

# **TFL\_PSF\_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE LAND AT CHRISTCHURCH ROAD & BRIXTON HILL, LAMBETH, SW2 4AP**

**Site Ref. 901**

## **Preliminary Geotechnical and Geo-Environmental Report**

NOVEMBER 2017

Incorporating

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CONSULTANCY



# LAND AT CHRISTCHURCH ROAD & BRIXTON HILL, LAMBETH, SW2 4AP

## Preliminary Geotechnical and Geo-Environmental Report

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This report dated 03 November 2017 has been prepared for Transport for London (TfL) Transport for London (TfL) (the "Client") in accordance with the terms and conditions of appointment dated 02 May 2017 (the "Appointment") between the Client and **Arcadis Consulting (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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# 1 Introduction

## 1.1 Terms of Reference

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a Geotechnical and Environmental desk study report and limited Site investigation for the land at Christchurch Road and Brixton Hill, Lambeth, London SW2 ('the Site').

TfL is aiming to divest a number of small Sites to enable positive regeneration. The objective of this review is to identify any potential abnormal development costs due to geotechnical and geo-environmental conditions on Site.

The objectives of this review are to:

- Review geo-environmental information regarding the Site and its surrounding area;
- Undertake a limited Site investigation to obtain preliminary information relating to ground conditions with limited testing to inform the assessment of contamination issues and foundation constraints;
- Provide outline information on potential geo-environmental and geotechnical constraints which may impact on the land value or redevelopment potential for the Site; and
- Identify potential development constraints due to geotechnical and geo-environmental conditions on Site.

The Site location is shown in Figure 1 below.

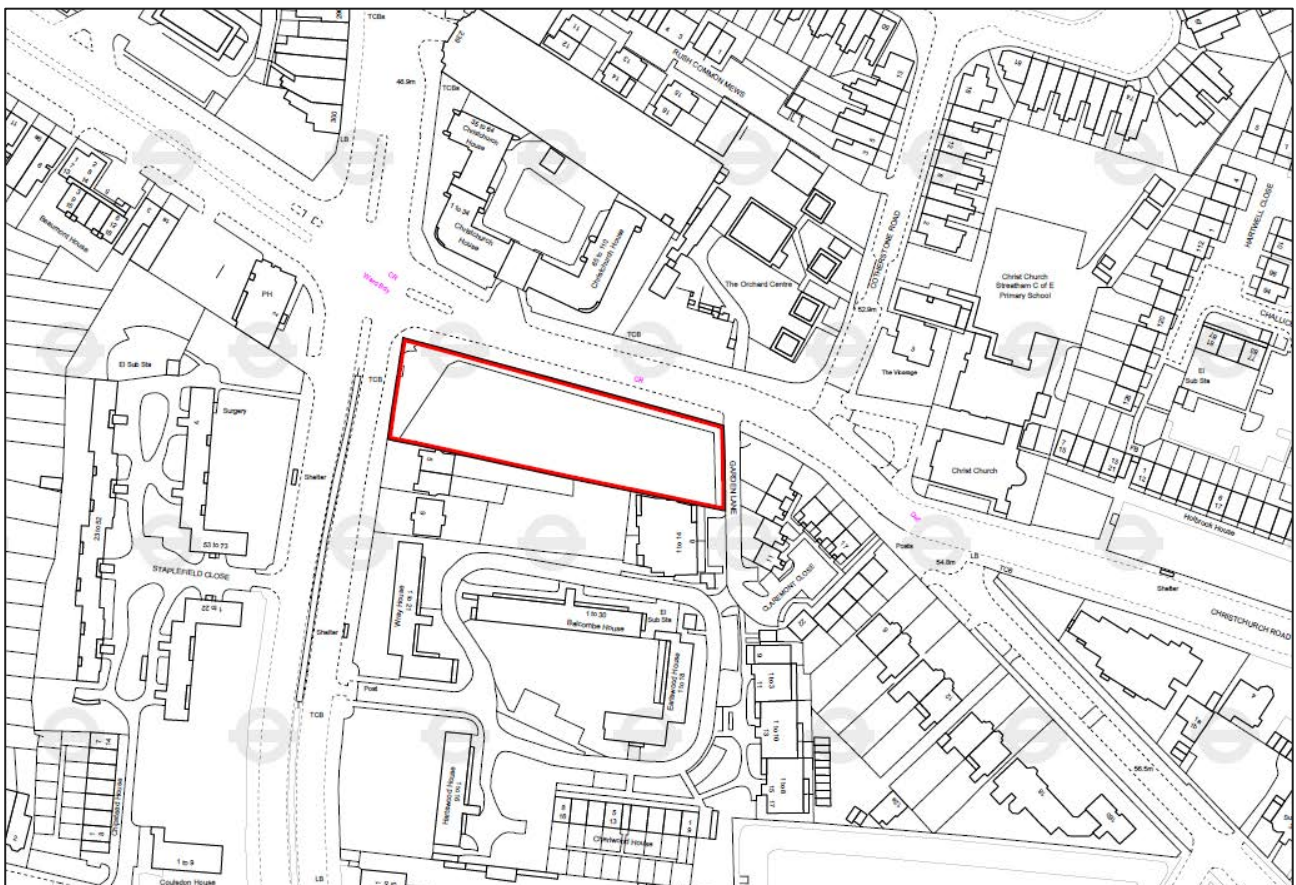


Figure 1: Site Location Plan (extract from TFL drawing (March 2017))

## 1.2 Sources of Information

As part of this report various sources of information have been used and are detailed below:

- The on-line British Geological Survey (BGS) 1:50 000 scale geological map comprising the Site (Ref. 1);
- Historical borehole records available through BGS website;
- Historical Ordnance Survey maps (included in Appendix A);
- Groundsure Environmental Data Reports (Appendix B);
- The Environment Agency (EA) What's in Your Backyard website (Ref. 2);
- The Bomb Sight Project <http://bombsight.org/>; and
- Zetica Regional Unexploded Ordnance (UXO) Map and UXO Desk Study and Risk assessment report (Ref. 3) (Appendix C).

## 1.3 Limitations and Expectations

This report has been prepared for the Client in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by any third party. The copyright of this document, including the electronic format shall remain the property of Arcadis.

This report has been compiled from a number of sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

Ground conditions can only be inferred between test locations and as such localised conditions on Site may vary. Furthermore, observations made at the time of investigations and during the monitoring visit may be subject to variation due to atmospheric, seasonal or other effects.

This report is based on a preliminary ground investigation and the purpose of which is to provide an initial indication of ground conditions and potential ground abnormalities and enable an assessment of contamination issues and foundation constraints. Further development-specific ground investigation and risk assessment will be required.

## 2 Site Setting and History

### 2.1 Site Location

Table 2.1 Details relating to Site Location

Site Location / Address	Land at Christchurch Road and Brixton Hill, SW2 4AP
National Grid Reference	530507,173395 Site
Approximate Site Area	The Site covers an area of approximately 0.32 hectares.
Description of Site	The Site is a rectangular vacant parcel of land covered in vegetation (recently reduced in height) with mature trees in the south and west. The Site is bordered by metal fencing to the north, east and west, and brick walls and wooden fencing to the south. The southern walls and fences are in poor repair in some places.
Topography	Site is generally flat and level, a brick retaining wall is present along the west of the Site by Streatham Hill (A23) which is approximately 0.75m lower than the Site. The surrounding area generally slopes down to the northwest. The Site lies approximately 52m Above Ordnance Datum (AOD).
Surrounding Area	<p>The Site is located in an urban area which is predominantly residential housing. Local amenities such as schools, churches and retail are located near the Site and a car dealership occupies the former LCC tramways depot 60m to the north of the Site (Section 2.2).</p> <p>Christchurch Road (South Circular Road A205) runs along the northern border of the Site beyond which is a six-storey residential block and Orchard Primary School.</p> <p>The A23 Streatham Hill road borders the Site to the west and public house and four-storey residential blocks of flats around Staplefield Close are located beyond.</p> <p>Immediately south of the Site are 19<sup>th</sup> century terraced houses with gardens and three-storey residential flats around Garden Lane and Streatham Hill road to the southeast.</p> <p>To the east are low rise residential properties beyond Garden Lane which borders the Site.</p>

### 2.2 Site History

A review of the available historical Ordnance Survey maps (Appendix A) has been undertaken to assess the historical development of the Site and surrounding areas.

It is not the intention of this report to provide a full history, but to identify those past uses on and within the vicinity of the Site that could have resulted in contamination of the soils and/or waters. Significant changes to the land use of the Site and surrounding areas are summarised in Table 2.2 below.

Table 2.2 History of Site and Surrounding Area

Date	Historical Development (Site and Surrounding Area)
1868, 1870, 1874	The map shows the Site and surrounding area as residential with large areas of open space and occasional ponds. Within the Site, two houses were established in the west of the Site fronting with part of the front gardens extending beyond the boundary and Streatham Hill road beyond. Large ornate gardens are present within the majority of the Site with smaller buildings and possibly greenhouses in the east fronting onto Garden Lane.

Date	Historical Development (Site and Surrounding Area)
	Approximately 100m south of the Site is Lambeth Water Works and reservoir, a nursery, Royal Asylum of St Anne's Society (later becoming a workhouse). A printing office and two shafts are shown approximately 200m south of the Site.
1896	No significant changes are noted within the Site.  St. Pancras workhouse was established at the Royal Asylum approximately 150m south with a Tramway depot having been established beyond and the reservoir had expanded. A tramway is shown servicing Streatham Hill road to the west of the Site.
1916	No significant changes are noted within the Site.  The reservoir has been expanded to the south and is now present 100m to 250m southeast of the Site.
1950, 1951	The map shows the two houses and outbuildings having been demolished and replaced by thirteen small buildings (Christchurch Bungalows) across the Site.  Houses along Christchurch Road opposite the Site to the north have been demolished and replaced with the current u-shaped block of flats. Houses to the east of the Site have also been demolished.  Behind the flats a large Tramway Depot is shown 60m north of the Site. A tank is also present 50m north of the Site.  Approximately 100m south, the reservoir Site has been covered and the workhouse has been demolished and replaced with flats. An electrical substation is shown 120m south of the Site  Some buildings within 100m south of the Site are shown as ruins, likely due to wartime bomb damage.
1954	West of Streatham Hill road (approximately 50m from the Site) flats with an electrical substation off Staplefield Close were developed on previously open ground. The tramway on Streatham Hill had been removed and the tramway depot building 180m to the south had been expanded and is labelled as Brixton Garage. The tramway depot to the north is no longer labelled.
1972	The map shows the two westernmost bungalows on the Site had been demolished and replaced with the current path layout. Streatham Hill road has been widened and now borders the Site to the west.  A surgery is present 70m west of the Site. The tank to the north of the Site is no longer present. An electrical substation is shown 40m to the south.
1985	No significant changes are noted within the Site.  A garage/petrol filling station is shown 100m northwest of the Site (see Table 3.2).
1987	The map shows the bungalows within the Site had been demolished and nothing is shown within the Site boundary.
1991	No significant changes are noted within the Site.  The houses to the east of the Site beyond Garden Lane have been built.
2014	No significant changes are noted within the Site or surrounding area.

Historical land use on the Site was residential, with limited potential contaminant sources, principally Made Ground associated with demolition.

Many of the off-site potentially contaminative land uses identified above are not considered likely to have impacted the Site. These include the Lambeth Water Works and reservoir, the workhouse, the surgery and electrical substations. The mitigating effects of distance from the Site, topography, and/or probable low ground permeability will eliminate potential contaminant pathways from these off-site sources. The tramway depots to the north and south (now a car dealership and bus depot respectively) and associated historical tank, and the historical petrol filling station, are considered to have had the potential to impact the Site.

## 2.3 Unexploded Ordnance

With reference to the Zetica Regional Unexploded Bomb Risk of London (Appendix C), the Site is designated as lying within an area denoted as “low to medium” bomb risk area. The Bombsite website (Ref. 4) indicates that no bombs are recorded as having been dropped within the Site. However, the closest high explosive bombs are recorded approximately 25m west, 70m south, and 70m north of the Site, around Streatham Hill Road.

A UXO desk study and risk assessment has been carried out by for the Site by a specialist consultant (Zetica) to inform the ground investigation. The report is presented in Appendix C and is summarised below:

- During World War II, 16 No. high explosive bombs were recorded within 100m of the Site;
- Significant bomb damage to buildings were recorded in the eastern part of the Site. This may have obscured the presence of unexploded bombs (UXB) during subsequent raids. Therefore, the eastern part of the Site is classified as **Moderate** UXO hazard level; and
- No evidence of significant bomb damage or other UXO hazard indicators are recorded in the remainder of the Site. Therefore, the remainder of the Site is classified as a **Low** UXO hazard level.

For areas of moderate risk, UXO mitigation measures including forward clearance (i.e. down-hole magnetometer) of borehole positions were recommended, and were adopted during the Site investigation.

It is noted that UXO clearance is also recommended for pile construction, but UXO awareness training and non-intrusive clearance methods or Explosive Ordnance Clearance (EOC) engineer supervision is considered prudent for excavations.

Further details are given in [Appendix C](#).

### 3 Physical and Environmental Setting

#### 3.1 Published Geology, Hydrogeology and Hydrology

With reference to the sources of information detailed in Section 1.2, the following information has been obtained.

Table 3.1 Information regarding geology, hydrogeology and hydrology

Geology (Aquifer Status)	<p>Superficial Deposits: Head Deposits (Secondary Aquifer – Undifferentiated)</p> <p>Solid Geology: London Clay Formation (Unproductive Strata)</p> <p>The underlying geological sequence comprises the Lambeth Group, Thanet Sand Formation and White Chalk Subgroup.</p>
BGS Boreholes (within 100m of the Site)	<p>Five historical boreholes are located on-Site, but these are confidential, with a further six within 100m.</p> <p>TQ37SW280 (53m NW) for Greater London Council in 1966 indicates that Made Ground was present to 0.65m, underlain by soft to firm sandy clay with occasional gravel to a final depth of 1.83m.</p> <p>TQ37SW/428 (62m S) for London County Council Housing Division in 1953 indicates that topsoil was present to 0.38m, stony clay to 1.14m, sandy/stony clay to 1.35m, underlain by solid brown clay with blue streaks to the termination depth at 2.12m.</p> <p>TQ37SW429 (96m S) for London County Council Housing Division in 1953 indicates that topsoil was present to 0.66m, underlain by stony brown clay / very sandy clay to 1.57m and solid brown clay with blue streaks to the termination depth at 3.28m.</p> <p>TQ37SW430 (96m S) for London County Council Housing Division in 1953 indicates that topsoil was encountered to depth of 1.22m, underlain by sandy clay to 2.39m, underlain by solid brown clay with blue streaks to the termination depth at 3.18m.</p> <p>The other nearby historical boreholes generally confirmed the sequence above.</p> <p>It is worth noting that borehole TQ37SW682 (350m Northwest) which extended deeper, revealed Superficial Deposits to 2.1m, underlain by London Clay Formation to a depth of 58.9m (-13.1m AOD), below which were clays and sands of the Lambeth Group to a final borehole depth of 63m (-17.2m AOD).</p>
Within a Source Protection Zone	Zone 2 (outer catchment).
Licensed Groundwater Abstraction Points	None are recorded within 500m of the Site, however at 890m north there is one historical and one active abstraction for portable water supply operated by Thames Water Utilities Ltd; these are likely to be associated with the source protection zone and abstraction from the deep aquifer underlying the London Clay.
Surface Water Feature	None identified within 1km of study area
Likely Groundwater Flow Direction	<p>Based on the orientation of the source protection zone and portable water abstraction, it is likely that the groundwater flow in the underlying chalk aquifer is towards the north.</p> <p>Perched groundwater may be present within the Head Deposits.</p>

A preliminary ground investigation has been undertaken at four locations within the Site and the ground conditions encountered during these works are discussed in Section 5.2.



### 3.2 Environmental Public Registers

Public register information from available environmental datasets (Appendix B) for the Site and the surrounding area has been summarised in Table 3.2 below.

It is not the purpose of this section to provide a comprehensive account of the environmental data but only to detail those factors that are or could impact the Site.

Table 3.2. Environmental Data

Data type	Description	Distance (m) and Direction
Radon	The Site is not in a radon affected area, as less than 1% of properties are above the Action level	N/A
Landfill sites	None identified within 1km of the Site	N/A
Fuel Storage and Retail	Streatham Place Jet Filling Station (obsolete)	160m NW
Local Authority Pollution Prevention and Controls	Two identified within 250m of the Site:	
	Pinewood Motor Company – vehicle respraying (revoked)	110m N
	Dry Cleaners (current permit)	123m N
Contemporary Trade Directory Entries	Ten identified within 250m of the Site, including: electrical substations vehicle repair garages bus and coach station salvage dealers	nearest are 38m S and 72m W 111m N and 155m NW 219m S 227m NE

The Site and immediate surrounding area have been subject to various phases of demolition and redevelopment into housing and roads including transport infrastructure (bus and tramway depots) and commercial / retail uses. Made Ground is likely to be present within and immediately adjacent to the Site associated with these activities. This is discussed further in Section 4.

## 4 Preliminary Conceptual Site Model

Geo-environmental assessments are required in accordance with current regulatory guidance to consider the significance of potential contamination in terms of plausible source-pathway-receptor contaminant linkages. As part of this process, it is necessary to develop a conceptual model of these potential contaminant linkages by identifying the potential contamination sources, sensitive receptors and any potential exposure pathways. A risk assessment is then undertaken to determine the likelihood and significance of these potential contaminant linkages.

### 4.1 Potential Contaminant Sources

Based on the information obtained from the existing data and information obtained from historical and environmental research and the Site walkover, there are a number of potential contaminative sources identified on and off site. These are detailed in Table 4.1 below.

It should be noted that it is considered unlikely that all these substances would be present at significant concentrations across the Site.

Table 4.1: Potential Sources of Contamination on Site

Source	Potential Contaminants
<b>On Site</b>	
Made Ground associated with demolition and redevelopment of residential properties.	Metals, polyaromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), asbestos, ground gas and vapours.
London Clay	Sulphates (potential aggressive ground conditions for concrete)
<b>Off Site</b>	
Made Ground associated with demolition and redevelopment adjacent to the Site	Metals, PAH, TPH, asbestos, ground gas and vapours
Petrol filling station (c.1985 to 2006) 100m northwest	PAH, TPH, volatile organic compounds (VOC)
Current and historical - vehicle garages and transport depots, repair and respray facilities, tramway and tanks within 100m	PAH, TPH, VOC

### 4.2 Potential Receptors

The proposed land use is currently unknown. Based on the Site's current setting and location, it has been assumed that residential properties without gardens (such as flats / apartments) with limited areas of soft landscaping are likely. However, as a precautionary approach, the residential end-use scenario with gardens, which is more conservative, has been used for this initial assessment.

#### 4.2.1 Human Health

- Site Users (residents, visitors, maintenance workers and contractors).

Contamination risks to construction workers are not appraised by chronic (long term) exposure human health risk assessments. There are no appropriate published criteria applicable to assessment of potential risks to construction workers. The potential risks should be addressed by a Site-specific construction workers risk assessment and implementation of appropriate health and safety measures, to adequately mitigate any potential risks. All works should be conducted in accordance with the CDM Regulations (2015) or any other relevant guidance. Construction workers are not considered further in this assessment.



## 4.2.2 Controlled Waters

- Groundwater beneath the Site – The Head Deposits are a Secondary (undifferentiated) Aquifer.
- The Site is within a Groundwater Source Protection Zone (SPZ) 2 and there is an active groundwater abstraction for potable water supply approximately 890m north. The aquifer associated with this abstraction is likely to be associated with the Thanet Sand and/or Chalk which is overlain by circa 50m thick layer of London Clay. Therefore, given the depth, this is not considered further.

## 4.2.3 Buildings

- Underground /structures/services (water pipes, concrete, foundations).
- Proposed buildings.

## 4.3 Potential Pathways

Potential pathways are the routes that link the receptor to the contamination source. The potential pathways for this Site are summarised in Table 4.2.

Table 4.2: Potential Contaminant Pathways

Receptor	Description
Human Health (residents, visitors, maintenance workers and contractors)	<p>Accidental ingestion of contaminants within soil, water and dust</p> <p>Ingestion of contamination in home-grown produce</p> <p>Inhalation of dust, vapours and ground gases</p> <p>Dermal contact with contaminants within soil, water and dust</p>
Controlled Waters (Secondary (undifferentiated Aquifer)	<p>Leaching of potential contaminants in soil or Made Ground into groundwater.</p> <p>Vertical migration of soluble contaminants through the unsaturated zone into groundwater (head deposits) beneath the Site.</p>
Buildings	<p>Direct contact of building services or foundations with contaminants in the soil and Made Ground, including sulphate attack.</p> <p>Gas accumulation in confined and poorly ventilated spaces.</p>

## 4.4 Summary

Terraced housing which formed part of the existing row of early housing along Streatham Hill was recorded in the west of the Site between the 1800s and 1940s with some smaller buildings present in the east. The terraced housing was demolished sometime after WWII (possibly as a result of the bomb damage that was recorded nearby, which affected the eastern part of the Site, see Section 2.3) when 13 bungalows were developed within the Site. Two of the bungalows were removed by 1972 when Streatham Hill road was widened, and the Site was cleared by 1987. Made Ground is therefore anticipated on the Site which could be a source of contamination. Human exposure could occur in gardens or soft landscaped areas, especially if soils are disturbed by activities such as digging/gardening. Ground gas / vapours could be generated by the Made Ground which could accumulate in confined spaces and poses potential risk to future Site users.

Historical and current off-site potential sources of contamination include a petrol filling station and vehicle garages and transport depots from 100m to the north and west of the Site.

The Site is underlain by a Secondary (undifferentiated) Aquifer (Head Deposits) and groundwater may be perched within this material.

Based on the historic use of the Site and surrounding area, and the geology present, gross contamination capable of impacting the built environment (foundations and services) is unlikely to be significant.

The London Clay is a source of naturally occurring sulphates, which could impact buried concrete.

Near surface investigation comprising dynamic sampling completed by Arcadis to assess the chemical properties of the existing near surface soils and to characterise the underlying subsurface soils is discussed in the following sections.

## 5 Preliminary Ground Investigation

### 5.1 Scope and Rationale of Investigation

A preliminary ground investigation was undertaken on the 19<sup>th</sup> June 2017 to assess the shallow ground conditions at four locations across the Site. An exploratory hole location plan is included within Appendix D.

#### 5.1.1 Rationale

The development of the preliminary CSM highlighted possible pollutant linkages with respect to the proposed future development. The ground investigation was designed to provide a better understanding of these potential pollutant linkages to facilitate a preliminary contamination and foundation assessment and to provide further recommendations, as necessary. The objectives of the investigation were therefore to:

- Characterise the Made Ground, Head Deposits and London Clay;
- Establish a preliminary understanding of the geo-environmental regime (soil only);
- Establish the preliminary groundwater conditions beneath the Site;
- Establish the preliminary soil borne gas regime;
- Preliminary waste classification based on the *HazwasteOnline* tool; and
- Identify the geotechnical properties of the natural soils.

It should be noted that as part of the preliminary nature of the investigation, testing comprised a general suite of contaminants which were used within the preliminary assessment. No Volatile Organic Compounds (VOCs) were tested as no olfactory evidence of contamination was noted during the works and, in addition, no asbestos quantification testing, leachates or groundwater testing was included.

#### 5.1.2 Scope

The ground investigation comprised:

- 4No. windowless sampling boreholes placed to provide general coverage within the Site;
- Chemical testing – 9No. soil samples were tested for the following suite; arsenic, boron, cadmium, chromium (total), chromium (vi), copper, lead, mercury, nickel, selenium, zinc, PAH (16 speciated), pH, sulphate (water soluble) and asbestos. In addition, 2 samples of Head Deposits and London Clay were tested for sulphates in accordance with BRE SD1 (Ref. 5);
- 3No. soil samples were analysed for moisture content and Atterberg limits, 2No. samples were tested for particle size distribution (wet sieve);
- Gas and groundwater monitoring standpipes were installed into two of the boreholes upon completion with response zones targeting the Head Deposits and one return monitoring visit for ground gas concentrations and groundwater level monitoring.

An exploratory hole location plan, exploratory hole logs, and chemical and geotechnical laboratory test results are presented within Appendix D.

### 5.2 Ground Conditions Encountered

The windowless sampled boreholes were spread approximately equally over the Site to provide even coverage; as shown on Drawing 0002-UA009686, the logs, which are presented within Appendix D revealed:

- Boreholes WS101 to WS103 were drilled to 5.45m terminating within the London Clay. WS104 was terminated within the hand dug pit at 1.0 m bgl due to a brick structure.
- Made Ground was encountered from the surface to 0.9m in WS101 to WS103; it was described as comprising brown slightly clayey slightly gravelly sand with abundant roots. The gravel included flint, brick, slate, ceramics and concrete.
- The Made Ground is underlain by Head Deposits were encountered from 0.9m to depths of 3.0m (WS01), 3.3m (WS103) and 3.6m (WS102). The Head Deposits comprised soft, brown, slightly gravelly clay overlying yellowish brown sand (WS101) and gravelly sand (WS103), or firm (becoming stiff) brown clay with occasional sand pockets (WS102). Towards the base of the Head Deposits they are described as gravelly clay with lenses of clayey or sandy gravel in WS102 and WS103.
- The London Clay formation was encountered underlying the Head Deposits and was not proven beyond 5.45m. It was generally described as stiff, fissured brown mottled grey clay, indicative of weathered material.

- In WS104, Made Ground comprising gravelly sand was recorded to 0.1m which was underlain by light brown gravelly sand with some flint, within a brick structure. Chiselling and breaking out of the structure using hand tools proceeded to 1.0m bgl. A sketch of the void created is shown as Drawing 101-UA009686 in Appendix D. The excavation appeared to be within or next to a relict brick structure as bricks were observed on all four sides of the inspection pit. The pit was terminated at 1.0m when further progress was not possible. The full depth of the brick structure was not confirmed.
- No groundwater was encountered during excavation of the exploratory holes with the exception of a slight seepage at 2.65m in WS103 associated with the gravel layer from the Head Deposits at this location.
- No visual or olfactory evidence of contamination was encountered during the investigation.

### 5.3 Geotechnical Laboratory and Field Testing

#### 5.3.1 Made Ground

Samples of the Made Ground were not tested for geotechnical properties.

#### 5.3.2 Head Deposits

The general geotechnical properties for the Head Deposits are summarised below:

Table 5.3 Head Deposits – Geotechnical Testing Summary

Parameter	Number of Tests	Values	Average	Assessment
Natural Moisture Content (%)	2	29	-	-
Liquid Limit (%)	2	84 to 89	86.5	Very high plasticity clay Modified plasticity index of high volume change potential
Plastic Limit (%)	2	29 to 30	29.5	
Plasticity Index (%)	2	55 to 59	57	
% passing 425µm sieve	2	79 to 100	89.5	
SPT N Values – coarse soils	2	23 to 27	25	Medium dense
SPT N Values – fine soils	6*	8 to 22	12	Soft to stiff (firm)

\* The SPT at WS103 3.0m bgl terminated within the London Clay. The N value was 13.

Two particle size distribution tests were undertaken on samples of the granular Head Deposits. In WS101 at 2.0m and at WS103 at 2.0m the material is described as a clayey fine to medium sand.

#### 5.3.3 London Clay

The general geotechnical properties for the London Clay are summarised below:

Table 5.4 London Clay – Geotechnical Testing Summary

Parameter	Number of Tests	Values	Average	Assessment
Natural Moisture Content (%)	2	29 to 32	30.5	-
Liquid Limit (%)	2	91 to 95	93	Extremely high plasticity clay. Modified plasticity index of high volume change potential.
Plastic Limit (%)	2	28 to 32	30	
Plasticity Index (%)	2	63	-	
% passing 425µm sieve	2	100	-	

Parameter	Number of Tests	Values	Average	Assessment
SPT N Values	7	8 to 25	14	Soft to stiff (firm)

## 5.4 Concrete Assessment

Chemical testing of the two soil samples for concrete classification (Ref. 5) to provide a preliminary assessment of the potential for aggressive ground conditions. The Design Sulphate Class (DS) and Aggressive Chemical Environment for Concrete (ACEC) class are summarised in Table 5.5 below.

Table 5.5 Concrete Assessment

Material	Samples	Water soluble sulphate (2:1) as SO <sub>4</sub> (mg/l)	Design Sulphate Class	Acid-soluble Sulphate (%)	Total Potential Sulphate (%)	Oxidisable Sulphides (%)	Soil pH	Assessment Class
Made Ground	WS101 0.30m	1.77	DS-1	-	-	-	8.2	AC-1
	WS101 0.50m	<1.25					7.8	
	WS102 0.30m	73.8					8.2	
	WS102 0.50m	2.88					7.9	
	WS103 0.30m	1.31					8.0	
	WS103 0.50m	49.7					8.2	
	WS104 0.30m	117					8.4	
	WS104 0.50m	18.1					8.3	
Head Deposits	WS102 2.0-3.0m	76.1	DS-1	0.028	0.011	0.017	8.2	AC-1
London Clay	WS101 4.0-4.45m	146	DS-1	0.046	0.017	0.029	7.2	AC-1

The Site was assessed as a location where disturbance of pyrite-bearing natural ground could result in additional sulphate. Mobile groundwater was assumed for the assessment.

The results indicate that the Head Deposits and London Clay at the Site are unlikely to present a risk of aggressive ground conditions (DS-1 and AC-1). This should be confirmed with additional testing during a development-specific ground investigation in accordance with current guidance (Ref. 5).

## 6 Preliminary Qualitative Risk Assessment

### 6.1 Human Health Screening

The proposed use is not currently known and therefore, as a preliminary assessment, the chemical test results have been screened against the LQM / CIEH S4ULs (Ref. 6) for a residential with plant uptake scenario. This is considered to be suitably conservative and representative of, for example, residential housing with private gardens. Exceedances are summarised in Table 6.1.

Asbestos fragments or fibres were not visually identified during the investigation however, asbestos cement board debris (chrysotile) was detected by the laboratory in samples WS103 E1 (0.3m bgl) and E2 (0.5m bgl) located in the centre of the Site.

Table 6.1. Exceedances of the human health screening criteria in soils

Determinant	Location	Screening Criteria (mg/kg) Residential with plant uptake	Concentration (mg/kg)
Asbestos	WS103 0.30m bgl WS103 0.50m bgl	N/A	Chrysotile- Hard/Cement Type Material, Sheeting/Board Debris
Benzo(b)fluoranthene	WS103 0.30m bgl WS103 0.50m bgl	2.6	3.0 4.6
Benzo(a)pyrene	WS103 0.30m bgl WS103 0.50m bgl	2.2	2.6 3.3
Dibenz(a,h)anthracene	WS101 0.30m bgl WS102 0.30m bgl WS103 0.30m bgl WS103 0.50m bgl	0.24	0.27 0.31 0.39 0.60
Lead	WS101 0.30m bgl WS101 0.50m bgl WS102 0.30m bgl WS102 0.50m bgl WS103 0.30m bgl WS103 0.50m bgl WS104 0.30m bgl WS104 0.50m bgl	310*	540 830 690 870 390 450 2,000 4,400

\* screening criteria for lead from C4SL value (DEFRA)

Lead exceeded the screening criteria for a residential without plant uptake land use in all eight samples of Made Ground tested. Elevated concentrations were recorded in WS104 which is located in the southwest of the Site. Four samples of Made Ground from WS101 to WS103 also marginally exceed the screening criteria for three PAH compounds and asbestos cement board fragments were detected at WS103.

Whilst the development proposals are unknown, it is likely that to facilitate the development the Made Ground or part of it will be removed. The source removal, the non-volatile nature of the contaminants will sever the potential pathway and, therefore, may mitigate the risk to future human health receptors where buildings or hardstanding is proposed. In areas of gardens or soft landscaping, a clean cover system may be required., although this is based on the limited testing available and further testing should be undertaken to confirm the most appropriate mitigation measures.

## 6.2 Soil Waste Assessment

The chemical results from the nine soil samples tested, comprising eight from the Made Ground and one from natural soils (Head Deposits), were screened using HazWasteOnline software to determine whether excavated materials requiring off-site disposal would potentially be classified as hazardous or non-hazardous waste.

The concentration threshold for HP7: Carcinogenic was exceeded in WS104 0.3 due to the concentration of lead (2000 mg/kg). The concentration threshold for HP7: Carcinogenic, HP10 Toxic for Reproduction and HP14: Ecotoxic was exceeded in WS104 0.5m due to the concentration of lead (4400 mg/kg). WS104 0.3m and WS104 0.5m are therefore classified as **Hazardous**. Waste acceptance Criteria (WAC) testing should be undertaken of the material to be disposed of prior to removal off-site to inform the potential disposal options.

The List of Wastes Code used in the assessment for non-hazardous material is 17.06.04; soils and stones other than those mentioned in 17.05.03, whilst the code applicable for hazardous material is 17.05.03.

Asbestos was identified in WS103 0.3 and WS103 0.5. Asbestos quantification analysis has not been undertaken at this stage. For the waste to be classified as Hazardous with regard to asbestos, greater than 0.1% loose asbestos fibres would need to be identified. Therefore, until quantification has been undertaken, the samples have been classified as **potentially hazardous**. WAC testing and asbestos quantification analysis of the actual material to be disposed of should be undertaken prior to removal off-site to inform the potential disposal options.

The other 5 samples (WS101 0.3, WS101 0.5, WS102 0.3, WS102 0.5 and WS101 1.0) are classified as **non-hazardous** based on the determinants analysed. It is likely that arisings represented by these samples would be suitable for disposal as inert waste, subject to the results of Waste Acceptance Criteria (WAC) testing.

It should be noted that to secure disposal at a landfill site, a waste management facility may require testing of the actual material that is to be disposed of off-site prior to acceptance, and that there is no obligation on a landfill operator to accept the waste.

The developer has a statutory responsibility under the Duty of Care Regulations to abide by the Environmental Protection Act 1990 to ensure that contaminated soils and waste are disposed of off-site to a suitably licenced waste management facility in a safe and approved manner. To comply with the Duty of Care all wastes taken off-site must be handled by a registered waste carrier and be accompanied by a consignment note that describes the waste.

Any imported soil proposed for fill or landscaping should be suitable for its intended use (i.e. not present an environmental risk) and its condition validated as necessary.

The results of the HazWaste assessment are attached in Appendix D.

### 6.3 Ground Gas Assessment

One monitoring visit was carried out on the 26th June 2017 for monitoring standpipes installed in WS101 and WS102 (with response zones targeting the Head Deposits). The results are summarised below.

Table 6.2. Ground Gas and Groundwater Monitoring Results

Parameter	Unit	WS101	WS102
Gas flow rate	l/h	<0.1	<0.1
Methane (CH <sub>4</sub> )	% v/v	<0.1	<0.1
Carbon Dioxide (CO <sub>2</sub> )	% v/v	2.0	1.8
Oxygen (O <sub>2</sub> )	% v/v	19.1	18.7
Carbon Monoxide (CO)	ppm	<1	<1
Hydrogen Sulphide (H <sub>2</sub> S)	ppm	<1	<1
Volatile Organic Compounds (VOC)	ppm	<1	0.8
Depth to groundwater	m bgl	DRY	DRY

Note: Ground gas concentrations monitored for a minimum of 90 seconds or until stabilised. Maximum readings are given for all parameters except oxygen for which the minimum value is shown.

The gas monitoring revealed concentrations of carbon dioxide to a maximum of 2.0 % v/v. Concentrations of methane, hydrogen sulphide and VOCs were below detection limits as were gas flow rates.

An initial assessment was carried out in accordance with CIRIA C665 (Ref. 7). This indicated that the highest gas concentration (carbon dioxide) of 2.0 % and maximum flow (taken as the detection limit of <0.1 l/hr) result in a gas screening value (GSV) of 0.002 l/hr for carbon dioxide, potentially, placing the Site within 'Characteristic Gas Situation 1' (very low risk) based upon modified Wilson and Card methodology (Ref. 7) or Green in accordance with NHBC guidance (Ref. 8).

For preliminary assessment purposes and based on the development of private housing type buildings and CS1 classification, no specific gas protection measures would be required.



## 6.4 Refined Conceptual Site Model

Exceedances of the screening values have been recorded in the soils tested including lead and PAHs, and asbestos-containing materials were identified in samples of the Made Ground. The following refined CSM has been prepared based on the available information.

Table 6.3 Refined Conceptual Site Model

Source	Pathway	Receptor
On-Site Made Ground, lead, PAH and asbestos	Accidental ingestion of contaminants within soil, water and dust	Human Health (residents, visitors, maintenance workers and contractors)
	Ingestion of contamination in home-grown produce	Human Health (residents)
	Inhalation of dust	Human Health (residents, visitors, maintenance workers and contractors)
	Dermal contact with contaminants within soil, water and dust	
	Leaching of PAH and metals from Made Ground	Secondary (undifferentiated) aquifer (Head Deposits)
	Direct contact of building services or foundations with contaminants in the soil and Made Ground.	Buildings
Sulphates in London Clay	Direct contact with sulphates leading to concrete degradation.	Buildings
Made Ground	Gas accumulation in confined and poorly ventilated spaces.	Buildings
		Human Health (residents, visitors, maintenance workers and contractors)

## **7 Waste Management and Potential Development Constraints**

### **7.1 Waste Management**

Consideration should be given to disposal of waste soils / Made Ground generated by the development. Chemical testing of soils / Made Ground is likely to be required to inform a waste classification assessment and determine the potential disposal options. It should be noted that the waste contractor may require testing of the actual material to be disposed prior to acceptance, and that there is no obligation on a landfill operator to accept the waste.

Soils suspected of being contaminated should be segregated from soils which appear to be 'clean' and should not be used elsewhere on the Site as fill or landscaping unless they can be proven to be fit for purpose.

Imported topsoil for landscaped areas should be clean, fit for purpose and validated as necessary.

The preliminary waste assessment carried out indicates that some of the Made Ground may be classed as hazardous based on the presence of asbestos and elevated lead concentrations. The remainder of the Made Ground is classified as non-hazardous, and would likely be suitable for disposal as inert waste, subject to the results of Waste Acceptance Criteria (WAC) testing.

### **7.2 Potential Development Constraints**

The Site is located between Streatham Hill road (A23) to the west and Christchurch Road (South Circular) to the north within a mixed residential / commercial area with local amenities including retail units. The historical review reveals former uses of the Site has been limited to two phases of residential development and some current and historical off-site sources have been recorded (petrol filling stations, garages, trams and depots being). A preliminary ground investigation has been carried out and gross contamination was not encountered, although elevated concentrations of some contaminants and asbestos were recorded associated with the Made Ground.

Subsurface obstructions (possible brick foundations) were encountered in WS104 in the southwest of the Site, possibly associated with the original early 19<sup>th</sup> Century terraced housing within was present in the west.

From experience, the potential for remediation to be required should be limited given the Site has not previously been used for industrial or commercial use and the findings of the initial ground investigation information.

The following potential environmental and geotechnical conditions have been identified that will warrant further consideration and/or implementation:

- Buried obstructions (foundations and services) associated with the former buildings are present in the southwest and may be elsewhere on Site and may require removal prior to redevelopment.
- Buried services may require removal, protection, diversion or chasing and plugging at the boundary;
- Gross contamination is not anticipated however, provisions should be allowed for the potential for unforeseen contamination (this can be a planning requirement);
- Asbestos has been identified within one of the three Made Ground samples tested and further testing and assessment including quantification testing will be required;
- No gas protection measures are expected to be required, but this has been based on one return visit, therefore further monitoring and discussions with Building Control are recommended. If CS1 conditions are confirmed, no gas protection measures would be required;
- Sulphate resistant concrete is not expected to be required based on a preliminary assessment of two samples, however this should be confirmed during a development-specific ground investigation;
- Contaminant resistant water supply pipes may be required;
- Provision of clean cover system in landscaped areas are likely to be required;
- Design specific ground investigation and consultancy advice to support planning obligations will be required; and
- UXO mitigation measures.

## 8 Geotechnical Considerations

Ground conditions encountered within the four exploratory holes reveal Made Ground to a maximum depth in three of the holes to 0.9m. The Made Ground is underlain by Head Deposits comprising interbedded layers of soft to firm gravelly clay and loose to medium dense clayey sand and clayey sandy gravel to 3.0m to 4.6m bgl (49.4m to 50.4m AOD). The London Clay Formation underlies the Head Deposits, comprising firm to stiff fissured clay.

Groundwater was encountered as a slight seepage within the Head Deposits at 2.4m bgl (50.05m AOD) in WS103, reference to the exploratory hole log reveals it is likely to be associated with a gravel band recorded at this depth. The proposals for the Site including structure layouts and loadings are unknown therefore the following has been provided for indicative purposes only.

Potential founding solutions will be dependent on the thickness of Made Ground and the geotechnical properties of the natural deposits. The Made Ground is generally considered unsuitable for foundations due to its variable composition and its potential for high total and differential settlement. The ground investigation has confirmed that the head deposits are interbedded with soft loose bands suggesting conventional shallow foundations are unlikely to be suitable. Trench fill foundations are also not considered suitable given the depth to the London Clay. Depending on the final proposals for the Site a piled solution bearing onto the London Clay is likely to be required.

WS104 encountered a buried obstruction in the southwest of the Site. Further obstructions may also be present elsewhere. Ground disturbance caused by the removal of historical structures may increase the thickness of Made Ground already present beneath the Site locally.

There are currently several mature trees on Site. Consideration will need to be given to trees that may have been removed or the planting of future trees when considering the depths of the foundations (Ref. 9). The fine-grained materials of the Head Deposits and London Clay include very high plasticity clay which have a high potential for shrinkage and swelling.

Sulphates within the London Clay can cause sulphate attack on concrete structures and sulphate resistant concrete may therefore be required. An initial assessment (Section 5.4) indicates a DS-1, AC-1 classification. However, this should be confirmed by further investigation during the design phase.

The potential for relict shear slip surfaces within the London Clay should also be considered during further investigation / design.

Consultation with external stakeholders (e.g. highways) may be required during design.

Buried services were not detected on Site, however, the potential for live or abandoned services on Site cannot be discounted.

## 9 Conclusions and Recommendations

The Site is a vacant parcel of land currently covered in turf with several mature trees in the south and west. The Site is located south of Christchurch Road (South Circular) within a mixed residential / commercial / retail area. The A23 and Garden Lane adjoin the Site to the west and east, respectively and terraced housing and residential flats are present immediately to the south. Terraced properties were recorded in the west before being removed and replaced with bungalows which occupied the entire Site until circa 1980s when they were demolished. Potential off-Site sources including a petrol filling station, garages, trams and depots have been recorded.

A preliminary Site investigation has been undertaken comprising four window sampling boreholes (one of which was terminated due to a brick obstruction within the Made Ground) to investigate ground conditions and to provide an indication of the levels of contaminants in the Site.

### 9.1 Design Considerations

Potential risks to human health, controlled waters and the built environment have been identified from on-Site Made Ground and hydrocarbons and vapours are possible risks to human health from the off-Site sources. Gross contamination was not encountered during the preliminary ground investigation, however, concentrations of contaminants (lead, PAH and asbestos) within the Made Ground were recorded in excess of applicable guideline values. The proposals for the Site are unknown and therefore a conservative assumption of residential housing with private gardens has been used for the assessment. A clean cover system to sever potential pathways to future end-users may be required in gardens or areas of soft landscaping. This would be subject to confirmation by additional testing of near-surface soil in these areas, once known.

Further development-specific ground investigation will be required to confirm the requirements for (but not limited to):

- Confirm concrete design for sulphate resistance for foundations and services;
- Determine the extent and depth of buried obstructions within the Site;
- Further gas monitoring and assessment of the potential risk of ground gases to receptors, and to determine whether gas protection measures would be required for future development; and
- Consideration of shrinkage and swelling, trees, potential for relict shear slip surfaces and buried services may need to be considered during the design.

### 9.2 Construction Considerations

During construction, a watching brief should be undertaken to identify the presence of any unforeseen contamination. If contamination is encountered, all works should cease until the advice of a suitably qualified professional can be sought.

Construction / demolition workers should use appropriate PPE and follow the site-specific contractors risk assessment which should include risks to human health from potential contamination. Due to the historic phases of development and demolition (and identification of asbestos containing materials in the preliminary ground investigation) consideration should be given to the presence of asbestos within the Made Ground.

Good site management practices should be adopted during the construction phase such as covering stockpiles to minimise surface runoff/dust creation.

The west and central areas of the Site are considered to have a 'moderate' potential of encountering unexploded ordnance (UXO). For future excavations or piling which may be proposed within the east of the Site (Moderate UXO hazard level), a non-intrusive UXO detection survey, or monitoring by an Explosive Ordnance Clearance (EOC) Engineer where a survey is impractical, is considered prudent to mitigate the potential UXO risks. Further details are in the UXO report in Appendix C.

Material re-used on site would need to be assessed in terms of its chemical and geotechnical suitability for reuse as engineering or landscaping fill. If off-site disposal is required, a waste assessment for the Made Ground and shallow soil materials would need to be undertaken to determine whether they are classified as hazardous or non-hazardous waste. Based on a preliminary assessment, Made Ground associated with the structures in the west of the Site may be hazardous due to elevated lead concentrations, and other Made Ground material may be hazardous depending on the quantity of asbestos present.

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**APPENDIX A**

**Historical Maps**



#### Site Details:

Land at Christchurch Road &  
Brixton Hill, Lambeth, SW2 4AP

**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1868

**Scale:** 1:2,500

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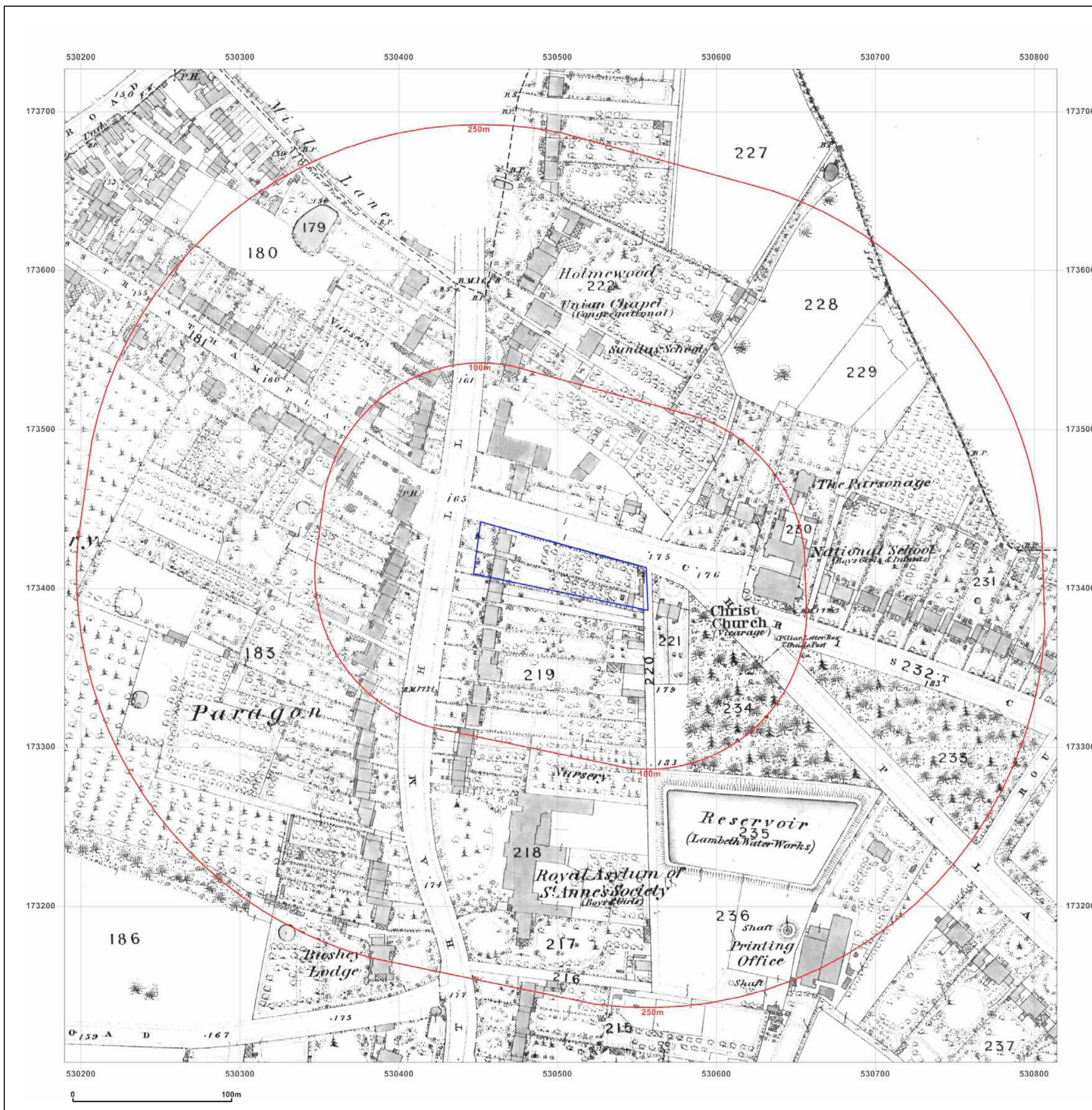


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**Client Ref:** PO0067007-1  
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**Map Name:** County Series

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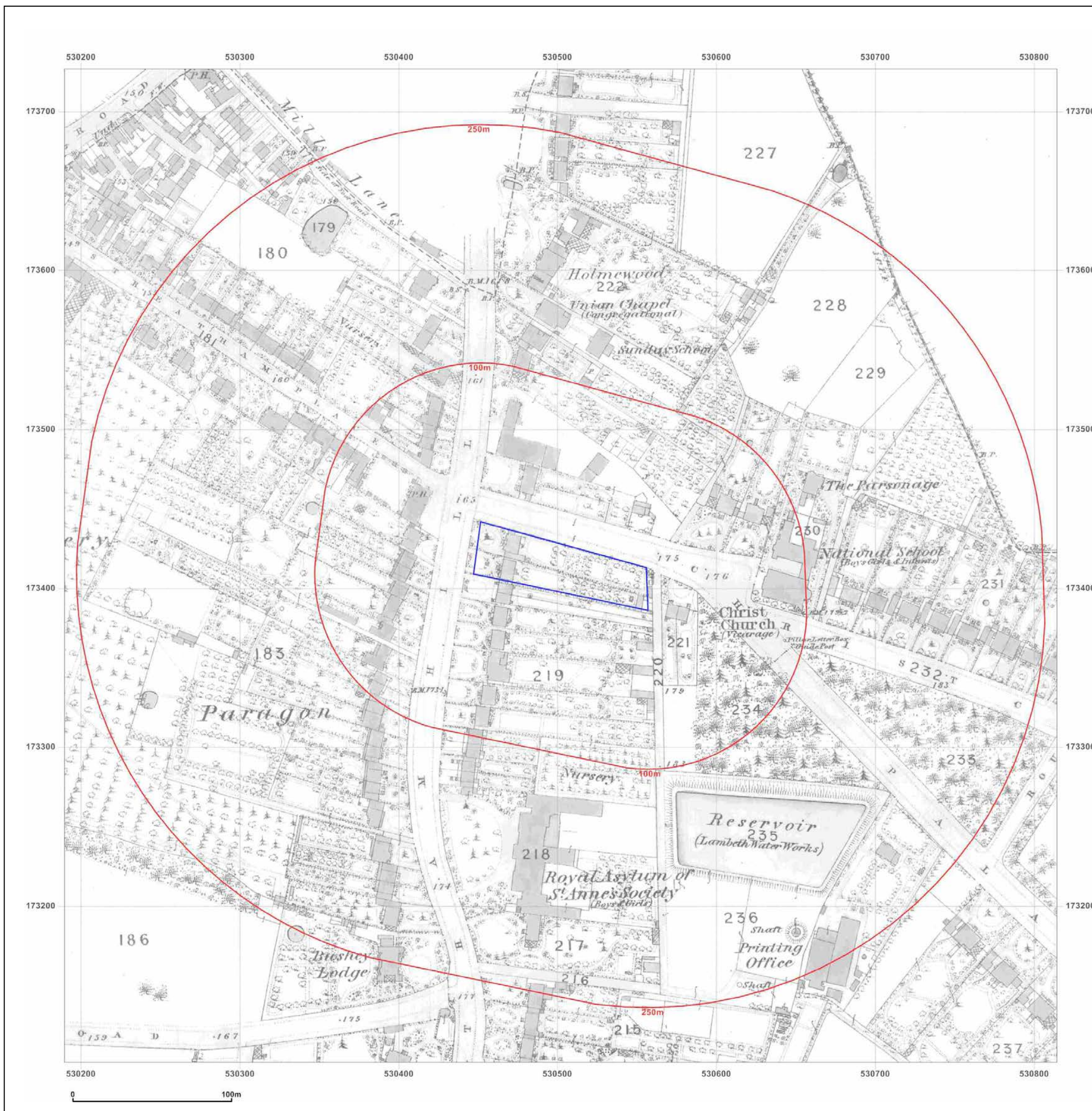


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**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

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**Map date:** 1874

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
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**Map Name:** 1056 Scale Town Plan

