Boilers – Servicing, Replacements and Repairs	82m SW	Active
	Electrical Engineers	164m NW	Active
	Freight Forwarders	278m S	Active
	Petrol Filling Station	293m S	Active
	Road Haulage Services	380m SW	Active
	Garage Services	419m NW	Inactive
	Car Body Repairs	450m SW	Inactive
Pollution Incidents	The Envirocheck report lists five pollution incidents within 1km, two of which are classified as category 2 (significant) incidents. The nearest of these is located approximately 574m southeast and pertains to the release of an unknown pollutant to a local dyke in August 1993.		
Sensitive Land Use	A local nature reserve lies approximately 269m to the west.		

2.3 Site History

A summary of historical map data from 1888 to 2015 is provided below and copies of relevant historic maps and any others examined during the investigation are included in this report as Appendix F.

- In 1888, the site appears to have two buildings / structures present on site. A small structure can be seen along the western boundary, whilst a larger building lies to the south-centre. By 1904, the larger building has been removed.
- Mapping from 1931 now shows a large building covering most of the western half of the site. By 1972, this building is labelled as a 'store'. Information provided by the client indicates that the site's most recent usage was as a motorcycle workshop which subsequently burnt down.



- With regard to the surrounding area, in 1888, a railway line and associated station lie 200m to the southwest.
- Mapping depicting 1972 shows the most development of the surrounding area. By this point, a works is located 50m east, a store 50m west, a garage 50m northeast, a coal yard and depot 150m southwest, a garage and works 175m northwest and a warehouse 175m northeast. Also by this time, the railway line has been demolished.
- An electricity sub-station can be seen 150m north from the mapping showing 1979-83.
- By 1989-91, Long Sutton County Primary School lies adjacent to the west.

3 CONCEPTUAL MODEL & PRELIMINARY RISK ASSESSMENT

The following section provides a review of the contaminant linkages that may be active at the site through examination of the potential sources that may be present as a result of historic and / or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

3.1 Source Characterisation

The following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current and Historic Site Use	In-fill material of unknown origin (Made Ground) used to level areas beneath existing / historic buildings and hardstanding.	PAH, Metals, ACM
	Historic use of the site as a motorcycle workshop	Metals, PAH, TPH (including BTEX)
	Burnt ground associated with the historic fire to the motorcycle workshop	PAH
Current and Historic Surrounding Land-Use	Current / historic industrial land use of the surrounding area including nearby garages and works.	TPH, VOC, SVOC PAH, Metals
	Electricity Sub-Station located 150m north	TPH (including PAH) PCB

Notes:

PAH	Polycyclic Aromatic Hydrocarbons	ACM	Asbestos Containing Material
TPH	Total Petroleum Hydrocarbons	BTEX	Benzene, Toluene, Ethylbenzene & Xylenes
VOC	Volatile Organic Compounds	SVOC	Semi Volatile Organic Compounds
PCB	Polychlorinated Biphenols		

3.2 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report '*Using Science to Create A Better Place: Updated Technical Background to the CLEA Model – Science Report SC050021/SR3*'. This guidance document defines a series of standard land-uses, which form a basis for the development of a Conceptual Site Model.

The proposed development plan includes the erection of three residential properties. Therefore the land use has been considered as:

- Residential

In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for any contaminant impact are discussed in the table on the following page.

Receptor	Site Specific Description
Human	Future site users, site workers involved in the site redevelopment, and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
Groundwater	The site is reported to be underlain by Tidal Flat Deposits and Ampthill Clay Formation, which are classified by the EA as unproductive strata; and the site does not lie within a SPZ for nearby groundwater abstraction. Therefore groundwater is not considered as a potential receptor to site derived contaminants.
Surface Water Bodies	The nearest surface water feature lies around 195m to the northeast. Given the likely limited permeability of the underlying geology, a means by which contaminants of concern could reach nearby surface waters is not considered plausible. As such, surface water has not been considered as a sensitive receptor to site derived contaminants.
Flora and Fauna	The proposed development plan includes the provision of domestic garden areas. Some of the identified contaminants of concern are known to be phytotoxic and as such the potential for this impact should be considered.
Buildings & Infrastructure	Subsurface structures are likely to be present at the site that may be adversely affected by the potential presence of the identified contaminants of concern. These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	Adjacent properties including private residential dwellings are considered to be a sensitive receptor to site derived contaminants.

3.3 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with contaminated soil
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outside
- Inhalation of vapours inside

Clearly, not all of these potential pathways apply for every standard land-use; the simplest example for exclusions being a commercial / industrial site which is covered by concrete hard standing. The concrete precludes the direct exposure of humans working at the site to any contaminated soils.

However in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the following:

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

3.4 Summary of Contaminant Linkages

Considering the site use and environmental setting, and the proposed land use; the plausible contaminant linkages that require further investigation are summarised in the following table:

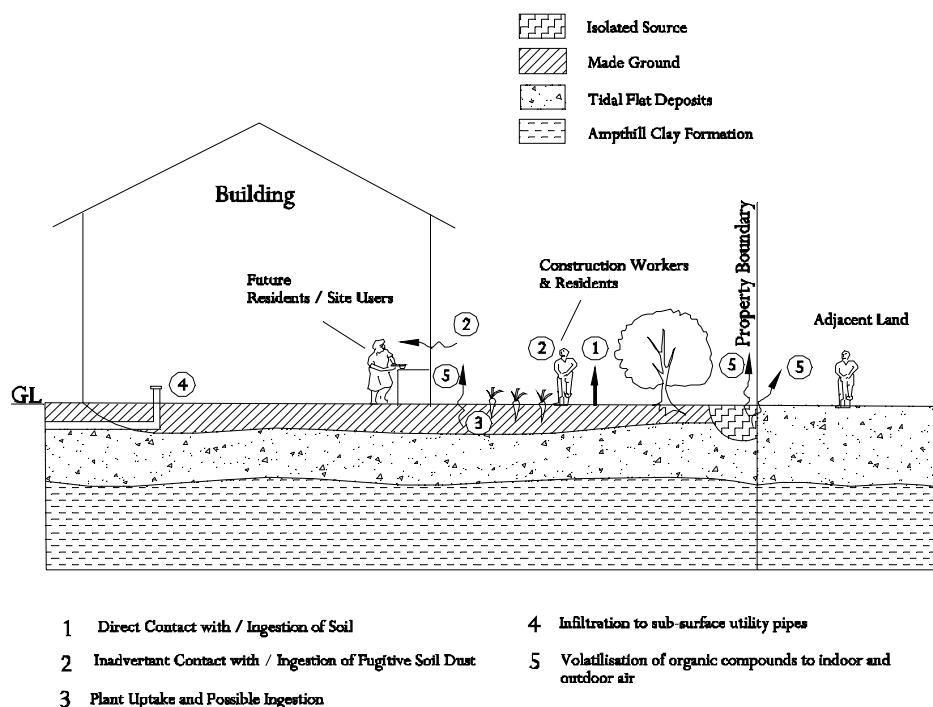
Source	Pathway	Receptor
Contaminated soil	Direct contact and inadvertent ingestion by eating or smoking with dirty hands.	Construction workers during redevelopment & site users
Contaminated soil	Inhalation of fugitive dusts.	Site users
Contaminated soil	Direct uptake and / or adherence of contaminated soil to vegetation and subsequent ingestion.	Site users
Contaminated soil	Ingress / diffusion through permeable potable water supply pipes.	Site users
Contaminated soil	Direct uptake via root systems.	Plants
Contaminated soil	Volatilisation of organic compounds.	Site users
Contaminated soil	Off-site migration and volatilisation of organic compounds.	Adjacent site users

The following comments are made with respect to contaminant linkages which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- Whilst the majority of relatively modern electrical transformers do not contain insulation oils containing PCBs, the electricity sub-station identified nearby to the site does represent a potential off-site source that could contain PCBs. However, given the distance of this sub-station and limited mobility of PCBs in the environment, this source is not considered to pose a significant risk to the proposed development.
- Controlled waters have not been identified as a potential receptor within section 3.2 and therefore a plausible contaminant linkage has not been identified associated with impact to surface water or groundwater from site derived contaminants of concern.
- Whilst a number of current and historic commercial sites are reported in the surrounding area, given the distance of these sites and the limited permeability of the underlying geology a contaminant linkage has not been identified associated with on-site migration of contaminants in shallow soils.

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which may need further investigation or control to ensure safe development:

Land adjacent to 4 Swapcoat Lane, Long Sutton – Illustrative Conceptual Site Model



4 SUMMARY OF INTRUSIVE INVESTIGATIONS

Intrusive ground investigations were undertaken on the 15th September 2015 in accordance with EPS standard operating procedures, copies of which will be made available on request. A summary of all site activities is presented in the following sections:

4.1 Borehole Locations

Borehole locations were selected through consideration of the potential contaminant linkages identified in Section 3.4 above, the proposed development plan and operational health and safety requirements.

Five boreholes (HA1-HA5) were undertaken at the site to a maximum depth of 1.2m bgl using a hand-held pneumatic window sampler.

The rationale for the selection of all borehole locations is detailed within the table below:

Location	Rationale
HA1-HA5	To provide information on the quality and nature of shallow soils.

All boreholes were drilled in accordance with standard EPS drilling methodologies. A detailed site layout plan showing the location of the boreholes completed during the investigation is presented as Figure 4.

4.2 Soil Sampling

Each borehole was logged for ground conditions encountered and inspected for any physical evidence of contamination such as soil staining, odour and the presence of separate phase liquids.

Shallow soil samples were obtained from each location and submitted for laboratory analysis to assess the nature and quality of underlying soils.

Where potentially volatile organic compounds are suspected, EPS carries a Photoionisation Detector (PID), which can be used to measure the relative concentrations of vapour associated with soil samples collected from different depths and locations at the site. In this case, no palpable evidence of volatile organic compounds was encountered therefore the PID was not used.

4.3 Laboratory Testing

Samples obtained for analysis of identified contaminants of concern were submitted to Jones Environmental Forensics Ltd of Deeside, who hold appropriate UKAS / MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered to the laboratory by approved courier.

A laboratory testing schedule is included as Table 1.

5 FINDINGS OF THE INVESTIGATION

This section of the report provides a summary of the findings of the intrusive investigation.

5.1 Ground Conditions

Ground conditions were consistent across the site and comprised layers of made / reworked ground, predominantly a brown loose clayey sandy material with occasional brick fragments, factory clinker, tarmac and stones. This layer extended to between 0.5 and 0.7m bgl.

Beneath this material a brown / orangey brown silty sandy clay was reported to the base of all the boreholes at a maximum depth of 1.2m bgl.

5.2 Groundwater

No groundwater was encountered at any borehole location.

5.3 Physical Evidence of Contamination

Aside from the made / reworked ground materials described above, no physical evidence of contamination, waste or putrefiable material was encountered at any of the sampling locations during the investigation.

5.4 Laboratory Analysis

A laboratory analysis testing schedule is presented as Table 1 and all environmental sample results obtained from the laboratory are included as Appendix G. The key results of laboratory testing on environmental soil samples are summarised in the following table:

Contaminant	No. of Samples	No of Detections	Range of Detections (mg/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	5	5	8.5	33.5	HA1 0.1-0.4
Cadmium	5	-	-	-	n/a
Chromium	5	5	31.1	40.5	HA3 0.3-0.6
Copper	5	5	13	208	HA1 0.1-0.4
Mercury	5	4	0.4	0.6	HA1 0.1-0.4
Nickel	5	5	16.3	25.1	HA4 0.2-0.5
Lead	5	5	18	994	HA1 0.1-0.4
Selenium	5	-	-	-	n/a
Zinc	5	5	65	357	HA2 0.1-0.4
PAH (Total of 16)	5	3	6.3	80.3	HA1 0.1-0.4
Benzo(a)pyrene	5	3	0.59	6.48	HA1 0.1-0.4
TPH	5	3	144	1346	HA4 0.2-0.5
MTBE	5	-	-	-	n/a
Benzene	5	-	-	-	n/a
Toluene	5	-	-	-	n/a
Ethylbenzene	5	1	-	0.085	HA5 0.3-0.7
m-p/Xylene	5	1	-	0.33	HA5 0.3-0.7
o-Xylene	5	-	-	-	-

Notes: - Contaminant not found above laboratory detection limits
 TPH Total Petroleum Hydrocarbons
 MTBE Methyl Tert-Butyl Ether
 PAH Polycyclic Aromatic Hydrocarbons

6 GENERIC QUANTITATIVE RISK ASSESSMENT

The following section summarises the method used to assess the risks posed to human health and identifies any sample results found by this investigation which warrant further consideration.

6.1 Generic Screening – Soils

In order to screen laboratory data for concentrations of contaminants in soil with potential to cause harm to human health in a residential setting, relevant generic screening values for contaminants in soil have been used. The technical framework used to derive the assessment criteria and the documents in which they are published are summarised as follows:

- *EA Science Reports* (SC050021/SR2, SC050021/SR3, and SC050021/SR7)
- *EA Soil Guideline Value Science Reports*
- *Suitable For Use Levels ('S4ULs') for Human Health Risk Assessment* – LQM and CIEH (2015)
- *Soil Generic Assessment Criteria for Human Health Risk Assessment* - EIC/AGS/CL:AIRE (2010)

Category 4 Screening Levels (C4SLs) released in December 2013 by The Department for the Environment, Food and Rural Affairs (DEFRA), (*Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010*) provide generic suitable for use screening values for concentrations of Benzo(a)Pyrene (BaP) and Lead for a variety of land uses.

For concentrations of Lead and BaP in soil, EPS has used DEFRA's C4SL as an appropriate guide for professional judgement with respect to reasonable 'low risk' levels in the context of this site and its suitability for use.

A summary of the screening criteria and the methodology used to derive them is included in Appendix H.

6.2 Assessment of Soil Results

The results of the screening process for on-site human receptors show that generic screening values representative of low risk values for the protection of human health have been exceeded for Lead, aromatic hydrocarbon compounds and a number of PAHs. It has been considered reasonable to utilise recorded concentrations of Benzo[a]pyrene as a risk driver representative of genotoxic PAHs to further assess the data.

To further assess the minimal risk exceedance for lead and Benzo[a]pyrene, comparison has been made to the relevant C4SL representative of low risk in a residential setting. Exceedances of these criteria are summarised in the table below.

Contaminant	C4SL (mg/kg) Residential	No. of Exceedances	Highest Exceedance (mg/kg) & Sampling Location
Lead	200	3	994 (HA1 0.1-0.4)
Benzo(a)pyrene	5	1	6.48 (HA1 0.1-0.4)

Given that no C4SLs are currently available for comparison against concentrations of petroleum hydrocarbons in soil, S4ULs have been selected as the most appropriate screening criteria. Exceedances of these criteria are summarised in the table below:

Contaminant	S4UL (mg/kg) Residential	No. of Exceedances	Highest Exceedance (mg/kg) & Sampling Location
Aromatic C16-C21	260	1	442 (HA4 0.2-0.5)

6.2.1 Statistical Analysis

In order to further assess the potential risks posed to site residents by the above contaminants in soil, several statistical analyses were carried out on the soil concentration datasets.

Initially, an outlier test was carried out and was found to identify outliers for TPH. However due to the relatively homogenous nature of shallow made ground materials, the historic / recent site use and the proposed domestic garden areas, these outliers could not be identified as a secondary population, and as such all data has been included in the statistical analysis.

An upper 95th percentile confidence limit on the true mean (U95) was also calculated for each dataset so that a better comparison for lifetime exposure to future site users can be made for the site. This was carried out in line with recent guidance from CIEH and CL:AIRE entitled 'Guidance on Comparing Soil Contamination Data with a Critical Concentration' and the results are included in the following table.

Contaminant	Generic Screening Criteria (mg/kg)	U95 th Value
Lead	200	805.20
Benzo(a)pyrene	5	5.08
Aromatic C16-C21	260	302.36

The summary of the calculations for statistical testing referred to in this subsection are provided as Appendix I of this report, with detailed information regarding the calculations undertaken available on request.



7 CONCLUSIONS

Through consideration of the site's history and environmental setting, the Phase I Desk Study has identified a number of plausible contaminant linkages that could become active at this site through the proposed redevelopment.

These contaminant linkages primarily comprise human health risks associated with exposure of site workers and future users to potentially contaminated shallow soils, particularly within proposed domestic garden areas. Risks associated with the volatilisation of organic compounds to indoor and outdoor air were also identified.

