

SMALL SITES

x

SMALL BUILDERS

CHRISTCHURCH ROAD

TECHNICAL INFORMATION

LAND AT CHRISTCHURCH ROAD, BRIXTON HILL, SW2 4AP

Navigate this pack using the links below or the pdf bookmarks

Aerial and OS maps

Planning Statement

Site Investigation Summary Report

Topographical Survey

Ecology Assessment

Arboricultural Survey

Archaeological Desktop Review

**Geotechnical and Geo-Environmental Desk Study and
Preliminary Investigation**

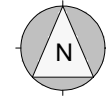
Unexploded Ordnance Desk Study and Risk Assessment



Transport for London

TfL Operational Property
Commercial Development
Windsor House
42-50 Victoria Street
SW1H 0TL

Site Ref: 901
Land at Christchurch Road
and Brixton Hill



A3 Landscape

Date : Mar 2017

Initial : REM

File : PAR

Scale : 1/1250 at A3

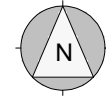




Transport for London

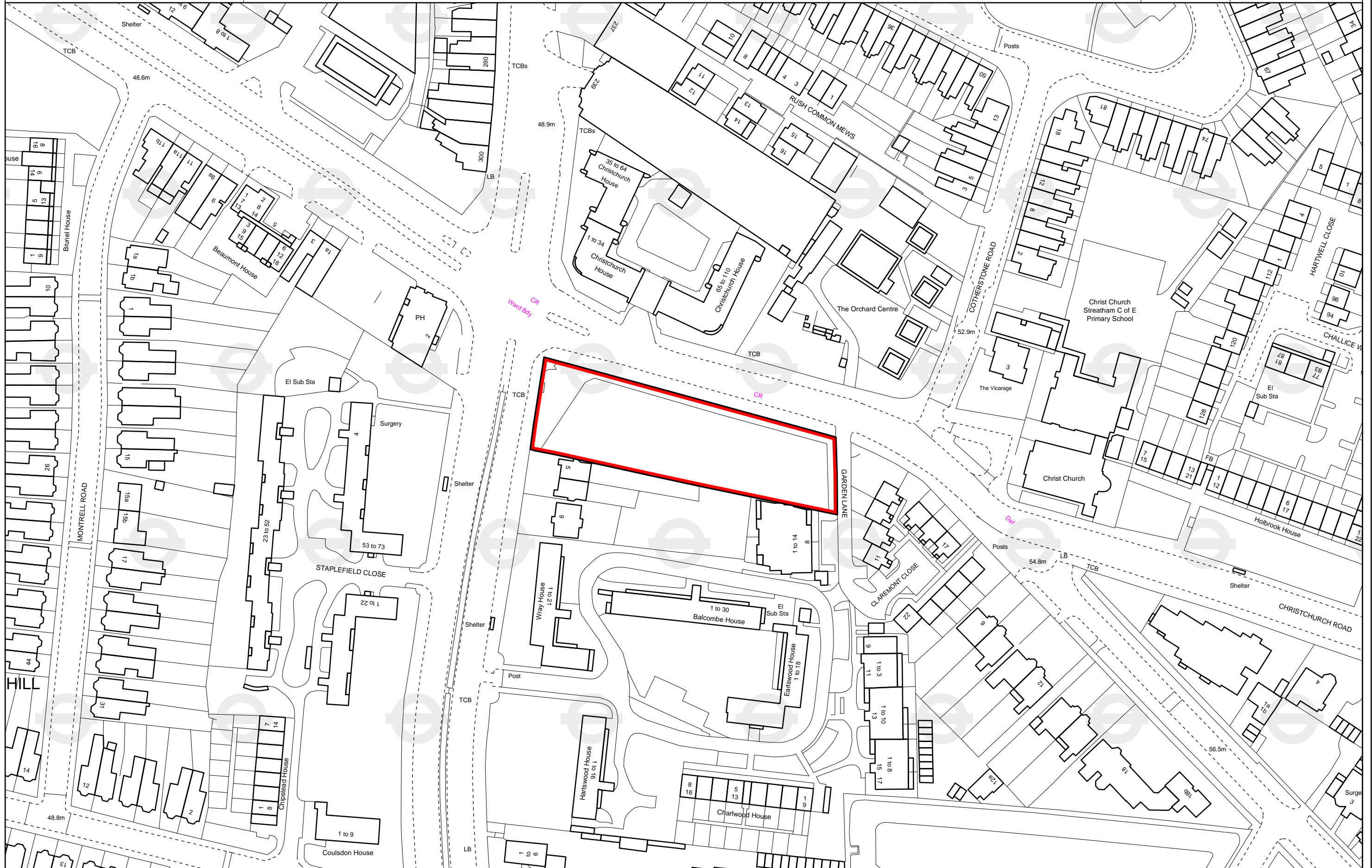
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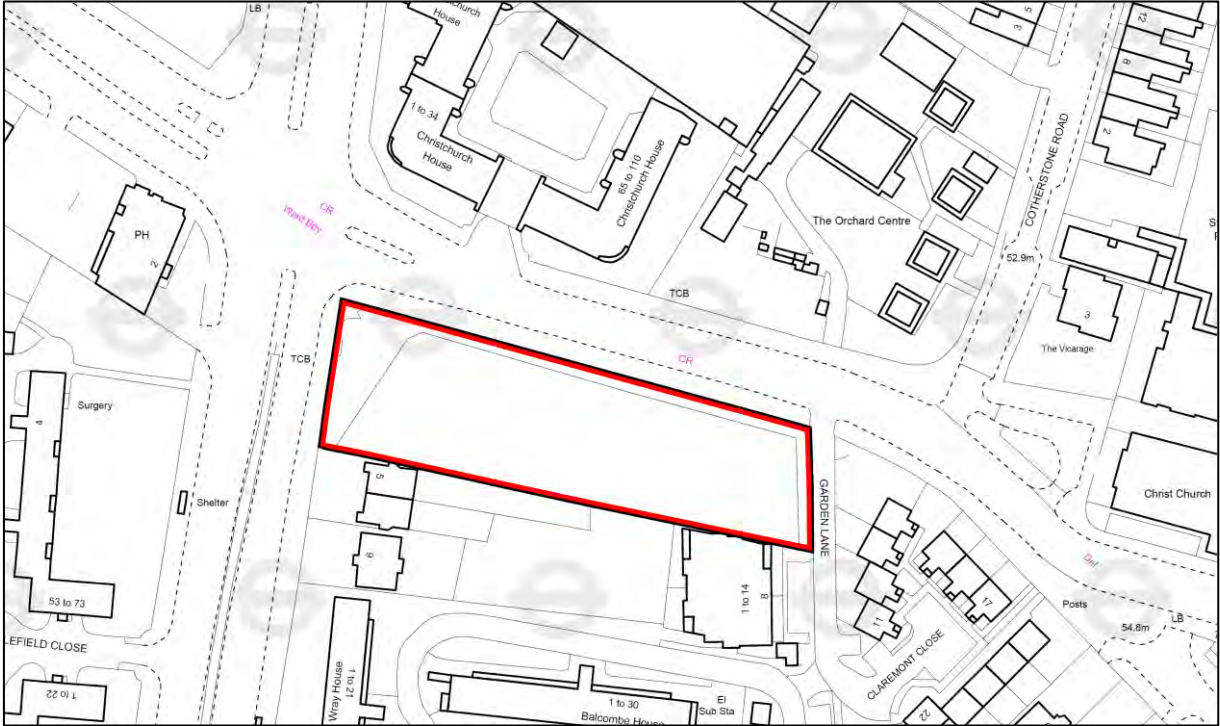
Site Ref: 901
Land at Christchurch Road
and Brixton Hill



A3 Landscape

Date : Mar 2017
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File : PAR
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1. PROPERTY DETAILS	
Site Name & Address	Land at Christchurch Road & Brixton Hill, SW2 4AP
Unique Ref (PAR)	901
Borough	Lambeth
Zone (TfL)	3
Site Area (acres)	Approx. 0.81 (3271.83 sq. m)
Location and Site Plan	 
Existing Use	<ul style="list-style-type: none"> - Open space - The site previously had a number of residential, pre fabricated bungalows which were demolished after 1976
2. TOWN PLANNING	
Planning Policy Documents	<ul style="list-style-type: none"> - Adopted: London Plan (consolidated 2016); Lambeth Local Plan (2015), Local Plan Policies Map (2015), - A partial review of the Lambeth Local Plan, Call for Sites was undertaken in 2015. An Issues and Options consultation is due in Autumn 2017.
Site Allocations	<ul style="list-style-type: none"> - No site specific allocations, but the site is identified as housing amenity land open space within the Lambeth Open Space Study (2013)

Housing zone or Opportunity Area	- No				
Heritage Designations	- Opposite the Rush Common and Brixton Hill Conservation Area. The site is also opposite a number of listed buildings which are part of the heritage Aspen House Open Air School (Grade II) and approximately 100m to the west of the Grade I Listed Christ Church				
Flood Zone	- No				
Ecological Designations	- No, but the trees on the site are protected by a Tree Preservation Order.				
PTAL	- 6a				
Tall buildings permitted	- Policy Q26 outlines the boroughs approach to tall and large buildings. Due to the site's location within a designated local view and in the setting of a number of listed buildings, tall buildings are not considered appropriate at this location.				
Car parking standards	- Car free development is considered appropriate in areas with high PTAL (Policy T7).				
LPA affordable housing target	Threshold	Affordable Housing target (unit)	Affordable Housing Tenure Split	Provision Requirement	
	10 units of more, or greater than 0.1 ha	50% with public subsidy, 40% without	70% Social Rented and 30% Intermediate	On site preferred	
	9 units of less	n/a	n/a	Financial contribution towards the provision of off-site housing	
Other	<ul style="list-style-type: none"> - TfL has previously submitted two planning applications for residential development on the site, details of which are below. These were refused by the Local Planning Authority and dismissed at appeal. - New build flatted development to the south has units overlooking the site. Privacy and amenity of these units will need to be maintained. - The site is identified as housing amenity land local open space within the Lambeth Open Space Strategy 2013. 				
Planning Policy Overview	<ul style="list-style-type: none"> - The site falls within the local protected vista north west of Christ Church along Christ Church Road (Policy Q25). Policy Q25 states that the council will resist harm to significant strategic views including Panoramas. - Policy Q20 states that development affecting listed buildings will be supported where it would conserve and not harm the special interest and not harm the significance/setting of a listed building. - Policy EN1 states that development which would involve the loss of existing public or private open space will not be supported unless it meets the tests outlined, specifically that: Replacement open space of equivalent or better quality and quantity should be provided within a suitable location in the local area. - Policy Q22 outlines the council's approach to development affecting Conservation Areas. The policy states that development proposals affecting the Conservation Areas will be permitted where they preserve or enhance the character and appearance of the Conservation Area including protecting the setting. - Policy Q10 outlines the borough's approach to trees. The policy notes that the council will not permit development that would result in the loss of trees of significant amenity, historic or ecological/habitat conservation value. Trees of value that are retained must be satisfactorily protected from construction impacts and site works during the development stage. 				
Planning History	Date	Reference	Description	Status	
	30/06/1986	86/01328/PLANAP	Erection of 2 non-illuminated 96 sheet advertisement panels each measuring 40' x 10' with feather edged fencing and landscaping	Granted with conditions	
	23/12/2004	04/03842/OUT	Outline application to erect 3 storey terrace combining 7	Refused and dismissed at	

			properties	appeal
	06/09/2007	07/03541/FUL	Erection of three 2-storey 2 bedroom houses and 2-storey building to provide 4x1 bedroom and 2x2 bedroom units (all affordable housing)	Refused and dismissed at appeal
Local Planning Authority and GLA Feedback Meeting with Sue Foster of London Borough of Lambeth on 08/06/2017 and Sarah Cosidine of the GLA on 22/06/2017	<ul style="list-style-type: none"> - Principal of development - The principal for development has not yet been established on this site. It has been agreed that the principal for residential development will need to be established through an allocation within the emerging Local Plan (partial review). - Next steps - TfL will be promoting the site to the Local Planning Authority for residential development in Summer / Autumn 2017. 			

**TFL_PSF_9131 SITE
INVESTIGATIONS: SMALL SITES
INITIATIVE
LAND AT CHRISTCHURCH ROAD &
BRIXTON HILL, LAMBETH, SW2 4AP**


Site Ref: 901


Summary Report

JULY 2017

Summary Report

Author Various

Checker Alison Pugh 

Approver Angela Mulgrew 

Report No 205-UA009686-UP32R-02

Date JULY 2017

VERSION CONTROL

Version	Date	Author	Changes
01	July 2017	Various	1 st issue
02	July 2017		Final Issue

This report dated 25 July 2017 has been prepared for 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

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a number of technical surveys for a site at Land at Christchurch Road and Brixton Hill, Lambeth, London ('the Site').

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of the survey work is to provide robust and pragmatic advice associated with arboriculture, ecology, archaeology and geotechnical and geo-environmental conditions. This report provides a summary of the technical surveys commissioned for the Site and reference should be made to the individual reports for further detailed information.

The site is currently undeveloped and vacant and is located in the borough of Lambeth. The site is centred at grid reference 530503,173418. It is approximately 0.32 ha in area and is currently a fenced area comprised of vegetation.

The immediate surrounding residential area is predominantly housing and open spaces. The A23 Streatham Hill road borders the site to the west. Christchurch Road runs along the northern border of the site.

The surveys carried out on the Site comprise the following;

- Topographical Survey (Ref 1);
- Ecological Assessment (Ref.2);
- Preliminary Tree Survey (Ref 3);
- Archaeological Desktop Review (Ref 4); and
- Preliminary Geotechnical and Geo-Environmental Report (Ref 5).

A summary of the findings of these surveys are detailed in the following sections.

2 Topographical Survey

The topographical survey indicates that the Site slopes gently down to the west with an approximate 2m change in height between the eastern (53.05m AOD north-east corner) and western (51.27m AOD north-west corner) sides of the site.

4 Ecology Assessment

The ecological assessment comprised a desk-based study using publicly available information and an ecological constraints survey to identify potential constraints present on Site.

Ecology does not present a significant constraint to the development of the Site.

The Site is not located within or near any statutory or non-statutory designated sites. The Site supported a limited range of habitats and was comprised of dense scrub, tall ruderals, managed and unmanaged amenity grassland with tall ruderals and scattered trees. Although the habitats on Site are generally of poor quality due to the lack of positive management and fly tipping, these habitats are valuable in terms of general green Infrastructure, likely performing important ecosystem services (such as water quality and volume attenuation, air quality attenuation etc.).

Within the Site, there was limited potential for protected or notable species. Nesting birds are likely to be utilising the trees and scrub on the Site, including potentially species listed on the London biodiversity Action Plan (BAP) such as house sparrow. Removal of all scrub vegetation on the Site will need to be conducted outside of the bird nesting season (March – August inclusive) or under an ecological watching brief.

Habitats present on Site, such as unmanaged amenity grassland and dense scrub are suitable for reptiles. All native reptiles in England are protected from intentional killing and injury, therefore site supervision with regards to this species during site clearance is recommended. Site clearance at ground level should be avoided during hibernation season between mid-October and April as disturbance during hibernation carries a high probability of mortality.

Not all of the trees on Site were fully inspected for roosting bat potential (access was limited due to the dense scrub present). None of the trees on Site which were inspected had any evidence of potential roost features (PRF's) for bats. Further tree inspections are recommended when access permits and when there is a greater level of information with regards to the potential impact on trees from future development.

No mammal burrows were observed on Site, however areas of dense vegetation were not fully inspected and fox earths may be present within those areas. Foxes are protected against inhumane injury or killing, therefore site supervision is recommended during any site clearance so that recommendations to humanely remove fox earths can be provided if required.

There is potential for grey squirrels to be breeding within the trees on Site. This species is non-native and of negligible ecological value, however squirrels are protected from inhumane injury or killing. If squirrel dreys are found on Site, these should be removed in a humane manner.

There is potential for the London Biodiversity Action Plan (BAP) species Stag beetle to be present within the Site. Site supervision with regards to this species during Site clearance is recommended and retention of an area a dead wood habitat on Site if stag beetle are confirmed to be present.

There will be some ecological benefit from the removal of non-native and invasive species listed on the LISI (London Invasive Species Initiative) list with regards to future development. Trees should be re-provisioned on the Site within any development. These should be of a suitable species and preferably native species of local origin. In addition, consideration to biodiversity roofs, rain gardens and other green infrastructure should be included in any development. There is the opportunity for enhancements for general biodiversity and green infrastructure and for London BAP species. Bird boxes for sparrows would be a valuable enhancement, along with appropriately located bat roosting boxes and dead wood loggeries if possible.

5 Arboricultural Survey

An arboricultural survey was conducted in accordance with British Standard 5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations.

Some trees that were recorded within the study area (the Site and its immediate surroundings) are protected by two Tree Preservation Orders (TPO) that protect on-Site and off-Site trees. These Orders are the London Borough of Lambeth No.160 (Land fronting Streatham Hill and Christchurch Road) TPO 1980 and London Borough of Lambeth No.159 (Land between 6 Christchurch Road and Garden Lane) TPO 1980. Within the Site a total of five trees are protected by TPO No.160, one off-Site is protected by TPO No.160 and six off-Site trees are protected by TPO No.159.

While not likely to prevent development, tree protection for trees to be retained and tree re-provisioning for any trees lost due to development are a material consideration for planning determination. The TPOs may present constraints to the design and construction of this Site in terms of a reduction in potentially developable land if they are to be retained. For any works to trees covered by a TPO it is a requirement to contact the Local Planning Authority (LPA) and follow the appropriate procedures before undertaking any works that might affect the protected trees. The procedures require an application to the LPA to remove or undertake works on the TPO trees, a decision which can often take at least 2 months. This application to remove can also be incorporated into a planning application submission and subsequent decision. Consultation with the LPA is recommended at the earliest opportunity to determine the development parameters of the Site.

If trees cannot be replaced on-Site due to development, off-Site options for tree re-provisioning to ensure no net loss should be considered. Individual Local Planning Authority (LPAs) may ask for re-provisioning in excess of 1 to 1 for trees of Category A or B grade or ask for additional re-provisioning for trees with protected by a TPO.

The Site and the off-Site trees are not within a Conservation Area and there are no Planning Application Conditions protecting the trees.

A total of 23 arboricultural items were recorded within the study area. Three individual trees and one group were graded as Category A (trees of high quality), three individual trees and one group were graded as Category B (trees of moderate quality), four individual trees and two groups were graded as Category C (trees of low quality) and seven individual trees and two groups were graded as Category U (trees of poor quality unsuitable for retention).

On-site a London plane (*Platanus x hispanica*), and two common limes (*Tilia x europaea*) are all Category A trees and the London Plane and one of common limes are protected within the TPO No.160.

Two on-Site false acacias (*Robinia pseudoacacia*) (protected by TPO no.160) have been categorised as Category U trees given their dangerous structural form and they are located within failure distance of the public highway. One of these is protected by a TPO and a five days notice of an imminently hazardous and or dangerous tree has to be submitted to the LPA before any tree works take place.

The off-Site common limes are Category A and Category B trees and are protected within the TPO No.159. These trees have the potential to be an access constraint within any future development of the Site should the Green Lane need to be widened. Full consideration should be given to preventing impacts to these trees should Garden Lane be used as an access route for construction. The crowns are over growing Garden Lane and the roots are likely to be running underneath the lane. Any works to crown lift (i.e. to remove the basal branches of the tree) the trees and works that would prune the roots will require consent from the LPA. The off-Site horse chestnut within the TPO No.159 may also be within the zone of influence of any future development. The other trees covered within the TPO No 159 are not likely to be within the zone of influence of future development.

Should any future development proposal require the removal of trees or incursions into the Root Protection Areas (RPAs) of any trees, an Arboricultural Impact Assessment (AIA) would be required in support of any planning application.

Although a Preliminary Arboricultural Method Statement is presented within the Arboricultural Survey Report (Ref 3), a bespoke AMS may be required post planning and when the construction details are known by the LPA to protect the retained trees within and adjoining the Site.

All new tree planting should be in accordance with British Standard 8545: Trees: From Nursery to Independence in the Landscape – Recommendations, 2014; and all tree works must be carried out by a qualified contractor in accordance with BS3998:2010: Tree Work – Recommendations.

6 Archaeological Desktop Review

An archaeology desktop review has been carried out. This involved a rapid information-gathering and review of the Site and a 500m study area using information from publicly held sources. A brief assessment of potential heritage/archaeological constraints and opportunities at the Site has been made.

There are no scheduled monuments within the Site or study area. The Site is not within a Conservation Area or a Registered Park or Garden. There are 27 Listed Buildings within the study area, of all grades, but none within the Site boundary. The Site lies within an Archaeology Priority Area (APA), being located next to or on a Roman road.

Although the Site has potential for buried archaeological remains to exist, these heritage assets are not considered likely to prevent development on the Site.

However for any future planning application, the potential for below ground remains need to be fully evaluated. The Greater London Archaeological Advisory Service (GLAAS) who advise the local planning authority are likely to recommend a full archaeological desk-based assessment and an evaluation to be undertaken prior to planning permission being determined. This would include a specific archaeology Site walkover, a visit to the record office to gather historic maps and relevant documentary evidence, a map regression exercise as well as preparation of distribution maps showing designated and un-designated heritage assets. The evaluation would likely consist of a programme of trial trenching and subsequent reporting. If heritage assets of significance are encountered during the evaluation stage, there may be a requirement for further recording in the form of an excavation or watching brief. This may be delivered through a post-determination condition.

7 Geotechnical and Geo-Environmental Desk Study and Preliminary Site Investigation

The geo-environmental and geotechnical desk study comprised a review of existing historical and current information on the Site. The historical review indicated that terraced properties were recorded in the west before being removed and replaced with bungalows which occupied the entire Site until circa 1980 when they were demolished. Potential off-Site sources of contamination including a petrol filling station, garages, trams and depots have been recorded.

A preliminary site investigation has been undertaken comprising four window sampling boreholes to investigate ground conditions and to provide an indication of the levels of contaminants in the Site.

Potential risks to human health, controlled waters and the built environment have been identified from on-Site and 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 for a sensitive residential development. However if apartments or retail with first floor flats are proposed, hardstanding is likely to cover the majority of the Site. This would reduce the risk to future end-users as potential pathways to the contaminants would be broken. Where soft landscaping is proposed (e.g. for gardens), a clean cover system is likely to be required to remove the risk.

Further development-specific ground investigation will be required to confirm the requirements for future development. These include (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.

Based on the findings to date and assuming that the Site will be developed for residential use with gardens, it is anticipated that some remediation (off-site disposal, clean cover, gas membrane, basic asbestos monitoring and pipe upgrade but excluding foundation) may be required. Indicative costs are provided in the report (Ref. 5) which are based on the information known to date.

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 recommended to mitigate the potential UXO risks. Further details are in the UXO report which is included as an Appendix in the Preliminary Geotechnical and Geo Environmental Report (Ref 5).

8 References

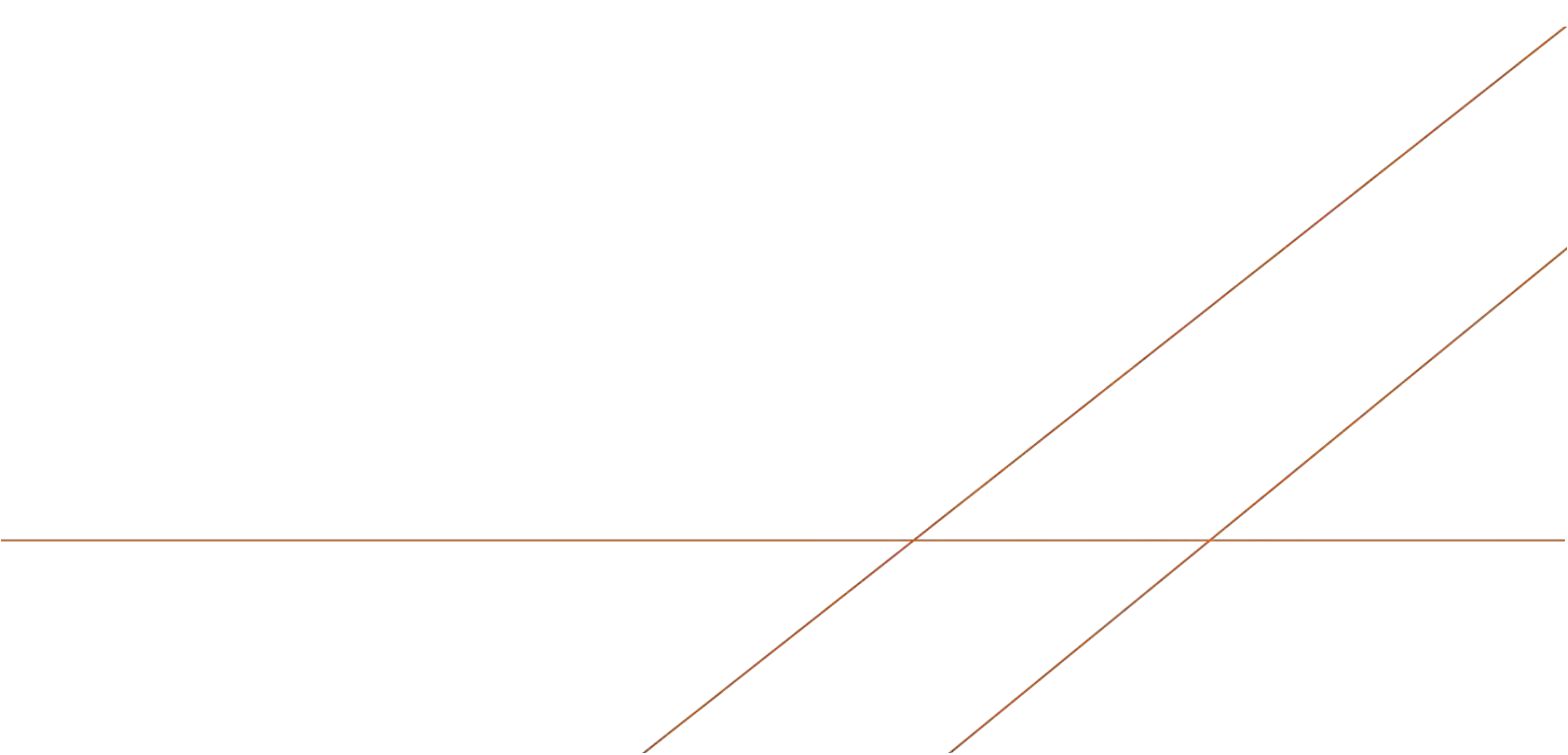
1. 40Seven (May 2017) Topographical Survey Land at Christchurch Road and Brixton Hill, Lambeth (Site Ref 901)
2. Arcadis Consulting (UK) Limited (July 2017) Land at Christchurch and Brixton Hill, Lambeth, SW2 4AP Ecological Survey (Report 202-UA009686-UE21R-02)
3. Arcadis Consulting (UK) Limited (July 2017) Land at Christchurch and Brixton Hill, Lambeth, SW2 4AP Preliminary BS5837 :2012 Tree Survey (Report 203-UA009686-UE21R-02)
4. Arcadis Consulting (UK) Limited (June 2017) Land at Christchurch and Brixton Hill, Lambeth, SW2 4AP Archaeological Desktop Review (Report Number 204 -UA009686-UE21R-04)
5. Arcadis Consulting (UK) Limited (July 2017) Land at Christchurch and Brixton Hill, Lambeth, SW2 4AP Preliminary Geotechnical and Geo Environmental Report (Report Number 201-UA009686-UP32R-01)

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**TFL_PSF_9131 SITE
INVESTIGATIONS: SMALL SITES
INITIATIVE
LAND AT CHRISTCHURCH ROAD AND
BRIXTON HILL, LAMBETH, SW2 4AP**

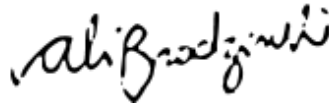
Site Ref: 901

Ecological Assessment

OCTOBER 2017

Land at Christchurch Road and Brixton Hill, Lambeth, SW2 4AP Ecological Assessment

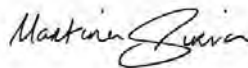
Author Aline Brodzinski



Checker Brandon Murray



Approver Martina Girvan



Report No 202-UA009686-UE21R-02

Date OCTOBER 2017

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Version	Date	Author	Changes
01	July 2017	Aline Brodzinski	1 st Issue
02	October 2017	Aline Brodzinski	Final Issue

This report dated 02 October 2017 has been prepared for 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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APPENDICES

APPENDIX A

Desk Study Review

APPENDIX B

Bat Habitat Suitability and London Population Status

APPENDIX C

Selected Legislation, Nature Conservation Status and Policy

1 INTRODUCTION

1.1 Background

Arcadis Consulting (UK) Limited (Arcadis) was commissioned by Transport for London (TfL) to undertake an ecological assessment to support the feasibility for potential development at Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP hereafter referred to as “the Site”.

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of the Small Sites Initiative is to provide robust and pragmatic advice that sensibly de-risks each of the sites such that unreasonable “abnormal” development costs are not included by developers.

The objective of this report is to identify potential ecological development constraints due to current ecological conditions on Site based on the findings of a desk study and ecological constraints survey. The report outlines the ecological constraints associated with the Site with regards to biodiversity legislation and policy and provides advice on mitigation and enhancement opportunities, including requirement for any further assessment or licensing, if necessary.

1.2 Site Location and Setting

The Site is located south of the A205, in the London Borough of Lambeth. The Site is centred at the central grid reference of 530503, 173418 and around the postcode of SW2 4AP.

It is approximately 0.32ha in area and is currently comprised of dense scrub, tall ruderals and managed and unmanaged grassland with scattered broadleaved trees.

The immediate surrounding is largely residential.

The Site boundary for assessment is presented in Figure 2.

2 METHODOLOGY

2.1 Desk Study

Desk-based ecological information was collated from multiple sources.