**Map date:** 1874

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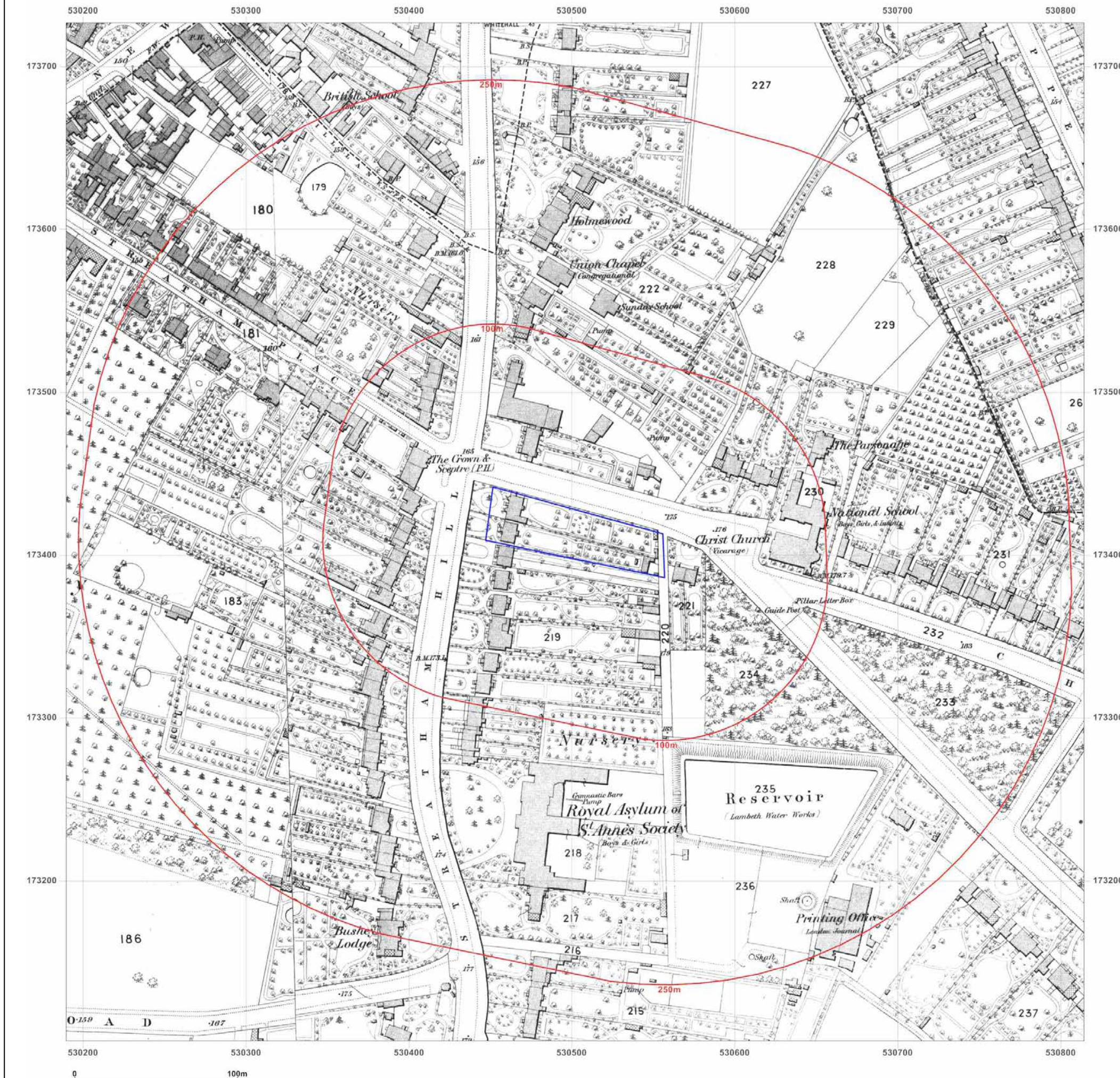


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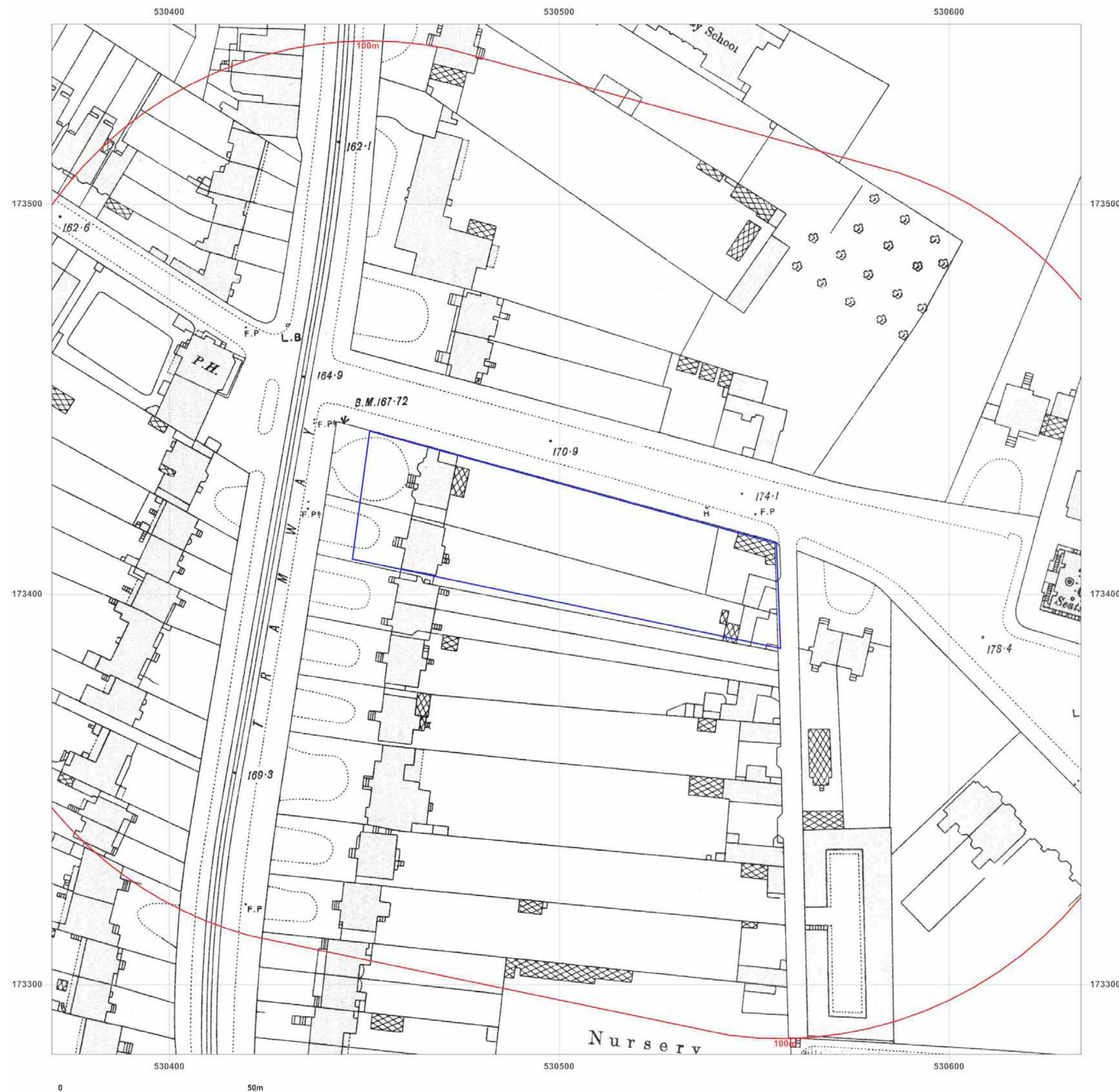


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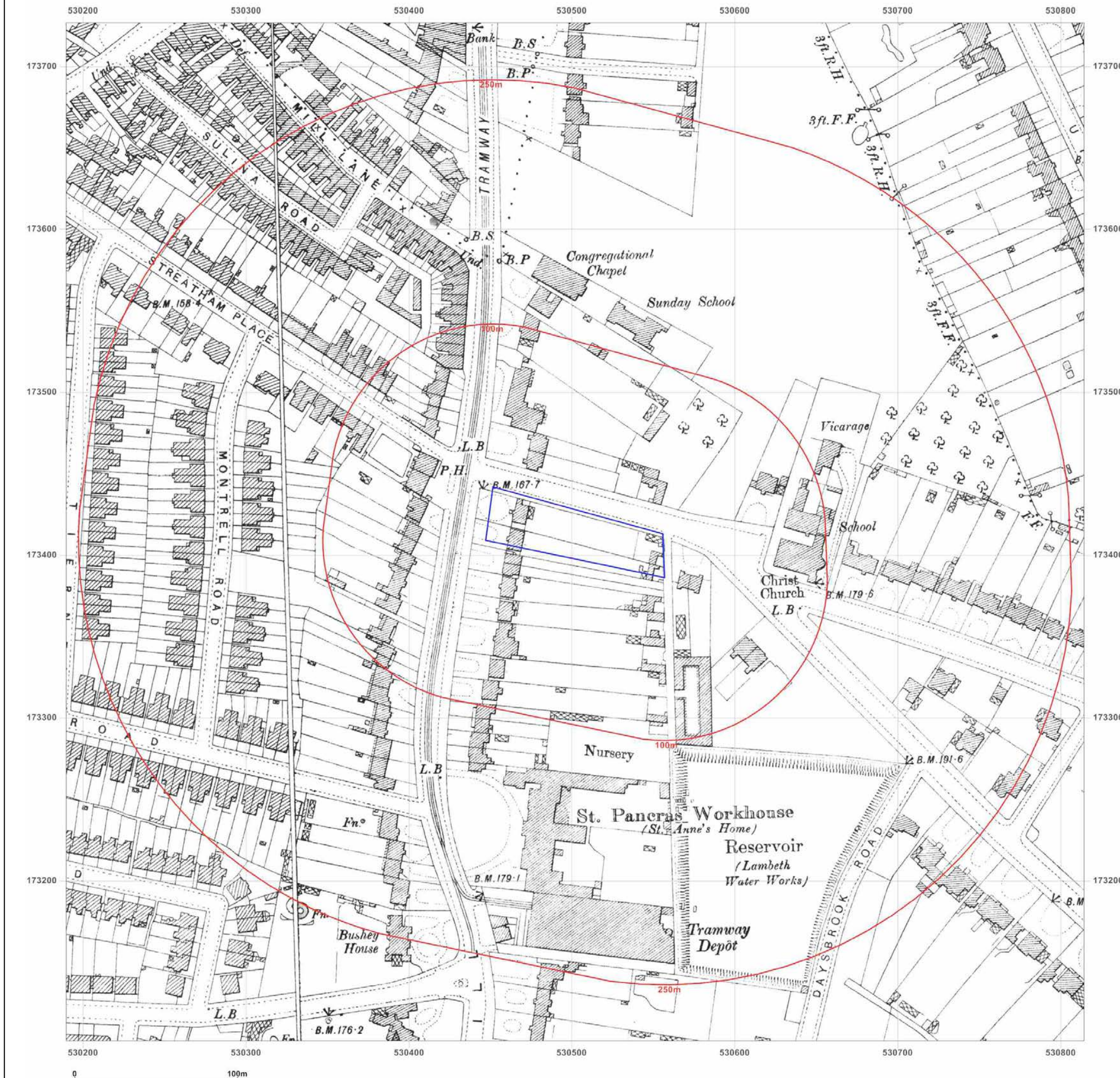


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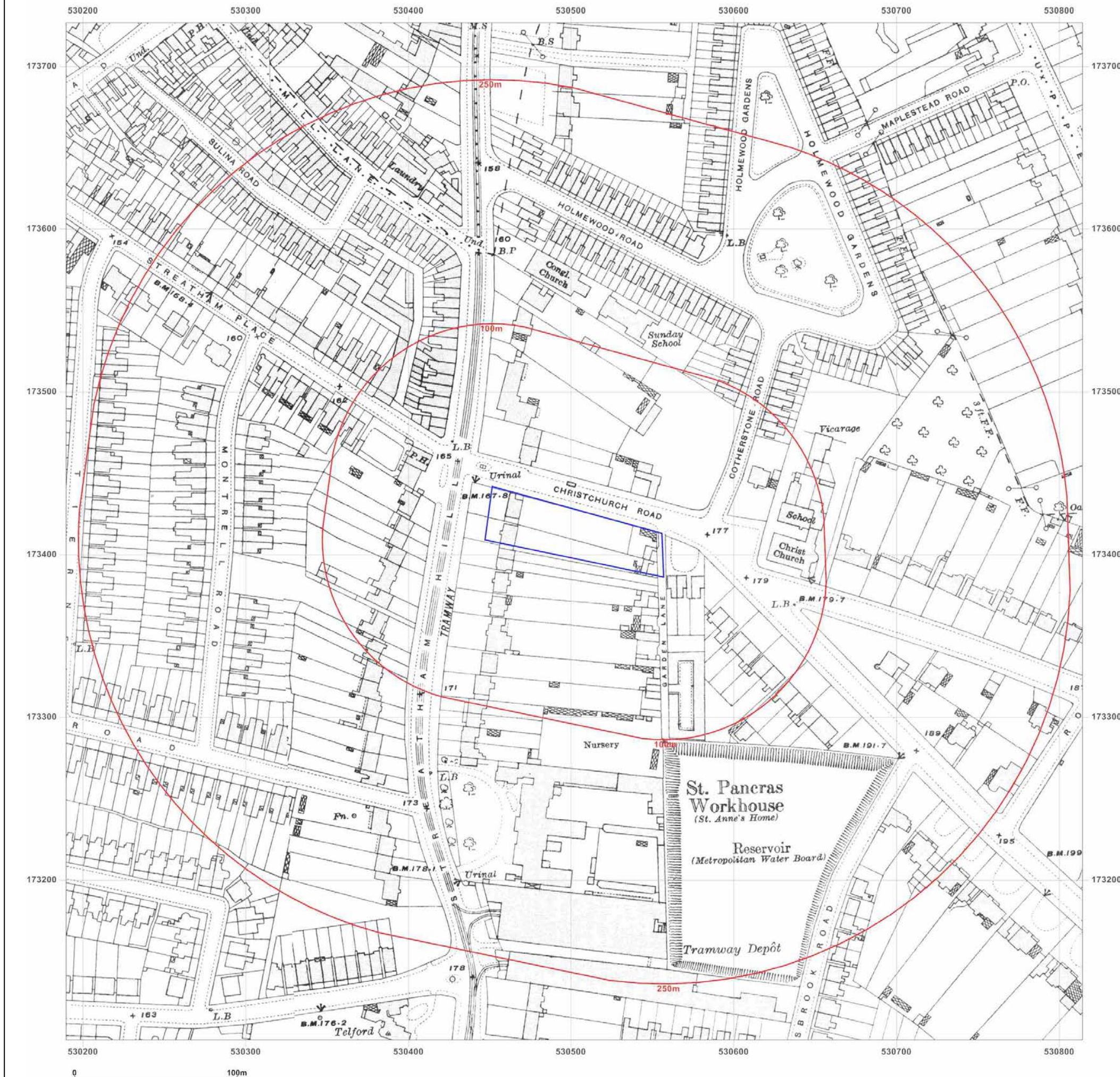


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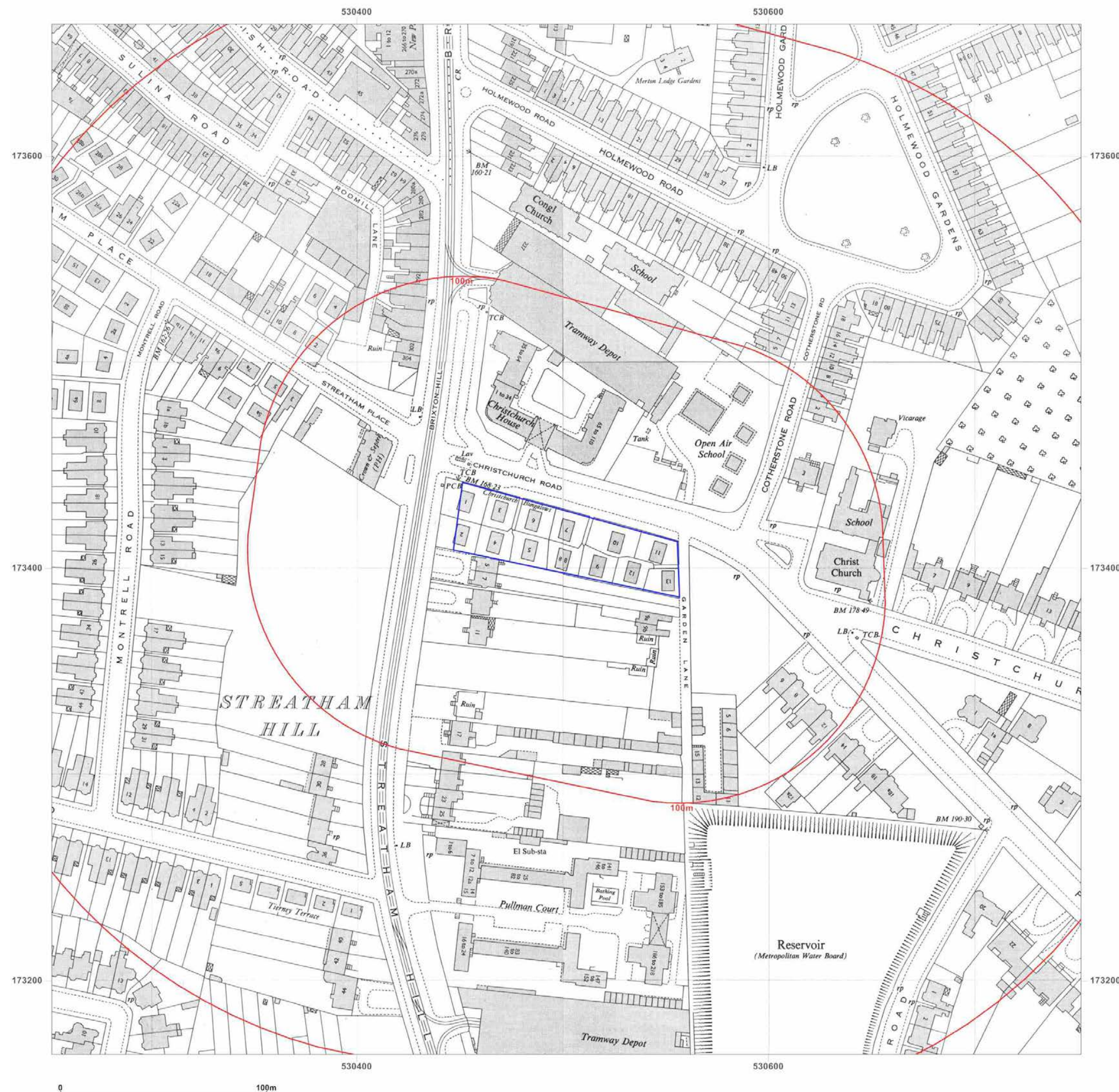


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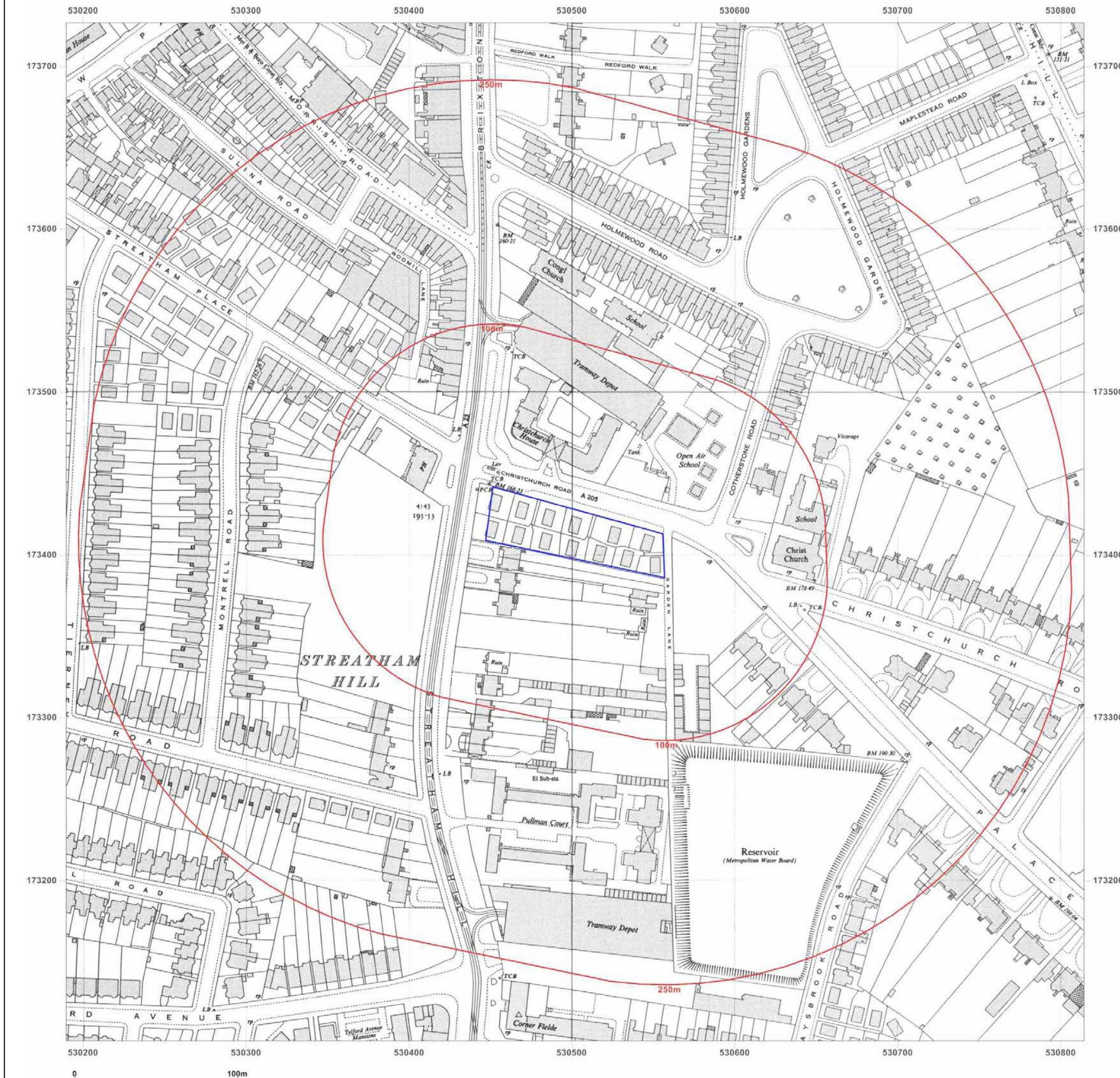


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#### Site Details:

Land at Christchurch Road &  
Brixton Hill, Lambeth, SW2 4AP

**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1951

**Scale:** 1:1,250

**Printed at:** 1:2,000



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

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Revised N/A  
Edition N/A  
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Revised N/A  
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#### Site Details:

Land at Christchurch Road &  
Brixton Hill, Lambeth, SW2 4AP

**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1954

**Scale:** 1:1,250

**Printed at:** 1:2,000



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Edition N/A  
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#### Site Details:

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1953-1955

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed 1955  
Revised 1955  
Edition N/A  
Copyright N/A  
Levelled 1954

Surveyed 1950  
Revised 1953  
Edition N/A  
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#### Site Details:

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

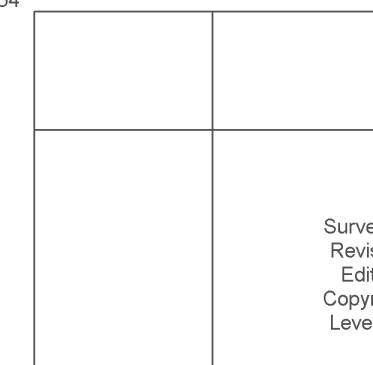
**Map date:** 1962

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed 1950  
Revised 1962  
Edition N/A  
Copyright 1962  
Levelled 1954



Surveyed 1950  
Revised 1962  
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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1972

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed 1950  
Revised 1971  
Edition N/A  
Copyright 1972  
Levelled 1957

Surveyed 1950  
Revised 1972  
Edition N/A  
Copyright 1972  
Levelled 1954

Surveyed 1950  
Revised 1971  
Edition N/A  
Copyright 1972  
Levelled 1962

Surveyed 1950  
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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1978

**Scale:** 1:1,250

**Printed at:** 1:2,000



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

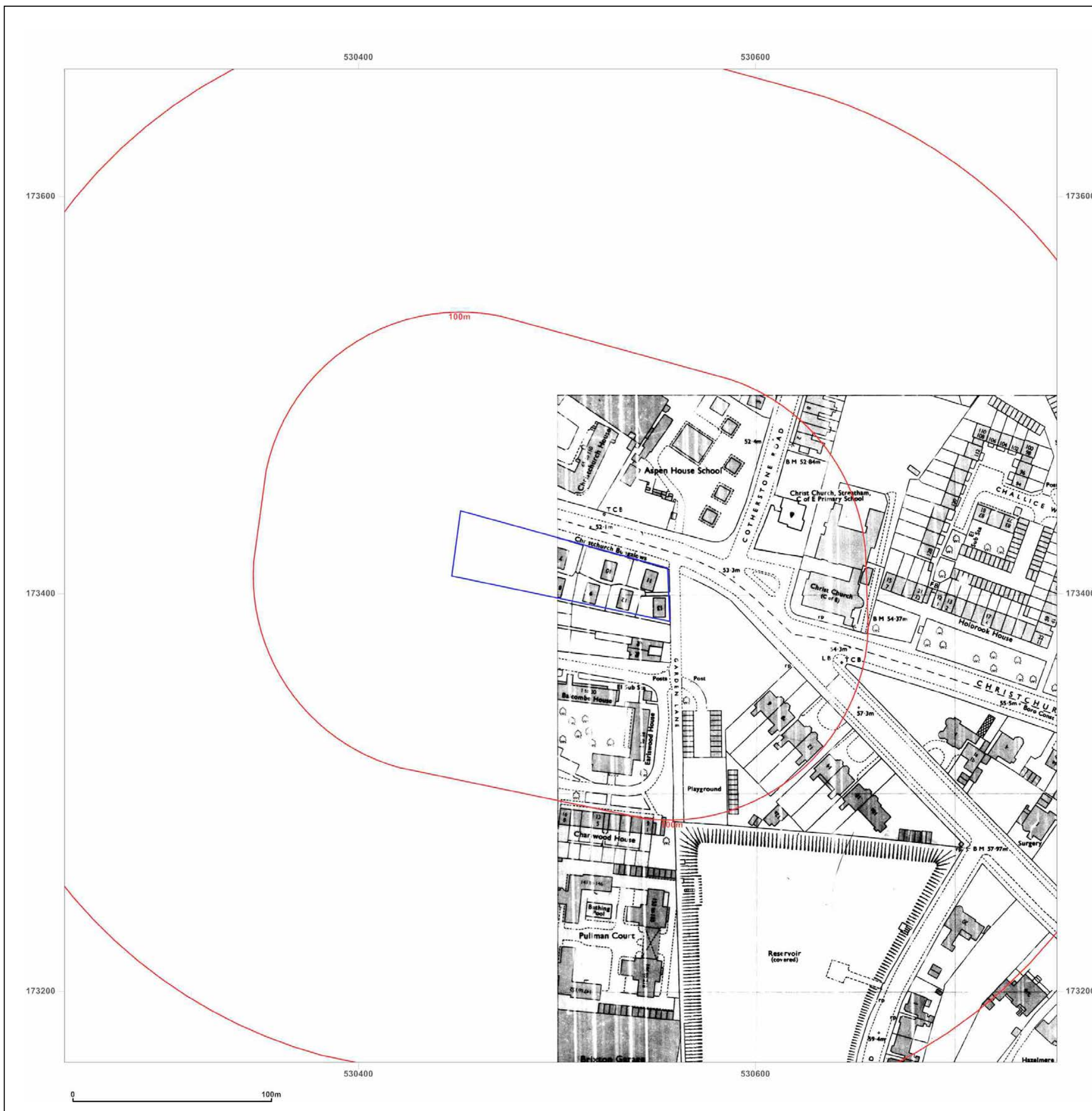


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

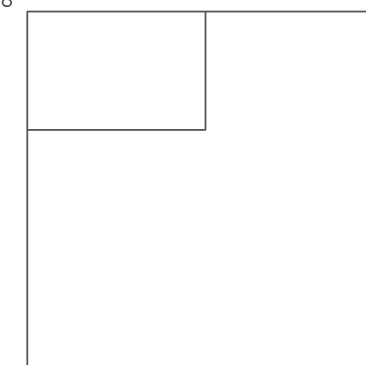
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**Printed at:** 1:2,000



Surveyed 1978  
Revised 1985  
Edition N/A  
Copyright 1985  
Levelled 1978

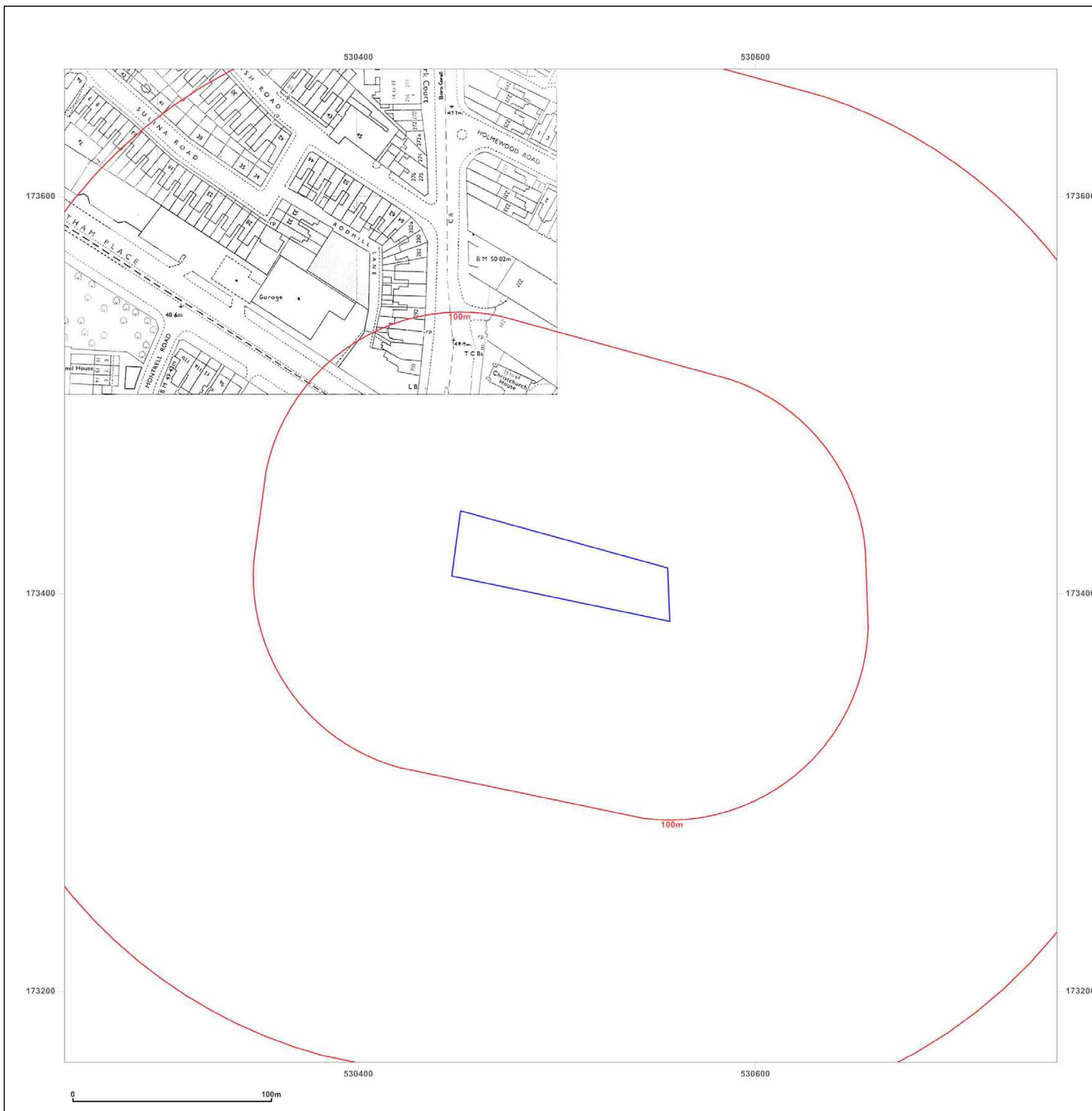


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1991

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed N/A  
Revised N/A  
Edition N/A  
Copyright 1991  
Levelled N/A

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Revised N/A  
Edition N/A  
Copyright 1991  
Levelled N/A

Surveyed N/A  
Revised N/A  
Edition N/A  
Copyright 1991  
Levelled N/A

Surveyed N/A  
Revised N/A  
Edition N/A  
Copyright 1991  
Levelled N/A

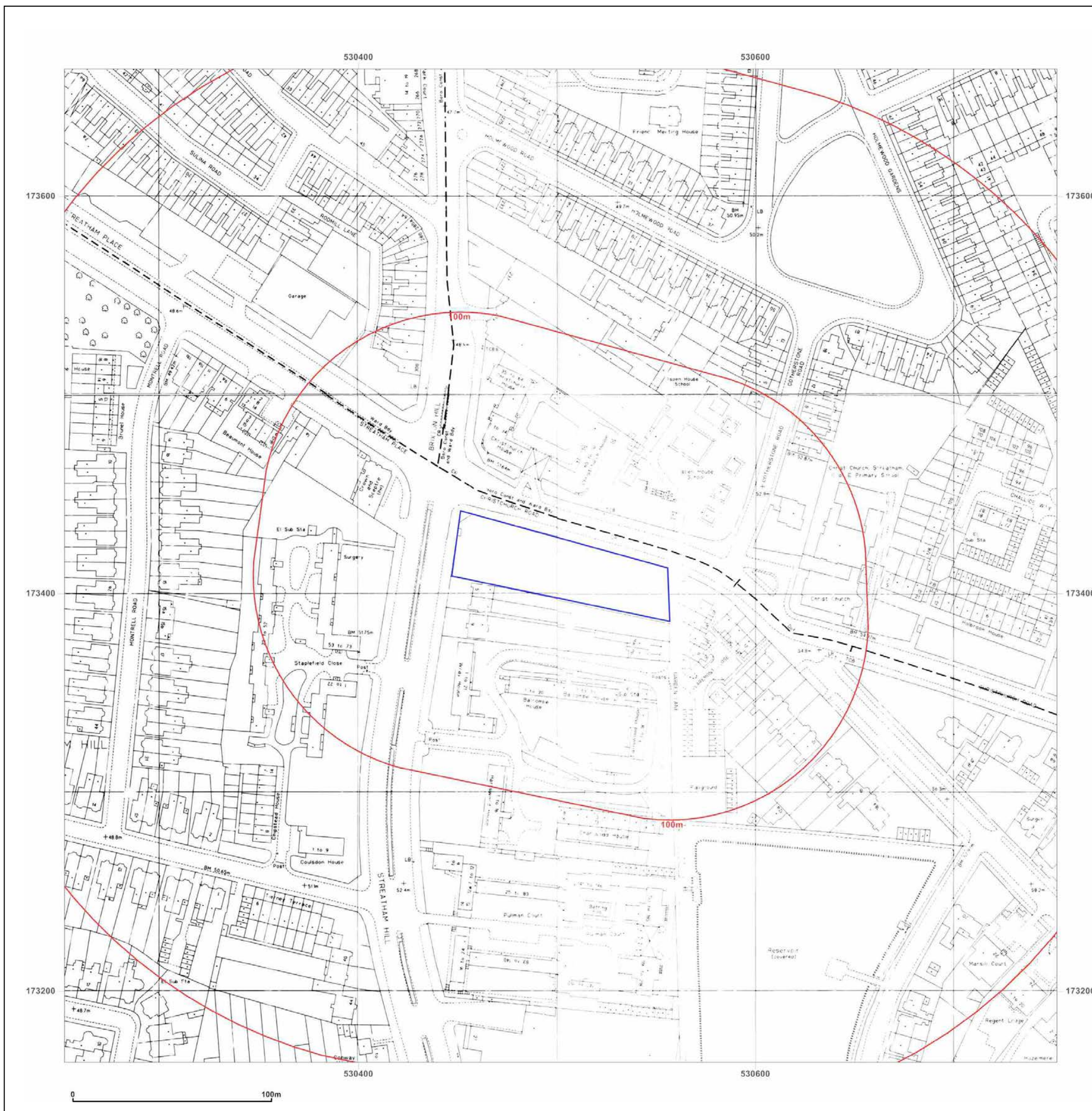


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1991

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed 1991  
Revised 1991  
Edition N/A  
Copyright 1991  
Levelled N/A

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Revised 1991  
Edition N/A  
Copyright 1991  
Levelled N/A

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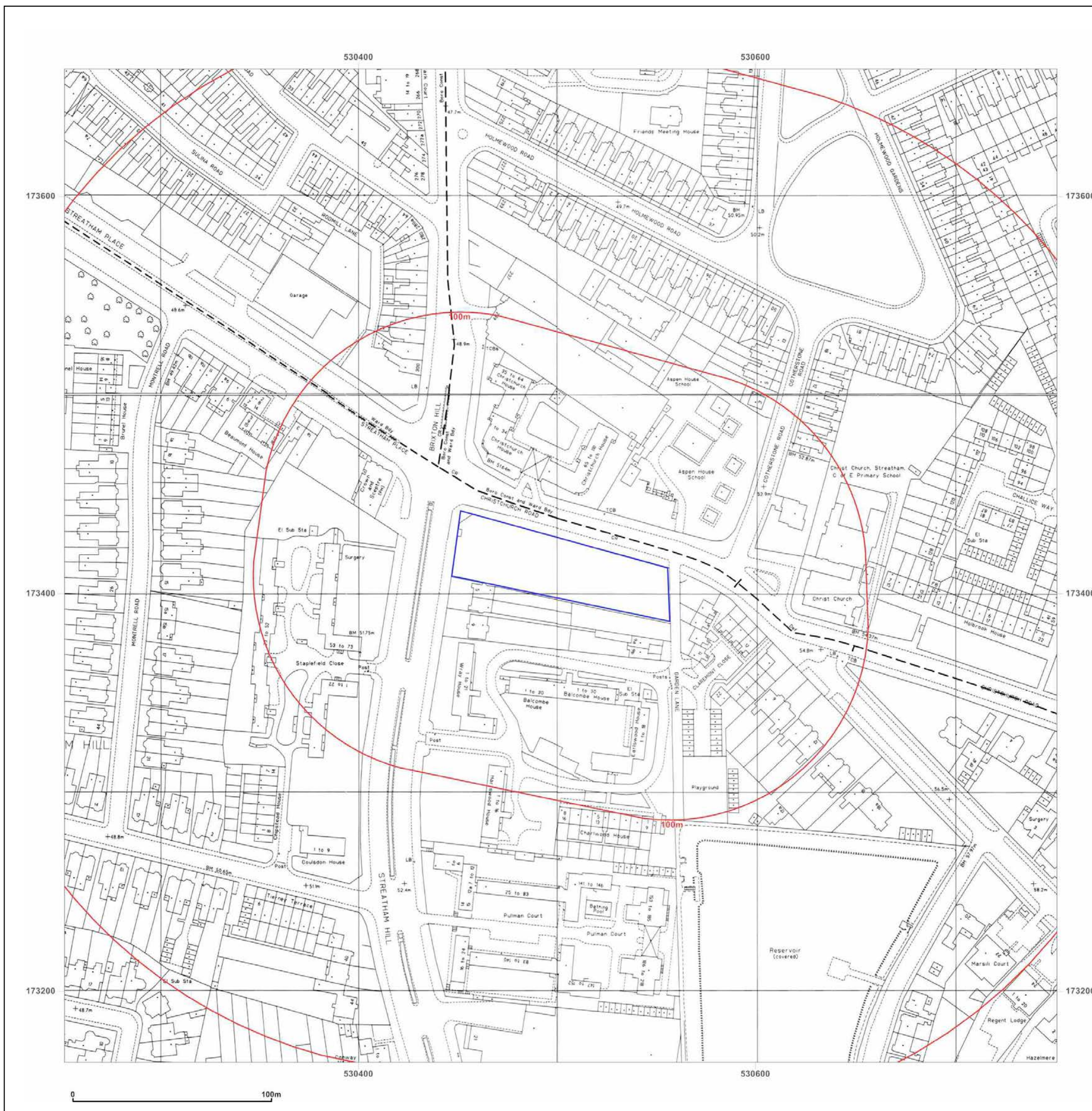


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1994

**Scale:** 1:1,250

**Printed at:** 1:2,000



Surveyed 1994  
Revised 1994  
Edition N/A  
Copyright N/A  
Levelled N/A

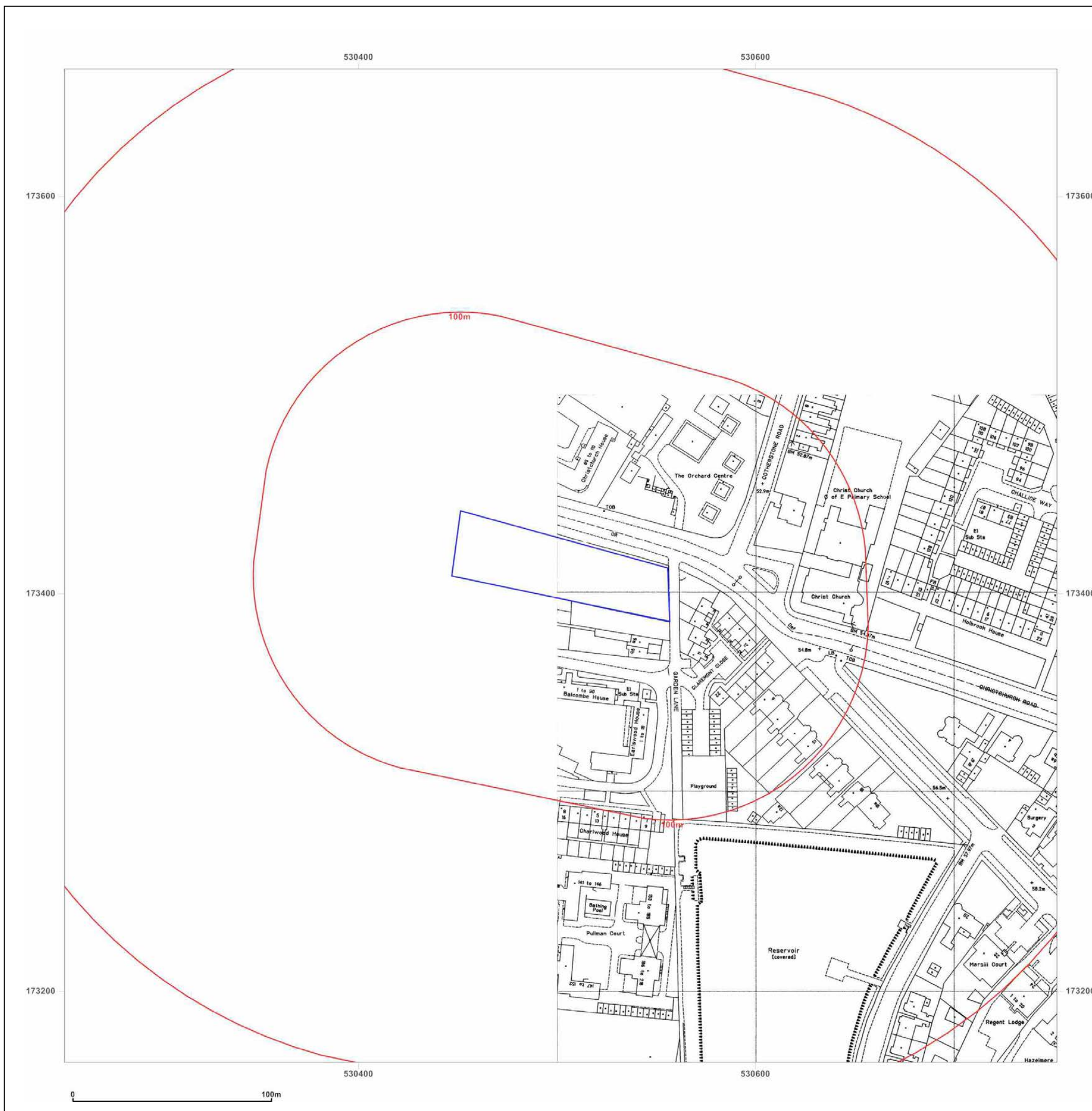


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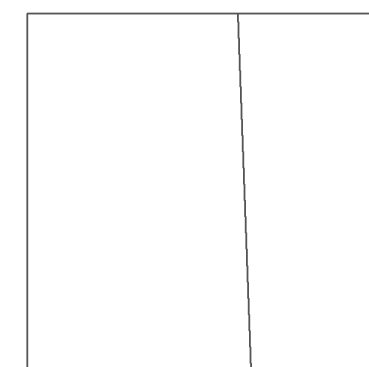
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**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1863

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1863  
Revised 1863  
Edition N/A  
Copyright N/A  
Levelled N/A

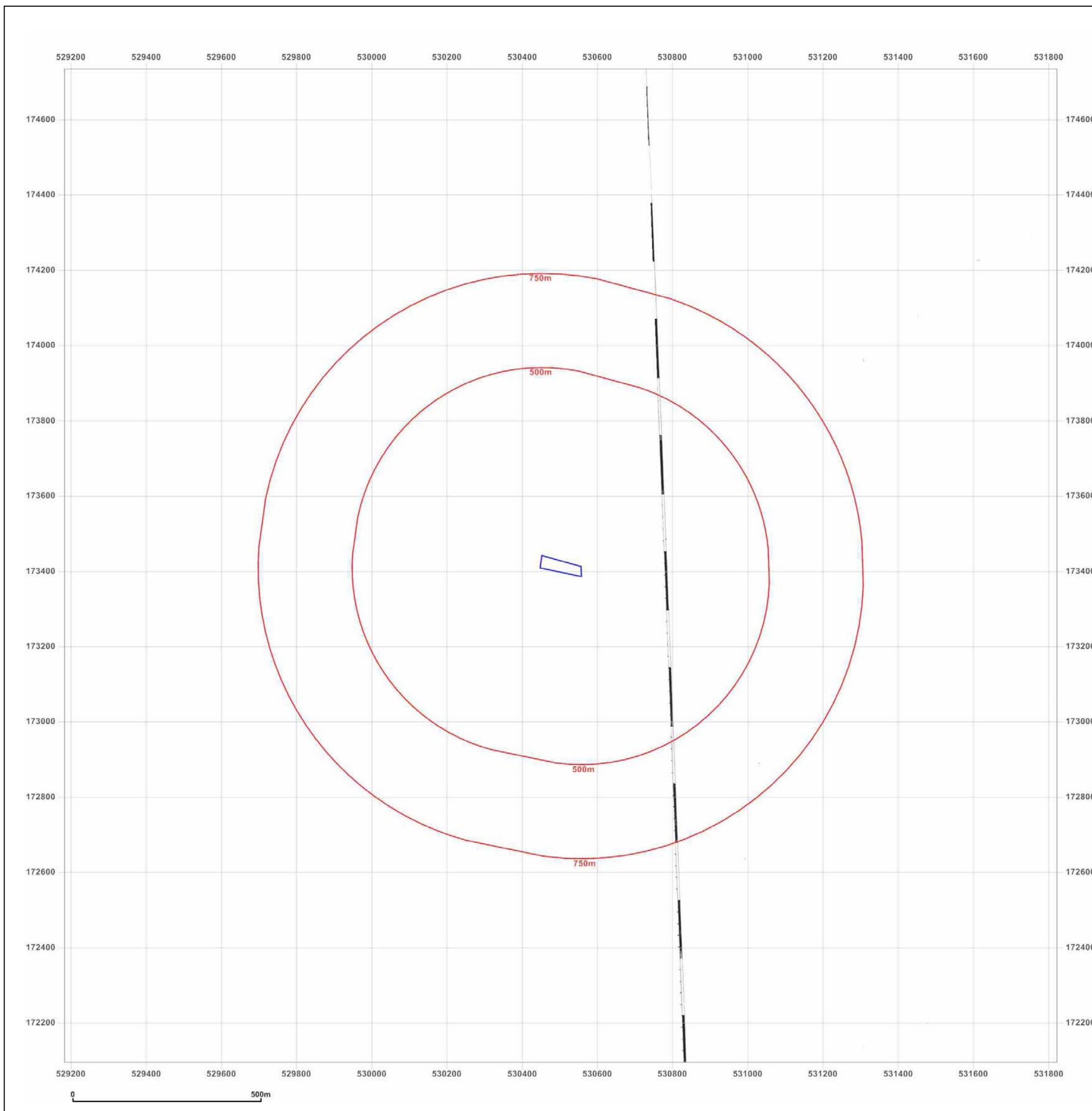


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1870

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1870  
Revised 1870  
Edition N/A  
Copyright N/A  
Levelled N/A

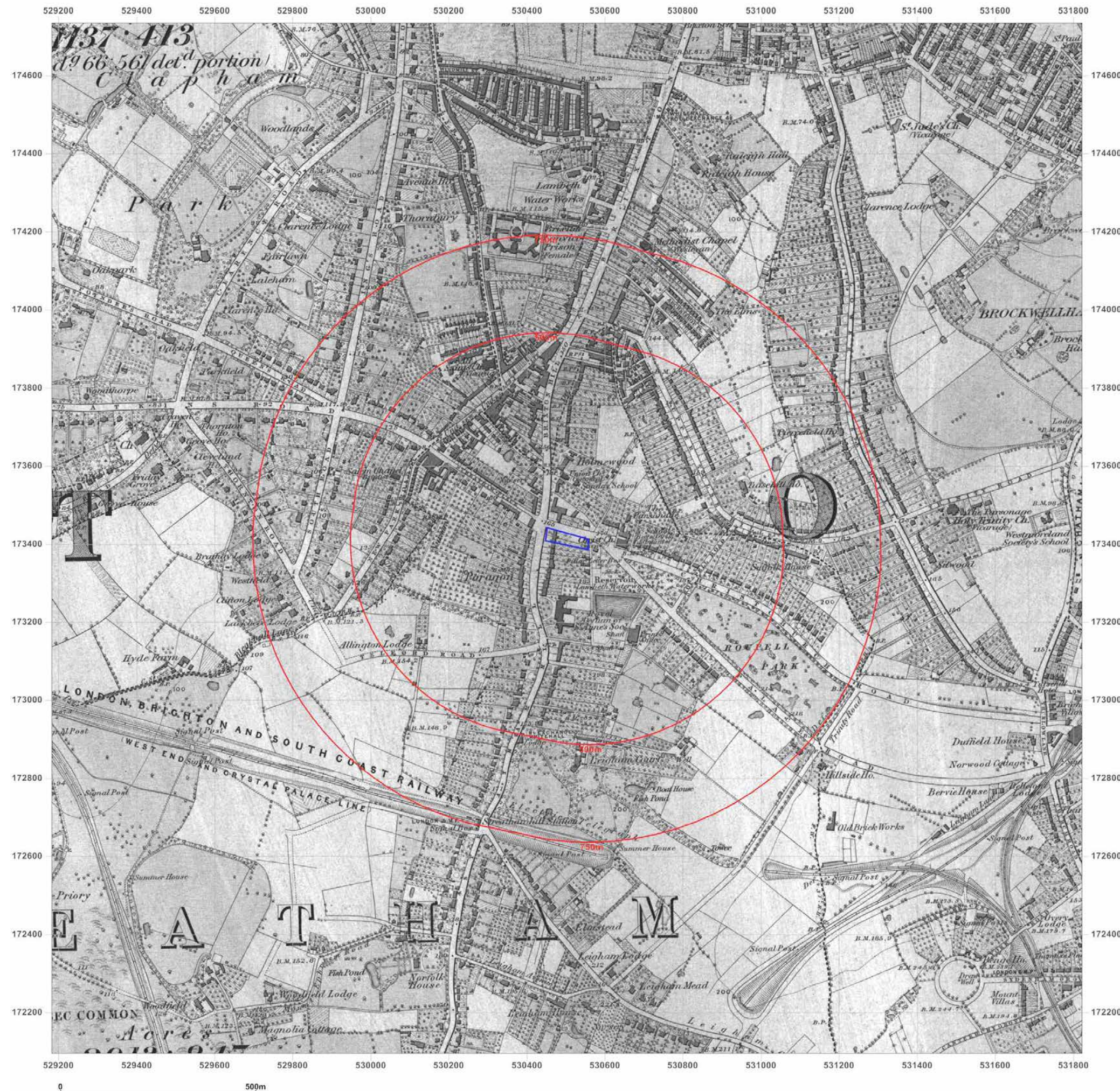


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

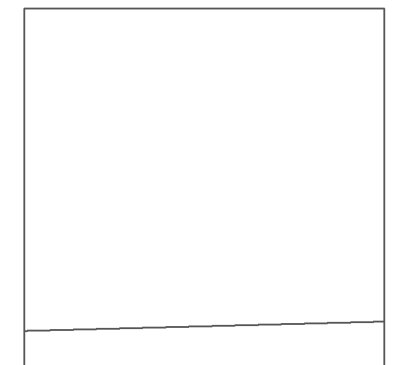
**Map date:** 1871

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1871  
Revised 1871  
Edition N/A  
Copyright N/A  
Levelled N/A