No volatile contaminants have been identified, and on this basis no significant risks have been identified to future or adjacent site users from volatilisation of contaminants to indoor or outdoor air. However, laboratory analysis of shallow soils (made ground) sampled from across the site has identified concentrations of lead, Benzo[a]pyrene and selected petroleum hydrocarbons to be present which exceeded relevant screening criteria for residential land use. Further statistical analysis was carried out which demonstrated that the calculated U95 value for all of these contaminants also exceeded the relevant screening criteria.

On this basis, the made ground currently in place across the site is not considered suitable for use where it coincides with proposed domestic garden areas. Consideration of control measures through which any such risk could be appropriately mitigated are therefore required. One such control measure which is considered appropriate is the installation of a cover system following guidance presented in the BRE publication: *Cover Systems for Land Regeneration: Thickness Design of Cover Systems for Contaminated Land* (BRE, Mar 2004), for which recommendations have been made in Section 8, below.

Potential short term risks associated with exposure of soils to construction workers involved with redevelopment work at the site may most appropriately be controlled through standard health and safety precautions; these are also detailed in Section 8.

In accordance with the *Model Procedures for Management of Land Contamination (Contaminated Land Report 11)*, the risks identified by this work will require further assessment unless control measures are implemented. Recommended control measures are outlined in Section 8, below, and a summary of the approach outlined in CLR11, marking the work already completed under the risk assessment phase, is presented as a flow diagram in Figure 5 of this report.

8 RECOMMENDATIONS

The following recommendations are made with respect to further environmental assessment and proposed control measures which should be implemented prior to or during the forthcoming site redevelopment works.

- a) It is recommended that a minimum of **460mm** of certified clean cover material is placed across the proposed domestic gardens and landscaped areas at the site, (it is recognised that some material may have to be removed to achieve this thickness). The cover system calculations on which this minimum thickness is based are included as Appendix J. It should be noted that this recommendation is made only for domestic garden areas, and there is no such requirement for areas beneath any hard standing or building footprint.

All imported topsoil / subsoil for use within areas of gardens or soft landscaping should be accompanied by appropriate laboratory analysis to demonstrate its suitability for use. Accompanying analysis should include TPH, PAH and metals. It is also recommended that once the proposed cover system is in place, verification of the site is undertaken to confirm that the thickness of cover material has been correctly installed. EPS can undertake the necessary verification works if required, a proposal for these works will be provided upon request.

- b) All construction workers operating at the site should be advised of the potential for exposure to and contact with made ground in the subsurface. Appropriate health and safety precautions should also be adopted during any excavation works to avoid exposure to soils. Reference should be made to the following HSE document: *Protection of Workers and the General Public during Development of Contaminated Land*.
- c) Should any palpable evidence of unexpected contamination be encountered during the redevelopment work, it should be reported to EPS so that an inspection can be made and appropriate sampling and assessment work carried out. A method statement for encountering any unexpected contamination is included as Appendix K of this report.
- d) If any visible evidence of asbestos is encountered during redevelopment works, a specialist contractor will need to be commissioned to safely remove this material.
- e) Given the thickness of made ground identified at the site it is possible that any new water supply pipe work will be laid within natural soils. If this is not the case, supply pipe work should be installed in accordance with the requirements of UK Water Industry Research Report 10/WM/03/21 – ‘Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites’ (2010).

It is recommended that a copy of this report be provided to the Environmental Health Department of South Holland District Council for inclusion in their land quality records.

FIGURES



Approximate Site Location

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Title: Site Location Plan

Project: Land Adjacent to No.4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd

Fig No: 1

Scale: As Shown

Drawn By: MJ **Approved By:** WE

Job No: UK15.2001

Dwg No: D&R/Long Sutton/1015/01

Date: October 2015



— Approximate Site Boundary

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Title: Site Layout Plan

Project: Land Adjacent to No.4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd

Figure: 2

Scale: NTS

Drawn By: MJ | Approved By: WE

Job No: UK15.2001

Dwg No: D&R/LongSutton/1015/02

Date: October 2015



— Approximate Site Boundary

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Title: Aerial Photograph

Project: Land Adjacent to No.4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd

Fig No: 3

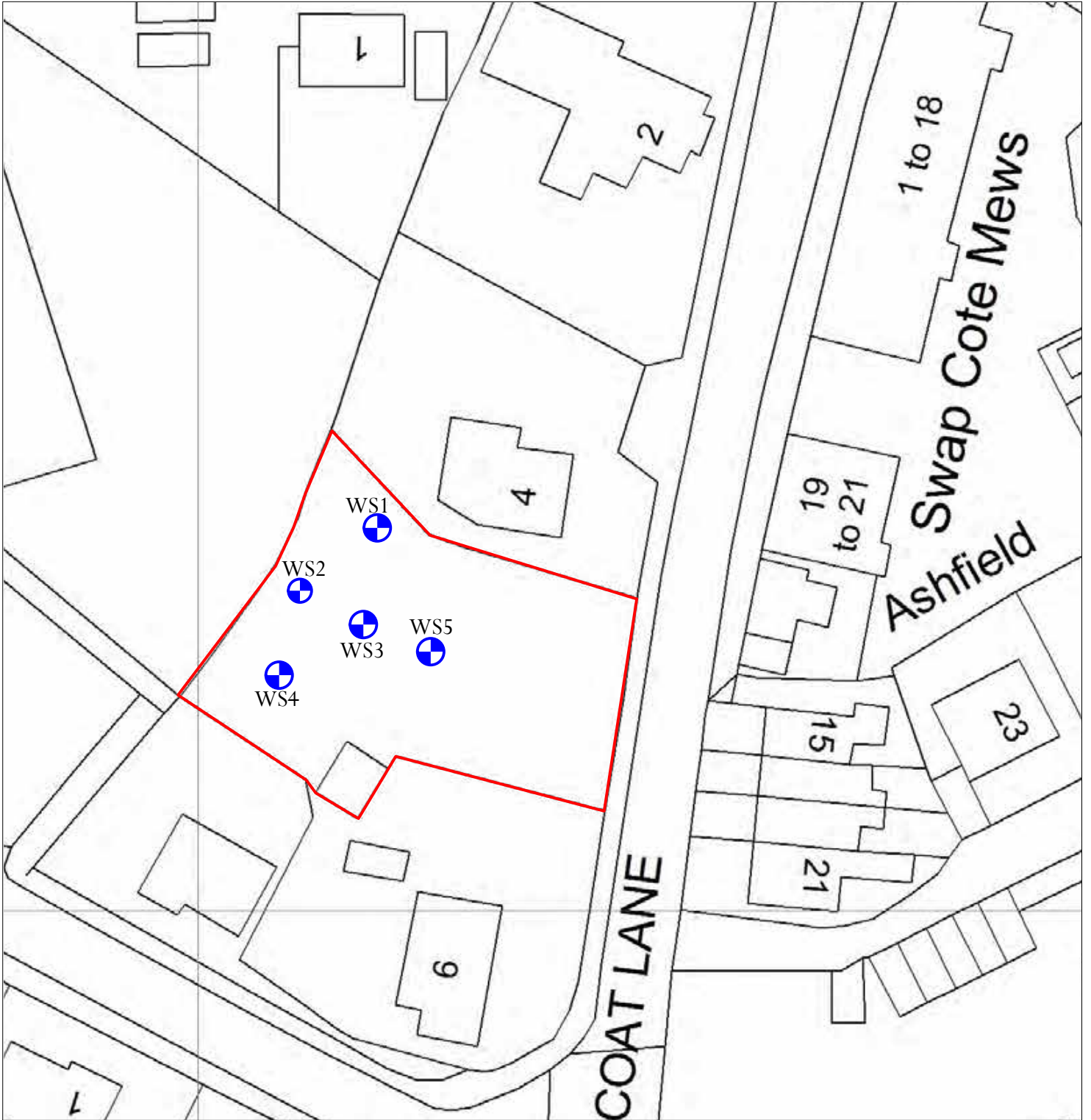
Scale: As Shown

Drawn By: MJ **Approved By:** WE

Job No: UK15.2001

Dwg No: D&R/Long Sutton/1015/03

Date: October 2015



Key:



Approx EPS Borehole Location



Approx Site Boundary

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Title: Borehole Location Plan

Project: Land Adjacent to No.4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd

Fig No: 4

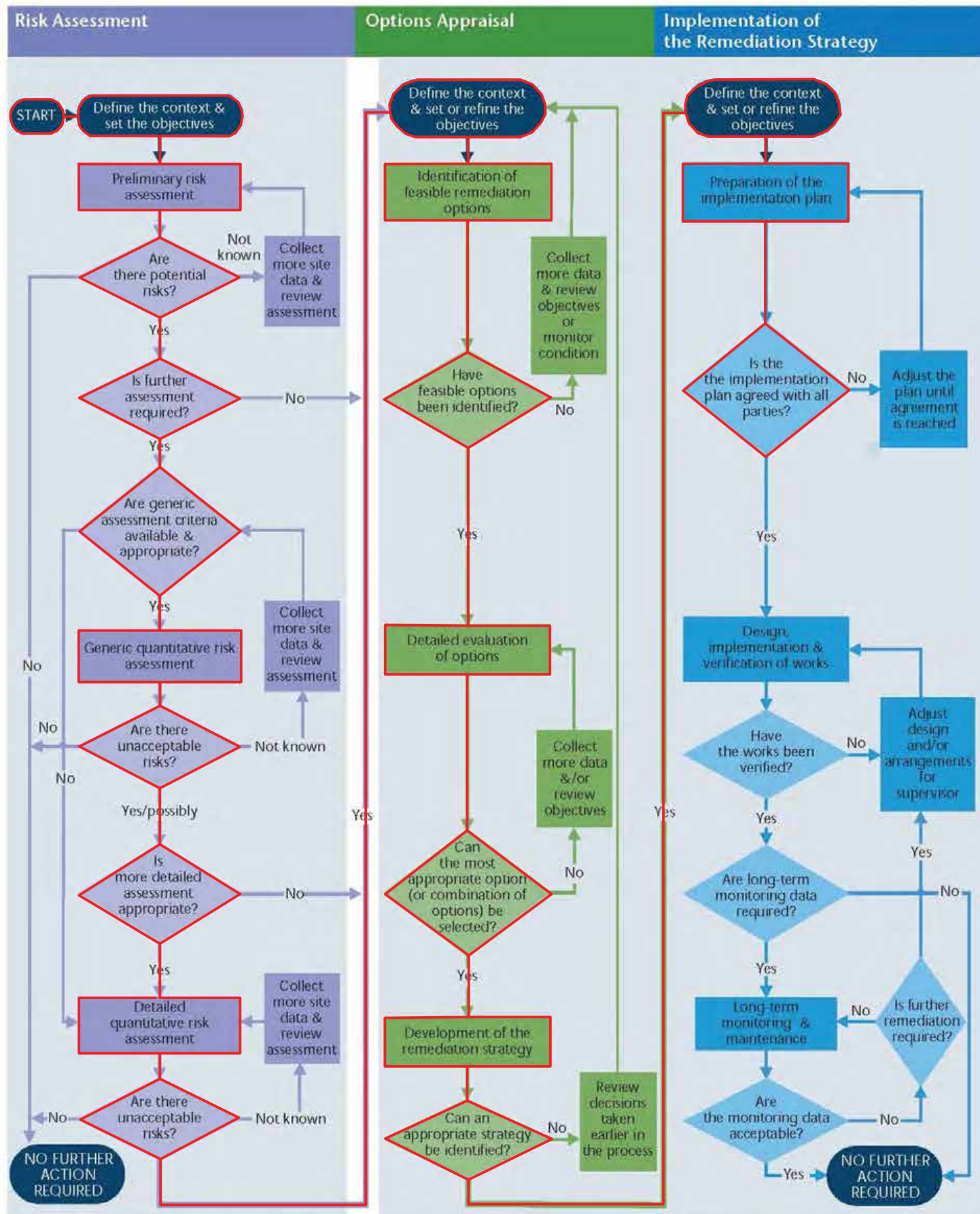
Scale: As Shown

Drawn By: MJ **Approved By:** WE

Job No: UK15.2001

Dwg No: D&R/LongSutton/1015/04

Date: October 2015



Assessment Pathway for Site



Title: Site Context - CLR11

Project: 4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd.

Fig No: 5

Scale: n/a

Drawn By: MJ

Approved By: WE

Job No: UK15.2001

Dwg No: D&R/LongSutton/1015/05

Revision Date: October 2015

TABLES

Table 1 – Laboratory Testing Schedule

Sample ID	Sample Depth (m bgl)	EPS Mini Suite	EPS TPH Suite
HA1	0.1-0.4	1	1
HA2	0.1-0.4	1	1
HA3	0.3-0.6	1	1
HA3	0.2-0.5	1	1
HA5	0.3-0.7	1	1

Notes:
mbgl meters below ground level
1 Sample Taken
- Sample Not Analysed
EPS Mini Suite Organic Matter, Cyanide, Metals, PAH's, Phenols, Asbestos
EPS TPH Suite Total Petroluem Hydrocarbons, MTBE, BTEX



APPENDICES



APPENDIX A

Selected Site Photographs



Key:

- ① Approximate Photo Location
- Approximate Site Boundary

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Title: Photo Location Plan

Project: Land Adjacent to No.4 Swapcoat Lane, Long Sutton

Client: D & R Property Services Ltd

Appendix: A

Scale: As Shown

Drawn By: MJ | **Approved By:** WE

Job No: UK15.2001

Dwg No: D&R/LongSutton/1015/A

Date: October 2015

Photo 1: View of the rear of the site, looking west.	Photo 2: View of the centre of the site, looking east.
	
Photo 3: View looking east towards the entrance, from the centre of the site.	Photo 4: Example of drilled borehole (circular hole towards bottom left).
	