The Multi-Agency Geographic Information for the Countryside (MAGIC) website¹ and other Natural England and Forestry Commission datasets were used to search for any statutory or non-statutory designated sites of nature conservation importance within a specific radius of the Site boundary, as follows:

- Special Protection Areas (SPAs) or Ramsar Sites designated for their bird interests (5km radius);
- Special Areas of Conservation (SACs) (5km radius);
- Sites of Special Scientific Interest (SSSIs) and all other statutory designated sites (2km radius);
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR); and
- Woodlands registered on the Ancient Woodland Inventory (AWI).

Records of protected or otherwise notable species of conservation concern (that the Site has the potential to support) located 1km of the Site boundary were obtained from the following sources:

- Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006) Species of Principle Importance in England²;
- National Biodiversity Network Atlas³;
- London Biodiversity Action Plan⁴; and
- Local Biodiversity Action Plan.

In addition, the Lambeth Council website⁵ was reviewed for citations of any non-statutory designated Sites located within a 1km radius of the Site, including Local Wildlife Sites (LWS) and Sites of Importance for Nature Conservation (SINCs).

SINCs fall into three sub designations:

- Sites of Metropolitan Importance for Nature Conservation (SMINCs);
- Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II; and
- Sites of Local Importance for Nature Conservation (SLINCs).

Waterbodies located within 250m of the Site identified from OS mapping were assessed with regards to their connectivity to the Site and their potential suitability for supporting a population of breeding great crested newts (*Triturus cristatus*).

2.2 Field Survey

This survey was conducted by Aline Brodzinski in May 2017. Habitats were classified according to their JNCC Phase 1 habitat categories (JNCC 2010)⁶ and plants named after Stace (1997)⁷ and are presented on Figure 2.

2.3 Limitations and Expectations

This report has been prepared for TfL 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.

¹ MAGIC (2002). MAGIC Map Search. [online] Available at <http://magic.defra.gov.uk> [Accessed May 2017]

² NERC Act (2006) Section 41 Species <http://www.nhm.ac.uk/our-science/data/uk-species/checklists/NHMSYS0020515439/index.html>

³ National Biodiversity Network <https://nbn.org.uk/> [Accessed May 2017]

⁴ London BAP (Reviewed 2007) <http://www.gigl.org.uk/london-bap-priority-species/> [Accessed May 2017]

⁵ <http://maps.lambeth.gov.uk> [accessed June 2017]

⁶ Joint Nature Conservation Committee (2010), *Handbook for Phase 1 habitat survey - a technique for environmental audit*

⁷ Stace, C. (1997). *New Flora of the British Isles Second Edition*. Cambridge University Press

Ecological Assessment

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.

3 SURVEY RESULTS

3.1 Reporting Outline

The results of the desk study and ecological constraints survey are described below, with sites or features of particular nature conservation interest detailed as appropriate.

Supporting information to be read in conjunction with the results and subsequent discussion are as follows:

- Figure 1: Designated Sites within 2km of the Site centre;
- Figure 2: Extended Phase 1 Habitat Map (with dedicated survey results and target notes);
- Table 1: Ecological Constraints and Mitigation Summary Table; and
- Table 2: Site photographs.

Only information potentially relevant to the development of the Sites is included within the report other information is appended as follows:

- Appendix A: Desk Study Results;
- Appendix B: Bat Habitat Suitability Assessment and London Bat Population Status; and
- Appendix C: Selected Legislation, Nature Conservation Status and Policy.

3.2 Desk Study Results

Only desk study results that are potentially relevant to the Site are presented within the report. Detailed status and protections conferred by the relevant designations below are presented in Appendix A and Figure 1. The relevant Site information is summarised below.

There is negligible potential for significant impacts to any designated sites from development of this Site:

- There were records of hedgehog (*Erinaceus europaeus*) within 1km of the Site which is a Section 41 and London biodiversity Action Plan (BAP) species;
- There were records of stag beetle (*Lucanus cervus*) within 1km of the Site which is a London BAP species;
- There were records of fox (*Vulpes vulpes*) and grey squirrel (*Sciurus carolinensis*) within 1km of the Site which although not protected for conservation value are protected from inhumane killing or injury by the Wild Mammal Act (1996)⁸; and
- There were no relevant records of protected or notable reptiles, amphibians or birds or of badger.

3.3 Site Overview

The Site supported a limited range of habitats and was comprised of dense scrub, managed and unmanaged amenity grassland, areas of tall ruderals with some scattered trees. The habitats on Site were generally of poor quality due to the lack of positive management, fly tipping and potential illegal occupation by vagrants. However, these habitats are valuable in terms of general green infrastructure, likely performing important ecosystem services (such as water quality and volume attenuation, air quality attenuation etc.) in addition to the ecological value they have.

3.4 Habitats

Phase 1 habitat categories and descriptions of these habitats are presented below and the locations of these habitats are presented in Figure 2.

- **Dense scrub and introduced shrub:** The majority of the Site was covered by dense scrub and unmanaged amenity grassland. The scrub was predominantly bramble (*Rubus fruticosus*

⁸ Anon The Wild Mammal Act (1996). HMSP

agg.) with a ground flora dominated by ivy (*Hedera helix*) and nettle (*Urtica dioica*). Other species present included: green alkanet (*Pentaglottis sempervirens*) which is listed on the London Invasive Species Initiative (LISI) and bamboo (*Phyllostachys* sp.).

- **Managed and unmanaged amenity grassland:** The grassed areas were dominated by cock's-foot grass (*Dactylis glomerata*), false oat-grass (*Arrhenatherum elatius*), cup-leaved geranium (*Pelargonium* sp.), dandelion (*Taraxacum* sp.), lesser stitchwort (*Stellaria graminea*), red fescue (*Festuca rubra*); daisy (*Bellis perennis*); annual meadow grass (*Poa annua*); spreading hedge parsley (*Torilis arvensis*); creeping buttercup (*Ranunculus repens*); cleavers (*Galium aparine*); spear thistle (*Cirsium vulgare*); broadleaved dock (*Rumex obtusifolius*); ribwort plantain (*Plantago lanceolata*) and garlic mustard (*Alliaria petiolata*).
- **Individual scattered trees:** Sycamore (*Acer pseudoplatanus*), common lime (*Tilia x europea*) false acacia (*Robinia pseudoacacia*) and holm oak (*Quercus ilex*) both on LISI.

3.5 Protected and Notable Species

The following protected or notable species have the potential to be present on / adjacent to the Site:

- **Nesting birds:** There is potential for nesting birds to be utilising the trees and scrub on the Site, including species listed on the London BAP such as house sparrow (*Passer domesticus*). House sparrow, blackbird (*Turdus merula*) and common wood pigeon (*Columba palumbus*) were observed on Site during the survey.
- **Bats:** Not all of the trees on Site were fully inspected for bat roosting potential (access was limited due to the dense scrub present). None of the trees on Site which were inspected had any evidence of potential roost features (PRF's). There is potential for bats to forage within the Site, however the Site is relatively isolated and not directly connected to larger areas suitable for foraging.
- **Stag beetle:** There is potential for stag beetle to be present on the Site. Piles of deadwood, fallen tree and waste suitable for this species were present on the Site and with records from within 500m from 2015 were returned by NBN Atlas.
- **Other mammals:** No mammal burrows were observed on the Site, however there is potential that fox earths may be present within the inaccessible dense scrub area. The presence of fox earths within this area will need to be confirmed once some of the dense vegetation is cleared from the Site. No badger signs or clear paths were observed suggesting that this species is not present on the Site. There is potential for grey squirrels to be breeding within the vegetation on Site.
- **Reptiles:** Habitat suitable for reptiles, such as unmanaged amenity grassland, dense scrub, piles of wood were present on Site.

No ponds were present within 500m of the Site or with connectivity to the Site, so the presence of great crested newts is extremely unlikely. Overall, within the Site, there was limited potential for protected or notable species.

3.6 Invasive Species

On Site, no invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) were recorded during the survey. However, species listed on the LISI were recorded on Site, including false acacia, holm oak, and green alkanet.

4 POTENTIAL ECOLOGICAL CONSTRAINTS

The potential ecological constraints and associated further works including mitigation is briefly presented below, further detail is presented in Table 1.

4.1 Habitats/Invasive Species

The habitats on Site are likely to be considered as 'local' or 'less than local' value according to the CIEEMs *Guidelines for Ecological Impact Assessment* (CIEEM 2016)⁹. However, these habitats are valuable green infrastructure, likely performing important ecosystem services (such as drainage, air quality etc.).

There will be some ecological benefit from the removal of non-native species listed on LISI. For any loss of trees, trees should be re-provisioned on the Site, of a suitable species, preferably native species of local origin appropriate to the sylvan culture of the area. An ecologist and arboriculturist should contribute to the evolution of the development and landscaping design to minimise biodiversity loss and to maximise the replacement green infrastructure with regards to biodiversity.

4.2 Protected and Notable Species

The following notable or protected species have the potential to be impacted by the works:

- **Nesting birds:** it is likely that nesting birds will utilise the Site, clearance of vegetation should be avoided during the nesting bird season (March to August inclusive) and replacement nesting opportunities should be provided within any development;
- **Bats:** when further access is available, trees to be removed should be inspected from the ground to assess their potential to support roosting bats. Should roosting potential be found in addition to further survey, replacement or additional roosts should be provided within the development. Linear green corridors should be maintained within any development if possible;
- **Stag beetle:** dead wood should be removed under site supervision and should stag beetle be found, a dead wood loggery should be provided on Site; and
- **Reptiles:** suitable habitat and wood piles are present on Site. Site clearance should be undertaken under ecological supervision, avoiding disturbance during hibernation season between April and mid-October.

While not protected or notable for their conservation status the following species may be present that are protected against inhumane injury under the Wild Mammal Act (1996):

- **Fox:** a watching brief should be undertaken for vegetation clearance to ensure that any fox earths are excluded and destroyed humanely; and
- **Grey squirrel:** trees should be inspected from the ground for squirrel dreys before being excluded and humanely destroyed if present.

⁹ CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater and Coastal.

5 LEGISLATION AND KEY POLICY COMPLIANCE

Potentially relevant Legislation and Policy are presented in Appendix CE and further detail with regards to surveys and mitigation required are presented in Table 1.

5.1 Relevant Legislation

Development of the Site will require surveys and or mitigation to fulfil legislative requirements for the following protected species:

- WCA, as amended 1981, and the Conservation of Habitats and Species Regulations (2010, as amended)¹⁰ for bats: When access is possible, and the potential impact on trees is known, trees should be assessed for their potential to support roosting bats.
- WCA, as amended 1981, for nesting birds: Clearance works will need to be timed to avoid the nesting bird season (March to August inclusive) or supervised to prevent impacts to nesting birds.
- The Mammal Act (1996) for fox and squirrel: Construction works will need to ensure that there are no inhumane impacts to fox or squirrel if present.
- WCA, as amended 1981, for reptiles: Site clearance will need supervision to avoid injuring or killing. Works will need to be timed to avoid the hibernation season between mid-October and April.

Full details of subsequent works required are included within Table.

5.2 Relevant Policy

Elements of national, London and local policies and plans have the potential to be applicable to any development of the Site. These relate to:

- The safeguarding and replacement of trees to be lost to development;
- Creation and enhancement of biodiversity where possible: and
- Material consideration of S41 species; and
- Although no invasive species with legal obligations were recorded on the Site, there were plants recorded listed on LISI. While there is no legal requirement to remove or control these species (false acacia, holm oak and green alkanet) it would be appropriate and beneficial to remove them as part of a future development.

An ecology report addressing the required design and construction mitigation for any proposed development will be required in support of future planning.

5.3 Potential for Enhancement Within a Development

In addition to the recommended further works, enhancements should be considered within any development. For example, biodiversity roofs, rain gardens and other green infrastructure should be considered and the soft landscaping should be designed to maximise the biodiversity potential.

There are also opportunities for enhancements for London BAP species. Bird boxes for sparrows would be a valuable enhancement, along with bat roosting boxes.

¹⁰ Anon. The Conservation of Habitats and Species Regulations (2010) as amended. HMSO.

6 SUMMARY OF ECOLOGICAL CONSTRAINTS AND MITIGATION REQUIRED

Table 1 Ecological Constraints and Mitigation Summary Table

Key Issues	Legislation/Policy	Assumption	Further Survey / input?	Seasonal Timing	Mitigation Required	Seasonal Timing	Programme Delay Risk	Survey/ Mitigation Cost Estimate*	Risk Rating
Nesting Birds									
<p>All green infrastructure listed below is suitable for nesting birds. These are likely to be removed for development.</p> <ul style="list-style-type: none"> Dense scrub; Broadleaved woodland; Individual trees. 	WCA, 1981, as amended	Trees and scrub to be removed for development / site investigation.	No (but see mitigation recommendations)	N/A	Remove any remaining trees and scrub vegetation outside the core nesting bird season (March to August inclusive) or vegetation removal will need to be supervised by an ecological watching brief.	September to February remove trees and shrubs	If vegetation removal is required during the nesting bird season and nest are found by the ecological watching brief, a delay of 6 weeks is likely to be required until chicks have fledged.	<p>Mitigation £500 - £1000 per day for ecological supervision / nesting bird check.</p> <p>Design and replacement of green infrastructure not costed</p>	Low
Reptiles									
<p>The Site is suitable for common reptiles, although given the location of the Site, if present they would be in low numbers. The species of reptile most commonly associated with habitats of this type and location is slow worm in the unmanaged grassland areas</p>	WCA, 1981, as amended	Unmanaged grassland to be removed for development / site investigation.	No (but see mitigation recommendations)	N/A	Remove ground level vegetation outside the hibernation period which is mid-October to April inclusive under site supervision.	Remove ground level vegetation between April and mid-October inclusive	Clearance could be undertaken under supervision during the hibernation period but there is a risk of killing or injuring of reptiles.	<p>Mitigation £500 - £1000 per day for ecological supervision</p>	Low (if vegetation cleared outwith the hibernation period)
Green Infrastructure/ Trees									
<p>Trees / groups as present and may be impacted by development: Large areas of scrub on Site which is likely to be removed prior to development or.</p>	Potential TPOs although removal will be granted with planning permission national and local policy on no net loss	Trees and shrubs are likely to be removed or damaged due to development	Yes: BS 3857 2012 Tree survey	Removal of trees affected by bird nesting season see above.	Protection of trees to be retained and adjacent trees and replacement of trees and green infrastructure implemented via an Arboricultural Method Statement and Landscape Strategy	N/A	None	<p>Survey: £1,900</p> <p>Mitigation: £1,000 demarcation and bespoke Arboricultural Method Statement</p> <p>Design and replacement of green infrastructure not costed</p>	Low
Roosting Bats (Trees)									
<p>Trees could not be fully assessed for roosting bat potential assessments due to the dense scrub preventing access to the trees.</p>	<p>Schedule 5 of the of the WCA, 1981, as amended</p> <p>The Conservation of Habitats and Species Regulations 2010</p>	Assumption is that some trees may be felled for development and that there may be lighting effects on bats if present.	Yes - Further assessment once access is possible and there is greater knowledge around the potential impacts on trees. There are subsequent potential for requirements for ground and climbed tree inspections or emergence / re-entry surveys if potential roost features (PRFs) are observed.	<p>Ground based tree assessments can be conducted year round as can climbed tree inspections.</p> <p>Emergence / re-entry surveys can be conducted May to September inclusive (weather dependant).</p>	If bat roosts are found, mitigation could include tree felling in winter, potentially requiring a European Protected Species Licence	<p>European Protected Species Licence takes 30 working days from submission (post planning)</p> <p>Exclusion of any bat roosts may be restricted to November to February inclusive dependent upon the species and</p>	6 months for the process from surveys to licence to exclusion (i.e. so that the tree can be removed).	<p>Survey: Up to £4,500</p> <p>Mitigation: Up to £3,500 for an EPS licence and site supervision</p> <p>Design and replacement of green infrastructure not costed.</p>	Low (due to likelihood of bat roosts being present)

Ecological Assessment

Key Issues	Legislation/Policy	Assumption	Further Survey / input?	Seasonal Timing	Mitigation Required	Seasonal Timing	Programme Delay Risk	Survey/ Mitigation Cost Estimate*	Risk Rating
						roost type present.			
Fox									
Fox earths potentially on the Site. Fox are protected against cruelty and killing in certain ways. Should fox earths be present the development could cause the inhumane killing or injury of a fox.	Wild Mammals Protection Act 1996 PR and reputational risk.	Vegetation clearance and or excavations could cause inhumane killing or injury.	No (but see mitigation recommendations)	N/A	Site supervision during vegetation clearance if fox earths are identified gating of earth to exclude foxes prior to earth destruction	N/A	None	Mitigation for site supervision and gating £1500	Low
Grey squirrel									
Trees on Site may contain squirrel dreys, removal of trees and vegetation may cause potential harm to squirrels. Although these are a non-native species care to avoid inhumane killing or injury.	Wild Mammals Protection Act 1996, PR and reputational risk.	Trees and scrub to be removed for development	No	N/A	Dreys should be removed when juvenile squirrels are unlikely to be present Avoidance of the 2 main breeding seasons when young are in the drey (February to October inclusive) is recommended.	Fell the trees in winter (November to January inclusive) or check the trees for dreys prior to felling. They are obvious large round untidy looking nests about the size of a football.	None	Mitigation £500- 1000 per day for site supervision or drey removal during felling / vegetation removal if present	Low
London BAP species									
Stag beetle	Listed on London BAP and Section 41 NERC Act 2006.	The Site is suitable for stag beetle. Records of stag beetle from within the vicinity of the Site have been returned from 2015 by NBN Atlas.	No	N/A	Site supervision during vegetation clearance and relocation of habitat should stag beetle or larvae be found. Retention of stag beetle habitat on Site	N/A	None	Mitigation £500- 1000 per day for site supervision Design and replacement of green infrastructure not costed	Low
Invasive species									
False acacia, holm oak and green alkanet	London Invasive Species Index	Development could cause these species to spread	No	N/A	It would be good practice to remove these species during subsequent development and to implement mitigation to ensure they are not spread	N/A	N/A	N/A Can be undertaken with vegetation clearance for development.	Low

* Cost estimates only, actual costs would depend on the design and programme of any subsequent development and do not include costs for reports in support of planning application or any associated protected species licencing

7 CONCLUSIONS

There are no likely significant ecological constraints with regards to the development of this Site. The Site is not located within or near any statutory or non-statutory designated sites.

Constraints are listed below:

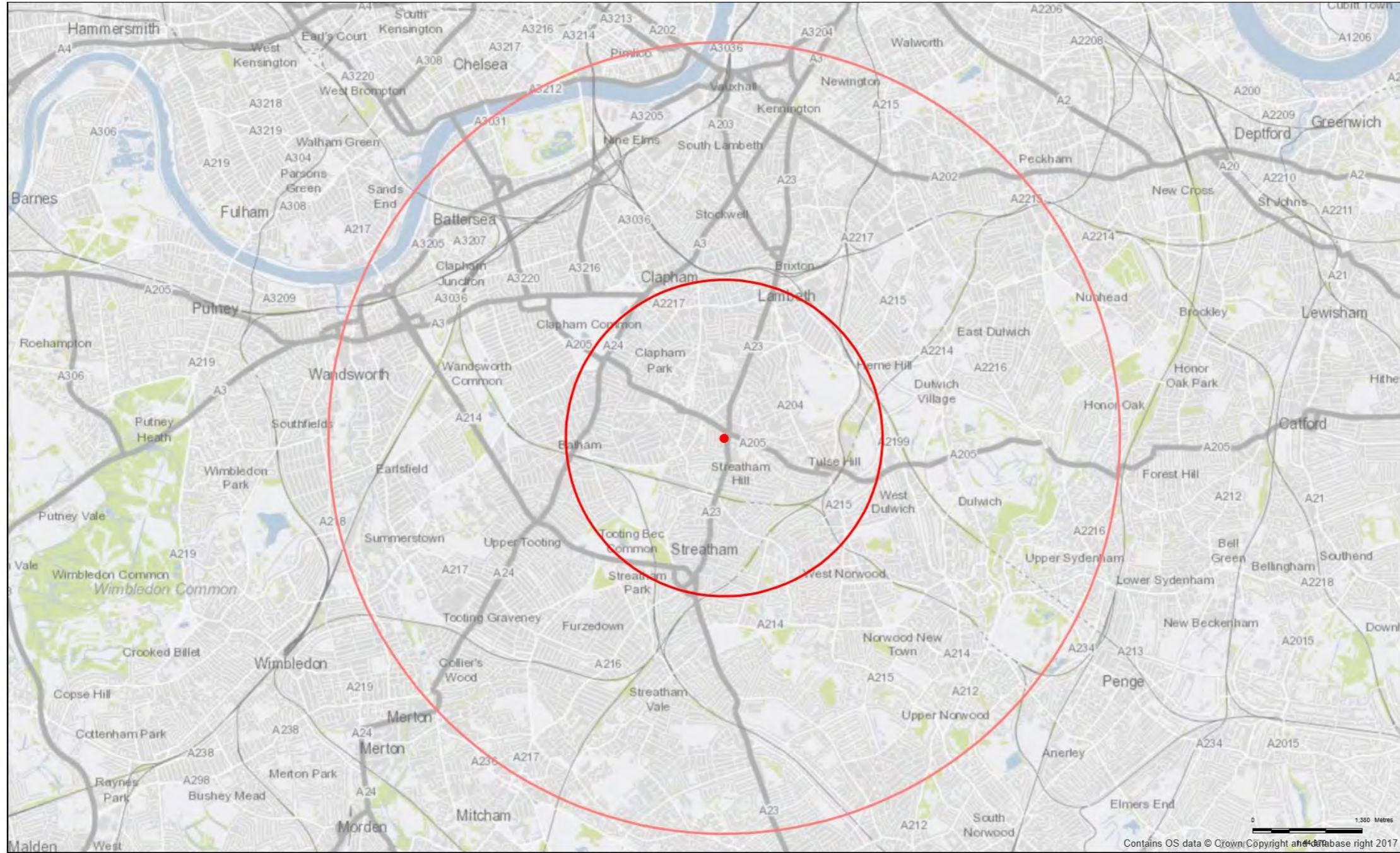
- The Site was comprised of dense scrub, managed and unmanaged amenity grassland, tall ruderals and scattered trees. The habitats on Site were generally of poor quality and with limited potential for protected or notable species due to the lack of positive management, fly tipping and potential illegal occupation by vagrants. However, these habitats are valuable in terms of green infrastructure, likely performing important ecosystem services (such as water quality and volume attenuation and air quality attenuation etc.).
- There is potential for nesting birds to be utilising the trees and scrub on the Site, including species listed on the London BAP such as house sparrow. Removal of all trees and scrub vegetation on the Site will need to be conducted outside of the bird nesting season (March – August inclusive) or under an ecological watching brief.
- Habitats present on Site, such as unmanaged amenity grassland and dense scrub are suitable for reptiles. All native reptiles in England are protected from intentional killing and injury. Therefore Site supervision with regards to this species during site clearance is recommended. Site clearance should be avoided during hibernation season between mid-October and April as disturbance during hibernation carries a high probability of mortality.
- Not all of the trees on Site were fully inspected for roosting bat potential (access was limited due to the dense scrub present). None of the trees on Site which were inspected had any evidence of potential roost features (PRF's). Further inspections should be undertaken when access is available and there is more information regarding potential impacts to the trees.
- No mammal burrows were observed on the Site, however there is potential that fox earths may be present within the inaccessible dense scrub area. The presence of fox earths within this area will need to be confirmed once more of the dense vegetation is cleared from the Site. Foxes are protected against cruelty, so if fox earths are found, these will have to be removed from the Site humanely.
- There is potential for grey squirrel to be breeding within the trees. This species is non-native and of negligible ecological value, however squirrels are protected from cruelty. If squirrels are found on Site, these should be removed in a humane manner.
- There is potential for the London BAP species Stag beetle to be present within the Site. Site supervision during vegetation clearance is recommended.
- There will be some ecological benefit from the removal of non-native and invasive species on LISI, which is likely to occur when the site is cleared for any construction. There is no legal obligation to control any of the LISI species recorded on the Site or to remove of them as controlled waste but it is good practice to remove them and to avoid their spread.
- Trees and other vegetation should be replaced within any proposed soft landscaping and these designs should be evolved in liaison with an ecologist and arboriculturist. In addition, rain gardens, biodiversity roofs and other green infrastructure should be considered within any development.
- There are also opportunities for enhancements for London BAP species. Bird boxes for sparrows would be a valuable enhancement along with appropriately located bat roosting boxes and dead wood loggeries if possible.

SITE PHOTOGRAPHS

Table 2: Land at Christchurch Road and Brixton Hill

Land at Christchurch Road and Brixton Hill: Site Photographs	
	
Photograph 1: Unmanaged amenity grassland.	Photograph 2: Managed Amenity Grassland.
	
Photograph 3: Tall ruderals and gate access to Site (south west corner of the Site).	Photograph 4: Open access to Site (south east corner of the Site).
	
Photograph 5: Evidence of fly tipping and Site access for the illegal occupation on the Site.	Photograph 6: dense scrub.

FIGURE 1: STATUTORY DESIGNATED SITES WITHIN 2KM OF THE SITE CENTRE



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<p>N.B. Non statutory designated sites not shown (SINCs)</p>		<p>Legend</p> <ul style="list-style-type: none"> ● Site centre point ○ 2km buffer (national statutory designated sites) ○ 5km buffer (international statutory designated sites) 		<p>Client</p> <p>Transport For London Client</p>		<p>Subsidiary Description:</p> <p>FINAL</p> <table border="1"> <tr> <td>Designed</td> <td>A. POPPLETON</td> <td>Date</td> <td>02/06/17</td> <td>Signer</td> <td>[Signature]</td> </tr> <tr> <td>Drawn</td> <td>A. POPPLETON</td> <td>Date</td> <td>02/06/17</td> <td>Signer</td> <td>[Signature]</td> </tr> <tr> <td>Checked</td> <td>A. BROODINGS</td> <td>Date</td> <td>02/06/17</td> <td>Signer</td> <td>[Signature]</td> </tr> <tr> <td>Approved</td> <td>M. GIBSON</td> <td>Date</td> <td>02/06/17</td> <td>Signer</td> <td>[Signature]</td> </tr> </table>		Designed	A. POPPLETON	Date	02/06/17	Signer	[Signature]	Drawn	A. POPPLETON	Date	02/06/17	Signer	[Signature]	Checked	A. BROODINGS	Date	02/06/17	Signer	[Signature]	Approved	M. GIBSON	Date	02/06/17	Signer	[Signature]	<p>PROJECT:</p> <p>TFL - Small Sites Project Due Diligence</p>		<p>ARCADIS Design & Consultancy for natural and built assets</p> <p>Registered office: 100 Abchurch Lane London EC4N 3DF www.arcadis.com</p>	
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<table border="1"> <tr> <td>REV</td> <td>Date</td> <td>Description</td> <td>Drawn</td> <td>Check</td> <td>Approv</td> </tr> <tr> <td>02</td> <td>02/06/17</td> <td>Designated Sites Map</td> <td>EP</td> <td>AB</td> <td>MG</td> </tr> </table>		REV	Date	Description	Drawn	Check	Approv	02	02/06/17	Designated Sites Map	EP	AB	MG	<p>TITLE:</p> <p>Christchurch Road International and National Statutory Designated Sites</p>		<p>Drawing Number: 0302-UE21-UA009686</p> <p>Revision: 02</p>																			
REV	Date	Description	Drawn	Check	Approv																														
02	02/06/17	Designated Sites Map	EP	AB	MG																														

FIGURE 2: EXTENDED PHASE 1 HABITAT MAP (WITH DEDICATED SURVEY RESULTS AND TARGET NOTES)



Appendix A : Desk Study Review

Statutory Designated Sites

The desk study found no Natura 2000 sites (SPAs, SACs, Ramsar) within 5km of the Site or LNR's within 2km of the Site.

Non-Statutory Designated Sites

The Lambeth Council website returned, the following non-statutory designated sites within 1km of the Site:

Sites of Borough Importance for Nature Conservation (SBINCs):

- Rush Common and Brixton Hill;
- Palace Road Nature Gardens;
- Unnamed – Railway sections;
- Brockwell Park; and
- Clapham common.

Sites of Metropolitan Importance for Nature Conservation (SMINCs):

- Tooting Common

It was assessed that there was negligible potential for significant impacts to these sites from any development on the Site.

Woodlands registered on the Ancient Woodland Inventory (AWI)

There were no woodlands registered on the Ancient Woodland Inventory found within 2km of the Site.

Non-Statutory Designated Sites

Table A:1: Non-Statutory Designated Sites

Site Name	Designation	Size (ha)	Distance (m)	Direction	Description
Sites of Borough Importance for Nature Conservation (SBINCs)					
Rush Common and Brixton Hill	SBINC	N/A	300	North	Rush Common land is a much valued and historic area whose character and open space provide a valuable amenity to Brixton.
Palace Road Nature Gardens	SBINC	0.6	500m	South east	A number of the trees and shrubs as well as part of the path system date from the original garden with specimen trees including evergreen oak, Swedish whitebeam and conifer now overlaid by native tree and regenerated native plant material. The pond has good aquatic planting, with a meadow near the entrance. The small park is off a tree-lined road with wide grass verges, itself an important survival of earlier landscaping.

Ecological Assessment

Site Name	Designation	Size (ha)	Distance (m)	Direction	Description
Unnamed – Railway sections	SBINC	N/A	700m	South and South west	Railway sections
Brockwell Park	SBINC	51	915m	North east	Brockwell Park is a large, historic park located between Brixton, Dulwich and Herne Hill. As well as ornamental ponds, formal flower beds, a walled 'Old English' herbaceous flower garden and a charming 19th century clock tower, Brockwell Park contains a number of historic buildings, including Brockwell Hall and the Brockwell Lido.
Clapham Common	SBINC	89	1900m	North west	Clapham Common is a large triangular urban park in Clapham, south London. Originally common land for the parishes of Battersea and Clapham, it was converted to parkland under the terms of the Metropolitan Commons Act 1878.
Sites of Metropolitan Importance for Nature Conservation (SMINCs)					
Tooting Common	SMINC	62	930m	South west	Tooting Common is a Site of Metropolitan Importance due to its stretches of acid grassland, and it is notable for the many large oak trees and historic avenues.