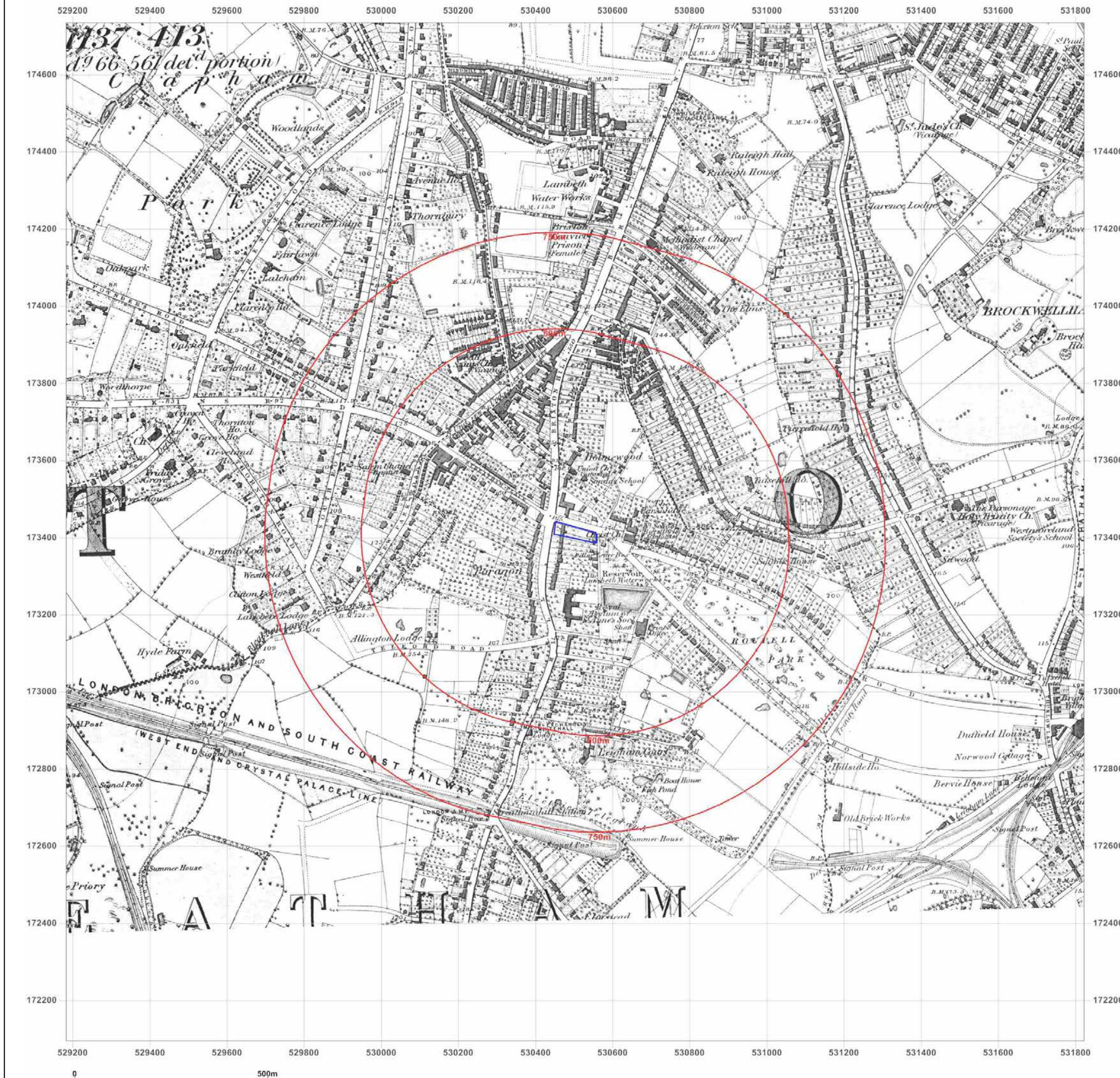


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1894

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1894  
Revised 1894  
Edition N/A  
Copyright N/A  
Levelled N/A

Surveyed 1894  
Revised 1894  
Edition N/A  
Copyright N/A  
Levelled N/A

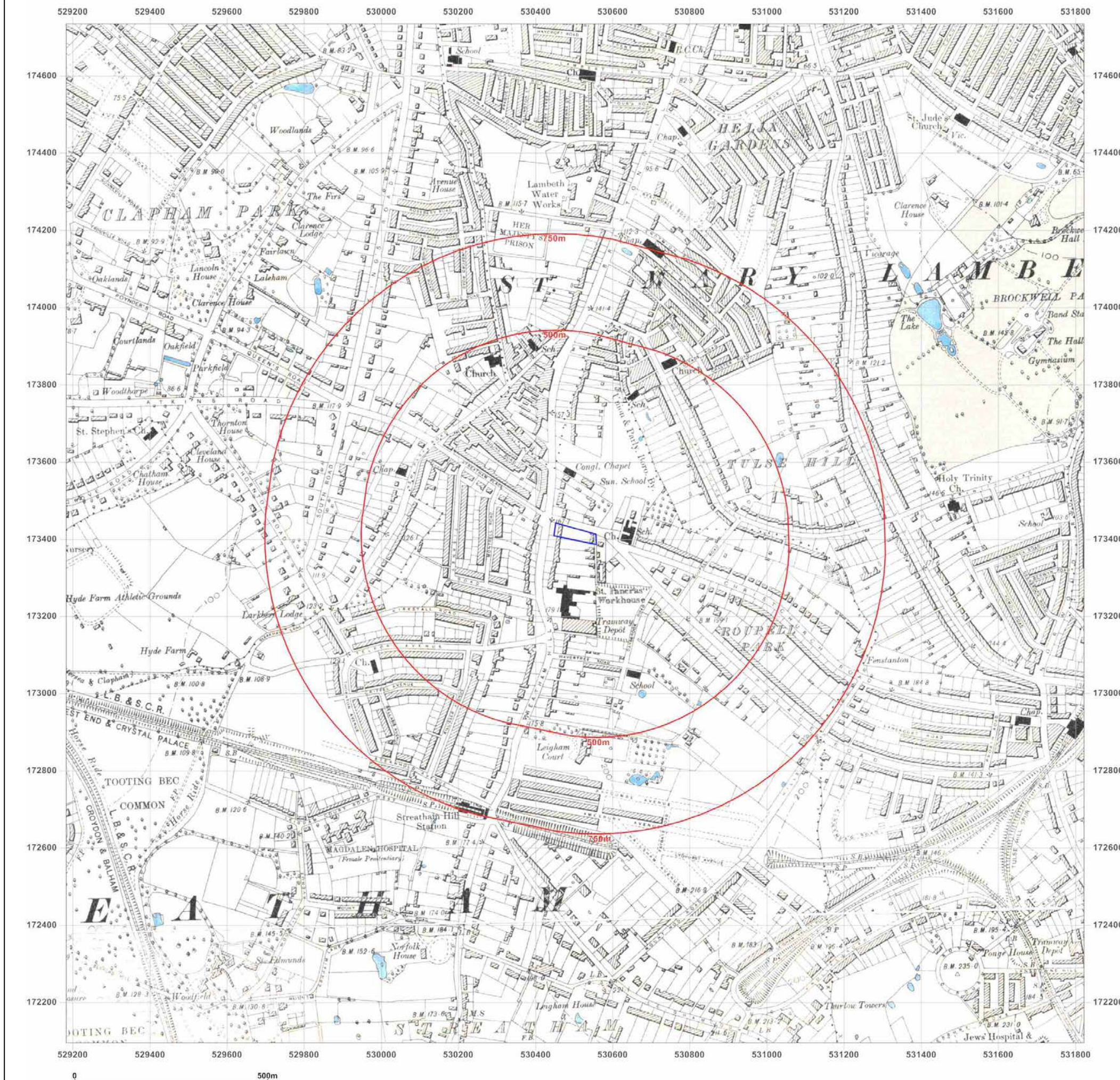


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Client Ref: PO0067007-1  
Report Ref: GS-3884845  
Grid Ref: 530502, 173414

Map Name: County Series

Map date: 1894-1898

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1868  
Revised 1894  
Edition N/A  
Copyright N/A  
Levelled N/A

Surveyed 1868  
Revised 1894  
Edition N/A  
Copyright N/A  
Levelled N/A

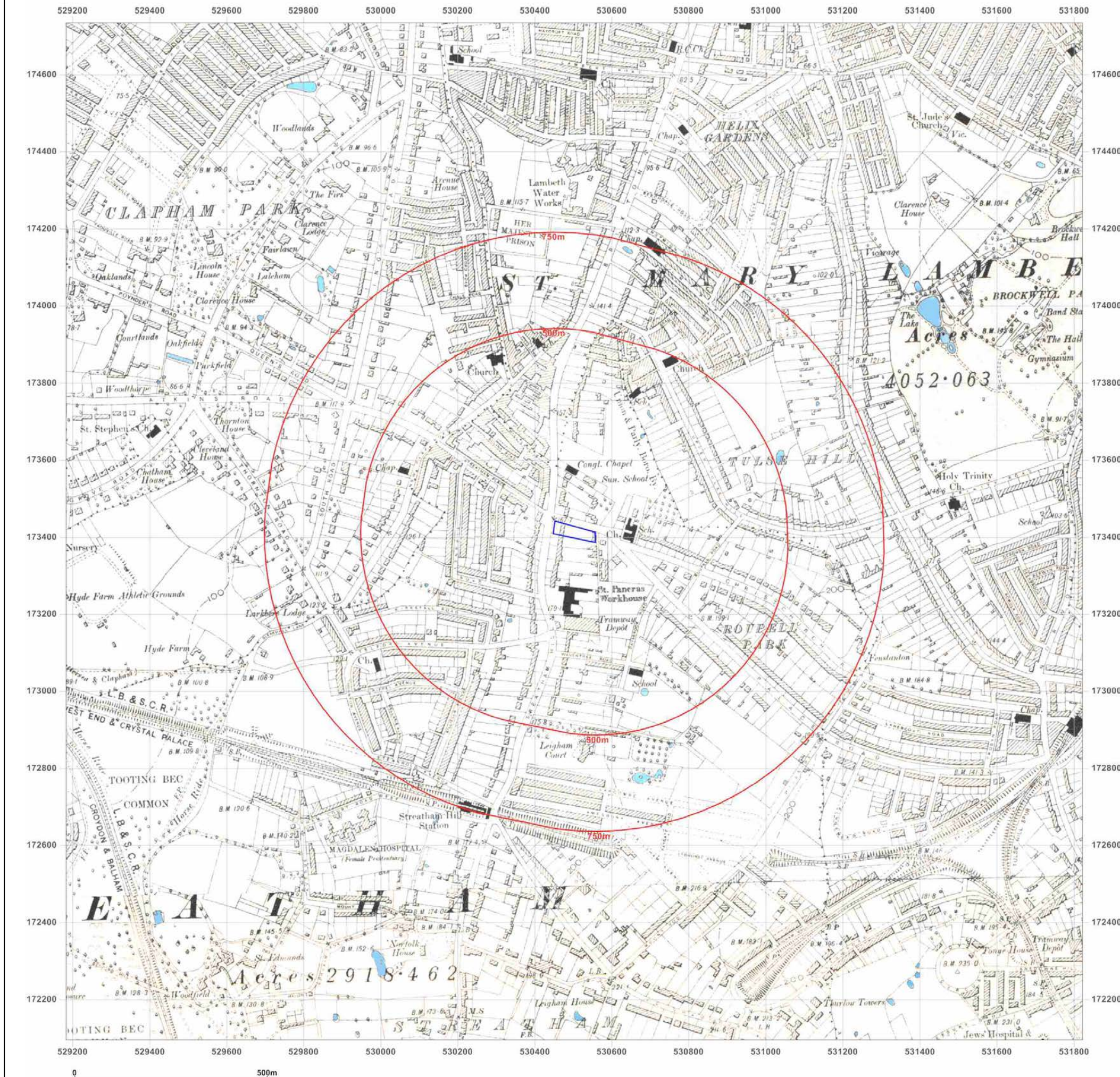


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1898

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1894  
Revised 1894  
Edition 1898  
Copyright N/A  
Levelled N/A

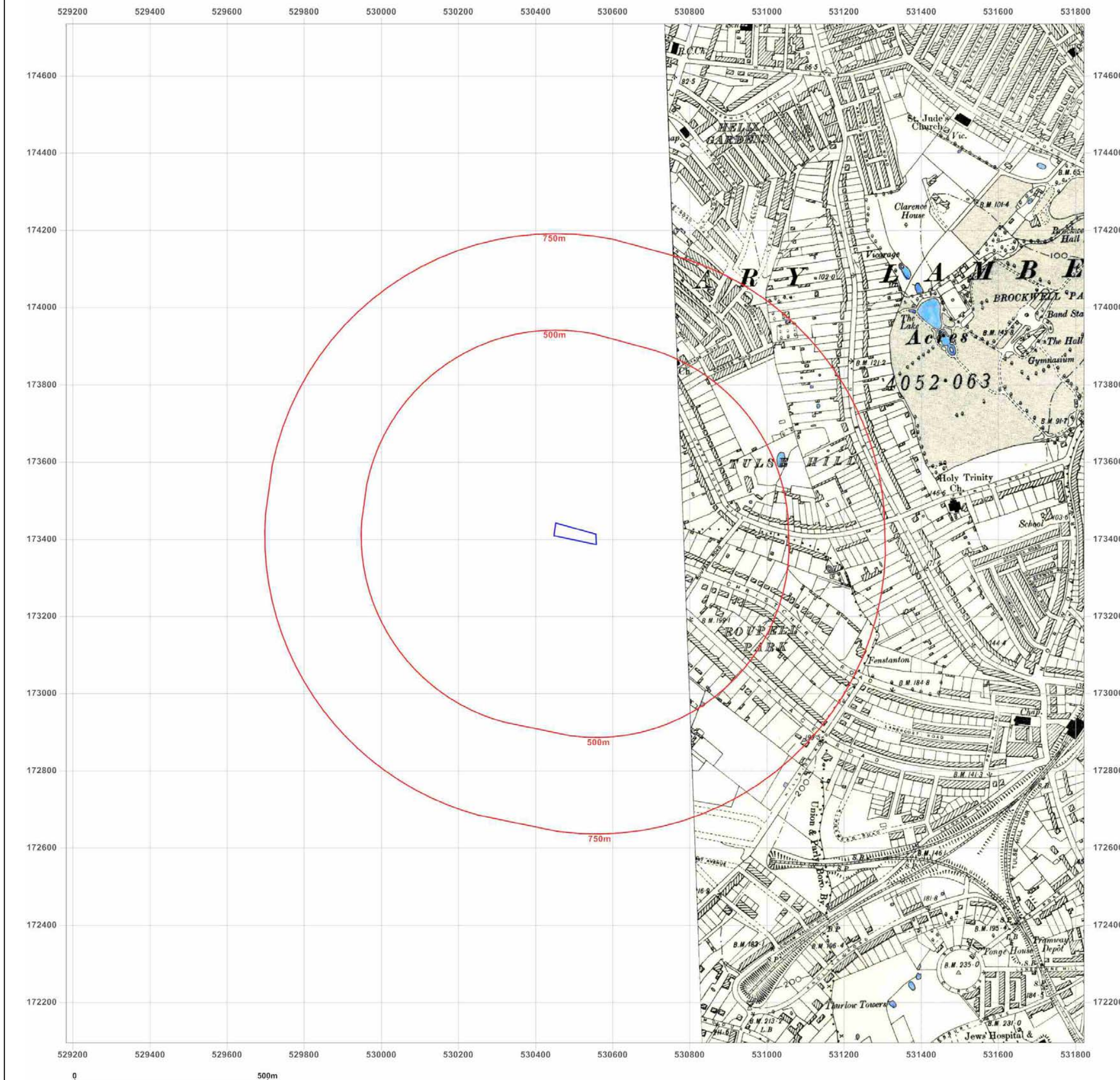


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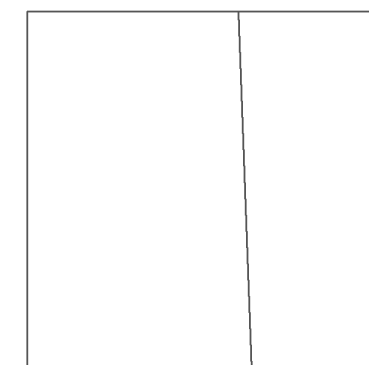
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**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1898

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1862  
Revised 1898  
Edition N/A  
Copyright N/A  
Levelled N/A

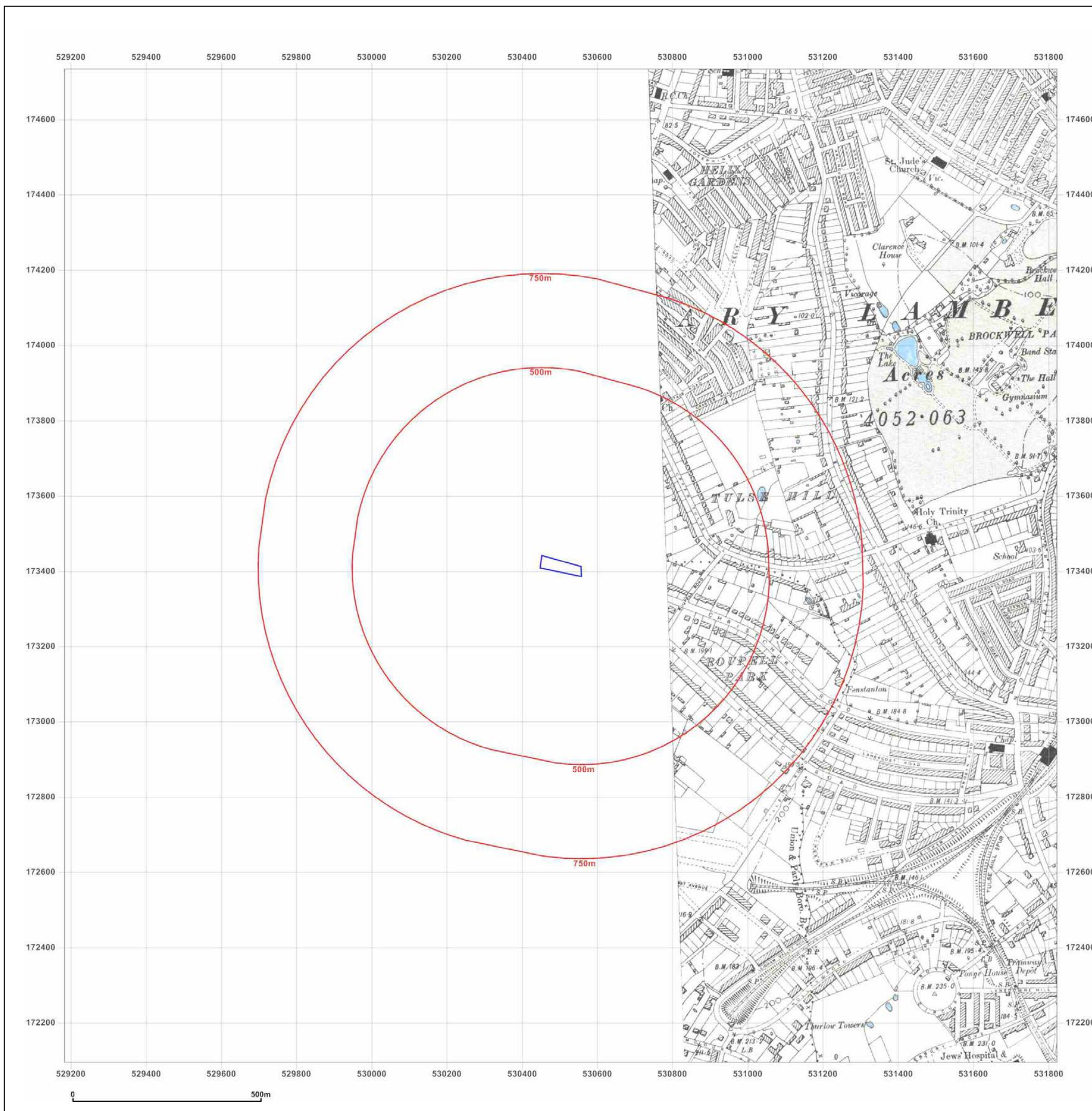


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Client Ref: PO0067007-1  
Report Ref: GS-3884845  
Grid Ref: 530502, 173414

Map Name: County Series

Map date: 1898-1899

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1869  
Revised 1894  
Edition N/A  
Copyright N/A  
Levelled N/A

Surveyed 1868  
Revised 1898  
Edition N/A  
Copyright N/A  
Levelled N/A

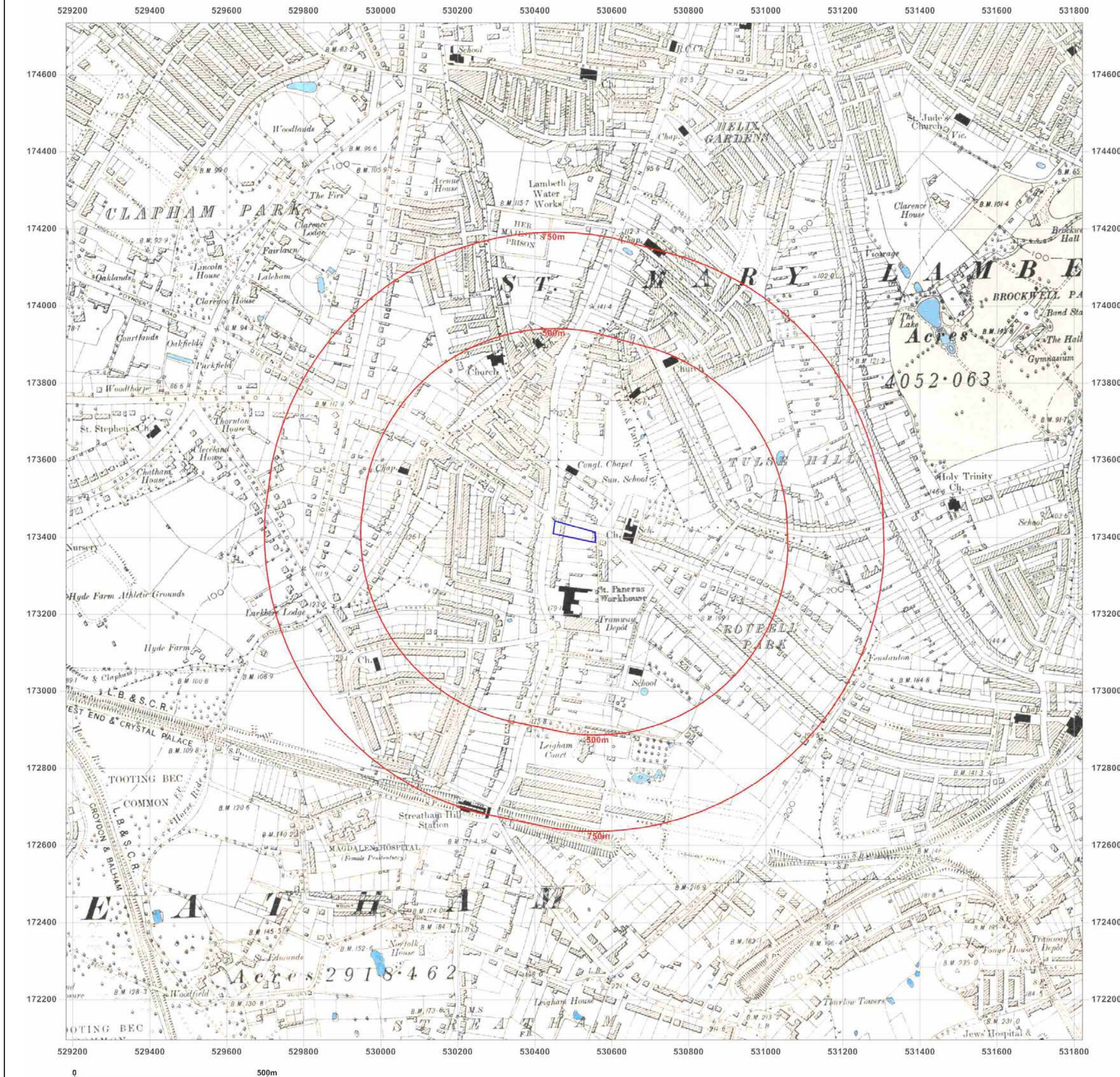


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1919-1920

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1870  
Revised 1914  
Edition 1920  
Copyright N/A  
Levelled N/A

Surveyed 1869  
Revised 1919  
Edition N/A  
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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** County Series

**Map date:** 1933-1938

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1870  
Revised 1938  
Edition N/A  
Copyright N/A  
Levelled N/A

Surveyed 1866  
Revised 1933  
Edition N/A  
Copyright N/A  
Levelled N/A



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#### Site Details:

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** Provisional

**Map date:** 1948

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed N/A  
Revised 1948  
Edition N/A  
Copyright N/A  
Levelled 1934

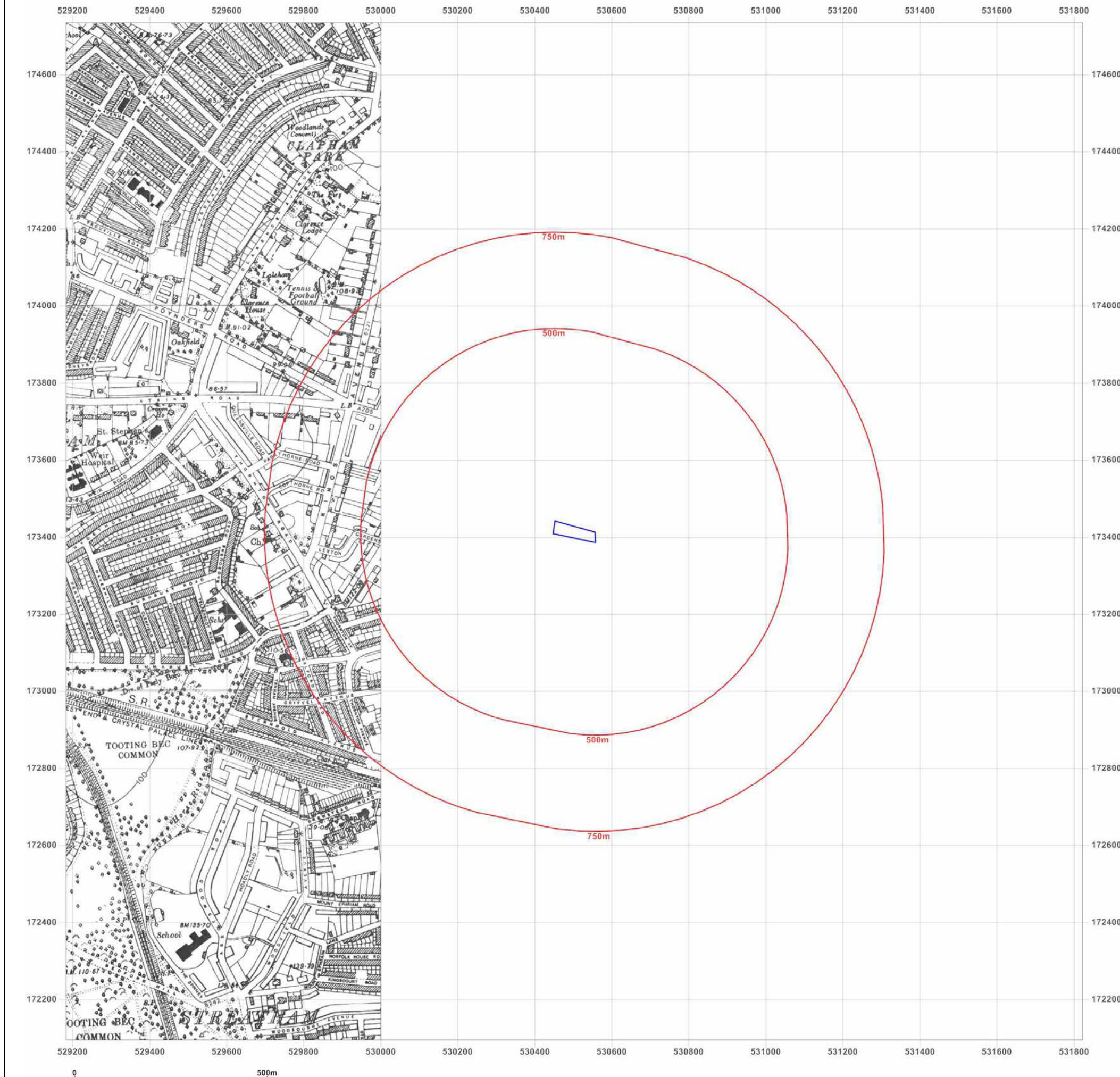


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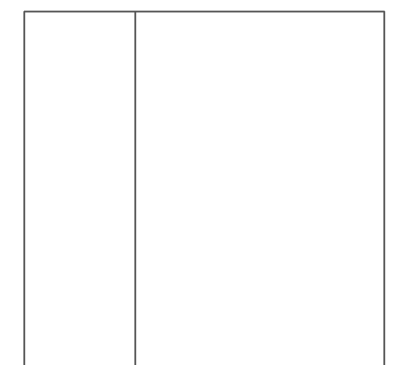
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**Grid Ref:** 530502, 173414

**Map Name:** Provisional

**Map date:** 1957

**Scale:** 1:10,560

**Printed at:** 1:10,560



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

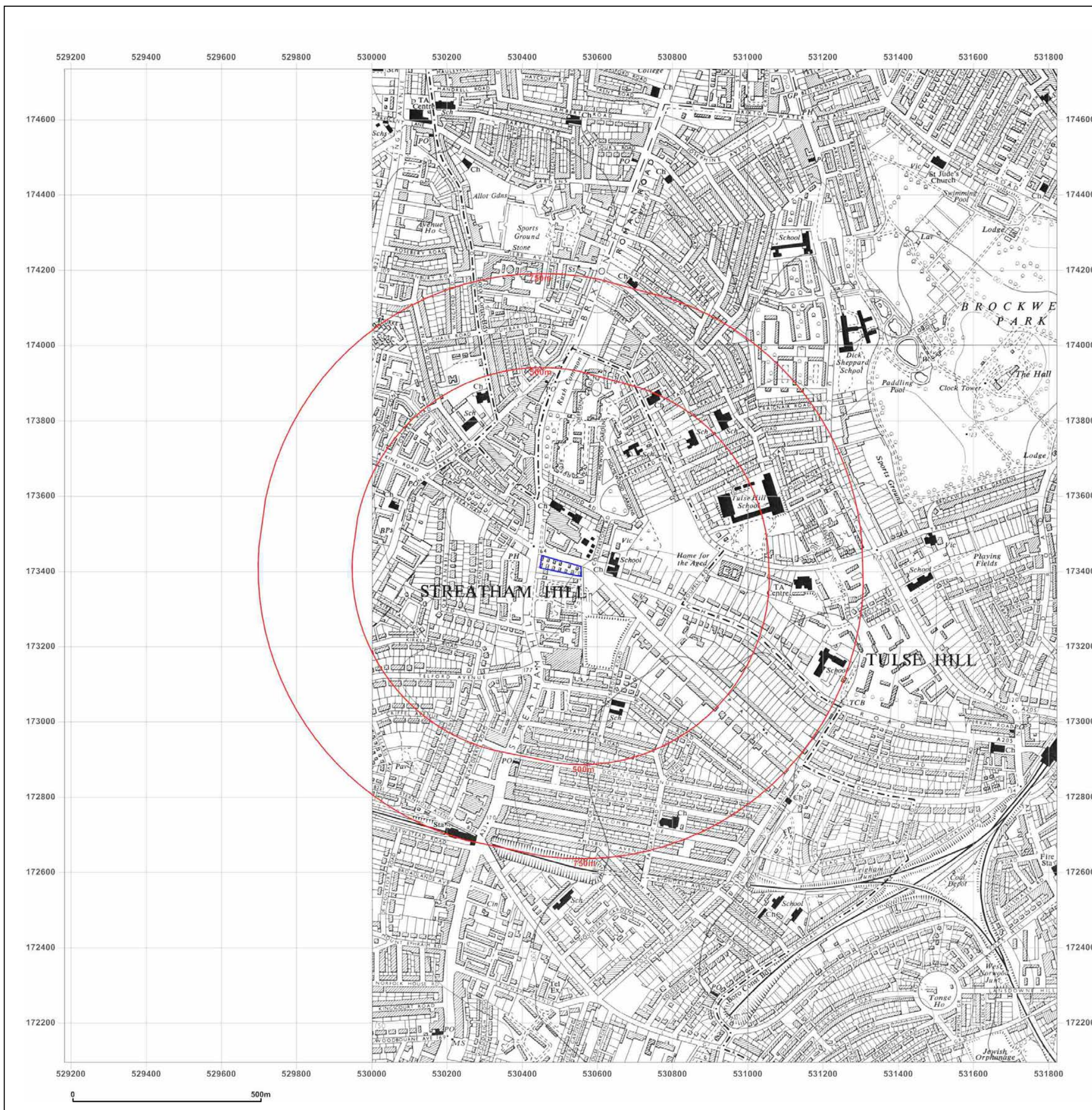


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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** Provisional

**Map date:** 1965-1968

**Scale:** 1:10,560

**Printed at:** 1:10,560



Surveyed 1965  
Revised 1965  
Edition N/A  
Copyright N/A  
Levelled N/A

Surveyed 1968  
Revised 1968  
Edition N/A  
Copyright N/A  
Levelled N/A

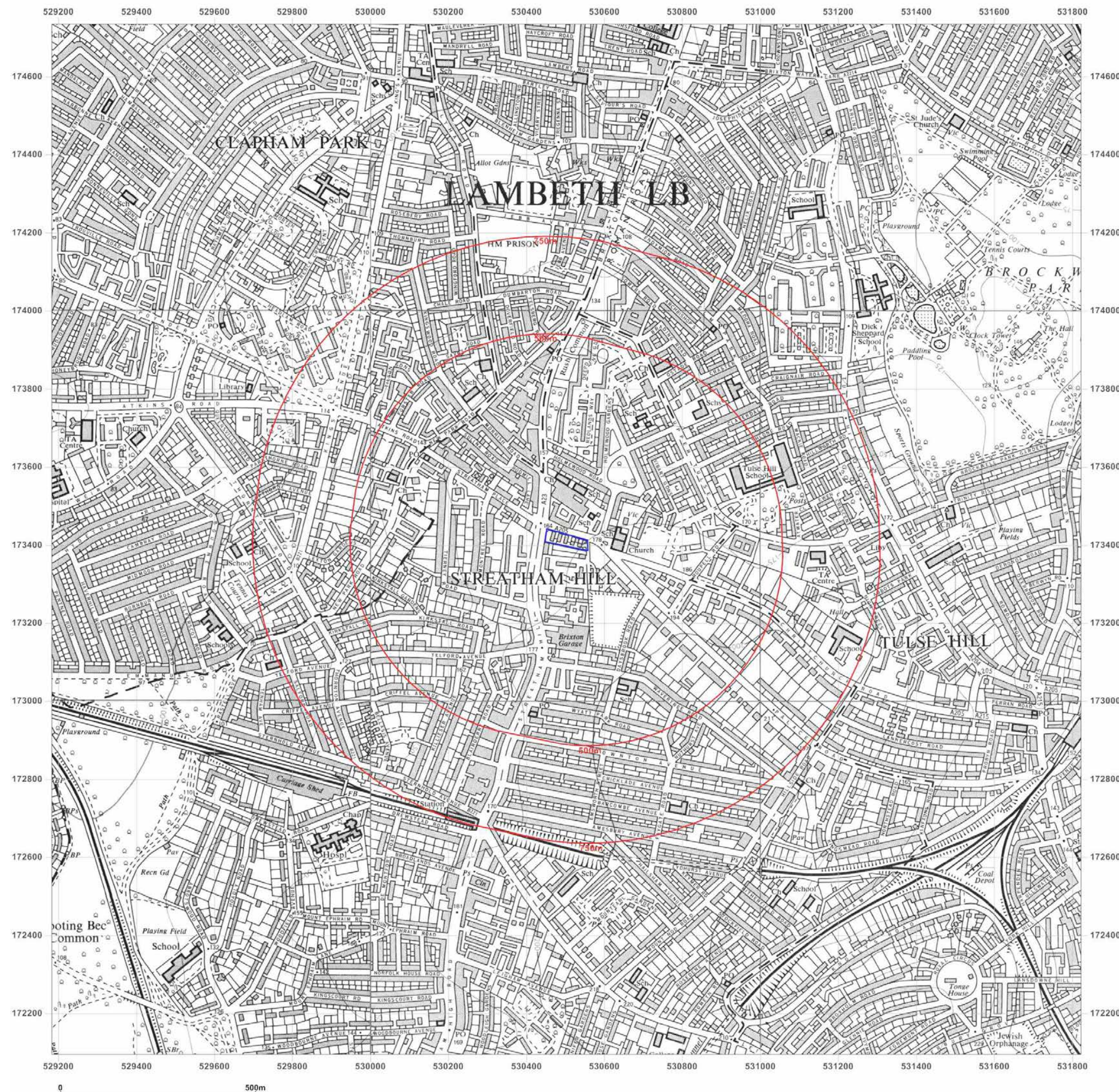


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**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1973-1974

**Scale:** 1:10,000

**Printed at:** 1:10,000



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Edition N/A  
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Levelled N/A

Surveyed 1973  
Revised 1973  
Edition N/A  
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Levelled N/A

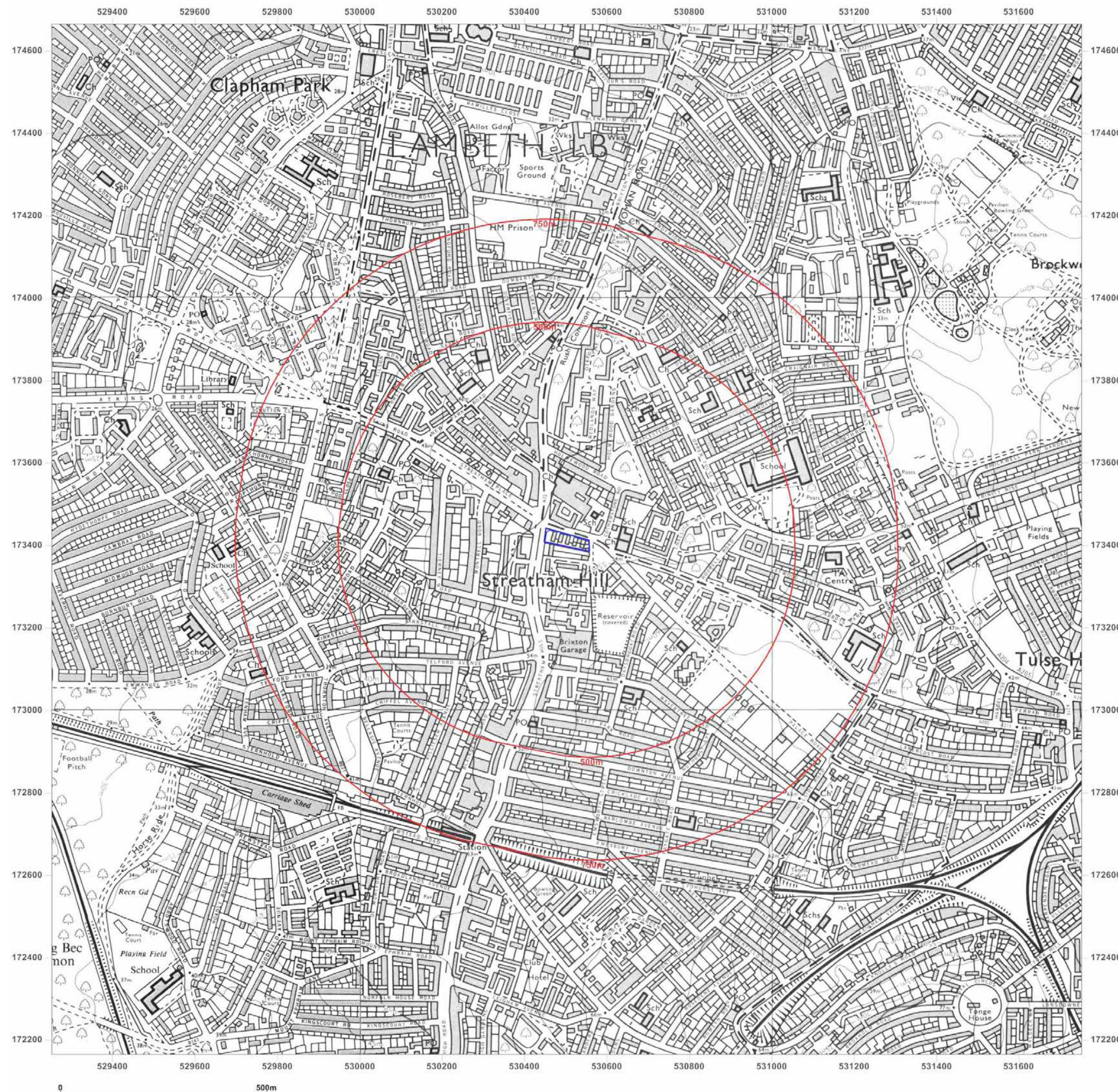


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**Site Details:**

Land at Christchurch Road &  
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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1982-1987

**Scale:** 1:10,000

**Printed at:** 1:10,000



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#### Site Details:

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 1987-1992

**Scale:** 1:10,000

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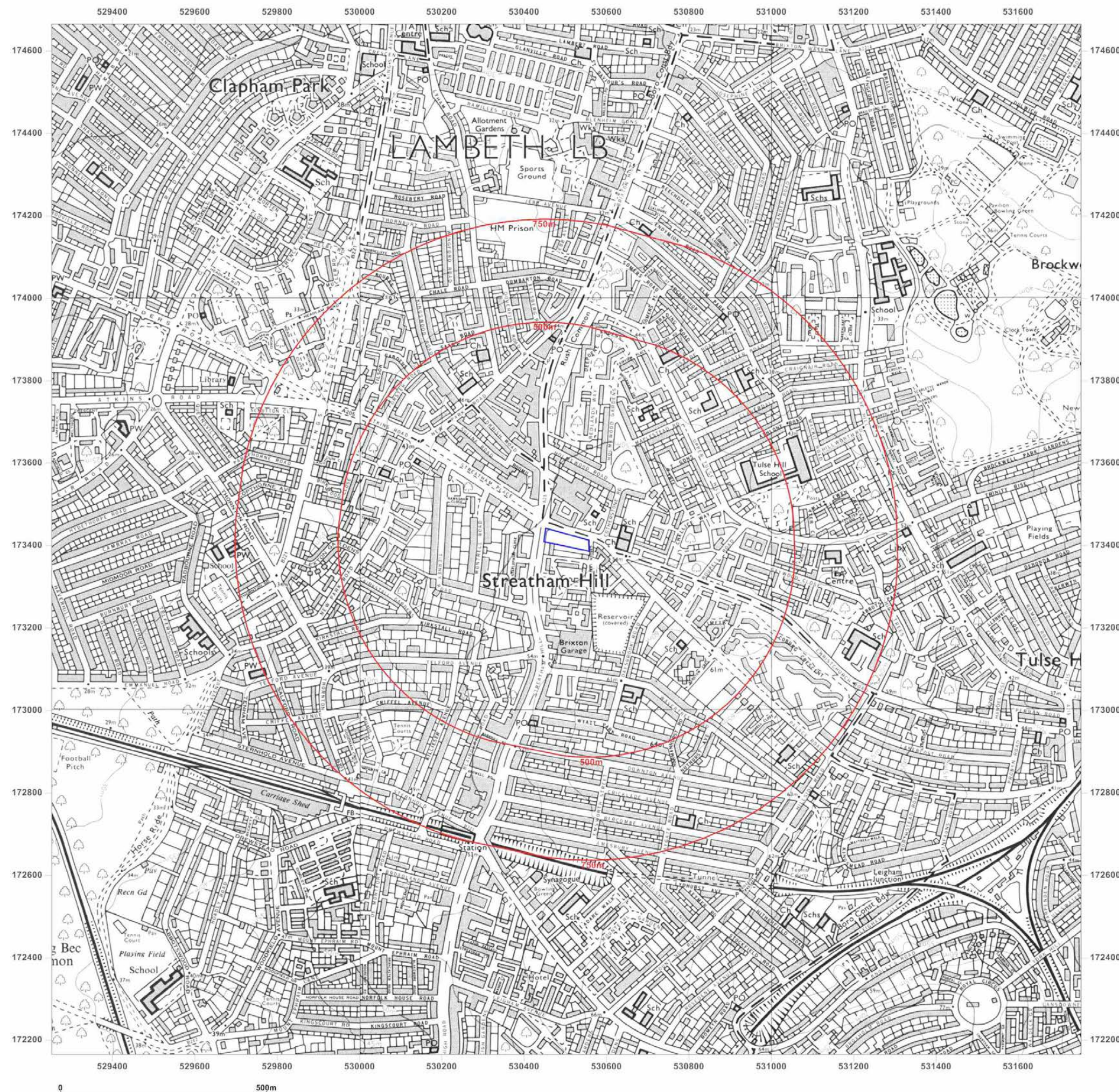


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**Site Details:**

Land at Christchurch Road &  
Brixton Hill, Lambeth, SW2 4AP

**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** 1:10,000 Raster

**Map date:** 2002

**Scale:** 1:10,000

**Printed at:** 1:10,000



2002



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#### Site Details:

Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP

Client Ref: PO0067007-1  
Report Ref: GS-3884845  
Grid Ref: 530502, 173414

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000



2010



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#### Site Details:

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**Client Ref:** PO0067007-1  
**Report Ref:** GS-3884845  
**Grid Ref:** 530502, 173414

**Map Name:** National Grid

**Map date:** 2014

**Scale:** 1:10,000

**Printed at:** 1:10,000



2014

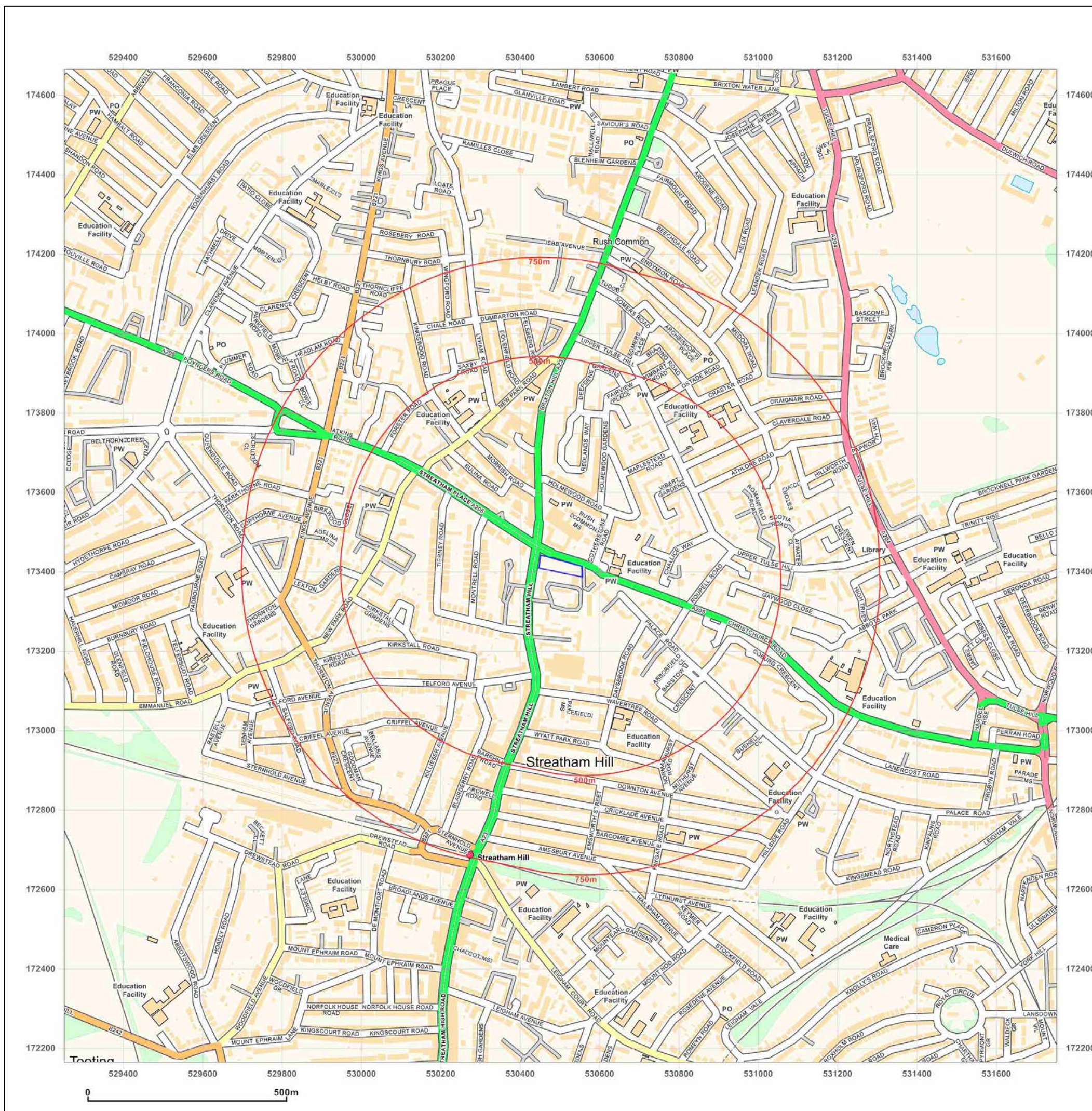


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**APPENDIX B**  
**Environmental Data Sheets**





Arcadis

Arcadis, 10, MEDAWAR ROAD,  
GUILDFORD, GU2 7AR

Groundsure  
Reference:

GS-3884843

Your Reference: PO0067007-1

Report Date 16 May 2017

Report Delivery Method: Email - pdf

## Groundsure Enviro Insight

Address: Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

Managing Director  
Groundsure Limited

Enc.  
Groundsure Enviroinsight



# Groundsure Enviro Insight

Address: Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP  
Date: 16 May 2017  
Reference: GS-3884843  
Client: Arcadis

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 20-Apr-2013  
Grid Reference: 530503,173418  
Site Size: 0.32ha

Report Reference: GS-3884843  
Client Reference: PO0067007-1



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# Overview of Findings

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

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	1	1	22	2
1.2 Additional Information – Historical Tank Database	0	2	3	16
1.3 Additional Information – Historical Energy Features Database	0	3	14	53
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	9	5
1.6 Potentially Infilled Land	0	0	15	5
Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	2	3
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	2	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	0	0
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0



Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	0	0	0
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	0
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	1

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	1	9	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	1	0
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology				0-500m		
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?				Yes		
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?				Yes		
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	2	2
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	2	0
6.6 Source Protection Zones (within 500m of the study site)	1	0	1	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	0	0	0	0	Not searched	Not searched



Section 6: Hydrogeology and Hydrology	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	No
6.10 Detailed River Network entries within 500m of the site	0	0	0	0	Not searched	Not searched
6.11 Surface water features within 250m of the study site	No	No	No	Not searched	Not searched	Not searched

Section 7: Flooding						
7.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	No					
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No					
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low					
7.4 Are there any Flood Defences within 250m of the study site?	No					
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No					
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No					
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Limited potential					
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	High					

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	0	0	0
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0



Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards	
9.1 What is the maximum risk of natural ground subsidence?	Moderate
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Moderate
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Very Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining	
10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	No
10.3 Are there any brine affected areas within 75m of the study site?	No



# Using this report

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

## 1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

## 2. Environmental Permits, Incidents and Registers

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

## 3. Landfills and Other Waste Sites

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

## 4. Current Land Uses

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

## 5. Geology

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

## 6. Hydrogeology and Hydrology

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

## 7. Flooding

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

## 8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

## 9. Natural Hazards

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

## 10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

## 11. Contacts

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

## Note: Maps

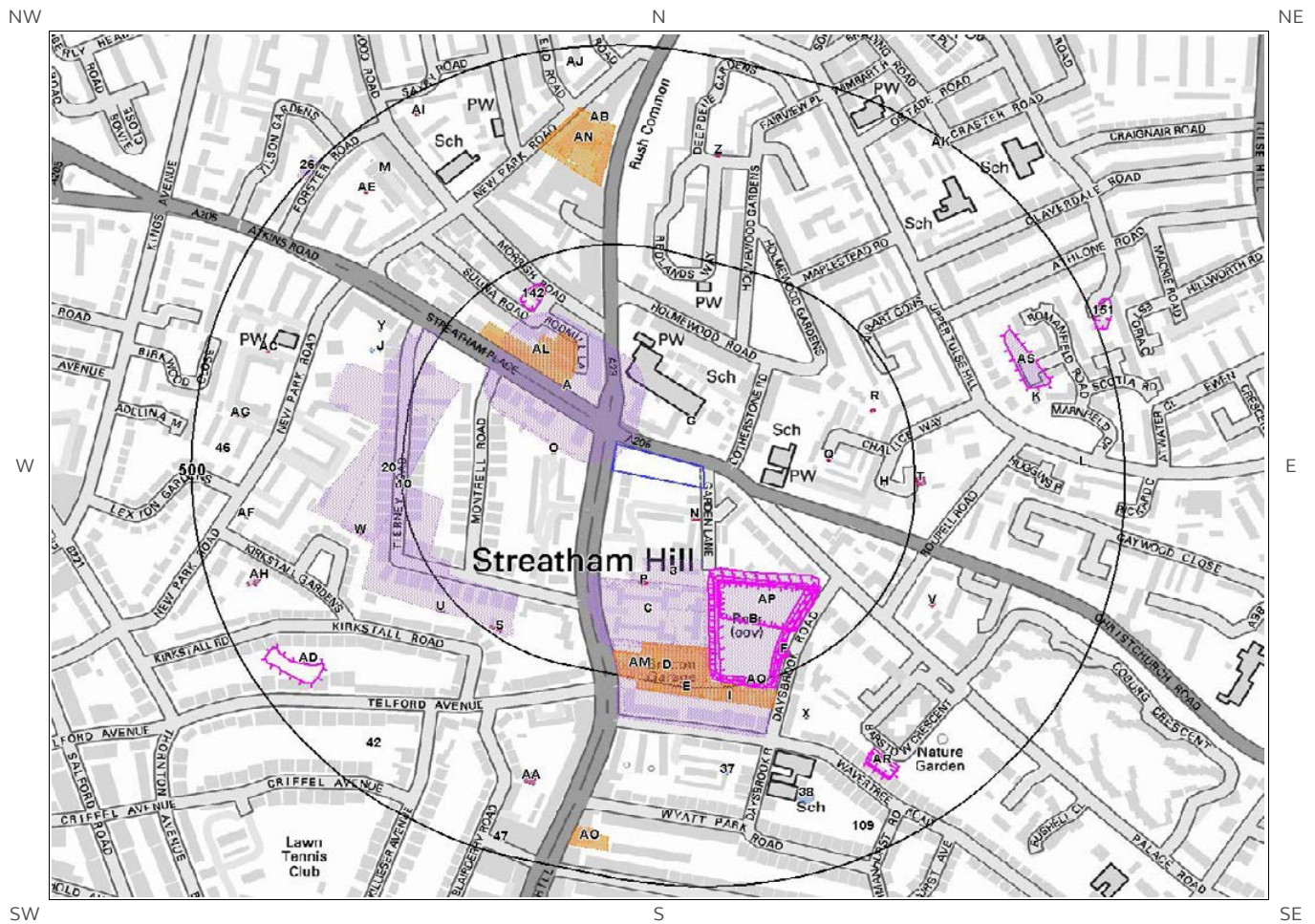
Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes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

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

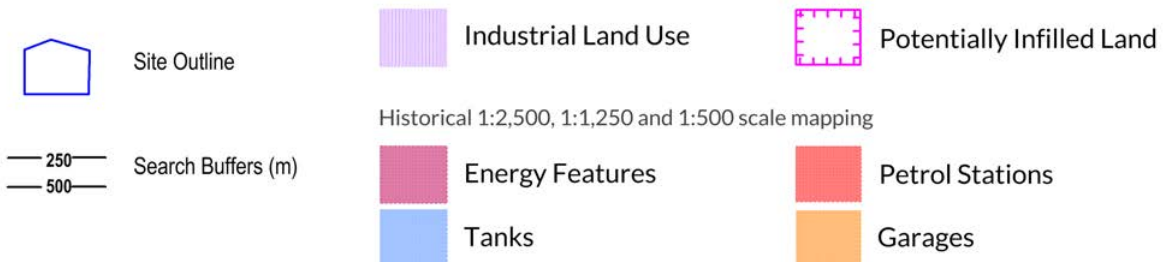
All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.