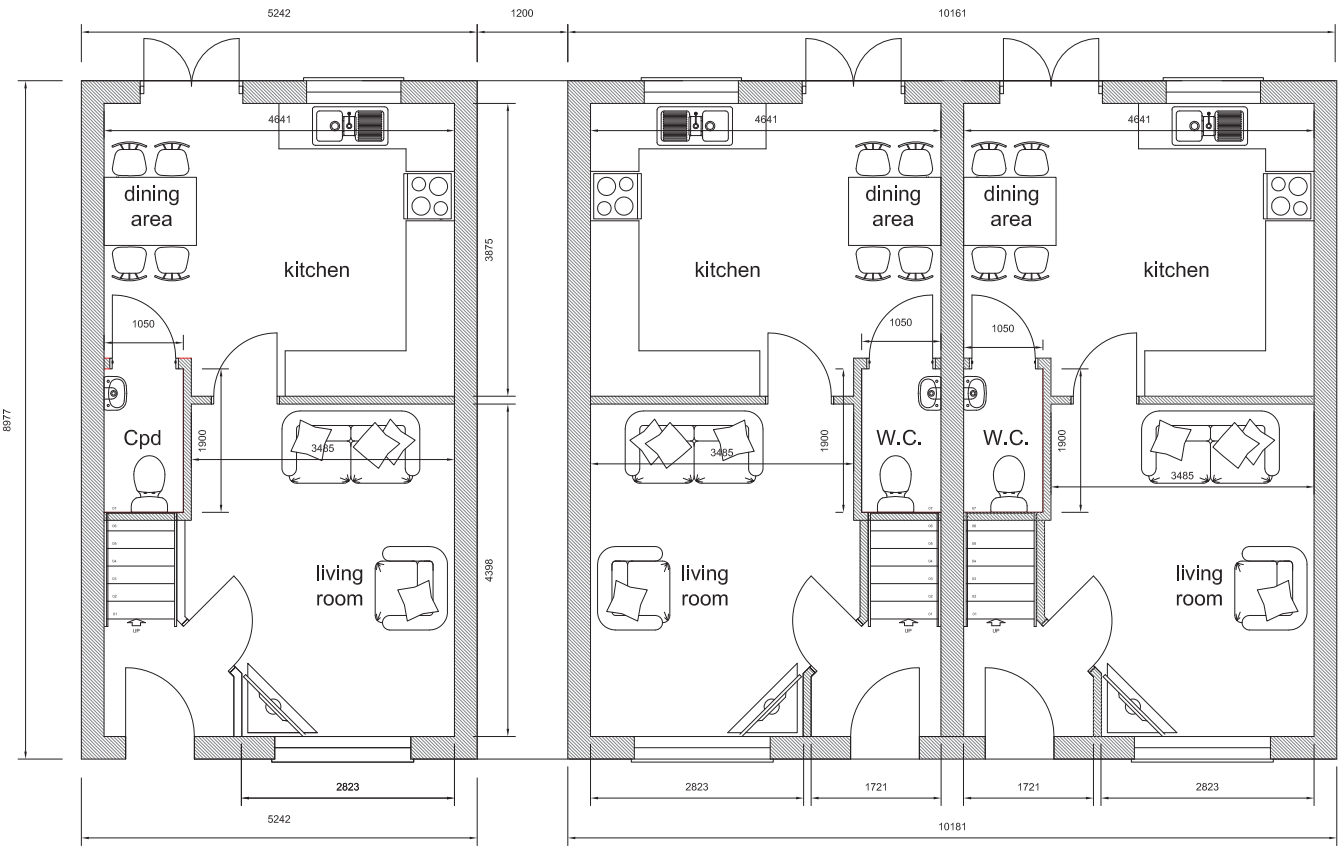


APPENDIX B

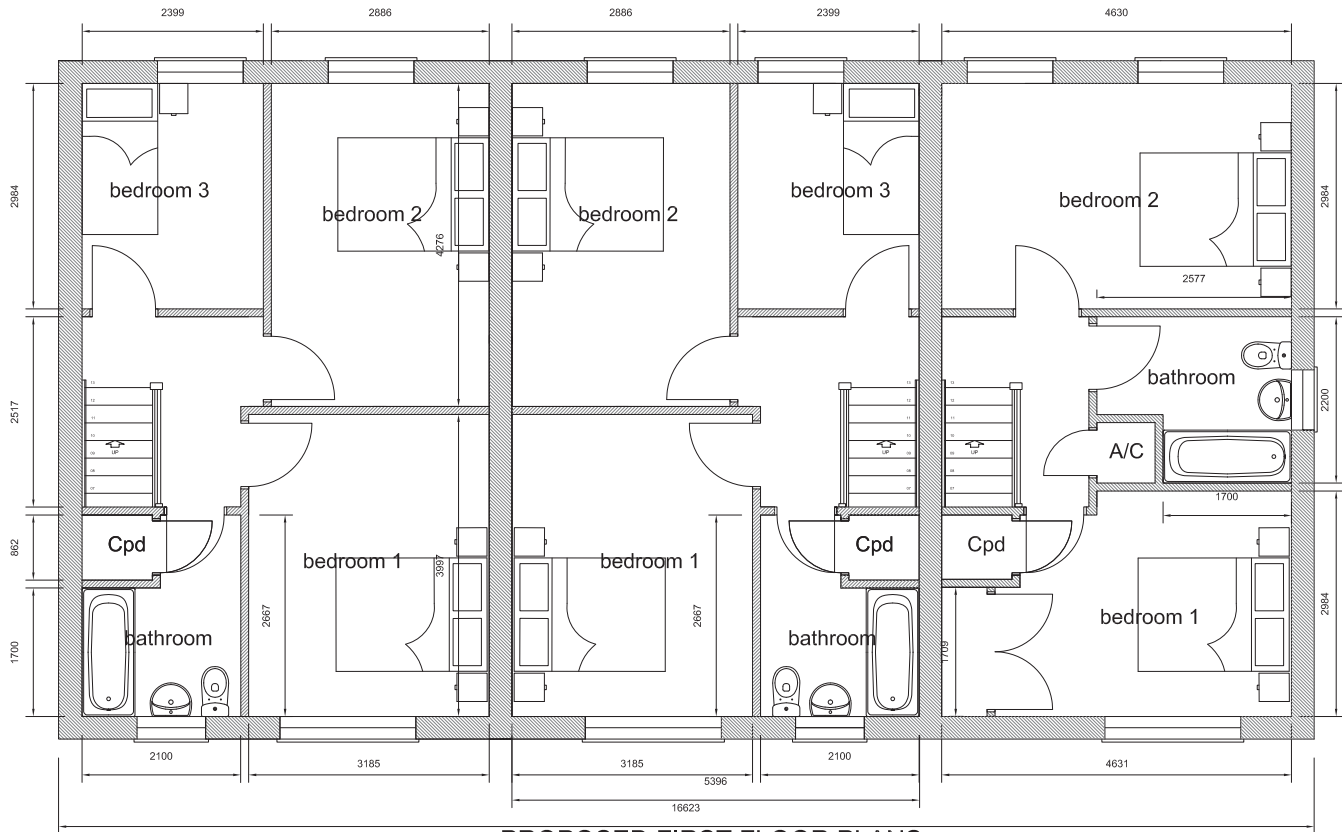
Proposed Development Plan



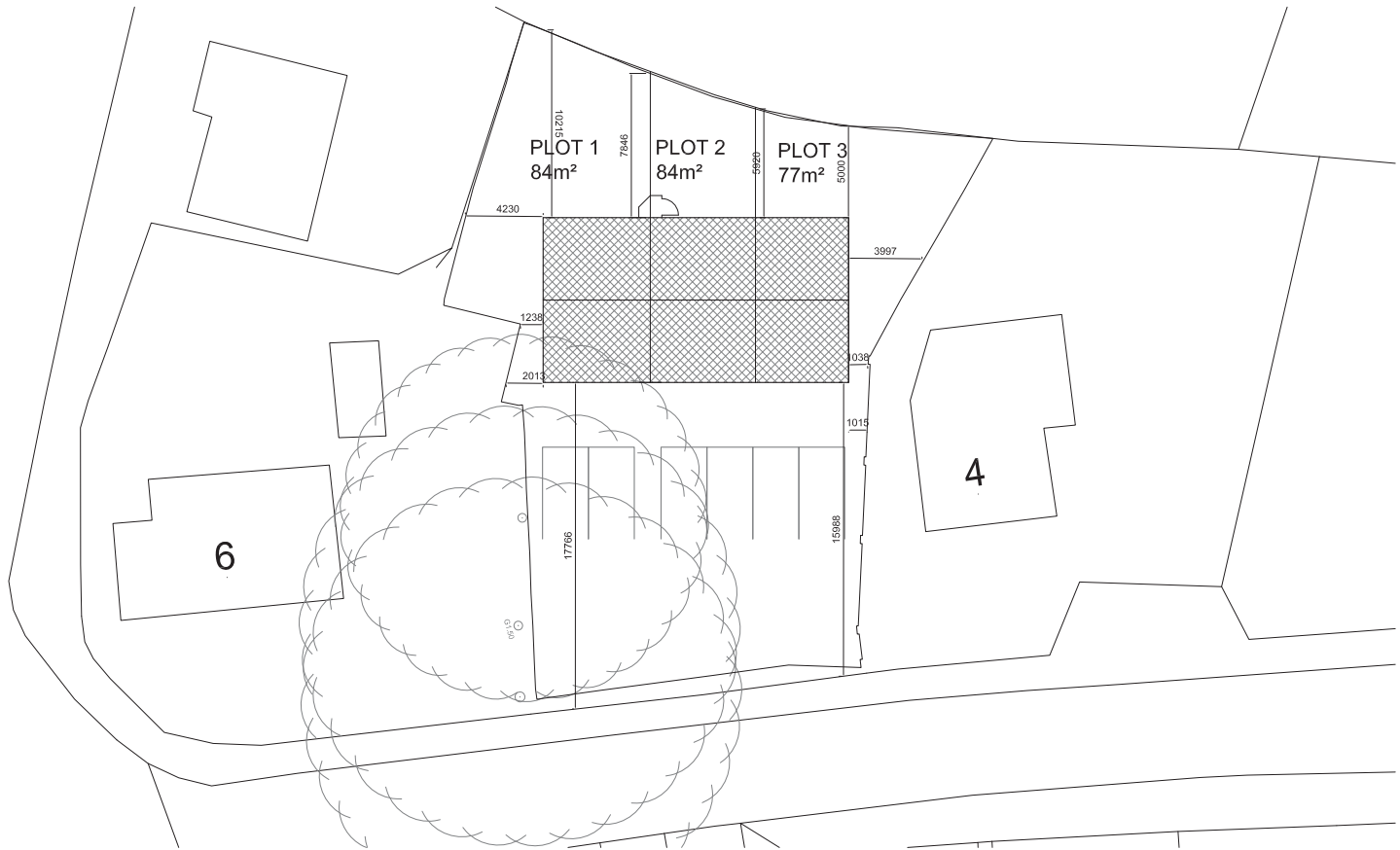
PROPOSED ELEVATIONS



PROPOSED GROUND FLOOR PLANS



PROPOSED FIRST FLOOR PLANS



PROPOSED BLOCK PLAN



LOCATION PLAN



APPENDIX C

Surrounding Land Use



General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buttressed Bank)
- EA Historic Landfill (Flyash)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundaries)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point buffered to 100m)
- Registered Landfill Site (Point buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Geological

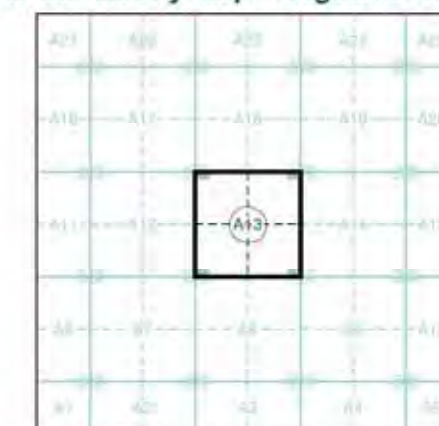
- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- COMAH Site
- Explosive Site
- HAHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Hazardous Substances

Site Sensitivity Map - Segment A13



Order Details

Order Number: 72447051_1_1
 Customer Ref: UK15.2001
 National Grid Reference: 542920, 323120
 Slice: A
 Site Area (Ha): 0.07

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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 Fax: 0844 844 9851
 Web: www.enwrochick.co.uk



General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buried Run)
- EA Historic Landfill (Flygen)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundry)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Fur buffered to 100m)
- Registered Landfill Site (Fur buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

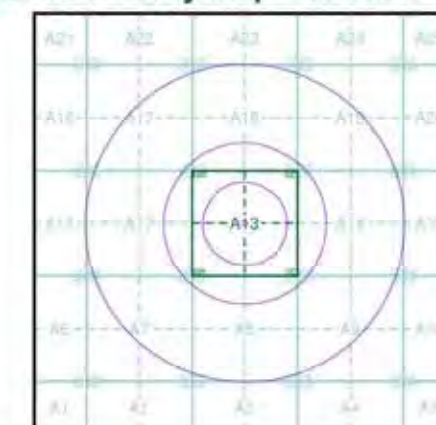
Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- COMAH Site
- Explosive Site
- HAHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Slice A



Order Details

Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 1000

Site Details

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Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



APPENDIX D

Geological Context

Geology 1:50,000 Maps Legends

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	TFD	Tidal Flat Deposits	Clay and Silt	Holocene - Holocene

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	AMC	Amphill Clay Formation	Mudstone	Oxfordian - Oxfordian



Geology 1:50,000 Maps

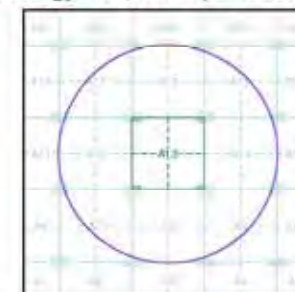
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	145
Map Name:	King's Lynn and
Map Date:	1978
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Available
Faults:	Not Supplied
Landslip:	Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



Order Details:

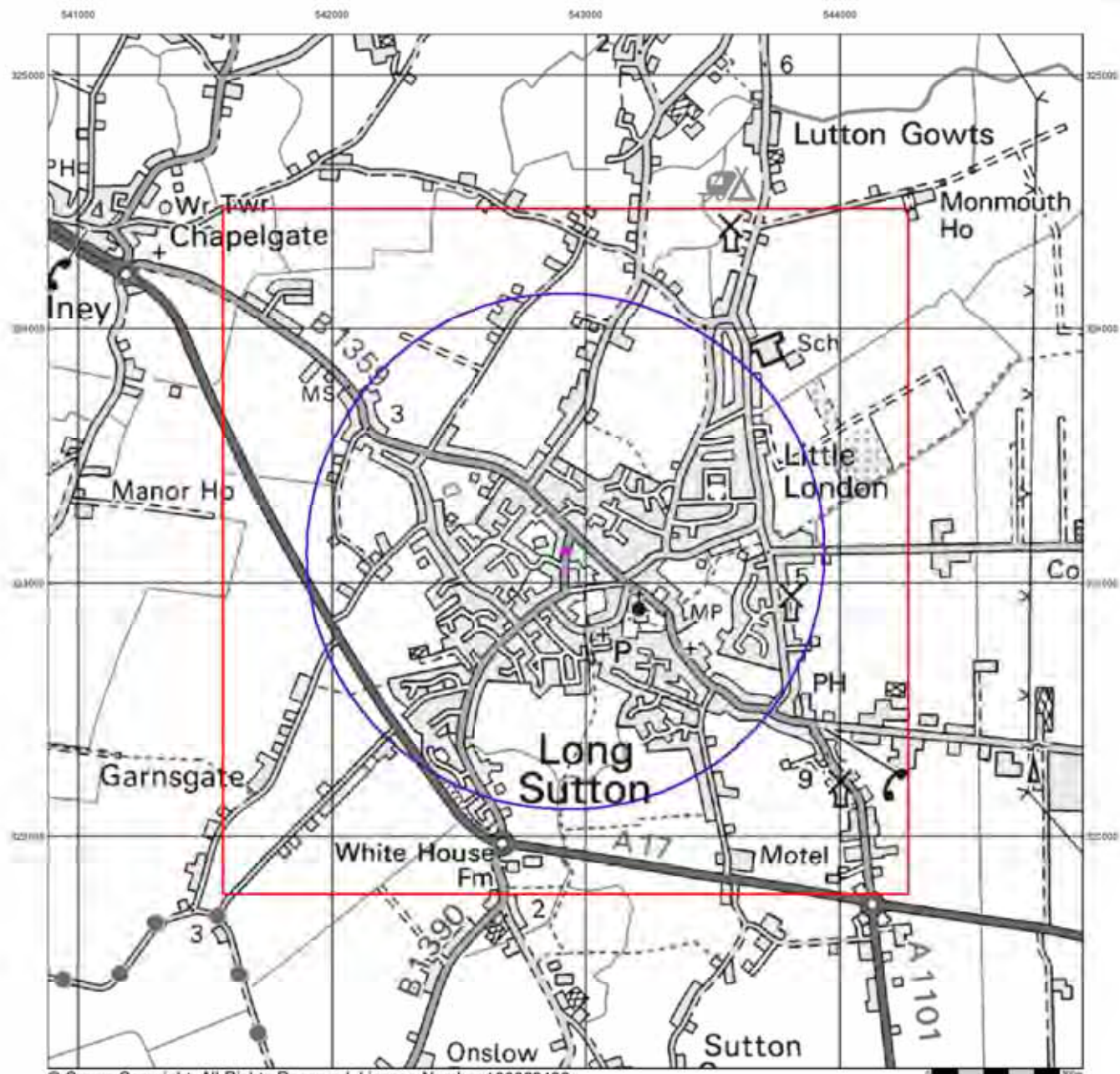
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Customer Reference:	UK15.2001
National Grid Reference:	542920, 325120
Slice:	A
Site Area (Ha):	0.07
Search Buffer (m):	1000

Site Details:

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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Fax: 0844 944 9961
Web: www.landmark.co.uk



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Artificial Ground and Landslip

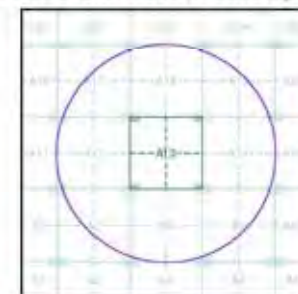
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



Order Details:

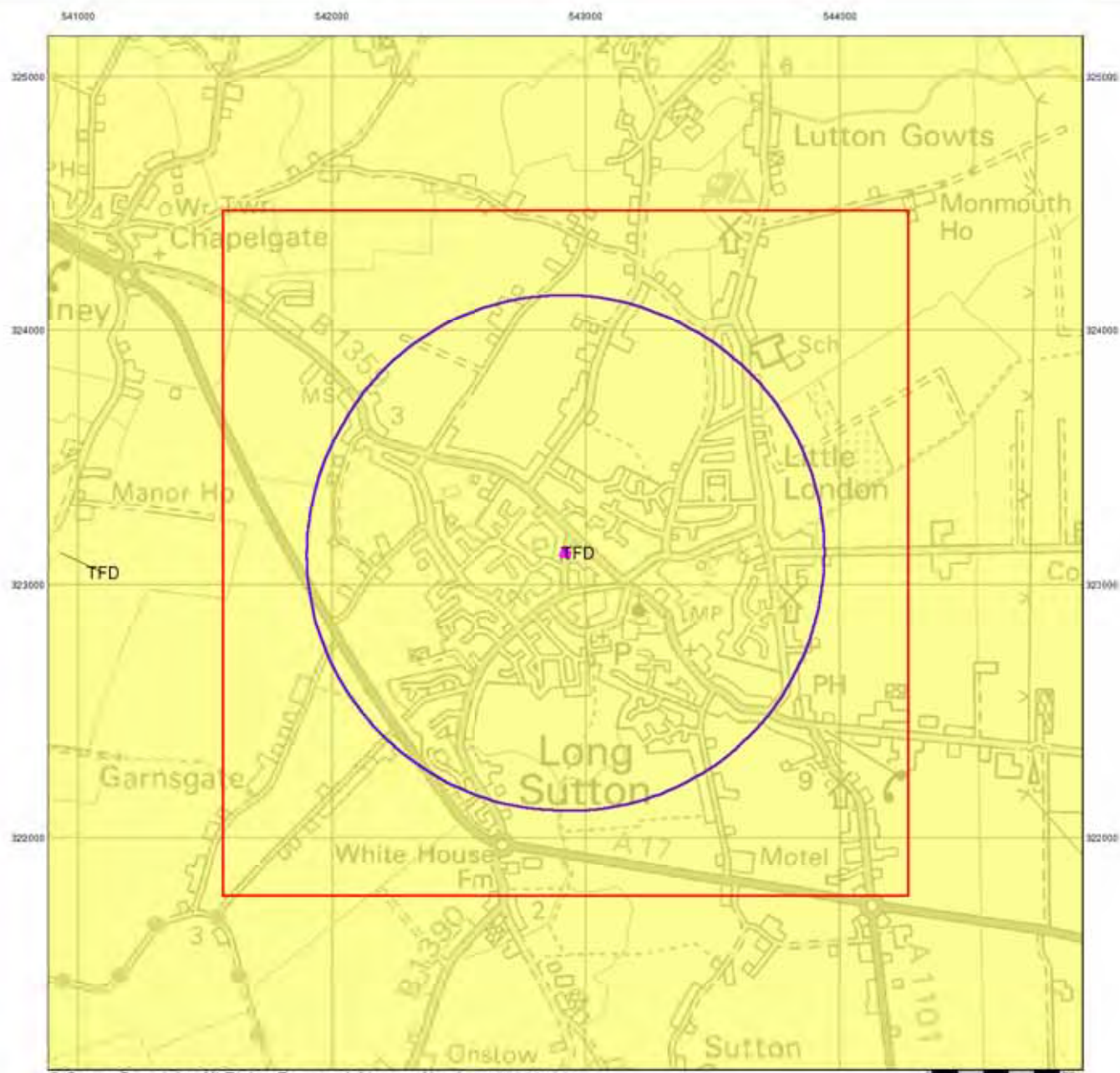
Order Number: 72447051_1_1
 Customer Reference: UK15.2001
 National Grid Reference: 542920, 325120
 Slice: A
 Site Area (Ha): 0.07
 Search Buffer (m): 1000

Site Details:

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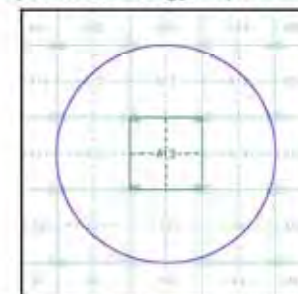
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

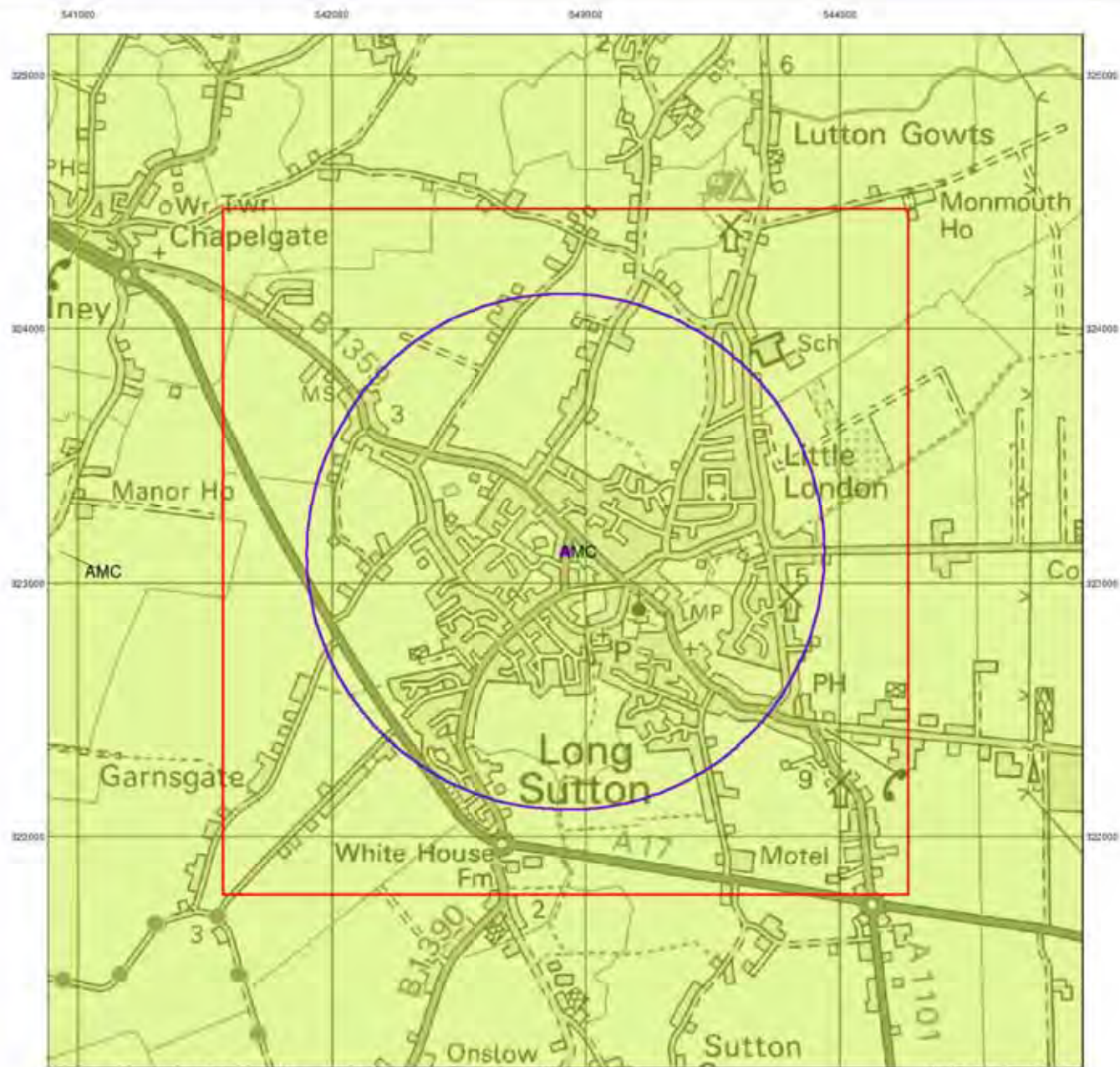
Order Number:	72447051_1_1
Customer Reference:	UK15 2001
National Grid Reference:	542920, 323120
Slice:	A
Site Area (Ha):	0.07
Search Buffer (m):	1000

Site Details:

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Bedrock and Faults

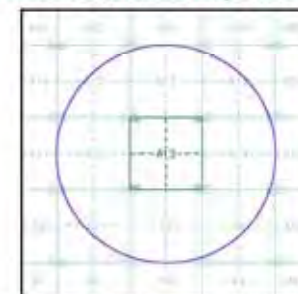
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

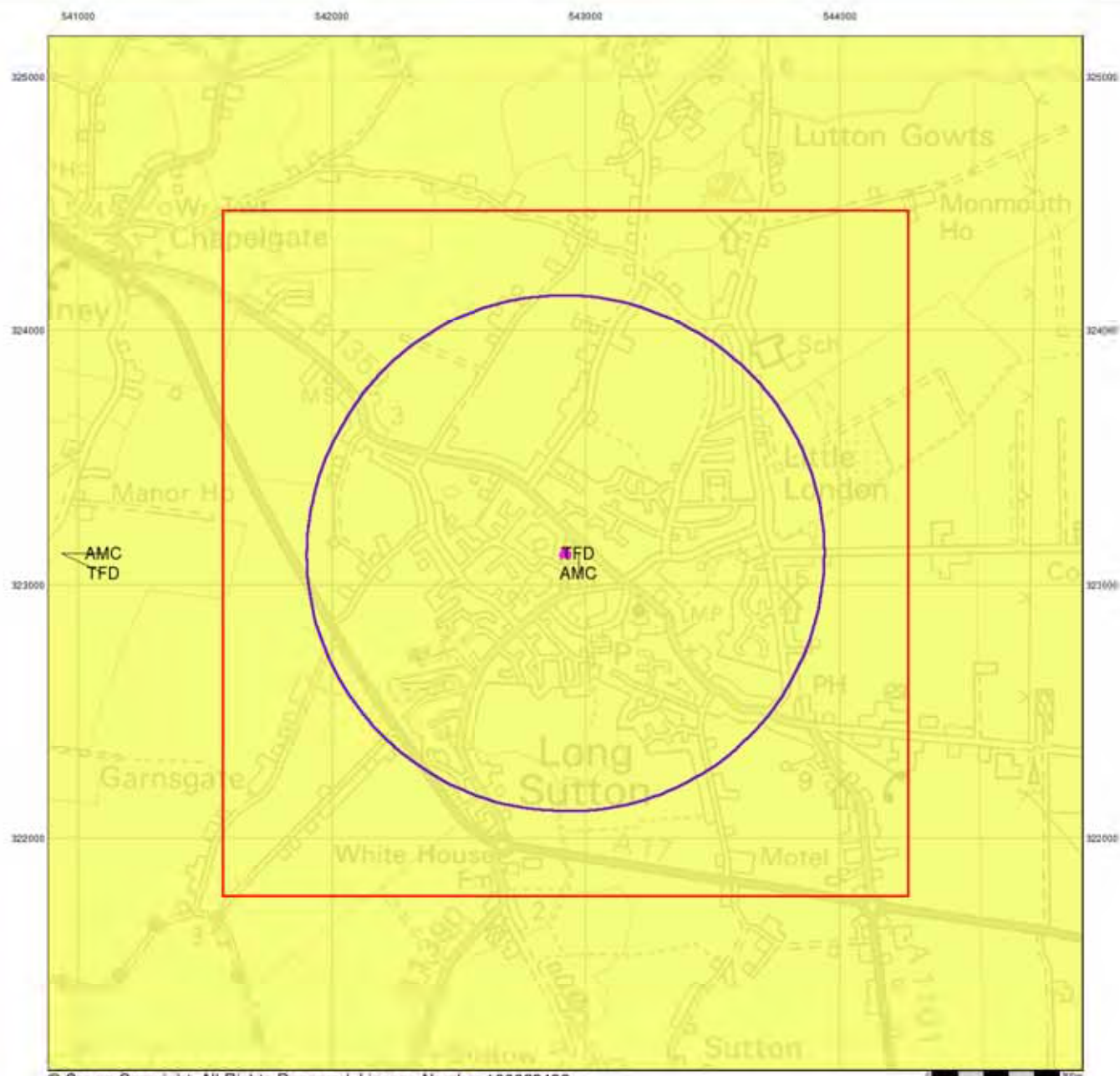
Order Number:	72447051_1_1
Customer Reference:	UK15 2001
National Grid Reference:	542920, 323120
Slice:	A
Site Area (ha):	0.07
Search Buffer (m):	1000

Site Details:

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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

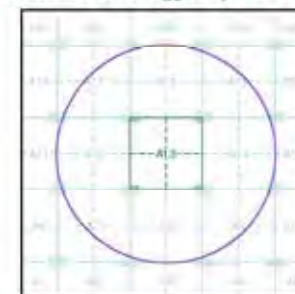
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details:

Order Number: 72447051_1_1
Customer Reference: UK15 2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 1000

Site Details:

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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Fax: 0844 944 9951
Web: www.landmark.co.uk

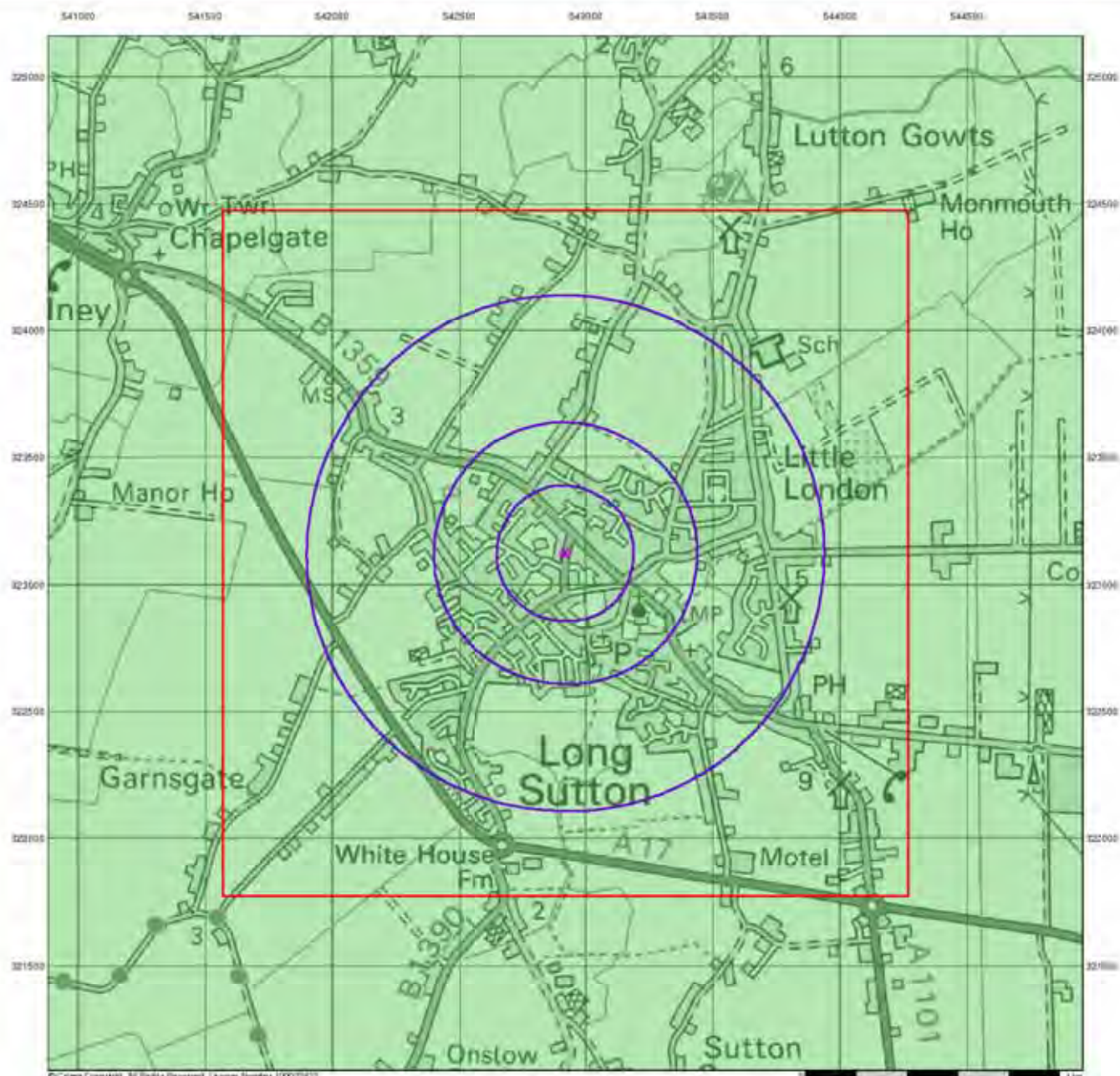
TF 428W20

MOU. 113



APPENDIX E

Groundwater Vulnerability and Flood Maps



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Groundwater Vulnerability

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

Major Aquifer (Highly Permeable)