Overview of Protected, Notable and Invasive Species in London

This section of this report outlines the status of protected and notable species in London. The status of these species on the Site is discussed in section 3. Relevant conservation status and legislation is presented in Appendix B and C.

Non-native invasive species in Greater London

London is an extremely urbanised area and is a major international port for both people and goods, this in addition to its climate and major levels of construction has encouraged the spread of a number of non-native invasive species that are becoming pests. Therefore, in addition to those species listed on Schedule 9 of the Wildlife and Countryside Act (WCA)¹¹ (1981, as amended) there is a London Invasive Species Initiative (LISI)²²: Managed by the London Biodiversity Partnership, which lists non-native invasive species that should be controlled in London. Species potentially relevant to the Site include those presented in Table A2.

Table A.2: Potential Schedule 9 (WCA 1981, as amended) or LISI species

Common Name	English Name	Status
Japanese Knotweed	<i>Fallopia japonica</i>	Schedule 9 and LISI
Cotoneaster (numerous)	<i>Cotoneaster</i> spp.	Schedule 9 and LISI
Rhododendron	<i>Rhododendron ponticum</i>	Schedule 9 and LISI
Indian (or Himalayan balsam)	<i>Impatiens glandulifera</i>	Schedule 9 and LISI
Virginia creeper	<i>Parthenocissus quinquefolia</i>	Schedule 9
Montbretia	<i>Crocsmia x crocosmiiflora</i>	LISI
Cherry Laurel	<i>Prunus laurocerasus</i>	LISI
False acacia	<i>Robinia pseudoacacia</i>	LISI
Green alkanet	<i>Pentaglottis sempervirens</i>	LISI
Butterfly-bush	<i>Buddleia davidii</i>	LISI
Snowberry	<i>Symphoricarpos albus</i>	LISI
Tree of heaven	<i>Ailanthus altissima</i>	LISI
Holm oak	<i>Quercus ilex</i>	LISI
Passion flower	<i>Passiflora caerulea</i>	LISI
Spanish bluebell	<i>Hyacinthoides hispanica</i> & <i>H. x massartiana</i>	LISI
Holm oak	<i>Quercus ilex</i>	LISI

¹¹ WCA, 1981 as amended

²² London Invasive Species Plan (2012). Legislative and Information Exchange Framework. [online] Available at <http://www.londonisi.org.uk/tackling-inns/lisp/>. [accessed May 2017]

Bats in Greater London

From previous Arcadis work in London and from data from the London Bat Group the most likely bats species to be present are common and soprano pipistrelle (*Pipistrellus pipistrellus* and *P. pygmaeus*) which are by far the more frequent, followed by Daubenton's (*Myotis daubentoni* in the vicinity of open water) noctule (*Nyctalus noctula*) and brown long-eared (*Plecotus auritus*). These are all London BAP species and S41 species with the exception of Daubenton's and common pipistrelle. Full details of the conservation status of these species and the results from the London Bat Group Species Action Plan Audit are presented in Appendix B Table B2 **Error! Reference source not found.**

In general, every borough will have bats present, as even in the inner boroughs there are usually some areas of suitable habitat that can provide feeding habitat for small numbers of common and light tolerant bat species such as soprano and common pipistrelles. In general, the outer boroughs with larger areas of more suitable habitat should be expected to have higher numbers of bats and a greater diversity of species.

Birds in Greater London

There are a number of bird species that although relatively common are in decline and have been highlighted section 41 or London Priority BAP species and/or birds of conservation concern that have the potential to be present (Table A3).

Table A.3: *Birds of conservation concern associated with London*

Common Name	English Name	Status	Typical London habitats
Black redstart	<i>Phoenicurus ochrurus</i>	L	Traditionally found on brownfield sites around the built environment in proximity to standing or tidal Thames water
Dunnock	<i>Prunella modularis</i>	S41:L:	Associated with dense scrub and trees in private gardens and pocket parks
Grey heron	<i>Ardea cinerea</i>	L	associated with tidal Thames and standing water
House sparrow	<i>Passer domesticus</i>	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks traditionally a species associated with nesting in buildings
Peregrine	<i>Falco peregrinus</i>	L	Tidal Thames and the built environment using tall buildings for roosting and nesting and foraging on other birds particularly pigeons
Song thrush	<i>Turdus philomelos</i>	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks
Starling	<i>Sturnus vulgaris</i>	S41:L:R	Built environment
Tree sparrow	<i>Passer montanus</i>	S41:L:R	Associated with dense scrub and trees in private gardens and pocket parks

Section 41 = S41: London BAP = L: R = Birds of Conservation Concern Red List

Reptiles in Greater London

Records from SARG (Surrey Amphibian and Reptile Group) and the London Biodiversity Action Plan show that the presence of European Protected Species of reptile in the London area is generally very unlikely. Common lizard (*Zootoca vivipara*) and Slow worm (*Anguis fragilis*) are the most likely reptiles to be present followed by Grass snake (*Natrix natrix*) with Adder (*Vipera berus*) being unlikely to be present these are all Section 41 and London BAP species.

Badger in Greater London

Badger is a London BAP species and can be found using private gardens, woodlands and parklands across London.

Amphibians including Great Crested Newts (GCN) in Greater London

GCN are Section 41 and London BAP species, that while uncommon are found breeding in ponds associated with private gardens, from data available from Froglife (2012), 71 Sites across Greater London were surveyed where historical GCN records were identified, of none of these sites were located within the London Borough of Barnet¹². Of the other amphibians that are London BAP species Common frog (*Rana temporaria*), palmate newt (*Triturus helveticus*) and Common toad (*Bufo bufo*), common toad is also a Section 41 species

Other Potentially Relevant S41 and London BAP species

There are a number of other species that have the potential to be relevant to the Site:

- Black poplar (*Populus nigra*);
- Mistletoe (*Viscum album*);
- Hedgehog (*Erinaceus europaeus*); and
- Stag beetle (*Lucanus cervus*), there was an NBN record within 500m of the Site.

Table A.4: Designated site descriptions

Designation	Description
Special Areas of Conservation (SAC) Special Protected Areas (SPAs)	Sites designated under European law and are the most important sites for wildlife in the UK, along with Special Protected Areas (SPAs). SACs are designated under the European Habitats Directive (Council Directive 92/43/EEC). Both the Habitats and Birds Directives provide for the creation of a network of protected areas across the EU, to be known as 'Natura 2000'. The designations aim to conserve important or threatened species and habitats and provide them with increased protection and management
National Nature Reserve (NNR)	Statutory reserves established for the nation under the Wildlife and Countryside Act, 1981. NNRs may be owned by a relevant national body, e.g. Natural England, or by established agreement; a few are owned and managed by non-statutory bodies. NNRs cover a selection of the most important sites for nature conservation in the UK.
Sites of Special Scientific Interest (SSSI)	Are areas notified under the Wildlife and Countryside Act 1981 by Natural England as being of special interest for nature conservation. SSSI notification forms the statutory bedrock for site protection. Biological SSSIs form a national network of wildlife sites, with each site being of national significance for its nature conservation value. Consultation and some form of agreement with the national statutory conservation agency is mandatory before any listed, potentially damaging development or change in land use can be carried out
Local nature reserves (LNR)	These are land owned, leased or managed by Local Authorities and designated under the National Parks and Access to the Countryside Act. These are sites of some nature conservation value managed for educational objectives. In some cases it is managed by a non-statutory body (e.g. the London Wildlife Trust). Local Authorities have the power to pass bylaws controlling (e.g.) access, special protection measures.

¹² Capital Great Crested Newts Revisited (2012). Project report – Public Web Edition

Designation	Description
Sites of Metropolitan Importance for Nature Conservation (SMINCs)	These are sites that contain the best examples of London's habitats. These sites are of strategic significance and are therefore of the highest priority against damage or loss
Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II	Sites of Borough Importance for Nature Conservation (SBINCs) Grades I and II are important in the context of the borough. The nature conservation quality of these sites varies and so these sites are graded as I or II in relation to their nature conservation potential.
Sites of Local Importance for Nature Conservation (SINCs)	These are sites of particular importance to people nearby (such as residents and schools). Local sites are particularly important in areas otherwise deficient in nearby wildlife sites.

Appendix B : Bat Habitat Suitability and London Population Status

Table B: 1 BCT (2016) – Habitat Suitability Criteria

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	<p>A structure with one or more potential roost sites that could be used by individual bats opportunistically.</p> <p>However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions^a and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).</p> <p>A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.</p>	<p>Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat.</p> <p>Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.</p>
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species	<p>Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens.</p> <p>Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.</p>

Ecological Assessment

	conservation status, which is established after presence is confirmed).	
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	<p>Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge.</p> <p>High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland.</p> <p>Site is close to and connected to known roosts.</p>

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Table B: 2 Bat species status in London from the London Bat Species Action Plan Audit

Common Name	Latin Name	UK Status	London Status	Notes
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	Endangered BAP Priority	Extinct	Last Greater London record from Oxleas Wood in 1953.
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	Endangered BAP Priority	Extinct	Last Greater London record from Abbey Wood (Woolwich) in 1952-3.
Whiskered bat	<i>Myotis mystacinus</i>	Vulnerable	Rare	Due to difficulty in separation, these are considered together. Occur rarely and in low numbers in outer London Boroughs such as Hillingdon, Richmond, Bexley and Bromley. One current known (winter) roost only.
Brandt's bat	<i>Myotis brandtii</i>	Vulnerable	Rare	
Natterer's bat	<i>Myotis nattereri</i>	Vulnerable	Scarce	Still relatively few records in Greater London. Most central locations are Highgate Wood and Hampstead Heath, otherwise Richmond and Hounslow and occasionally other outer London Boroughs. 8 current known roosts (mostly winter).
Daubenton's bat	<i>Myotis daubentoni</i>	Not Threatened	Locally frequent but declining	Relatively widespread and strongly associated with ponds, lakes & rivers. Occasional summer roosts have been found in trees on Wimbledon Common and in Ruislip Woods. Contrary to the national trend, this species is apparently declining in London and its sensitivity to increasing ambient light levels is a possible reason. 4 current known winter roosts.
Serotine	<i>Eptesicus serotinus</i>	Vulnerable	Rare; has declined	Serotines are found in outer London Boroughs, especially Bromley, Havering, Sutton and Richmond. 2 current known summer roosts, in Bromley and Teddington.
Noctule	<i>Nyctalus noctula</i>	Vulnerable; declining BAP Priority	Widespread but declining	The status of this large, wide-ranging bat is difficult to assess, but the past two decades have seen a rapid decline in the species and this mirrors the national trend. An exclusively tree-roosting bat; current known roosts number <10 London-wide.
Leisler's bat	<i>Nyctalus leisleri</i>	Vulnerable	Scarce	Leisler's bat has been recorded infrequently in London area, yet sightings have doubled in the last three years. New foraging sites for the species include the Barnes area, Wandsworth Common and Brent Reservoir. 3 current known roosts (Haringey, Bromley and Bexley).

Common Name	Latin Name	UK Status	London Status	Notes
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	Not Threatened	Common	A widespread species, the common pipistrelle is believed to occur in all London boroughs. Roosts are still discovered relatively infrequently, however.
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	BAP Priority	Common	Also widespread and probably London's commonest bat. Apparently more associated with wetland habitats than its close relative, <i>P. pipistrellus</i> . Known roosts currently number 15-25?, but many more pass undetected.
Nathusius's pipistrelle	<i>Pipistrellus nathusii</i>	Rare	Rare	Only recently confirmed as a UK breeding species. Detector records from an increasing list of sites include Lesnes Abbey Woods, Chislehurst Ponds and the Wetland Centre at Barnes. 1 known current roost site in bat boxes in Hounslow.
Brown long-eared bat	<i>Plecotus auritus</i>	Declining BAP Priority	Scarce	Brown long-eared bats are fairly secretive and may be under-recorded in Greater London, although reasons for the national decline are also likely to affect London's population. Roosts have been found in Bexley, Bromley, Hillingdon, Wandsworth, Kensington & Chelsea, Barnet, and Richmond.

NB: This audit is based on data from the London Bat Project collected in the mid-1980s, as well as that collected since by the London Bat Group and is therefore not systematic. This audit is the best possible understanding of the status of bats in London that can currently be realised by the London Bat Group.

Appendix C: Selected Legislation, Nature Conservation Status and Policy

Legislation

Table C: 1 Legislation Summary

Receptor	Legislation
Nesting Birds	<p>The legislation relevant to the potential ecological constraints on Site associated with nesting birds.</p> <p>All wild birds, their nests and eggs are protected under the Wildlife and Countryside Act 1981 (as amended)¹³. Section 1 of the Act makes it an offence to:</p> <ul style="list-style-type: none"> intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built; or

¹³ Anon (1981) Wildlife and Countryside Act. HMSO, London

Receptor	Legislation
	<ul style="list-style-type: none"> • intentionally take or destroy an egg of any wild bird. <p>It is also an offence to:</p> <ul style="list-style-type: none"> • intentionally disturb any wild bird included in Schedule 1 of the Act while it is building a nest or is in, on or near a nest containing eggs or young; or • disturb dependent young of such a bird. • Species listed on Schedule 1 include the black redstart, barn owl (<i>Tyto alba</i>), Cetti's warbler (<i>Cettia cetti</i>) and kingfisher (<i>Alcedo atthis</i>). <p>There is no potential for Schedule 1 birds to be nesting on Site, the legislation regarding common nesting birds will be complied with due to the precautionary mitigation previously stated.</p>
<p>Badgers</p>	<p>Badgers are protected from inhumane killing or injury under the Badgers Act (1992)¹⁸, this also protects their setts from damage and prohibits blocking access to their setts.</p>
<p>Bats</p>	<p>The legislation relevant to the constraint identified associated with bats.</p> <p>Bats are protected under the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2010 (as amended).</p> <p>Bats are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and are subject to the provisions of Section 9 of the Act, which make it an offence to:</p> <ul style="list-style-type: none"> • intentionally or recklessly disturb a wild animal listed on Schedule 5 whilst it is occupying a structure or place which it uses for shelter or protection; • intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a wild animal listed on Schedule 5; • sell, offer or expose for sale, or to possess or transport for sale alive or dead wild animal listed on Schedule 5 or any part of or anything derived from a wild animal listed on Schedule 5. <p>Bats are also listed on Schedule 2 (European protected species of animals) of the Conservation of Habitats and Species Regulations 2010 (as amended) and are subject to the provisions of Regulation 41 which makes it an offence to:</p> <ul style="list-style-type: none"> • deliberately capture, injure or kill any wild animal of a European protected species; • deliberately disturb wild animals of any such species (where disturbance is likely to impair their ability to survive, breed or reproduce, rear or nurture their young; or to hibernate or migrate; or to affect significantly the local distribution or abundance of the species); • damage or destroy a breeding site or resting place of such an animal; or

¹⁸ Protection of Badgers Act 1992 (as amended)

Receptor	Legislation
	<ul style="list-style-type: none"> • be in possession of, control, transport, sell or exchange, or offer for sale or exchange any live or dead animal of such a species or any part of a wild animal or anything derived from an animal or any part of an animal of such a species.
<p>Great Crested Newts</p>	<p>Great crested newts are a European Protected Species (EPS), listed on Annex II and IV of the EEC Directive on the Conservation of Natural Habitats and Wild Fauna and Flora, receiving protection under The Conservation of Habitats and Species Regulations 2010. This species is also afforded full protection under the Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) (WCA 1981). Under such legislation it is an offence to:</p> <ul style="list-style-type: none"> • Intentionally or recklessly kill, injure or take a great crested newt; • Possess or control any live or dead specimen or anything derived from a great crested newt; • Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a great crested newt; and <p>• Intentionally or recklessly disturb a great crested newt while it is occupying a structure or place which it uses for that purpose.</p>
<p>Reptiles</p>	<p>The relevant legislation relevant to the constraint identified associated with reptiles All native British reptile species are protected under the Wildlife and Countryside Act 1981 (as amended). Reptiles are listed under Schedule 5 of the Act. The four more widespread species including common lizard, slow worm, adder and grass snake are subject to some of the provisions of Section 9 of the Act, which make it an offence to:</p> <p>*</p> <ul style="list-style-type: none"> • intentionally kill or injure a reptile; or * sell, offer or expose for sale, or • to possess or transport for sale alive or dead reptile or any part of, or anything derived from, a reptile.
<p>Other Mammals</p>	<p>Other mammals not protected by their own legislation are protected by the Mammal Act (1996). The Act makes provision for the protection of wild mammals from certain cruel acts.</p> <p>An offence is committed if any person mutilates, kicks, beats, nails, or otherwise impales, stabs, burns, stones, crushes, drowns, drags, or asphyxiates any wild mammal with intent to inflict unnecessary suffering.</p>
<p>Non Native Invasive Species</p>	<p>Numerous species are listed on Schedule 9 (of the Wildlife and Countryside Act 1981, as amended) whereby it is an offence to grow or to cause this species to grow in the wild. A species on Schedule 9 that commonly occurs in London is Japanese Knotweed (<i>Fallopia japonica</i>) which is also covered by the Environmental Protection Act (EPA) 1990 which designates this as a controlled waste.</p>

Nature Conservation Status

- **Birds of Conservation Concern (BOCC) (2015)**

The UK's leading bird conservation organisations worked together to produce The Population Status of Birds in the UK: Birds of Conservation Concern Four (BoCC).

Commonly referred to as the UK Red List for birds, this is the fourth review of the status of birds in the UK, Channel Islands and Isle of Man, and updates the last assessment in 2009. Using standardised criteria, 244 species with breeding, passage or wintering populations in the UK were assessed by experts from a range of bird NGOs and assigned to the Red, Amber or Green lists of conservation concern.

Table C: 2 Bird Population Status Criteria for Birds of Conservation Concern in the UK

Criteria	Status
Red list criteria	<p>Globally threatened</p> <p>Historical population decline in UK during 1800–1995</p> <p>Rapid (> or =50%) decline in UK breeding population over last 25 years Rapid (> or =50%) contraction of UK breeding range over last 25 years</p>
Amber list criteria	<p>Historical population decline during 1800–1995, but recovering; population size has more than doubled over last 25 years</p> <p>Moderate (25-49%) decline in UK breeding population over last 25 years</p> <p>Moderate (25-49%) contraction of UK breeding range over last 25 years</p> <p>Moderate (25-49%) decline in UK non-breeding population over last 25 years</p> <p>Species with unfavourable conservation status in Europe, termed Species of European Conservation Concern (SPEC)</p> <p>Five-year mean of 1–300 breeding pairs in UK</p> <p>> or =50% of UK breeding population in 10 or fewer sites, but not rare breeders</p> <p>> or =50% of UK non-breeding population in 10 or fewer sites</p> <p>> or =20% of European breeding population in UK</p> <p>> or =20% of northwest European (wildfowl), East Atlantic Flyway (waders) or European (others) non-breeding populations in UK</p>
Green list	No identified threat to the population's status

Relevant Policy

National

The Site survey, assessment and recommended mitigation ensure compliance with the following policies, any additional enhancement measures would further comply with these policies:

- **The National Planning Policy Framework (NPPF 2012)**¹⁴ sets out how the planning system should protect and enhance nature conservation interests. Section 11 is concerned with conserving and enhancing the natural environment Opportunities to enhance biodiversity are also encouraged.
- **The Natural Environment and Rural Communities (NERC) Act 2006**¹⁵ places a duty upon public bodies to consider Section 41 lists flora, fauna and habitats (previously UK BAP habitats and species) as a material consideration in planning and to consider enhancement of biodiversity.
- **Biodiversity 2020:** A strategy for England's Wildlife and Ecosystem Services¹⁶ includes a list of Habitats of Principal Importance in England (HPIEs) and Species of Principal Importance in England (SPIEs). These were previously included as Priority Habitats and Priority Species in the UK BAP.

London

- **London Invasive Species Initiative (LISI)**¹⁷: Managed by the London Biodiversity Partnership, LISI lists non-native invasive species that should be controlled in London. Species relevant to the Scheme include Japanese Knotweed and Butterfly-bush.
- **London Biodiversity Action Plan (BAP)**¹⁸: Managed by the London Biodiversity Partnership (2006), the London BAP sets out priority habitats and species for the city. London BAP habitats relevant to the Scheme include reed beds, standing water and wasteland.
- **The London Plan (2011) Strategic Policy 7.19 Biodiversity and Access to Nature and Policy 7.21 Trees and woodlands) (updated with the Minor Alterations to the London Plan 2016)**¹⁹: Regional planning policy for London is presented in the London Plan: Spatial Development Strategy for Greater London. It contains various policies with regard to nature conservation in London, which include commitments to protect, enhance, create, promote, expand and manage the extent and quality of green infrastructure and biodiversity and to increase access to nature, the following elements of SP 7 are as follows:
 - **Strategic Policy 7.19 Biodiversity and Access to Nature and Policy:**
 - A) The Mayor will work with all relevant partners to ensure a proactive approach to the protection, enhancement, creation, promotion and management of biodiversity in support of the Mayor's Biodiversity Strategy.
 - B) Any proposals promoted or brought forward by the London Plan will not adversely affect the integrity of any European site of nature conservation importance.
 - C) Development Proposals should:
 - a) wherever possible, make a positive contribution to the protection, enhancement, creation and management of biodiversity
 - b) prioritise assisting in achieving targets in biodiversity action plans (BAPs), set out in Table 7.3, and/or improving access to nature in areas deficient in accessible wildlife sites
 - c) not adversely affect the integrity of European sites and be resisted where they have significant adverse impact on European or nationally designated sites or on the population or conservation status of a protected species or a

¹⁴ Anon (2012) The National Planning Policy Framework HMSO, London

¹⁵ Anon (2006) The Natural Environment and Rural Communities Act HMSO, London

¹⁶ Department for Environment, Food and Rural Affairs (2011) *Biodiversity 2020: A strategy for England's Wildlife and Ecosystem Services*

¹⁷ London Invasive Species Plan (2012). Legislative and Information Exchange Framework. [online] Available at <http://www.londonisi.org.uk/tackling-inns/lisp/>. [Available June 2016]

¹⁸ City of London (2009). *London Biodiversity Action Plan 2010 – 2015*

¹⁹ Greater London Authority (2011) *The London Plan Strategic Policy 7.19 Biodiversity and Access to Nature and Policy 7.21 Trees and woodlands) (updated with the Minor Alterations to the London Plan 2016)*

- priority species or habitat identified in a UK, London or appropriate regional BAP or borough BAP.
- D) On Sites of Importance for Nature Conservation development proposals should:
 - a) give the highest protection to sites with existing or proposed international designations¹ (SACs, SPAs, Ramsar sites) and national designations² (SSSIs, NNRs) in line with the relevant EU and UK guidance and regulations
 - b) give strong protection to sites of metropolitan importance for nature conservation (SMIs). These are sites jointly identified by the Mayor and boroughs as having strategic nature conservation importance
 - c) give sites of borough and local importance for nature conservation the level of protection commensurate with their importance.
 - E) When considering proposals that would affect directly, indirectly or cumulatively a site of recognised nature conservation interest, the following hierarchy will apply:
 - 1 avoid adverse impact to the biodiversity interest
 - 2 minimize impact and seek mitigation
 - 3 only in exceptional cases where the benefits of the proposal clearly outweigh the biodiversity impacts, seek appropriate compensation.
 - F) In their LDFs, Boroughs should:
 - a use the procedures in the Mayor's Biodiversity Strategy to identify and secure the appropriate management of sites of borough and local importance for nature conservation in consultation with the London Wildlife Sites Board.
 - b identify areas deficient in accessible wildlife sites and seek opportunities to address them
 - c include policies and proposals for the protection of protected/priority species and habitats and the enhancement of their populations and their extent via appropriate BAP targets
 - d ensure sites of European or National Nature Conservation Importance are clearly identified
 - e identify and protect and enhance corridors of movement, such as green corridors, that are of strategic importance in enabling species to colonise, re-colonise and move between sites.
 - **Strategic Policy 7.21 Trees and Woodlands:**
 - A) Trees and woodlands should be protected, maintained and enhanced, following the guidance of the London Tree and Woodland Framework (or any successor strategy). In collaboration with the Forestry Commission the Mayor has produced supplementary guidance on Tree Strategies to guide each borough's production of a Tree Strategy covering the audit, protection, planting and management of trees and woodland. This should be linked to a green infrastructure strategy.
 - B) Existing trees of value should be retained and any loss as the result of development should be replaced following the principle of 'right place, right tree. Wherever appropriate, the planting of additional trees should be included in new developments, particularly large-canopied species.
 - C) Boroughs should follow the advice of paragraph 118 of the NPPF to protect 'veteran' trees and ancient woodland where these are not already part of a protected site.
 - D) Boroughs should develop appropriate policies to implement their borough tree strategy.
 - **The London Plan (2011) , Housing Supplementary Planning Guidance (March 2016)²⁰:**

With regards to housing, recently a dedicated supplementary planning guidance has been produced, the relevant elements of which are presented below

²⁰ Greater London Authority (2016) *London Plan 2016 Implementation Housing Supplementary Planning Guidance adopted in March 2016*

- Standard 40 and Policy 7.19 “Biodiversity and access to nature promotes a proactive approach to the protection, promotion and management of biodiversity across the capital” and that “Proposals for development should give full consideration to their direct and indirect effects on ecology. Ecological improvements can be achieved as part of Sustainable Urban Drainage Systems and incorporated into green or brown roofs, green walls and soft landscaping.”
- Policies 7.19 and 7.21 “supporting biodiversity, protecting London’s trees, ‘green corridors and networks”.
- Development proposals should also enhance provision of green infrastructure in the public realm, helping to mitigate and adapt to climate change (Policy 5.10 Urban Greening), extend tree cover (Policy 7.21), improve biodiversity (Policy 7.19).
- Public, communal and private open spaces should be protected and enhanced, and where possible new open spaces should be created. This is supported by Policy 2.18 Green Infrastructure, Policy 7.18 Protecting open space, Policy 7.19 Biodiversity and Policy 7.21 Trees and Woodlands.
- **The Mayor’s Biodiversity Strategy (2002)**²¹: Connecting with London’s Nature: The Mayor’s Biodiversity Strategy provides a statutory framework for the delivery of biodiversity policies in London. It seeks to ensure that there is no overall loss of wildlife habitats in London.
- **The London Plan (2011), Sustainable Design and Construction Supplementary Planning Guidance (April 2014)**²²:
 - Mayor’s Priority - Developments should contribute to the Mayor’s target to increase tree cover across London by 5% by 2025.
 - Mayor’s Priority - There is no net loss in the quality and quantity of biodiversity.
 - Mayor’s Priority - Developers make a contribution to biodiversity on their development site.
 - Mayor’s Priority - Any loss of a tree/s resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of providing the same canopy cover as that provided by the original tree/s.

Local

- **Lambeth Local Plan** (London Borough of Lambeth 2011)²³
 - Policy D3: In order to support growth in the borough, the council will safeguard and improve essential social, physical and green infrastructure and work in partnership with service providers to ensure the delivery of the additional infrastructure. The potential and predicted infrastructure requirements over the lifetime of the Local Plan;
 - Policy EN1: Open space and Biodiversity: The council will meet requirements for open space by: Protecting and maintaining open spaces and their function. Development which would involve the loss of existing public or private open space will not be supported unless at least one of the following tests is met:
 - (i) Replacement open space of equivalent or better quality and quantity is provided within a suitable location in the local area.
 - (ii) In the case of housing estate amenity areas, significant regeneration and community benefits would be achieved that could not be achieved in any other way, and appropriate compensatory provision for the loss of open space is made, including improvements to the quality of the remaining open space.
 - (iii) It is for the provision of facilities directly related to the use of open space including ecology centres, indoor sports facilities, changing rooms, toilets or cafes as long as these are appropriate in scale and form to the size and character of the open space and acceptable in terms of impact on openness and do not harm the function and operation of the open space.
 - Policy Q9: Landscaping: Development will be supported where landscaping:
 - (i) is fit for purpose and demonstrates that satisfactory provision has been made for future growth and aftercare;

²¹ Greater London Authority (2002), *Connecting with Nature: The Mayor’s Biodiversity Strategy adopted in 2002*

²² Greater London Authority (2011), *The London Plan Sustainable Design and Construction Supplementary Planning Guidance adopted in April 2014*

²³ <https://www.lambeth.gov.uk/sites/default/files/pl-lambeth-local-plan-2015.pdf> London Borough of Lambeth 2015, [accessed June 2017]

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- (ii) retains and enhances existing planting and landscape features of value and protects them during construction;
- (iii) protects and enhances existing designated habitats and creates new habitats/areas of nature conservation interest and biodiversity value;
- (iv) maximises opportunities for greening, such as through planting of trees and other soft landscaping;
- (v) makes use of plant species that are in keeping with the character of the existing vegetation on the site and in the general area;
- (vi) takes into account established or potential pedestrian and cycle desire lines and suitably accommodates them;
- (vii) provides strong boundary treatments, including trees and shrubs where appropriate;

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**TFL_PSF_9131 SITE
INVESTIGATIONS: SMALL SITES
INITIATIVE
LAND AT CHRISTCHURCH ROAD AND
BRIXTON HILL, LAMBETH, SW2 4AP**

Site Ref: 901

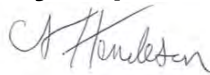
Preliminary BS5837:2012 Tree Survey Report

OCTOBER 2017

LAND AT CHRISTCHURCH ROAD AND BRIXTON HILL, LAMBETH, SW2 4AP

Preliminary BS5837:2012 Tree Survey Report

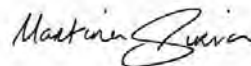
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This report dated 02 October 2017 has been prepared for Transport for London (TfL) (the "Client") in accordance with the terms and conditions of appointment dated 02 May 2017 (the "Appointment") between the Client and Arcadis Consulting (UK) Limited ("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 Overview

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a number of technical surveys for Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP hereafter referred to as "the Site".

TfL is aiming to divest a number of small Sites to enable prospective regeneration. The objective of the Small Sites Initiative is to provide robust and pragmatic advice such that unreasonable "abnormal" development costs are not included by developers.