# 1. Historical Land Use



Historical 1:10,000 and 1:10,560 scale mapping



Historical 1:2,500, 1:1,250 and 1:500 scale mapping



# 1. Historical Industrial Sites

## 1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 26

ID	Distance [m]	Direction	Use	Date
1A	0	On Site	Nursery	1871
2A	5	NW	Nursery	1870
3	90	S	Nursery	1920
4B	102	S	Unspecified Heap	1968
5B	102	S	Unspecified Heap	1957
6C	118	S	Unspecified Workhouse	1894
7C	123	S	Unspecified Workhouse	1899
8C	124	S	Unspecified Workhouse	1894
9C	130	S	Unspecified Workhouse	1920
10	193	SW	Nursery	1870
11D	194	S	Garage	1982
12D	194	S	Garage	1968
13D	194	S	Garage	1973
14D	194	S	Garage	1992
15D	198	S	Tramway Depot	1894
16D	199	S	Tramway Depot	1899
17D	200	S	Tramway Depot	1894
18E	202	S	Tramway Depot	1938
19E	206	S	Tramway Depot	1920
20	213	W	Nursery	1871
21F	219	SE	Unspecified Heap	1870
22F	223	SE	Unspecified Shaft	1870
23F	226	SE	Unspecified Shaft	1871
24AQ	250	S	Unspecified Shaft	1871
25AS	391	NE	Unspecified Pit	1955
26	494	NW	Laundry	1920

## 1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.



Records of historical tanks within 500m of the search boundary:

21

ID	Distance (m)	Direction	Use	Date
27G	46	N	Unspecified Tank	1950
28G	46	N	Unspecified Tank	1950
29H	211	E	Unspecified Tank	1870
30H	211	E	Unspecified Tank	1868
31R	218	E	Unspecified Tank	1950
32I	264	S	Unspecified Tank	1991
33I	264	S	Unspecified Tank	1972
34J	302	NW	Unspecified Tank	1870
35J	302	NW	Unspecified Tank	1868
36J	310	W	Unspecified Tank	1875
37	354	S	Unspecified Tank	1896
38	395	S	Unspecified Tank	1896
39K	400	E	Unspecified Tank	1916
40K	402	E	Unspecified Tank	1896
41M	437	NW	Unspecified Tank	1896
42	445	SW	Unspecified Tank	1896
43L	449	E	Unspecified Tank	1991
44L	449	E	Unspecified Tank	1992
45M	458	NW	Unspecified Tank	1896
46	461	W	Unspecified Tank	1875
47	482	S	Unspecified Tank	1875

### 1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary:

70

ID	Distance (m)	Direction	Use	Date
48N	33	S	Electricity Substation	1994
49N	33	S	Electricity Substation	1991
50N	36	S	Electricity Substation	1972
51O	70	W	Electricity Substation	1953
52O	70	W	Electricity Substation	1991
53O	70	W	Electricity Substation	1972
54P	128	S	Electricity Substation	1953
55P	128	S	Electricity Substation	1950
56P	129	S	Electricity Substation	1950
57Q	146	E	Electricity Substation	1994



58Q	146	E	Electricity Substation	1972
59Q	147	E	Electricity Substation	1991
60R	210	E	Electricity Substation	1972
61R	210	E	Electricity Substation	1994
62R	211	E	Electricity Substation	1991
63S	238	SW	Electricity Substation	1991
64S	238	SW	Electricity Substation	1972
65T	252	E	Electricity Substation	1972
66T	252	E	Electricity Substation	1991
67T	252	E	Electricity Substation	1994
68U	266	SW	Electricity Substation	1991
69U	266	SW	Electricity Substation	1972
70V	305	SE	Electricity Substation	1994
71V	306	SE	Electricity Substation	1972
72V	306	SE	Electricity Substation	1991
73W	307	W	Electricity Substation	1991
74W	308	W	Electricity Substation	1972
75X	308	SE	Electricity Substation	1994
76X	309	SE	Electricity Substation	1991
77X	309	SE	Electricity Substation	1972
78Y	312	NW	Electricity Substation	1972
79Y	313	NW	Electricity Substation	1985
80Y	313	NW	Electricity Substation	1991
81Z	379	N	Electricity Substation	1991
82Z	379	N	Electricity Substation	1972
83Z	379	N	Electricity Substation	1955
84AA	388	S	Electricity Substation	1991
85AA	389	S	Electricity Substation	1972
86AA	389	S	Electricity Substation	1950
87AA	389	S	Electricity Substation	1953
88AB	403	N	Electricity Substation	1972
89AB	404	N	Electricity Substation	1991
90AB	404	N	Electricity Substation	1985
91AC	428	W	Electricity Substation	1972
92AC	428	W	Electricity Substation	1950
93AC	428	W	Electricity Substation	1950
94AC	428	W	Electricity Substation	1985
95AC	428	W	Electricity Substation	1991
96AD	431	SW	Electricity Substation	1991
97AE	432	NW	Electricity Substation	1972
98AD	432	SW	Electricity Substation	1972
99AE	432	NW	Electricity Substation	1950
100AE	432	NW	Electricity Substation	1950
101AH	432	W	Electricity Substation	1972
102AE	433	NW	Electricity Substation	1985
103AE	433	NW	Electricity Substation	1991



104AF	436	W	Electricity Substation	1991
105AF	436	W	Electricity Substation	1972
106AG	441	W	Electricity Substation	1991
107AG	441	W	Electricity Substation	1972
108AH	453	W	Electricity Substation	1991
109	465	SE	Electricity Substation	1991
110AI	473	NW	Electricity Substation	1972
111AI	474	NW	Electricity Substation	1985
112AI	474	NW	Electricity Substation	1991
113AJ	475	N	Electricity Substation	1985
114AJ	475	N	Electricity Substation	1991
115AJ	475	N	Electricity Substation	1972
116AK	488	NE	Electricity Substation	1972
117AK	489	NE	Electricity Substation	1991

## 1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

## 1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 14

ID	Distance (m)	Direction	Use	Date
118AL	95	NW	Garage	1985
119AL	95	NW	Garage	1991
120D	199	S	London Transport Garage	1991
121E	199	S	London Transport Garage	1962
122E	199	S	London Transport Garage	1972
123D	200	S	London Transport Garage	1994
124AM	202	S	London Transport Garage	1991
125AM	202	S	London Transport Garage	1953
126AM	203	S	London Transport Garage	1972
127AN	324	N	Carriage and Engineering Works	1950



128AN	324	N	Carriage and Engineering Works	1950
129AN	348	N	Garage	1962
130AO	445	S	Garage	1987
131AO	445	S	Garage	1991

## 1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 20

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

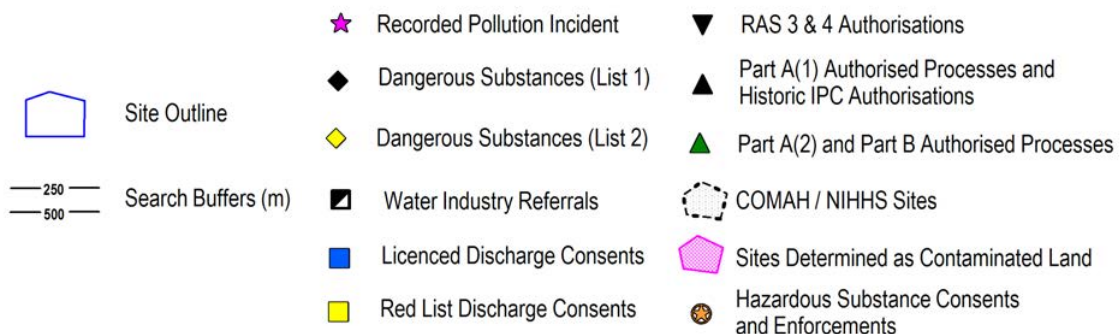
ID	Distance(m)	Direction	Use	Date
132B	102	S	Unspecified Heap	1957
133B	102	S	Unspecified Heap	1968
134B	111	S	Reservoir	1955
135B	113	S	Reservoir	1938
136B	113	S	Reservoir	1920
137B	116	S	Covered Reservoir	1973
138B	116	S	Covered Reservoir	1982
139B	116	S	Covered Reservoir	1992
140AP	118	S	Reservoir	1870
141AP	119	S	Reservoir	1871
142	194	NW	Pond	1870
143F	219	SE	Unspecified Heap	1870
144F	223	SE	Unspecified Shaft	1870
145F	226	SE	Unspecified Shaft	1871
146AQ	250	S	Unspecified Shaft	1871
147AR	383	SE	Pond	1870
148AR	387	SE	Pond	1871
149AS	391	NE	Unspecified Pit	1955
150AD	420	SW	Ponds	1871
151	499	E	Pond	1894



## 2. Environmental Permits, Incidents and Registers Map



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## 2. Environmental Permits, Incidents and Registers

### 2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

#### 2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

---

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

0

Database searched and no data found.

---

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

0

Database searched and no data found.

#### 2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

---

#### 2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

---



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

5

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
3	110	N	530488 173546	Address: Pinewood Motor Company Limited, 237 Brixton Hill, SW2 1NR Process: Respraying of Road Vehicles Status: Revoked Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
4	132	N	530427 173548	Address: Fabric Care Dry Cleaners, 280A Brixton Hill, London, SW2 1HT Process: Dry Cleaning Status: Current Permit Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
5B	287	NW	530234 173630	Address: Displaycraft Limited, 1- 31 Morrish Road, SW2 4ES Process: Printing Status: Revoked Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
6B	287	NW	530234 173630	Address: Fuelforce Ltd, 2 -22 Streatham Place, SW2 4QY Process: Unloading of Petrol into Storage at Service Stations Status: Historical Permit Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
7	410	S	530390 173038	Address: Capital Cleaners, 86 Streatham Hill, London, SW2 4RD Process: Dry Cleaning Status: Current Permit Permit Type: Part B Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

## 2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.



### 2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

2

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
1A	189	S	530600 173202	<p>Address: Streatham Hill (N), Streatham Hill (N), -, -, -</p> <p>Effluent Type: TRADE DISCHARGES - UNSPECIFIED</p> <p>Permit Number: TEMP.0255</p> <p>Permit Version: 1</p> <p>Receiving Water: RIVER THAMES</p> <p>Status: REVOKED - UNSPECIFIED</p> <p>Issue date: 15/09/1989</p> <p>Effective Date: 15-Sep-1989</p> <p>Revocation Date: 05/10/2000</p>
2A	190	S	530600 173201	<p>Address: Streatham Hill (S), Streatham Hill (S), -, -, -</p> <p>Effluent Type: TRADE DISCHARGES - UNSPECIFIED</p> <p>Permit Number: TEMP.0256</p> <p>Permit Version: 1</p> <p>Receiving Water: RIVER THAMES</p> <p>Status: REVOKED - UNSPECIFIED</p> <p>Issue date: 15/09/1989</p> <p>Effective Date: 15-Sep-1989</p> <p>Revocation Date: 05/10/2000</p>

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

0

Database searched and no data found.

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

0

Database searched and no data found.

## 2.2 Dangerous or Hazardous Sites

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

0

Database searched and no data found.



## 2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

### 2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

0

Database searched and no data found.

---

### 2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

Database searched and no data found.

---

## 2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

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

0

Database searched and no data found.

---



# 3. Landfill and Other Waste Sites Map



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# 3. Landfill and Other Waste Sites

## 3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

---

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

0

Database searched and no data found.

---

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

0

Database searched and no data found.

---

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

0

Database searched and no data found.

---

## 3.2 Other Waste Sites

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

0

Database searched and no data found.

---



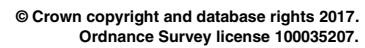
### 3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

1

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
Not shown	1424	NE	531630 174348	<p>Site Address: Brixton Transfer Station, Shakespeare Wharf, Brixton, London, SE24 OLA</p> <p>Type: Household, Commercial &amp; Industrial Waste T Stn</p> <p>Size: &gt;= 75000 tonnes</p> <p>Environmental Permitting Regulations (Waste) Licence Number: AJB004</p> <p>EPR reference: EA/EPR/ZP3890EF/V003</p> <p>Operator: S I T A Waste Handling Ltd</p> <p>Waste Management licence No: 83343</p> <p>Annual Tonnage: 87750.0</p> <p>Issue Date: 10/12/2002</p> <p>Effective Date: -</p> <p>Modified: 05/08/2011</p> <p>Surrendered Date: -</p> <p>Expiry Date: -</p> <p>Cancelled Date: -</p> <p>Status: Modified</p> <p>Site Name: Brixton Transfer Station</p> <p>Correspondence Address: -</p>







## 4. Current Land Uses

### 4.1 Current Industrial Data

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

10

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

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	38	S	Electricity Sub Station	530546 173350	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities
2	72	W	Electricity Sub Station	530377 173432	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities
3	111	N	Jemca Group	530488 173546	Jemca Group, 237, Brixton Hill, London, SW2 1NR	Vehicle Repair, Testing and Servicing	Repair and Servicing
4	155	E	Electricity Sub Station	530710 173429	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities
5	155	NW	G H Motors	530313 173513	G H Motors, Top Floor Flat 11b, Streatham Place, London, SW2 4PY	Vehicle Repair, Testing and Servicing	Repair and Servicing
6	214	E	Electricity Sub Station	530757 173485	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities
7	219	S	Arriva Plc	530546 173167	Arriva Plc, Brixton Garage 39, Streatham Hill, London, SW2 4TB	Bus and Coach Stations, Depots and Companies	Public Transport, Stations and Infrastructure
8	227	NE	South West Clearance Service	530688 173597	South West Clearance Service, 56, Holmewood Gardens, London, SW2 3NB	Clearance and Salvage Dealers	Recycling Services
9	239	SW	Electricity Sub Station	530314 173210	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities
10	244	E	Electricity Sub Station	530801 173394	Electricity Sub Station, SW2	Electrical Features	Infrastructure and Facilities



## 4.2 Petrol and Fuel Sites

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

1

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
11	160	NW	530328 173544	Jet	Streatham Place Filling Station, 2-22, Streatham Place, Streatham Place, Streatham Hill, London, Inner London, SW2 4PZ	Not Applicable	Obsolete

## 4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site:

0

Database searched and no data found.

## 4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site:

0

Database searched and no data found.



# 5. Geology

## 5.1 Artificial Ground and Made Ground

Database searched and no data found.

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

---

## 5.2 Superficial Ground and Drift Geology

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

Lex Code	Description	Rock Type
HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL

---

## 5.3 Bedrock and Solid Geology

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

Lex Code	Description	Rock Type
LC-XCZ	LONDON CLAY FORMATION	CLAY AND SILT

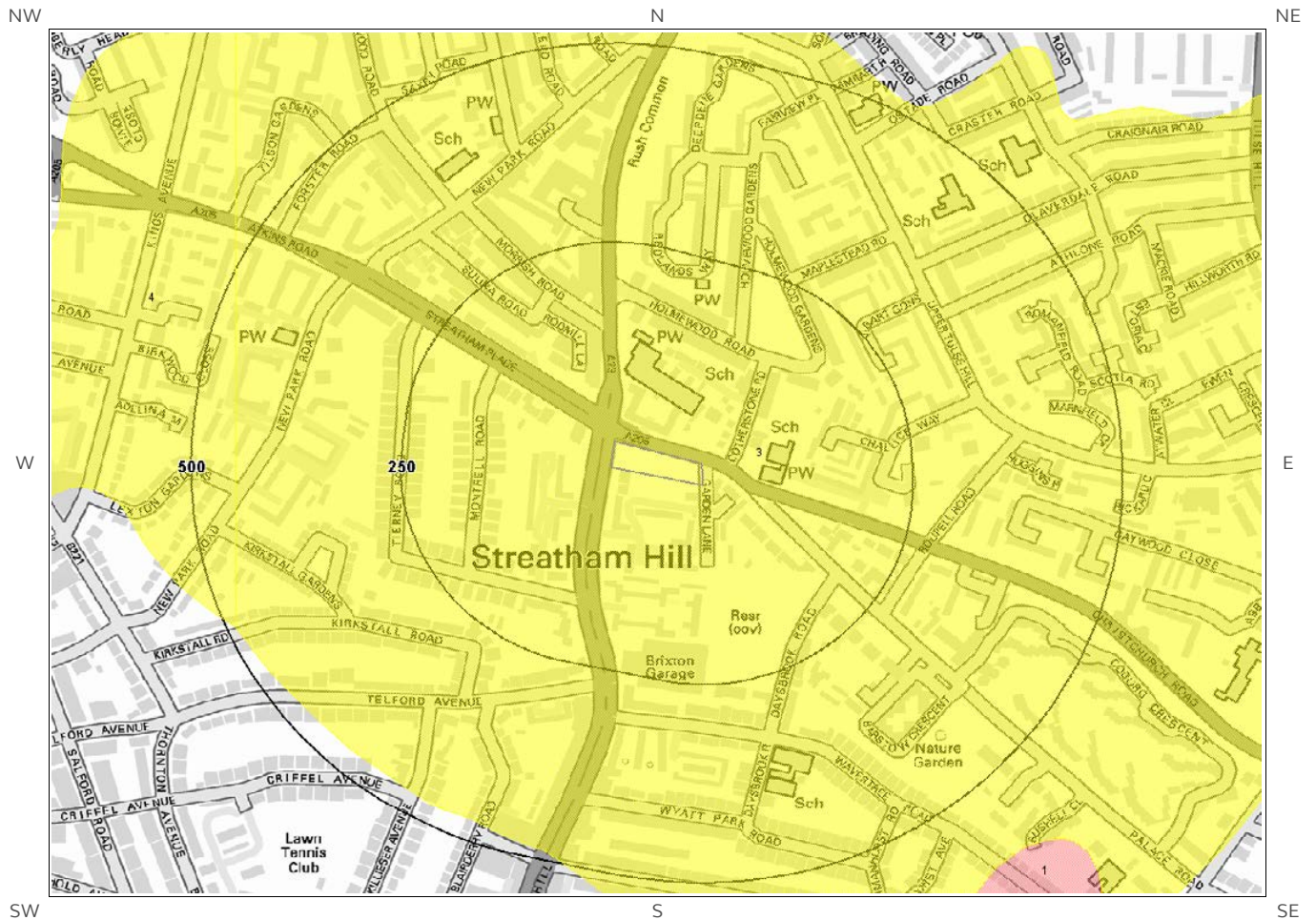
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

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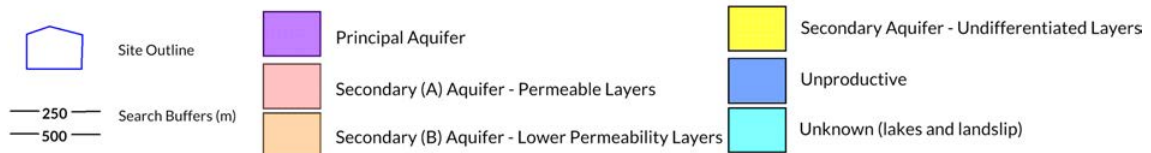


# 6 Hydrogeology and Hydrology

## 6a. Aquifer Within Superficial Geology



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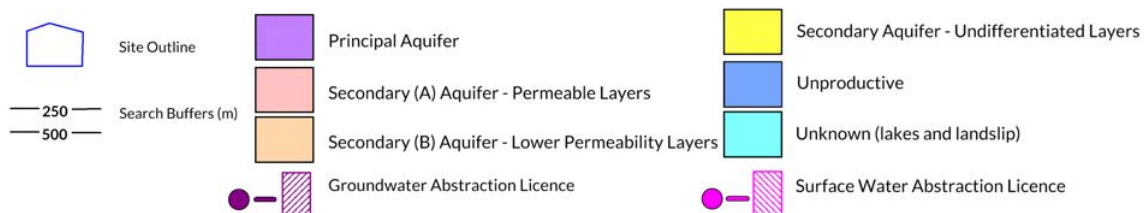




# 6b. Aquifer Within Bedrock Geology and Abstraction Licenses

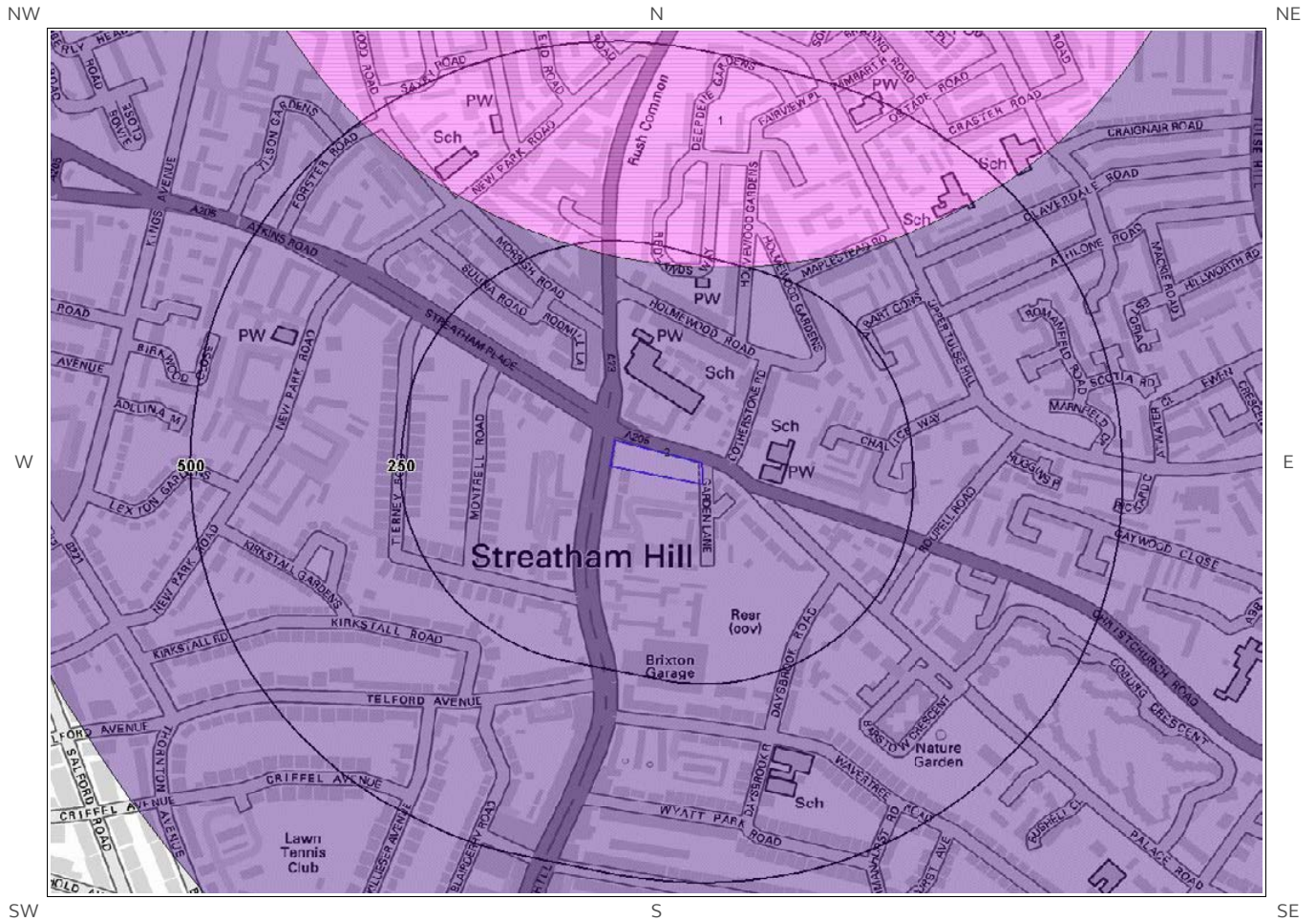


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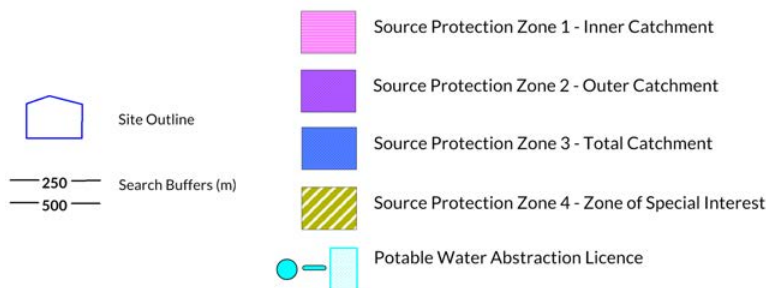




# 6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses

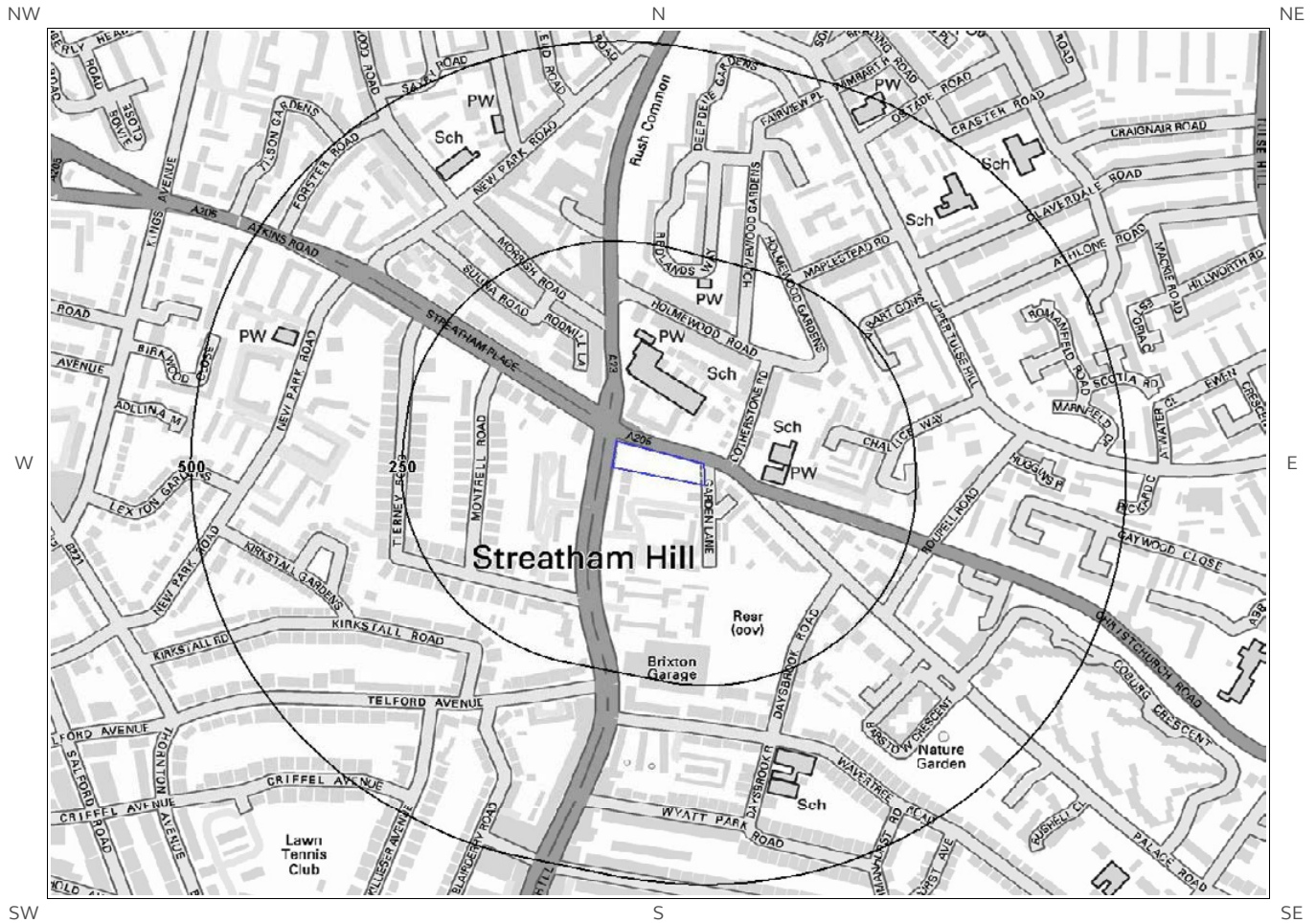


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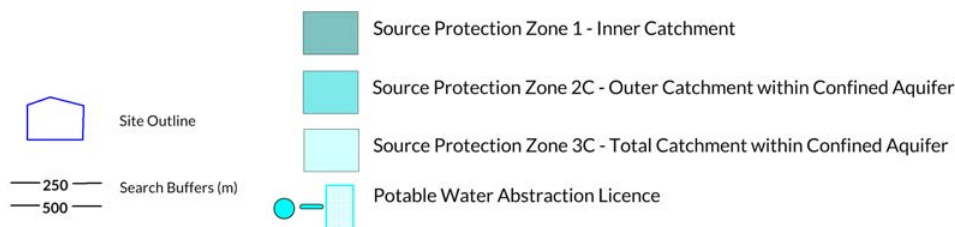




# 6d. Hydrogeology – Source Protection Zones within confined aquifer

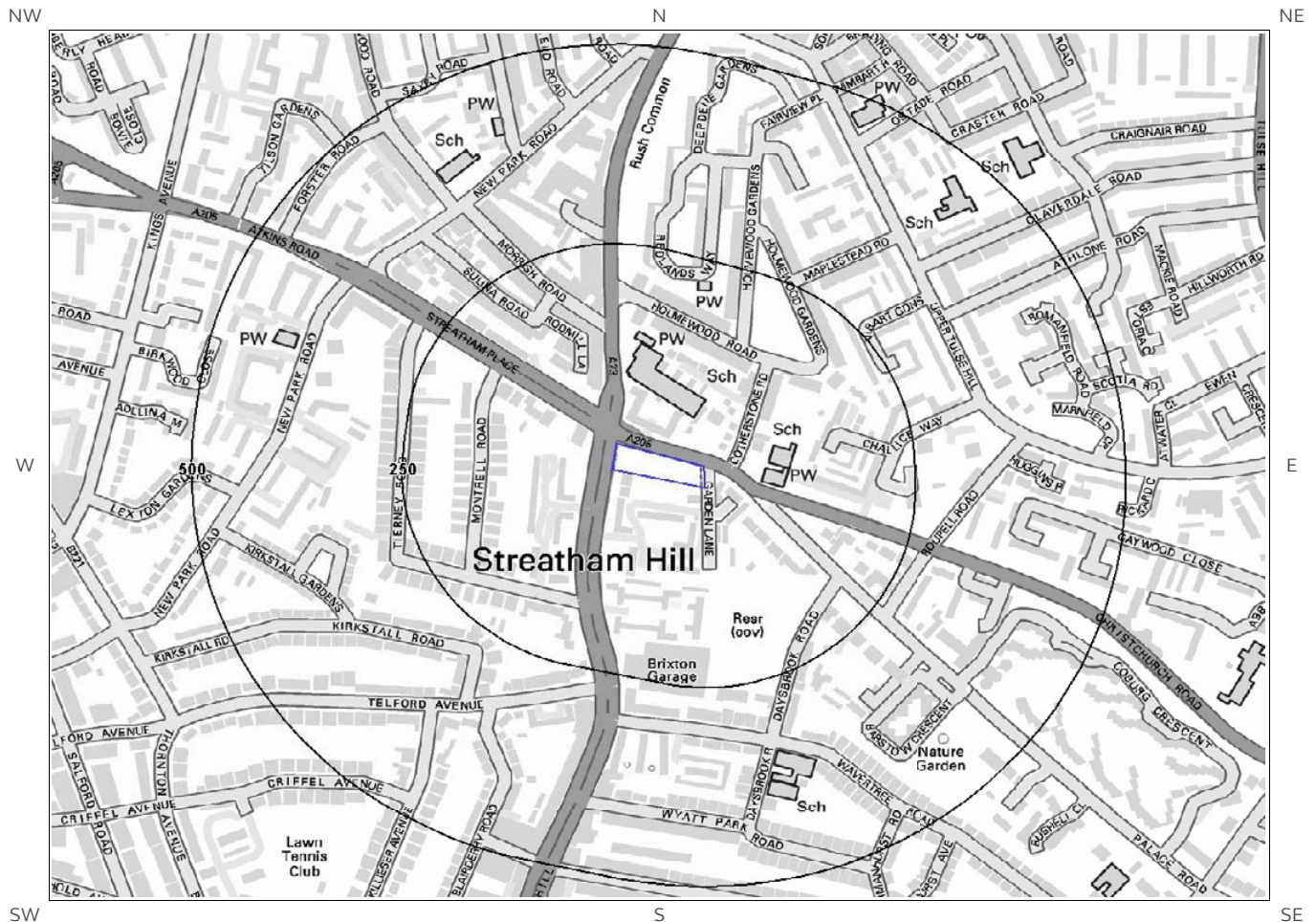


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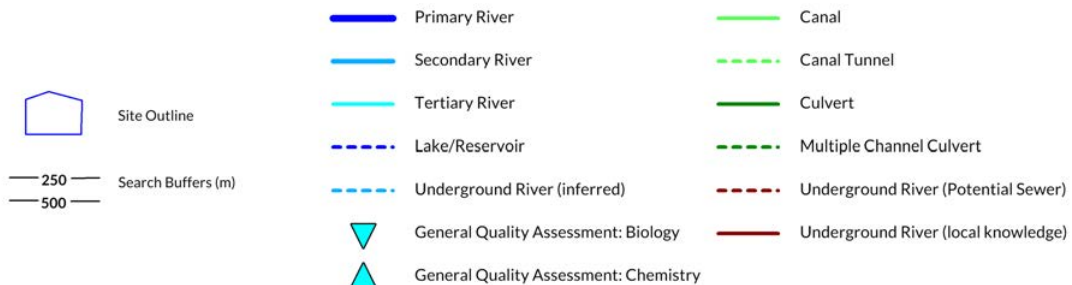




# 6e. Hydrology – Detailed River Network and River Quality



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# 6. Hydrogeology and Hydrology

## 6.1 Aquifer within Superficial Deposits

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

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

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
3	0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
4	447	W	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

## 6.2 Aquifer within Bedrock Deposits

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

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

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	447	W	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow



## 6.3 Groundwater Abstraction Licences

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

Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
Not shown	890	N	530510 174330	Status: Historical Licence No: 28/39/42/0063 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Brixton Pumping Station, London Sw2 - Borehole Data Type: Point Name: THAMES WATER UTILITIES LTD Annual Volume (m³): 3650000 Max Daily Volume (m³): 13400 Original Application No: WRA/R/1004 Original Start Date: 10/4/2002 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 10/4/2002 Version End Date:
Not shown	891	N	530541 174328	Status: Active Licence No: TH/039/0042/019 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Borehole At Brixton Pumping Station Data Type: Point Name: THAMES WATER UTILITIES LTD Annual Volume (m³): 3650000 Max Daily Volume (m³): 13400 Original Application No: NPS/WR/009267 Original Start Date: 1/4/2013 Expiry Date: 31/3/2019 Issue No: 1 Version Start Date: 1/4/2013 Version End Date:
Not shown	1578	N	530200 175000	Status: Historical Licence No: 28/39/42/0006 Details: General Washing/Process Washing Direct Source: Thames Groundwater Point: Acre Lane, Brixton, - Borehole 'a' Data Type: Point Name: SUNLIGHT SERVICE GROUP LTD Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: WR/RG1467 Original Start Date: 14/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 25/4/1996 Version End Date:
Not shown	1582	N	530180 175000	Status: Active Licence No: 28/39/42/0006 Details: General Washing/Process Washing Direct Source: Thames Groundwater Point: 125 Acre Lane, brixton, sw2 - Borehole Data Type: Point Name: Berendsen UK Limited Annual Volume (m³): 95000 Max Daily Volume (m³): 1227 Original Application No: NPS/WR/013881 Original Start Date: 14/3/1966 Expiry Date: - Issue No: 102 Version Start Date: 22/7/2013 Version End Date:

## 6.4 Surface Water Abstraction Licences

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

No

Database searched and no data found.



## 6.5 Potable Water Abstraction Licences

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

Yes

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

ID	Distance (m)	Direction	NGR	Details
Not shown	890	N	530510 174330	Status: Historical Licence No: 28/39/42/0063 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Brixton Pumping Station, London Sw2 - Borehole Data Type: Point Name: THAMES WATER UTILITIES LTD Annual Volume (m³): 3650000 Max Daily Volume (m³): 13400 Original Application No: WRA/R/1004 Original Start Date: 10/4/2002 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: Version End Date:
Not shown	891	N	530541 174328	Status: Active Licence No: TH/039/0042/019 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Borehole At Brixton Pumping Station Data Type: Point Name: THAMES WATER UTILITIES LTD Annual Volume (m³): 3650000 Max Daily Volume (m³): 13400 Original Application No: NPS/WR/009267 Original Start Date: 1/4/2013 Expiry Date: 31/3/2019 Issue No: 1 Version Start Date: Version End Date:

## 6.6 Source Protection Zones

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

Yes

The following Source Protection Zones records are represented on the SPZ and Potable Water Abstraction Map (6c):

ID	Distance (m)	Direction	Zone	Description
2	0	On Site	2	Outer catchment
1	227	N	1	Inner catchment

## 6.7 Source Protection Zones within Confined Aquifer

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

No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.



## 6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? No

Database searched and no data found.

---

## 6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? No

### 6.9.1 Biological Quality:

Database searched and no data found.

---

### 6.9.2 Chemical Quality:

Database searched and no data found.

---

## 6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? No

Database searched and no data found.

---

## 6.11 Surface Water Features

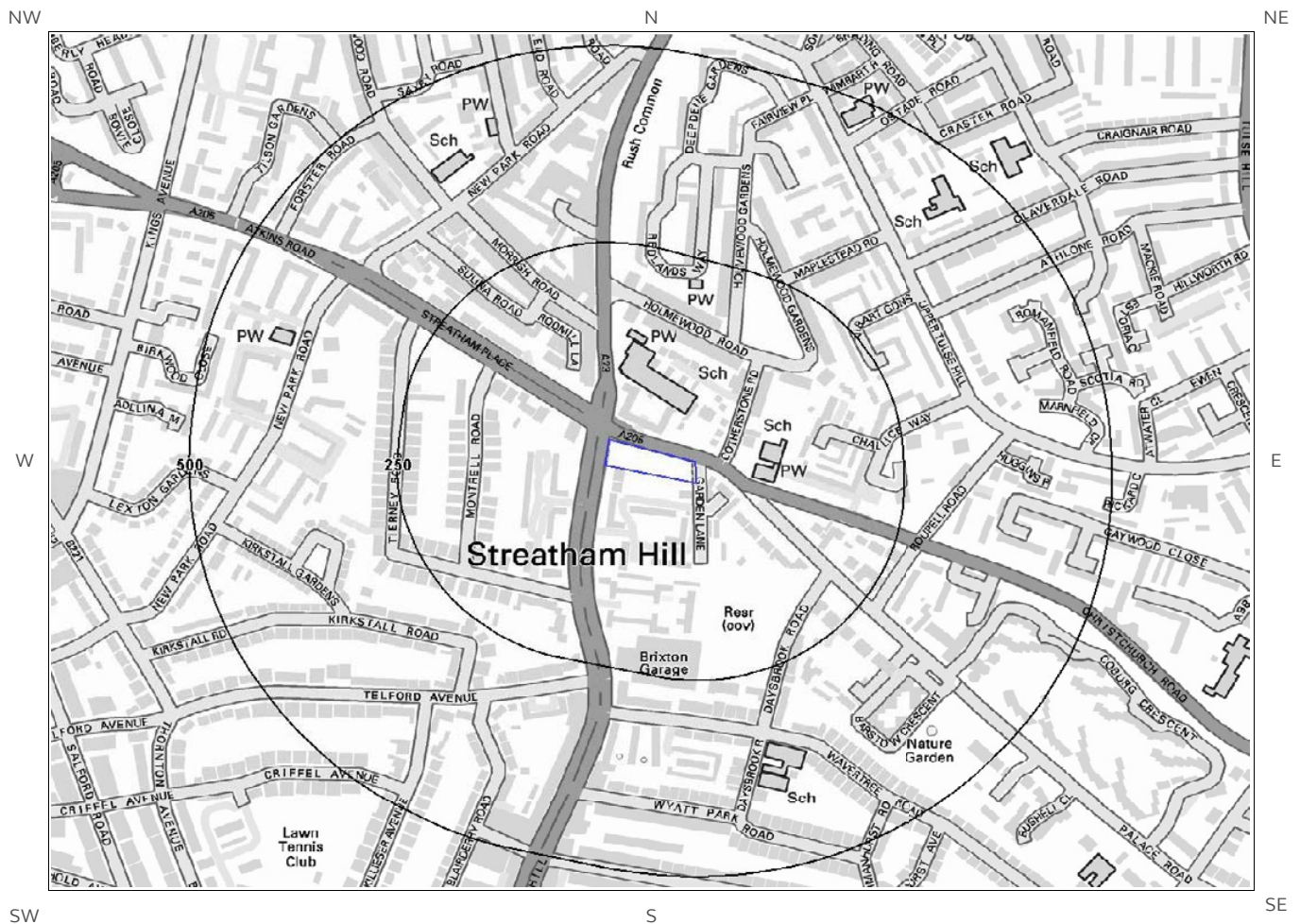
Are there any surface water features within 250m of the study site? No

Database searched and no data found.

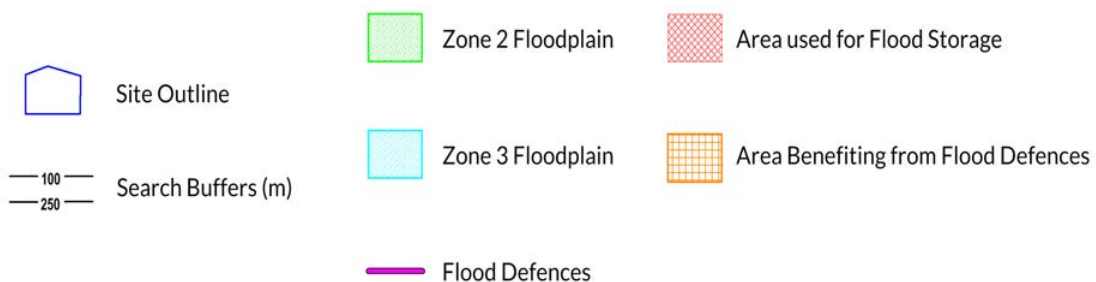
---



# 7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



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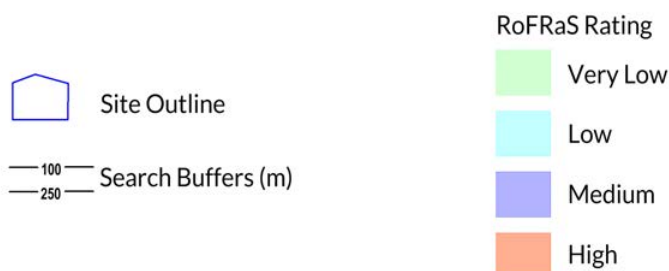




# 7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



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# 7 Flooding

## 7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

---

## 7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

---

## 7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

---

## 7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No  
Database searched and no data found.

---

## 7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No



## 7.6 Areas benefiting from Flood Storage

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

No

## 7.7 Groundwater Flooding Susceptibility Areas

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

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

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

Limited potential

Where limited potential for groundwater flooding to occur is indicated, this means that although given the geological conditions there may be a groundwater flooding hazard, unless other relevant information, e.g. records of previous flooding, suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard.

## 7.8 Groundwater Flooding Confidence Areas

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

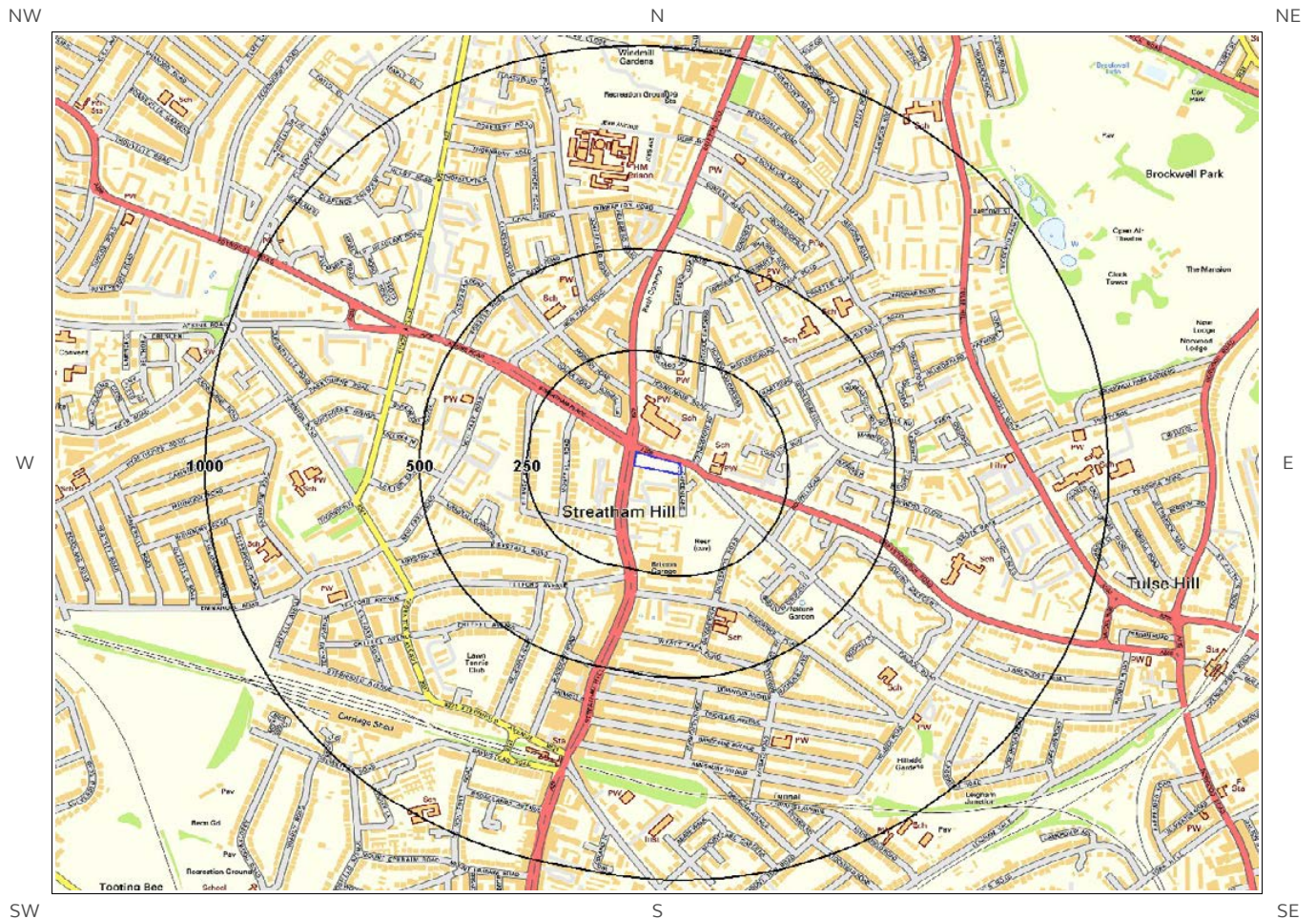
High

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

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



# 8. Designated Environmentally Sensitive Sites Map



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# 8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site?

No

## 8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

## 8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

## 8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

## 8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

## 8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.



#### 8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

---

#### 8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

---



### 8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

0

Database searched and no data found.

---

### 8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

---



# 9. Natural Hazards Findings

## 9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a **Groundsure Geo Insight**, available from our [website](#). The following information has been found:

### 9.1.1 Shrink Swell

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

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

Hazard
Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

### 9.1.2 Landslides

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

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

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

### 9.1.3 Soluble Rocks

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

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

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

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



#### 9.1.4 Compressible Ground

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

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

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

#### 9.1.5 Collapsible Rocks

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

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

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

#### 9.1.6 Running Sand

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

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

Hazard
Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

### 9.2 Radon

#### 9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

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



### 9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing

ones as described in publication BR211 by the Building Research Establishment?

No radon protective measures are necessary.



# 10. Mining

## 10.1 Coal Mining

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

Database searched and no data found.

---

## 10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? No

Database searched and no data found.

---

## 10.3 Brine Affected Areas

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

Guidance: No Guidance Required.

---



# Contact Details

**Groundsure Helpline**  
Telephone: 08444 159 000  
info@groundsure.com

**British Geological Survey Enquiries**

Kingsley Dunham Centre  
Keyworth, Nottingham NG12 5GG  
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Fax: 0115 936 3276.  
Email:

Web: [www.bgs.ac.uk](http://www.bgs.ac.uk)

BGS Geological Hazards Reports and general geological enquiries:  
[enquiries@bgs.ac.uk](mailto:enquiries@bgs.ac.uk)

**Environment Agency**

National Customer Contact Centre, PO Box 544  
Rotherham, S60 1BY  
Tel: 03708 506 506

Web: [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)

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[www.gov.uk/phe](http://www.gov.uk/phe)

Email: [enquiries@phe.gov.uk](mailto:enquiries@phe.gov.uk)  
Main switchboard: 020 7654 8000

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[www.coal.gov.uk](http://www.coal.gov.uk)

**Ordnance Survey**

Adanac Drive, Southampton  
SO16 0AS  
Tel: 08456 050505

**Local Authority**

Authority: London Borough of Lambeth  
Phone: 020 7926 1000  
Web: <http://www.lambeth.gov.uk/>  
Address: Town Hall, Brixton Hill, London, SW2 1RW

**Gemapping PLC**

Virginia Villas, High Street, Hartley Witney,  
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Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.

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<https://www.groundsure.com/terms-and-conditions-sept-2016>



Arcadis

Arcadis, 10, MEDAWAR ROAD,  
GUILDFORD, GU2 7AR

Groundsure  
Reference:

GS-3884844

Your Reference: PO0067007-1

Report Date 16 May 2017

Report Delivery Method: Email - pdf

## Groundsure Geo Insight

Address: Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director  
Groundsure Limited

Enc.  
Groundsure Geo Insight

# Groundsure Geo Insight

Address: Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP

Date: 16 May 2017

Reference: GS-3884844

Client: Arcadis



Aerial Photograph Capture date: 20-Apr-2013

Grid Reference: 530503,173418

Site Size: 0.32ha



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# Overview of Findings

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

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

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

## Section 1: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	Yes
	1.2.2 Are there any records of landslide within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	Yes

## Section 2: Geology 1:50,000 Scale

2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslide within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

## Section 2: Geology 1:50,000 Scale

### 2.3 Bedrock, Solid Geology and Faults

2.3.1 For records of Bedrock and Solid Geology beneath the study site\* see the detailed findings section.

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

Yes

2.3.3 Are there any records of faults within 500m of the study site boundary?

Yes

## Section 3: Radon

### 3. Radon

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

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

3.2 Radon Protection

No radon protective measures are necessary.