Minor Aquifer (Variably Permeable)

Non Aquifer (Slightly Permeable)

Water or Sea

Drift Deposit

Soil Classes

- High (H) 1, 2, 3, 0
- Intermediate (I) 1, 2
- Low
- High (H) 1, 2, 3, 1
- Intermediate (I) 1, 2
- Low

Site Sensitivity Context Map - Slice A



Order Details

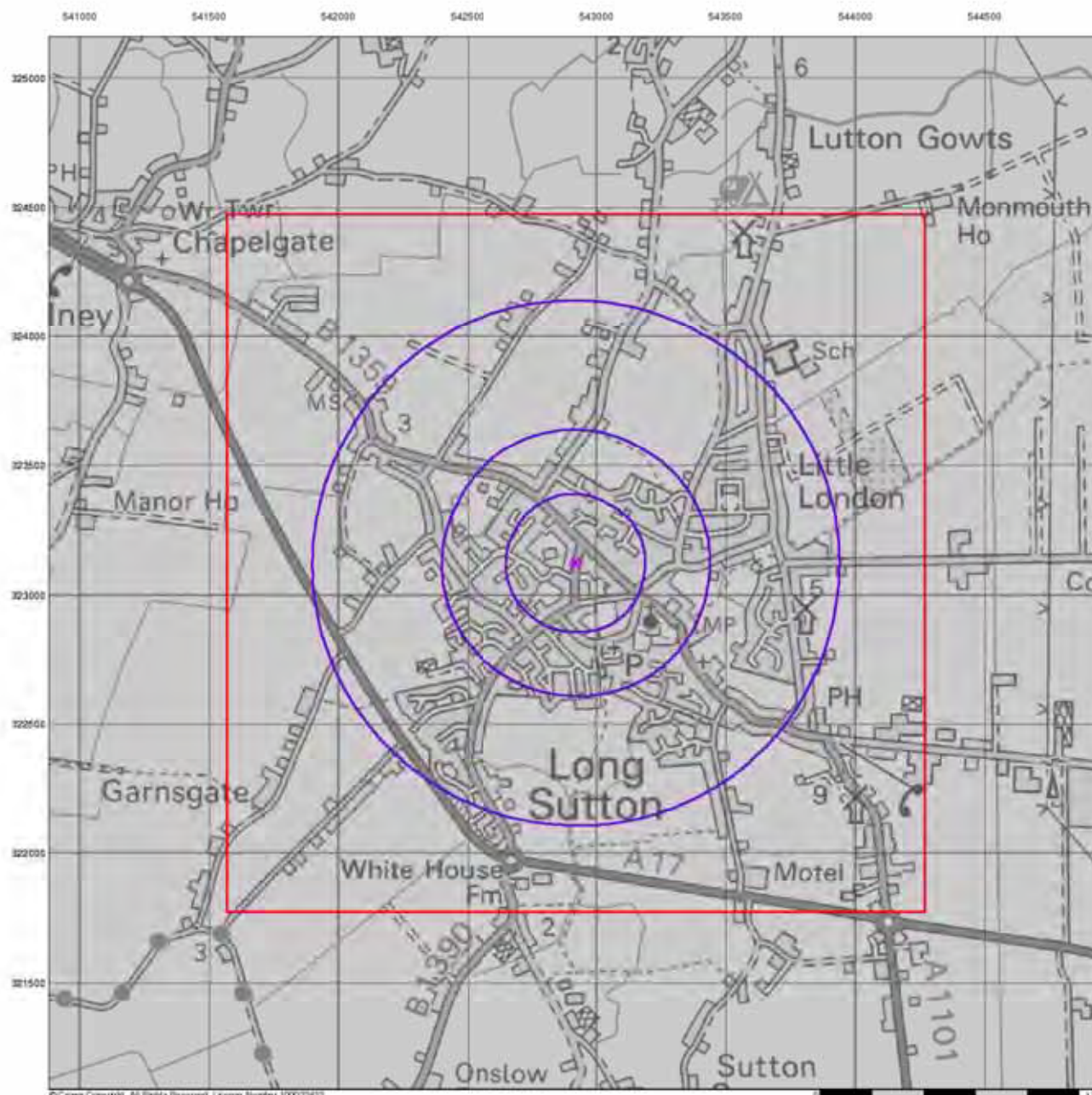
Order Number: 72447051_1.1
 Customer Ref: UK15.2001
 National Grid Reference: 542920, 323120
 Slice: A
 Site Area (ha): 0.07
 Search Buffer (m): 1000

Site Details

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Bedrock Aquifer Designation

General

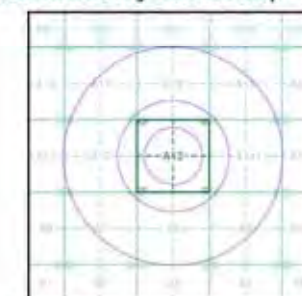
- Specified Circle
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

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

Site Sensitivity Context Map - Slice A



Order Details

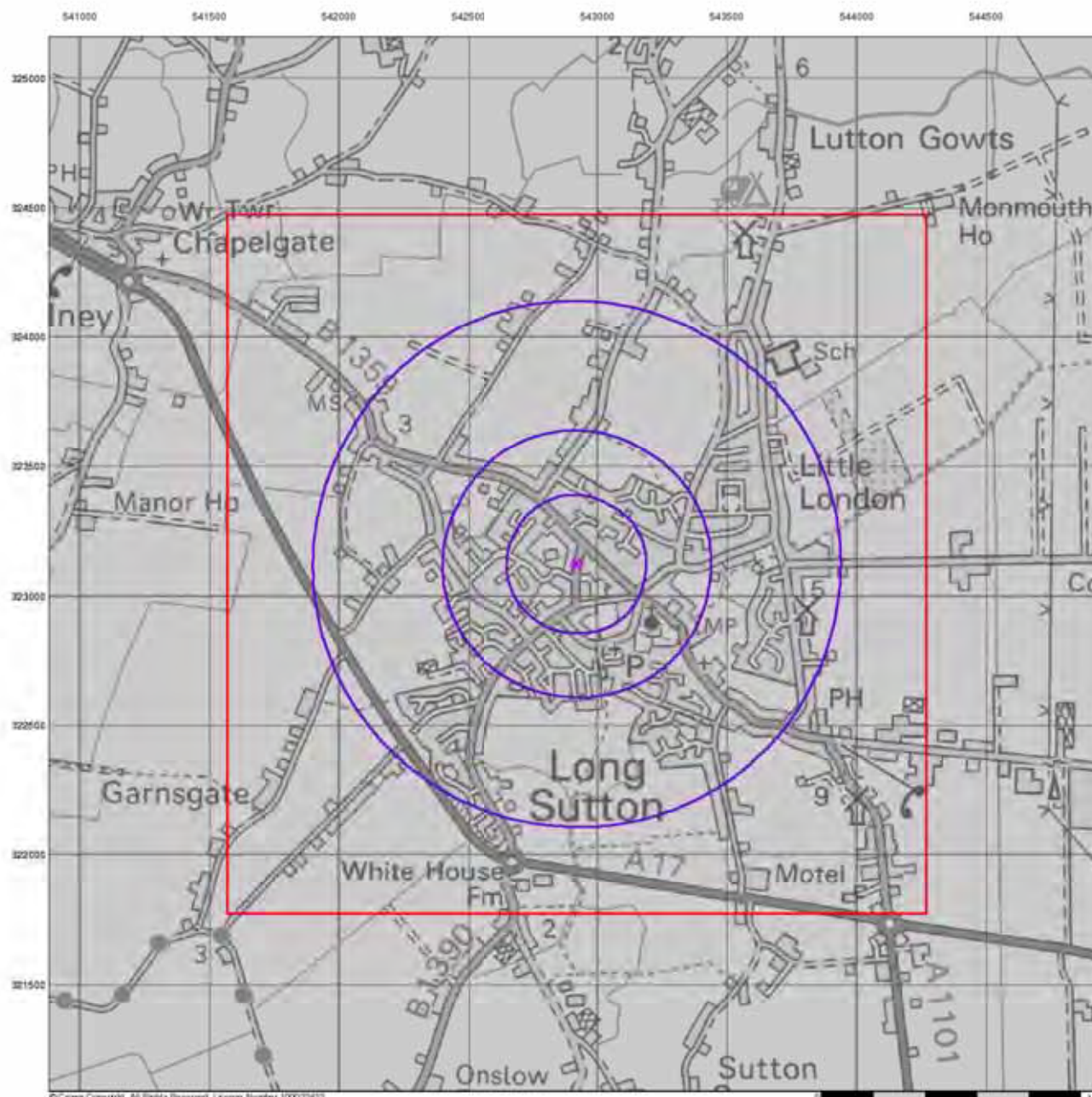
Order Number: 72447051_1_1
 Customer Ref: UK15 2001
 National Grid Reference: 542920, 323120
 Slice: A
 Site Area (ha): 0.07
 Search Buffer (m): 1000

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



Tel: 0344 944 9952
 Fax: 0344 944 9951
 Web: www.landmark.co.uk



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Superficial Aquifer Designation

General

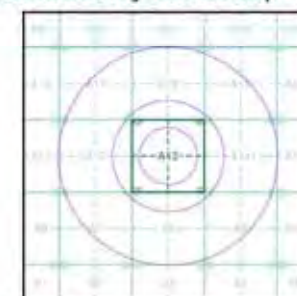
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

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

Site Sensitivity Context Map - Slice A



Order Details

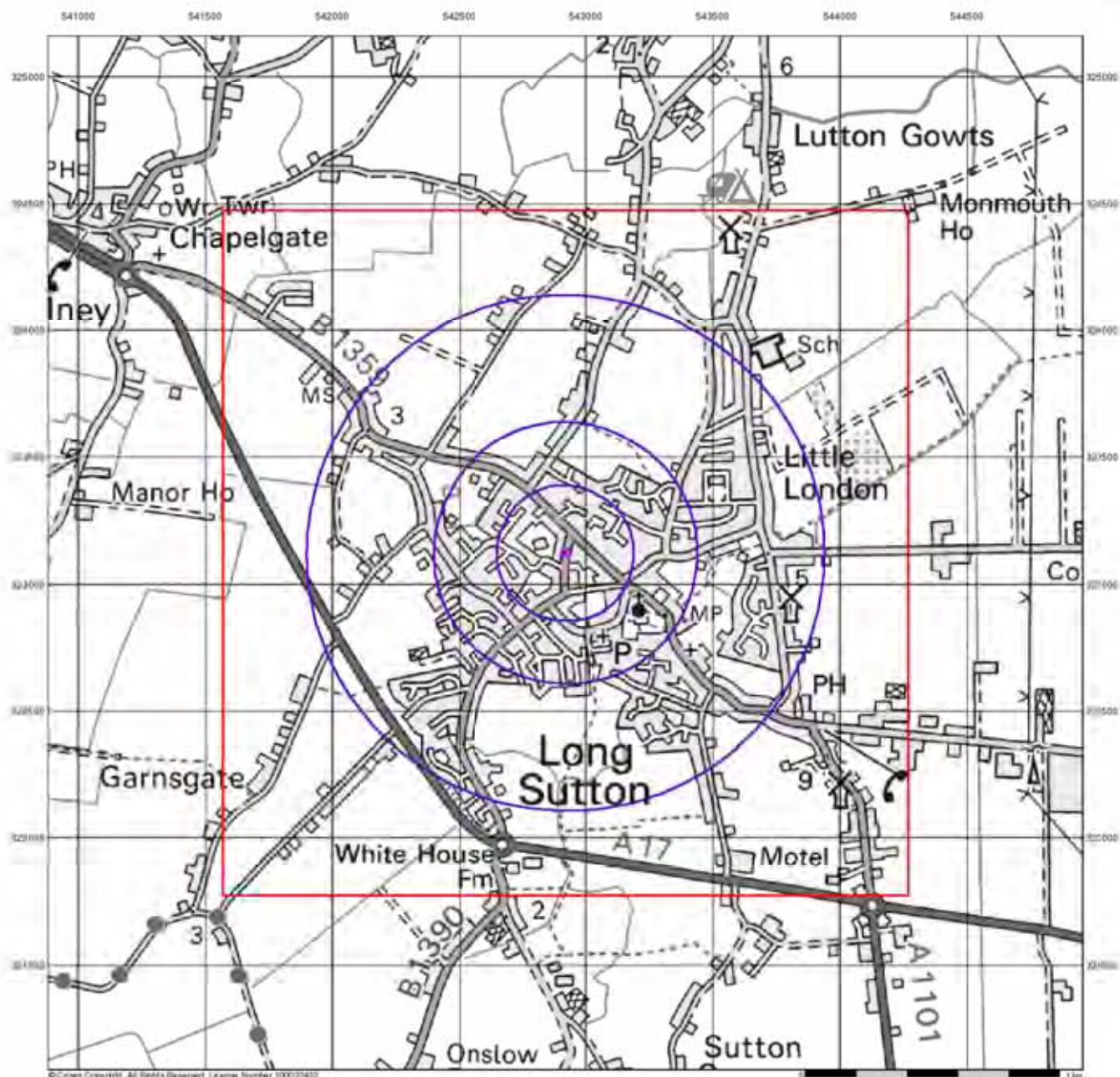
Order Number: 72447051_1_1
 Customer Ref: UK15 2001
 National Grid Reference: 542920, 323120
 Slice: A
 Site Area (ha): 0.07
 Search Buffer (m): 1000

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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Source Protection Zones

General

- Specified Gals
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 72447051_1_1
 Customer Ref: UK15.2001
 National Grid Reference: 542920, 523120
 Slice: A
 Site Area (ha): 0.07
 Search Buffer (m): 1000

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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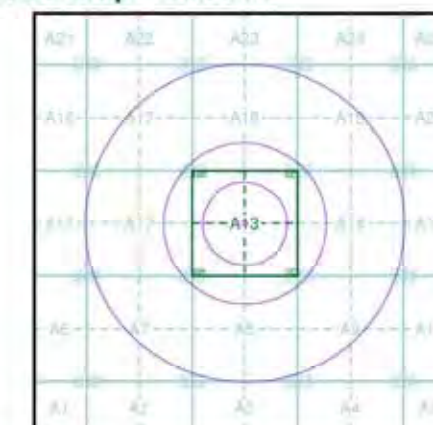
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 1000

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs,
PE12 9HD



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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



APPENDIX F

A Selection of Historic Maps



Lincolnshire

Published 1888

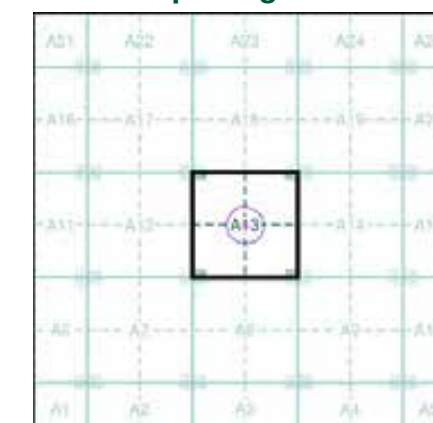
Source map scale - 1:2,500

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)