The objective of this assessment is to present the potential constraints and future requirements with regards to trees and any future development.

1.2 Site Location and Setting

The Site is located south of the A205, in the London Borough of Lambeth and centred at the central grid reference of 530503, 173418 and around the postcode of SW2 4AP.

It is approximately 0.32ha in area and is currently comprised of dense scrub dense scrub, tall ruderals and managed and unmanaged grassland with scattered broadleaved trees.

The immediate surrounding is largely residential. The Site adjoins the public footpath to the north and west, to the south is an area of dense scrub that has a number of scatted mature trees within it, and to the east Garden Lane an unclassified access road.

An aerial screen shot illustrating the Site boundary is presented in Image 1-1. Photographs of the Site and trees can be found in Appendix D - Photographs.

Image 1-1 Site Location Plan



2 Methodology

2.1 Tree Survey Methodology

An Arboricultural Survey was undertaken by Callum Henderson BSc (For) M. ArborA (Principle Arboriculturist) on 30th June 2017 in accordance with BS 5837:2012.

Observations were conducted from ground level, utilising the “Visual Tree Assessment” (VTA) system as outlined in The Body Language of Trees, A Handbook for Failure Analysis Research for Amenity Trees No.4 (Department of the Environment, 1994) with the aid of binoculars.

The Site and its immediate surroundings were surveyed. This area is referred to as the study area.

2.2 Individual Trees and General Data Capture

For reference, individual trees are identified with the letter T and associated number on the Tree Schedules and a Tree Constraints Plan. The stem diameter of the trees on Site was recorded using a rounded down diameter tape at 1.5m above ground level. Measurements were taken in millimetres. The height of the subject trees was estimated to the nearest metre using a digital clinometer.

Maximum crown spread of the subject tree was measured from the centre of the trunk to the tips of the live lateral branches taken at four compass points (N-E-S-W) using a ground tape. Crown spread measurements were taken in metres.

Tree age was estimated from visual indicators (such as tree size and appearance of bark) which was taken as a provisional guide. Age estimates often need to be modified based on further information such as historical records and local knowledge.

If direct access to the tree was not possible, estimations from appropriate vantage points were taken, any limitations or estimations are presented within the survey limitations section and noted in the associated schedules.

2.3 Groups of Trees

Groups of trees are identified with the letter G and number on the associated Tree Schedules and Tree Constraints Plan. Stem diameter of groups of trees was set as an average stem diameter of the trees within these individual groups and a maximum height of the tallest tree within the group.

2.4 Categorisation

In compliance with Table 1 of BS 5837: 2012 the trees surveyed have been categorised according to their arboricultural quality and value. A glossary of survey terms can be found in Appendix A - Explanation of Terms.

2.5 Root Protection Area

The Root Protection Areas (RPA) of the trees were calculated in accordance with Section 4.6.1 in BS: 5837:2012. This is calculated from the measurement of the stem diameter at 1.5m above ground level or at ground level if the tree is multi-stemmed. These are recorded in Table B2 in the appendix and as a circle on the initial Tree Protection Plan (TPP) and form the initial Construction Exclusion Zone (CEZ) to protect the trees within and adjoining the Site. The RPA is represented by pink-shaded areas in the Tree Constraints Plan. The shape and size of RPAs can be amended in accordance with Section 4.6.3 in BS: 5837:2012.

Within Section 5.3.1 in BS: 5837:2012 it is stated the default position is that proposed development should not be within the RPA of retained trees, however, where there is an overriding need for construction and associated activity with the RPA of trees arboricultural mitigation should take place to protect the trees.

2.6 Survey Limitations

Topographical base mapping was provided. For the purposes of BS 5837: 2012, only trees with a stem diameter greater than 75mm, (measured at 1.5m above ground level), have been included within the survey.

However, it should be noted that a number of individual trees and shrubs with a stem diameter of less than 75mm were present within the study area.

Only trees within the study area as defined above were assessed. The RPAs are based on a given tree stem diameter taken at 1.5m above ground level with each RPA (see Appendix B - Tree Schedules) being calculated from the above ground portions of the tree. It should be recognised that the RPA may not entirely encompass all of the tree's rooting material.

Some areas of the study area were off-Site within neighbouring properties, preventing a full assessment and an accurate measurement of some trees. Where tree survey data has been estimated (based on assessments from the nearest safe vantage points). These trees are denoted by a # in the associated Schedules.

Trees are living organisms and as such their health and condition are naturally subject to change over time. Unforeseen future circumstances such as neglect, wilful damage or severe/extreme weather conditions may affect the future health and condition of the trees included in this report.

2.7 Statutory Tree Protection

A search was undertaken on the Local Planning Authority (LPA) on 6th July 2017. According to the London Borough of Lambeth pdf list on their Websites <https://www.lambeth.gov.uk/sites/default/files/pl-tree-preservation-order-schedule.pdf> there are Orders protecting trees on and off-Site.

The trees within the Site are protected by London Borough of Lambeth No.160 (Land fronting Streatham Hill and Christchurch Road) TPO 1980.

The off-Site trees to the east of the Site on the other side of Garden Lane, separated from the site by a single track road, are protected by London Borough of Lambeth No.159 (Land between 6 Christchurch Road and Garden Lane) TPO 1980.

The Site and the off-Site trees are not within a Conservation Area and there are no Planning Application Conditions protecting the trees.

The 12 on-Site trees covered by TPO No.160, five have been previously felled and are numbered T2, 4, 5, 10, 11 and 12 on the TPO (Appendix E) which relate to T5, 8, 7,17, 16, 14 within this report.

The off-Site trees T8 to T13 covered by TPO No. 159 and are numbered T1, 2 and G1 within this report and may be within the zone of influence of future development on the Site (Appendix E).

When tree maintenance works are undertaken by a Highway Authority to trees protected by a TPO and within a Conversation Area are considered an exception within the Town and Country Planning (Tree Preservation) (England) Regulations (2012). However, all non-routine tree works including works to enable development must have a decision notice approving the tree works or Full Planning Consent from the LPA before the tree works take place.

3 Tree Survey Results

3.1 Tree Assessment and Categorisation

A total of 23 arboricultural items were recorded within the study area as follows:

- Twelve individual trees on-Site (T3, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16 and T17);
- Three groups of trees on-Site (G4, G5 and G6);
- Five individual trees (T1, T2, T4, T5 and T6) on the east side of Garden Lane;
- Three groups of trees (G1, G2 and G3) on the east side of Garden Lane.

Full details of the survey data are presented within the Tree Schedules in Appendix B and Figure 1 Tree Constraints Plan.

Each arboricultural item was assigned to one of four categories, as listed below:

- Category A individual trees, groups of trees: Three individual trees (T8, T9 and T17) and one group (G1) were graded as Category A (trees of high quality) as part of this survey;
- Category B individual trees, groups of trees: Three individual trees (T2, T5 and T7) and one group (G6) were graded as Category B (trees of moderate quality) as part of this survey;
- Category C individual trees, groups of trees: Four individual trees (T6, T12, T13 and T14) and two groups (G2 and G3) were graded as Category C (trees of low quality) as part of this survey due to poor form or inappropriate past management;
- Category U individual trees, groups of trees: Seven individual trees (T1, T3, T4, T10, T11, T14 and T15) and two groups (G4 and G5) were graded as Category U (trees of poor quality unsuitable for retention) as part of this survey due to poor structural and physiological condition.

3.2 Tree Species Diversity

Ten different tree species were recorded during the survey and are represented throughout the study area. A summary of the species surveyed can be found within the Tree Schedule in Appendix B and also provided in Table 1 Table 1 Tree Species Recorded. The numbers below include species of individual trees and groups of trees.

Table 1 Tree Species Recorded

Tree Species	Number of Individual Stems	Approximate Percentage
Ash (<i>Fraxinus excelsior</i>)	8	11%
Common holly (<i>Ilex aquifolium</i>)	1	1.5%
Common lime (<i>Tilia x europaea</i>)	8	11%
False acacia (<i>Robinia pseudoacacia</i>)	41	55%
Goat willow (<i>Salix caprea</i>)	1	1.5%
Holm oak (<i>Quercus ilex</i>)	1	1.5%
Horse chestnut (<i>Aesculus hippocastanum</i>)	1	1.5%

Tree Species	Number of Individual Stems	Approximate Percentage
London plane (<i>Platanus x hispanica</i>)	1	1.5%
Sycamore (<i>Acer pseudoplatanus</i>)	10	14%
Wild cherry (<i>Prunus avium</i>)	1	1.5%
Totals	73	100%

3.3 Age Diversity

Analysis of the data identified that the majority of the trees within the study area were within the young age classification set by BS 5837: 2012 with an estimated useful life expectancy of over 20 years, as illustrated in Table 2.

Table 2 Age Diversity

Age Class	Number of Individual Stems	Approximate Percentage
Young	39	53%
Early-mature	5	7.25%
Semi-mature	4	5.5%
Mature	20	27%
Over-mature	5	7.25%
Totals	73	100%

3.4 Bat Roosting Potential

While undertaking the Arboricultural Survey, an assessment of the trees potential to support roosting bats was undertaken in accordance with Bat Conservation Trust (BCT), Bat Surveys for Professional Ecologists: Good Practice Guidelines, 2016. All trees that were surveyed within this Tree Survey had negligible potential to support bats.

4 Discussion and Conclusions

A total of 23 arboricultural items were recorded within the study area as follows:

- Twelve individual trees on-Site (T3, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16 and T17);
- Three groups of trees on-Site (G4, G5 and G6);
- Five individual trees (T1, T2, T4, T5 and T6) on the east side of Garden Lane;
- Three groups of trees (G1, G2 and G3) on the east side of Garden Lane.

Within the Site three individual trees (T8, T9 and T17) and one group off-Site (G1) has been identified as Category A (trees of high quality). Within the Site one individual tree (T7) and one Group (G6) and two off-Site individual trees (T2 and T5) have been identified as Category B (trees of moderate quality). Within the Site four individual trees (T6, T12, T13 and T14) and two groups (G2 and G3) have been identified as Category C (trees of low quality). Within the Site five individual trees (T3, T10, T11, T14, T15) and two groups of trees (G4 and G5) and two off-Site individual trees (T1 and T4) have been identified as Category U (trees of poor quality unsuitable for retention).

Although the Site and the off-Site trees are not within a Conservation Area and there are no Planning Application Conditions protecting the trees, some trees that were recorded within the study area (the Site and its immediate surroundings) are protected by two Tree Preservation Orders (TPO) that protect on-Site and off-Site trees. These Orders are the London Borough of Lambeth No.160 (Land fronting Streatham Hill and Christchurch Road) TPO 1980 and London Borough of Lambeth No.159 (Land between 6 Christchurch Road and Garden Lane) TPO 1980. Within the Site a total of five trees are protected by TPO No.160, one off-Site is protected by TPO No.160 and six off-Site trees are protected by TPO No.159.

In the absence of a design layout for the site, it is difficult to say whether the trees would need to be removed and if there is space for any new trees to be re-provisioned on the site. Once designs are developed then this could be determined.

While not likely to prevent development, tree protection for trees to be retained and tree re-provisioning for any trees lost due to development are a material consideration for planning determination. The TPOs may present constraints to the design and construction of this Site in terms of a reduction in potentially developable land if they are to be retained. For any works to trees covered by a TPO it is a requirement to contact the LPA and follow the appropriate procedures before undertaking any works that might affect the protected trees. The procedures require an application to the LPA to remove or undertake works on the TPO trees, a decision which can often take at least 2 months. This application to remove can also be incorporated into a planning application submission and subsequent decision. Consultation with the LPA is recommended at the earliest opportunity to determine the development parameters of the Site.

If trees cannot be replaced on-Site due to development, off-Site options for tree re-provisioning to ensure no net loss should be considered. Individual Local Planning Authority (LPAs) may ask for re-provisioning in excess of 1 to 1 for trees of Category A or B grade or ask for additional re-provisioning for trees with protected by a TPO.

The on-Site trees T8 London plane (*Platanus x hispanica*), T9 common lime (*Tilia x europaea*) and T17 common lime are all Category A trees and T8 and T17 are protected within the TPO No.160. These trees are likely to present a constraint to any future development of the Site in terms of a reduction in developable land if they are to be retained or the need for gaining consent for any impacts on the trees.

The on-Site false acacia (*Robinia pseudoacacia*) T14 (protected by TPO no.160) and T15 have been categorised as Category U trees given their dangerous structural form and they are located within failure distance of the public highway. Given that T14 is protected by a TPO a five days' notice of an imminently hazardous and or dangerous tree has to be submitted to the LPA before any tree works take place.

The off-Site trees common lime within G1 and T2, (known as T9 to T13 on the TPO) are Category A (G1) and Category B (G2) trees and are protected within the TPO No.159. These trees have the potential to be an access constraint within any future construction and development of the Site should the Green Lane need to be widened. Given the protection of these lime trees full consideration should be given to preventing impacts

to these trees should Garden Lane be used as an access route for construction. The crowns of G1 and T2 are over growing Garden Lane and the roots are likely to be running underneath the lane. Any works to crown lift (i.e. to remove the basal branches of the tree) the trees and works that would prune the roots of G1 will require consent from the LPA.

The off-Site horse chestnut T1 is also within the TPO No.159 (known as T8 on the TPO) and may also be within the zone of influence of any future development. The other trees covered within the TPO No 159 are not likely to be within the zone of influence of the scheme.

The main development considerations for the trees protected by the on-Site Order (TPO No.160) and the off-Site Order (No.159) are:

- Location of TPO trees within developable area;
- Over-hanging crowns;
- The planting location, height, width and density of the crowns will cast shade on to the Site;
- The RPA of the trees within the Site; and
- According to British Geological Survey on-line map the Site is on London Clay. Therefore, the foundation design of any proposed new structure will have to reduce the risk of vegetation induced clay shrinkage subsidence damage occurring.

5 Further Work

Consultation with the LPA regarding the potential TPO constraints is advised at the earliest opportunity to determine the parameters of any future development.

Should any future proposed development require tree removals or RPA incursions within RPA's of the retained trees an Arboricultural Impact Assessment (AIA) will be required by the LPA in support of a planning application.

The AIA should include a tree schedule, although one is provided within this report, a review of any proposed development should be undertaken to ensure that there are no additional trees within the zone of influence of the development. For example, parking requirements often extend the zone of influence.

The AIA should state the trees to be removed due to the design and access requirements and any proposed tree facilitation pruning works. This should also be accompanied by an assessment of the likely impacts due to construction activity on the trees to be retained. Indicative arboricultural mitigation measures should be provided which would include recommendations for tree re-provisioning. The AIA should be accompanied by an updated Tree Constraints Plan and a Tree Impact and Protection Plan based on the proposed design.

The AIA should also include a Tree Replacement Strategy which should take into consideration the landscape character, local treescape and biodiversity features of the immediate and adjoining areas. The species, number, size, type of stock, location and planting aids for the compensating planting should be chosen for landscape, wildlife and arboriculture values. To ensure that appropriate and sustainable planting is achieved advice should be sought from an ecologist and arboriculturist. Furthermore, liaison with the LPA Tree Officer will be necessary during the planning process to agree an approved tree compensation and or landscape scheme plan.

All new tree planting should be in accordance with British Standard 8545: Trees: From Nursery to Independence in the Landscape – Recommendations, 2014 and all tree works must be carried out by a qualified contractor in accordance with BS3998:2010: Tree Work – Recommendations.

This document encloses a Preliminary Arboricultural Method Statement (AMS) outlining tree protection measures. However following planning determination and when full construction measures are known a bespoke AMS may be required to ensure protection of the trees to be retained on and adjoining the Site.

6 References

British Standards Institution (2010) BS 3998:2010, Tree Work Recommendations.

British Standards Institution (2012) BS 5837: 2012 Trees in relation to design, demolition and construction – Recommendations.

British Standards Institution (2014) BS 8545: Trees: From nursery to Independence in the Landscape – Recommendations.

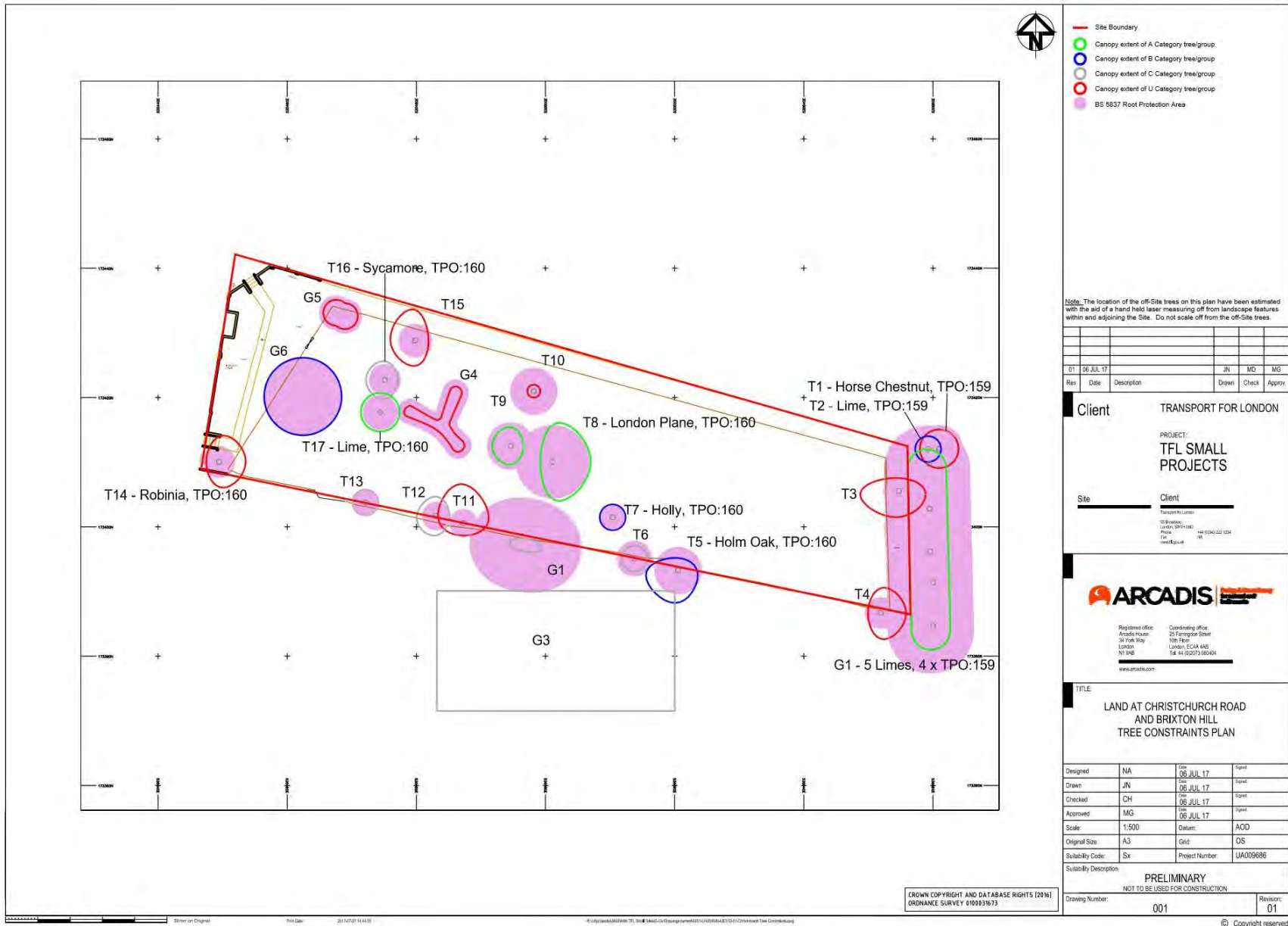
Mattheck, C. and Broeler, H. DETR (1994) The Body Language of Trees: A Handbook for Failure Analysis Research for Amenity Trees No.4.

The Secretary of State for Communities and Local Government, Statutory Instruments (2012) No. 605, The Town and Country (Tree Preservation) (England) Regulations 2012.

British Geological Survey on-line map accessed July 2017

<http://mapapps.bgs.ac.uk/geologyofbritain/home.html?location=SW23ES&gobBtn=go>

FIGURE 1. Tree Constraints Plan



APPENDIX A. Explanation of Terms

Age Class

Young – Trees in the first fifth of full life expectancy

Semi-mature – Trees in the second fifth of full life expectancy

Early-mature – Trees in the third fifth of full life expectancy

Mature – Trees in the fourth fifth of full life expectancy

Over Mature – Trees having reached full life expectancy and trees in natural decline

Veteran – Trees of interest biologically, culturally and aesthetically because of their age

Stem Diameter

The diameter of the stem measured in millimetres (mm) at a height of 1.5m above ground level

Crown Spread

Average measured in metres using a ground tape where possible

Physiological Condition

Good – Healthy tree with no signs of ill health and signs of good extension growth for species

Fair – Trees with signs of disease, minor defects and decreased life expectancy due to physical damage

Poor – Trees with significant disease, significantly reduced life expectancy and/or under major physiological stress

Dead – Dead tree or trees with over 70% crown dieback

Structural Condition

Good – Trees with no significant defects

Fair – Trees with remedial defects which require minor tree surgery works

Poor – Trees with remedial defects which require significant tree surgery works or felling

Dead – Trees which require felling

BS 5837 Retention Category

Each tree, group of trees or hedge is assigned to a retention category where:

Table A1 Categorisation of trees

Category	Description
A	Trees of high quality and value, retention is highly desirable
B	Trees of moderate quality and value where retention is desirable
C	Trees of low quality and value, or young trees with a stem diameter <150mm. Category C trees may be retained, replaced or in the case of younger trees, relocated
U	Trees of poor quality and value, unsuitable for retention or trees which should be removed

In addition, each tree, group of trees or hedge is assigned to a retention sub-category where categorisation is for:

Table A2 Reasons for Categorisation

Sub-category	Reason for Categorisation
1	Mainly arboricultural qualities
2	Mainly landscape qualities
3	Mainly cultural values, including conservation

APPENDIX B. Tree SchedulesClient: **Transport for London (TfL)**
Survey date: **30th June 2017**Project: **Land at Christchurch Hill and Brixton Hill, Lambeth SW2 4AP**
Surveyor: **Callum Henderson BSc (For) M. ArborA**

Table B1 Tree Schedule

Tree reference number	Species	Height (m)	Stem diameter (mm)	Branch spread (m)				Height of crown clearance (m)	Age class	Physiological condition	Structural condition	Additional Information/Bat Roosting Potential	Estimated remaining contribution (years)	Category grading
				N	E	S	W							
T1	Horse chestnut (<i>Aesculus hippocastanum</i>)	20	600	3	3	3	3	2	Over-mature	Poor	Poor	Negligible TPO No 159 T8	<10	U
T2	Common lime (<i>Tilia x europaea</i>)	22	600	2	2	2	2	2	Mature	Fair	Fair	Negligible TPO No 159 T9	20-40	B1,2,3
T3	Sycamore (<i>Acer pseudoplatanus</i>)	16	340	2	5	4	6	2	Mature	Fair	Poor	Negligible	<10	U
T4	Sycamore (<i>Acer pseudoplatanus</i>)	16	400	4	4	4	2	2	Over-mature	Poor	Poor	Negligible	<10	U
T5	Holm oak (<i>Quercus ilex</i>)	18	600	2	3	5	5	1	Mature	Fair	Poor	Negligible TPO No 160 T2	20-40	B1,2,3
T6	Ash (<i>Fraxinus excelsior</i>)	12	450	2	2	2	2	2	Early-mature	Poor	Poor	Negligible	10-20	C2
T7	Common holly (<i>Ilex aquifolium</i>)	10	300	2	2	2	2	1	Semi-mature	Fair	Good	Negligible TPO No 160 T5	20-40	B2
T8	London plane (<i>Platanus x hispanica</i>)	18	940	6	6	6	3	2	Mature	Good	Good	Negligible TPO No 160 T4	+40	A1,2
T9	Common lime (<i>Tilia x europaea</i>)	18	600	3	2	3	3	2	Mature	Good	Fair	Negligible	+40	A1,2
T10	False acacia (<i>Robinia pseudoacacia</i>)	6	MS 300	1	1	1	1	1	Young	Fair	Poor	Negligible	<10	U
T11	Wild cherry (<i>Prunus avium</i>)	8	350	6	4	2	4	0	Over-mature	Dead	Poor	Negligible	<10	U
T12	Sycamore (<i>Acer pseudoplatanus</i>)	16	360	3	2	3	3	2	Semi-mature	Fair	Fair	Negligible	10-20	C1
T13	Sycamore (<i>Acer pseudoplatanus</i>)	16	320	2	2	2	2	0	Semi-mature	Fair	Fair	Negligible	10-20	C1
T14	False acacia (<i>Robinia pseudoacacia</i>)	16	MS 480	4	4	4	2	4	Over-mature	Poor	Dangerous	Negligible TPO No 160 T12	<10	U
T15	False acacia (<i>Robinia pseudoacacia</i>)	18	420	5	2	4	4	2	Over-mature	Poor	Dangerous	Negligible	<10	U

Tree reference number	Species	Height (m)	Stem diameter (mm)	Branch spread (m)				Height of crown clearance (m)	Age class	Physiological condition	Structural condition	Additional Information/Bat Roosting Potential	Estimated remaining contribution (years)	Category grading
				N	E	S	W							
T16	Sycamore (<i>Acer pseudoplatanus</i>)	16	400	3	2	3	3	0	Semi-mature	Poor	Fair	Negligible TPO No 160 T11	10-20	C1,2
T17	Common lime (<i>Tilia x europaea</i>)	18	440	3	3	3	3	2	Mature	Good	Good	Negligible TPO No 160 T10	+40	A1,2
#G1	5x Common lime (<i>Tilia x europaea</i>)	22	850	3	3	3	3	3	Mature	Fair	Fair	Negligible TPO No 159 T10, T11, T12, T13,	+40	A1,2,3
#G2	1x Ash (<i>Fraxinus excelsior</i>), 2x Sycamore (<i>Acer pseudoplatanus</i>) and 1x Goat willow (<i>Salix caprea</i>)	10	MS 200	2	2	2	2	2	Early-mature	Fair	Fair	Negligible	10-20	C2
#G3	6x Ash (<i>Fraxinus excelsior</i>), 1x Sycamore (<i>Acer pseudoplatanus</i>)	18	750	3	3	3	3	6	Mature	Poor	Fair	Negligible	10-20	C1,2,3
G4	35x False acacia (<i>Robinia pseudoacacia</i>)	5	MS 100	1	1	1	1	1	Young	Fair	Poor	Negligible	<10	U
G5	3x False acacia (<i>Robinia pseudoacacia</i>)	6	MS 125	2	2	2	2	1	Young	Fair	Poor	Negligible	<10	U
G6	2x Sycamore (<i>Acer pseudoplatanus</i>)	16	MS 600	6	6	6	6	1	Mature	Good	Fair	Negligible	20-40	B1,2

#. Tree located off Site within neighbouring property and survey data has been estimated (based on assessments from the nearest safe vantage points)

Preliminary BS5837:2012 Tree Survey Report

Table B2 Root Protection Area

Tree reference number	Species	Stem diameter (mm)	Radius of nominal circle (m)	RPA (m ²)
T1	Horse chestnut (<i>Aesculus hippocastanum</i>)	600	7.2	162.9
T2	Common lime (<i>Tilia x europaea</i>)	600	7.2	162.9
T3	Sycamore (<i>Acer pseudoplatanus</i>)	340	4.1	52.3
T4	Sycamore (<i>Acer pseudoplatanus</i>)	400	4.8	72.4
T5	Holm oak (<i>Quercus ilex</i>)	600	7.2	162.9
T6	Ash (<i>Fraxinus excelsior</i>)	450	5.4	91.6
T7	Common holly (<i>Ilex aquifolium</i>)	300	3.6	40.7
T8	London plane (<i>Platanus x hispanica</i>)	940	11.3	399.8
T9	Common lime (<i>Tilia x europaea</i>)	600	7.2	162.9
T10	False acacia (<i>Robinia pseudoacacia</i>)	MS 300	3.0	28.3
T11	Wild cherry (<i>Prunus avium</i>)	350	4.2	55.4
T12	Sycamore (<i>Acer pseudoplatanus</i>)	360	4.3	58.6
T13	Sycamore (<i>Acer pseudoplatanus</i>)	320	3.8	46.3
T14	False acacia (<i>Robinia pseudoacacia</i>)	MS 480	4.8	72.4
T15	False acacia (<i>Robinia pseudoacacia</i>)	420	5.0	79.8

Preliminary BS5837:2012 Tree Survey Report

Tree reference number	Species	Stem diameter (mm)	Radius of nominal circle (m)	RPA (m ²)
T16	Sycamore (<i>Acer pseudoplatanus</i>)	400	4.8	72.4
T17	Common lime (<i>Tilia x europaea</i>)	440	5.3	87.6
#G1	5x Common lime (<i>Tilia x europaea</i>)	850	10.2	326.9
#G2	1x Ash (<i>Fraxinus excelsior</i>), 2x Sycamore (<i>Acer pseudoplatanus</i>) and 1x Goat willow (<i>Salix caprea</i>)	MS 200	2.0	12.6
#G3	6x Ash (<i>Fraxinus excelsior</i>), 1x Sycamore (<i>Acer pseudoplatanus</i>)	750	9.0	254.5
G4	35x False acacia (<i>Robinia pseudoacacia</i>)	MS 100	1.0	3.1
G5	3x False acacia (<i>Robinia pseudoacacia</i>)	MS 125	1.3	4.9
G6	2x Sycamore (<i>Acer pseudoplatanus</i>)	MS 600	6.0	113.1

Table B3 Key to Categories

Tree Reference Number	Category
T/GXX	Category A
T/GXX	Category B
T/GXX	Category C
T/GXX	Category U

Table B4 Key to Bat Roost Potential*

Bat Roost Potential Category	Reason for Categorisation
Negligible	Saplings or semi-mature trees with a small girth. No ivy cover, loose bark, cracks or fissures
Low	Small or semi-mature trees. May have small amounts of ivy present, stems of small diameter. Trees may have some loose bark but no obvious cracks, fissures or holes.
High/medium	Trees with large crack, crevices or disused woodpecker holes that can provide refuge for bats. Trees may support dense ivy with multiple stems.
Known or confirmed roost	Tree with know or confirmed roosts from previous ecology survey.