## Section 4: Ground Workings

	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	12	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	3	0	8
4.3 Current Ground Workings	0	0	0	0	1

## Section 5: Mining, Extraction & Natural Cavities

	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	3	0	0
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	1	0	0	2	3
5.4 Non-Coal Mining*	0	0	0	0	1
5.5 Non-Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0



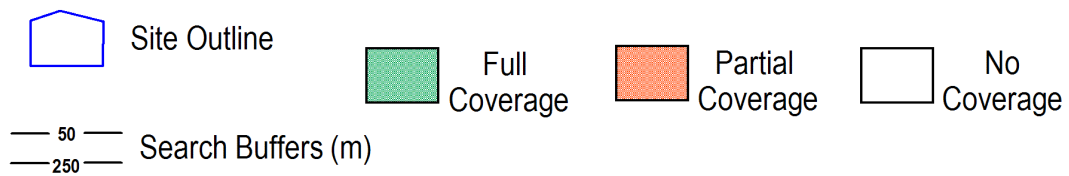
Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-site				
6.1 Shrink-Swell Clay	Moderate				
6.2 Landslides	Very Low				
6.3 Ground Dissolution of Soluble Rocks	Negligible				
6.4 Compressible Deposits	Negligible				
6.5 Collapsible Deposits	Very Low				
6.5 Running Sand	Very Low				
Section 7: Borehole Records	On-site	0-50m	51-250		
7 BGS Recorded Boreholes	5	0	21		
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250		
8 Records of Background Soil Chemistry	2	0	0		
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searched	
9.2 Historical Railway and Tunnel Features	0	0	6	Not Searched	
9.3 Historical Railways	0	0	7	Not Searched	
9.4 Active Railways	0	0	0	Not Searched	
9.5 Railway Projects	0	0	0	0	

# 1:10,000 Scale Availability



1\_10,000 Availability Legend

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# Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	Some deposits are mapped	Full	Full	No coverage
2	447.0	Some deposits are mapped	Full	Full	No coverage
N3	1558.0	Some deposits are mapped	Full	Full	No coverage
N4	1622.0	Some deposits are mapped	Full	Full	No coverage

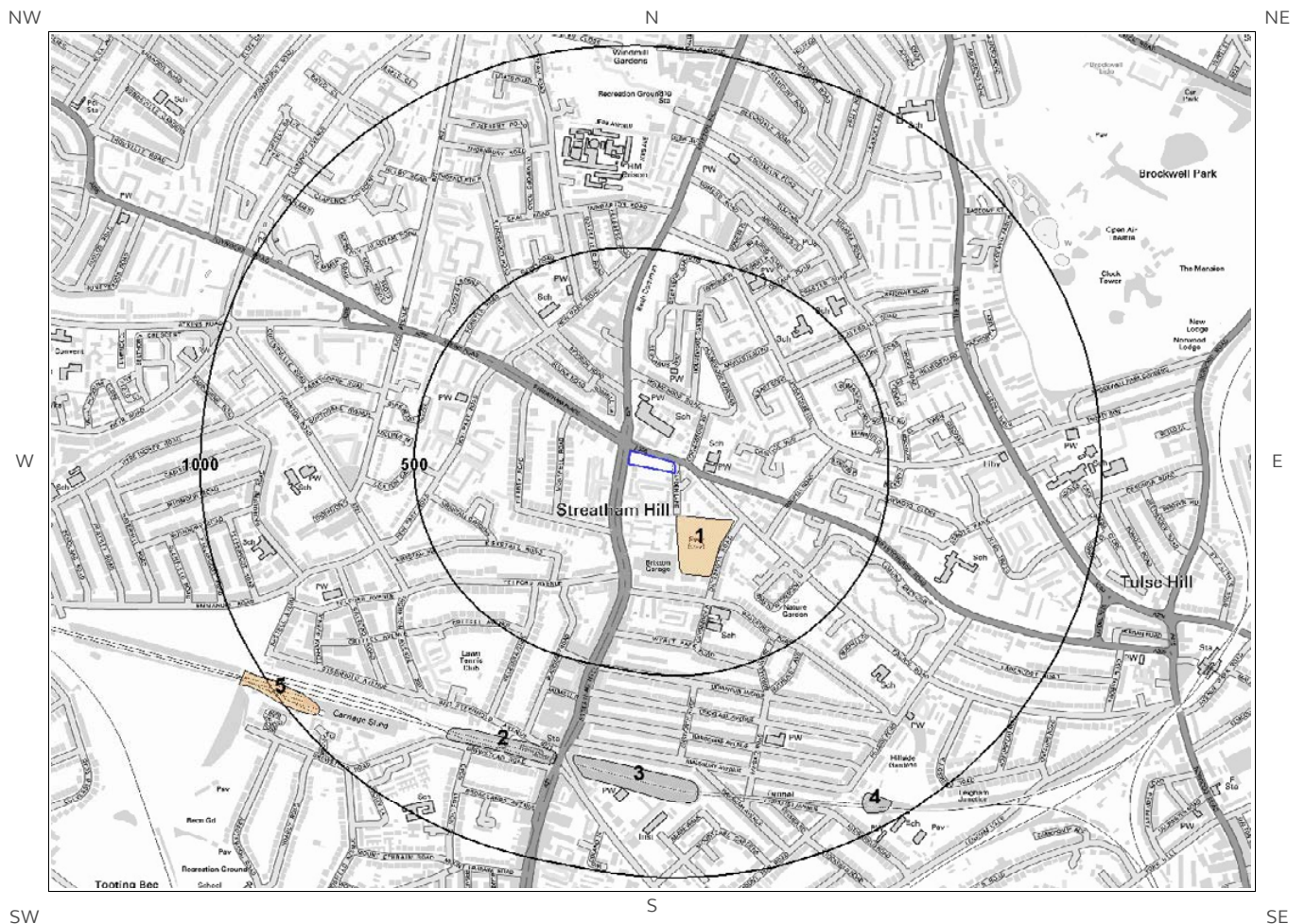
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

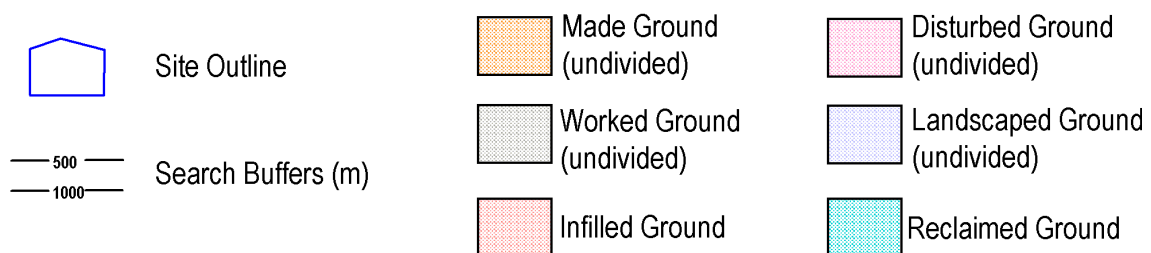
# 1 Geology (1:10,000 scale).

## 1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

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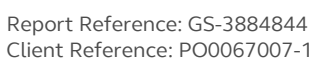
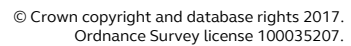
# 1. Geology 1:10,000 scale

## 1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	106.0	S	MGR- UNKNOWN	Made Ground (Undivided)	Unknown/unclassified Entry





# 1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

## 1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	HEAD-C	Head - Clay (unlithified Deposits Coding Scheme)	Clay
2	447.0	W	HEAD-Z	Head - Silt	Silt

## 1.2.2 Landslip

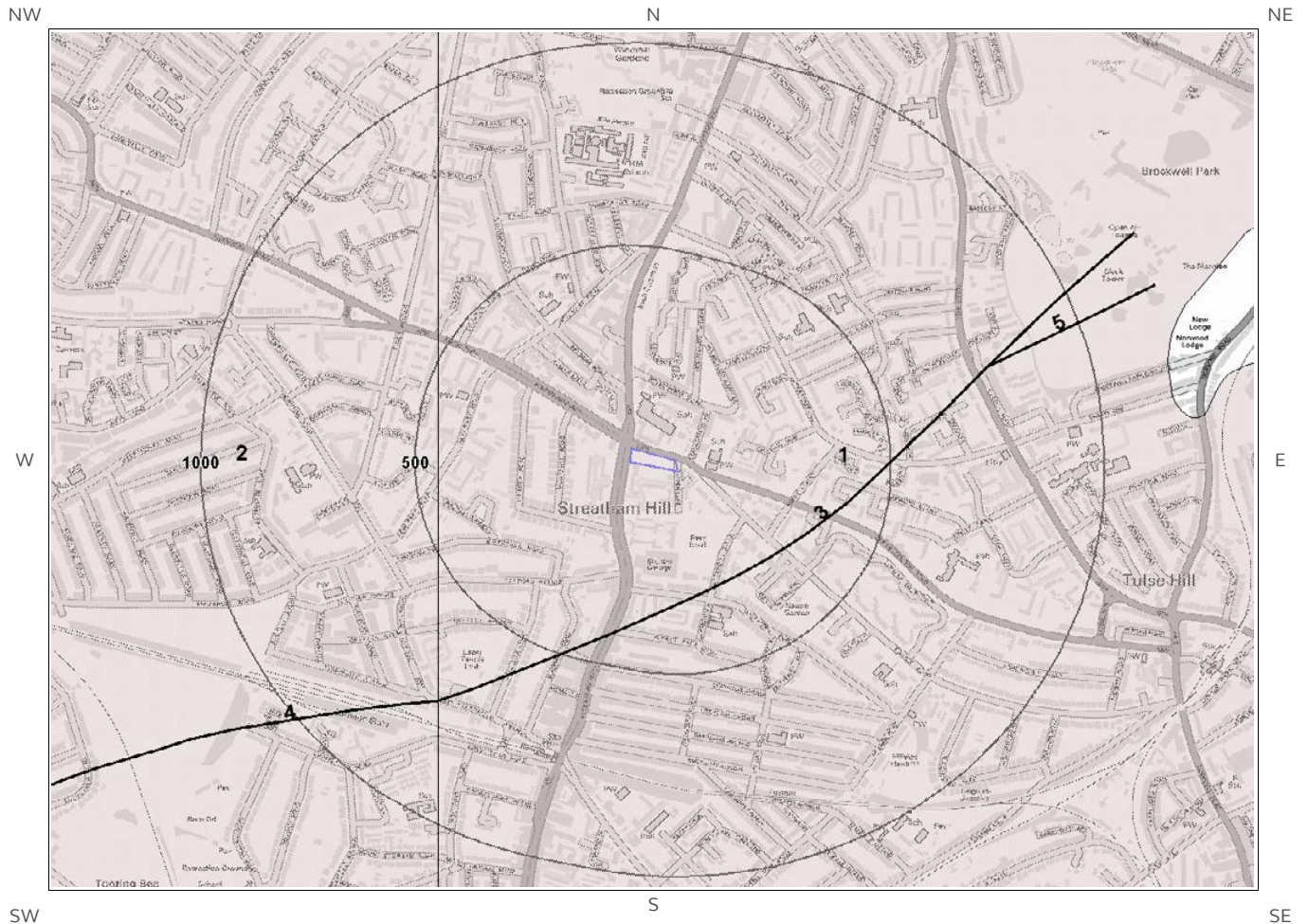
Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

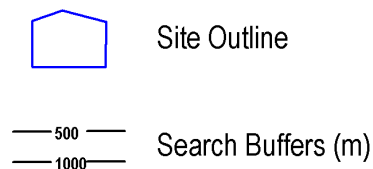
This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

# 1.3 Bedrock and Faults Map (1:10,000 scale)



**Bedrock and Faults Legend**

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## 1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

### 1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	LC-CLAY	London Clay Formation - Clay	Eocene Epoch
2	447.0	W	LC-CLAY	London Clay Formation - Clay	Eocene Epoch

---

### 1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? Yes

ID	Distance (m)	Direction	Category Description	Feature Description
3	293.0	SE	FAULT	Normal fault, inferred

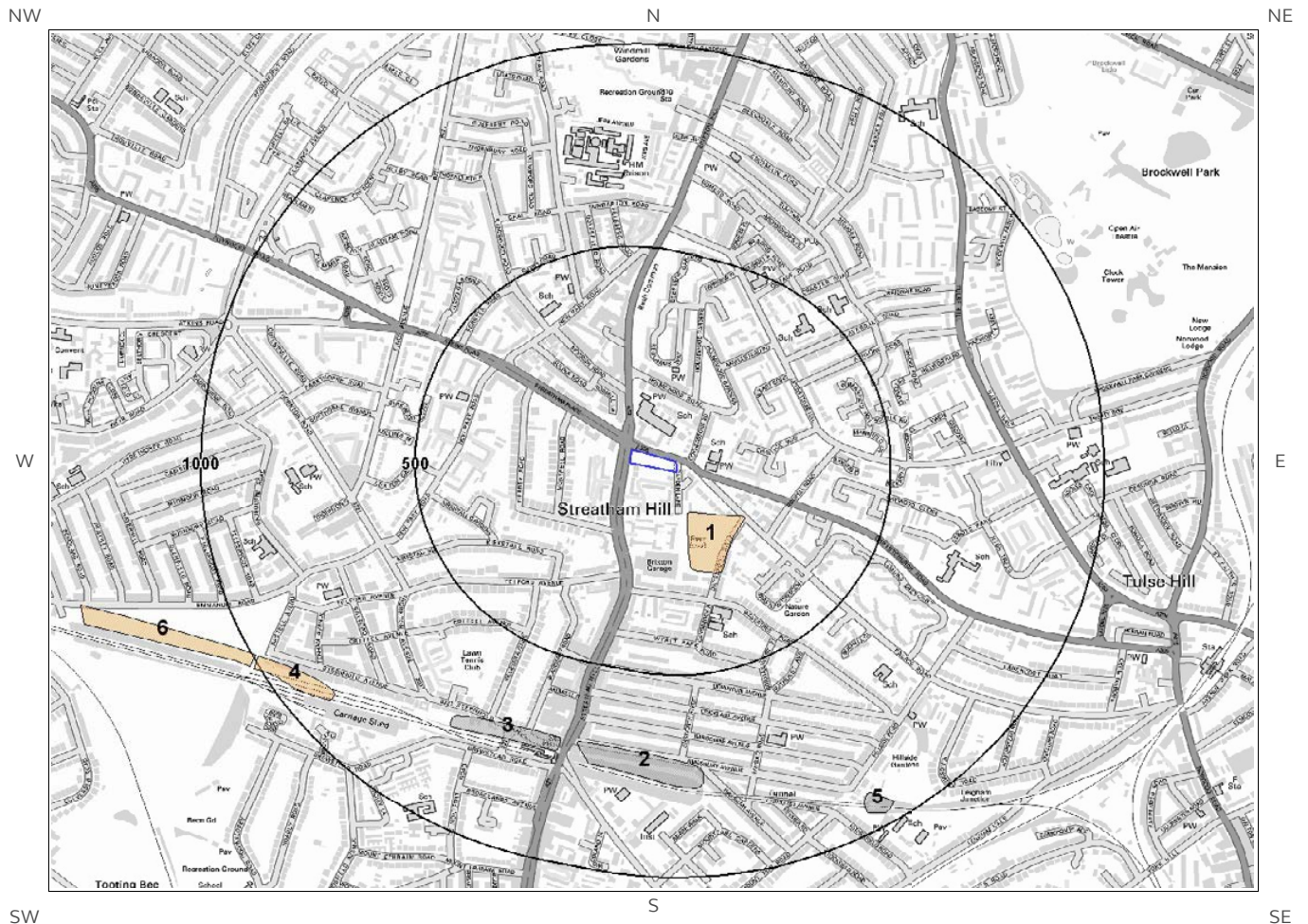
The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

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

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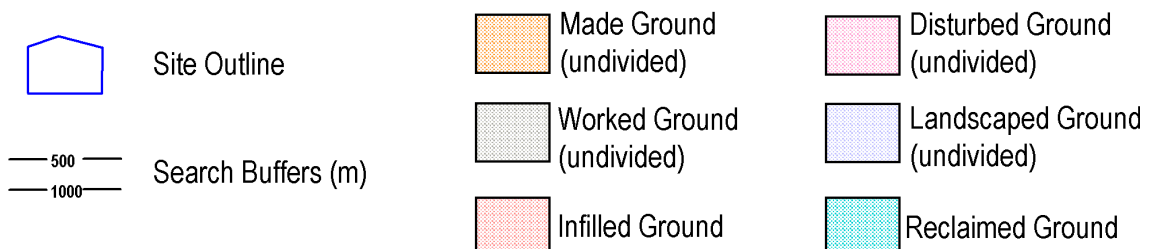
# 2 Geology 1:50,000 Scale

## 2.1 Artificial Ground Map



Ground Workings Legend

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## 2. Geology 1:50,000 scale

### 2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 270

#### 2.1.1 Artificial/ Made Ground

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

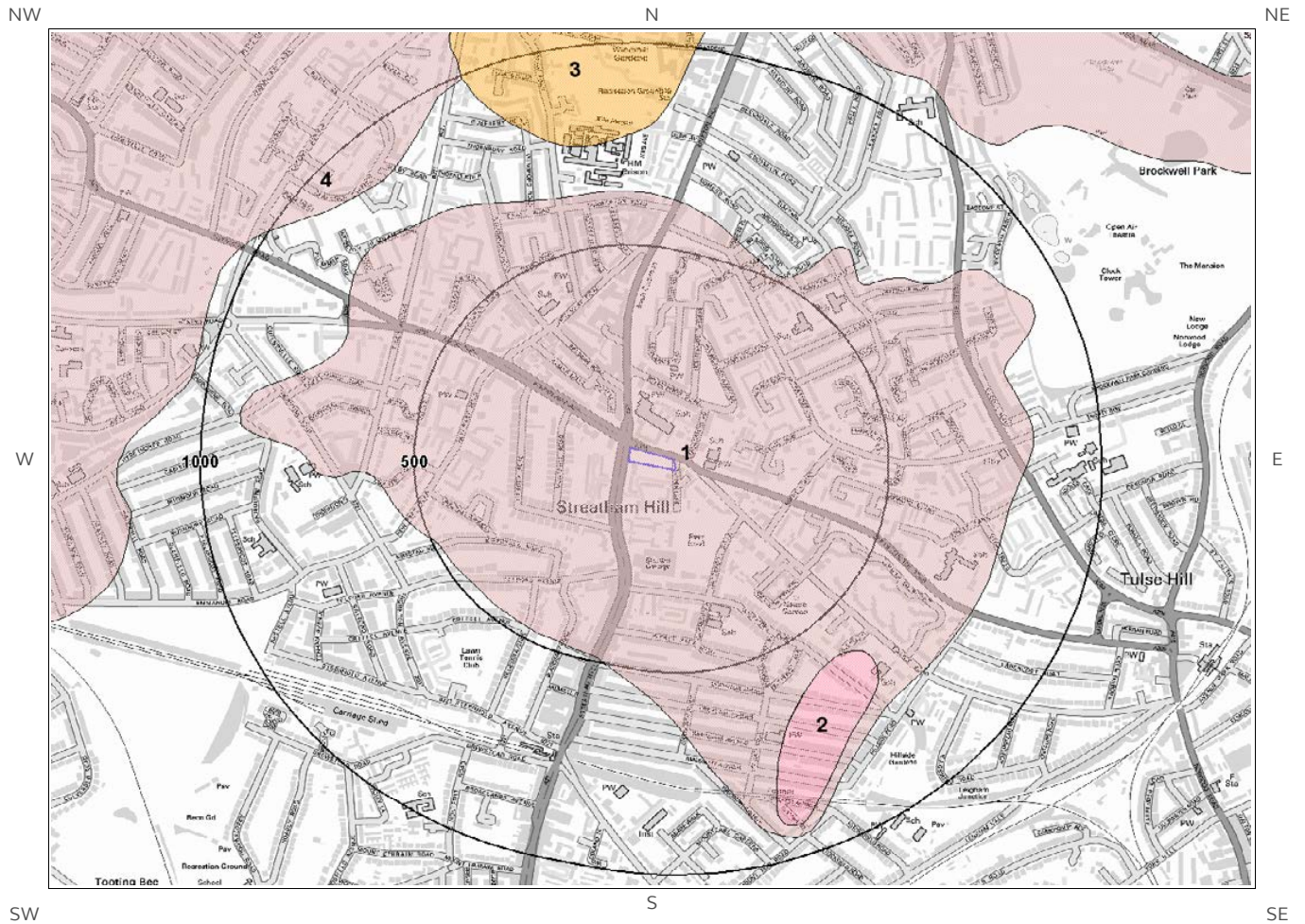
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	104.0	S	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

#### 2.1.2 Permeability of Artificial Ground

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

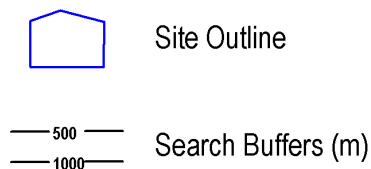
Database searched and no data found.

## 2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

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## 2.2 Superficial Deposits and Landslips

### 2.2.1 Superficial Deposits/ Drift Geology

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

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL

### 2.2.2 Permeability of Superficial Ground

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

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	High	Very Low

### 2.2.3 Landslip

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

Database searched and no data found.

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

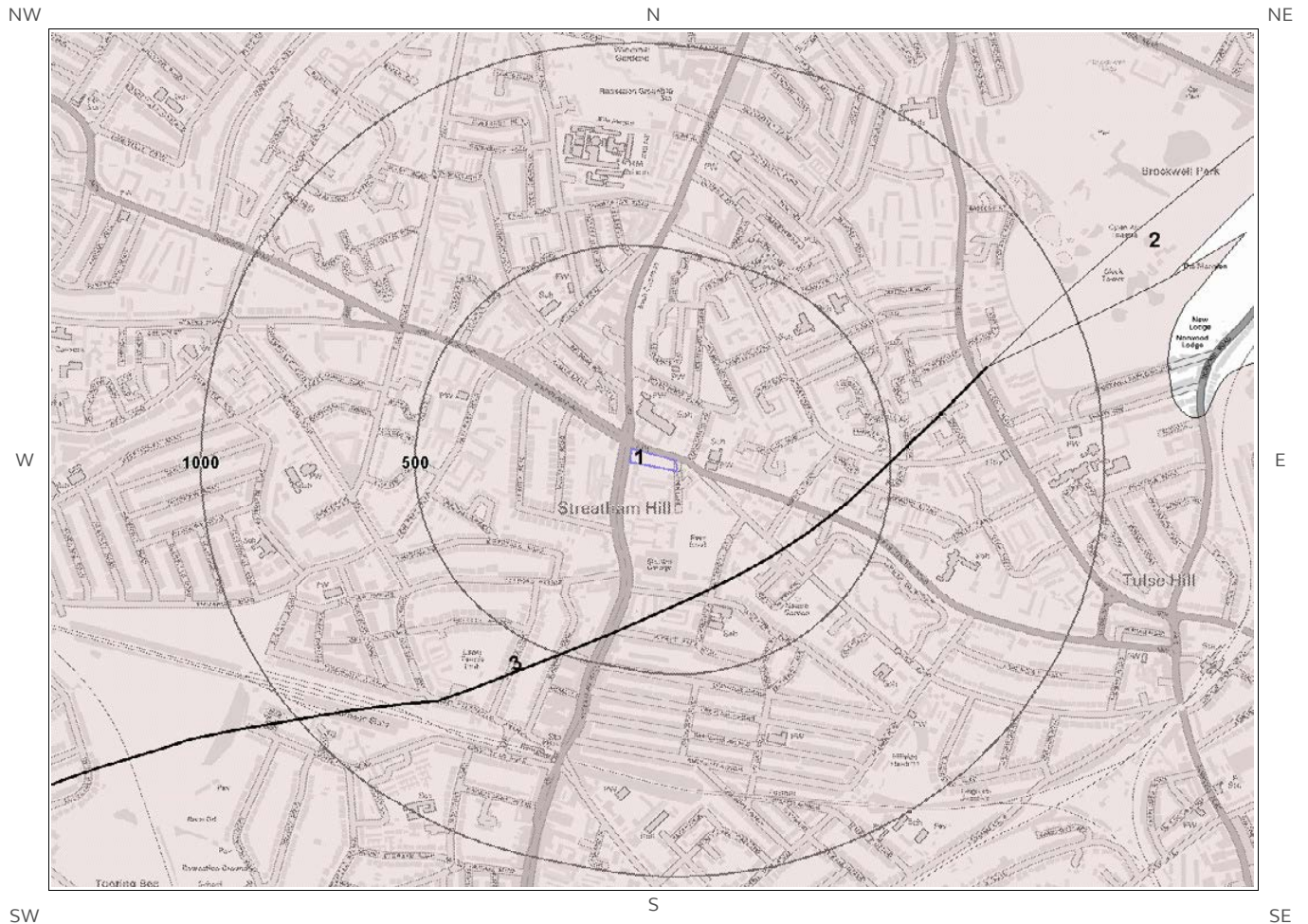
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

### 2.2.4 Landslip Permeability

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

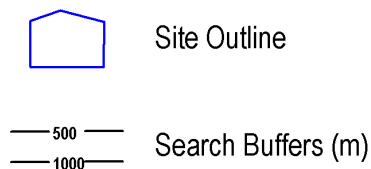
Database searched and no data found.

## 2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

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## 2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 270

### 2.3.1 Bedrock/Solid Geology

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

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	LC-XCZ	LONDON CLAY FORMATION - CLAY AND SILT	YPRESIAN

### 2.3.2 Permeability of Bedrock Ground

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

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Low	Very Low

### 2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? Yes

ID	Distance	Direction	Category Description	Feature Description
3	293.0	SE	FAULT	Fault, inferred

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

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

## 3 Radon Data

### 3.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?      The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

---

### 3.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?      No radon protective measures are necessary.

---

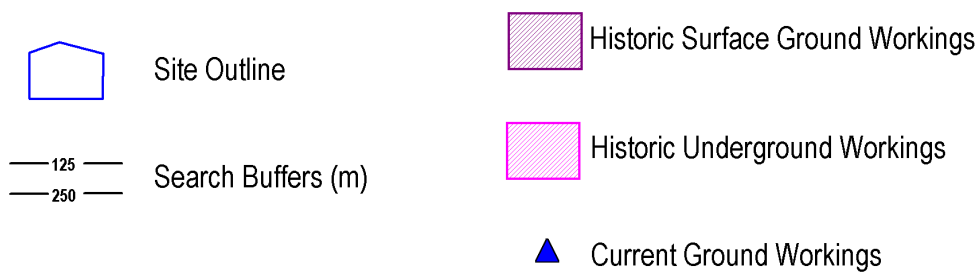


# 4 Ground Workings Map



Ground Workings Legend

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# 4 Ground Workings

## 4.1 Historical Surface Ground Working Features derived from Historical Mapping

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

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

ID	Distance (m)	Direction	NGR	Use	Date
1A	102.0	S	530627 173211	Unspecified Heap	1957
2A	102.0	S	530627 173211	Unspecified Heap	1968
3A	111.0	S	530624 173211	Reservoir	1955
4A	113.0	S	530627 173207	Reservoir	1938
5A	113.0	S	530627 173207	Reservoir	1914
6A	116.0	S	530630 173205	Covered Reservoir	1992
7A	116.0	S	530630 173205	Covered Reservoir	1973
8A	116.0	S	530630 173205	Covered Reservoir	1982
9B	118.0	S	530634 173239	Reservoir	1870
10B	119.0	S	530634 173238	Reservoir	1871
11	194.0	NW	530352 173625	Pond	1870
12C	219.0	SE	530651 173181	Unspecified Heap	1870



## 4.2 Historical Underground Working Features derived from Historical Mapping

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

Are there any Historical Underground Working Features within 1000m of the study site boundary? Yes

The following Historical Underground Working Features are provided by Groundsure:

ID	Distance (m)	Direction	NGR	Use	Date
13C	223.0	SE	530651 173181	Unspecified Shaft	1870
14C	226.0	SE	530650 173179	Unspecified Shaft	1871
15	250.0	S	530617 173142	Unspecified Shaft	1871
Not shown	782.0	S	530802 172585	Tunnel	1957
Not shown	782.0	S	530802 172585	Tunnel	1955
Not shown	782.0	S	530802 172585	Tunnel	1973
Not shown	782.0	S	530802 172585	Tunnel	1968
Not shown	782.0	S	530802 172585	Tunnel	1992
Not shown	782.0	S	530802 172585	Tunnel	1982
Not shown	789.0	S	530807 172578	Tunnel	1938
Not shown	789.0	S	530807 172578	Tunnel	1914

## 4.3 Current Ground Workings

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

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
Not shown	936.0	SE	531174 172682	Clay & Shale	Tulse Hill Brick Works	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

# 5 Mining, Extraction & Natural Cavities Map



Mining, Extraction and  
Natural Cavities Legend

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# 5 Mining, Extraction & Natural Cavities

## 5.1 Historical Mining

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

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

The following Historical Mining information is provided by Groundsure:

ID	Distance (m)	Direction	NGR	Details	Date
2A	223.0	SE	530651 173181	Unspecified Shaft	1870
3A	226.0	SE	530650 173179	Unspecified Shaft	1871
4	250.0	S	530617 173142	Unspecified Shaft	1871

## 5.2 Coal Mining

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

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

## 5.3 Johnson Poole and Bloomer

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

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

The following information provided by JPB is not represented on mapping: Whilst outside of an area where The Coal Authority have information on coal mining activities, Johnson Poole & Bloomer (JPB) have information such as mining plans and maps held within their archive of mining activities that have occurred within 1km of this property. Further details and a quote for services can be obtained by emailing this report to [enquiries.gs@jpb.co.uk](mailto:enquiries.gs@jpb.co.uk).

## 5.4 Non-Coal Mining

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

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

The following non-coal mining information is provided by the BGS:

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	669.0	E	Not available	Chalk	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered

## 5.5 Non-Coal Mining Cavities

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

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

## 5.6 Natural Cavities

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

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

## 5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.



## 5.8 Gypsum Extraction

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

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

---

## 5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

---

## 5.10 Clay Mining

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

Are there any Clay Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

---

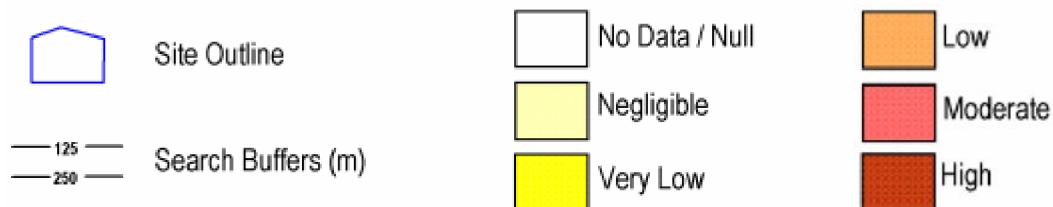
# 6 Natural Ground Subsidence

## 6.1 Shrink-Swell Clay Map



Shrink Swell Clay Legend

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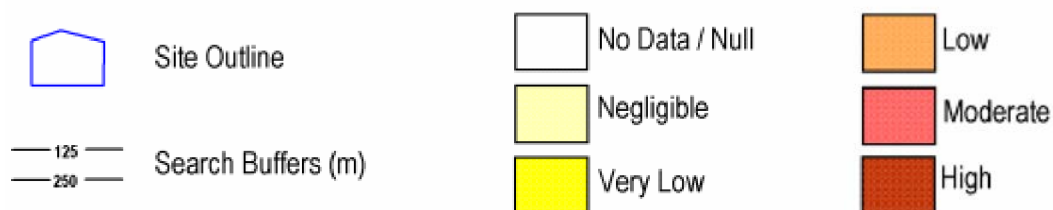


## 6.2 Landslides Map

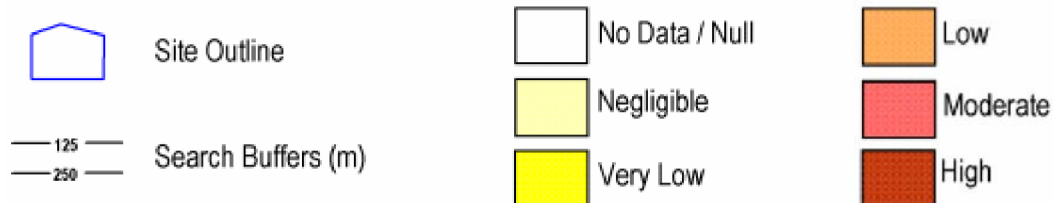


Landslides Legend

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## 6.3 Ground Dissolution of Soluble Rocks Map



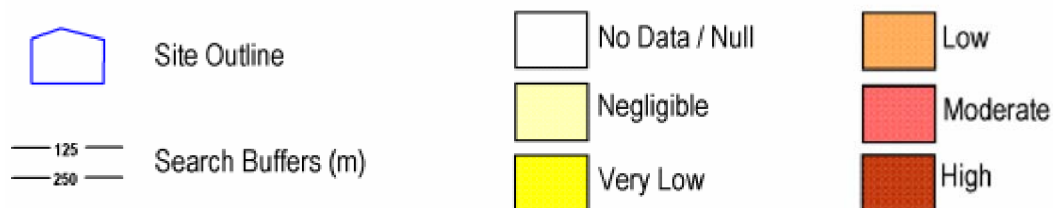


## 6.4 Compressible Deposits Map



Compressible Deposits Legend

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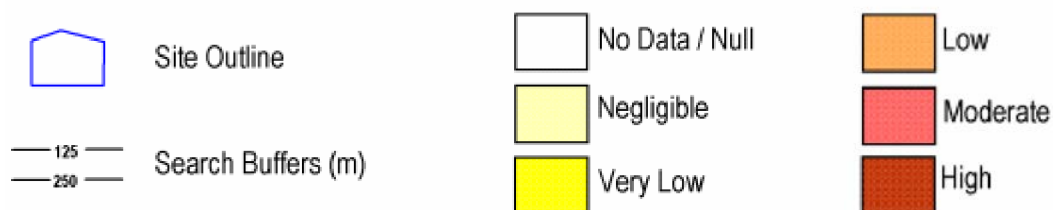


## 6.5 Collapsible Deposits Map



Collapsible Deposits Legend

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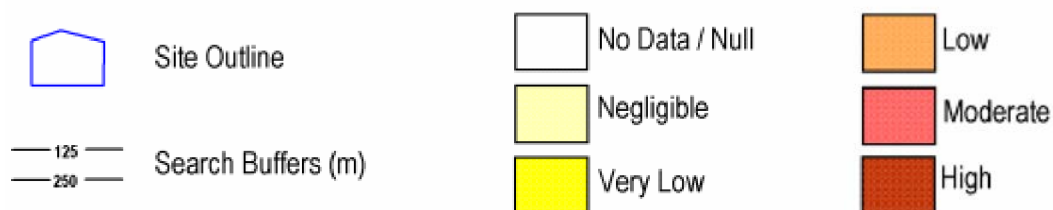


## 6.6 Running Sand Map



Running Sand Legend

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## 6 Natural Ground Subsidence

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

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

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

### 6.1 Shrink-Swell Clays

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

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
2	0.0	On Site	Moderate	Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

### 6.2 Landslides

The following Landslides information provided by the British Geological Survey:

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

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



## 6.3 Ground Dissolution of Soluble Rocks

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

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

## 6.4 Compressible Deposits

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

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

## 6.5 Collapsible Deposits

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

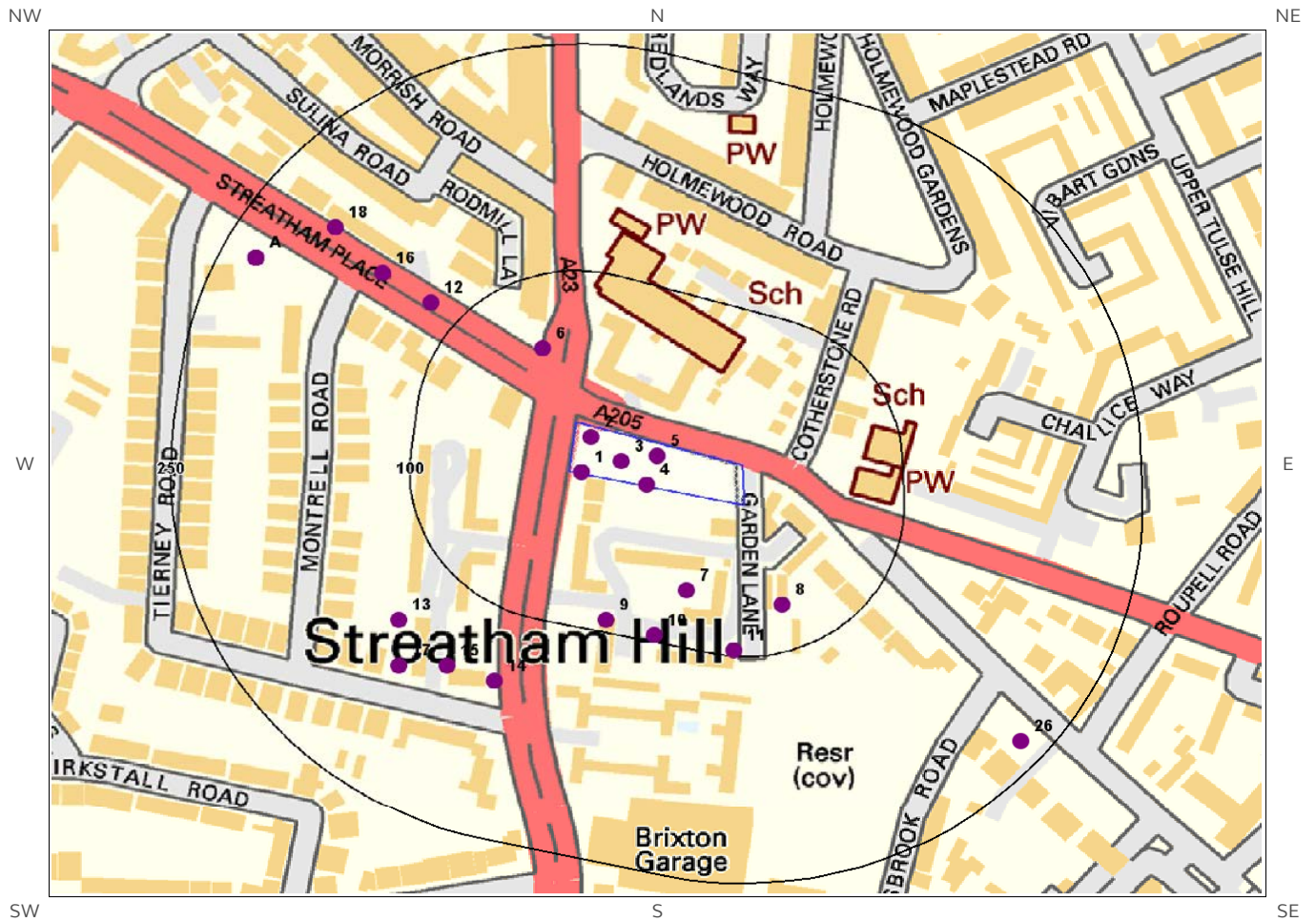
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible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

## 6.6 Running Sands

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

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

# 7 Borehole Records Map



Borehole Records Legend

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# 7 Borehole Records

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

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

26

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	0.0	On Site	530454 173408	TQ37SW737	-1.0	CHRISTCHURCH RD LAMBETH 5
2	0.0	On Site	530460 173431	TQ37SW736	-1.0	CHRISTCHURCH RD LAMBETH 4
3	0.0	On Site	530479 173415	TQ37SW735	-1.0	CHRISTCHURCH RD LAMBETH 3
4	0.0	On Site	530495 173400	TQ37SW734	-1.0	CHRISTCHURCH RD LAMBETH 2
5	0.0	On Site	530502 173419	TQ37SW733	-1.0	CHRISTCHURCH RD LAMBETH 1
6	53.0	NW	530430 173490	TQ37SW280	1.82	STREATHAM PLACE WIDENING 7
7	62.0	S	530520 173330	TQ37SW428	3.04	CLAREMONT ESTATE STREATHAM HILL WANDSWORTH TP A
8	70.0	S	530580 173320	TQ37SW424	3.04	CLAREMONT ESTATE TP.G
9	92.0	S	530470 173310	TQ37SW423	3.04	CLAREMONT ESTATE TP.F
10	96.0	S	530500 173300	TQ37SW430	3.04	CLAREMONT ESTATE STREATHAM HILL WANDSWORTH TP C
11	96.0	S	530550 173290	TQ37SW429	3.04	CLAREMONT ESTATE STREATHAM HILL WANDSWORTH TP B
12	120.0	NW	530360 173520	TQ37SW279	3.04	STREATHAM PLACE WIDENING 6
13	146.0	SW	530340 173310	TQ37SW425	3.35	CLAREMONT ESTATE TP.H
14	147.0	S	530400 173270	TQ37SW422	3.04	CLAREMONT ESTATE TP.D
15	150.0	SW	530370 173280	TQ37SW427	3.04	CLAREMONT ESTATE TP.K
16	156.0	NW	530330 173540	TQ37SW278	3.04	STREATHAM PLACE WIDENING 5
17	168.0	SW	530340 173280	TQ37SW426	3.04	CLAREMONT ESTATE TP.J,J1
18	198.0	NW	530300 173570	TQ37SW277	1.67	STREATHAM PLACE WIDENING 4
19A	229.0	NW	530250 173550	TQ37SW20/D	6.09	L.C.C.NEW PARK ROAD SITE D O
20A	229.0	NW	530250 173550	TQ37SW20/F	6.09	L.C.C.NEW PARK ROAD SITE D Q
21A	229.0	NW	530250 173550	TQ37SW20/G	6.09	L.C.C.NEW PARK ROAD SITE D R

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
22A	229.0	NW	530250 173550	TQ37SW20/A	9.14	L.C.C.NEW PARK ROAD SITE D J
23A	229.0	NW	530250 173550	TQ37SW20/E	6.09	L.C.C.NEW PARK ROAD SITE D P
24A	229.0	NW	530250 173550	TQ37SW20/B	9.14	L.C.C.NEW PARK ROAD SITE D K
25A	229.0	NW	530250 173550	TQ37SW20/C	9.14	L.C.C.NEW PARK ROAD SITE D L
26	233.0	SE	530730 173230	TQ37SW137	12.19	PALACE ROAD BH17 LAMBETH

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#6: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602618](https://scans.bgs.ac.uk/sobi_scans/boreholes/602618)  
 #7: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602778](https://scans.bgs.ac.uk/sobi_scans/boreholes/602778)  
 #8: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602774](https://scans.bgs.ac.uk/sobi_scans/boreholes/602774)  
 #9: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602773](https://scans.bgs.ac.uk/sobi_scans/boreholes/602773)  
 #10: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602780](https://scans.bgs.ac.uk/sobi_scans/boreholes/602780)  
 #11: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602779](https://scans.bgs.ac.uk/sobi_scans/boreholes/602779)  
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 #21A: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602091](https://scans.bgs.ac.uk/sobi_scans/boreholes/602091)  
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 #23A: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602089](https://scans.bgs.ac.uk/sobi_scans/boreholes/602089)  
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 #26: [scans.bgs.ac.uk/sobi\\_scans/boreholes/602398](https://scans.bgs.ac.uk/sobi_scans/boreholes/602398)



# 8 Estimated Background Soil Chemistry

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

2

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

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	London	No data	No data	No data	No data	No data
0.0	On Site	London	No data	No data	No data	No data	No data

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

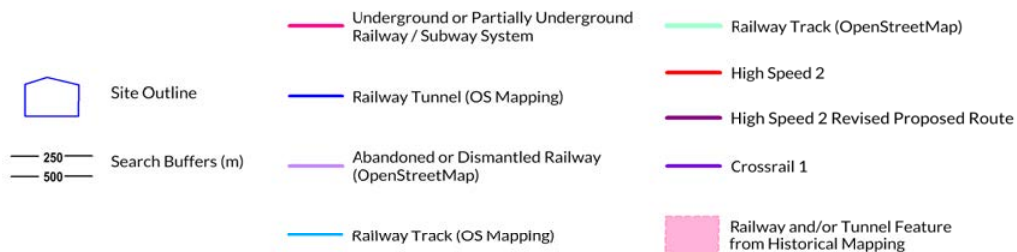
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# 9 Railways and Tunnels Map



Railways and Tunnels Legend

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# 9 Railways and Tunnels

## 9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

*Any records that have been identified are represented on the Railways and Tunnels Map.*

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

*Any records that have been identified are represented on the Railways and Tunnels Map.*

## 9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? No

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1A	85	N	530455 173543	Tramway Sidings	1950
2A	86	N	530456 173543	Tramway Sidings	1950
3	199	S	530428 173198	Tramway Sidings	1896
4B	215	S	530443 173175	Tramway Sidings	1950
5B	216	S	530442 173174	Tramway Sidings	1950
6	219	S	530437 173157	Tramway Sidings	1916

*Any records that have been identified are represented on the Railways and Tunnels Map.*

## 9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Status
63	N	Disused
66	N	Disused
68	N	Disused
71	N	Disused
74	N	Disused
77	N	Disused
80	N	Disused

Multiple sections of the same track may be listed in the detail above  
*Any records that have been identified are represented on the Railways and Tunnels Map.*

## 9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above  
*Any records that have been identified are represented on the Railways and Tunnels Map.*

## 9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project? No

*Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.*



The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

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BGS Geological Hazards Reports and general geological enquiries

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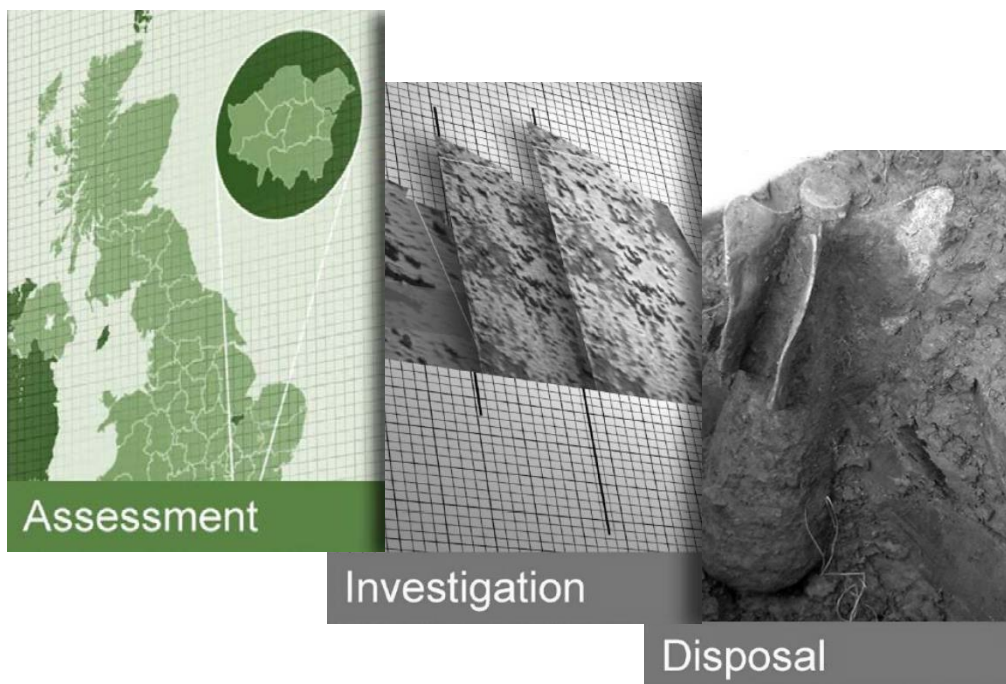
# Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:  
**<https://www.groundsure.com/terms-and-conditions-sept-2016/>**



## **APPENDIX C**

### **Zetica UXO Maps / Desk Study and Risk Assessment Report**



## Christchurch Road, Brixton - UXO Desk Study & Risk Assessment

Drafted by Sam Nicklin  
Checked by Stefan Lang  
Authorised by Mike Sainsbury



**Document Title** UXO Desk Study & Risk Assessment  
**Document Ref.** P6931-17-R1  
**Revision** A  
**Project Location** Christchurch Road, Brixton  
**Client** Arcadis  
**Date** 13<sup>th</sup> June 2017

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## UXO DESK STUDY & RISK ASSESSMENT

### Christchurch Road, Brixton

#### EXECUTIVE SUMMARY

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.3 hectares (ha) at Christchurch Road, Brixton, London Borough of Lambeth ('the Site').

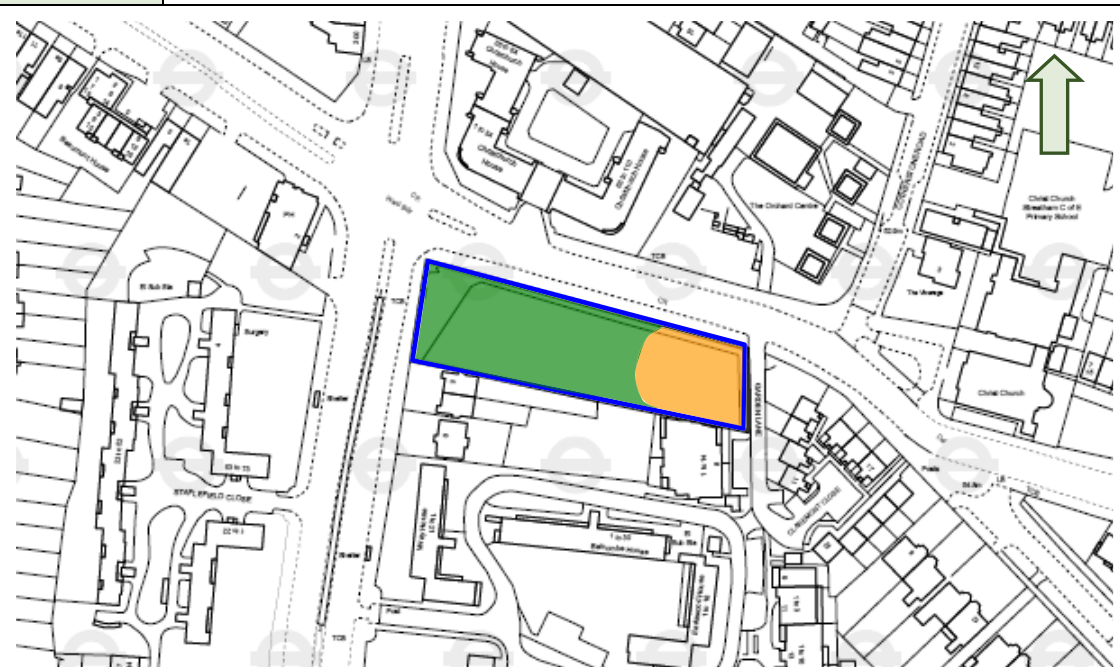
The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Records have been found indicating that during World War Two (WWII), 16No. High Explosive (HE) bombs fell within 100m of the Site. The bombing caused significant damage to buildings on the eastern part of the Site, which may have masked the impact of an Unexploded Bomb (UXB) during subsequent heavy raids. Given this, it is considered prudent to assign the eastern part of the Site a moderate UXO hazard level.

No evidence of any significant bomb damage or other sources of UXO hazard have been identified on the remainder of the Site, which is assigned a low UXO hazard level.







It is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in the following Figure, reproduced as Figure 6 in the main report.

**Figure** UXO hazard zone plan of the Site



Source: Client

Not to Scale

Legend	Very Low		Low		Moderate	
	High		Very High		Site boundary	



It should be noted that the UXO hazard will have been mitigated within the depth and extents of any post-WWII excavation, such as for building foundations. Outside the footprint of post-WWII construction, between piles and below shallow raft foundations and basements, the UXO hazard level remains unchanged to the depth of the likely maximum bomb penetration.

The main findings of the report are summarised below.

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- During WWII, strategic targets in the vicinity of the Site included public utilities, transport infrastructure and industries engaged in the war effort.
- During WWII the Site was located in the Metropolitan Borough (MB) of Wandsworth, which officially recorded a high regional bombing density.
- Records indicate that 16No. HE bombs fell within approximately 100m of the Site during WWII. This caused significant damage to buildings on the eastern part of the Site.
- No significant post-WWII military activity is recorded on the Site.

The Table below, reproduced as Table 4 in the main report, provides a UXO risk assessment for potential work on the Site.

Further details on the methodology for the risk assessment are provided in Section 10.1 of the main report.

Table	UXO risk assessment for the Site								
Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	6	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	12	Low
		Deep Excavations	1	1	1	1	4	12	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)									
Shallow excavations defined as <1.0m below ground level (bgl).									
Risk Mitigation Recommendations									
To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:									

## Low Risk

### Excavations

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

### Boreholes/Piles

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

## Moderate Risk

### Excavations

For those involved in excavations, the raising of awareness (as per low risk) is considered essential.

A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.

Where UXO detection is not feasible due to ground conditions, restricted access or programme, an Explosive Ordnance Clearance (EOC) Engineer can be used to supervise during excavation works.

The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.

### Boreholes/Piles

Clearance certification for any borehole or pile locations is considered essential.

This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB.

Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.

Table 5 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.



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## UXO DESK STUDY & RISK ASSESSMENT

### Christchurch Road, Brixton

**Note:** To aid the reader of this report, Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Paragraphs in a dark green text with a green background are paragraphs containing background information or explanations which may appear as standard text in all similar reports.

## 1 INTRODUCTION

### 1.1 Project Outline

Zetica Ltd was commissioned by Arcadis to carry out an Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.3 hectares (ha) at Christchurch Road, Brixton, London Borough of Lambeth ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

This hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance (UXO).
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be readily identifiable and therefore there cannot be any guarantee that all UXO hazards within the Site have been identified in this report.

### 1.2 Historical Information

With most locations, the potential presence of UXO as a result of enemy action, unauthorised disposal or unrecorded military activity can never be totally discounted.

Detailed records of military activity are rarely released into the public domain. Even when military information is made public there may be gaps in the records because files have been lost or destroyed.

Records for periods such as WWII are only as detailed and accurate as the resources and working conditions would allow at the time. Densely populated areas tend to have a greater number of records than rural areas. Such records may be inaccurate due to the confusion surrounding continuous air raids.



Press records can supplement local information, although this source of information must be treated with caution, as inaccuracies do exist, either inadvertently or intentionally in order to confuse enemy intelligence. Classified official records can sometimes be considered inaccurate for the same reason.

Recent research indicates that England alone had 17,434No. recorded defence sites, of which 12,464No. were classified as defensive anti-invasion sites. The precise locations of many of these sites are still to be identified, illustrating the scale of the problem when establishing potential risks from limited historical data.

### 1.3 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area utilising a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

#### 1.3.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

#### 1.3.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica Ltd's website (<http://zeticauxo.com/downloads-and-resources/risk-maps/>).

#### 1.3.3 Ministry of Defence and Government Records

Various government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Home Office records of abandoned bombs.

#### 1.3.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, Historic England and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

#### 1.3.5 Local Authority Records

Information has been obtained from Wandsworth London Borough Council and Lambeth Council.

#### 1.3.6 Local Record Offices and Libraries

The Lambeth Archives and Wandsworth Heritage Service were consulted.

#### 1.3.7 Local Historical and Other Groups

Local history groups and archaeological bodies were consulted.