136_13
1888
1:2,500
144_01
1888
1:2,500

Historical Map - Segment A13



Order Details

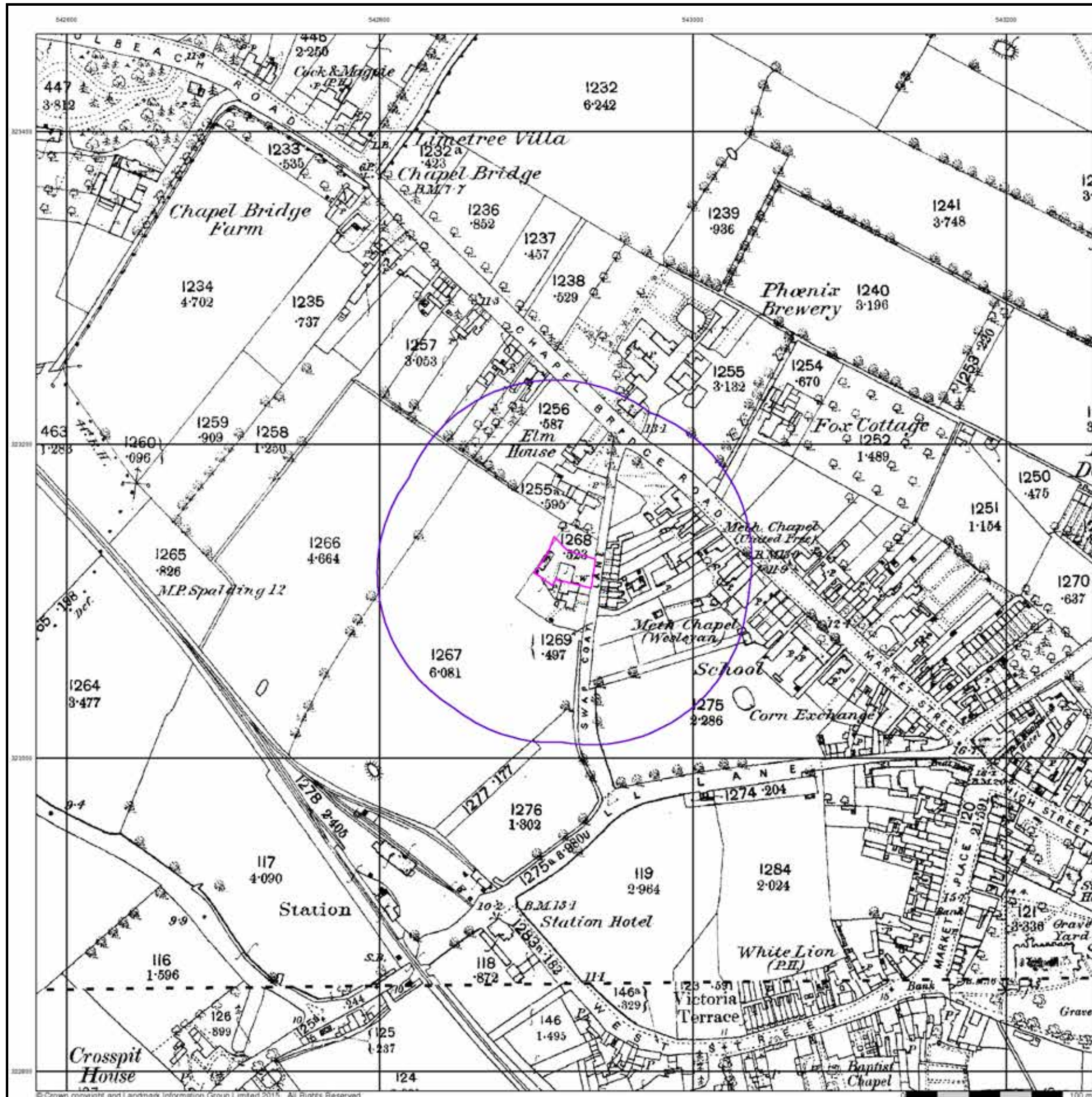
Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 100

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





Lincolnshire

Published 1904

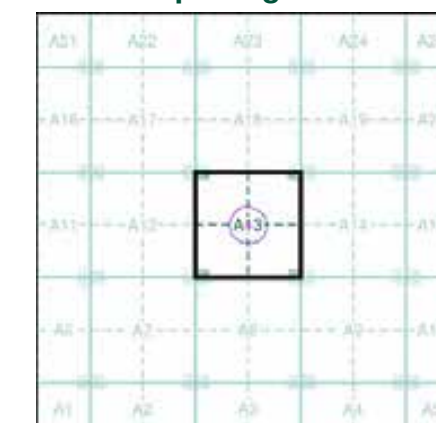
Source map scale - 1:2,500

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)

136_13
1904
1:2,500
144_01
1904
1:2,500

Historical Map - Segment A13



Order Details

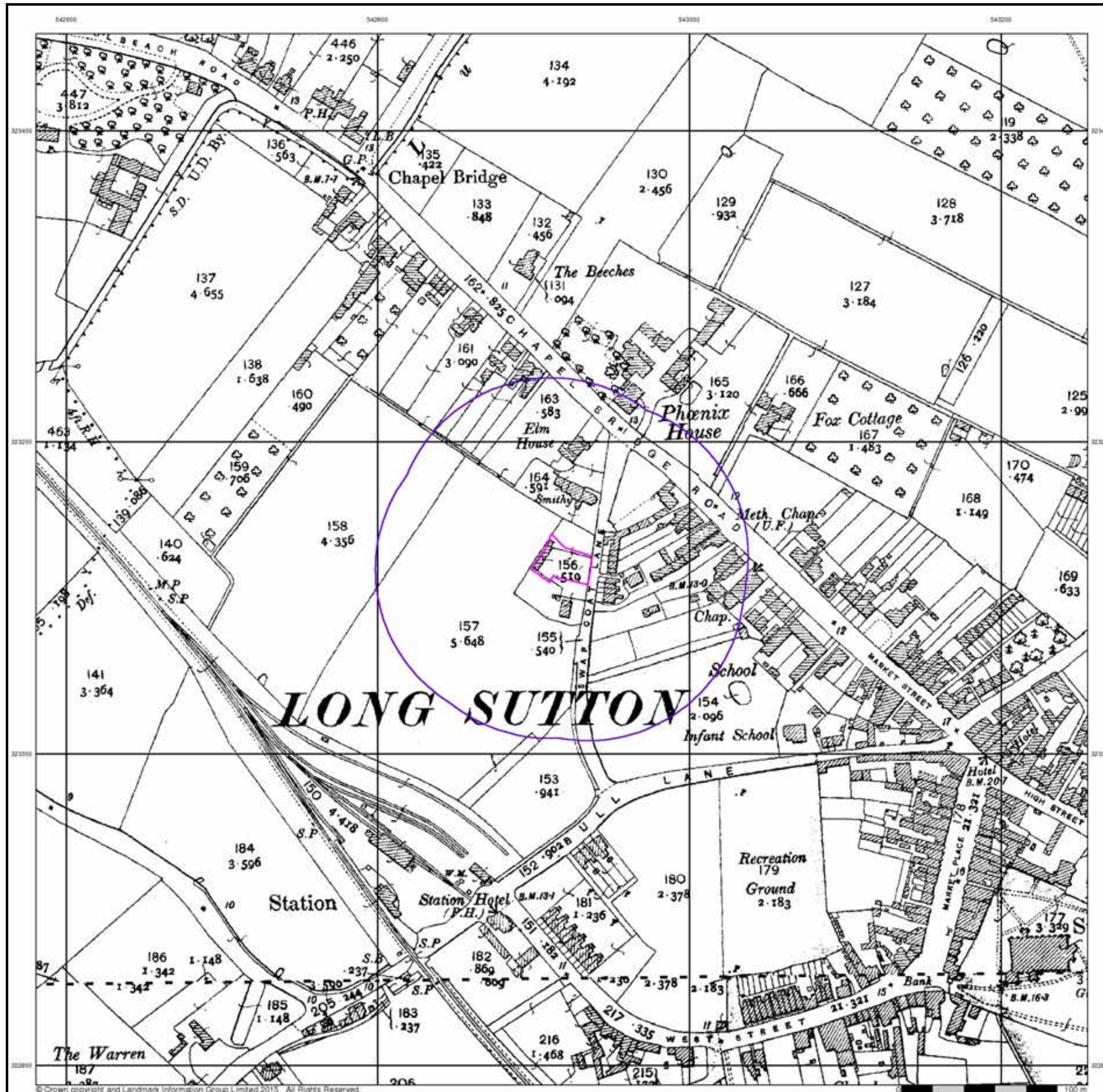
Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 100

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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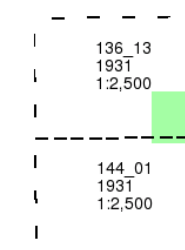
Lincolnshire

Published 1931

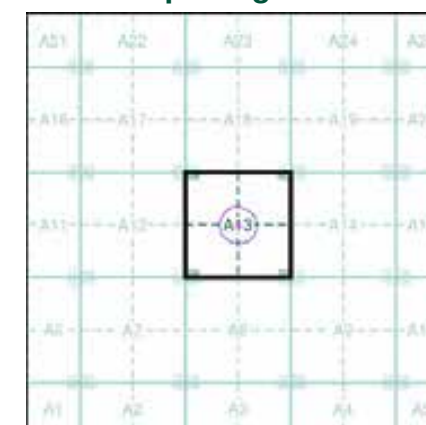
Source map scale - 1:2,500

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

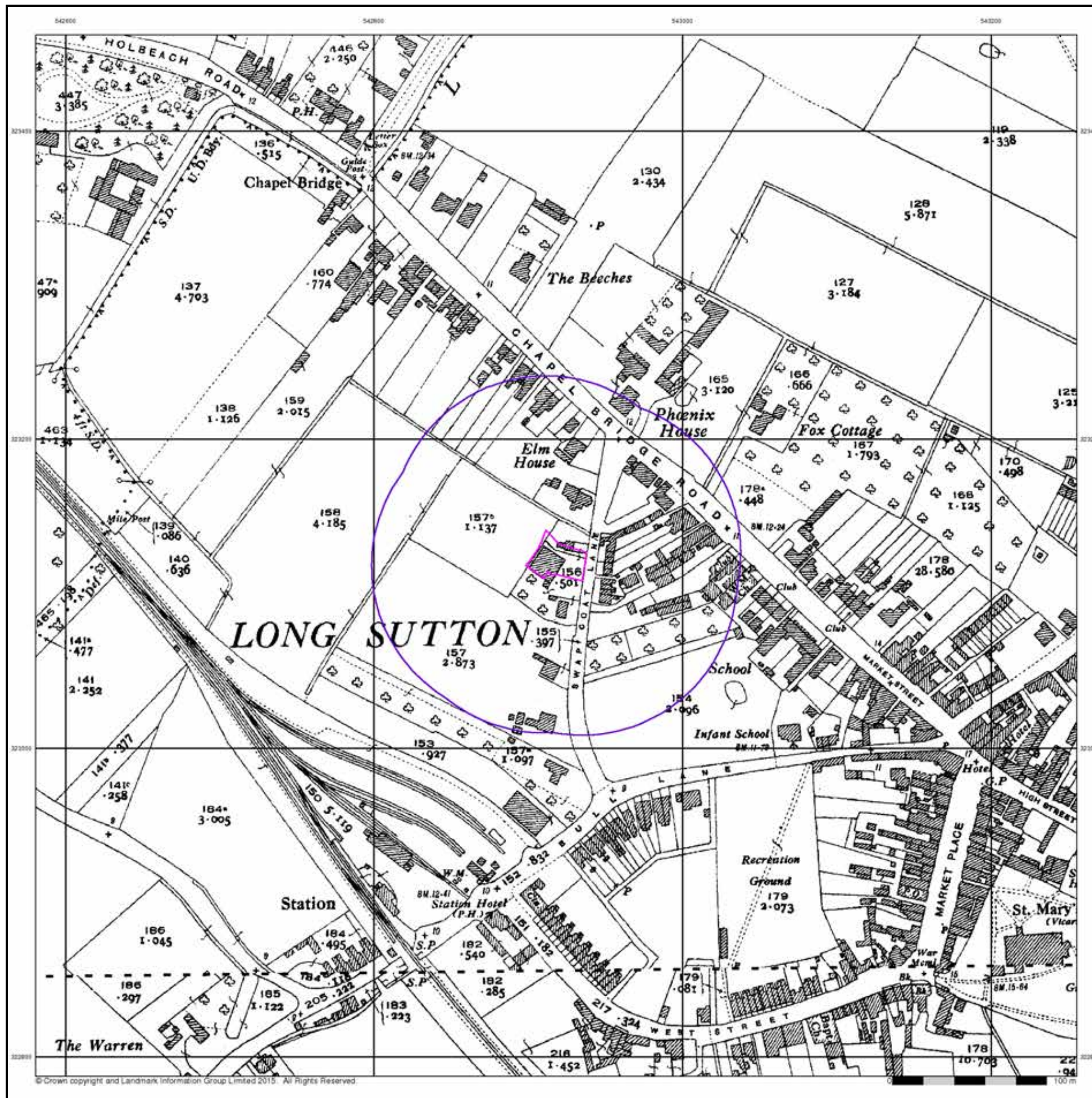
Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 100

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs,
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Ordnance Survey Plan

Published 1972

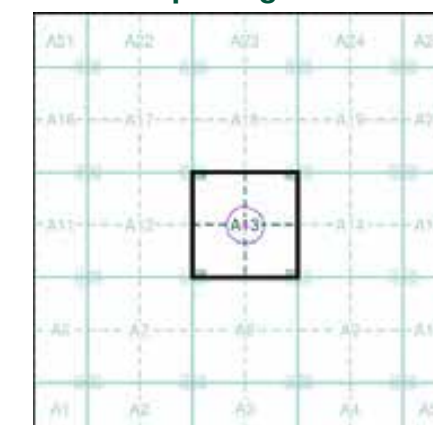
Source map scale - 1:2,500

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)

TF4223 1972 12,500	TF4323 1972 12,500
TF4222 1972 12,500	TF4322 1972 12,500

Historical Map - Segment A13



Order Details

Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 100

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



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Fax: 0844 844 9951
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Ordnance Survey Plan

Published 1989 - 1991

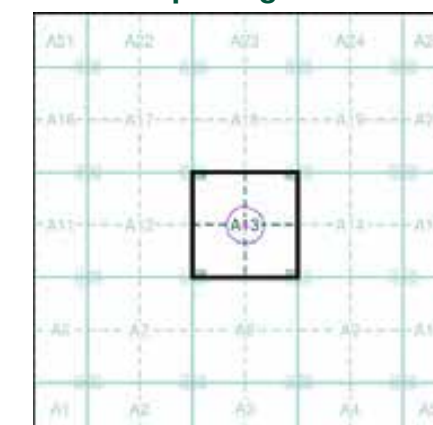
Source map scale - 1:2,500

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)

TF4223 1989 12,500	TF4323 1989 12,500
TF4222 1991 12,500	TF4322 1991 12,500

Historical Map - Segment A13



Order Details

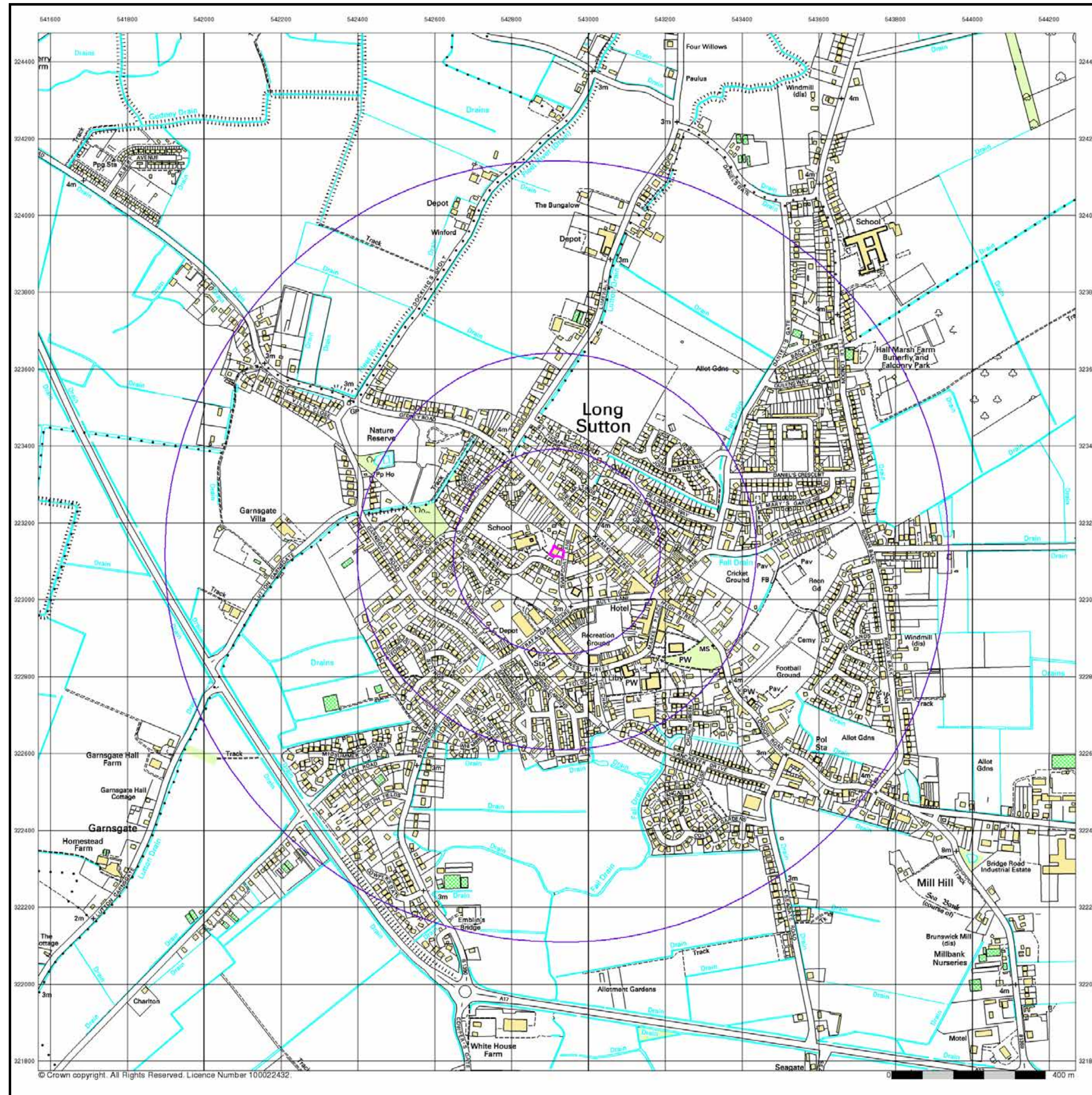
Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 100