*Bat Conservation Trust Bat Surveys for Professional Ecologists: Good Practice Guidelines, 2016

APPENDIX C. Preliminary Arboricultural Method Statement

Overview

This Preliminary Arboricultural Method Statement provides generic best practice measures to be adopted in order to protect retained trees during the development process. It has been prepared in order to inform the planning and the construction/ development process.

Protective Fencing

The purpose of this fencing is to provide protection to the RPA of retained trees/groups and to protect trees and hedgerows prior to their translocation. The type of fencing used shall be appropriate to the level of adjacent construction activity and shall be agreed with the Local Authority tree officer. Weather-proof notices shall be attached to any protective fencing located adjacent to retained trees displaying the words "Construction Exclusion Zone" and listing restrictions which apply. All personnel must be made aware of these restrictions.

It is anticipated that three specifications for fencing would be employed during construction.

Low-use areas

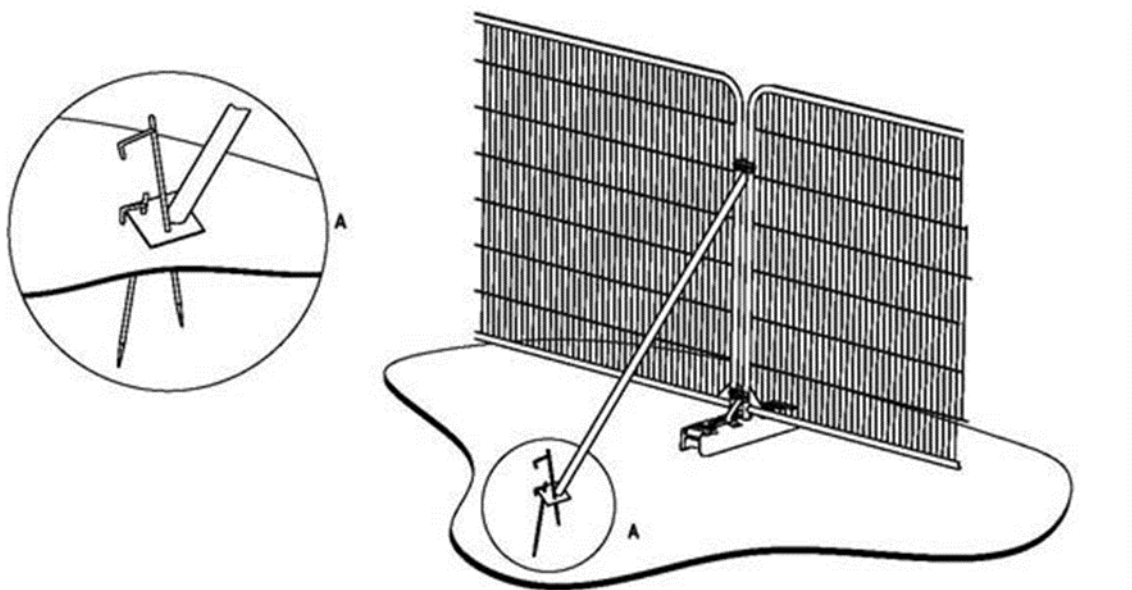
The system illustrated in Figure C1 is adequate to define areas of protected vegetation and exclude traffic, and comprises Cleft Chestnut Pale Fence in accordance with *BS 1722 Part 4: Specification for cleft chestnut pale fences (British Standards Institution, 1991)* supported by 150mm wooden stakes. Assembled with galvanized 14-gauge (2 mm) wire, four strands per row, peeled and pointed one end. Approximate spacing of pales 75 mm.



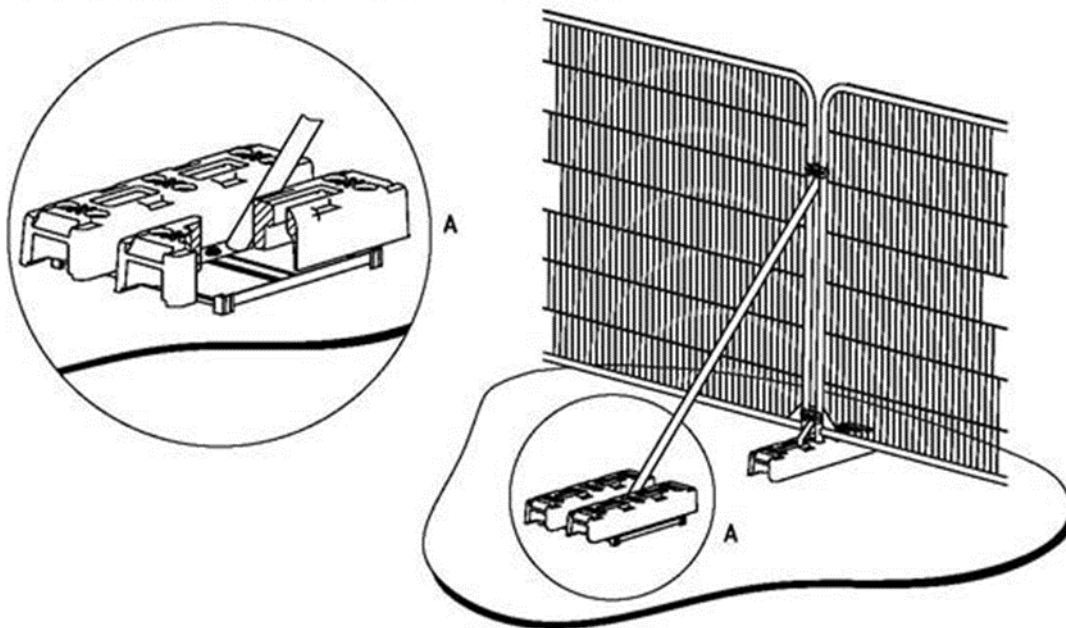
Figure C1 Tree Protection fencing example for low use areas

Medium-use areas

This system comprises anti-climb weldmesh panels connected by clamps and supported by rubber or concrete bases and bracing struts. The system is illustrated in Figure C2 and is based on *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations (British Standards Institution, 2012)* (Ref 1) guidelines. This kind of system is robust enough to withstand occasional knocks by plant machinery.



a) Stabilizer strut with base plate secured with ground pins

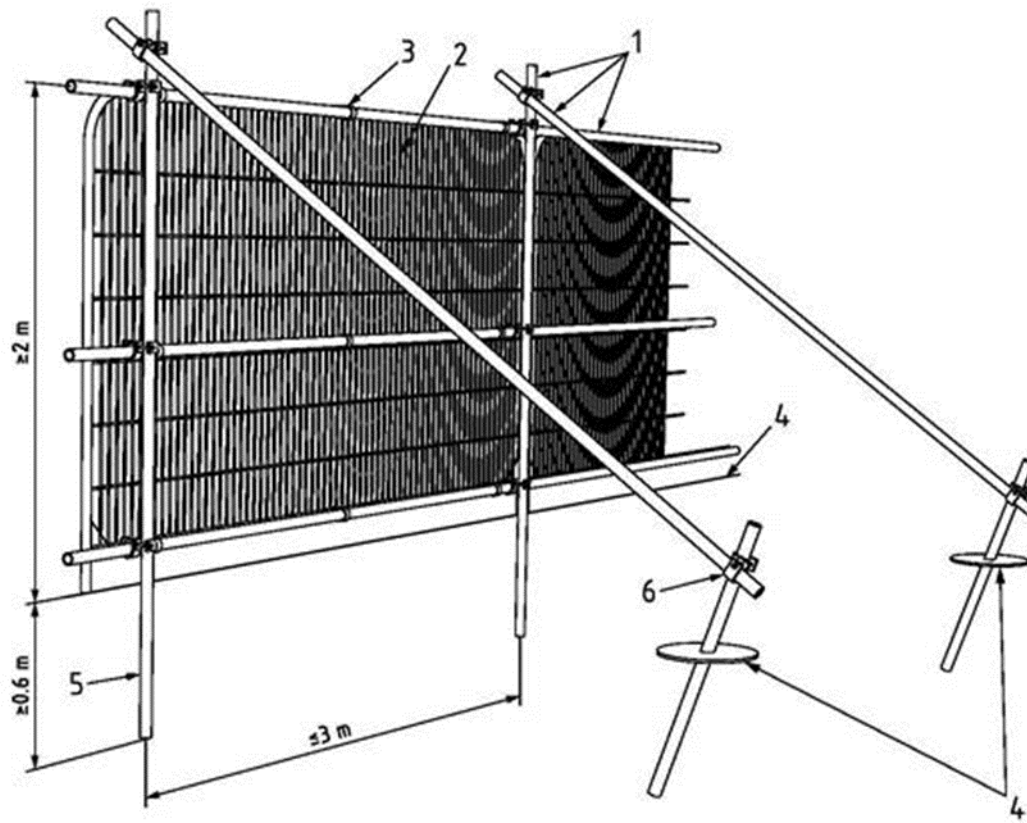


b) Stabilizer strut mounted on block tray

Figure C2 Tree Protection Fencing specification (extract from BS 5837)

High-use areas

This system involves driving scaffold poles into the ground, onto which are affixed horizontal scaffold poles and diagonal bracing struts. Anti-climb weldmesh panels are secured to this scaffold framework using standard scaffold clips or wire. The system is illustrated in diagram Figure. C3 and is based on *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations (British Standards Institution, 2012)* (Ref 1) guidelines. This kind of system provides the highest level of security.



Key

- 1 Standard scaffold poles
- 2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
- 3 Panels secured to uprights and cross-members with wire ties
- 4 Ground level
- 5 Uprights driven into the ground until secure (minimum depth 0.6 m)
- 6 Standard scaffold clamps

Figure C3 Tree Protection Fencing specification (extract from BS5837)

Construction Exclusion Zone (CEZ)

The Construction Exclusion Zone (CEZ) is the area identified by an arboriculturist to be protected during development, including Site clearance and construction work, through the use of barriers and/or ground protection fit-for-purpose to ensure the successful long-term retention of a tree. The area within the construction exclusion zone is to be regarded as sacrosanct and the fencing shall not be taken down or relocated at any time.

All areas excluded by protective tree fencing shall be treated as CEZs, and the following restrictions shall apply:

- No construction activity whatsoever must occur within these areas.
- No tree works, without the written consent from the Local Authority.
- No alterations of ground levels or conditions.
- No chemicals or cement washings.
- No excavation.
- No temporary structures. *
- No storage of soil, rubble or other materials.
- No vehicles or machinery to be used or parked without appropriate ground protection measures as per BS5837 recommendations. This will require the use of a proprietary system of reinforced concrete slabs/steel road plates on a compressible layer, or side butting scaffold boards/ 18mm plywood sheets on a compressible layer. The type of ground protection used shall be appropriate for the likely loading applied.
- No fixtures (lighting, signs etc.) to be attached to trees.
- No fires within 10 metres of the canopies of any tree or hedgerow.

1

**Sales Cabins or Site huts, provided they are of the Jack Leg type, can be sited to act as ground protection for the duration of the construction.*

General Construction Activity

Since the canopies of retained trees may be in close proximity to areas of crane operation, the following restrictions will apply:

- All cranes will be sited outside the defined RPAs of retained trees / groups, and the appointed contractor will ensure all relevant personnel shall be made aware of the location of branches and the need to avoid causing damage to them.
- Prior to the implementation of lifting operations, a representative from the equipment supply company shall visit the Site and ensure all operations can be completed without causing damage to retained trees. A lifting plan will be prepared and submitted for approval prior to all lifting operations. The lifting plan will make provision for the potential for damage of retained trees.
- All lifting operations will be completed under the close direction of a qualified banksman, who will be briefed by the appointed contractor as to the need to avoid damage the stems and branches of retained trees.
- Should additional tree removal or pruning be required the Local Authority Tree Officer shall be contacted and the scope of works agreed in writing.
- All materials will be stored within designated areas and no materials shall be stored within any RPA.

Hazardous Materials

Any mixing of cement-based materials is to take place outside the RPAs of all trees. Provision shall be made to ensure that the mixing area is contained so that no water runoff enters the RPAs of any trees. All mixers and barrows shall be cleaned within this dedicated mixing area.



All other chemicals hazardous to tree health, including petrol and diesel, are to be stored in suitable containers as specified by the Control of Substances Hazardous to Health (COSHH) Regulations (2002) (Ref 4), and kept away from the RPAs.



Example of Protective Fencing Signs



APPENDIX D. Photographs

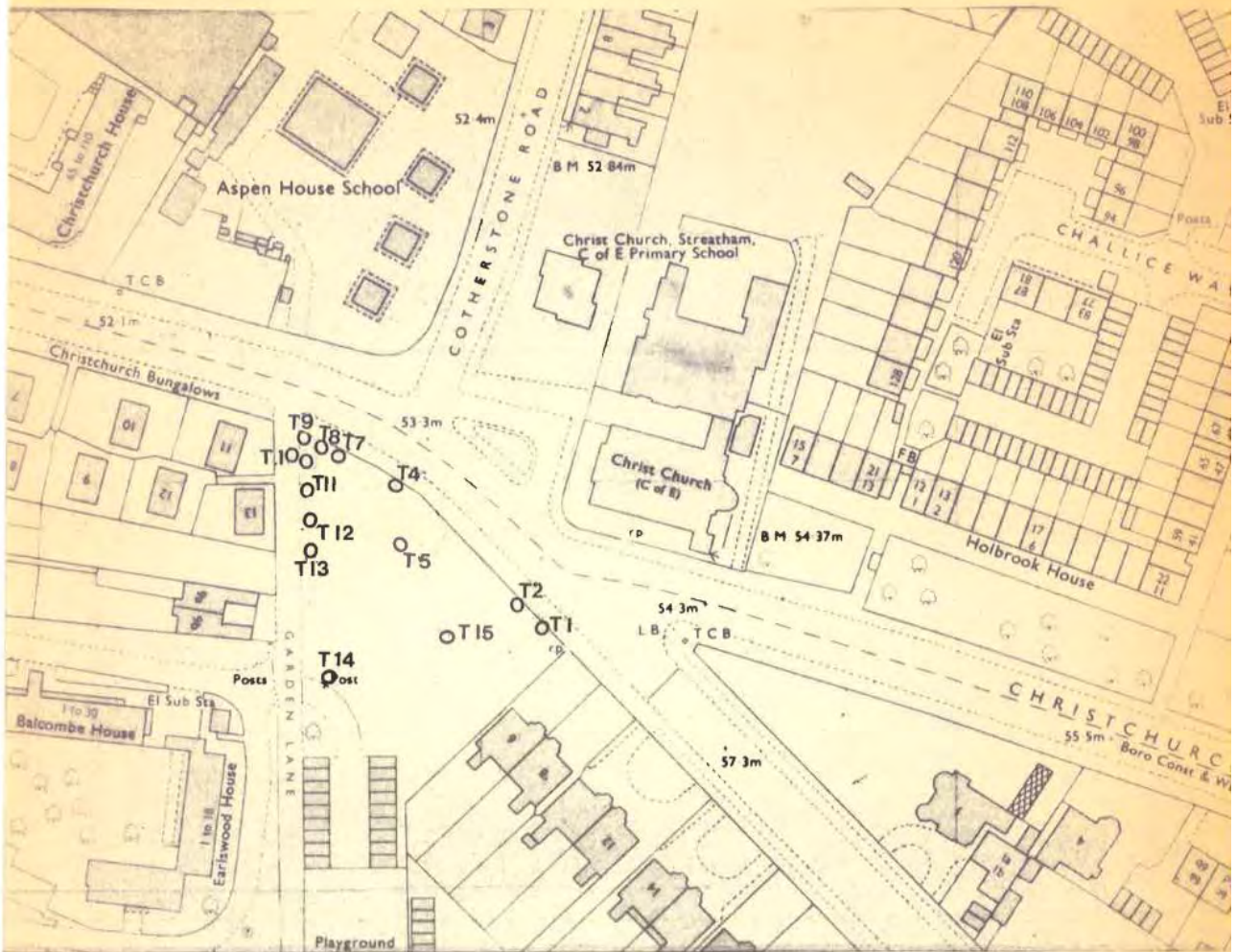
Tree No.	Description	Photograph
<p>G1 (5x common lime) and T3 (sycamore)</p>	<p>Green Lane possible access road G1 lime to the right of the image protected within TPO No.159 1980. Sycamore T3 Category U tree has been damage when the protective fence was installed. The T3 is holding deadwood and leaning towards the Site.</p>	
<p>T1 horse chestnut and T2 lime</p>	<p>T1 (horse chestnut <i>Aesculus hippocastanum</i>) and T2 lime (<i>Tillia x europea</i>) within TPO No.159 T2 separated from G1 limes by a wall.</p>	

Tree No.	Description	Photograph
T8 London plane	T8 London plane (<i>Platanus x hispanica</i>) is protected by a TPO No. 160 1980. The tree is easily visible from the surrounding public highway	
T15 false acacia	Poor structural condition of the Category U tree	

Tree No.	Description	Photograph
T15 false acacia	Western upper stem the right-hand side apical attachment is suboptimal and increase the risk of failure of this part of the tree	
T14 false acacia	North and western side of tree dead wood on western canopy over the roadway Category U tree	

APPENDIX E Tree Preservation Orders

MAP REFERRED TO IN THE
 LONDON BOROUGH OF LAMBETH N O 159 (Landbetween6Christchurch Road andGarden Lane
 TREE PRESERVATION ORDER 1980.



THE COMMON SEAL OF
 THE LONDON BOROUGH OF LAMBETH
 WAS HERE UNTO AFFIXED THIS

DAY OF 19

LONDON BOROUGH OF LAMBETH
 DIRECTORATE OF TOWN PLANNING

Edward Hollamby OBE FRIBA FRTPi Dip TPI
 Director of Town Planning

CHIEF SOLICITOR

MAP NO 159 TPO scale 1:1250

LONDON BOROUGH OF LAMBETH NO.159

(6 Christchurch Road/Garden Lane)

TREE PRESERVATION ORDER 1980

FIRST SCHEDULE

TREES SPECIFIED INDIVIDUALLY (encircled in black on the map)

No. on Map	Description	Situation
1	Horse Chestnut	
2	Oak	
4	Lime	Area between No.6 Christchurch Road and Garden Lane
5	Ash	
7	Lime	
8	Horse Chestnut	
9	Lime	
10	Lime	
11	Lime	
12	Lime	
13	Lime	
14	Sycamore	
15	Lime	

LONDON BOROUGH OF LAMBETH NO.160
(STREATHAM HILL/CHRISTCHURCH ROAD)
TREE PRESERVATION ORDER 1980

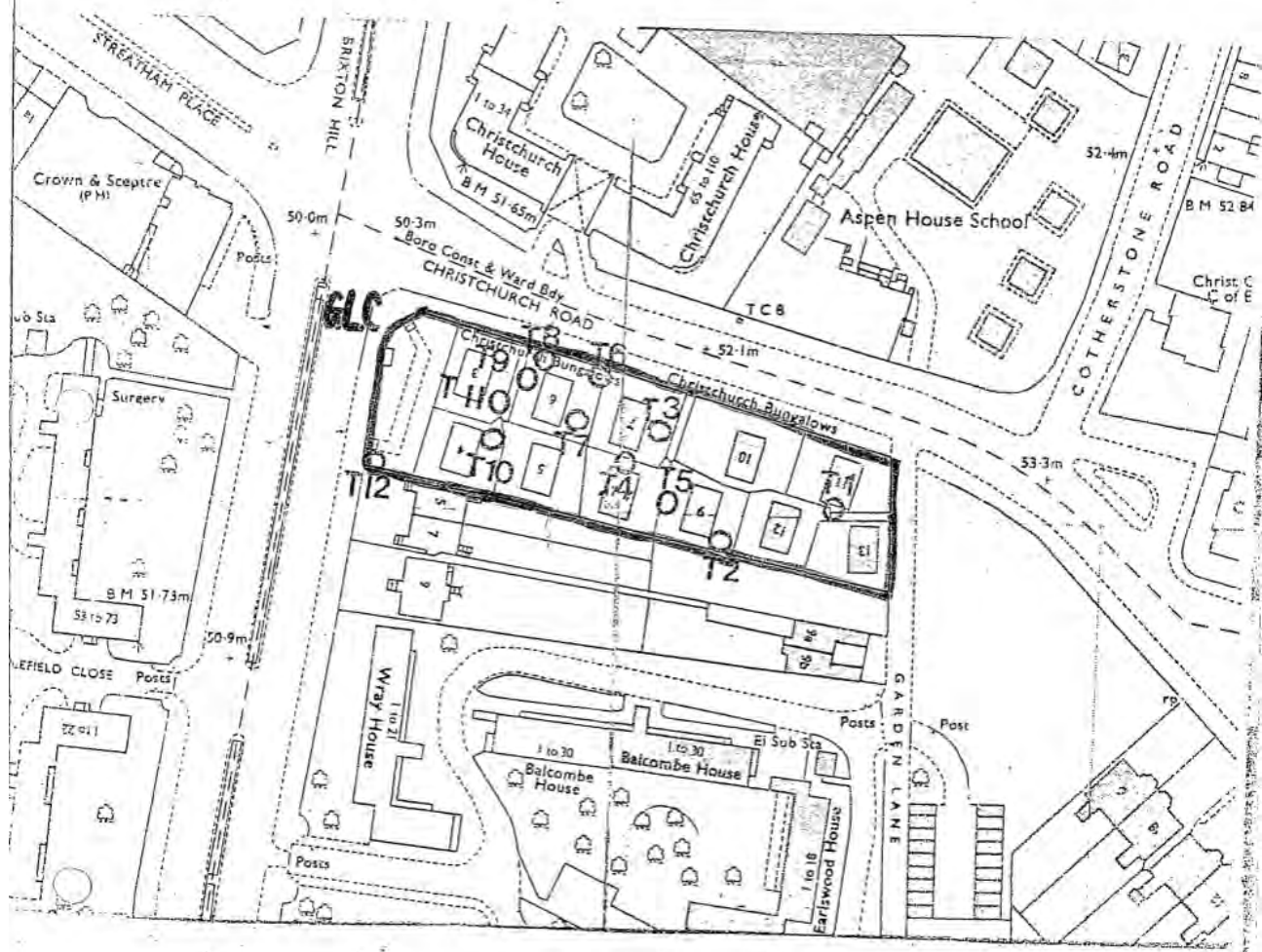
SCHEDULE

Trees specified individually (encircled in black on the map)

No. on Map	Description	Situation
1	Sycamore	
2	Holm Oak	
3	Copper Beech	
4	Plane	
5	Holly	
6	Lime	
7	Sycamore	
8	Sycamore	
9	Robinia	
10	Lime	
11	Sycamore	
12	Robinia	

10027/160

MAP REFERRED TO IN THE
LONDON BOROUGH OF LAMBETH N O 160 (Land fronting Streatham Hill and Christchurch Road)
TREE PRESERVATION ORDER 1980.



THE COMMON SEAL OF
THE LONDON BOROUGH OF LAMBETH
WAS HERE UNTO AFFIXED THIS

DAY OF 19

LONDON BOROUGH OF LAMBETH
DIRECTORATE OF TOWN PLANNING
Edward Hollamby OBE FRIBA FRTPi Dip TPI
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CHIEF SOLICITOR

MAP NO 160 TPO scale 1:1250

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TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE LAND AT CHRISTCHURCH ROAD AND BRIXTON HILL, LAMBETH, SW2 4AP

Site Ref. 901

Archaeology Desktop Review

OCTOBER 2017

Incorporating

EC HARRIS
BUILT ASSET
CONSULTANCY



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

Archaeology Desktop Review

Author Kate Clover



Checker Jenny Wylie



Approver Jenny Wylie



Report No 204-UA009686-UE21R-05

Date OCTOBER 2017

VERSION CONTROL

Version	Date	Author	Changes
001	31/5/2017	Kate Clover	
002	1/6/2017	Kate Clover	Review changes
003	8/6/2017	Kate Clover	Review changes
004	21/6/2017	Kate Clover	TfL amendments
005	02/10/17	Kate Clover	Final Issue

This report dated 02 October 2017 has been prepared for 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 Background

Arcadis Consulting (UK) Limited (Arcadis) has been commissioned by Transport for London (TfL) 'the Client' to undertake a number of technical surveys for a Site referred to as Land on Christchurch Road and Brixton Hill in the London Borough of Lambeth ('the Site').

TfL is aiming to divest a number of small sites to enable prospective regeneration. The objective of this archaeology desktop review is to identify potential development constraints due to buried archaeological remains and above ground heritage assets on the Site.

1.2 Scope of Works

The scope of the review is to carry out a desktop search of publicly available information on designated and un-designated heritage assets within a study area of 500m of the Site boundary. Using this information, a brief assessment of potential heritage/archaeological constraints and opportunities at the Site has been made, focusing on key constraints. The review also highlights when a Site should be subject to further detailed assessment to support a planning application for any future development.

1.3 Limitations

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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.

2 SITE OVERVIEW

The Site is located at the corner of three main roads; Christchurch Road, Brixton Hill and Streatham Hill in the London Borough of Lambeth (NGR 530503 173418). The Site comprises a rectangular parcel of open space of 0.32 ha, within an otherwise built up area of London. The majority of the Site is fenced with iron railings and covered by long grass, with some tree cover in the west. Outside the railings, at the verge with the pavements, the Site is short grass. On the Streatham Hill frontage, the Site is slightly raised above pavement level and bounded by a low brick retaining wall. On the Christchurch Road frontage, the Site is level with the pavement and bounded by a metal barrier.

3 DATA SOURCES

Records for the Site and a 500m study area were examined. Data was obtained for designated heritage assets from the Heritage List for England on 25th May 2017 and for non-designated heritage assets and Archaeology Priority Areas (APA) from the Greater London Historic Environment Record (GLHER) on the 19th May 2017. Information of Conservation Areas and Locally Listed Buildings was obtained from London Borough of Lambeth's website and details on other designations was obtained from the Defra's MAGIC.

Numbers in brackets in the text are unique identifiers assigned to heritage assets for the purposes of this report. A list of all heritage assets including archaeological events can be found on Tables 1 and 2. All heritage assets and APAs are shown on GL Figure 1.

4 BASELINE CONDITIONS

4.1 Designated Heritage Assets

There are no scheduled monuments within the Site or study area. The Site is not within a Conservation Area however it is bordered to the north by The Rush Common and Brixton Hill Conservation Area (CA49). There are 27 Listed Buildings within the study area, of all grades, but none within the Site boundary. All the Listed Buildings are 19th and 20th century in date (Table 1). There are no Registered Parks and Gardens (RPG) within 500m of the Site, the nearest RPG being the Grade II Brockley Park, 0.9km to the east.

The western side of the Site lies within an APA4 This APA has been so defined due to the location of a Roman Road from London to Lewes (29 and 46). The Site also lies 0.13km south of a second APA (APA11 – Brixton medieval village centre). Whilst these do not receive statutory protection they have been identified in the Borough's local plan as areas where potential for below ground archaeological remains to survive is high and where archaeological investigations are therefore likely to be required. The APAs are not tiered. Historic England's website provides more information about APAs and the different levels of sensitivity to development: (<https://www.historicengland.org.uk/services-skills/our-planning-services/greater-london-archaeology-advisory-service/greater-london-archaeological-priority-areas/>).

The Borough maintains a list of locally important buildings which do not have statutory protection. The Crown and Sceptre Public House (2a Streatham Hill) is located opposite the Site and is a Locally Listed Building (LLB) of 19th century date. This appears to be the only LLB within the study area.

4.2 Un-designated Heritage Assets

There is one possible known heritage asset within the Site and there are 39 other un-designated heritage assets within the 500m study area (Table 2). The Site is located on or near a Roman Road leading from London to Lewes (29 and 46). Streatham Hill and Brixton Hill follow the line of this north-south road. Metalling of the road surface has been revealed at the corner of Telford Road and Streatham Hill to the south of the site. The Roman Road line has been outlined as an APA by the London Borough of Lambeth. A buffer of 40m either side of the modern road line has been included in the APA and the western part of the Site falls within it. It is possible that road metalling or roadside ditches may survive within the western bounds of the Site. The route appears to have carried on in use into the medieval period (46).

The second APA (APA11) is 1.13km north of the Site and comprises a medieval settlement (30) located at the intersection of three medieval roads (44, 46 and 48). This includes an undated standing stone named 'Brixton's Stone' which gave Brixton its name (31). A medieval manor lies away from the medieval settlement, 0.5km to the east of the Site (32).

Post-medieval heritage assets are scarce and consist of Stock's Mill Windmill (39) on Morrish Road and Black's Hall on New Park Road (28). A post-medieval brick-lined well was recorded during an archaeological investigation to the north of the Site (40).

The majority of heritage assets within the study area are 19th or 20th century buildings, reflecting the rapid residential development of the area. Christchurch (1) was built in 1840 and stands just to the east of the Site. Blocks of flats such as the Listed Pullman Court (13-22) to the south of the Site and unlisted Clapham Park (47-52) to the north-west form important built assets of the area. Fragments of 19th century pottery and kiln furniture were found at Roupell Court (33-34) 0.5km to the east of the Site, indicative of a kiln operating in this period.

A brief review of historic OS maps of the late 19th century onwards shows that the Site was occupied by two or three houses fronting Streatham Hill, and their gardens. By the early 1950s these houses had been removed and 13 bungalows were built over the entire Site. These were removed in the 1980s and the Site appears to have been open land since that time.