#### **1.4 Data Confidence Level**

In general, there is a high level of confidence in the researched information sources used for this report. Any exceptions to this are specifically detailed in the text of this report.



## 2 THE SITE

### 2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) TQ 305734. It is located in Streatham, approximately 1.9km southwest of Brixton and 6km south of London city centre.

The Site comprises an area of open ground which is heavily vegetated. It is bounded to the east by Garden Lane, to the west by Streatham Hill, to the north by Christchurch Road and to the south by residential properties.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

**Figure 1** Site location map



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey

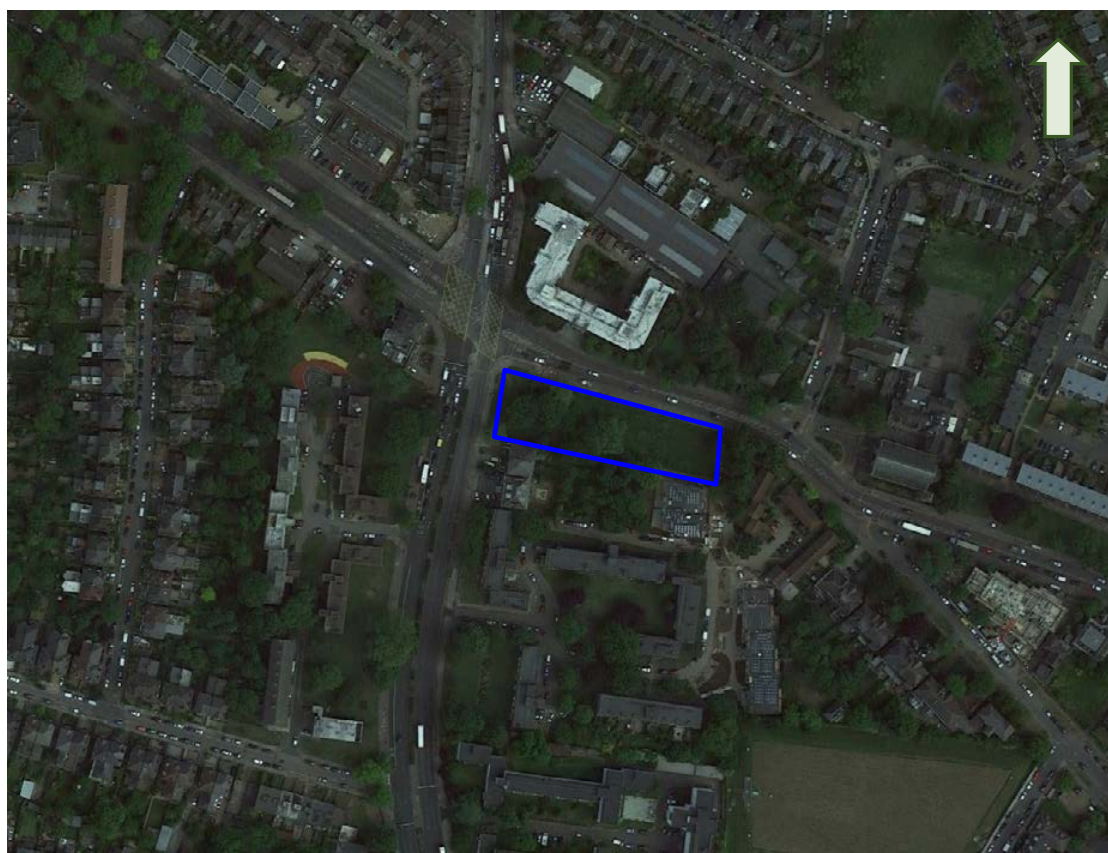
Not to Scale

#### Legend

Site boundary



**Plate 1** Recent aerial photograph of the Site



Source: Google Earth

Not to Scale

**Legend**

Site boundary



## 2.2 Proposed Works

It is understood that planned works on the Site include an initial ground investigation comprising window samples to ~5.0m bgl. Future works on the Site may include excavations and piling.

## 2.3 Site History

The historical map of 1914 (Figure 2) shows that the Site comprised residential properties and associated gardens on Christchurch Road, which ran adjacent to the northern boundary of the Site.

The surrounding area was predominantly residential.



**Figure 2** Historical map, 1914



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey

Not to Scale

**Legend**

Site boundary ———

The historical map of 1938 (Figure 3) shows that there had been no changes on the Site prior to WWII.

**Figure 3** Historical map, 1938



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey

Not to Scale

**Legend**

Site boundary



The buildings on the Site sustained bomb damage during WWII and were subsequently demolished (see Section 3.3).

Plate 2, an aerial photograph dated the 29<sup>th</sup> May 1947, shows that a series of bungalows had been constructed on the Site as part of an emergency housing programme post-WWII.

Several other areas occupied by prefabricated buildings and areas of demolition are evident the area surrounding the Site, the result of WWII bomb damage.



**Plate 2**

Aerial photograph, 29<sup>th</sup> May 1947



Source: Historic England


Not to Scale

**Legend**

Site boundary



The bungalows on the Site were demolished in the 1970s. Plate 3, an aerial photograph dated the 11<sup>th</sup> July 1987, shows that the Site now comprised heavily vegetated open ground.

<b>Plate 3</b>	Aerial photograph, 11 <sup>th</sup> July 1987
 <p>Source: Historic England</p> <p>Not to Scale</p>	
<b>Legend</b>	Site boundary <span style="color: blue;">—</span>
No significant development has occurred on the Site since 1987 (see Plate 1).	
<b>2.4 Pre-WWI Military Activity</b>	
No records of any significant pre-WWI military activity on or in close proximity to the Site have been found.	
<b>2.5 WWI Military Activity</b>	
The Site was in a largely residential suburb during WWI and there were no significant strategic targets in its immediate vicinity.	
During WWI an estimated 9,000No. German bombs were dropped over Britain. It was the first time that strategic aerial bombing had been used.	
No records have been found indicating that the Site was bombed during WWI. The nearest recorded incident is described below.	



### 23<sup>rd</sup> September 1916

Zeppelin L33 raided the Streatham and Brixton areas.

High Explosive (HE) bombs and Incendiary Bombs (IBs) fell along Streatham Hill, from Streatham Hill Station to Christchurch Road.

2No. of the HE bombs fell on the junction between Streatham Hill and Christchurch Road, approximately 50m west of the Site.

In response to the air raids, Anti-Aircraft (AA) guns were established. These were potential sources of Unexploded AA (UXAA) shells which could land up to 13km from the firing point, although more typically fell within 10km during WWI.

Records indicate that 22No. static AA gun batteries were located within 10km of the Site. The nearest was located at Dulwich (TQ 338727), approximately 3.3km east-southeast of the Site. This was armed with 1No. 3 inch (") gun.

WWI military activity is not considered to provide a source of UXO hazard to the Site.

## 2.6 WWII Military Activity

Lambeth and Wandsworth were heavily bombed during WWII. Details for recorded air raid incidents in the vicinity of the Site are provided in Section 3 and Appendix 1.

Defensive and offensive military establishments were built during WWII. These included lines of defences (Stop Lines), pillboxes, AA guns and bombing decoys. Details for those nearest to the Site are provided in Section 4.

Military airfields and aircraft crashes in the vicinity of the Site are described in Section 5.

Details of munitions factories and stores in the vicinity of the Site are provided in Section 6.

Military training areas and ranges in the vicinity of the Site are described in Section 7.

## 2.7 Post-WWII Military Activity

No records of any significant post-WWII military activity on or in close proximity to the Site have been found.

### 3 WWII BOMBING

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, industrial premises, power stations and airfields.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact, within 25m of this, death or fatal injury could occur.

PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration. Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any UXO. In more rural areas, fewer bombing raids occurred. It is known that ARP records under-represent the number and frequency of bombs falling in rural and coastal areas.

Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid Anti-Aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural, river, marsh or coastal areas were often unrecorded or entered as 'fell in open country', 'fell in the sea' or 'fell in the river' and left little evidence of the fall.

#### 3.1 Bombing in London

London was a principal target of Luftwaffe bombing during the WWII. The first air raid of the Blitz on London took place on 7<sup>th</sup> September 1940 when a large German force bombed the docks and surrounding areas.



From mid-September until the end of that year, London was raided on all but 3No. nights. The raids continued through the early months of 1941 becoming less frequent, although often more intense. Heavier bombs, including PMs and OBs, were now used and major incendiary raids on the 29<sup>th</sup> December 1940 and 10<sup>th</sup> May 1941 caused widespread fire damage across the city.

From July 1941 the bombing campaign against London entered a period of relative inactivity. Raids still took place but tended to be relatively minor in severity. Manned bomber raids returned to London in the first few months of 1944 and, after a brief respite, were followed by the start of the Pilotless Aircraft (V1) offensive against the capital in June 1944.

These weapons arrived at any time of day and caused massive blast damage (although little fire damage). The V1 offensive on London was all but over by September 1944, although some V1s continued to fall on the capital until March 1945.

In September 1944 the Long Range Rocket (V2) offensive on London began. Falling from a height of some 50 miles (80km) above the city, these ballistic missiles caused larger craters and greater damage to underground utilities than the V1s, although their surface blast effect was generally less.

The Brixton area was largely residential and had few significant strategic targets. Bombing in the area was usually a result of overspill from raids against the industries and public utilities along the River Thames, approximately 4.5km north of the Site.

Between 1944 and 1945, 21No. V1s fell in the Brixton and Streatham Hill area.

## 3.2 Strategic Targets

The presence of strategic targets significantly increased the likelihood of bombing within the local area. Airfields, docks, industrial facilities, transport infrastructure and anti-invasion defences were all targeted by Luftwaffe bombers. The inherent bombing inaccuracies at the time meant that areas surrounding the targets were often subjected to bombing.

Details of the main targets in the vicinity of the Site are described in the following Sections.

### 3.2.1 Transport Infrastructure

The Southern Railway (SR) West End and Crystal Palace Line ran approximately 0.7km south of the Site. There were extensive sidings located at Steatham Hill Station, approximately 0.9km south-southwest of the Site, which also had a small coal depot.

There was a large railway junction at Battersea, approximately 3.5km north-northwest of the Site, which had large sidings, goods depots and engineering works.

This junction connected several lines of the SR including a mainline that ran through Clapham Junction and Waterloo Station, approximately 3.8km northwest and 6.3km north-northeast of the Site, respectively.

### 3.2.2 Industrial and Commercial Targets

There were no significant industrial targets in the immediate vicinity of the Site.

In the surrounding area, several factories were engaged in wartime production. These included Patton's factory on Colwell Road, approximately 3.2km northeast of the Site, which manufactured aero engine parts.

The Projectile & Engineering Company had a factory on Stewart's Road, approximately 3.3km north-northwest of the Site, which manufactured shells and other projectiles, in addition to parts for motor vehicles.

Tilling Motor Services Limited manufactured shell cases at their premises in Dulwich, approximately 3.6km east-northeast of the Site.

### 3.2.3 Public Utilities

Public utilities were frequently targeted to disrupt the power and water supply to local industries.

The Metropolitan Water Board Reservoir was located approximately 0.1km south-southeast of the Site.

There were large gas works at Nine Elms, approximately 4.2km northeast of the Site, and Vauxhall, approximately 4.5km north-northeast of the Site.

Battersea Power Station, a major Luftwaffe target, was located approximately 4.2km north of the Site.

Plate 4 is a Luftwaffe target photograph of the Battersea and Lambeth area. The target photo identifies Battersea Power Station (Target GB 50 2), Nine Elm Gas Works (GB 52 24) and Vauxhall Gas Works (Target GB 52 27).

**Plate 4** Luftwaffe target photograph of Battersea and Lambeth



Source: Clarke

Not to Scale



### 3.3 Bombing Density and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal or Metropolitan Boroughs (MB) and Country Boroughs (CB). The Site was located in Wandsworth Metropolitan Borough.

The figures for West Ham CB, generally considered to represent a high regional bombing density, are included for comparison.

**Table 1** Bombing Statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1,000 acres)
<b>Wandsworth MB</b>	<b>1,437</b>	<b>5</b>	<b>38</b>	<b>1,480</b>	<b>162.3</b>
Lambeth MB	1,436	4	42	1,482	363.0
Fulham MB	452	4	24	480	281.4
Battersea MB	514	3	14	531	245.5
Mitcham MB	293	8	7	308	105.0
Barnes MB	240	3	15	258	102.4
Wimbledon MB	305	0	11	316	98.4
West Ham CB	1,498	45	47	1,590	334.0

Note that Table 1 excludes the figures for V1s (Pilotless Aircraft, also known as Doodlebugs), V2s (Long Range Rockets), AA shells and IBs. Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

The nearest recorded incidents to the Site are described in the Section below. Further details of air raid incidents in the vicinity of the Site are given in Appendix 1.

#### 8<sup>th</sup> September 1940

1No HE bomb fell on the junction between Rodmill Lane and Morrish Road, approximately 0.1km north-northwest of the Site.

#### 9<sup>th</sup> September 1940

1No. HE bomb fell on 13 Streatham Hill, approximately 20m south of the Site.

1No. HE bomb fell on Garden Lane, approximately 30m southeast of the Site.

1No. HE bomb fell on the junction of Palace Road and Christchurch Road, approximately 60m east-southeast of the Site.

2No. HE bombs fell on the garden of Christchurch Vicarage, approximately 0.1km northwest of the Site.

1No. HE bomb fell on 1 Cotherston Road, approximately 0.1km northwest of the Site.

#### 1<sup>st</sup> November 1940

1No. HE bomb fell on 6 Calders Row, approximately 0.1km northeast of the Site.

#### **26<sup>th</sup> November 1940**

2No. HE bombs fell near Pullman Court, approximately 0.1km south of the Site.

#### **11<sup>th</sup> January 1941**

1No. HE bomb fell on the junction between Streatham Place and Christchurch Road, approximately 20m west of the Site.

1No. HE bomb fell on 10 Streatham Place, approximately 90m northwest of the Site.

#### **12<sup>th</sup> January 1941**

1No. HE bomb fell on the rear of 21 Streatham Hill, approximately 50m south of the Site.

#### **8<sup>th</sup> March 1941**

3No. HE bombs fell on Streatham Hill, between approximately 30m and 0.1km south-southwest of the Site.

#### **15<sup>th</sup> March 1941**

IBs fell across Christchurch Road, Cotherstone Road, Holmewood Road and Holmewood Gardens, in the immediate vicinity of the Site.

1No. HE bomb fell on Rodmill Lane, approximately 90m north-northwest of the Site.

#### **17<sup>th</sup> May 1941**

1No. HE bomb fell on Christchurch Road, approximately 30m east of the Site.

#### **17<sup>th</sup> May 1941**

1No. HE bomb fell on Christchurch Road, approximately 30m east of the Site.

It should be noted that during WWII, many UXB were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 4 is a map showing the approximate locations of recorded bomb impacts in the vicinity of the Site. IBs shown are indicative of large numbers of similar devices that fell within the given area. The map has been compiled from a number of different sources, including air raid incident reports, bomb census maps and historical aerial photographs.

Note that air raid incident reports did not always record precise locations, often only indicating on which street or area a bomb fell.



**Figure 4** Compiled bomb impact map for the vicinity of the Site



Source: © Crown Copyright 2017. Reproduced by permission of Ordnance Survey

Not to scale

<b>Legend</b>	Site boundary —	HE bomb ●	IBs ▲	V1 ●
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Figure 5 is an extract from the London County Council (LCC) bomb damage map, compiled at the end of WWII, on which the colouring denotes the severity of damage to buildings.

Black indicates a destroyed building; purple, red and pink indicate structural damage, while orange and yellow indicate blast damage.

The bomb damage map indicates that major damage occurred on and in close proximity to the eastern part of the Site. Blast damage is recorded on the western part of the Site.

**Figure 5** Extract from the London bomb damage map



Source: London Topographical Society

Not to scale

**Legend**

Site boundary —

Plate 5 is an aerial photograph dated the 13<sup>th</sup> March 1945. It shows that the buildings on and adjacent to the eastern part of the Site had been demolished after sustaining bomb damage.

There is no evidence of significant damage on the western part of the Site.

Extensive bomb damage, characterised by demolished areas and prefabricated buildings, is evident in the immediate vicinity of the Site.



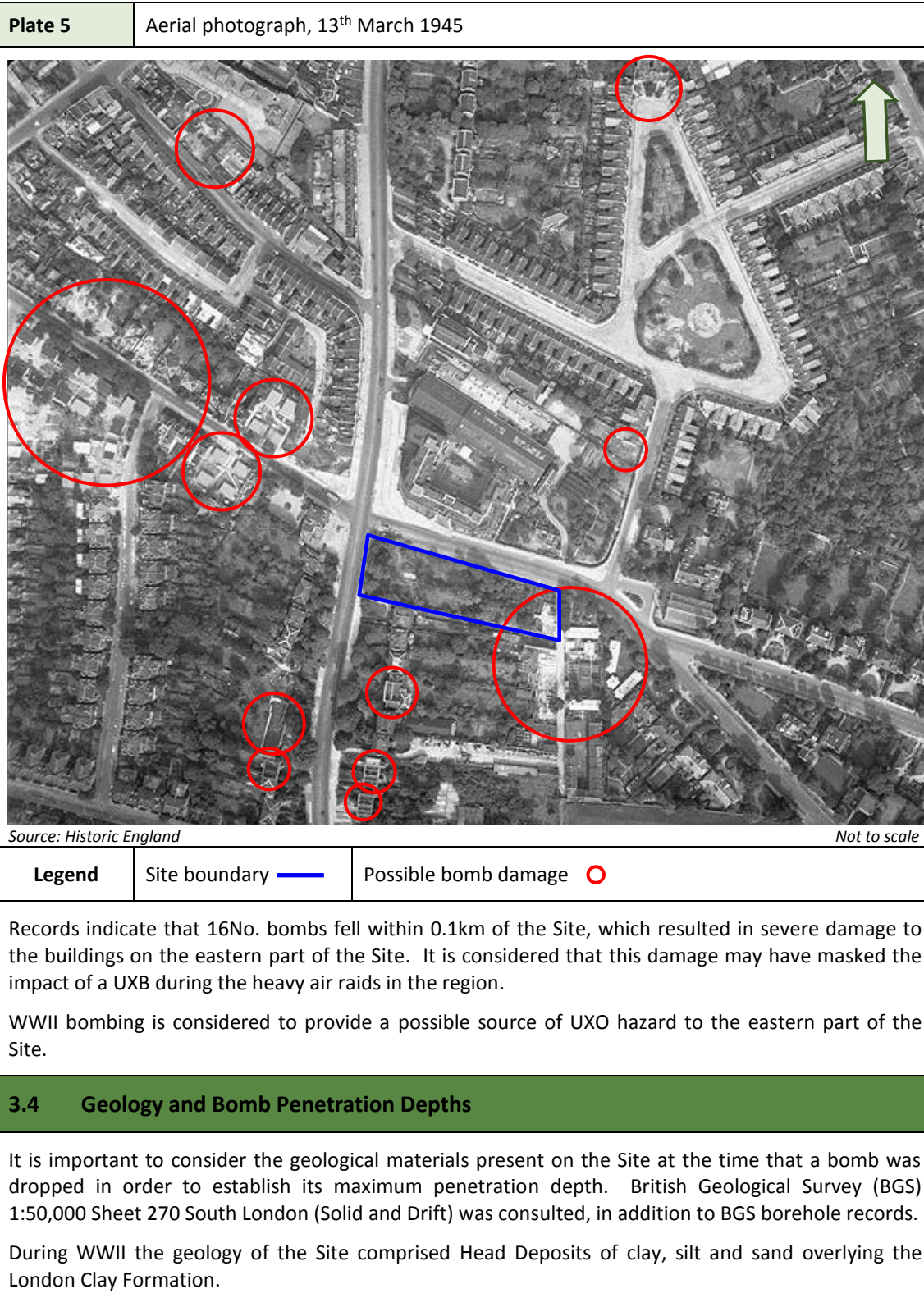


Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of approximately 1m of sand and gravel, overlying more than 30m of stiff clay.

Table 2	Estimated average maximum bomb penetration depths	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	4.0m
	500kg	12.5m
	1,000kg	14.5m

The estimated bomb penetration depths given in Table 2 are from the WWII ground level and are based on the following assumptions:

- a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).
- b) A strike angle of 10 to 15 degrees to the vertical.
- c) That the bomb is stable, both in flight and on penetration.
- d) That no retarding units are fitted to the bomb.
- e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

In low level attacks over deep water bodies, the offset distances from the point of entry at the water surface may be considerably enhanced due to hydrodynamic effects before the bomb penetrates or settles on the sea bed. Shallow water has little effect on bomb penetration depths during high level attacks.



## 4 WWII DEFENCES

### 4.1 Bombing Decoys

In order to draw enemy aircraft away from towns and other strategically important targets, a series of decoys were developed between 1940 and 1941.

They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. Approximately 792No. static decoy sites were built at 593No. locations in England. In addition, numerous temporary and mobile decoys were deployed.

Several different types of decoy were devised:

- Night time dummy airfields (Q sites).
- Daytime dummy airfields (K sites).
- Diversionary fires to simulate successful bombing raids on airfields (QF sites), petroleum depots (P sites) and major towns and cities (Starfish or SF sites).
- Simulated urban lighting (QL sites).
- Dummy Heavy Anti-Aircraft (HAA) batteries, factories and buildings (C series).
- Mobile decoys representing 'hards' for troop embarkation (MQLs), tanks and other vehicles.

Machine gun emplacements and Light Anti-Aircraft (LAA) guns were used to prevent possible enemy landings at decoy airfields.

By their nature, decoy sites provide a potential risk from Unexploded Bombs (UXB), both within the decoy site boundary and in the surrounding areas.

The nearest recorded bombing decoy was located in Richmond Park (TQ 203729), approximately 10km west of the Site.

This decoy is not considered to provide a source of UXO hazard to the Site.

### 4.2 Anti-Aircraft Defences

Anti-Aircraft (AA) gun batteries were targeted by the Luftwaffe. They were also a source of Unexploded AA (UXAA) shells which could land up to 27km from the firing point during WWII, although more typically fell within 15km. These could be distributed over a wide area.

AA batteries present a potential source of UXO hazard as a result of the storage, use and disposal of ordnance associated with the armaments used. They may have a risk from small caches of ammunition buried locally to them. 3No. types of AA batteries existed:

- Heavy Anti-Aircraft (HAA) batteries of large guns designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- Light Anti-Aircraft (LAA) weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields.
- Rocket batteries (ZAA) firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were also relatively permanent emplacements.

Many AA batteries were associated with searchlights and consequently 'visible' at night, providing clear targets to the Luftwaffe bombers and a potential for UXB.

During WWII the Site was within the range of guns deployed in the London Gun Defended Area (GDA). Table 3 is a list of recorded HAA and ZAA batteries within 10km of the Site.

<b>Table 3</b> WWII HAA and ZAA batteries within 10km of the Sites				
<b>Grid Reference</b>	<b>Serial No.</b>	<b>Location</b>	<b>Armament</b>	<b>Approximate Distance and Direction from Site</b>
TQ 293723	2Z	Tooting Bec	64No. UP Projectors	1.7km SW
TQ 289751	ZS16/-	Clapham Common	4No. 4.5" guns, later 4No. 3.7" guns and GL Mk II radar	2.2km NW
TQ 341727	ZS14/-	Dulwich	4No. 4.5" guns & GL MkII radar, later 4No. 5.25" guns	3.6km ESE
TQ 341729	18Z	Dulwich	64No. UP Projectors	3.6km E
TQ 301696	ZS15/-	Norbury	Unknown	3.7km S
TQ 284775	9Z	Battersea Park	64No. UP Projectors	4.5km NW
TQ 346753	ZS25/-	Peckham Rye	Unknown	4.5km ENE
TQ 341696	3Z	Anerley	64No. UP Projectors	5.2km SE
TQ 343696	ZS24/-	Anerley	Unknown	5.3km SE
TQ 252758	ZW8/-	Hurlington	4No. 3" guns	5.7km NW
TQ 283675	ZS17/-	Mitcham Common	8No. 5.25" & GL Mk II radar, later 4No. 5.25" guns	6.2km SSW
TQ 373754	ZS11/-	Brockley	4No. 3.7" guns & GL Mk IA radar	7.0km ENE
TQ 354788	21Z	Southwark Park	64No. UP Projectors	7.1km NE
TQ 353789	ZE12/-	Southwark Park	Unknown	7.2km NE
TQ 280805	8Z	Hyde Park	64No. UP Projectors	7.3km NNW
TQ 350794	ZE12/-	Southwark Park	Unknown	7.4km NE
TQ 231722	ZS19/-	Wimbledon	2No. 5.25" guns & GL Mk II radar, later 4No. 5.25" guns	7.4km WSW
TQ 278806	ZW5/-	Hyde Park	2No. 3.7" guns, later 4No. 3.7" guns & GL Mk II radar	7.6km NNW
TQ 236689	ZS18/-	Raynes Park	2No. 3.7" guns	8.1km SW
TQ 373686	ZS12/-	Beckenham	4No. 3.7" guns	8.2km SE
TQ 382702	ZS23A/-	Summerhouse	Unknown	8.2km SE
TQ 387706	ZS23/-	Ravensbourne	Unknown	8.6km ESE
TQ 347652	ZS13/-	Shirley Park	4No. 3.7" & GL Mk II radar	9.2km SSE
TQ 382788	ZE8/-	Isle of Dogs	4No. 4.5" guns & GL MkII radar	9.3km NE
TQ 395768	4Z	Blackheath Common	64No. UP Projectors	9.4km NE
TQ 356819	ZE19/-	Walthamstow	Unknown	9.8km NE
TQ 204743	ZS20/-	Richmond Park	4No. 3.7" guns, later 8No. 3.7" guns & GL Mk II radar	10.0km WNW
It should be noted that the lack of official records of HAA batteries or armaments cannot be taken to imply their absence because many units were mobile and were moved around as operational requirements dictated.				



Given the number of gun batteries in the area, the possibility that a UXAA shell fell on the Site unnoticed, whilst unlikely, cannot be totally discounted.

### 4.3 Barrage Balloons and Anti-Landing Obstacles

Balloon barrages were flown in many British towns and cities to protect against air raids. Their presence deterred low flying aircraft, making it more difficult for bombs to reach their intended targets. Barrage balloon sites can be a source of UXO as they were targeted by the Luftwaffe. They also often had a small explosive charge fitted with tilt fuzes attached approximately 50m from each end of the balloon cables and designed to detonate if the cables were hit by an aircraft.

Measures were also taken to prevent enemy aircraft landing in the event of invasion. Obstructions were constructed around airfields and on other open sites deemed fit for use as landing grounds. Solid obstructions (such as concrete blocks), posts or stakes, felled trees, haystacks, scaffolding with wire and trenching were the main measures used.

No records have been found indicating that barrage balloons or anti-landing obstacles were located on the Site.

### 4.4 Anti-Invasion Defences

Defence structures are a potential source of UXB as they were especially targeted by low flying enemy aircraft, particularly during 'tip and run' raids which were common in industrialised regions. These defences may also be associated with small caches of UXO in the form of small arms, used by the troops manning the emplacement.

The rapid advance of German Troops into France, Holland and Belgium after the start of WWII prompted the War Office to review the vulnerability of the UK to invasion and a decision was taken to begin work on a national plan of anti-invasion defences. Static defences were built to interrupt and delay the progress of any invading force.

Coastal defences were strengthened (the 'Coastal Crust'). These defences included barbed wire entanglements and minefields, which were often combined to give defence in depth.

Inland, lines of defence structures were constructed along 'Stop Lines' in order to impede enemy progress for long enough to allow mobile defending forces to counter-attack.

Stop Lines included the fortification of key 'centres of resistance', such as river crossings and important road or rail junctions that could seriously hamper the enemy's advance across country. Bridges were mined for demolition and tank traps installed.

Stop Lines were further integrated into a network of fortified nodal points and 'Anti-Tank (AT) Islands'.

No records of anti-invasion defences on or in close proximity to the Site have been found.

#### 4.5 Pillboxes, Mortar and Gun Emplacements

Defences also included spigot mortar positions and gun emplacements.

Spigot mortars, also known as Blacker Bombards, were used primarily in an anti-tank role at road blocks or to defend airfields. Typically they fired a 20 pound (lb) HE mortar bomb. The fixed positions, in weapons pits with ammunition lockers, were frequently positioned near pillboxes.

Spigot mortar positions could be either fixed or mobile.

No records of gun emplacements on or in close proximity to the Site have been found.

Pillboxes provide a potential UXO hazard both from the storage, use and disposal of ordnance associated with them and from UXB because they were targeted by enemy aircraft.

Pillboxes were common along Stop Lines, perimeters of airfields, potential land invasion sites and around important civil sites. Several different designs existed including Seagull Trenches (semi-buried structures), Alan Williams and Tett Turrets (small prefabricated pillboxes). Fortified sites, buildings or loop-holed walls also functioned as pillboxes.

No records of pillboxes on or in close proximity to the Site have been found.

#### 4.6 Home Guard and Auxiliary Units

Local Defence Volunteers (LDV) units, later known as the Home Guard, were located in all cities, towns and large villages. Anti-invasion defences were to be defended by the Home Guard and regular Army troops for as long as possible in the event of an invasion. The troops were issued with 'No Withdrawal' orders.

Important elements of the ordnance supply for the use of the Home Guard included substantial supplies of Mills bombs (fragmentation grenades) and Self Igniting Phosphorus (SIP) grenades as well as machine gun and small arms ammunition.

Records of Home Guard activities and related sites are rarely preserved. Storage and disposal of munitions by the Home Guard was poorly documented and surplus supplies were either buried or dumped in lakes and ponds. Given the irregular nature of this activity, the possibility of items of UXO being discovered at any locations occupied or used for training by the Home Guard can never be totally discounted.

In addition to the regular Home Guard, Auxiliary Units existed which were made up of guerrilla troops trained in sabotage and assassination in case of invasion. Sites used by these Units were Top Secret and many locations are still unknown.

No Home Guard or Auxiliary Unit activity has been identified on or in close proximity to the Site.

The 28<sup>th</sup>, 31<sup>st</sup> and 52<sup>nd</sup> (County of London Regiment) Home Guard Battalions operated in the vicinity of the Site area, patrolling local transport infrastructure and industry. They were also tasked with manning gun emplacements in the vicinity of the Site in the event of an enemy invasion.

Home Guard and Auxiliary Unit activity is not considered to provide a source of UXO hazard to the Site.



#### **4.7 Minefields and Mined Locations**

Minefields were laid along the coast, in estuaries and along the banks of major rivers to deter infantry invasion. Strategic points such as bridges and gaps in cliffs were mined to impede enemy advance. Most of the mined locations in the UK have been cleared and the risk of finding UXO in these areas is considered to be low.

No records of minefields or mined locations on or in close proximity to the Site have been found.

## 5 MILITARY AIRFIELDS

Military airfields offer the potential for significant UXO hazards due to the use, storage and disposal of ordnance and as a result of enemy bombing during WWI and WWII.

Airfields active during WWII were targeted by the Luftwaffe, providing a potential source of UXB on the airfield.

As bombing accuracy was so poor during WWII, it is likely to find UXB in the surrounding areas. Aircraft crashes are also associated with operational airfields.

No records have been found indicating that there were any military airfields on or in close proximity to the Site.

The nearest military airfield was RAF Croydon (TQ 308630), located approximately 10.3km south of the Site. This was opened in 1916 for the Royal Flying Corps (RFC).

During WWI RFC Croydon was occupied by No. 39 Home Defence Squadron, and became known as Beddington Aerodrome.

In WWII, RAF Croydon was initially used as a Fighter Command airfield for the defence of London and was the operational centre of Fighter Group No. 11.

Later in WWII, RAF Croydon became a major centre for the dispatch of troops and other goods and material to Europe. Scheduled services commenced in November 1944.

The last squadrons left RAF Croydon in March 1946 and in September 1946 the airfield was returned to civilian control.

The facilities at Croydon Airport were gradually run down and the airfield was closed in the mid-1950s to all flying.

Military airfields are not considered to provide a source of UXO hazard to the Site.

### 5.2 Aircraft Crashes

Aircraft crash sites are a known UXO hazard. The MoD advises that if crashed aircraft are found, the safest policy is to leave them alone where possible. Unless disturbed there is no statutory requirement for the MoD to clear such sites.

No records have been found indicating that there were any aircraft crashes on or in close proximity to the Site.



## 6 EXPLOSIVES AND MUNITIONS ESTABLISHMENTS AND DEPOTS

Explosives and munitions manufacturing or storage sites offer a particularly high risk from both explosive substances and UXO. Standard procedures of explosive/ordnance disposal through burial or burning means that explosive and UXO hazards will be present in some areas of such establishments.

In addition, UXB hazards may be present as a result of enemy bombing during WWI and WWII.

### 6.1 Explosives and Ordnance Factories

No records of any explosives or ordnance factories on or in close proximity to the Site have been found.

There was a pyrotechnics factory adjacent to the railway lines at Honour Oak Park Station, approximately 5.3km east-northeast of the Site, during WWII.

This is not considered to provide a source of UXO hazard to the Site.

### 6.2 Munitions Stores

Local ammunition caches would have been present near to defended road blocks, pillboxes, HAA and LAA sites. Most of those associated with the anti-invasion sites are understood to have been cleared.

No records of any official munitions depots on or in close proximity to the Site have been found.

Belair House on Gallery Road, approximately 2.4km east of the Site, was requisitioned during WWII for use as an ordnance depot.

Munitions stores are not considered to provide a source of UXO hazard to the Site.

### 6.3 Informal Munitions Depots

Informal munitions depots, often made by requisitioning roadside lay-bys or parks. Other informal munitions depots were commonly located in areas of woodland or on train wagons along sidings in marshalling yards.

No records of any informal munitions depots on or in close proximity to the Site have been found.

### 6.4 Munitions Disposal Areas and Bomb Cemeteries

Munitions disposal areas were often made by requisitioning open areas of land, usually away from habitation. Marshland, beaches or sand dunes were frequently used for this purpose. Disposal of munitions was carried out in many different ways, ranging from destruction to burial. Full records were not necessarily maintained for these locations, and so they can potentially be a source of UXO.

No records of any official munitions disposal areas or bomb cemeteries on or in close proximity to the Site have been found.

Records indicate that an area near the bandstand at Brockwell Park, approximately 1.1km northeast of the Site, was identified as a potential emergency bomb cemetery in October 1940.

It is not known if any bomb disposal ever took place in Brockwell Park, and by July 1943 it had been removed from the list of potential bomb disposal sites.

Munitions disposal areas are not considered to provide a source of UXO hazard to the Site.

## 7 FIRING RANGES AND MILITARY TRAINING AREAS

By their nature, firing ranges and military training areas represent a potential source of UXO due to associated training activities. The training will involve both practice and live munitions and will offer a significant risk from a very wide range of potential UXO.

### 7.1 Small Arms Ranges

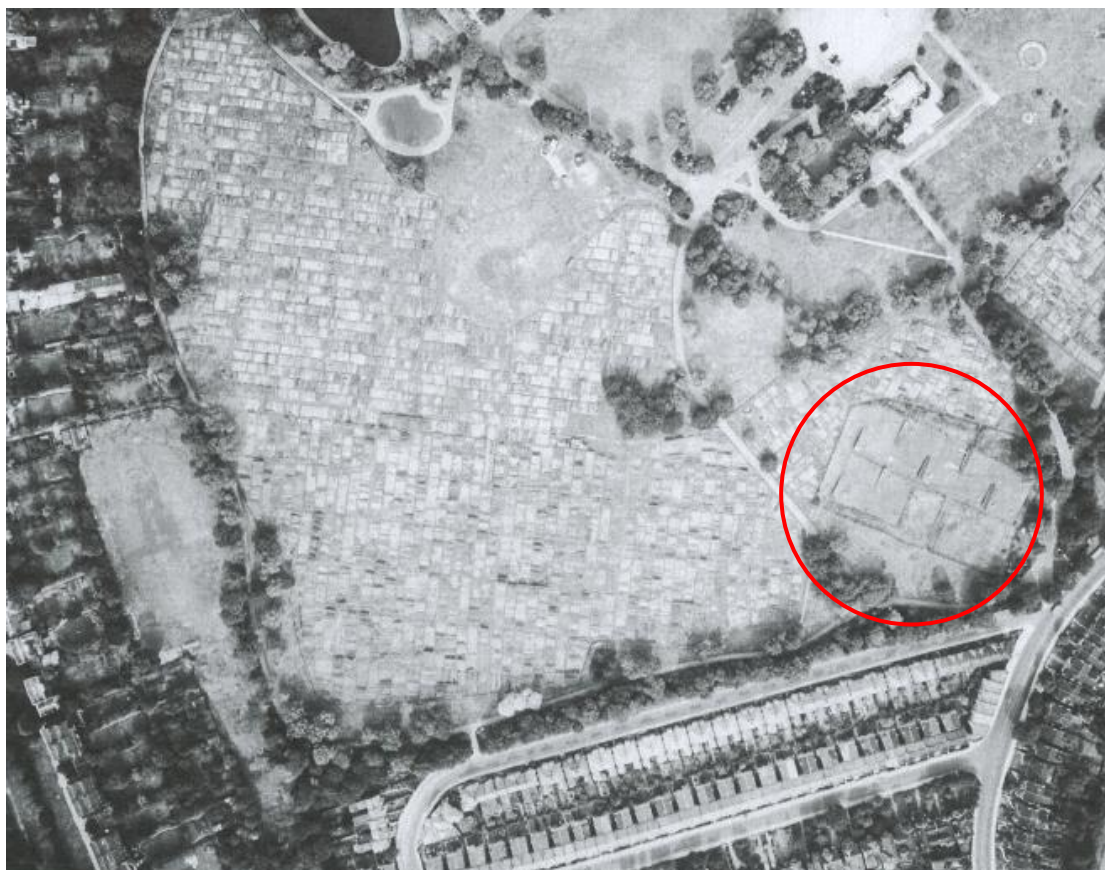
Small arms ranges (such as rifle ranges) and close combat ranges (such as mortar and grenade ranges) are likely to provide a significant source of UXO. It should be noted that even on small arms ranges, larger munitions such as mortars or grenades cannot be discounted.

No records of any small arms ranges on or in close proximity to the Site have been found.

Plate 6 is an aerial photograph, dated the 13<sup>th</sup> September 1945, showing a possible rifle range in Brockwell Park, approximately 1.2km east-northeast of the Site.

Other sources confirm that Brockwell Park was used for army training during WWII.


**Plate 6** Aerial photograph showing rifle range in Brockwell Park, 13<sup>th</sup> September 1945



Source: Historic England

Not to Scale

**Legend**

Rifle Range 



Small arms ranges are not considered to provide a source of UXO hazard to the Site.

## 7.2 Artillery Ranges

Artillery ranges will have utilised a wide range of munitions, predominantly shells, although close combat munitions such as mortars, or larger munitions such as bombs, cannot be discounted.

No records of any artillery ranges on or in close proximity to the Site have been found.

## 7.3 Bombing Ranges

Bombing ranges will have primarily used bombs, although other munitions such as shells and close combat munitions such as mortars cannot be totally discounted.

No records of any bombing ranges on or in close proximity to the Site have been found.

## 7.4 Training Areas

Training areas will have primarily used blank ammunition or practice shells in 'dry' areas, although live munitions such as shells and close combat munitions such as mortars cannot be discounted in any training area.

No records of any military training areas on or in close proximity to the Site have been found.

Brockwell Park, within approximately 1.1km northeast of the Site, was used by the military for basic drills and firing practice during WWII.

Training areas are not considered to provide a source of UXO hazard to the Site.

## 8 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27<sup>th</sup> February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear.

Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

### 8.1 Abandoned Bombs

No records of any officially abandoned bombs on the Site have been found.

### 8.2 EOC Tasks

Zetica Ltd holds the following records of post-WWII EOC tasks being undertaken in the vicinity of the Site.

#### 21<sup>st</sup> March 2012

1No. artillery shell was found on a building site on Acre Lane, near the junction with Strathleven Road, Brixton, approximately 1.6km north-northwest of the Site. It was removed.

#### 26<sup>th</sup> September 2014

1No. WWII UXB was found in a garden on Narbonne Avenue, Clapham, approximately 1.5km northwest of the Site. It was removed.

#### Unknown Date

1No. UXAA shell was discovered during site work at Camberwell Old Cemetery, approximately 4.3km east-northeast of the Site. It was removed.

The MoD has provided no additional information of official EOC tasks on the Site.



## 9 UXO HAZARD ASSESSMENT

### 9.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

#### Definitions of UXO Hazard Level for a Site

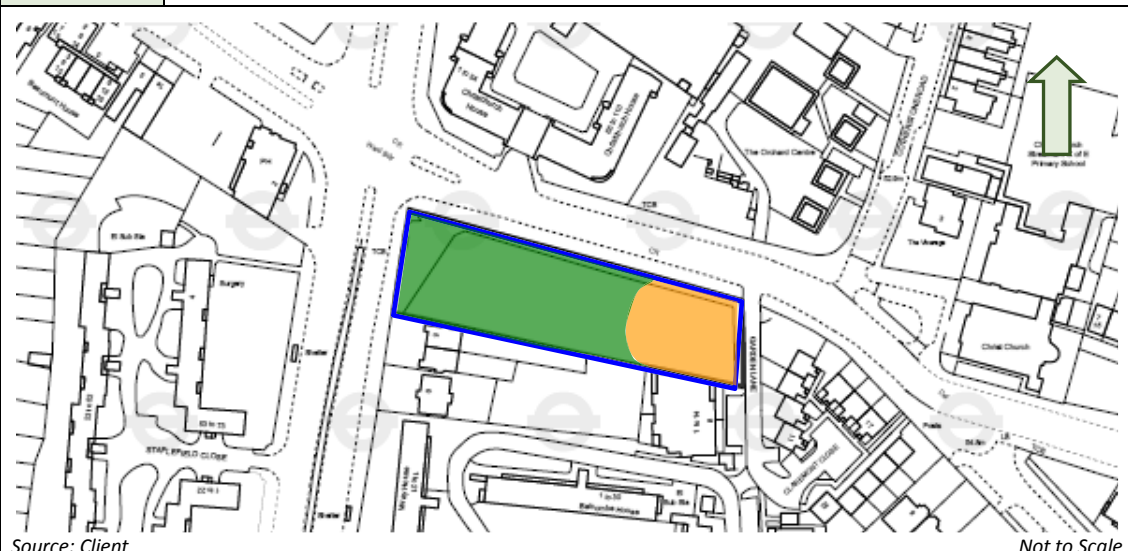
Hazard Level	Definition
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present and that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

Records have been found indicating that during WWII, 16No. HE bombs fell within 100m of the Site. The bombing caused significant damage to buildings on the eastern part of the Site, which may have masked the impact of a UXB during subsequent heavy raids. Given this, it is considered prudent to assign the eastern part of the Site a moderate UXO hazard level.

No evidence of any significant bomb damage or other sources of UXO hazard have been identified on the remainder of the Site, which is assigned a low UXO hazard level.

It is considered that the UXO hazard level on the Site can be zoned from low to moderate, as shown in Figure 6.

**Figure 6** UXO hazard zone plan of the Site



Legend	Very Low		Low		Moderate	
	High		Very High		Site boundary	

## 10 UXO RISK ASSESSMENT

### 10.1 UXO Risk Level

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0

**P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.**



The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix							
LIKELIHOOD (P)	SEVERITY (S)						
		5	4	3	2	1	0
	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

The final risk assessment for the Site is given in Table 4.

Table 4	UXO risk assessment for the Site								
Hazard Zone	Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
Moderate	UXB	Shallow Excavations	2	3	4	3	5	15	Moderate
		Deep Excavations	3	3	9	3	5	15	Moderate
		Piling/boreholes	2	4	8	3	4	12	Moderate
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
Low	UXB	Shallow Excavations	1	1	1	1	5	5	Low
		Deep Excavations	1	1	1	1	5	5	Low
		Piling/boreholes	1	1	1	1	4	4	Low
	Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
		Deep Excavations	1	1	1	1	4	4	Low
		Piling/boreholes	1	1	1	1	3	3	Low
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)									
Shallow excavations defined as <1.0m below ground level (bgl).									

UXO Risk	Matrix Rating	Definition
Very Low	0-1	Little action is required by the client provided that suitable records and procedures are in place to ensure appropriate action is undertaken should the UXO risk level change.
Low	2-5	Tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to.
Moderate	6-15	May be tolerable for the client, but it is prudent to reduce the risk where cost effective and reasonably practicable.
High	16-20	Tolerable to the client only where further risk reduction is impracticable or disproportionate to the risk involved. Essential that all practicable measures are taken to reduce the level of risk.
Very High	21-25	Unacceptable to the client except in extraordinary circumstances. Imperative that all control measures are taken.

## 10.2 Risk Mitigation Recommendations

To ensure that the UXO risk is reduced to As Low As Reasonably Practicable (ALARP) the following mitigation is advised:

### Low Risk

#### Excavations

Where a low risk of UXO encounter is anticipated, industry good practice is simply to raise the awareness of those involved in excavations so that in the unlikely event that a suspect item is discovered, appropriate action is taken. This can be achieved through UXO awareness briefings to site staff.

#### Boreholes/Piles

Clearance certification for borehole or pile locations is considered prudent only if a zero tolerance to risk is adopted. Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.

### Moderate

#### Excavations

For those involved in excavations, the raising of awareness (as per low risk) is considered essential.

A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.

Where UXO detection is not feasible due to ground conditions, restricted access or programme, an Explosive Ordnance Clearance (EOC) Engineer can be used to supervise during excavation works.

The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.



**Boreholes/Piles**

Clearance certification for any borehole or pile locations is considered essential.

This can be achieved by advancing a magnetometer into the ground at the borehole or pile location to provide detection of ferrous metal targets such as UXB.

Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.

Table 5 gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.

Further advice on the mitigation methods can be provided by Zetica on request.

Table 5		Risk mitigation for assumed Site activities			
Risk Level	Typical Future Activity on the Site				
	None	Shallow Excavations (<1.0m)	Deep Excavations (>1.0m)	Boreholes or Pile Construction	
Very low	Ensure suitable records and procedures are in place to highlight the risk should future development be planned.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted.  Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted.  Appropriate action is required to be detailed within site procedures.	Ensure site staff, are informed as part of the site safety induction that the potential presence of UXO cannot be discounted.  Appropriate action is required to be detailed within site procedures.	
Low	As very low.	As very low.  + It is considered prudent to include some UXO awareness training in site inductions.	As very low.  + It is considered prudent to include some UXO awareness training in site inductions.	As very low.  +Clearance certification for borehole or pile locations would be considered prudent only if a zero tolerance to risk is adopted.  Zero tolerance is commonly adopted for sites that have safety critical infrastructure such as nuclear establishments and oil refineries.	
Moderate	As very low.	As low.  +Non-intrusive investigation methods considered prudent where practical.  +Alternatively, EOC Engineer supervision is considered prudent.	As low.  +Non-intrusive investigation methods considered prudent where practical.  +Alternatively, EOC Engineer supervision is considered prudent.	As low.  +Clearance certification for borehole or pile locations is considered essential.	
High	As very low.	As moderate.  +Non-intrusive investigation methods considered essential where practical.  + Alternatively, EOC Engineer supervision is considered essential.	As moderate.  +Non-intrusive investigation methods considered essential where practical.  + Alternatively, EOC Engineer supervision is considered essential.	As moderate.	
Very High	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.	Requires immediate or special attention.	
The above table is for guidance only.					



## Appendices

### Appendix 1 WWII Bombing Incidents

#### 8<sup>th</sup> September 1940

1No HE bomb fell on the junction between Rodmill Lane and Morrish Road, approximately 0.1km north-northwest of the Site.

#### 9<sup>th</sup> September 1940

1No. HE bomb fell on 13 Streatham Hill, approximately 20m south of the Site.

1No. HE bomb fell on Garden Lane, approximately 30m southeast of the Site.

1No. HE bomb fell on the junction of Palace Road and Christchurch Road, approximately 60m east-southeast of the Site.

2No. HE bombs fell on the garden of Christchurch Vicarage, approximately 0.1km northwest of the Site.

1No. HE bomb fell on 1 Cotherston Road, approximately 0.1km northwest of the Site.

#### 1<sup>st</sup> November 1940

1No. HE bomb fell on 6 Calders Row, approximately 0.1km northeast of the Site.

#### 26<sup>th</sup> November 1940

2No. HE bombs fell near Pullman Court, approximately 0.1km south of the Site.

1No. HE bomb fell on the corner of Tierney Road and Streatham Hill, approximately 0.2km south of the Site.

#### 11<sup>th</sup> January 1941

1No. HE bomb fell on the junction between Streatham Place and Christchurch Road, approximately 20m west of the Site.

1No. HE bomb fell on 10 Streatham Place, approximately 90m northwest of the Site.

#### 12<sup>th</sup> January 1941

1No. HE bomb fell on the rear of 21 Streatham Hill, approximately 50m south of the Site.

#### 8<sup>th</sup> March 1941

3No. HE bombs fell on Streatham Hill, between approximately 30m and 0.1km south-southwest of the Site.

#### 15<sup>th</sup> March 1941

IBs fell across Christchurch Road, Cotherstone Road, Holmewood Road and Holmewood Gardens, in the immediate vicinity of the Site.

1No. HE bomb fell on Rodmill Lane, approximately 90m north-northwest of the Site.

**17<sup>th</sup> April 1941**

1No. HE bomb fell on 21 Streatham Place, approximately 0.2km northwest of the Site.

**19<sup>th</sup> March 1941**

IBs fell on Holmewood Gardens, approximately 0.2km north-northwest of the Site.

**23<sup>rd</sup> April 1941**

1No. HE bomb fell on 31 Montrell Road, approximately 0.2km southwest of the Site.

**17<sup>th</sup> May 1941**

1No. HE bomb fell on Christchurch Road, approximately 30m east of the Site.

**18<sup>th</sup> June 1944**

1No. V1 fell on Downton Avenue, near Streatham High Road, approximately 0.5km south of the Site.

**24<sup>th</sup> June 1944**

1No. V1 fell on Streatham High Road, opposite the end of Wyatt Park Road, approximately 0.4km south of the Site.

**2<sup>nd</sup> July 1944**

1No. V1 fell on Cornwall House, Stamford Street, approximately 0.5km north of the Site.

**3<sup>rd</sup> July 1944**

1No. V1 fell on the Streatham Hill theatre on the Barhill Road side, approximately 0.5km south of the Site.

**21<sup>st</sup> July 1944**

1No. V1 fell on Calders Row, Brixton Hill, approximately 0.4km north of the Site.

**27<sup>th</sup> July 1944**

1No. V1 fell on the junction between Wavertree Road and Daysbrook Road, approximately 0.3km south-southeast of the Site.

**9<sup>th</sup> August 1944**

1No. V1 fell on Streatham Place, on the corner of Montell Road, approximately 0.2km west-northwest of the Site.



## Appendix 2 UXO Hazard and Ordnance Types

When assessing the risk from UXO including UXB, it is important to be aware of ordnance type and function. The following Section briefly describes the more common types of UXO. More data on these can be found at <http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/>.

### A2.1 Small Arms Ammunition

Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Larger calibre small arms munitions can contain fuze mechanisms and high explosives or pyrotechnic fillings and may have been used for anti-aircraft or anti-vehicle purposes.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance. SAA is often associated with discarded ammunition boxes around firing practice ranges. The Plate below illustrates some common SAA.

**Plate** Photograph of typical WWII small arms ammunition



Source: Google Images

## A2.2 Hand Grenades

Hand grenades can be filled with explosives or chemicals and have 3No. main parts, a body, a fuze with a pull ring and a safety-clip assembly. Fragmentation grenades are the most common and have a metal or plastic body filled with an explosive. Most use a burning delay fuze that functions for 3 to 5 seconds after the safety lever is released.

Some, such as smoke grenades, are activated instantly when the lever is released. The Plate below illustrates the typical character and condition of No. 36 hand grenades (Mills Bombs) that have been excavated from a site.

<b>Plate</b>	Photographs of a typical and an excavated WWII No. 36 hand grenades
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Source: Google Images



Source: Zetica Ltd

## A2.3 Projected Grenades

Projected grenades are among the most commonly found UXO items, particularly the 40mm type. These contain high explosives and use a variety of fuzes, including some of the most sensitive internal impact-fuzing systems. They are extremely dangerous and can explode if moved or handled.

## A2.4 Mortars

A mortar is a short tube designed to fire a projectile at a steep angle. Mortars can range from approximately 50mm to 280mm in diameter and can be filled with explosives, toxic chemicals, white phosphorous or illumination flares. They generally have a thinner metal casing than projectiles, but use the same types of fuzing and stabilisation.

During WWII there are records that the target areas of RAF practice bombing ranges were occasionally used for mortar training.

The Plate below shows a typical 2-inch mortar bomb found (left) and a demonstration 3-inch mortar bomb (right).



<b>Plate</b>	Photographs of WWII 2-inch and 3-inch mortars
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Source: Daily Mail



Source: Zetica Ltd

## A2.5 Shells

Shells are a projectile containing an explosive charge designed to burst the casing that can contain High Explosives, pyrotechnic compounds or other chemicals.

Shells can be found in a range of sizes, from <20mm to several times this size. The most likely shells to be found on the Site are Small Arms Ammunition (SAA) or UXAA shells that have fallen back to the ground unexploded.

Most commonly used anti-aircraft shells were 2" and 3.7" HE shells.

If fired and found as UXO, shells can offer a particular hazard from accidental detonation as they can have sensitive fuze mechanisms. A fuze is a device which incorporates mechanical, electrical, chemical or hydrostatic components to initiate a train of fire or detonation.

The Plate below is a photograph of a 3.7" UXAA shell found in Camberwell, London.

<b>Plate</b>	Photograph of a recently excavated 3.7" AA shell
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Source: Zetica Ltd

## A2.6 Incendiary Bombs

Incendiary Bombs (IBs) ranged from small 1kg thermite filled, magnesium bodied bombs to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. By far the most common air dropped devices across the UK during WWII were small 1kg to 2kg IBs.