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs,
PE12 9HD



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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



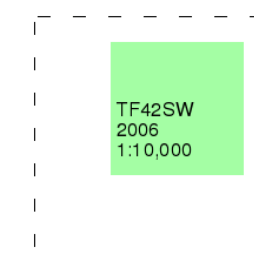
10k Raster Mapping

Published 2006

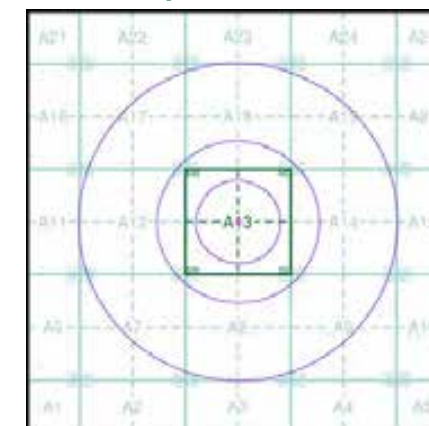
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 72447051_1_1
Customer Ref: UK15.2001
National Grid Reference: 542920, 323120
Slice: A
Site Area (Ha): 0.07
Search Buffer (m): 1000

Site Details

Land adj to 4 Swapcoat Lane, Long Sutton, Spalding, Lincs, PE12 9HD



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



APPENDIX G

Laboratory Analysis - Environmental



Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA, UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

EPS Ltd
7B Caxton House
Broad Street
Cambourne
Cambridgeshire
CB23 6JN

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781



Attention :	Giles Lock
Date :	23rd September, 2015
Your reference :	UK15.2001
Our reference :	Test Report 15/12867 Batch 1
Location :	Long Station
Date samples received :	17th September, 2015
Status :	Final report
Issue :	1

Five samples were received for analysis on 17th September, 2015 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Project Manager

Jones Environmental Laboratory

Client Name: EPS Ltd
Reference: UK15.2001
Location: Long Station
Contact: Giles Lock
JE Job No.: 15/12867

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-7	8-9	10-11						Please see attached notes for all abbreviations and acronyms		
Sample ID	HA1	HA2	HA3	HA4	HA5								
Depth	0.10-0.40	0.10-0.40	0.30-0.60	0.20-0.50	0.30-0.70								
COC No / misc													
Containers	V J	V J	V J T	V J	V J								
Sample Date	15/09/2015	15/09/2015	15/09/2015	15/09/2015	15/09/2015								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	17/09/2015	17/09/2015	17/09/2015	17/09/2015	17/09/2015						LOD/LOR	Units	Method No.
Arsenic ^{#M}	33.5	24.1	12.0	29.4	8.5						<0.5	mg/kg	TM30/PM15
Cadmium ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Chromium ^{#M}	39.9	31.1	40.5	39.5	38.9						<0.5	mg/kg	TM30/PM15
Copper ^{#M}	208	83	22	148	13						<1	mg/kg	TM30/PM15
Lead ^{#M}	994	518	37	525	18						<5	mg/kg	TM30/PM15
Mercury ^{#M}	0.6	0.4	0.4	0.4	<0.1						<0.1	mg/kg	TM30/PM15
Nickel ^{#M}	21.4	16.3	24.6	25.1	22.7						<0.7	mg/kg	TM30/PM15
Selenium ^{#M}	<1	<1	<1	<1	<1						<1	mg/kg	TM30/PM15
Total Sulphate ^{#M}	754	1620	364	<50	311						<50	mg/kg	TM50/PM29
Zinc ^{#M}	226	357	84	238	65						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene ^{#M}	0.37	0.19	<0.04	0.49	<0.04						<0.04	mg/kg	TM4/PM8
Acenaphthylene	1.33	0.06	<0.03	0.47	<0.03						<0.03	mg/kg	TM4/PM8
Acenaphthene ^{#M}	0.26	<0.05	<0.05	0.14	<0.05						<0.05	mg/kg	TM4/PM8
Fluorene ^{#M}	0.98	<0.04	<0.04	0.47	<0.04						<0.04	mg/kg	TM4/PM8
Phenanthrene ^{#M}	10.27	0.57	<0.03	5.81	<0.03						<0.03	mg/kg	TM4/PM8
Anthracene [#]	2.47	0.14	<0.04	1.54	<0.04						<0.04	mg/kg	TM4/PM8
Fluoranthene ^{#M}	13.79	0.92	<0.03	8.00	<0.03						<0.03	mg/kg	TM4/PM8
Pyrene [#]	10.07	0.71	<0.03	6.22	<0.03						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	8.24	0.64	<0.06	4.12	<0.06						<0.06	mg/kg	TM4/PM8
Chrysene ^{#M}	7.90	0.66	<0.02	4.63	<0.02						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene ^{#M}	11.49	1.03	<0.07	6.81	<0.07						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	6.48	0.59	<0.04	4.36	<0.04						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene ^{#M}	3.22	0.35	<0.04	1.92	<0.04						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	0.99	0.12	<0.04	0.41	<0.04						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	2.47	0.30	<0.04	1.74	<0.04						<0.04	mg/kg	TM4/PM8
PAH 16 Total	80.3	6.3	<0.6	47.1	<0.6						<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	8.27	0.74	<0.05	4.90	<0.05						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	3.22	0.29	<0.02	1.91	<0.02						<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	118	109	103	102	104						<0	%	TM4/PM8
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C6-C8 ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	1.4						<0.1	mg/kg	TM36/PM12
>C10-C12 ^{#M}	<0.2	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM16
>C12-C16 ^{#M}	<4	<4	<4	<4	<4						<4	mg/kg	TM5/PM16
>C16-C21 ^{#M}	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM16
>C21-C35 ^{#M}	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM16
Total aliphatics C5-35	<19	<19	<19	<19	<19						<19	mg/kg	TM5/PM16/PM22/PM15

Please see attached notes for all abbreviations and acronyms

Matrix : Solid

4 of 10

Client Name: EPS Ltd
Reference: UK15.2001
Location: Long Station
Contact: Giles Lock

Note:

Analysis was carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

If asbestos fibres are reported at trace levels there will not be enough fibres to quantify and will be less than 0.001%.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
15/12867	1	HA1	0.10-0.40	2	17/09/2015	Mass of Dry Sample	46.4 (g)
					17/09/2015	General Description (Bulk Analysis)	soil-stones
					17/09/2015	Asbestos Containing Material	None
					17/09/2015	Asbestos Containing Material (2)	None
					17/09/2015	Asbestos Screen	NAD
					17/09/2015	Asbestos Screen (2)	NAD
					17/09/2015	Asbestos Level	NAD
15/12867	1	HA2	0.10-0.40	4	17/09/2015	Mass of Dry Sample	47.1 (g)
					17/09/2015	General Description (Bulk Analysis)	soil-stones
					17/09/2015	Asbestos Containing Material	None
					17/09/2015	Asbestos Containing Material (2)	None
					17/09/2015	Asbestos Screen	NAD
					17/09/2015	Asbestos Screen (2)	NAD
					17/09/2015	Asbestos Level	NAD
15/12867	1	HA3	0.30-0.60	6	17/09/2015	Mass of Dry Sample	45.8 (g)
					17/09/2015	General Description (Bulk Analysis)	soil-stones
					17/09/2015	Asbestos Containing Material	None
					17/09/2015	Asbestos Containing Material (2)	None
					17/09/2015	Asbestos Screen	NAD
					17/09/2015	Asbestos Screen (2)	NAD
					17/09/2015	Asbestos Level	NAD
15/12867	1	HA4	0.20-0.50	9	17/09/2015	Mass of Dry Sample	44.8 (g)
					17/09/2015	General Description (Bulk Analysis)	soil-stones
					17/09/2015	Asbestos Containing Material	None
					17/09/2015	Asbestos Containing Material (2)	None
					17/09/2015	Asbestos Screen	NAD
					17/09/2015	Asbestos Screen (2)	NAD
					17/09/2015	Asbestos Level	NAD
15/12867	1	HA5	0.30-0.70	11	17/09/2015	Mass of Dry Sample	48.1 (g)
					17/09/2015	General Description (Bulk Analysis)	soil-stones
					17/09/2015	Asbestos Containing Material	None
					17/09/2015	Asbestos Containing Material (2)	None
					17/09/2015	Asbestos Screen	NAD
					17/09/2015	Asbestos Screen (2)	NAD
					17/09/2015	Asbestos Level	NAD

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 15/12867

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 15/12867

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID.	PM12/PM16	CWG GC-FID			AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	

JE Job No: 15/12867

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes	Yes	AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.	Yes	Yes	AD	Yes

JE Job No: 15/12867

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.			AR	
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes	Yes	AR	Yes
NONE	No Method Code	NONE	No Method Code			AR	Yes



APPENDIX H

Minimal and Low Risk Screening Criteria

EPS Generic Quantitative Risk Assessment

Minimal Risk Generic Screening Criteria - Residential Land Use

Contaminant	Soil Targets			Groundwater Targets	
	Human Health	Controlled Waters		Controlled Waters	
		LGwRP	HGwRP	LGwRP	HGwRP
Unit	mg/kg			ug/l	
Arsenic	37	n/c	n/c	50	10
Cadmium	11	n/c	n/c	5	5
Chromium III	910	n/c	n/c	250	50
Chromium VI	6	n/c	n/c	n/c	n/c
Copper	2400	n/c	n/c	28	28
Mercury (elemental)	1.2	n/c	n/c	1	1
Nickel	180	n/c	n/c	200	50
Lead	NA	n/c	n/c	250	10
Selenium	250	n/c	n/c	10	10
Zinc	3700	n/c	n/c	500	500
Benzene	0.087	0.252	0.008	30	1
Toluene	130	1.17	1.17	50	50
Ethylbenzene	47	15.0	10.0	300	200
Xylene (para)	56	0.885	0.885	30	30
MTBE#	49	0.138	0.0276	75	15
Benzo(a)Pyrene	2.2	10	1.44	0.7	0.1
Naphthalene	2.3	0.934	0.02	10	0.1
Dibenz(ah)anthracene	0.24	n/c	n/c	n/c	n/c
Aliphatic C5-C6	42	5.27	1.05	50	10
Aliphatic C6-C8	100	23.2	4.64	50	10
Aliphatic C8-C10	27	175	35.1	50	10
Aliphatic C10-C12	130(48)*	1380	276	50	10
Aliphatic C12-C16	1100(8.48)**	27500	5490	50	10
Aliphatic C16-C35	65000 (8.48)**	3.46E+06	6.91E+05	50	10
Aromatic C8-C10	34	8.74	1.75	50	10
Aromatic C10-C12	74	13.8	2.76	50	10
Aromatic C12-C16	140	27.5	5.5	50	10
Aromatic C16-C21	260	86.9	17.4	50	10
Aromatic C21-C35	1100	690	138	50	10

Notes:

LGwRP - Low Groundwater Resource Potential

HGwRP - High Groundwater Resource Potential

f = Oral, dermal and inhalation exposure compared with oral HCV N/C = Not Calculated

* = S4UL exceeds vapour saturation limit (in brackets)

** = S4UL exceeds solubility saturation limit (in brackets)

Soil Targets

Targets for Human Health have been taken from *S4ULs 'Suitable For Use Levels for Human Health Risk Assessment' – LQM and CIEH (2014)* derived using standard sandy loam soil with 1% SOM, except (#) = *EIC/AGS/CL:AIRE GAC 'Soil Generic Assessment Criteria' (2010)*. For sites where ground conditions differ significantly from sandy loam or site-specific SOM and pH are available, the generic human health targets may be revised.

Targets for Controlled waters have been derived using EA Remedial Targets Worksheet (v3.1) - using standard Sandy Loam ground conditions as described in Science Report SC050021/SR3, assuming no degradation for a 10m compliance distance with criteria of EQS or UKDWS for LGwRP and HGwRP respectively (see notes for GW targets).

Groundwater Targets

For LGwRP, targets have been taken as Freshwater EQS where available. For Ethylbenzene and BaP the WHO Health limit has been used and for MTBE and individual TPH fractions a 5 times multiplier of taste threshold and UKDWS has been taken respectively.

For HGwRP, targets have been taken as UKDWS where available, with the exception of Copper and Zinc where the EQS is lower than the DWS and therefore the EQS has been used as the groundwater target. For Ethylbenzene the upper WHO ATO limit has been used. For Toluene and Xylene, the WHO ATO limit is higher than the EQS and so the lower value has been taken. For MTBE the taste threshold has been taken.

Work carried out to calculate generic screening criteria for concentrations of contaminant in groundwater with respect of risks to Human Health has generally found that criteria far exceed (by at least 2 orders of magnitude) those listed for the protection of either LGwRP and HGwRP receptors. On this basis, the above Groundwater criteria are also considered protective of human health and further evaluation of these risks should be considered alongside any detailed quantitative risk assessments carried out for groundwater on a site specific basis.



EPS Generic Quantitative Risk Assessment

Low Risk Generic Screening Criteria - All Land Uses

	Soil Targets					
Contaminant	Residential		Allotments	Commercial	Public Open Spaces	
	With Home Grown Produce	Without Home Grown Produce			Residential	Parks
Unit	mg/kg					
Arsenic	37	40	49	640	79	168
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5	5.3	5.7	76	10	21
Cadmium	26	149	4.9	410	220	880
Chromium (VI)	21	21	170	49	23	250
Lead	200	310	80	2330	630	1300

Notes:

Targets for Human Health have been taken from available Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination issued by DEFRA in December 2013.



APPENDIX I

Summary of Statistical Calculations

Client/client ref	D & R Property Services Ltd
Project ref	UK15.2001
Site ref	Land adjacent to 4 Swapcoat Lane
Data description	Shallow soils - residential
Contaminant(s)	Lead, Benzo(a)pyrene, TPH
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)?
Date	10 September 2015
User details	mjudson

Statistics calculator (version 1)

Developed by:



On behalf of:



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the CIEH Statistics Calculator User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

Neither the CIEH nor ESI Ltd (ESI) promises that the spreadsheet will provide any particular facilities or functions. The user must ensure that the spreadsheet meets their needs and they remain solely responsible for the competent use of the spreadsheet. Users are entirely responsible for the consequences of any use of the spreadsheet, neither the CIEH nor ESI provides any warranty about the fitness for purpose or performance of any part of the spreadsheet. We do not promise that the media will always be free from defects, computer viruses, software locks or other similar code or that the operation of the spreadsheet will be uninterrupted or error free. The user should carry out all necessary virus checks prior to installing on their computing system.