Archaeological Desktop Review

Table 1: Designated Heritage Assets (Listed Buildings)

ID Number	Grade	Asset Name	NGR	GLHER Number
1	I	Christ Church, 1840-42.	530640 173403	DLO24041
2	II	Church hall at rear of Brixton United Reformed Church, 1878.	530544 173540	DLO23223
3	II	Forecourt Walls and Pylons to Christ Church, 1840.	530619 173405	DLO23361
4	II	Streatham Hill Theatre, 1928-29.	530322 172963	DLO23811
5	II	Main building of Richard Atkins Junior and Mixed Infants School, 1897.	530256 173786	DLO23882
6	II	40 Streatham Hill, early 19th century villa.	530388 173217	DLO23636
7	II	42 Streatham Hill, early 19th century villa.	530388 173212	DLO23636
8	II	44 Streatham Hill, early 19th century villa.	530417 173112	DLO23990
9	II	Classroom A at Aspen House open air school, 1926.	530576 173438	DLO24124
10	II	296 Brixton Hill, Butcher's Shop, 1891.	530427 173529	DLO24107
11	II	67 New Park Road, Streatham, early to mid 19th C house.	530248 173710	DLO23930
12	II	69 New Park Road, Streatham, early to mid 19th C house.	530245 173708	DLO23930
13	II*	Pullman Court, block of flats built 1933-35.	530479 173250	DLO23504
14	II*	Pullman Court.	530478 173214	DLO23504
15	II*	Pullman Court.	530547 173226	DLO23504
16	II*	Pullman Court.	530445 173265	DLO23504
17	II*	Pullman Court	530455 173253	DLO23504
18	II*	Pullman Court	530509 173256	DLO23504
19	II*	Pullman Court	530451 173217	DLO23504
20	II*	Pullman Court.	530504 173202	DLO23504
21	II*	Pullman Court.	530545 173209	DLO23504
22	II*	Pullman Court.	530550 173240	DLO23504
23	II	Classroom D at Aspen House Open Air School, 1925.	530586 173484	DLO24127
24	II	Classroom C at Aspen House Open Air School, 1925.	530588 173464	DLO24126
25	II	Classroom B at Aspen House Open Air School, 1925.	530583 173450	DLO24125
26	II	Former Dining Shelter at Aspen House Open Air School, 1925.	530567 173474	DLO24123
27	II	Brashiers Cottage, house early to mid 19th C with probable earlier origins.	530231 173646	DLO24135

Archaeological Desktop Review

Table 2: Un-Designated Heritage Assets

ID Number	Asset Name	NGR	Description	GLHER Number
28	New Park Road	530265 173805	Post-medieval house, also called 'Black's Hall', 1540 AD to 1900 AD.	MLO11406
29	Roman Road, Telford Avenue	530415 173125	Possible Roman Road metalling near suggested line of London-Brighton Way.	MLO11685
30	Brixton Hill	530405 173805	Isolated medieval and possibly Saxon village, 410 AD to 1539 AD.	MLO13543
31	'Brixi's Stone', Brixton Hill	530405 173805	Standing stone of unknown date which gave Brixton its name.	MLO1864
32	Upper Tulse Hill	530970 173530	Medieval manor recorded in documentary sources, 1066 AD to 1539 AD.	MLO4722
33	Roupell Court (Former)	530950 173400	Finds of mid 19 th century pottery and kiln furniture probably from potteries in Vauxhall and Lambeth. Found during at evaluation by MOLAS in 1995.	MLO62696
34	Roupell Court (Former)	530890 173389	Finds of mid 19 th century pottery and kiln furniture probably from potteries in Vauxhall and Lambeth. Found during at evaluation by MOLAS in 1995.	MLO62696
35	Streatham Place / New Park Road, Steatham Hill	530201 173650	Negative evidence from an archaeological evaluation carried out by Wessex Archaeology in 2005.	MLO97914
36	Site of Smock Mill, Morrish Road (opposite no 26)	530355 173715	Post-medieval windmill.	MLO5869
37	A well at 286-292 Brixton Hill	530435 173555	Observations by Southwark and Lambeth Archaeological Excavation Committee in 1979, recorded a brick-lined well, Post Medieval.	MLO63171
38	Upper Tulse Hill, SW2	530955 173545	Negative evidence.	MLO63228
39	28 Palace Road	530705 173105	Evaluation undertaken LPE in 1996 found only a single sherd of high medieval pottery.	MLO68904
40	St Martin's Estate, Tulse Hill	530871 173400	Negative evidence from an archaeological evaluation carried out by Wessex Archaeology 2006.	MLO97919
41	New Park Road/Emmanuel Road, Streatham Hill	529578 173076 to 530498 173928	New Park Road is thought to have originated as a medieval road.	MLO13557
42	Christ Church, Christchurch Road	530622 173413	Stone-coped brick wall to Christ Church, c 1840.	MLO88447
43	Streatham High Road, Streatham	530523 169958 to 531289 177503	Streatham High Road is thought to have medieval origins.	MLO13553
44	Morrish Road	530268 173747 to 530446 173588	Morrish Road is probably of medieval origin. The road served as a link between the medieval roads, now called New Park Road (MLO13557) and Streatham Hill (MLO13553).	MLO23344
45	Bedford Road	530023 175705 to	Bedford Road and Lyham Road follow the probable route of a medieval road from Clapham to Stockwell.	MLO23345

Archaeological Desktop Review

ID Number	Asset Name	NGR	Description	GLHER Number
		530333 173803		
46	Line of Roman Road Roman from London to Brighton	531291 177777 to 531386 162771	Line of Roman Road Roman from London to Brighton, leaving Stane Street at Streatham.	MLO107771
47	Clapham Park housing estate, Lambeth	530349 173736	Council Flats, 1951-55.	MLO99332
48	Clapham Park estate, Lambeth,	530157 173620	19 th century structural remains found during evaluation in 2007.	MLO99337
49	Clapham Park estate, Lambeth,	530106 173488	1955-1960s council flats.	MLO99333
50	Clapham Park estate, Lambeth,	530191 173710	1930s council flats.	MLO99331
51	Clapham Park housing estate, Lambeth	530099 173435	1951-55 council flats.	MLO99332
52	Clapham Park housing estate, Lambeth	530045 173401	1970s brutalist council flats.	MLO99334
53	Lyham Road [Church of All Saints], Lambeth	530297 173862	Site of 19th century church.	MLO88660
54	Holmewood Gardens Streatham Hill,	530638 173606	Garden square, 1890s.	MLO104329
55	Brixton Hill [Union Chapel-ground] Lambeth,	530499 173567	Post-medieval churchyard.	MLO70380
56	3 Christchurch Road (Haslemere), Streatham	530615 173447	Streatham Auxiliary Red Cross Hospital during World War One.	MLO107375
Events				
57	Streatham Place / New Park Road, Steatham Hill	530220 173639	Archaeological Evaluation 2005- negative	ELO6135
58	Clapham Park Housing Estate, Lambeth,	530103 173559	Archaeological Evaluation 2007- 19thC structural remains.	ELO7549
59	Clapham Park Housing Estate, Lambeth,	530157 173620	Archaeological Evaluation 2007- London Clay found at 0.8m.	ELO7549
60	Telford Avenue	530415 173125	Excavation.	ELO2285
61	Tulse Hill Secondary School	530955 173545	A watching brief in 1978 recorded modern disturbance only.	ELO1634
62	286-292 Brixton Hill	530435 173555	A watching brief in 1979 recorded a brick-lined well of post-medieval date.	ELO1725
63	28 Palace Road	530705 173105	Evaluation 1996.	ELO1760

Archaeological Desktop Review

ID Number	Asset Name	NGR	Description	GLHER Number
64	Telford Avenue	530430 173160	Watching Brief.	ELO1778
65	St Martin's Estate, Tulse Hill 2006	530871 173400	Evaluation.	ELO6097
66	Streatham Place / New Park Road, Steatham Hill 2006	530220 173638	Evaluation.	ELO6135
67	Streatham Hill/Kennington Park Road, Lambeth: Watching Brief	530441 173633	Watching Brief- negative evidence.	ELO12730

5 CONCLUSIONS

The key heritage constraints to development are that the Site lies within an APA, being located next to or on a Roman road.

There are no scheduled monuments within the Site or study area. The Site is not within a Conservation Area or a Registered Park or Garden. There are 27 Listed Buildings within the study area, of all grades, but none within the Site boundary.

Although the Site has a low to medium potential for buried archaeological remains to exist, these heritage assets are not considered likely to prevent development on the Site. The Greater London Archaeological Advisory Service (GLAAS) who advise the local planning authority are likely to recommend a full archaeological desk-based assessment and an evaluation to be undertaken prior to planning permission being determined. It is recommended that GLAAS are consulted at the earliest opportunity in order clarify if any field investigations such as trial trenching are required.

A full archaeological desk-based assessment would provide more information and a more detailed discussion of the Site and the potential impacts than is presented in this brief review. It would include a specific archaeological Site walkover, a visit to the record office to gather historic maps and relevant documentary evidence, a map regression exercise as well as preparation of distribution maps showing designated and un-designated heritage assets. The evaluation would likely consist of a programme of trial trenching and subsequent reporting. If heritage assets of significance are encountered during the evaluation stage, there may be a requirement for further recording in the form of an excavation or watching brief. This may be delivered through a post-determination condition.

FIGURES

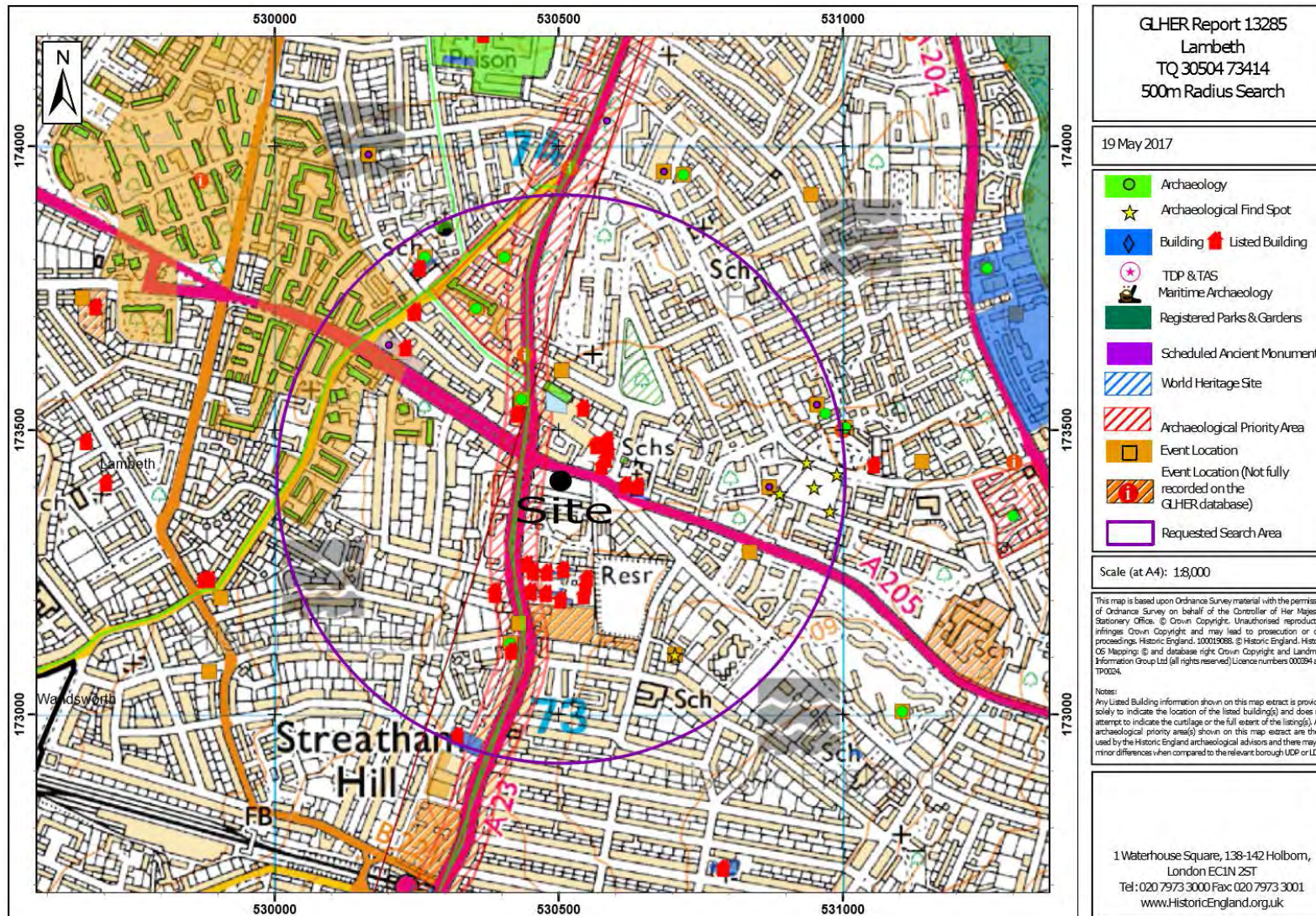


Figure 1: Designated and Un-Designated Heritage Assets within the Study Area

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

Site Ref. 901

**Preliminary Geotechnical and Geo-Environmental
Report**

NOVEMBER 2017

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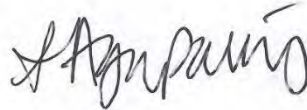
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This report dated 03 November 2017 has been prepared for Transport for London (TfL) Transport for London (TfL) (the "Client") in accordance with the terms and conditions of appointment dated 02 May 2017 (the "Appointment") between the Client and **Arcadis 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 19th 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.

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Date	Historical Development (Site and Surrounding Area)
	<p>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.</p>
1896	<p>No significant changes are noted within the Site.</p> <p>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.</p>
1916	<p>No significant changes are noted within the Site.</p> <p>The reservoir has been expanded to the south and is now present 100m to 250m southeast of the Site.</p>
1950, 1951	<p>The map shows the two houses and outbuildings having been demolished and replaced by thirteen small buildings (Christchurch Bungalows) across the Site.</p> <p>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.</p> <p>Behind the flats a large Tramway Depot is shown 60m north of the Site. A tank is also present 50m north of the Site.</p> <p>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</p> <p>Some buildings within 100m south of the Site are shown as ruins, likely due to wartime bomb damage.</p>
1954	<p>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.</p>
1972	<p>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.</p> <p>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.</p>
1985	<p>No significant changes are noted within the Site.</p> <p>A garage/petrol filling station is shown 100m northwest of the Site (see Table 3.2).</p>
1987	<p>The map shows the bungalows within the Site had been demolished and nothing is shown within the Site boundary.</p>
1991	<p>No significant changes are noted within the Site.</p> <p>The houses to the east of the Site beyond Garden Lane have been built.</p>
2014	<p>No significant changes are noted within the Site or surrounding area.</p>

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

<p>Geology (Aquifer Status)</p>	<p>Superficial Deposits: Head Deposits (Secondary Aquifer – Undifferentiated) Solid Geology: London Clay Formation (Unproductive Strata) The underlying geological sequence comprises the Lambeth Group, Thanet Sand Formation and White Chalk Subgroup.</p>
<p>BGS Boreholes (within 100m of the Site)</p>	<p>Five historical boreholes are located on-Site, but these are confidential, with a further six within 100m. 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. 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. 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. 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. The other nearby historical boreholes generally confirmed the sequence above. 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>
<p>Within a Source Protection Zone</p>	<p>Zone 2 (outer catchment).</p>
<p>Licensed Groundwater Abstraction Points</p>	<p>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.</p>
<p>Surface Water Feature</p>	<p>None identified within 1km of study area</p>
<p>Likely Groundwater Flow Direction</p>	<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. 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
On Site	
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)
Off Site	
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 19th 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 ₄ (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 during 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 ₄)	% v/v	<0.1	<0.1
Carbon Dioxide (CO ₂)	% v/v	2.0	1.8
Oxygen (O ₂)	% v/v	19.1	18.7
Carbon Monoxide (CO)	ppm	<1	<1
Hydrogen Sulphide (H ₂ 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 19th 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.

10 References

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7. CIRIA C665. (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings
8. NHBC (2007) Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Report Edition No.: 04, March 2007
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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

Printed at: 1:2,500



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

Map Name: County Series

Map date: 1870

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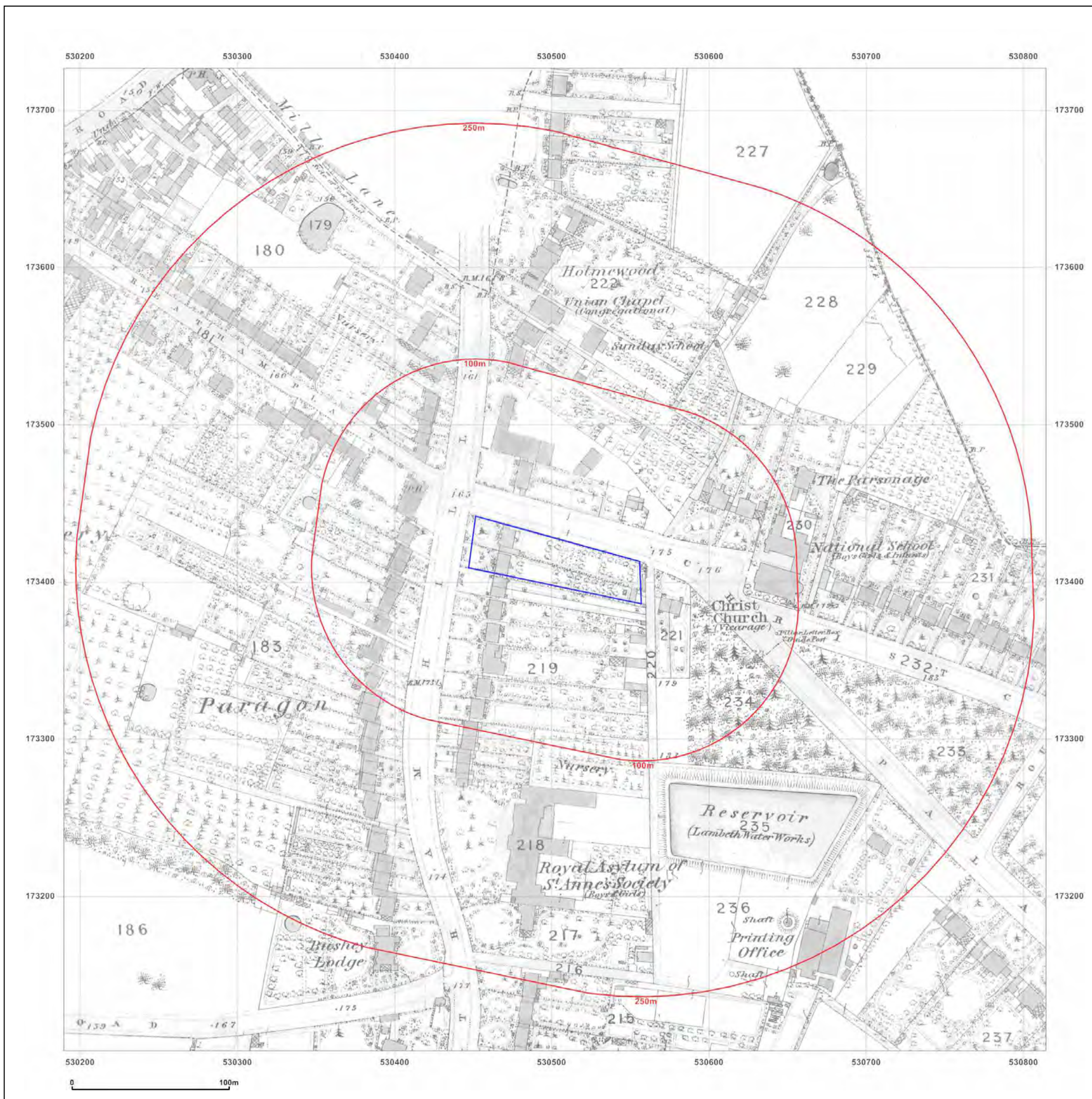


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Site Details:

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

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

Map Name: 1056 Scale Town Plan

Map date: 1874

Scale: 1:1,056

Printed at: 1:1,056



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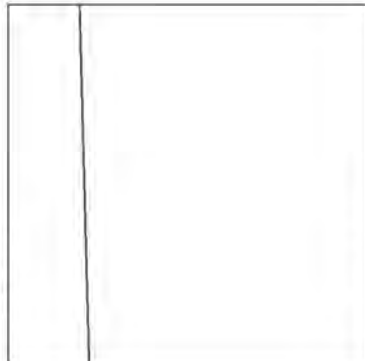
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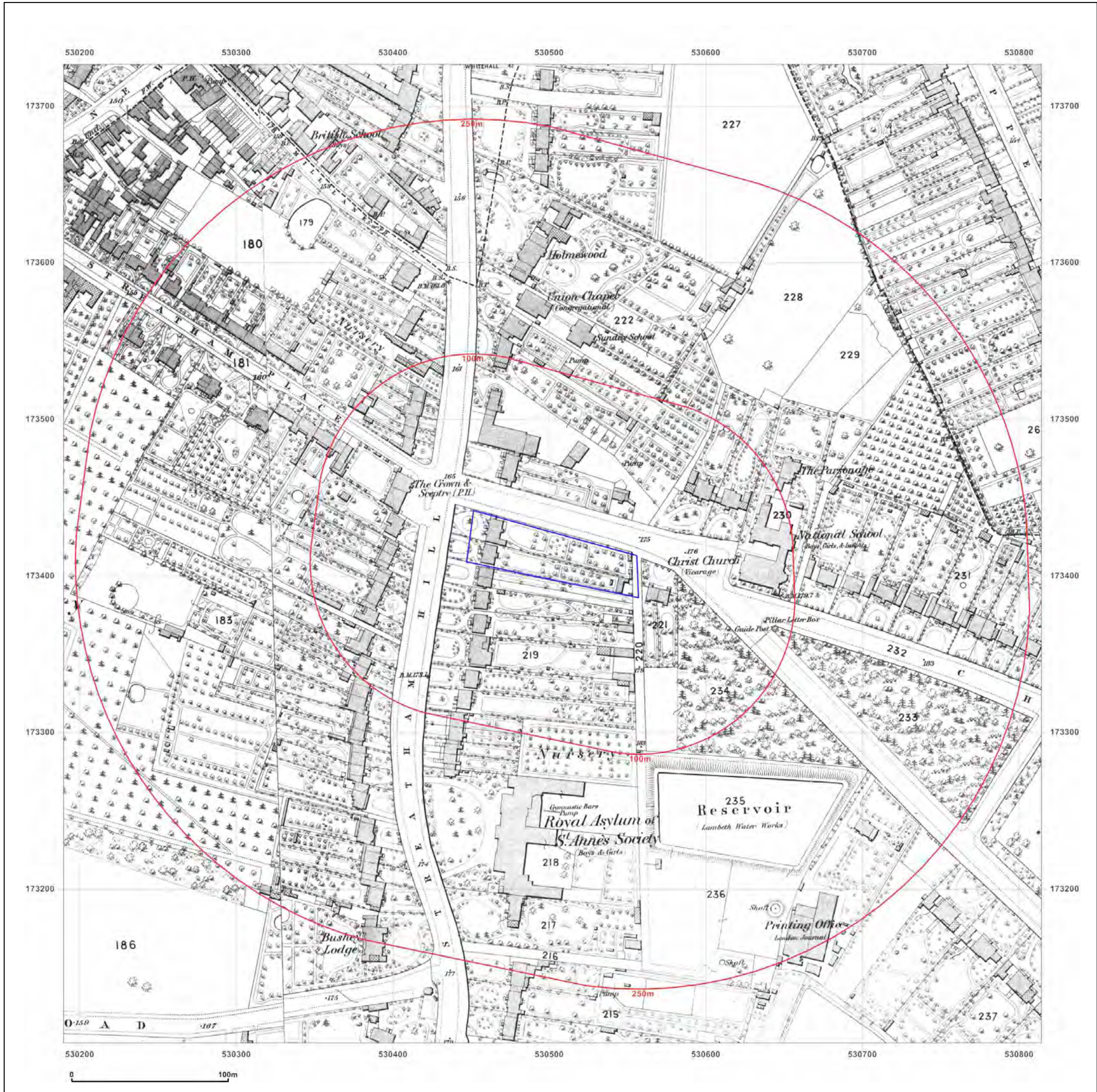


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Map Name: 1056 Scale Town Plan

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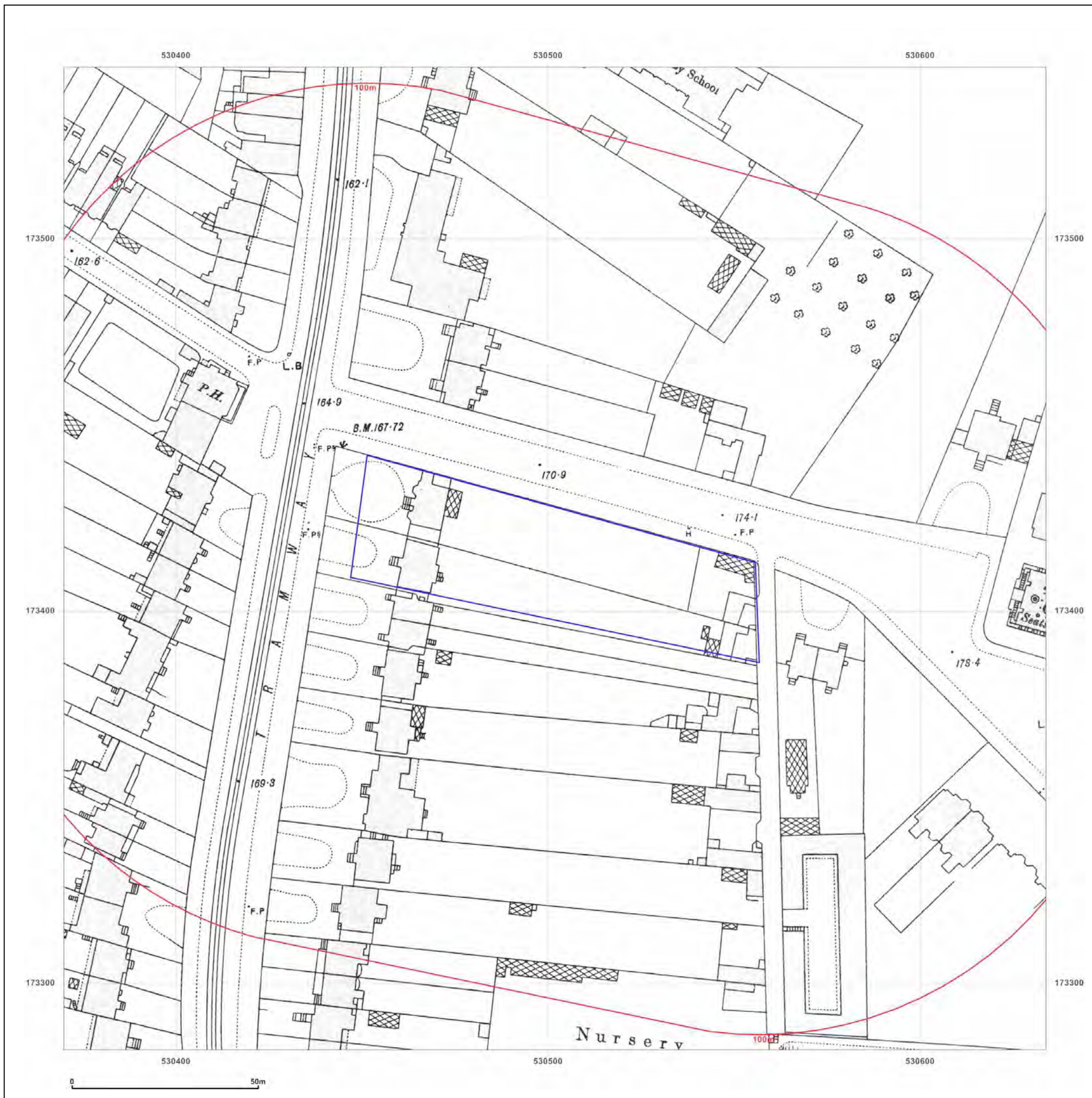


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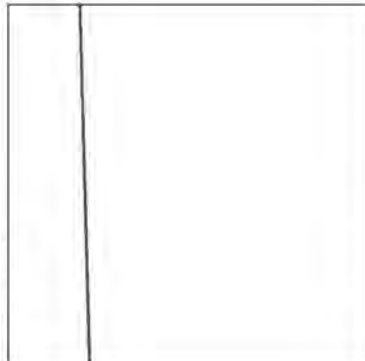
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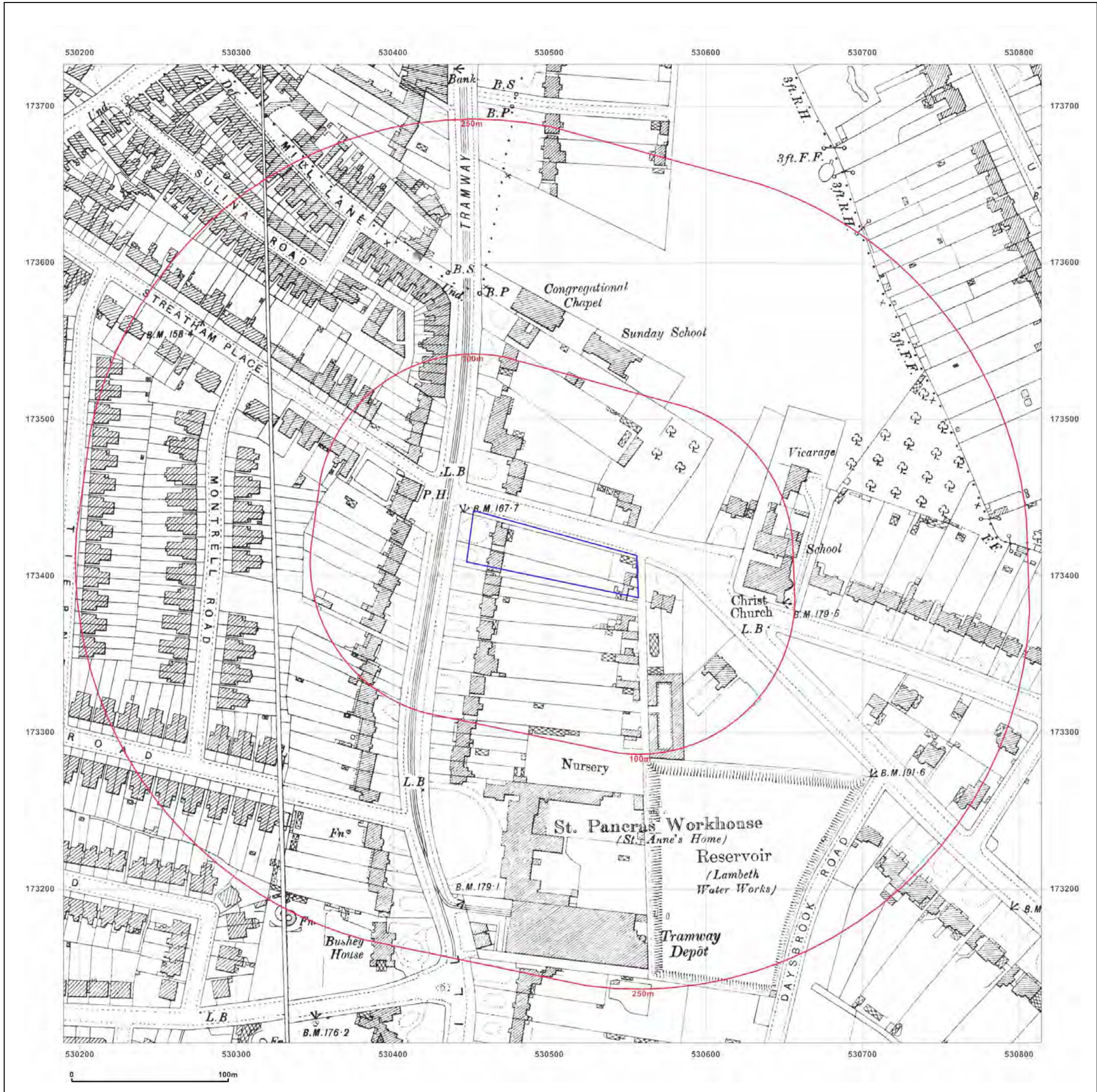