In some cases the IBs were fitted with a very small High Explosive (HE) bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs.

The small amount of HE, if any, and the almost negligible potential for IBs to remain active after more than 65 years in the ground means that these items have very little prospect of causing damage. In the majority of cases if IBs are found in the ground, the incendiary materials have deteriorated to such an extent that they are considered to provide a low UXO hazard level.

However, since magnesium and phosphorus were common components in IBs, some localised chemical contamination may occur where the contents have leached out of the IB into the surrounding soil.

The Plate below shows a typical variety of fragmentary remains of IBs and 2No. IBs recovered by the Civil Defence during WWII.

**Plate**

Photographs of typical fragmentary remains of IBs and a UXIB



Source: Swansea Museum



Source: Museum of London

## A2.7 German High Explosive Bombs

Probably the most common and certainly most publicised UXOs to be found in the UK are bombs. Air dropped bombs, as a result of WWII enemy action, are found on a relatively frequent basis as UXO. They tend to be highly publicised (at least on a local basis) due to the common disruption where an evacuation of the potentially affected area is put in place.

The amount of High Explosive and the potential for a fuze to still be activated means that these devices have the prospect of causing some of the most widespread damage. WWII bombs were particularly sophisticated for their time, with anti-tamper fuzes.

Many German bombs were designed to not explode on impact and instead to cause disruption as a UXB. Some fuzes were set with a delay time of over 70 hours. During this time, an anti-tamper fuze could also be activated to detonate should it be disturbed.

The most commonly used bombs during WWII were the 50kg and 250kg sized general purpose bombs. Less frequently, the 500kg bomb was also used. Larger bombs were used, but so infrequently that any assessment of hazard is more typically based on bombs ranging up to 500kg only.

It should be noted that the June 2008 find of a 1000kg bomb in London, does demonstrate that larger bombs can be found and any risk mitigation measures should consider this.

The Plate below shows the variety of UXB recovered by the Civil Defence during WWII.



Plate	Photograph of a variety of UXB recovered by the Civil Defence during WWII
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Source: Imperial War Museum

## A2.8 Detonators, Gaines and Fuzes

Bomb components such as detonators, gaines and fuzes were stored at operational airfields during WWII and typically contained some type of explosive charge to initiate the detonation of a munition.

A wide variety of these components were used and examples of some common fuzes are shown in the Plate below.

Plate	Photographs showing examples of WWII fuzes
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Source: Zetica Ltd

## A2.9 Land Mines

Wartime activities provide numerous sources of UXO within the land environment. Whilst efforts have been made to clear the known British minefields, it was common for mines to become lost for a variety of reasons and so not recovered. Additionally, such munitions might have been disposed of on an unofficial basis and so no records were kept.

Most of the mined beaches and other land areas in the UK have been cleared by the MoD. Occasionally, wave action or activities such as bombing caused mines to become displaced and these were missed as part of any past clearance activities.

The Plate below is a photograph of a typical WWII land mine used on the land area, beaches and cliffs around Britain. This example was found at Gatwick Airport formerly RAF Gatwick.

### Plate

Photographs of original and recently excavated WWII land mines



Source: Google Images



Source: Zetica Ltd

## A2.10 Home Guard Weapons

Initially, the Home Guard's armoury was largely second-hand and much of it was of WWI vintage. Personal weapons (such as shotguns) and home-made devices were also employed.

By the end of WWII, some units were well equipped with a wide variety of small arms and munitions.

These included .32, .38 and .455 revolvers, .303 P14, .300 P17 and .303 Canadian Ross rifles, anti-tank rifles and a variety of Sub- Machine Guns (SMG) such as the .45 Thompson and 9mm Sten Guns.

Other heavier Machine Guns (MG) at their disposal included Browning, Hotchkiss, Lewis, Vickers and Marlin MG. Sub-artillery weapons were developed for them, including grenade throwers (the Northover Projector) and spigot mortars (the Blacker Bombard). 2-pdr anti-tank guns and Projector, Infantry Anti Tank (PIAT) weapons were in circulation amongst some units, and the Home Guard also manned AA guns later in WWII.

Explosives were available to some Home Guard units and were used and stored by all Auxiliary Unit patrols. As well as the flame fougasse and hand grenades detailed in this Appendix, the Home Guard had stocks of Molotov Cocktails, Sticky Bombs and SIP grenades.

In October 2006 a cache of 76No. SIP grenades was found in a garden at Seend, Wiltshire. In October 2008, a further 26No. SIP grenades were discovered in a garden in Wimborne, Dorset. Similar caches were discovered in October 2009 in Hove, Sussex and during May 2010 in Halesowen in the West Midlands, and a further cache of 20No. was uncovered on a construction site at Birdlip, Gloucestershire, in July 2010.



Also in July 2010, a box of 24No. SIP grenades was found on Cogden Beach, Dorset. In April 2012, more than 8No. SIP grenades were found on a construction site in Banbury and destroyed by members of the Army Royal Logistic Corps (RLC).

In March 2015, 80No. SIP grenades were found at a building site in Eastbourne, some of which exploded before they could be made safe by a Bomb Disposal unit. In all 8No. cases, the bottles were in good condition and exploded in flames when broken.

Most recently, in May 2016, 1No. No. 76 SIP grenade was found during excavation at Chapel Point, Lincolnshire forcing works to be delayed. During WWII, the site was occupied by a pillbox and gun emplacement associated with the heavily-defended 'Coastal Crust', manned by Home Guard units. The device was removed safely.

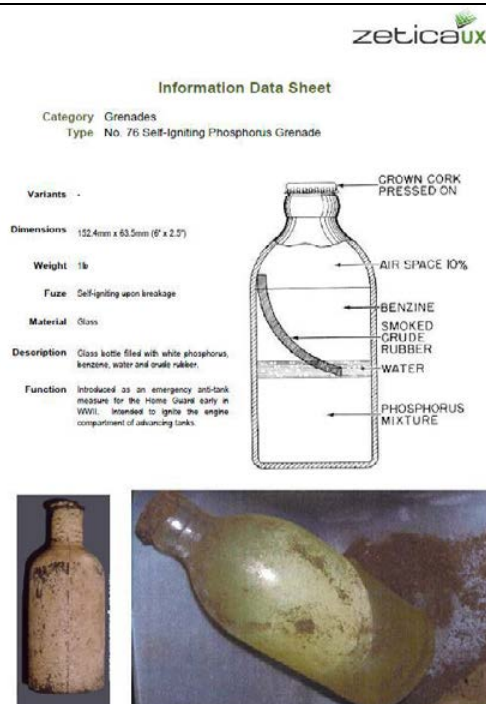
In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

The Plate below is a photograph of a No. 76 SIP grenade (LHS) with an explanatory leaflet produced by ZeticaUXO for site staff (RHS).

**Plate** Photograph of the No. 76 SIP grenade



Source: Zetica Ltd



Given the irregular nature of Home Guard activity, the possibility of items of UXO or weapons being discovered at any locations occupied or used for training by them can never be totally discounted.

## A2.11 UXO Migration

It is possible for explosive material, UXO or ordnance scrap to migrate to a site during landfill or dredging operations or other ground works which import Made Ground or natural materials already containing UXO. It is important to understand the nature and age of such landfill or dredging operations when assessing the potential UXO hazard level on the site.

## A2.12 Effects and Consequences

There have been a limited number of recorded incidents in the UK since WWII where bombs have detonated during engineering works, though a significant number of bombs have been discovered. Incidents involving smaller ordnance are, however, relatively common in the UK.

In the UK, there are no recorded incidents since the decade after WWII, of a UXB accidentally detonating. In recent years, bombs have been found that have fuze mechanisms that have started to operate indicating that given the right conditions a UXB may still function.

In June 2008 the UXB uncovered in the Lea Valley caused difficulty to No. 33 Regiment (Explosive Ordnance Disposal) Royal Engineers because the fuze mechanism started to operate.

The 1,000kg 'Hermann' bomb, the first of this size to be found in over 30 years, took 5 days to deactivate. This demonstrates that larger bombs can be found and any risk mitigation measures should provide the option to deal with this size of device. Since WWII, UXBs have been found on a regular basis in London.

Since WWII, UXBs have been found on a regular basis throughout Britain. Some of the most recent cases are described below.

In May 2009 1No. 50kg WWII bomb was found on a building site in Bexhill-on-Sea, Sussex, and on the 16<sup>th</sup> August 2009, 1No. 250kg WWII bomb was found near Ebberston, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8<sup>th</sup> March 2010 1No. 500kg WWII bomb was found at Bowers Marsh in Essex by Zetica EOC operatives following a Zetica desk study concluding a high risk of UXB on the site. The bomb was demolished in situ by members of the Army Royal Logistics Corps (RLC).

The Plate below is a photograph of the bomb in situ.

**Plate** Photograph of the 500kg WWII UXB at Bowers Marsh, 8<sup>th</sup> March 2010



Source: Zetica Ltd

On the 23<sup>rd</sup> February 2011, 1No. WWII UXB was found on a building site in Nottle Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.



On the 22<sup>nd</sup> July 2012, a landslip in the cliffs at Mappleton in the East Riding of Yorkshire exposed over 1,000No. UXO items, including practice bombs, mortars, rockets, shells and grenades. The cliff was part of a former bombing and artillery range, used during WWII and until the 1970s.

UXO items were removed by Explosive Ordnance Disposal (EOD) officers from Catterick and MoD staff from Leconfield. 15No. controlled explosions were undertaken by the Royal Engineers (RE) to detonate the more volatile items in situ, while other less hazardous UXO devices were left in place to be dealt with at a later date.

1No. WWI bomb (shown in the Plate below) was found on the Isle of Sheppey on the 2<sup>nd</sup> August 2012 during a geophysical survey following desk study research by Zetica Ltd which had established that a previously unknown WWI bombing range existed on the site. A further WWI bomb was found in the same location in August 2015.

<b>Plate</b>	Photograph of WWI bomb, Isle of Sheppey, 2 <sup>nd</sup> August 2012
--------------	--



Source: Zetica Ltd

On the 23<sup>rd</sup> March 2015, 1No. WWII 500kg UXB was found on a building site in The Grange, Bermondsey. The bomb was made safe by EOD personnel and removed for demolition.

On the 21<sup>st</sup> May 2015, 1No. 50kg UXB was found on a building site near Wembley Stadium, London Borough of Brent. The bomb was made safe by EOD personnel and removed for demolition.

On the 10<sup>th</sup> August 2015, 1No. 250kg UXB was found under the basement of a building site at Bethnal Green, London Borough of Tower Hamlets. It was made safe and removed by an EOD team from the RLC.

On the 21<sup>st</sup> September 2015, 1No. UXB was uncovered on a construction site in Cheylesmore, Coventry, by the operator of a mechanical digger. It was destroyed in situ by an EOD team from the RLC.

In January 2016, Zetica discovered 3No. 500lb British UXB at a former airfield in Cambridgeshire. These were destroyed in controlled explosions. The Plate below is a photograph of one of the bombs.

<b>Plate</b>	Photograph of a recently excavated WWII British 500lb GP bomb
	
<p><i>Source: Zetica Ltd</i></p>	
<p>On the 12<sup>th</sup> May 2016, 1No. 250kg UXB was found on a building site in Bath. It was made safe and then taken to a local quarry for demolition.</p> <p>In September 2016 1No. 500kg UXB and 1No. torpedo were discovered during dredging works in Portsmouth Harbour. An additional 250kg HE bomb was discovered on the 16<sup>th</sup> November 2016. These devices were towed out to sea and destroyed in controlled explosions.</p> <p>On the 19<sup>th</sup> January 2017, 1No. 50kg UXB was found during dredging works along the River Thames Victoria Embankment in Central London. The device was towed to Tilbury in Essex where it was destroyed in a controlled explosion.</p> <p>On the 25<sup>th</sup> January 2017, 1No. 250kg UXB and 1No. mortar shell were found in King's Forest, Thetford. They were destroyed in a controlled explosion.</p> <p>On the 2<sup>nd</sup> March 2017, 1No. 250kg German UXB was found on a building site in Brondesbury Park in the London Borough of Brent. It was defuzed by an EOD team and removed to a safe location where it was destroyed in a controlled explosion.</p> <p>On the 15<sup>th</sup> May 2017, 1No. suspected 250kg German UXB was found on a building site in Aston, Birmingham. Due to the corrosion of the fuzes, the UXB was destroyed in situ on the 17<sup>th</sup> May 2017.</p> <p>There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.</p> <p>In June 2010, 3No. members of a bomb disposal team were killed, and 6No. others injured, whilst attempting to defuze an unexploded WWII bomb in Goettingen, Central Germany.</p> <p>The bomb, the second found in Goettingen in the space of a few days, was unearthed at a depth of 7.5m during excavations for a sports stadium.</p> <p>In September 2008, 17No. people were injured and considerable damage occurred to adjacent buildings when a bomb exploded on a construction site in Hattingen, Germany.</p> <p>In October 2006 during road works on a motorway near Aschaffenburg in Bavaria, southern Germany, a bomb was struck by a machine and detonated. The plant driver was killed and 5No. others injured, including passing motorists.</p>	



In a similar incident in October 2004 in Linz, Austria a bomb exploded injuring 3No. workers and causing considerable damage to plant. In the same month, a WWII bomb under a back garden in Vienna, Austria, was detonated without warning by a minor earth tremor, after remaining undiscovered for over 60 years.

Incidents involving UXO are also reported from the marine areas around the North Sea. For example, on 6<sup>th</sup> April 2005, 3No. Dutch fishermen were killed when they accidentally trawled up a WWII UX bomb which exploded when it hit the deck.

More recently, an unexploded HE bomb was trawled from the sea floor off South Shields on the 25<sup>th</sup> February 2015 but caused no damage.

Further details of similar finds can be found at <http://zeticauxo.com/news/>.

The effects of a partial or full detonation of ordnance are usually shock, blast, heat and shrapnel damage. A 50kg buried bomb can damage brick / concrete structures up to a distance of approximately 16m away. Unprotected personnel on the surface up to 70m away from the blast could also be seriously injured. Larger ordnance would obviously be more destructive.

Explosives rarely lose effectiveness with age, although over time mechanisms such as fuzes and gaines can become more sensitive and therefore more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of a detonation of explosive ordnance are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved.

Appendix 3 Abbreviations	
AA	Anti-Aircraft
ACPO	Association of Chief Police Officers
AFV	Armoured Fighting Vehicle
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
ATA	Assault Training Area
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
BTA	Battle Training Area
CBRN	Chemical, Biological, Radiological and Nuclear
CMD	Conventional Munitions Disposal
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HSE	Health and Safety Executive
JSEODOC	Joint Services EOD Operations Centre



IB	Incendiary Bomb
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
PUCA	Pick Up and Carry Away
RAF	Royal Air Force
SAA	Small Arms Ammunition
SIP	Self-Igniting Phosphorous
TEP	Time Expired Pyrotechnics
USAAF	United States Army Air Forces
UXB	Unexploded Bomb
UXO	Unexploded Ordnance

Appendix 4 Glossary & Definitions	
<b>Abandoned Explosive Ordnance (AXO)</b>	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
<b>Camouflet</b>	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
<b>Demil</b>	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
<b>Detonation</b>	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
<b>Device</b>	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
<b>Explosive</b>	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
<b>Explosive Ordnance (EO)</b>	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
<b>Explosive Ordnance Clearance (EOC)</b>	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
<b>Explosive Ordnance Disposal (EOD)</b>	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
<b>Explosive Ordnance Reconnaissance (EOR)</b>	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.



<b>Explosive Remnants of War (ERW)</b>	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.
<b>Explosive Substances and Articles (ESA)</b>	<p>Explosive substance are solid or liquid substance (or a mixture of substances), which is either:</p> <ul style="list-style-type: none"> <li>capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.</li> <li>designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction.</li> </ul> <p>Explosive article is an article containing one or more explosive substances.</p>
<b>Fuze</b>	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
<b>Gaine</b>	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
<b>High Explosive</b>	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
<b>Munition</b>	<p>Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:-</p> <ul style="list-style-type: none"> <li>inert - contain no explosives whatsoever.</li> <li>live - contain explosives and have not been fired.</li> <li>blind - have fired but failed to function as intended.</li> </ul>
<b>Primary Explosive</b>	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.

<b>Propellants</b>	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
<b>Pyrotechnic</b>	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
<b>Unexploded Ordnance (UXO)</b>	UXO is explosive ordnance that has been either primed, fused, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.



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**Established for over 25 years, Zetica's services include**

- ☒ Desk studies
- ☒ Unexploded ordnance risk assessments and risk mitigation
- ☒ Topographic surveys
- ☒ Utility services detection
- ☒ Environmental and engineering geophysical surveys
- ☒ Transport infrastructure surveys
- ☒ Pipeline & cable route surveys
- ☒ Intrusive ground investigations

More details are available at

[www.zetica.com](http://www.zetica.com)



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## **APPENDIX D**

### **Site Investigation Data**

**0002-UA009696 Borehole Location Plan**

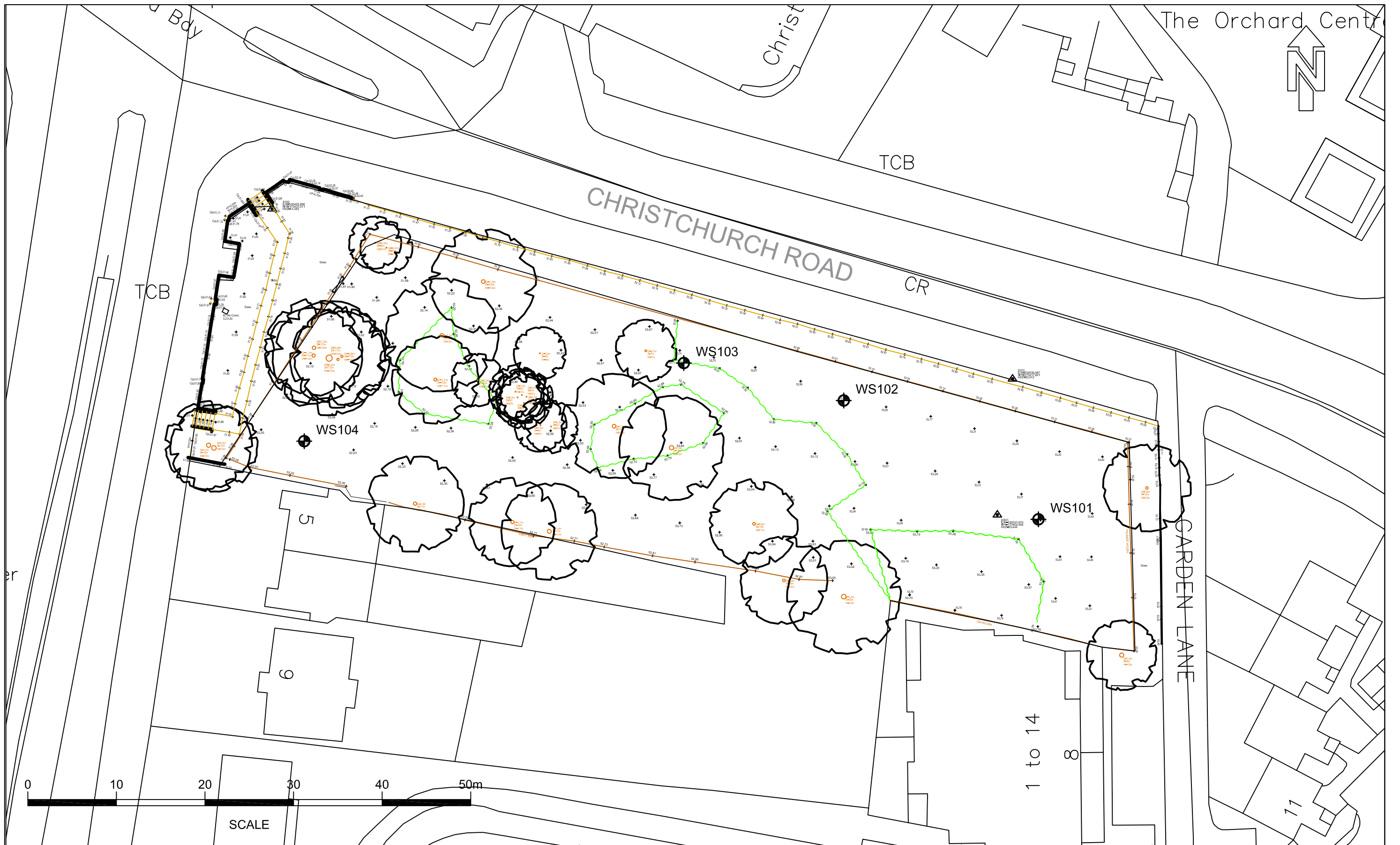
**Borehole logs**

**Chemical testing laboratory certificates**

**Geotechnical testing laboratory certificates**

**Chemical soil screening summary**

**HazWasteOnline report and summary**



REV	DATE	DESCRIPTION	DRN	CHK	APP
Rev	Date	Description	Drawn	Check	Approv

NOTES:

Based on topographic drawing by 40Seven Ltd. Drawing 901 - CHRISTCHURCH ROAD - 01, dated May 2017

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Client

TRANSPORT FOR LONDON

Address

Phone

Fax

Suitability Description:			
AB			
AS BUILT			
Designed	J. RAVEN	Date 18JUL17	Signed
Drawn	J. RAVEN	Date 18JUL17	Signed
Checked	T. AGAPAKIS	Date 20JUL17	Signed
Approved	T. WINDSOR	Date 21JUL17	Signed
Scale:	1:400 @ A3	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	AB	Project Number:	UA009686

PROJECT:

TfL PSF 9131 SITE INVESTIGATIONS

TITLE:

LAND AT CHRISTCHURCH ROAD AND BRIXTON HILL - BOREHOLE LOCATION PLAN



Design & Consultancy for natural and built assets

Registered office:  
Arcadis House  
34 York Way  
London  
N1 9AB

Coordinating office:  
The Surrey Research Park  
10 Medaware Road  
Guildford GU2 7AR  
Tel: 44 (0)1483 803 000

www.arcadis.com

Drawing Number:

0002-UA009686

Revision:

01



## SAMPLE TYPES

B	Bulk disturbed sample	ES	Environmental soil sample	U	Undisturbed sample
C	Core sample	EW	Environmental water sample	UT	Undisturbed thin wall sample
CBR-D	Disturbed sample from CBR test area	G	Gas sample	W	Water sample
CBR-U	Undisturbed sample from CBR test area	L	Liner sample		
D	Small disturbed sample	SPT	SPT split spoon sample		



## IN-SITU TESTING

SPTs	Standard Penetration Test (using a split spoon sampler)
SPTc	Standard Penetration Test (using a solid 60 degree cone)
N	Recorded SPT 'N' Value *
-/-	Blows/Penetration (mm) after seating blows totalling 150 mm
MX	Mexi Probe Test (records CBR as %)
HV	Hand Shear Vane Test (undrained shear strength quoted in kPa)
PP	Pocket Penetrometer Test (kg/m <sup>3</sup> )
( )	Denotes residual test value
PID	Photo Ionisation Detector (ppm) *
Kf/Kr	Permeability Test (f = falling head, r = rising head quoted in ms <sup>-1</sup> )
HPD	High Pressure Dilatometer Test (pressure meter)
PKR	Packer / Lugeon Permeability Test
CBR	California Bearing Ratio Test


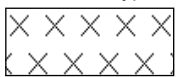
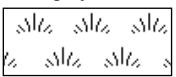
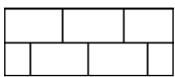
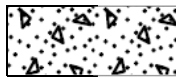
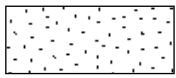

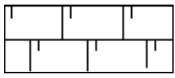

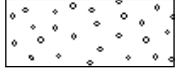
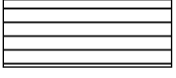

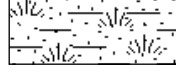
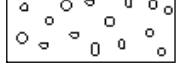
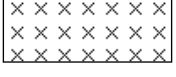

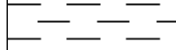



## ROTARY CORE DETAILS

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation (% of intact core >100 mm)
FI	Fracture Spacing (average fracture spacing; in mm, over indicated length of core) **
NI	Non-Intact Core
AZCL	Assumed Zone of Core Loss

## GROUNDWATER

	Groundwater strike
	Standing water level after 20 minutes; 1st, 2nd etc (number denotes level order)

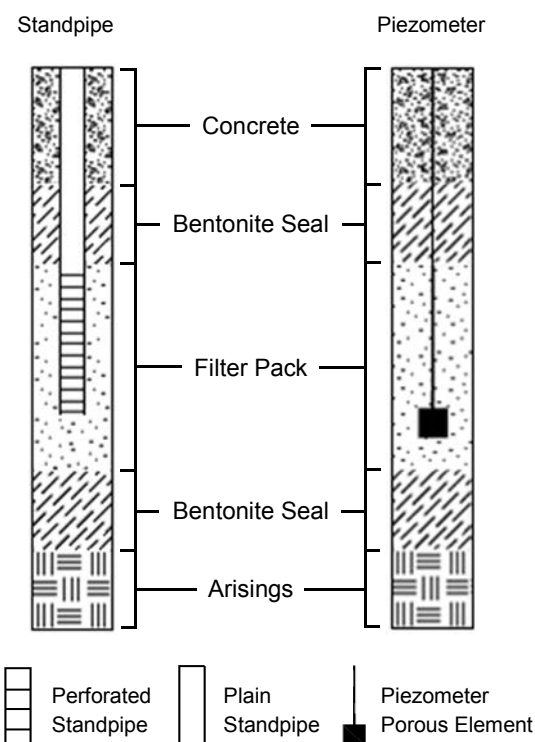
## STRATA LEGENDS - Note: Composite strata types are shown by combining symbols

	Made Ground		Silt		Peat		Limestone
	Concrete		Sand		Void		Chalk
	Bituminous Bound Materials		Gravel		Mudstone		Coal
	Topsoil		Cobbles		Siltstone		Metamorphic Rock
	Clay		Boulders		Sandstone		Fine Grained Igneous Rock

\* Where a single value is quoted this is the uncorrected 'N' value for a full 300 mm test drive following a seating drive of 150mm. Where the full test drive penetration is not achieved the number of blows is quoted for the penetration below the test total of 300mm, e.g.: 50/75.

\*\* The minimum, average and maximum are shown e.g. 5/45/125.

## INSTALLATION & BACKFILL DETAILS



## STRATUM BOUNDARIES

	Unit boundary
---	---------------

Sheet 1 of 1

Checked By  
**TA**



Project  
**TFL - Land at Christchurch Road & Brixton Hill**  
Client  
**Transport for London**

Project No.  
**UA009686-02**  
Easting (OS mE)  
**530521.00**

Ground Level (mAOD)  
**53.10**  
Northing (OS mN)  
**173415.00**

Start Date  
**19/06/2017**  
End Date  
**19/06/2017**

Scale  
**1:50**  
**Sheet 1 of 1**

SAMPLES		TESTS			Water Strikes	STRATA		Depth (Thickness)	Level	Install/ Backfill
Depth	Type/ No.	Depth	Type/ No.	Results		Description	Legend			
0.30	ES1					MADE GROUND: Grass over dark brown slightly clayey slightly gravelly fine to coarse SAND with abundant roots and rootlets. Gravel is angular to subrounded fine to medium of flint, brick, concrete and ceramic.		(0.90)		
0.50	D3									
0.50	ES2									
1.20 - 1.65	D4	1.20	SPT(S)	N=10 (1,2/2,2,3,3)		Firm light brown mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded, fine to medium flint. [HEAD DEPOSITS]		0.90 (0.50)	52.20	
1.80 - 2.00	D5									
2.00 - 3.40	B6	2.00	SPT(S)	N=12 (2,2/2,3,3,4)		Firm brown mottled grey slightly sandy slightly gravelly CLAY with occasional pockets of orange or cream fine to coarse sand and rare relict roots. Gravel is subangular to subrounded, fine to medium of claystone. [HEAD DEPOSITS]	becoming stiff becoming clayey	1.40 (2.00)	51.70	
		3.00	SPT(S)	N=22 (3,2/3,5,8,6)						
4.00 - 4.45	D7	4.00	SPT(S)	N=21 (3,3/4,5,6,6)		Yellowish brown slightly sandy very clayey GRAVEL. Gravel is angular to rounded, fine to coarse flint. [HEAD DEPOSITS] Stiff extremely closely fissured brown mottled grey CLAY. [WEATHERED LONDON CLAY]		3.40 (0.20) 3.60	49.70 49.50	
		5.00	SPT(S)	N=20 (3,4/4,5,5,6)				(1.85)		
								5.45	47.65	

Project  
**TFL - Land at Christchurch Road & Brixton Hill**  
Client  
**Transport for London**

Project No.  
**UA009686-02**  
Easting (OS mE)  
**530502.00**

Ground Level (mAOD)  
**52.70**  
Northing (OS mN)  
**173420.00**

Start Date  
**19/06/2017**  
End Date  
**19/06/2017**

Scale  
**1:50**  
Sheet 1 of 1

SAMPLES		TESTS			Water Strikes	STRATA		Depth (Thickness)	Level	Install/ Backfill						
Depth	Type/ No.	Depth	Type/ No.	Results		Description	Legend									
0.30	ES1					MADE GROUND: Grass over dark brown slightly clayey slightly gravelly fine to coarse SAND with abundant roots and rootlets. Gravel is angular to well rounded fine to coarse of flint, brick, concrete and ceramic. One subangular cobble of brick.		(0.90)	51.80							
0.50	ES2					Firm yellowish brown mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of flint. [HEAD DEPOSITS]		0.90								
0.80	D3															
1.20 - 1.65	D4	1.20	SPT(S)	N=9 (1,2/1,2,3,3)					(0.75)	51.05						
2.00 - 2.45	D5	2.00	SPT(S)	N=27 (5,5/5,7,7,8)					(0.70)	50.35						
3.00 - 3.45	D6	3.00	SPT(S)	N=13 (6,5/4,3,3,3)				(0.30)	50.05							
3.50 - 5.00	B7							(0.25)	49.80							
4.00 - 4.45	D8	4.00	SPT(S)	N=23 (3,4/5,6,5,7)				(0.40)	49.40							
5.00 - 5.45	D9	5.00	SPT(S)	N=25 (4,3/6,6,7,6)					(2.15)							
									5.45	47.25						
DRILLING TECHNIQUE				WATER OBSERVATIONS						HOLE/CASING DIAMETER				BACKFILL		
From	To	Technique		Date/Time	Strike At	Time Elapsed	Rise To	Casing	Sealed	Hole Dia.	Depth	Casing Dia.	Depth	Top	Base	Backfill
0.00	1.20	Inspection Pit		19/06/2017 14:30	2.65					300	1.20			0.00	1.00	Arisings
1.20	5.45	Dynamic Sample								87	2.00			1.00	2.00	Bentonite
										77	3.00			2.00	5.45	Arisings
										67	4.00					Arisings
Remarks																
Seepage at 2.65m bgl. Hole terminated at target depth. Coordinates and levels are approximate.																
															Termination Depth:	
															5.45m	



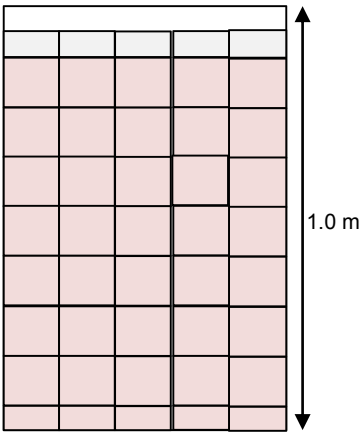
Sheet 1 of 1

Checked By  
TA

CROSS SECTION

W

E



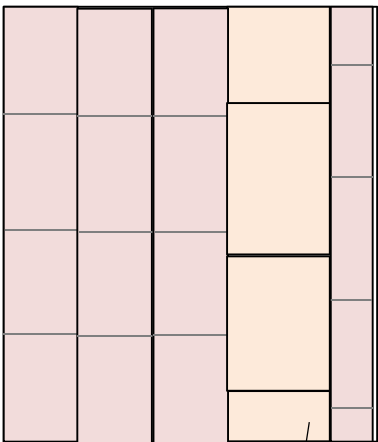
PHOTOGRAPHS



PLAN VIEW

WS104 hand pit  
Relic (foundation?)  
brick structure

Final depth 1.0m  
bgl.



Red and grey  
bricks

Yellow bricks



Client	Project				Land at Christchurch Road and Brixton Hill	Title	Arcadis Consulting (UK) Ltd 1 <sup>st</sup> Floor 2 Glass Wharf Temple Quay Bristol BS2 0FR Tel: 01 173 721385 Fax: 01 173 721200				
	Status						ARCADIS <small>BRISTOL OFFICE</small>				
	Scale						NTS				
	Datum		N/A				Author		J Raven		
	Grid		N/A				Checker		T Agapakis		
	© Copyright Reserved		Approver				T Windsor		Drawing No. 101		
						Inspection Pit WS104 Sketch		Project No. UA009686		Issue No. 01	





4041

# TEST CERTIFICATE

## Determination of Liquid and Plastic Limits

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Tested in Accordance with BS1377-2: 1990: Clause 4.3 &amp; 5: Definitive Method

Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 21/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

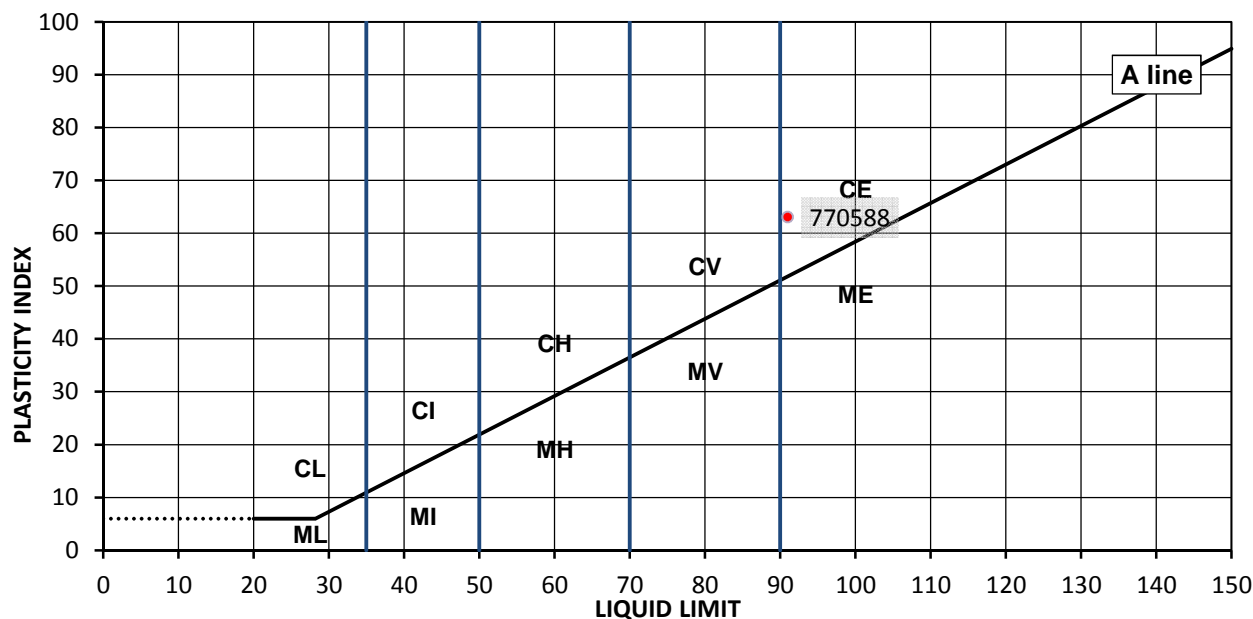
### TEST RESULTS

Laboratory Reference: 770588  
Sample Reference: Not Given

Description: Yellowish brown CLAY  
Location: WS101  
Sample Preparation: Tested in natural condition

Sample Type: B  
Depth Top [m]: 3  
Depth Base [m]: 5

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
32	91	28	63	100



Remarks

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

Date Reported: 06/07/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Determination of Liquid and Plastic Limits

i2 Analytical Ltd  
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Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 21/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

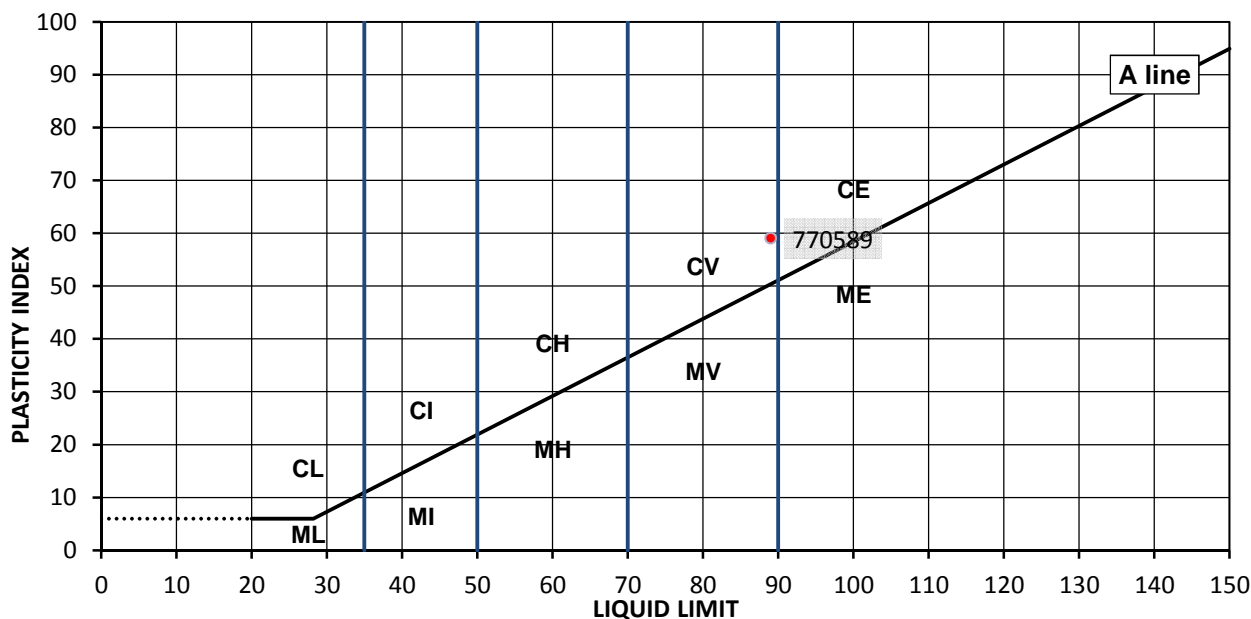
### TEST RESULTS

Laboratory Reference: 770589  
Sample Reference: Not Given

Description: Yellowish brown CLAY  
Location: WS102  
Sample Preparation: Tested in natural condition

Sample Type: D  
Depth Top [m]: 1.8  
Depth Base [m]: 2

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	89	30	59	100



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
		exceeding 90
Organic	O	append to classification for organic material ( eg CHO )

Remarks

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

Date Reported: 06/07/2017

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7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



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Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 21/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

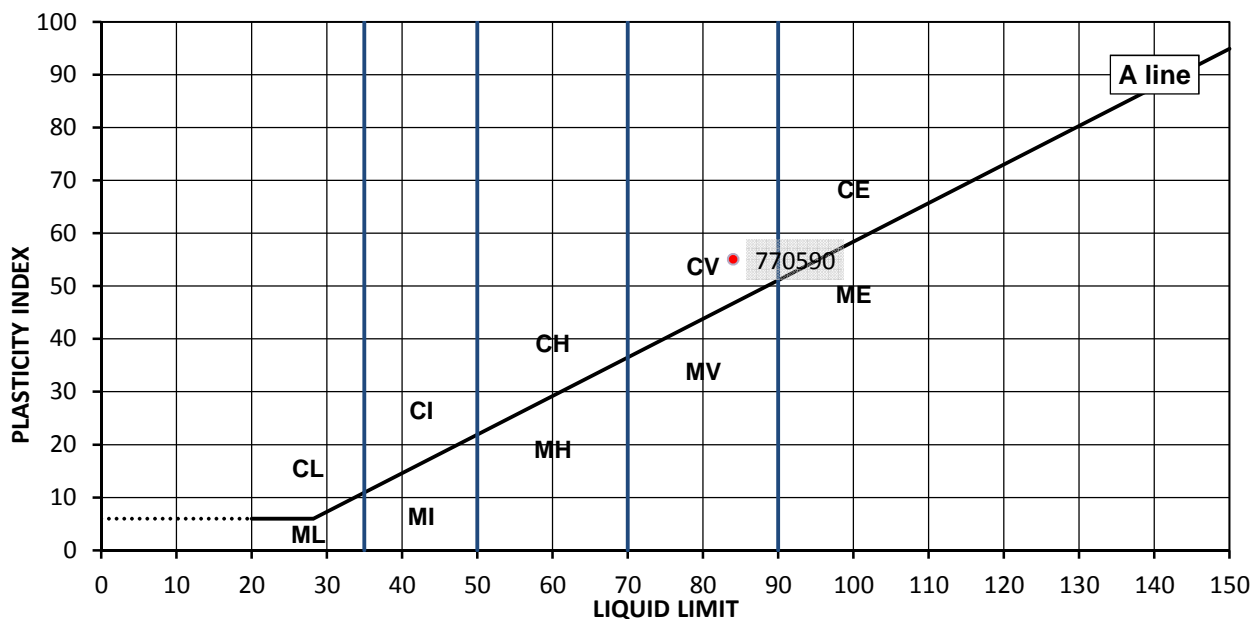
### TEST RESULTS

Laboratory Reference: 770590  
Sample Reference: Not Given

Description: Yellowish brown gravelly CLAY  
Location: WS103  
Sample Preparation: Tested after washing to remove >425um

Sample Type: D  
Depth Top [m]: 1.2  
Depth Base [m]: 1.65

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	84	29	55	79



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
		exceeding 90
Organic	O	append to classification for organic material ( eg CHO )

Remarks

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

Date Reported: 06/07/2017

for and on behalf of i2 Analytical Ltd

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## Determination of Liquid and Plastic Limits

i2 Analytical Ltd  
7 Woodshots Meadow  
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Watford Herts WD18 8YS



Tested in Accordance with BS1377-2: 1990: Clause 4.3 &amp; 5: Definitive Method

Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 21/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

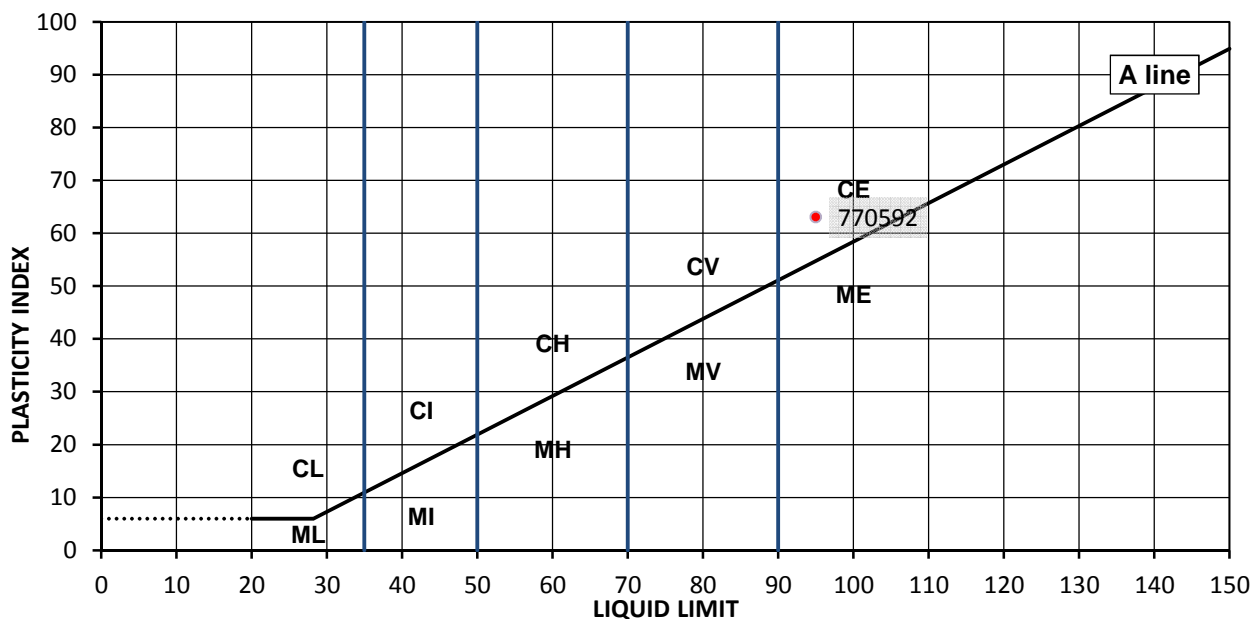
### TEST RESULTS

Laboratory Reference: 770592  
Sample Reference: Not Given

Description: Yellowish brown CLAY  
Location: WS103  
Sample Preparation: Tested in natural condition

Sample Type: D  
Depth Top [m]: 5  
Depth Base [m]: 5.45

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	95	32	63	100



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
		exceeding 90
Organic	O	append to classification for organic material ( eg CHO )

Remarks

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Signed:

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

Date Reported: 06/07/2017

for and on behalf of i2 Analytical Ltd

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# TEST CERTIFICATE

## Summary of Classification Test Results

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 21/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

### Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m³	Mg/m³		%	%	%	%	%
770588	WS101	Not Given	3.00	5.00	B	Yellowish brown CLAY			32	100	91	28	63	
770589	WS102	Not Given	1.80	2.00	D	Yellowish brown CLAY			29	100	89	30	59	
770590	WS103	Not Given	1.20	1.65	D	Yellowish brown gravelly CLAY			29	79	84	29	55	
770592	WS103	Not Given	5.00	5.45	D	Yellowish brown CLAY			29	100	95	32	63	

Comments:

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Date Reported: 06/07/2017

Signed:

Sushil Sharda  
Technical Manager (Geotechnical  
Division)

for and on behalf of i2 Analytical Ltd

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### Determination of Particle Size Distribution



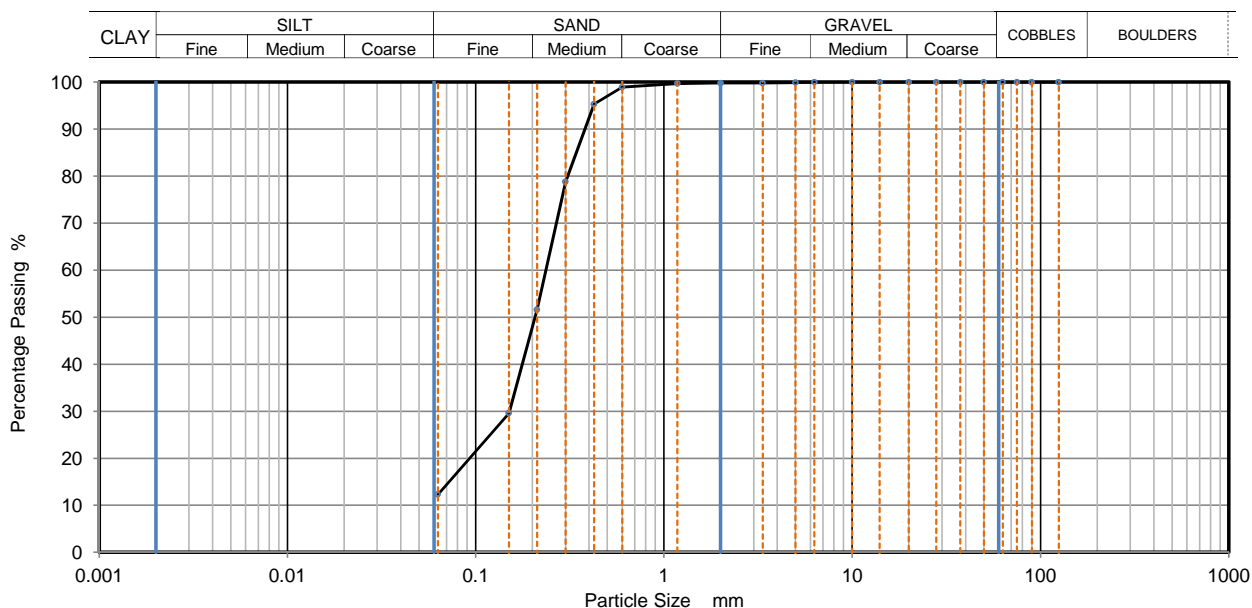
Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 12/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

Sample Reference: Not Given

Sample description: Brown slightly clayey SAND  
Location: WS101  
Supplier: Not Given

Sample Type: D  
Depth Top [m]: 2  
Depth Base [m]: 2.2



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density 2.65 (assumed) Mg/m3	
0.425	95		
0.3	79		
0.212	52		
0.15	30		
0.063	12		

Dry Mass of sample [g]: 204

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.20
Sand	87.50
Fines <0.063mm	12.30

<b>Grading Analysis</b>		
D100	mm	6.3
D60	mm	0.236
D30	mm	0.151
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Postuli

Signed:

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

*S. Howard*

Date Reported: 06/07/2017

**for and on behalf of i2 Analytical Ltd**

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4041

**TEST CERTIFICATE****Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

i2 Analytical Ltd  
7 Woodshots Meadow  
Croxley Green Business Park  
Watford Herts WD18 8YS



Client: Arcadis Consulting (UK) Ltd  
Client Address: 10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR  
Contact: Jon Raven  
Site Name: Land at Christchurch Road & Brixton Hill  
Site Address: Not Given

Client Reference: UA009686-02  
Job Number: 17-52275  
Date Sampled: Not Given  
Date Received: 12/06/2017  
Date Tested: 28/06/2017  
Sampled By: Not Given

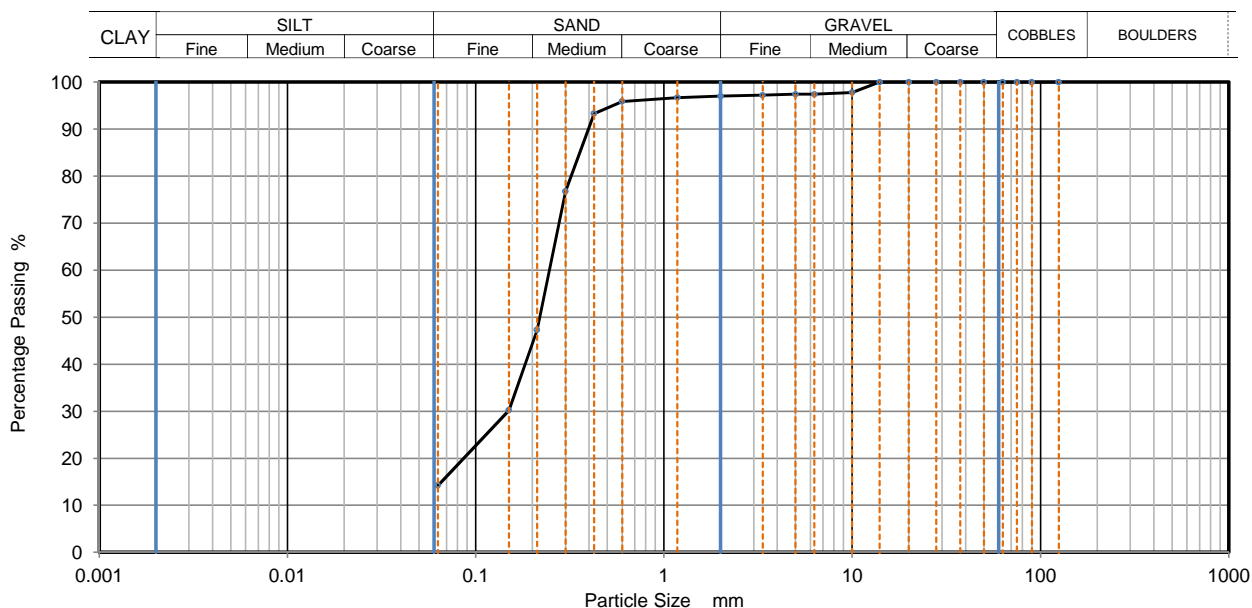
**TEST RESULTS**

Laboratory Reference: 770591

Sample Reference: Not Given

Sample description: Yellowish brown slightly clayey SAND  
Location: WS103  
Supplier: Not Given

Sample Type: D  
Depth Top [m]: 2  
Depth Base [m]: 2.45



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	98		
6.3	97		
5	97		
3.35	97		
2	97		
1.18	97		
0.6	96	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	93		
0.3	77		
0.212	47		
0.15	30		
0.063	14		

Dry Mass of sample [g]: 207

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	3.00
Sand	82.80
Fines <0.063mm	14.20

Grading Analysis	
D100	mm 14
D60	mm 0.246
D30	mm 0.149
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

Approved:

Signed:

Dariusz Piotrowski  
PL Laboratory Manager  
Geotechnical Section

Sushil Sharda  
Technical Manager  
(Geotechnical Division)

Date Reported: 06/07/2017

for and on behalf of i2 Analytical Ltd

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**Jon Raven**

Arcadis Consulting (UK) Ltd  
10 Medawar Road  
The Surrey Research Park  
Guildford  
Surrey  
GU2 7AR

**t:** 0870 000 3005  
**f:** 0870 000 3905  
**e:** jonathan.raven@arcadis.com

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

## **Analytical Report Number : 17-52356**

Replaces Analytical Report Number : 17-52356, issue no. 1

<b>Project / Site name:</b>	TFL- Land At Christchurch Road And Brixton Hill	<b>Samples received on:</b>	21/06/2017
<b>Your job number:</b>	UA009686-02	<b>Samples instructed on:</b>	22/06/2017
<b>Your order number:</b>	PO0067593	<b>Analysis completed by:</b>	14/07/2017
<b>Report Issue Number:</b>	2	<b>Report issued on:</b>	17/07/2017
<b>Samples Analysed:</b>	9 soil samples		

**Signed:**

Dr Irma Doyle  
Senior Account Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Analytical Report Number: 17-52356

Project / Site name: TFL- Land At Christchurch Road And Brixton Hill

Your Order No: PO0067593

Lab Sample Number	771168	771169	771170	771171	771172
Sample Reference	WS101	WS101	WS102	WS102	WS103
Sample Number	1	2	1	2	1
Depth (m)	0.30	0.50	0.30	0.50	0.30
Date Sampled	19/06/2017	19/06/2017	19/06/2017	19/06/2017	19/06/2017
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.1	9.3
Total mass of sample received	kg	0.001	NONE	1.8	1.7

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile-Hard/Cement Type Material, Sheetting/Board Debris
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Detected

#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	7.8	8.2	7.9	8.0
Water Soluble Sulphate as SO <sub>4</sub> 16hr extraction (2:1)	mg/kg	2.5	MCERTS	3.5	< 2.5	150	5.8	2.6
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	1.77	< 1.25	73.8	2.88	1.31

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.11	0.12	0.15	0.14	0.13
Acenaphthylene	mg/kg	0.05	MCERTS	0.16	< 0.05	0.13	< 0.05	0.19
Acenaphthene	mg/kg	0.05	MCERTS	0.10	< 0.05	0.12	< 0.05	0.68
Fluorene	mg/kg	0.05	MCERTS	0.14	< 0.05	0.12	< 0.05	0.69
Phenanthrene	mg/kg	0.05	MCERTS	1.6	1.1	1.6	1.2	3.6
Anthracene	mg/kg	0.05	MCERTS	0.36	0.18	0.35	0.11	0.63
Fluoranthene	mg/kg	0.05	MCERTS	3.7	2.2	3.8	2.7	6.1
Pyrene	mg/kg	0.05	MCERTS	3.1	1.9	3.2	2.3	5.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.9	1.2	2.0	1.1	2.8
Chrysene	mg/kg	0.05	MCERTS	1.4	1.1	1.5	1.3	2.4
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.6	1.4	2.0	1.6	3.0
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.5	0.83	1.5	0.81	1.8
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.7	1.3	1.9	1.4	2.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.2	0.97	1.2	1.1	1.9
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.27	0.19	0.31	0.21	0.39
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.3	0.99	1.2	1.2	1.8

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	20.2	13.3	21.1	15.1	33.8
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#### Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	22	20	20	31	20
Boron (water soluble)	mg/kg	0.2	MCERTS	1.9	2.3	2.1	2.9	1.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.5	0.5	< 0.2	0.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	35	36	32	32	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	100	110	150	73
Lead (aqua regia extractable)	mg/kg	1	MCERTS	540	830	690	870	390
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.4	2.0	1.2	1.6	1.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	25	22	23	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	440	520	360	450	190

Analytical Report Number: 17-52356

Project / Site name: TFL- Land At Christchurch Road And Brixton Hill

Your Order No: P00067593

Lab Sample Number	771173	771174	771175	771176	
Sample Reference	WS103	WS104	WS104	WS101	
Sample Number	2	1	2	4	
Depth (m)	0.50	0.30	0.50	1.00	
Date Sampled	19/06/2017	19/06/2017	19/06/2017	19/06/2017	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	11	9.0
Total mass of sample received	kg	0.001	NONE	1.9	1.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile-Hard/Cement Type Material, Sheetting/Board Debris	-	-	-	
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected	

#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	8.4	8.3	8.0	
Water Soluble Sulphate as SO <sub>4</sub> 16hr extraction (2:1)	mg/kg	2.5	MCERTS	99	230	36	< 2.5	
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	49.7	117	18.1	< 1.25	

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.19	< 0.05	< 0.05	-	
Acenaphthylene	mg/kg	0.05	MCERTS	0.30	< 0.05	< 0.05	-	
Acenaphthene	mg/kg	0.05	MCERTS	0.12	< 0.05	< 0.05	-	
Fluorene	mg/kg	0.05	MCERTS	0.15	< 0.05	< 0.05	-	
Phenanthrene	mg/kg	0.05	MCERTS	2.3	0.68	0.53	-	
Anthracene	mg/kg	0.05	MCERTS	0.38	0.11	< 0.05	-	
Fluoranthene	mg/kg	0.05	MCERTS	6.4	1.9	1.5	-	
Pyrene	mg/kg	0.05	MCERTS	5.4	1.6	1.2	-	
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.9	0.74	0.69	-	
Chrysene	mg/kg	0.05	MCERTS	3.3	0.83	0.65	-	
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	4.6	0.91	0.71	-	
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.8	0.49	0.54	-	
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.3	0.69	0.63	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.6	0.50	0.44	-	
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.60	0.11	< 0.05	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.6	0.59	0.48	-	

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	36.9	9.15	7.33	-	
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#### Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	14	16	12	
Boron (water soluble)	mg/kg	0.2	MCERTS	1.0	1.4	1.1	1.7	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	38	23	27	30	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	93	41	56	18	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	450	2000	4400	120	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	< 0.3	< 0.3	< 0.3	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	14	15	12	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	150	190	56	





**Analytical Report Number : 17-52356**

**Project / Site name: TFL- Land At Christchurch Road And Brixton Hill**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
771168	WS101	1	0.30	Brown loam and sand with gravel and vegetation.
771169	WS101	2	0.50	Brown loam and sand with gravel and vegetation.
771170	WS102	1	0.30	Brown loam and sand with gravel and vegetation.
771171	WS102	2	0.50	Brown loam and sand with gravel and vegetation.
771172	WS103	1	0.30	Brown loam and sand with gravel and vegetation.
771173	WS103	2	0.50	Brown loam and sand with gravel.
771174	WS104	1	0.30	Light brown loam and sand with gravel and vegetation.
771175	WS104	2	0.50	Light brown loam and sand with gravel and vegetation.
771176	WS101	4	1.00	Light brown clay and sand with vegetation.