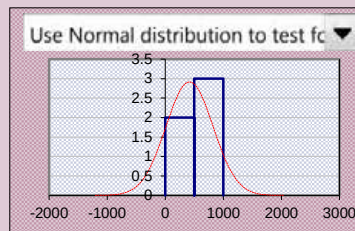
© ESI Ltd. 2008

Test Results

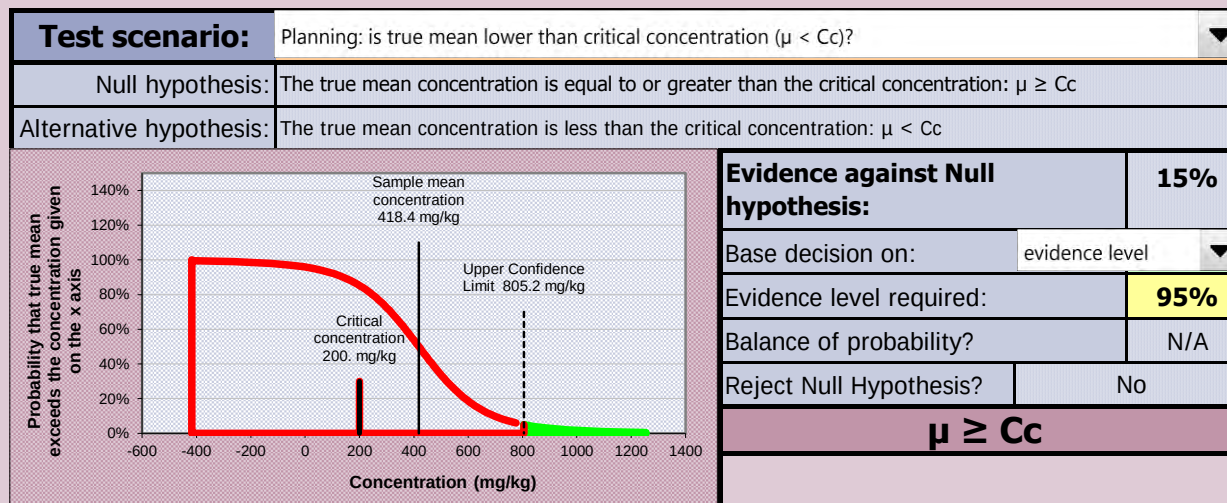
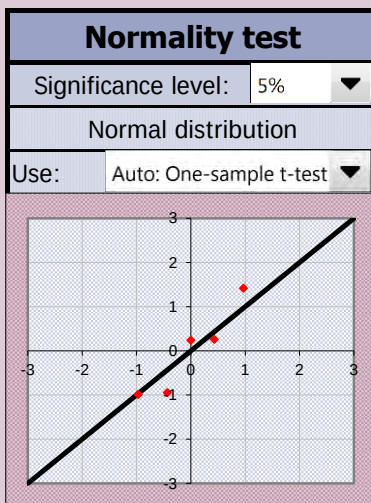
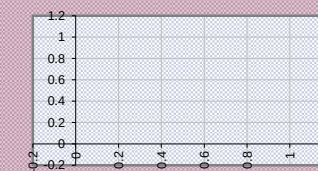
Client/client ref: D & R Property Site ref: Land adjacent to 4 Swapcoat Lane
Project ref: UK15.2001 Data description: Shallow soils - residential

Date: 10-Sep-2015
User details: mjudson

Dataset:	Lead (mg/kg) ▼
Sample mean, $\bar{X}$ (mg/kg)	418.4
Sample standard deviation, s	405.7
Sample size, n	5
Critical concentration, Cc (mg/kg)	200



Outliers & non-detects	
Outliers present?	NO
Significance level	5% ▼
Outliers removed?	0
Non-detects	0



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[Go to outlier test](#)

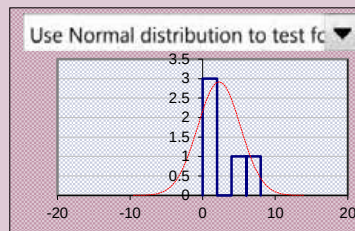
[Go to normality test](#)

Test Results

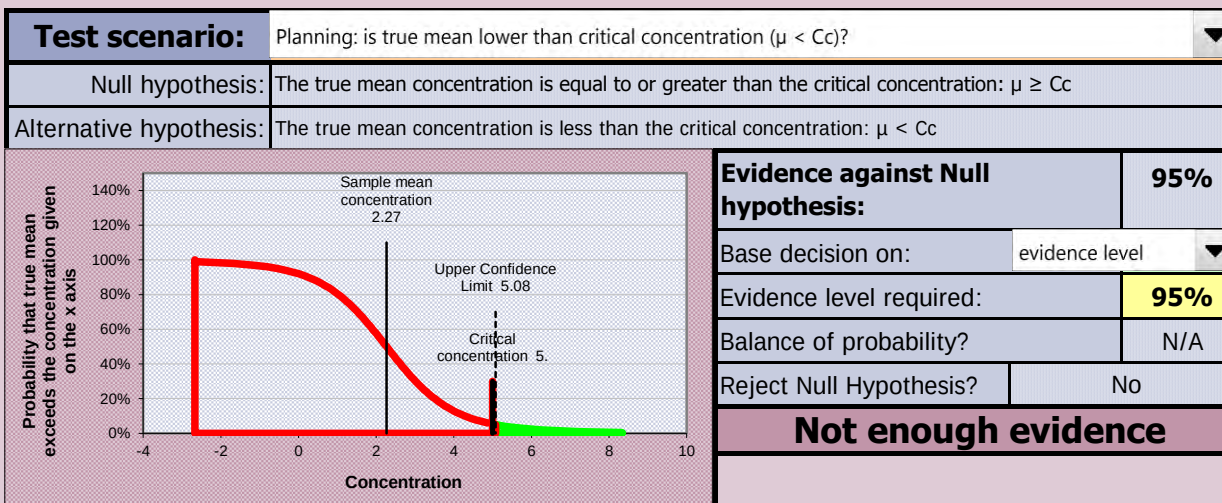
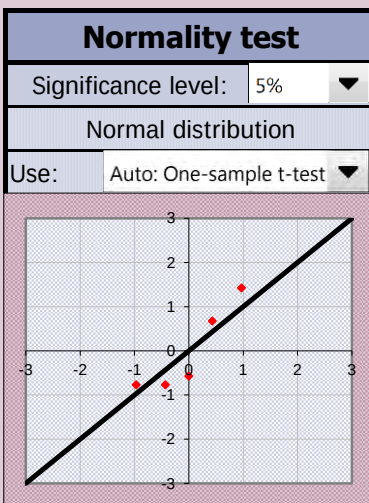
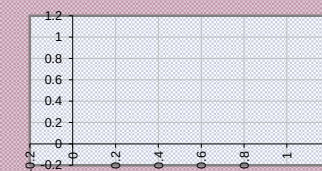
Client/client ref: D & R Property Site ref: Land adjacent to 4 Swapcoat Lane
Project ref: UK15.2001 Data description: Shallow soils - residential

Date: 10-Sep-2015
User details: mjudson

Dataset:	Benzo(a)pyrene ▼
Sample mean, $\bar{X}$	2.27
Sample standard deviation, s	2.9463
Sample size, n	5
Critical concentration, Cc	5



Outliers & non-detects	
Outliers present?	NO
Significance level	5% ▼
Outliers removed?	0
Non-detects	0



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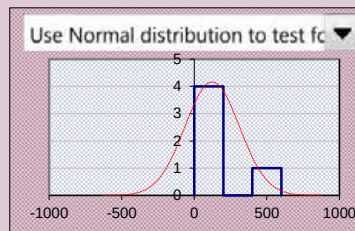
[Go to normality test](#)

Test Results

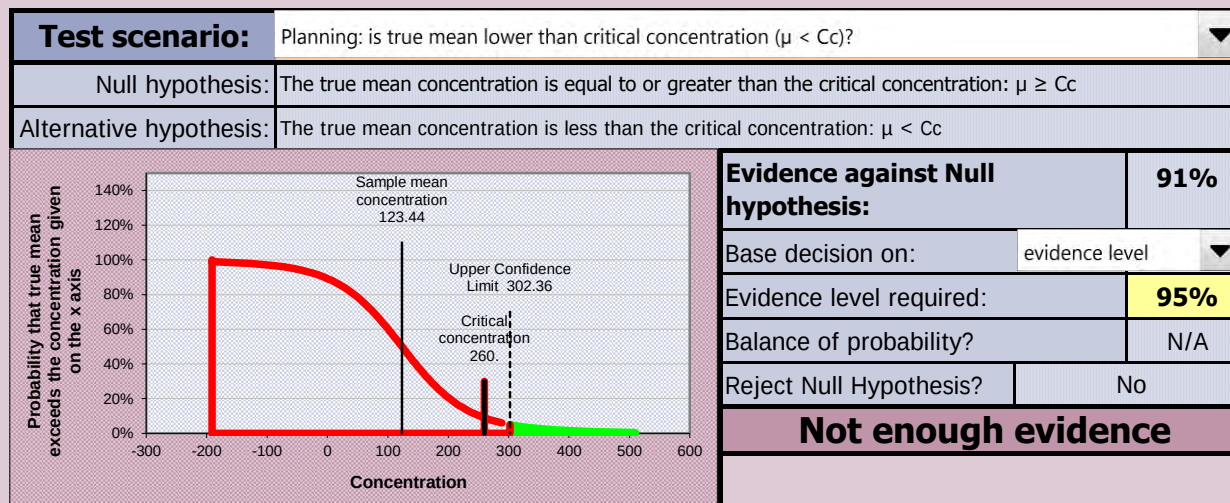
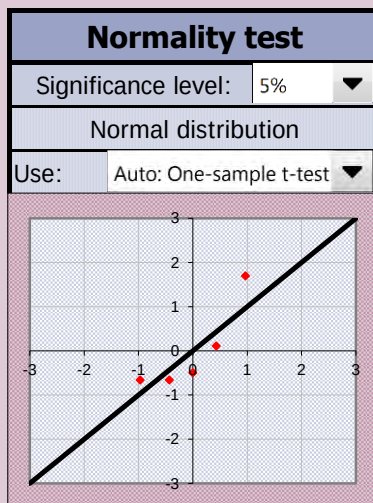
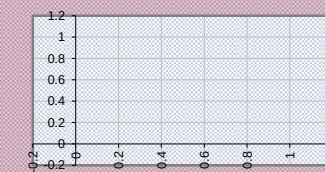
Client/client ref: D & R Property Site ref: Land adjacent to 4 Swapcoat Lane
Project ref: UK15.2001 Data description: Shallow soils - residential

Date: 10-Sep-2015
User details: mjudson

Dataset:	TPH ▼
Sample mean, $\bar{X}$	123.44
Sample standard deviation, s	187.67
Sample size, n	5
Critical concentration, Cc	260



Outliers & non-detects	
Outliers present?	YES
Significance level	5% ▼
Outliers removed?	0
Non-detects	0



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APPENDIX J

Summary of Cover System Calculations

Calculations based on mixed zone (M)	600	mm
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[illegible]

Summary		
	Target Guideline Value 1	Target Guideline Value 2
Number of contaminants	3	3
Number of contaminants with no thickness calculation	0	3
Breakdown - Number for which no TV specified	0	3
Breakdown - Number for which no soil specified	0	0
Breakdown - Number for which no cover specified	0	0
Breakdown - Number for which cover > TV	0	0
Number of contaminants with thickness calculation	3	0
Breakdown - Number for which no cover required	0	0
Breakdown - Number for which cover required	3	0
Overall thickness of cover required	457	0

Design Chart

Cc = 0.00 - 0.25 x Trigger levels

Cc = 0.25 - 0.50 x Trigger levels

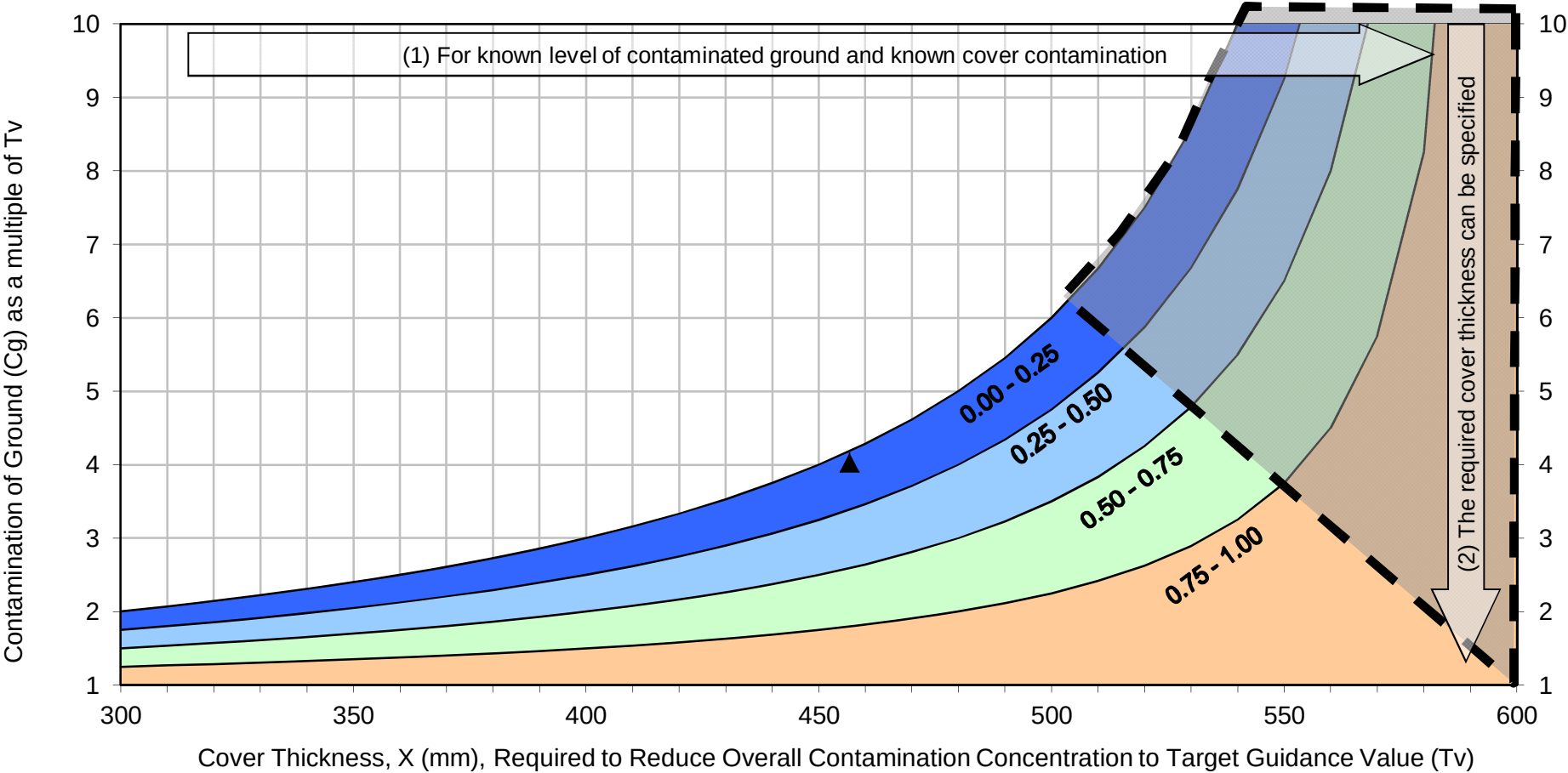
Cc = 0.50 - 0.75 x Trigger levels

Cc = 0.75 - 1.00 x Trigger levels

▲ Target Guideline Value 2

▲ Target Guideline Value 1

If site specific data falls in shaded area consideration should be given to the applicability





APPENDIX K

Method Statement for Unexpected Contamination



METHOD STATEMENT

ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

If at any point during intrusive groundworks at a site, evidence of unforeseen contamination is encountered in the form of significant noxious odours, discolouration, or instability within soils or sheen / discolouration in groundwater, the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment.
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered.
- In cases where EPS consider the unforeseen contamination likely to pose a significant risk of significant harm to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken.
- Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and validation samples obtained and conclusions and recommendations for any further actions considered necessary.
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

EPS Contact Details:

Giles Lock	Director	Tel: 0781 253 9656
Will Evans	Director	Tel: 0781 253 9655

Email: info@epstrategies.co.uk (Automatically forwarded to both of the above and office based personnel.)