**Analytical Report Number : 17-52356**

**Project / Site name: TFL- Land At Christchurch Road And Brixton Hill**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 dphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil by Gallery 16hr	Determination of water soluble Sulphate by discrete analyser (precipitation method).	In house method based on BS1377-3: 1990.	L082B-PL	D	MCERTS

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

**Jon Raven**

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## **Analytical Report Number : 17-52408**

<b>Project / Site name:</b>	TFL - Land At Chrstrchurch Road & Brixton Hill	<b>Samples received on:</b>	21/06/2017
<b>Your job number:</b>	UA009686-02	<b>Samples instructed on:</b>	22/06/2017
<b>Your order number:</b>		<b>Analysis completed by:</b>	03/07/2017
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	03/07/2017
<b>Samples Analysed:</b>	2 soil samples		

**Signed:**

Dr Irma Doyle  
Senior Account Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Analytical Report Number: 17-52408

Project / Site name: TFL - Land At Chrstrchurch Road & Brixton Hill

Lab Sample Number				771422	771423			
Sample Reference				WS101	WS102			
Sample Number				8	6			
Depth (m)				4.00-4.45	2.00-3.40			
Date Sampled				19/06/2017	19/06/2017			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	18	18			
Total mass of sample received	kg	0.001	NONE	0.52	0.35			

#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	8.2			
Total Sulphate as SO <sub>4</sub>	%	0.005	MCERTS	0.046	0.028			
Water Soluble SO <sub>4</sub> as SO <sub>4</sub> (2:1) Gallery 16h extraction	g/l	0.00125	MCERTS	0.146	0.0761			
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	22	7.0			
Total Sulphur	%	0.005	MCERTS	0.017	0.011			
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0			

#### Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	35	22			
Magnesium (leachate equivalent)	mg/l	2.5	NONE	17	11			



**Analytical Report Number : 17-52408**

**Project / Site name: TFL - Land At Chrstrchurch Road & Brixton Hill**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
771422	WS101	8	4.00-4.45	Brown clay and sand.
771423	WS102	6	2.00-3.40	Brown clay.

**Analytical Report Number : 17-52408**

**Project / Site name: TFL - Land At Chrstrchurch Road & Brixton Hill**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil by Gallery 16hr	Determination of water soluble Sulphate by discrete analyser (precipitation method).	In house method based on BS1377-3: 1990.	L082B-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**



Project / Site name: TFL- Land At Christchurch Road And Brixton Hill

Lab Sample Number	771168		771169	771170	771171	771172	771173	771174	771175	771176
Sample Reference	WS101		WS101	WS102	WS102	WS103	WS103	WS104	WS104	WS101
Sample Number	1		2	1	2	1	2	1	2	4
Depth (m)	0.30		0.50	0.30	0.50	0.30	0.50	0.30	0.50	1.00
Date Sampled	19/06/2017		19/06/2017	19/06/2017	19/06/2017	19/06/2017	19/06/2017	19/06/2017	19/06/2017	19/06/2017
Strata	MADE GROUND		MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND	HEAD DEPOSITS
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status							
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.1	9.3	7.5	11	9.8	11	9.6
Total mass of sample received	kg	0.001	NONE	1.8	1.7	1.9	1.9	1.8	1.9	1.6

GAC (residential with plant uptake) 1% SOM
NA
NA
NA

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile- Hard/Cement Type Material, Sheeting/Board Debris	Chrysotile- Hard/Cement Type Material, Sheeting/Board Debris	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Detected	Detected	Not-detected	Not-detected	Not-detected

NA
NA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	7.8	8.2	7.9	8	8.2	8.4	8.3	8
				3.5	< 2.5	150	5.8	2.6	99	230	36	
Water Soluble Sulphate as SO <sub>4</sub> 16hr extraction (2:1)	mg/kg	2.5	MCERTS									< 2.5
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	1.77	< 1.25	73.8	2.88	1.31	49.7	117	18.1	< 1.25

NA
NA
NA

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.11	0.12	0.15	0.14	0.13	0.19	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.16	< 0.05	0.13	< 0.05	0.19	0.3	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	0.1	< 0.05	0.12	< 0.05	0.68	0.12	< 0.05	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	0.14	< 0.05	0.12	< 0.05	0.69	0.15	< 0.05	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	1.6	1.1	1.6	1.2	3.6	2.3	0.68	0.53	-
Anthracene	mg/kg	0.05	MCERTS	0.36	0.18	0.35	0.11	0.63	0.38	0.11	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	3.7	2.2	3.8	2.7	6.1	6.4	1.9	1.5	-
Pyrene	mg/kg	0.05	MCERTS	3.1	1.9	3.2	2.3	5.1	5.4	1.6	1.2	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.9	1.2	2	1.1	2.8	2.9	0.74	0.69	-
Chrysene	mg/kg	0.05	MCERTS	1.4	1.1	1.5	1.3	2.4	3.3	0.83	0.65	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.6	1.4	2	1.6	3	4.6	0.91	0.71	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.5	0.83	1.5	0.81	1.8	1.8	0.49	0.54	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.7	1.3	1.9	1.4	2.6	3.3	0.69	0.63	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.2	0.97	1.2	1.1	1.9	2.6	0.5	0.44	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.27	0.19	0.31	0.21	0.39	0.6	0.11	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.3	0.99	1.2	1.2	1.8	2.6	0.59	0.48	-

2.3
170
210
170
95
2400
280
620
7.2
15
2.6
77
2.2
27
0.24
32

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	20.2	13.3	21.1	15.1	33.8	36.9	9.15	7.33	-
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NA
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	22	20	20	31	20	19	14	16	12
Boron (water soluble)	mg/kg	0.2	MCERTS	1.9	2.3	2.1	2.9	1.7	1	1.4	1.1	1.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.5	0.5	< 0.2	0.5	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	35	36	32	32	30	38	23	27	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	100	110	150	73	93	41	56	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	540	830	690	870	390	450	2000	4400	120
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.4	2	1.2	1.6	1.3	0.8	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	25	22	23	21	22	14	15	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	440	520	360	450	190	150	150	190	56

37
290
11
6
910
2400
220
40
130
250
3700

1.23 Result exceeds the Generic Assessment Criteria (GAC)

# Waste Classification Report



W4TV8-Q7SZR-VQKB5

## Job name

Land at Christchurch Road &amp; Brixton Hill

## Description/Comments

## Project

TFL

## Site

Land at Christchurch Road &amp; Brixton Hill

## Waste Stream Template

TFL Sites

## Classified by

Name:  
**Fiona Waldron**  
Date:  
**14/07/2017 08:20:58 UTC**  
Telephone:  
**0117 3721231**

Company:  
**Arcadis Consulting (UK) Ltd**  
**The Pithay**  
**5th Floor All Saints Street**  
**Bristol**  
**BS1 2NL**

## Report

Created by: Fiona Waldron  
Created date: 14/07/2017 08:20 UTC


## Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS101	0.30	Non Hazardous		2
2	WS101[1]	0.50	Non Hazardous		4
3	WS102	0.30	Non Hazardous		6
4	WS102[1]	0.50	Non Hazardous		8
5	WS103	0.30	Non Hazardous		10
6	WS103[1]	0.50	Non Hazardous		12
7	WS104	0.30	Hazardous	HP 7	14
8	WS104[1]	0.50	Hazardous	HP 7, HP 10, HP 14	16
9	WS101[2]	1.00	Non Hazardous		19

## Appendices

	Page
Appendix A: Classifier defined and non CLP determinands	21
Appendix B: Rationale for selection of metal species	22
Appendix C: Version	23

**Classification of sample: WS101**

 **Non Hazardous Waste**  
 Classified as **17 05 04**  
 in the List of Waste

**Sample details**

Sample Name:	LoW Code:
<b>WS101</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.30 m</b>	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>7.1%</b>	
(no correction)	

**Hazard properties**

None identified

**Determinands**


 Moisture content: **7.1%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				8.2 pH		8.2	pH	8.2 pH		
		PH									
2	naphthalene				0.11 mg/kg		0.11	mg/kg	0.000011 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				0.16 mg/kg		0.16	mg/kg	0.000016 %		
		205-917-1	208-96-8								
4	● acenaphthene				0.1 mg/kg		0.1	mg/kg	0.00001 %		
		201-469-6	83-32-9								
5	● fluorene				0.14 mg/kg		0.14	mg/kg	0.000014 %		
		201-695-5	86-73-7								
6	● phenanthrene				1.6 mg/kg		1.6	mg/kg	0.00016 %		
		201-581-5	85-01-8								
7	● anthracene				0.36 mg/kg		0.36	mg/kg	0.000036 %		
		204-371-1	120-12-7								
8	● fluoranthene				3.7 mg/kg		3.7	mg/kg	0.00037 %		
		205-912-4	206-44-0								
9	● pyrene				3.1 mg/kg		3.1	mg/kg	0.00031 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				1.9 mg/kg		1.9	mg/kg	0.00019 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				1.4 mg/kg		1.4	mg/kg	0.00014 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				1.6 mg/kg		1.6	mg/kg	0.00016 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				1.5 mg/kg		1.5	mg/kg	0.00015 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				1.7 mg/kg		1.7	mg/kg	0.00017 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				1.2 mg/kg		1.2	mg/kg	0.00012 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.27 mg/kg		0.27	mg/kg	0.000027 %		
	601-041-00-2	200-181-8	53-70-3								




#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
17	benzo[ghi]perylene				1.3 mg/kg		1.3 mg/kg	0.00013 %			
	205-883-8		191-24-2								
18	arsenic { arsenic trioxide }				22 mg/kg	1.32	29.047 mg/kg	0.0029 %			
	033-003-00-0	215-481-4	1327-53-3								
19	boron { boron tribromide/trichloride/trifluoride (combined) }				1.9 mg/kg	13.43	25.517 mg/kg	0.00255 %			
			10294-33-4, 10294-34-5, 7637-07-2								
20	cadmium { cadmium sulfide }			1	0.7 mg/kg	1.285	0.9 mg/kg	0.00007 %			
	048-010-00-4	215-147-8	1306-23-6								
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg	<0.0004 %			<LOD
	024-017-00-8										
22	chromium in chromium(III) compounds { chromium(III) oxide }				35 mg/kg	1.462	51.154 mg/kg	0.00512 %			
		215-160-9	1308-38-9								
23	copper { dicopper oxide; copper (I) oxide }				110 mg/kg	1.126	123.848 mg/kg	0.0124 %			
	029-002-00-X	215-270-7	1317-39-1								
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	540 mg/kg		540 mg/kg	0.054 %			
	082-001-00-6										
25	mercury { mercury dichloride }				2.4 mg/kg	1.353	3.248 mg/kg	0.000325 %			
	080-010-00-X	231-299-8	7487-94-7								
26	nickel { nickel dihydroxide }				25 mg/kg	1.579	39.487 mg/kg	0.00395 %			
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
27	selenium { selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %			<LOD
	034-002-00-8										
28	zinc { zinc oxide }				440 mg/kg	1.245	547.674 mg/kg	0.0548 %			
	030-013-00-7	215-222-5	1314-13-2								
Total:									0.139 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

**Classification of sample: WS101[1]**

 **Non Hazardous Waste**  
 Classified as **17 05 04**  
 in the List of Waste

**Sample details**

Sample Name:	LoW Code:
<b>WS101[1]</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.50 m</b>	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>9.3%</b>	
(no correction)	












**Hazard properties**

None identified

**Determinands**

Moisture content: 9.3% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				7.8 pH		7.8	pH	7.8 pH		
		PH									
2	naphthalene				0.12 mg/kg		0.12	mg/kg	0.000012 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8								
4	● acenaphthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9								
5	● fluorene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7								
6	● phenanthrene				1.1 mg/kg		1.1	mg/kg	0.00011 %		
		201-581-5	85-01-8								
7	● anthracene				0.18 mg/kg		0.18	mg/kg	0.000018 %		
		204-371-1	120-12-7								
8	● fluoranthene				2.2 mg/kg		2.2	mg/kg	0.00022 %		
		205-912-4	206-44-0								
9	● pyrene				1.9 mg/kg		1.9	mg/kg	0.00019 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				1.2 mg/kg		1.2	mg/kg	0.00012 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				1.1 mg/kg		1.1	mg/kg	0.00011 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				1.4 mg/kg		1.4	mg/kg	0.00014 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				0.83 mg/kg		0.83	mg/kg	0.000083 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				1.3 mg/kg		1.3	mg/kg	0.00013 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				0.97 mg/kg		0.97	mg/kg	0.000097 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.19 mg/kg		0.19	mg/kg	0.000019 %		
	601-041-00-2	200-181-8	53-70-3								

#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number							
17		benzo[ghi]perylene				0.99 mg/kg		0.99 mg/kg	0.000099 %		
		205-883-8		191-24-2							
18		arsenic { arsenic trioxide }				20 mg/kg	1.32	26.407 mg/kg	0.00264 %		
		033-003-00-0	215-481-4	1327-53-3							
19		boron { boron tribromide/trichloride/trifluoride (combined) }				2.3 mg/kg	13.43	30.889 mg/kg	0.00309 %		
				10294-33-4, 10294-34-5, 7637-07-2							
20		cadmium { cadmium sulfide }			1	0.5 mg/kg	1.285	0.643 mg/kg	0.00005 %		
		048-010-00-4	215-147-8	1306-23-6							
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg	<0.0004 %		<LOD
		024-017-00-8									
22		chromium in chromium(III) compounds { chromium(III) oxide }				36 mg/kg	1.462	52.616 mg/kg	0.00526 %		
			215-160-9	1308-38-9							
23		copper { dicopper oxide; copper (I) oxide }				100 mg/kg	1.126	112.589 mg/kg	0.0113 %		
		029-002-00-X	215-270-7	1317-39-1							
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	830 mg/kg		830 mg/kg	0.083 %		
		082-001-00-6									
25		mercury { mercury dichloride }				2 mg/kg	1.353	2.707 mg/kg	0.000271 %		
		080-010-00-X	231-299-8	7487-94-7							
26		nickel { nickel dihydroxide }				25 mg/kg	1.579	39.487 mg/kg	0.00395 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
		034-002-00-8									
28		zinc { zinc oxide }				520 mg/kg	1.245	647.251 mg/kg	0.0647 %		
		030-013-00-7	215-222-5	1314-13-2							
								Total:	0.176 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



## Classification of sample: WS102

✔ **Non Hazardous Waste**  
Classified as **17 05 04**  
in the List of Waste

## Sample details

Sample Name:	LoW Code:	
<b>WS102</b>	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>0.30 m</b>		
Moisture content:		
<b>7.5%</b>		
(no correction)		

## Hazard properties

None identified

## Determinands

Moisture content: 7.5% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				8.2 pH		8.2	pH	8.2 pH		
		PH									
2	naphthalene				0.15 mg/kg		0.15	mg/kg	0.000015 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				0.13 mg/kg		0.13	mg/kg	0.000013 %		
		205-917-1	208-96-8								
4	● acenaphthene				0.12 mg/kg		0.12	mg/kg	0.000012 %		
		201-469-6	83-32-9								
5	● fluorene				0.12 mg/kg		0.12	mg/kg	0.000012 %		
		201-695-5	86-73-7								
6	● phenanthrene				1.6 mg/kg		1.6	mg/kg	0.00016 %		
		201-581-5	85-01-8								
7	● anthracene				0.35 mg/kg		0.35	mg/kg	0.000035 %		
		204-371-1	120-12-7								
8	● fluoranthene				3.8 mg/kg		3.8	mg/kg	0.00038 %		
		205-912-4	206-44-0								
9	● pyrene				3.2 mg/kg		3.2	mg/kg	0.00032 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				2 mg/kg		2	mg/kg	0.0002 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				1.5 mg/kg		1.5	mg/kg	0.00015 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				2 mg/kg		2	mg/kg	0.0002 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				1.5 mg/kg		1.5	mg/kg	0.00015 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				1.9 mg/kg		1.9	mg/kg	0.00019 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				1.2 mg/kg		1.2	mg/kg	0.00012 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.31 mg/kg		0.31	mg/kg	0.000031 %		
	601-041-00-2	200-181-8	53-70-3								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
17	benzo[ghi]perylene				1.2 mg/kg		1.2 mg/kg		0.00012 %		
		205-883-8	191-24-2								
18	arsenic { arsenic trioxide }				20 mg/kg	1.32	26.407 mg/kg		0.00264 %		
	033-003-00-0	215-481-4	1327-53-3								
19	boron { boron tribromide/trichloride/trifluoride (combined) }				2.1 mg/kg	13.43	28.203 mg/kg		0.00282 %		
			10294-33-4, 10294-34-5, 7637-07-2								
20	cadmium { cadmium sulfide }			1	0.5 mg/kg	1.285	0.643 mg/kg		0.00005 %		
	048-010-00-4	215-147-8	1306-23-6								
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg		<0.0004 %		<LOD
	024-017-00-8										
22	chromium in chromium(III) compounds { chromium(III) oxide }				32 mg/kg	1.462	46.77 mg/kg		0.00468 %		
		215-160-9	1308-38-9								
23	copper { dicopper oxide; copper (I) oxide }				110 mg/kg	1.126	123.848 mg/kg		0.0124 %		
	029-002-00-X	215-270-7	1317-39-1								
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	690 mg/kg		690 mg/kg		0.069 %		
	082-001-00-6										
25	mercury { mercury dichloride }				1.2 mg/kg	1.353	1.624 mg/kg		0.000162 %		
	080-010-00-X	231-299-8	7487-94-7								
26	nickel { nickel dihydroxide }				22 mg/kg	1.579	34.749 mg/kg		0.00347 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
27	selenium { selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg		<0.000255 %		<LOD
	034-002-00-8										
28	zinc { zinc oxide }				360 mg/kg	1.245	448.097 mg/kg		0.0448 %		
	030-013-00-7	215-222-5	1314-13-2								
Total:									0.143 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

## Classification of sample: WS102[1]

✔ **Non Hazardous Waste**  
Classified as **17 05 04**  
in the List of Waste

## Sample details

Sample Name:	LoW Code:
<b>WS102[1]</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.50 m</b>	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>11%</b>	
(no correction)	

## Hazard properties

None identified

## Determinands

Moisture content: **11% No Moisture Correction applied (MC)**

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				7.9 pH		7.9	pH	7.9 pH		
2	naphthalene				0.14 mg/kg		0.14	mg/kg	0.000014 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8								
4	● acenaphthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9								
5	● fluorene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7								
6	● phenanthrene				1.2 mg/kg		1.2	mg/kg	0.00012 %		
		201-581-5	85-01-8								
7	● anthracene				0.11 mg/kg		0.11	mg/kg	0.000011 %		
		204-371-1	120-12-7								
8	● fluoranthene				2.7 mg/kg		2.7	mg/kg	0.00027 %		
		205-912-4	206-44-0								
9	● pyrene				2.3 mg/kg		2.3	mg/kg	0.00023 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				1.1 mg/kg		1.1	mg/kg	0.00011 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				1.3 mg/kg		1.3	mg/kg	0.00013 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				1.6 mg/kg		1.6	mg/kg	0.00016 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				0.81 mg/kg		0.81	mg/kg	0.000081 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				1.4 mg/kg		1.4	mg/kg	0.00014 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				1.1 mg/kg		1.1	mg/kg	0.00011 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.21 mg/kg		0.21	mg/kg	0.000021 %		
	601-041-00-2	200-181-8	53-70-3								




#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
17	benzo[ghi]perylene				1.2 mg/kg		1.2 mg/kg		0.00012 %		
	205-883-8		191-24-2								
18	arsenic { arsenic trioxide }				31 mg/kg	1.32	40.93 mg/kg		0.00409 %		
	033-003-00-0	215-481-4	1327-53-3								
19	boron { boron tribromide/trichloride/trifluoride (combined) }				2.9 mg/kg	13.43	38.947 mg/kg		0.00389 %		
			10294-33-4, 10294-34-5, 7637-07-2								
20	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg		<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6								
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg		<0.0004 %		<LOD
	024-017-00-8										
22	chromium in chromium(III) compounds { chromium(III) oxide }				32 mg/kg	1.462	46.77 mg/kg		0.00468 %		
		215-160-9	1308-38-9								
23	copper { dicopper oxide; copper (I) oxide }				150 mg/kg	1.126	168.883 mg/kg		0.0169 %		
	029-002-00-X	215-270-7	1317-39-1								
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	870 mg/kg		870 mg/kg		0.087 %		
	082-001-00-6										
25	mercury { mercury dichloride }				1.6 mg/kg	1.353	2.166 mg/kg		0.000217 %		
	080-010-00-X	231-299-8	7487-94-7								
26	nickel { nickel dihydroxide }				23 mg/kg	1.579	36.328 mg/kg		0.00363 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
27	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg		<0.000255 %		<LOD
	034-002-00-8										
28	zinc { zinc oxide }				450 mg/kg	1.245	560.121 mg/kg		0.056 %		
	030-013-00-7	215-222-5	1314-13-2								
Total:									0.179 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

**Classification of sample: WS103**

 **Non Hazardous Waste**  
 Classified as **17 05 04**  
 in the List of Waste

**Sample details**

Sample Name:	LoW Code:
<b>WS103</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.30 m</b>	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>9.8%</b>	
(no correction)	












**Hazard properties**

None identified

**Determinands**

 Moisture content: **9.8% No Moisture Correction applied (MC)**

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				8 pH		8	pH	8pH		
2	naphthalene				0.13 mg/kg		0.13	mg/kg	0.000013 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				0.19 mg/kg		0.19	mg/kg	0.000019 %		
		205-917-1	208-96-8								
4	● acenaphthene				0.68 mg/kg		0.68	mg/kg	0.000068 %		
		201-469-6	83-32-9								
5	● fluorene				0.69 mg/kg		0.69	mg/kg	0.000069 %		
		201-695-5	86-73-7								
6	● phenanthrene				3.6 mg/kg		3.6	mg/kg	0.00036 %		
		201-581-5	85-01-8								
7	● anthracene				0.63 mg/kg		0.63	mg/kg	0.000063 %		
		204-371-1	120-12-7								
8	● fluoranthene				6.1 mg/kg		6.1	mg/kg	0.00061 %		
		205-912-4	206-44-0								
9	● pyrene				5.1 mg/kg		5.1	mg/kg	0.00051 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				2.8 mg/kg		2.8	mg/kg	0.00028 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				2.4 mg/kg		2.4	mg/kg	0.00024 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				3 mg/kg		3	mg/kg	0.0003 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				1.8 mg/kg		1.8	mg/kg	0.00018 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				2.6 mg/kg		2.6	mg/kg	0.00026 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				1.9 mg/kg		1.9	mg/kg	0.00019 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.39 mg/kg		0.39	mg/kg	0.000039 %		
	601-041-00-2	200-181-8	53-70-3								

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
17		benzo[ghi]perylene				1.8 mg/kg			1.8 mg/kg		0.00018 %		
		205-883-8		191-24-2									
18		arsenic { arsenic trioxide }				20 mg/kg		1.32	26.407 mg/kg		0.00264 %		
		033-003-00-0	215-481-4	1327-53-3									
19		boron { boron tribromide/trichloride/trifluoride (combined) }				1.7 mg/kg		13.43	22.831 mg/kg		0.00228 %		
				10294-33-4, 10294-34-5, 7637-07-2									
20		cadmium { cadmium sulfide }			1	0.5 mg/kg		1.285	0.643 mg/kg		0.00005 %		
		048-010-00-4	215-147-8	1306-23-6									
21		chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg			<4 mg/kg		<0.0004 %		<LOD
		024-017-00-8											
22		chromium in chromium(III) compounds { chromium(III) oxide }				30 mg/kg		1.462	43.847 mg/kg		0.00438 %		
			215-160-9	1308-38-9									
23		copper { dicopper oxide; copper (I) oxide }				73 mg/kg		1.126	82.19 mg/kg		0.00822 %		
		029-002-00-X	215-270-7	1317-39-1									
24		lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	390 mg/kg			390 mg/kg		0.039 %		
		082-001-00-6											
25		mercury { mercury dichloride }				1.3 mg/kg		1.353	1.76 mg/kg		0.000176 %		
		080-010-00-X	231-299-8	7487-94-7									
26		nickel { nickel dihydroxide }				21 mg/kg		1.579	33.169 mg/kg		0.00332 %		
		028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
27		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg		2.554	<2.554 mg/kg		<0.000255 %		<LOD
		034-002-00-8											
28		zinc { zinc oxide }				190 mg/kg		1.245	236.496 mg/kg		0.0236 %		
		030-013-00-7	215-222-5	1314-13-2									
Total:												0.0878 %	

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



## Classification of sample: WS103[1]

✔ **Non Hazardous Waste**  
Classified as **17 05 04**  
in the List of Waste

## Sample details

Sample Name:	LoW Code:
<b>WS103[1]</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.50 m</b>	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>11%</b>	
(no correction)	

## Hazard properties

None identified

## Determinands

Moisture content: **11% No Moisture Correction applied (MC)**


#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				8.2 pH		8.2	pH	8.2 pH		
		PH									
2	naphthalene				0.19 mg/kg		0.19	mg/kg	0.000019 %		
	601-052-00-2	202-049-5	91-20-3								
3	● acenaphthylene				0.3 mg/kg		0.3	mg/kg	0.00003 %		
		205-917-1	208-96-8								
4	● acenaphthene				0.12 mg/kg		0.12	mg/kg	0.000012 %		
		201-469-6	83-32-9								
5	● fluorene				0.15 mg/kg		0.15	mg/kg	0.000015 %		
		201-695-5	86-73-7								
6	● phenanthrene				2.3 mg/kg		2.3	mg/kg	0.00023 %		
		201-581-5	85-01-8								
7	● anthracene				0.38 mg/kg		0.38	mg/kg	0.000038 %		
		204-371-1	120-12-7								
8	● fluoranthene				6.4 mg/kg		6.4	mg/kg	0.00064 %		
		205-912-4	206-44-0								
9	● pyrene				5.4 mg/kg		5.4	mg/kg	0.00054 %		
		204-927-3	129-00-0								
10	benzo[a]anthracene				2.9 mg/kg		2.9	mg/kg	0.00029 %		
	601-033-00-9	200-280-6	56-55-3								
11	chrysene				3.3 mg/kg		3.3	mg/kg	0.00033 %		
	601-048-00-0	205-923-4	218-01-9								
12	benzo[b]fluoranthene				4.6 mg/kg		4.6	mg/kg	0.00046 %		
	601-034-00-4	205-911-9	205-99-2								
13	benzo[k]fluoranthene				1.8 mg/kg		1.8	mg/kg	0.00018 %		
	601-036-00-5	205-916-6	207-08-9								
14	benzo[a]pyrene; benzo[def]chrysene				3.3 mg/kg		3.3	mg/kg	0.00033 %		
	601-032-00-3	200-028-5	50-32-8								
15	● indeno[123-cd]pyrene				2.6 mg/kg		2.6	mg/kg	0.00026 %		
		205-893-2	193-39-5								
16	dibenz[a,h]anthracene				0.6 mg/kg		0.6	mg/kg	0.00006 %		
	601-041-00-2	200-181-8	53-70-3								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
17	benzo[ghi]perylene				2.6 mg/kg		2.6 mg/kg	0.00026 %			
	205-883-8		191-24-2								
18	arsenic { arsenic trioxide }				19 mg/kg	1.32	25.086 mg/kg	0.00251 %			
	033-003-00-0	215-481-4	1327-53-3								
19	boron { boron tribromide/trichloride/trifluoride (combined) }				1 mg/kg	13.43	13.43 mg/kg	0.00134 %			
			10294-33-4, 10294-34-5, 7637-07-2								
20	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %			<LOD
	048-010-00-4	215-147-8	1306-23-6								
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg	<0.0004 %			<LOD
	024-017-00-8										
22	chromium in chromium(III) compounds { chromium(III) oxide }				38 mg/kg	1.462	55.539 mg/kg	0.00555 %			
		215-160-9	1308-38-9								
23	copper { dicopper oxide; copper (I) oxide }				93 mg/kg	1.126	104.708 mg/kg	0.0105 %			
	029-002-00-X	215-270-7	1317-39-1								
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	450 mg/kg		450 mg/kg	0.045 %			
	082-001-00-6										
25	mercury { mercury dichloride }				0.8 mg/kg	1.353	1.083 mg/kg	0.000108 %			
	080-010-00-X	231-299-8	7487-94-7								
26	nickel { nickel dihydroxide }				22 mg/kg	1.579	34.749 mg/kg	0.00347 %			
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
27	selenium { selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %			<LOD
	034-002-00-8										
28	zinc { zinc oxide }				150 mg/kg	1.245	186.707 mg/kg	0.0187 %			
	030-013-00-7	215-222-5	1314-13-2								
Total:									0.0915 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

## Classification of sample: WS104

 **Hazardous Waste**  
Classified as **17 05 03 \***  
in the List of Waste

## Sample details

Sample Name:	LoW Code:
<b>WS104</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.30 m</b>	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
<b>9%</b>	
(no correction)	

## Hazard properties

**HP 7: Carcinogenic** "waste which induces cancer or increases its incidence"

Hazard Statements hit:

**Carc. 1A; H350** "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.2%)

## Determinands

Moisture content: **9% No Moisture Correction applied (MC)**

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				8.4	pH		8.4	pH	8.4 pH		
			PH									
2	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
3	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
4	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
5	fluorene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7									
6	phenanthrene				0.68	mg/kg		0.68	mg/kg	0.000068 %		
		201-581-5	85-01-8									
7	anthracene				0.11	mg/kg		0.11	mg/kg	0.000011 %		
		204-371-1	120-12-7									
8	fluoranthene				1.9	mg/kg		1.9	mg/kg	0.00019 %		
		205-912-4	206-44-0									
9	pyrene				1.6	mg/kg		1.6	mg/kg	0.00016 %		
		204-927-3	129-00-0									
10	benzo[a]anthracene				0.74	mg/kg		0.74	mg/kg	0.000074 %		
	601-033-00-9	200-280-6	56-55-3									
11	chrysene				0.83	mg/kg		0.83	mg/kg	0.000083 %		
	601-048-00-0	205-923-4	218-01-9									
12	benzo[b]fluoranthene				0.91	mg/kg		0.91	mg/kg	0.000091 %		
	601-034-00-4	205-911-9	205-99-2									




#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
13	benzo[k]fluoranthene				0.49 mg/kg		0.49 mg/kg	0.000049 %		
	601-036-00-5	205-916-6	207-08-9							
14	benzo[a]pyrene; benzo[def]chrysene				0.69 mg/kg		0.69 mg/kg	0.000069 %		
	601-032-00-3	200-028-5	50-32-8							
15	indeno[123-cd]pyrene				0.5 mg/kg		0.5 mg/kg	0.00005 %		
		205-893-2	193-39-5							
16	dibenz[a,h]anthracene				0.11 mg/kg		0.11 mg/kg	0.000011 %		
	601-041-00-2	200-181-8	53-70-3							
17	benzo[ghi]perylene				0.59 mg/kg		0.59 mg/kg	0.000059 %		
		205-883-8	191-24-2							
18	arsenic { arsenic trioxide }				14 mg/kg	1.32	18.485 mg/kg	0.00185 %		
	033-003-00-0	215-481-4	1327-53-3							
19	boron { boron tribromide/trichloride/trifluoride (combined) }				1.4 mg/kg	13.43	18.802 mg/kg	0.00188 %		
			10294-33-4, 10294-34-5, 7637-07-2							
20	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg	<0.0004 %		<LOD
	024-017-00-8									
22	chromium in chromium(III) compounds { chromium(III) oxide }				23 mg/kg	1.462	33.616 mg/kg	0.00336 %		
		215-160-9	1308-38-9							
23	copper { dicopper oxide; copper (I) oxide }				41 mg/kg	1.126	46.161 mg/kg	0.00462 %		
	029-002-00-X	215-270-7	1317-39-1							
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	2000 mg/kg		2000 mg/kg	0.2 %		
	082-001-00-6									
25	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
26	nickel { nickel dihydroxide }				14 mg/kg	1.579	22.113 mg/kg	0.00221 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
27	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
	034-002-00-8									
28	zinc { zinc oxide }				150 mg/kg	1.245	186.707 mg/kg	0.0187 %		
	030-013-00-7	215-222-5	1314-13-2							
Total:								0.234 %		

#### Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

## Classification of sample: WS104[1]

 **Hazardous Waste**  
Classified as **17 05 03 \***  
in the List of Waste

## Sample details

Sample Name:	LoW Code:
<b>WS104[1]</b>	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
<b>0.50 m</b>	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
<b>9.6%</b>	
(no correction)	

## Hazard properties

**HP 7: Carcinogenic** "waste which induces cancer or increases its incidence"

Hazard Statements hit:

**Carc. 1A; H350** "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.44%)

**HP 10: Toxic for reproduction** "waste which has adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring"

Hazard Statements hit:

**Repr. 1A; H360Df** "May damage the unborn child. Suspected of damaging fertility."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.44%)

**HP 14: Ecotoxic** "waste which presents or may present immediate or delayed risks for one or more sectors of the environment"

Risk phrases hit:

**R50/53** "Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment"

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.44%)

## Determinands

Moisture content: **9.6%** No Moisture Correction applied (MC)






#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	pH				8.3 pH		8.3	pH	8.3 pH		
			PH								
2	naphthalene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3								
3	acenaphthylene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8								
4	acenaphthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9								
5	fluorene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7								

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
6	phenanthrene	201-581-5	85-01-8		0.53	mg/kg		0.53	mg/kg	0.000053 %		
7	anthracene	204-371-1	120-12-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
8	fluoranthene	205-912-4	206-44-0		1.5	mg/kg		1.5	mg/kg	0.00015 %		
9	pyrene	204-927-3	129-00-0		1.2	mg/kg		1.2	mg/kg	0.00012 %		
10	benzo[a]anthracene	601-033-00-9	200-280-6		0.69	mg/kg		0.69	mg/kg	0.000069 %		
11	chrysene	601-048-00-0	205-923-4		0.65	mg/kg		0.65	mg/kg	0.000065 %		
12	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.71	mg/kg		0.71	mg/kg	0.000071 %		
13	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.54	mg/kg		0.54	mg/kg	0.000054 %		
14	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.63	mg/kg		0.63	mg/kg	0.000063 %		
15	indeno[123-cd]pyrene	205-893-2	193-39-5		0.44	mg/kg		0.44	mg/kg	0.000044 %		
16	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
17	benzo[ghi]perylene	205-883-8	191-24-2		0.48	mg/kg		0.48	mg/kg	0.000048 %		
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4		16	mg/kg	1.32	21.125	mg/kg	0.00211 %		
19	boron { boron tribromide/trichloride/trifluoride (combined) }		10294-33-4, 10294-34-5, 7637-07-2		1.1	mg/kg	13.43	14.773	mg/kg	0.00148 %		
20	cadmium { cadmium sulfide }	048-010-00-4	215-147-8		<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
21	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex	024-017-00-8			<4	mg/kg		<4	mg/kg	<0.0004 %		<LOD
22	chromium in chromium(III) compounds { chromium(III) oxide }	215-160-9	1308-38-9		27	mg/kg	1.462	39.462	mg/kg	0.00395 %		
23	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7		56	mg/kg	1.126	63.05	mg/kg	0.0063 %		
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			4400	mg/kg		4400	mg/kg	0.44 %		
25	mercury { mercury dichloride }	080-010-00-X	231-299-8		<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
26	nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]		15	mg/kg	1.579	23.692	mg/kg	0.00237 %		
27	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8			<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
28	zinc { zinc oxide }	030-013-00-7	215-222-5		190	mg/kg	1.245	236.496	mg/kg	0.0236 %		
Total:										0.481 %		



---

**Key**

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<b>&lt;LOD</b>	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

## Classification of sample: WS101[2]

✔ **Non Hazardous Waste**  
Classified as **17 05 04**  
in the List of Waste

## Sample details

Sample Name:	LoW Code:	
<b>WS101[2]</b>	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
<b>1.00 m</b>		
Moisture content:		
<b>13%</b>		
(no correction)		

## Hazard properties

None identified

## Determinands

Moisture content: 13% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	● pH				8 pH		8 pH	8pH		
2	● arsenic { arsenic trioxide }				12 mg/kg	1.32	15.844 mg/kg	0.00158 %		
	033-003-00-0	215-481-4	1327-53-3							
3	● boron { boron tribromide/trichloride/trifluoride (combined) }				1.7 mg/kg	13.43	22.831 mg/kg	0.00228 %		
			10294-33-4, 10294-34-5, 7637-07-2							
4	● cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
5	chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex				<4 mg/kg		<4 mg/kg	<0.0004 %		<LOD
	024-017-00-8									
6	● chromium in chromium(III) compounds { chromium(III) oxide }				30 mg/kg	1.462	43.847 mg/kg	0.00438 %		
		215-160-9	1308-38-9							
7	● copper { dicopper oxide; copper (I) oxide }				18 mg/kg	1.126	20.266 mg/kg	0.00203 %		
	029-002-00-X	215-270-7	1317-39-1							
8	● lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	120 mg/kg		120 mg/kg	0.012 %		
	082-001-00-6									
9	● mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
10	● nickel { nickel dihydroxide }				12 mg/kg	1.579	18.954 mg/kg	0.0019 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
11	● selenium { selenium compounds with the exception of cadmium selenosulfide and those specified elsewhere in this Annex }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %		<LOD
	034-002-00-8									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
12	zinc { zinc oxide }				56 mg/kg	1.245	69.704	mg/kg	0.00697 %		
	030-013-00-7	215-222-5	1314-13-2								
Total:									0.0319 %		

**Key**

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification



## Appendix A: Classifier defined and non CLP determinands

### • pH (CAS Number: PH)

Description/Comments: Appendix C4  
Data source: WM3 1st Edition 2015  
Data source date: 25/05/2015  
Risk Phrases: None.  
Hazard Statements: None.

### • acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 17/07/2015  
Risk Phrases: R22 , R26 , R27 , R36 , R37 , R38  
Hazard Statements: Acute Tox. 4 H302 , Acute Tox. 1 H330 , Acute Tox. 1 H310 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315

### • acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 17/07/2015  
Risk Phrases: R36 , R37 , R38 , N R50/53 , N R51/53  
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Aquatic Chronic 2 H411

### • fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 06/08/2015  
Risk Phrases: N R50/53  
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

### • phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 06/08/2015  
Risk Phrases: R22 , R36 , R37 , R38 , R40 , R43 , N R50/53  
Hazard Statements: Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Carc. 2 H351 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Skin Irrit. 2 H315

### • anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 17/07/2015  
Risk Phrases: R36 , R37 , R38 , R43 , N R50/53  
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

### • fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 21/08/2015  
Risk Phrases: Xn R22 , N R50/53  
Hazard Statements: Acute Tox. 4 H302 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

### • pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 21/08/2015  
Risk Phrases: Xi R36/37/38 , N R50/53  
Hazard Statements: Skin Irrit. 2 H315 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

• **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 06/08/2015  
Risk Phrases: R40  
Hazard Statements: Carc. 2 H351

• **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 23/07/2015  
Risk Phrases: N R50/53  
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

• **boron tribromide/trichloride/trifluoride (combined)** (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43  
Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride  
Data source: N/A  
Data source date: 06/08/2015  
Risk Phrases: R14 , T+ R26/28 , C R34 , C R35  
Hazard Statements: EUH014 , Acute Tox. 2 H330 , Acute Tox. 2 H300 , Skin Corr. 1A H314 , Skin Corr. 1B H314

• **chromium(III) oxide** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462  
Description/Comments: Data from C&L Inventory Database  
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>  
Data source date: 17/07/2015  
Risk Phrases: R20 , R22 , R36 , R37 , R38 , R42 , R43 , R50/53 , R60 , R61  
Hazard Statements: Acute Tox. 4 H332 , Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Resp. Sens. 1 H334 , Skin Sens. 1 H317 , Repr. 1B H360FD , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

• **dicopper oxide; copper (I) oxide** (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X  
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)  
Additional Risk Phrases: N R50/53 , N R50/53 >= 0.25 %  
Additional Hazard Statement(s): None.  
Reason for additional Hazards Statement(s)/Risk Phrase(s):  
10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases  
10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

• **lead compounds with the exception of those specified elsewhere in this Annex (worst case)**

CLP index number: 082-001-00-6  
Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)  
Additional Risk Phrases: None.  
Additional Hazard Statement(s): Carc. 1A H350  
Reason for additional Hazards Statement(s)/Risk Phrase(s):  
03/06/2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium [www.reach-lead.eu/substanceinformation.html](http://www.reach-lead.eu/substanceinformation.html) (worst case lead compounds). Review date 29/09/2015

## Appendix B: Rationale for selection of metal species

### arsenic {arsenic trioxide}

Worst case species based on hazard statements

### boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on hazard statements

### cadmium {cadmium sulfide}

Worst case species based on hazard statements

### chromium in chromium(III) compounds {chromium(III) oxide}

Worst case species based on hazard statements

### copper {dicopper oxide; copper (I) oxide}

Most likely common species

---

**lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}**

---

Insufficient concentration of chromium to form Lead chromate. Species changed to the next worst case

**mercury {mercury dichloride}**

---

Worst case species based on hazard statements

**nickel {nickel dihydroxide}**

---

Worst case species based on hazard statements

**selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}**

---

Worst case species based on hazard statements

**zinc {zinc oxide}**

---

Insufficient concentration of chromium to form zinc chromate. Zinc oxide used as the most likely species to be present.

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## Appendix C: Version

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HazWasteOnline Classification Engine: WM3 1st Edition, May 2015

HazWasteOnline Classification Engine Version: 2017.193.3356.6759 (12 Jul 2017)

HazWasteOnline Database: 2017.193.3356.6759 (12 Jul 2017)

This classification utilises the following guidance and legislation:

**WM3 - Waste Classification** - May 2015

**CLP Regulation** - Regulation 1272/2008/EC of 16 December 2008

**1st ATP** - Regulation 790/2009/EC of 10 August 2009

**2nd ATP** - Regulation 286/2011/EC of 10 March 2011

**3rd ATP** - Regulation 618/2012/EU of 10 July 2012

**4th ATP** - Regulation 487/2013/EU of 8 May 2013

**Correction to 1st ATP** - Regulation 758/2013/EU of 7 August 2013

**5th ATP** - Regulation 944/2013/EU of 2 October 2013

**6th ATP** - Regulation 605/2014/EU of 5 June 2014

**WFD Annex III replacement** - Regulation 1357/2014/EU of 18 December 2014

**Revised List of Wastes 2014** - Decision 2014/955/EU of 18 December 2014

**7th ATP** - Regulation 2015/1221/EU of 24 July 2015

**8th ATP** - Regulation (EU) 2016/918 of 19 May 2016

**9th ATP** - Regulation (EU) 2016/1179 of 19 July 2016

**10th ATP** - Regulation (EU) 2017/776 of 4 May 2017

**POPs Regulation 2004** - Regulation 850/2004/EC of 29 April 2004

**1st ATP to POPs Regulation** - Regulation 756/2010/EU of 24 August 2010

**2nd ATP to POPs Regulation** - Regulation 757/2010/EU of 24 August 2010



Land and Christchurch Road & Brixton Hill - HazWaste Assessment

Determinand (laboratory concentrations)	Unit	WS101	WS101[1]	WS102	WS102[1]	WS103	WS103[1]	WS104	WS104[1]	WS101[2]
Initial Classification		Non Hazardous	Non Hazardous	Non Hazardous	Non Hazardous	Non Hazardous	Non Hazardous	Hazardous	Hazardous	Non Hazardous
Hazardous Properties						HP7: Carcinogenic	HP7: Carcinogenic	HP7: Carcinogenic	HP7- Carcinogenic HP10 - Toxic for Reproduction HP14 - Ecotoxic	
Comment/ Justification						Asbestos has been identified but no quantification analysis has been undertaken at this stage - see notes below	Asbestos has been identified but no quantification analysis has been undertaken at this stage - see notes below			
Final Classification						Potentially Hazardous	Potentially Hazardous	Hazardous	Hazardous	
Depth	m	0.30	0.50	0.30	0.50	0.30	0.50	0.30	0.50	1.00
moisture {no correction}	%	7.1	9.3	7.5	11	9.8	11	9	9.6	13
asbestos	mg/kg	Not-detected	Not-detected	Not-detected	Not-detected	Detected - Chrysotile - Hard/ Cement Type Material, sheeting/Board Debris	Detected - Chrysotile- Hard/Cement Type Material, Sheeting/Board Debris	Not-detected	Not-detected	Not-detected
pH	pH	8.2	7.8	8.2	7.9	8	8.2	8.4	8.3	8
naphthalene	mg/kg	0.11	0.12	0.15	0.14	0.13	0.19	<0.05	<0.05	
acenaphthylene	mg/kg	0.16	<0.05	0.13	<0.05	0.19	0.3	<0.05	<0.05	
acenaphthene	mg/kg	0.1	<0.05	0.12	<0.05	0.68	0.12	<0.05	<0.05	
fluorene	mg/kg	0.14	<0.05	0.12	<0.05	0.69	0.15	<0.05	<0.05	
phenanthrene	mg/kg	1.6	1.1	1.6	1.2	3.6	2.3	0.68	0.53	
anthracene	mg/kg	0.36	0.18	0.35	0.11	0.63	0.38	0.11	<0.05	
fluoranthene	mg/kg	3.7	2.2	3.8	2.7	6.1	6.4	1.9	1.5	
pyrene	mg/kg	3.1	1.9	3.2	2.3	5.1	5.4	1.6	1.2	
benzo[a]anthracene	mg/kg	1.9	1.2	2	1.1	2.8	2.9	0.74	0.69	
chrysene	mg/kg	1.4	1.1	1.5	1.3	2.4	3.3	0.83	0.65	
benzo[b]fluoranthene	mg/kg	1.6	1.4	2	1.6	3	4.6	0.91	0.71	
benzo[k]fluoranthene	mg/kg	1.5	0.83	1.5	0.81	1.8	1.8	0.49	0.54	
benzo[a]pyrene; benzo[def]chrysene	mg/kg	1.7	1.3	1.9	1.4	2.6	3.3	0.69	0.63	
indeno[123-cd]pyrene	mg/kg	1.2	0.97	1.2	1.1	1.9	2.6	0.5	0.44	
dibenz[a,h]anthracene	mg/kg	0.27	0.19	0.31	0.21	0.39	0.6	0.11	<0.05	
benzo[ghi]perylene	mg/kg	1.3	0.99	1.2	1.2	1.8	2.6	0.59	0.48	
arsenic {arsenic trioxide}	mg/kg	22	20	20	31	20	19	14	16	12
boron {boron tribromide/trichloride/trifluoride (combined)}	mg/kg	1.9	2.3	2.1	2.9	1.7	1	1.4	1.1	1.7
cadmium {cadmium sulfide}	mg/kg	0.7	0.5	0.5	<0.2	0.5	<0.2	<0.2	<0.2	<0.2
chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex	mg/kg	<4	<4	<4	<4	<4	<4	<4	<4	<4
chromium in chromium(III) compounds {chromium(III) oxide}	mg/kg	35	36	32	32	30	38	23	27	30
copper {dicopper oxide; copper (I) oxide}	mg/kg	110	100	110	150	73	93	41	56	18
lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}	mg/kg	540	830	690	870	390	450	2000	4400	120
mercury {mercury dichloride}	mg/kg	2.4	2	1.2	1.6	1.3	0.8	<0.3	<0.3	<0.3
nickel {nickel dihydroxide}	mg/kg	25	25	22	23	21	22	14	15	12
selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
zinc {zinc oxide}	mg/kg	440	520	360	450	190	150	150	190	56

Notes:

Asbestos fibres have been identified in the sample but not yet quantified. When WAC testing is undertaken by a waste carrier prior to removal of arisings, the waste will be classed as hazardous is greater than 0.1% loose asbestos fibres are found. If large individual pieces of asbestos tile are found they must be assessed separately. Therefore without quantification the waste has been assessed as potentially hazardous.

Note: even if less than 0.1% asbestos fibres are found the landfill operator may decline to accept the waste."

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A decorative graphic consisting of three thin orange lines. One line is horizontal, extending across the width of the page. Two other lines are diagonal, starting from the bottom left and extending towards the top right, intersecting the horizontal line.