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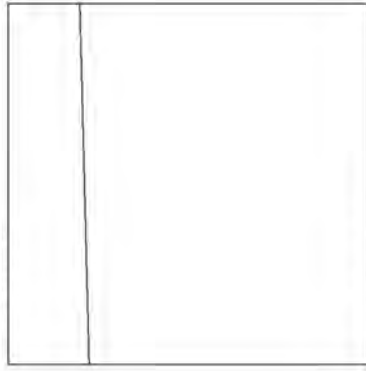
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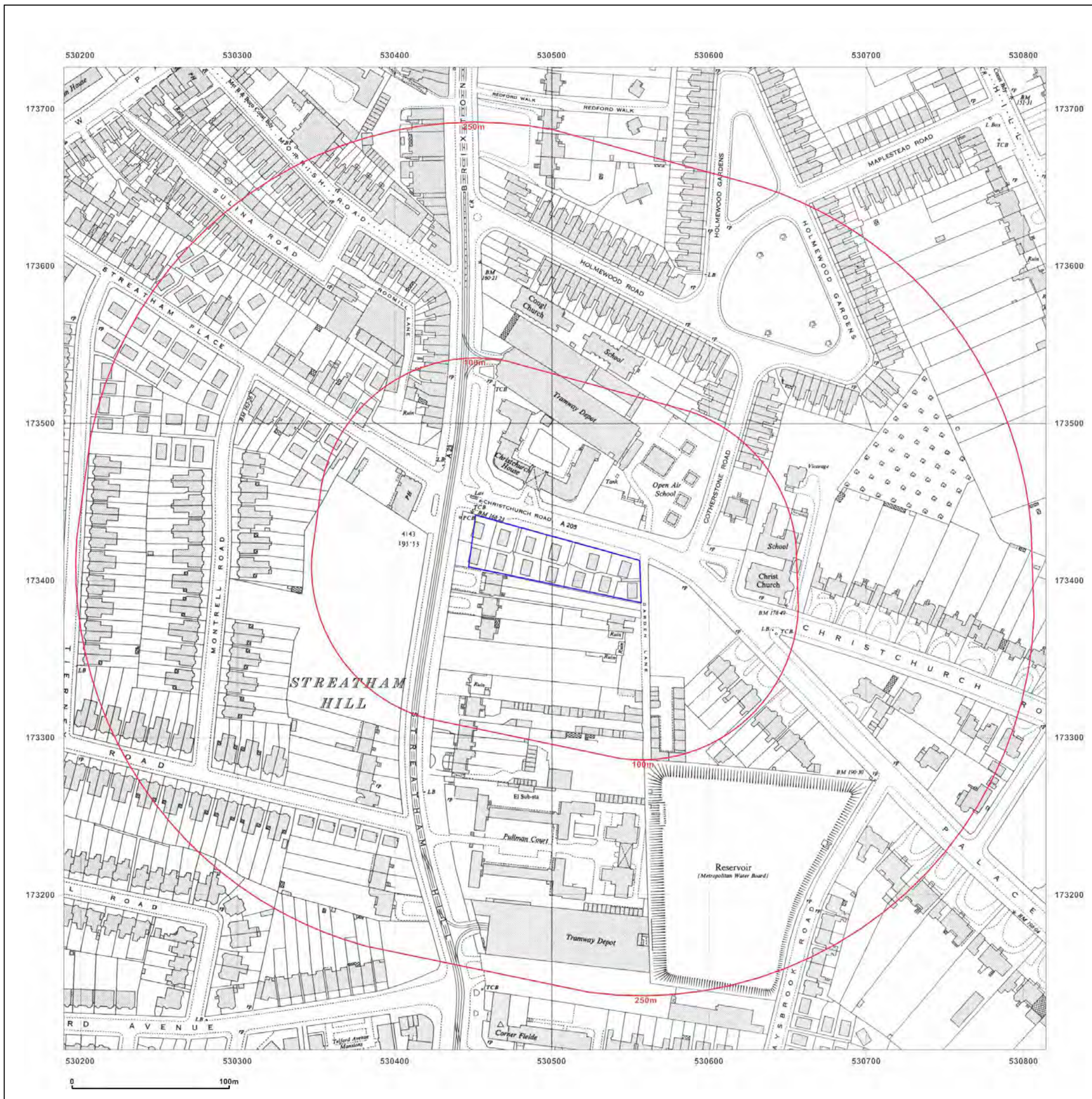


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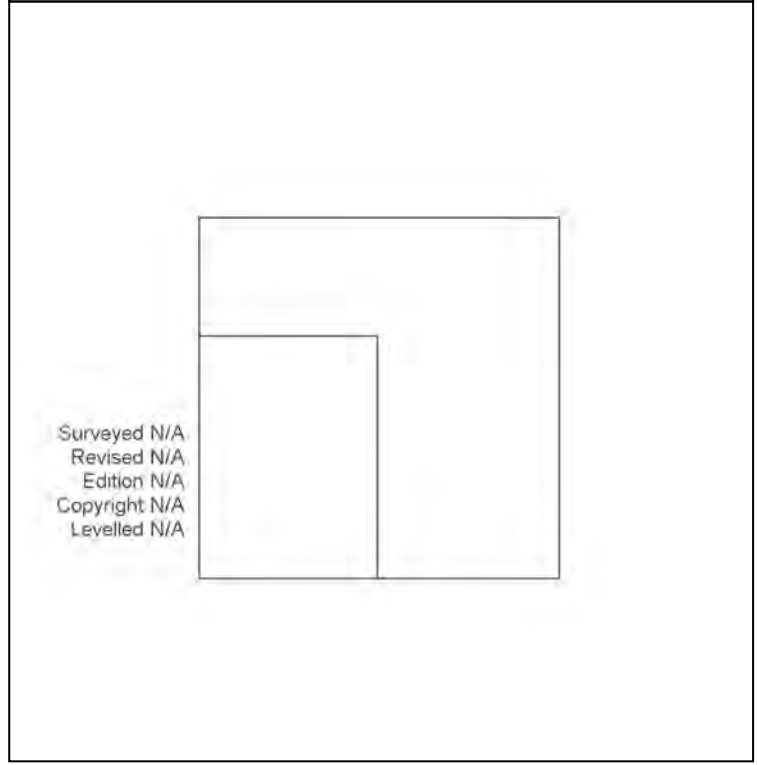
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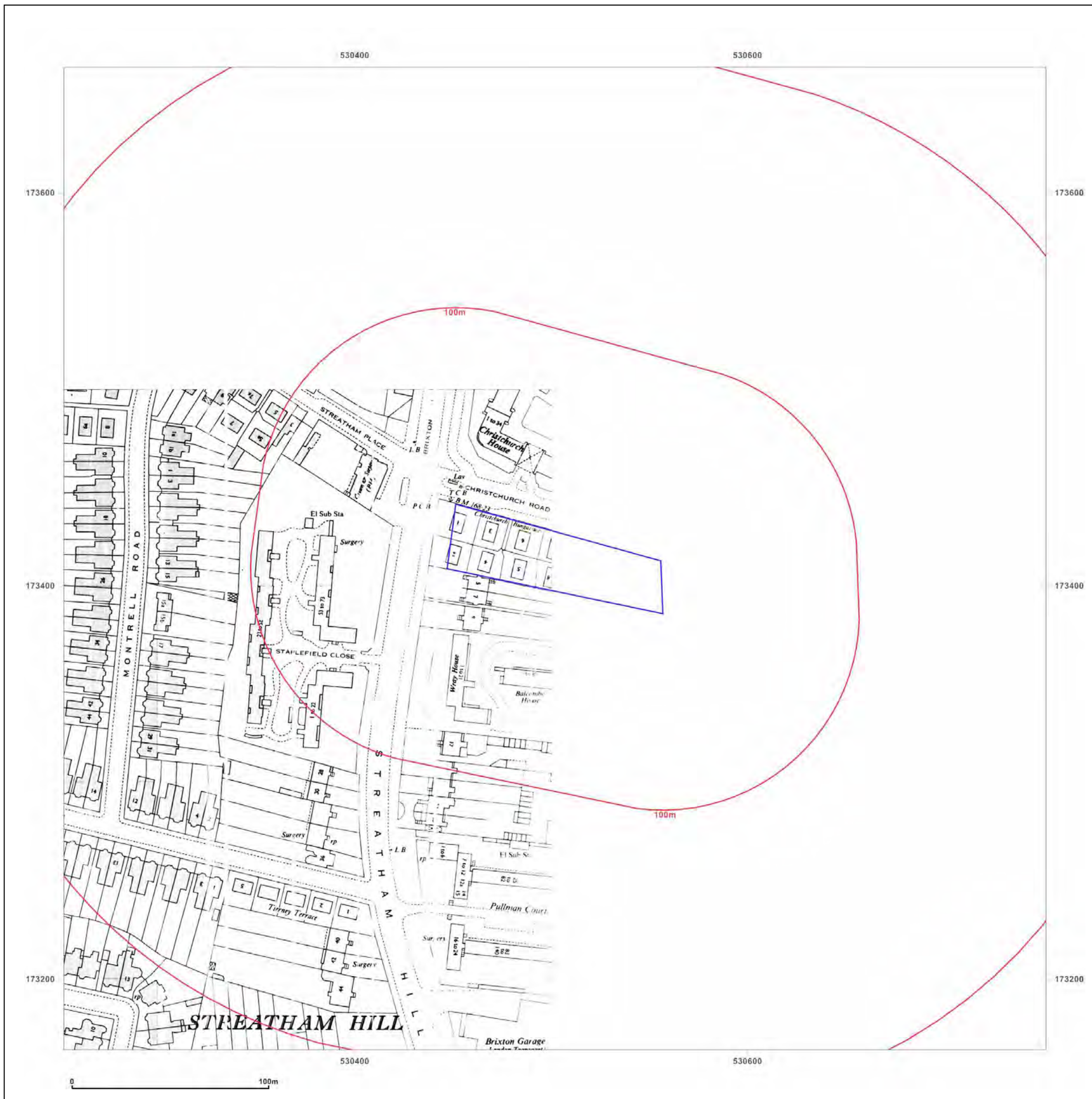


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Site Details:

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: 1953-1955

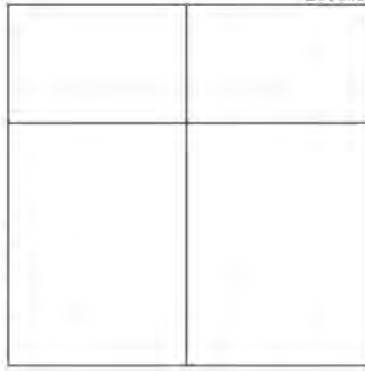
Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1950
Revised 1953
Edition N/A
Copyright N/A
Levelled 1934

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




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Site Details:

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

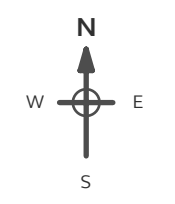
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Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

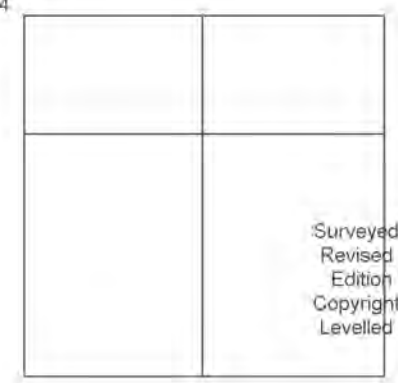
Map date: 1962

Scale: 1:1,250

Printed at: 1:2,000



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



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



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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: 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
 Revised 1972
 Edition N/A
 Copyright 1972
 Levelled 1954

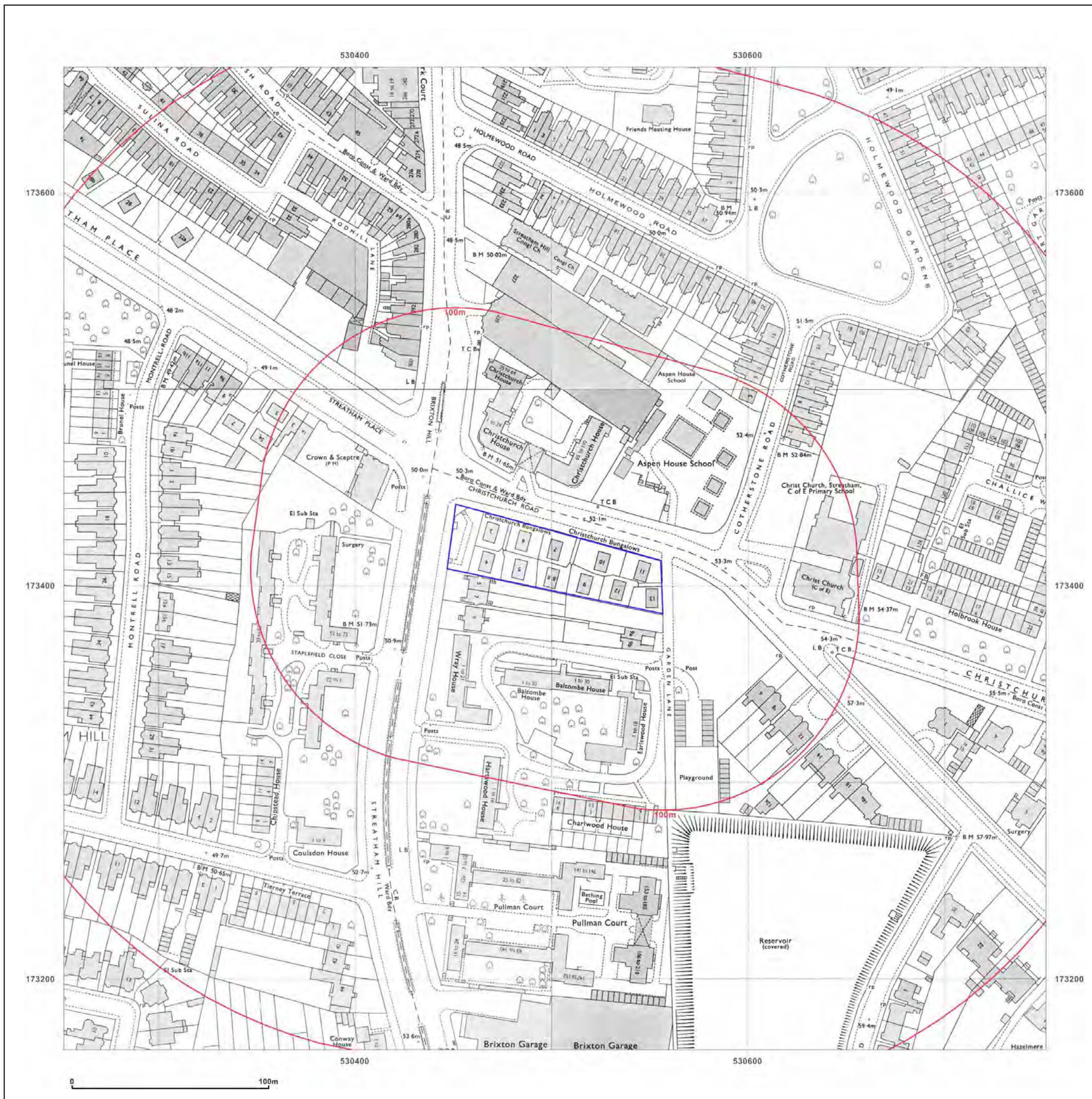


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Site Details:

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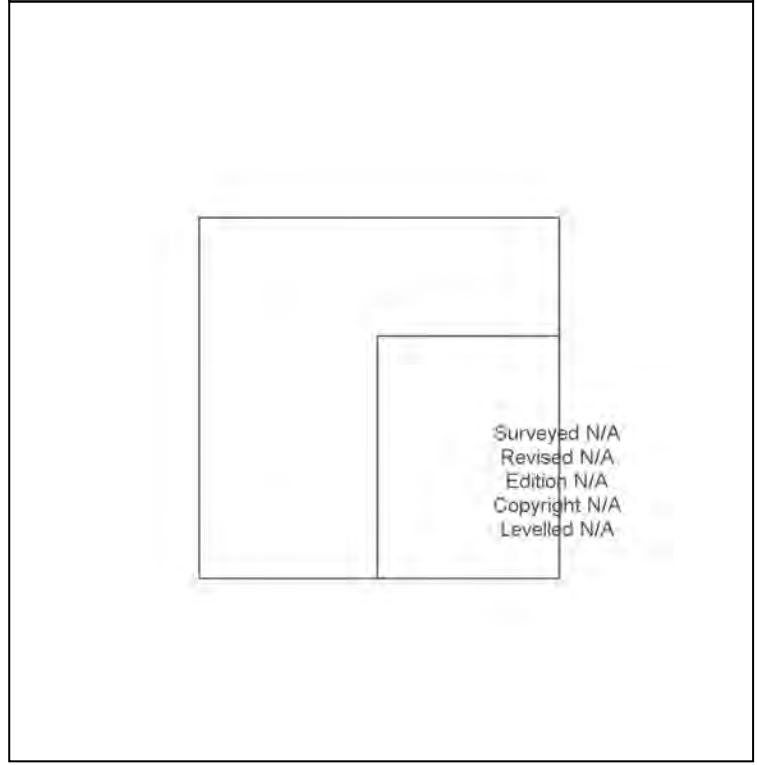
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

Map date: 1978

Scale: 1:1,250

Printed at: 1:2,000

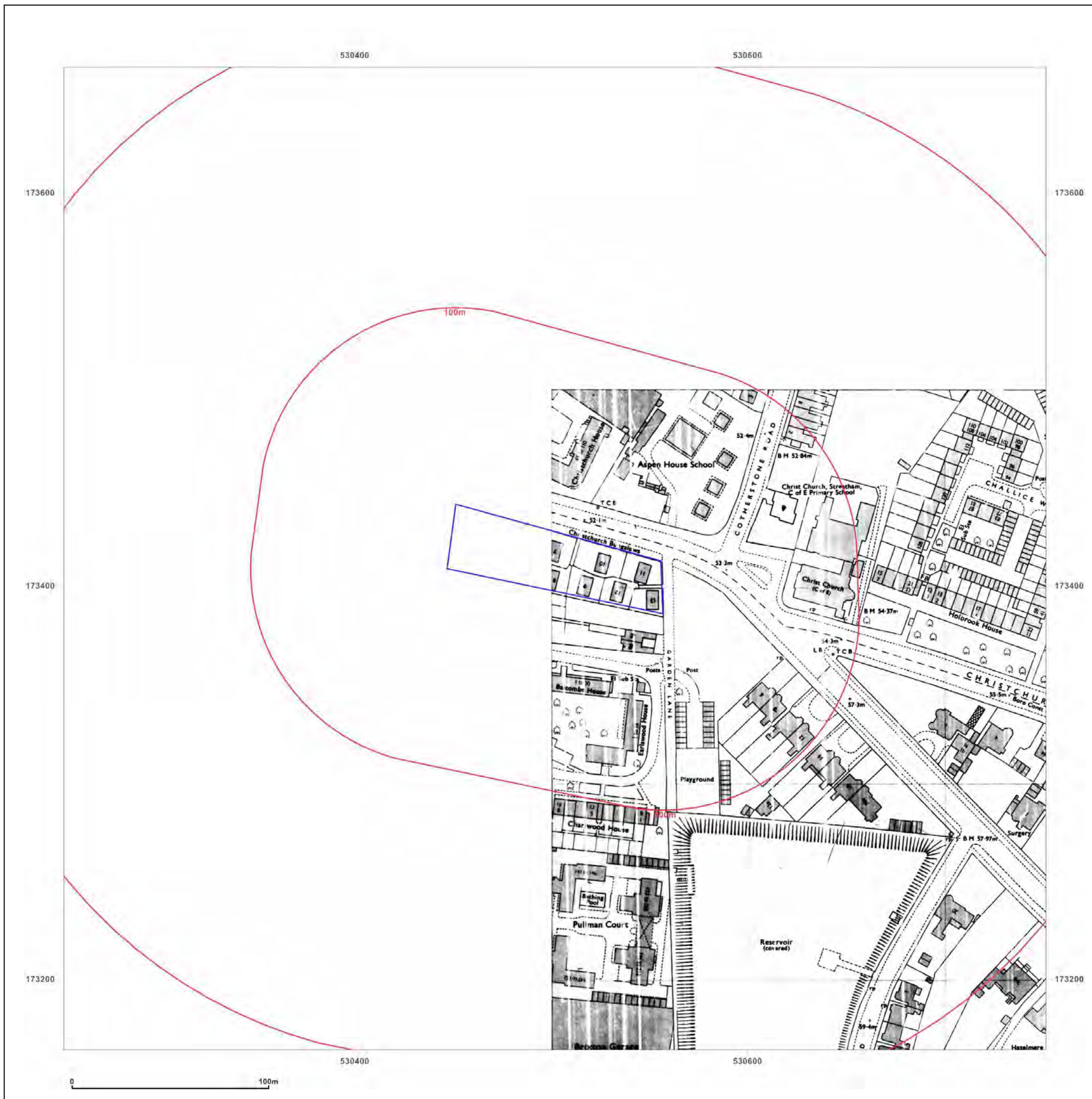


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Site Details:

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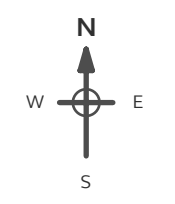
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Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

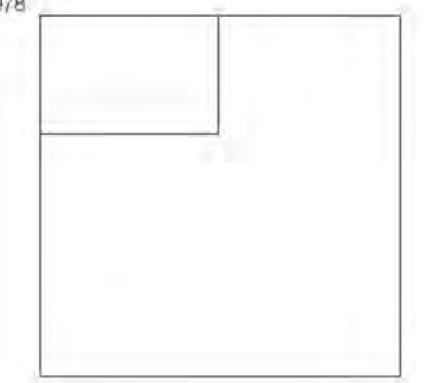
Map date: 1985

Scale: 1:1,250

Printed at: 1:2,000



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

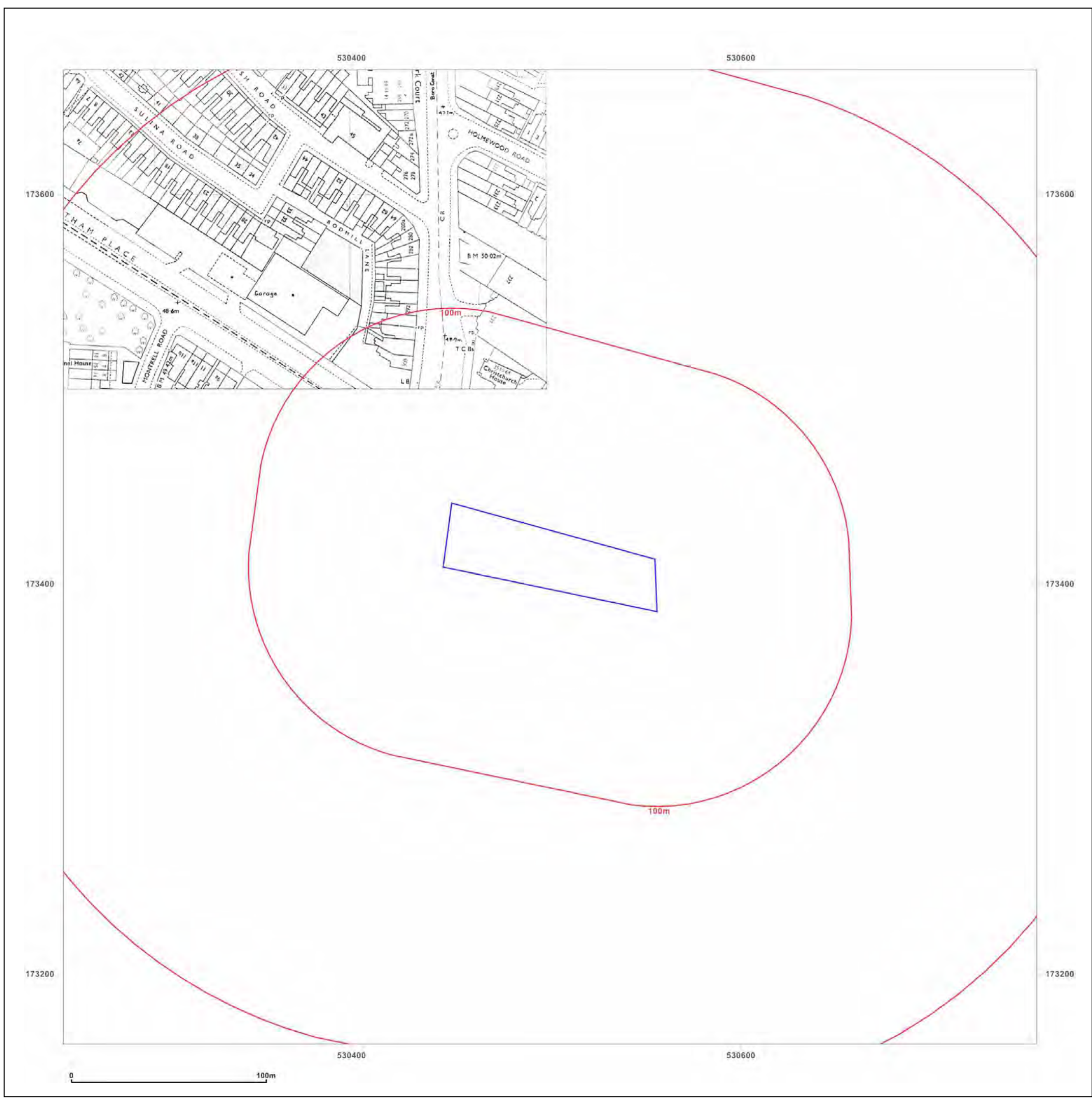


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Production date: 16 May 2017

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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: 1991

Scale: 1:1,250

Printed at: 1:2,000



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

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

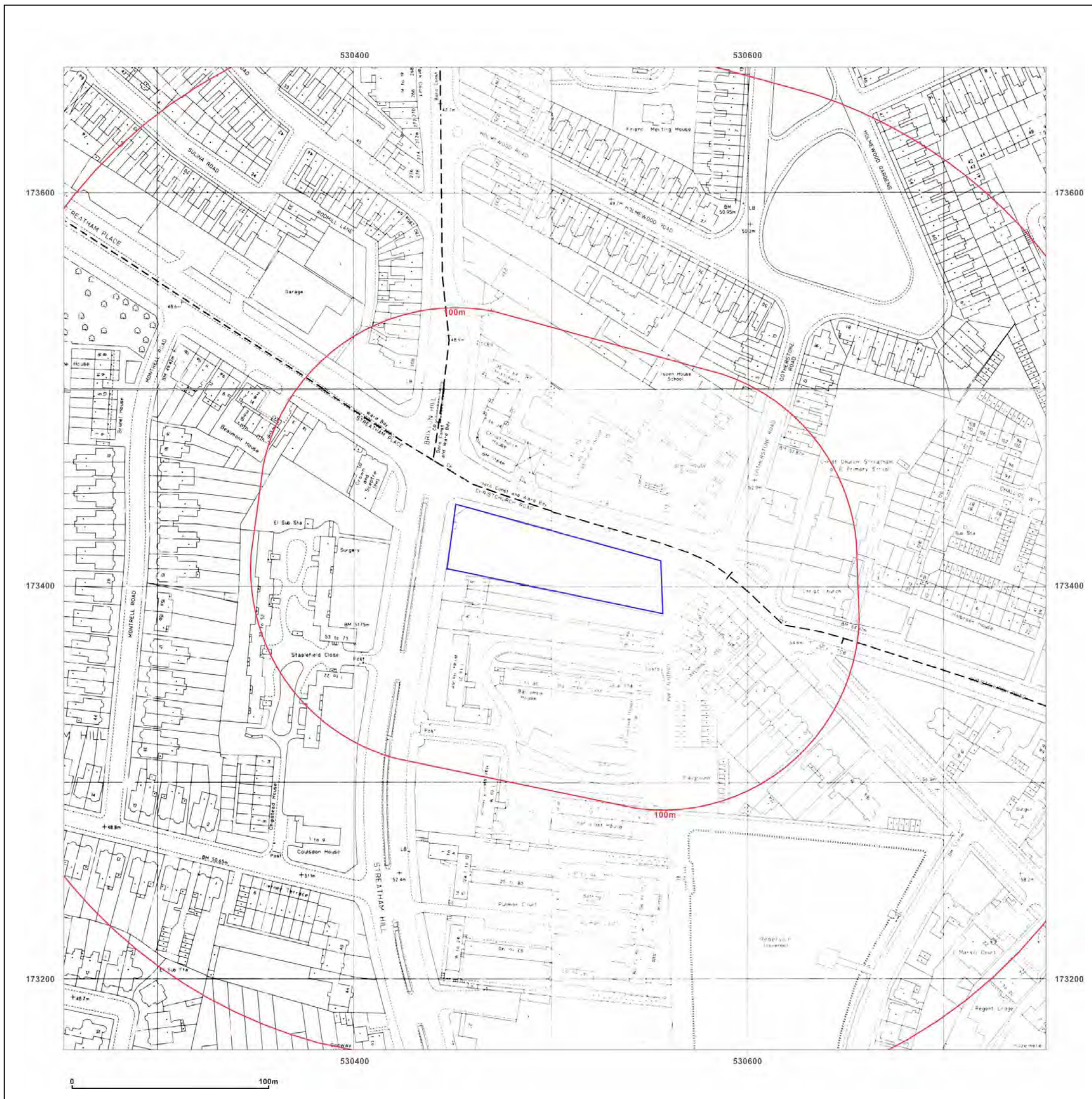


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Site Details:

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

Map Name: National Grid

Map date: 1991

Scale: 1:1,250

Printed at: 1:2,000



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

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

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

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



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Site Details:

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

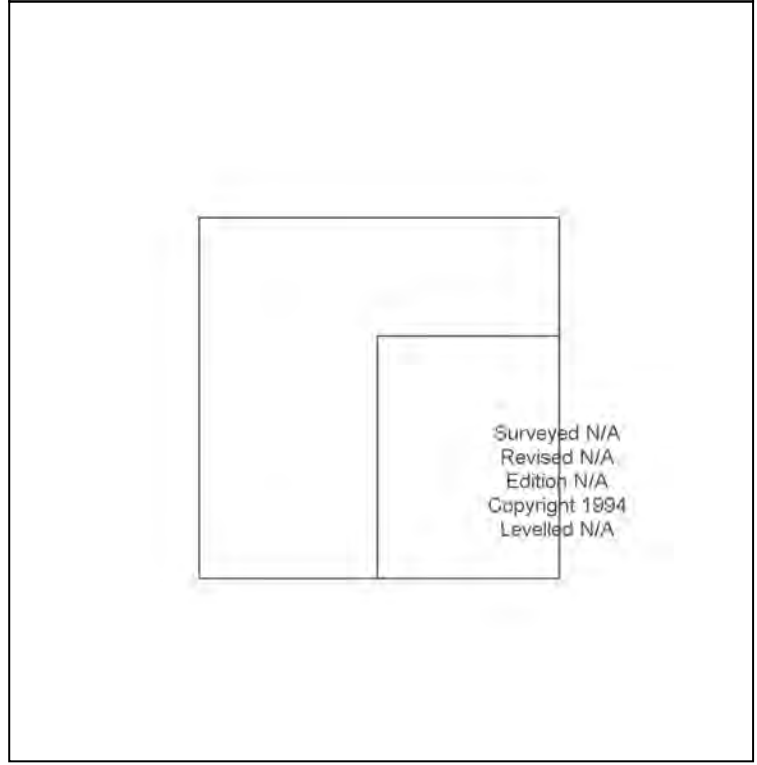
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

Map date: 1994

Scale: 1:1,250

Printed at: 1:2,000

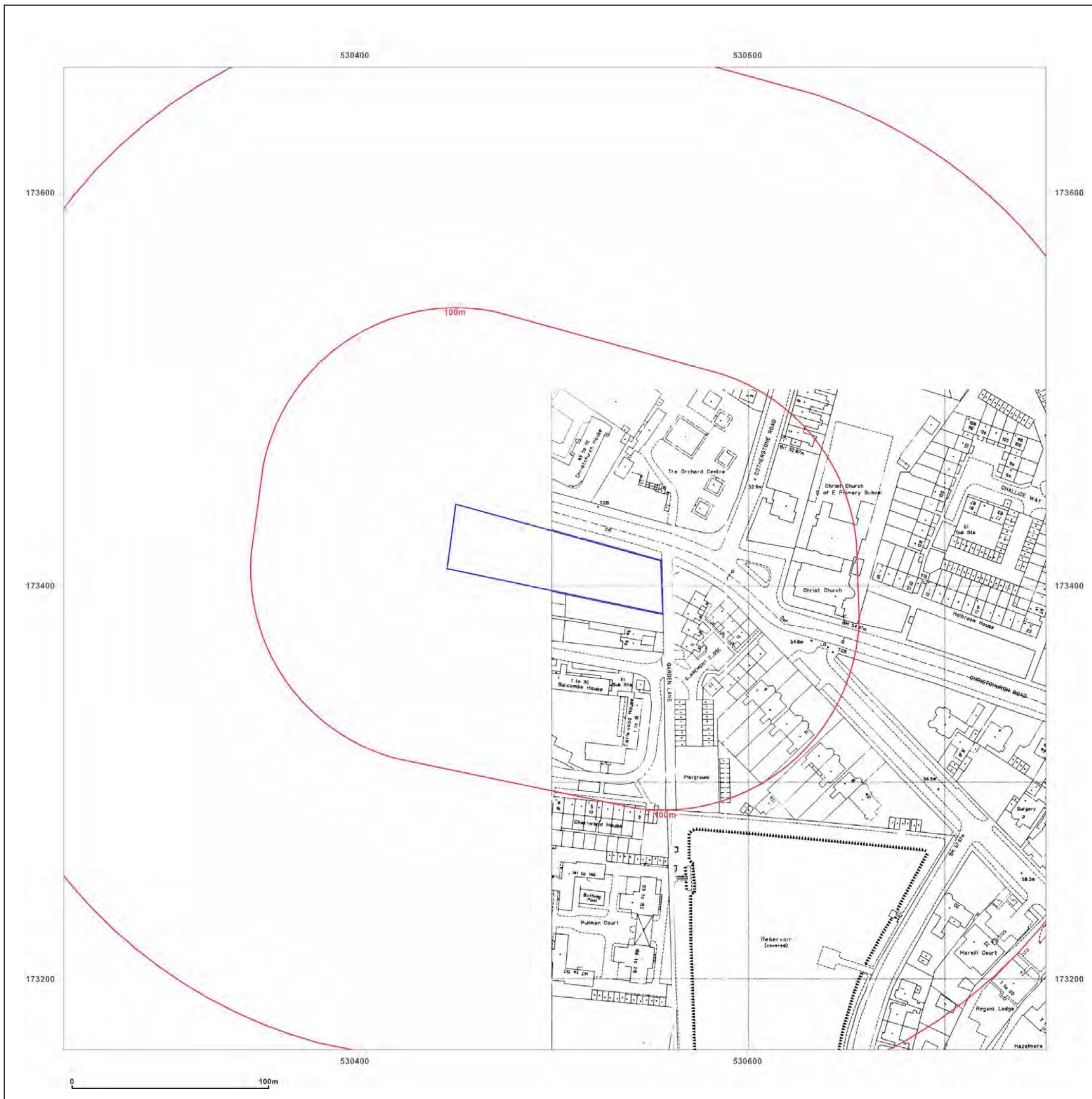


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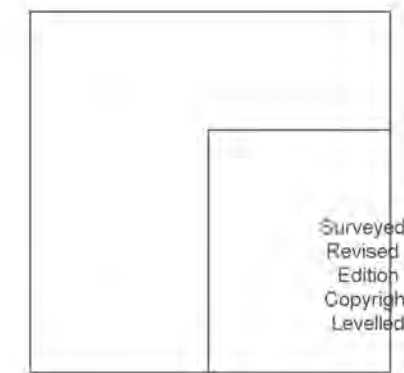
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

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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Site Details:

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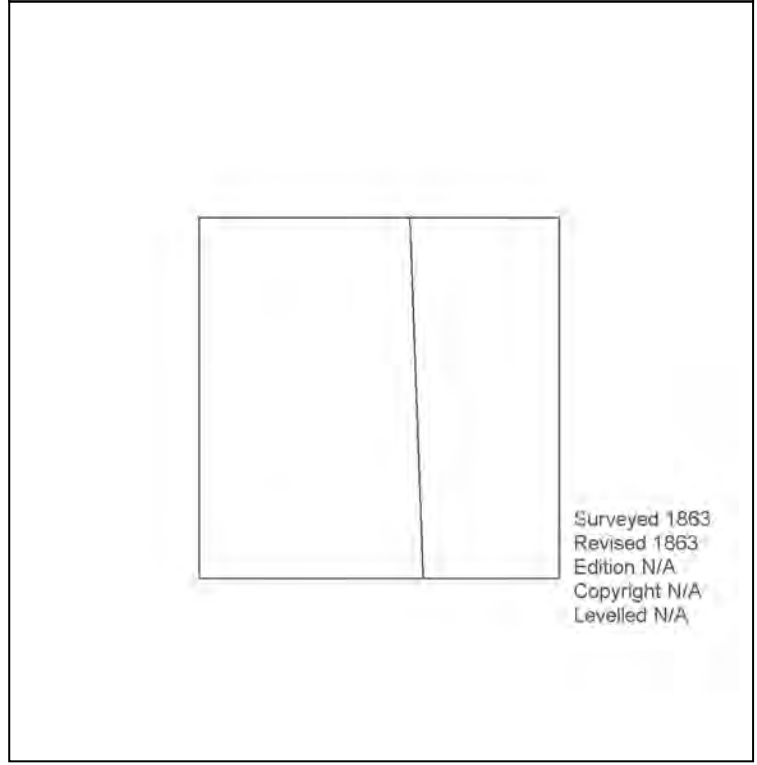
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

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

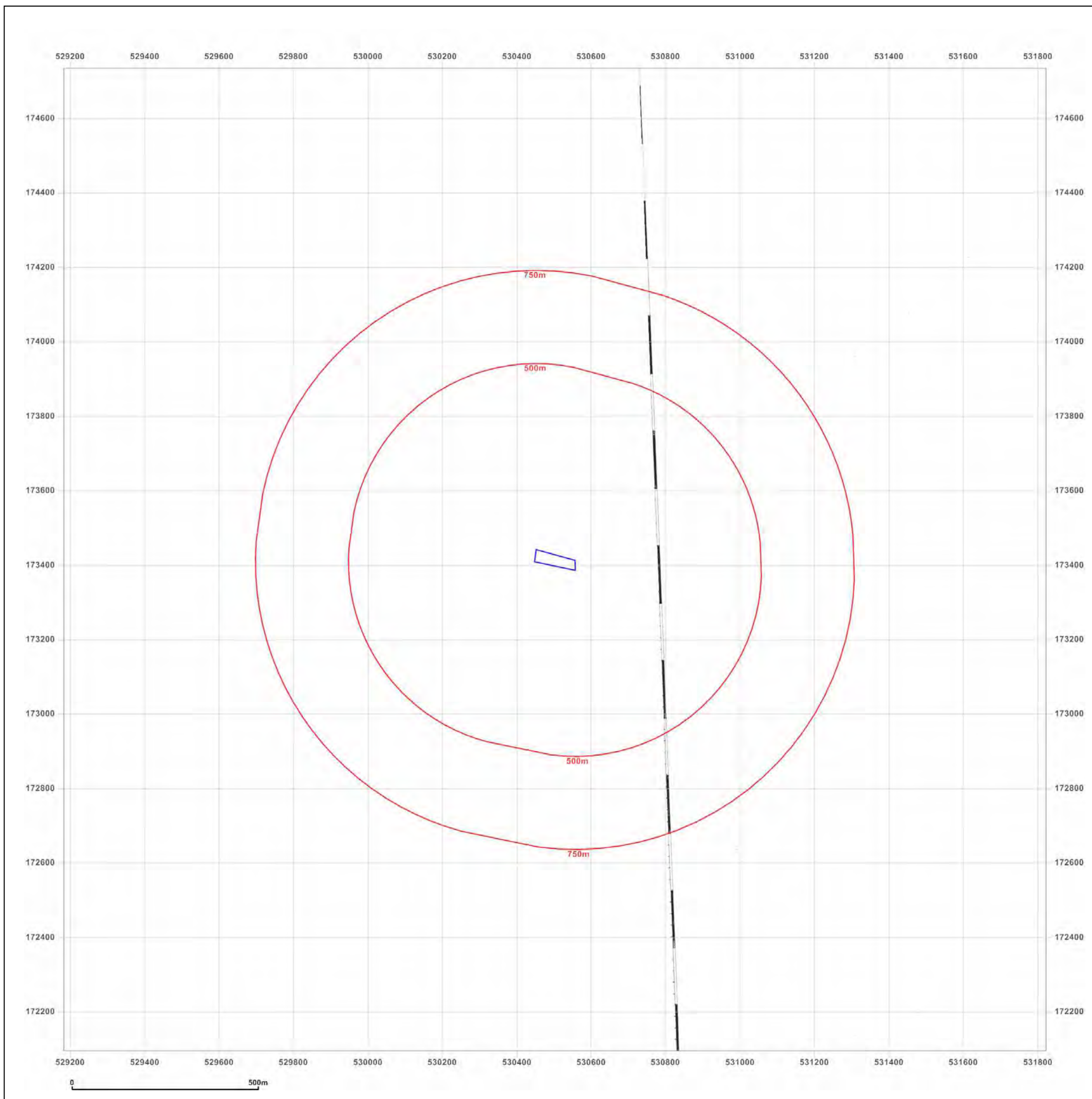


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Site Details:

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: 1870

Scale: 1:10,560

Printed at: 1:10,560



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

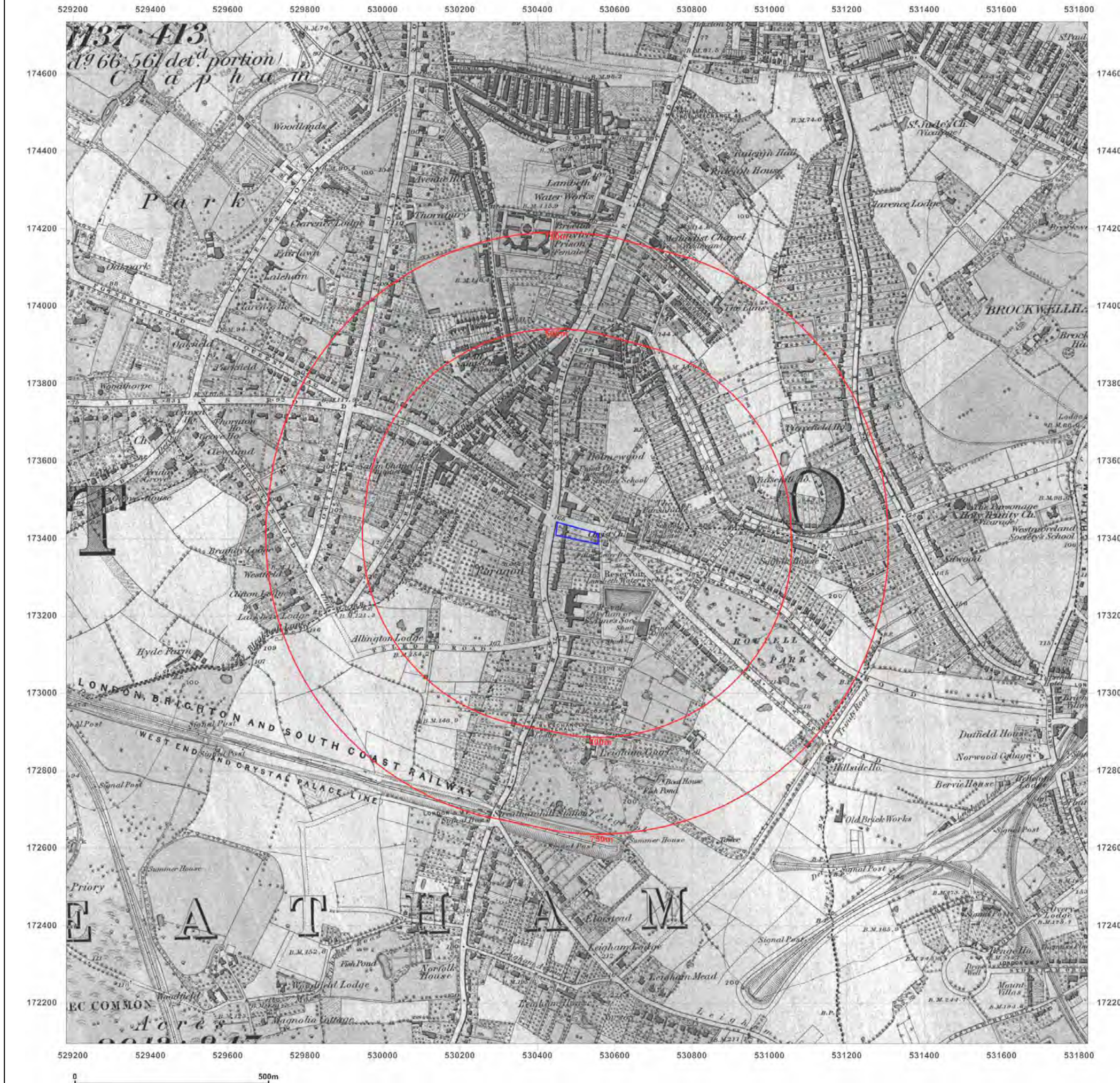


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Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: County Series

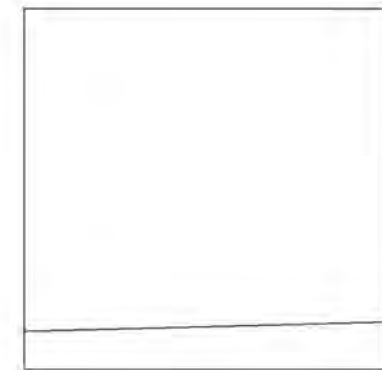
Map date: 1871

Scale: 1:10,560

Printed at: 1:10,560



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

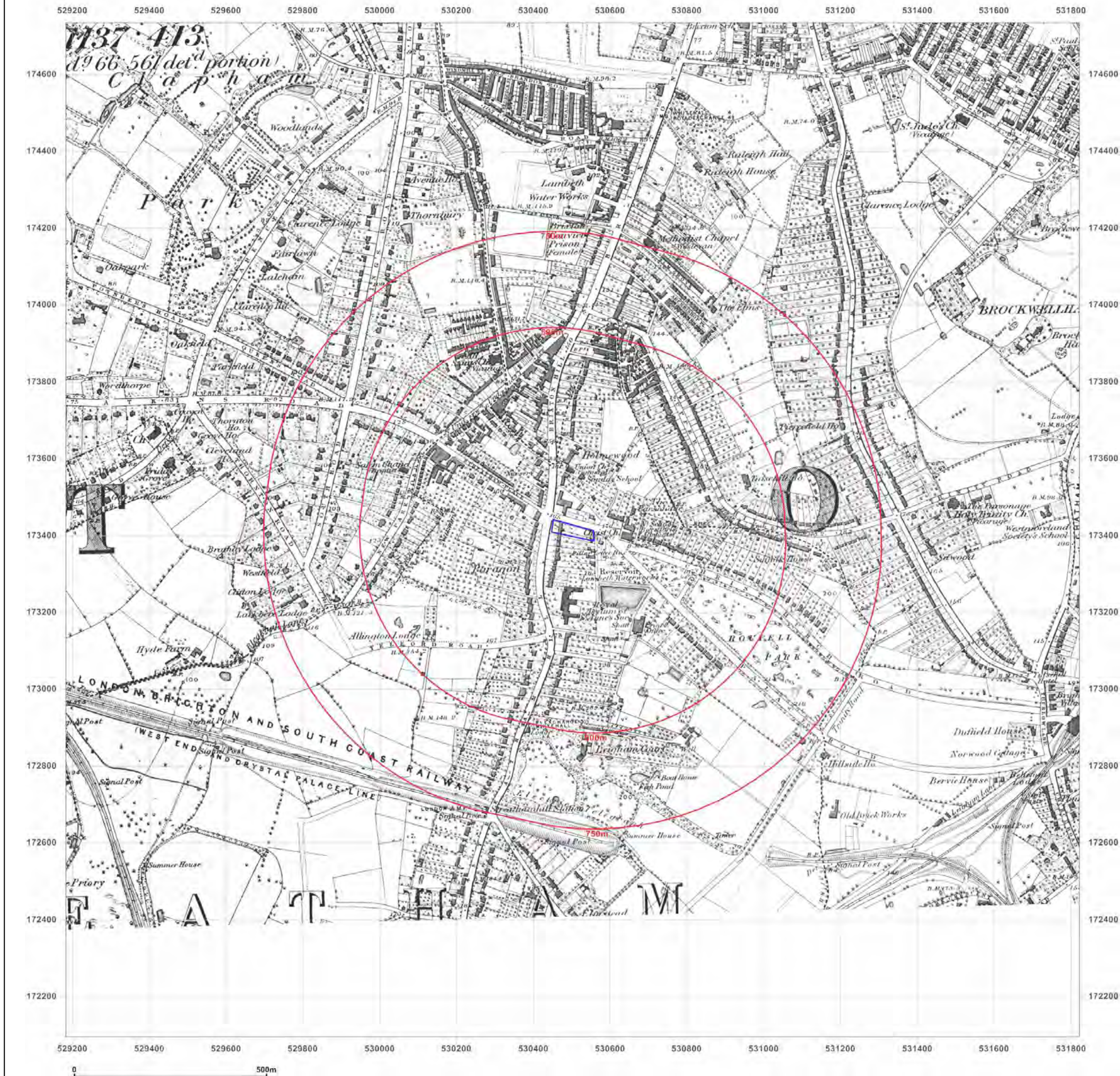


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Land at Christchurch Road & Brixton Hill, Lambeth, SW2 4AP

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

Map Name: County Series

Map date: 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

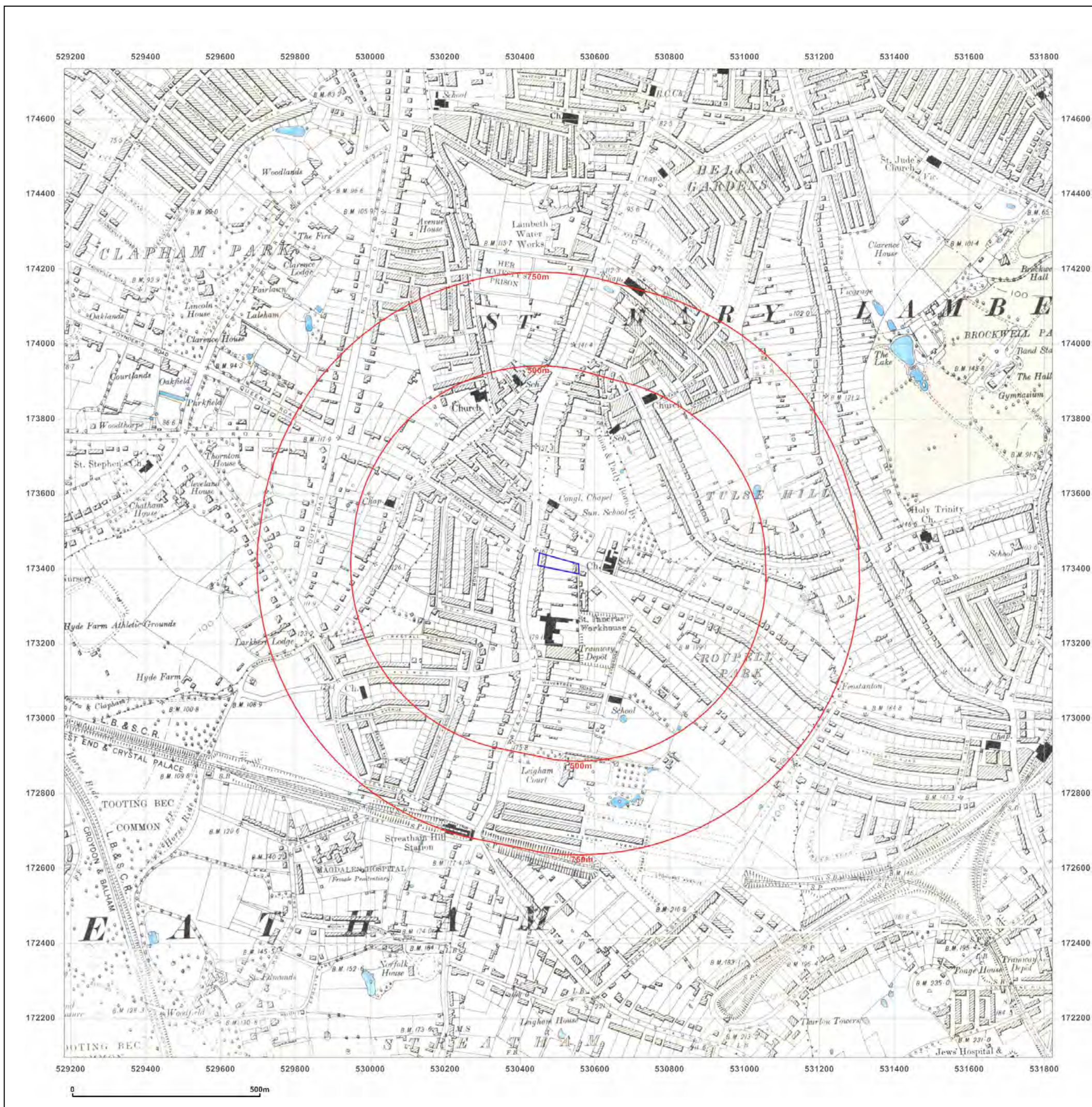


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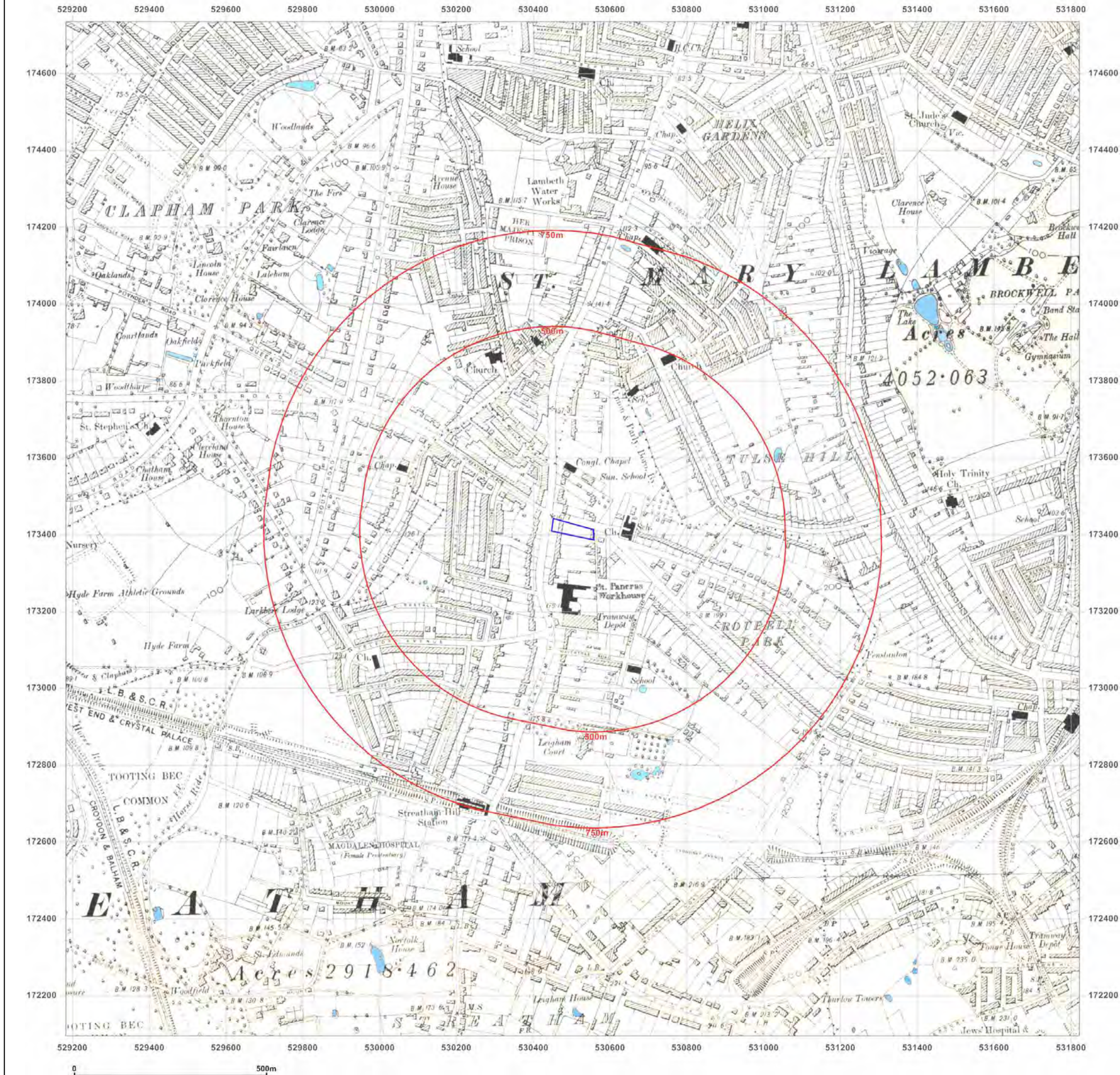
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: County Series

Map date: 1894-1898

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1869
 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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Site Details:

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

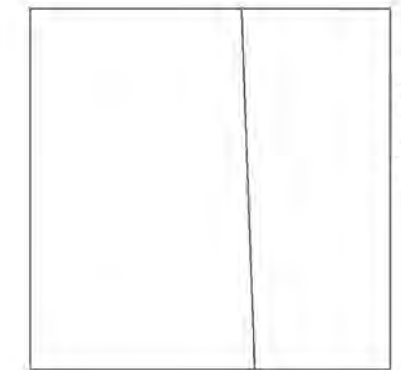
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: County Series

Map date: 1898

Scale: 1:10,560

Printed at: 1:10,560



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

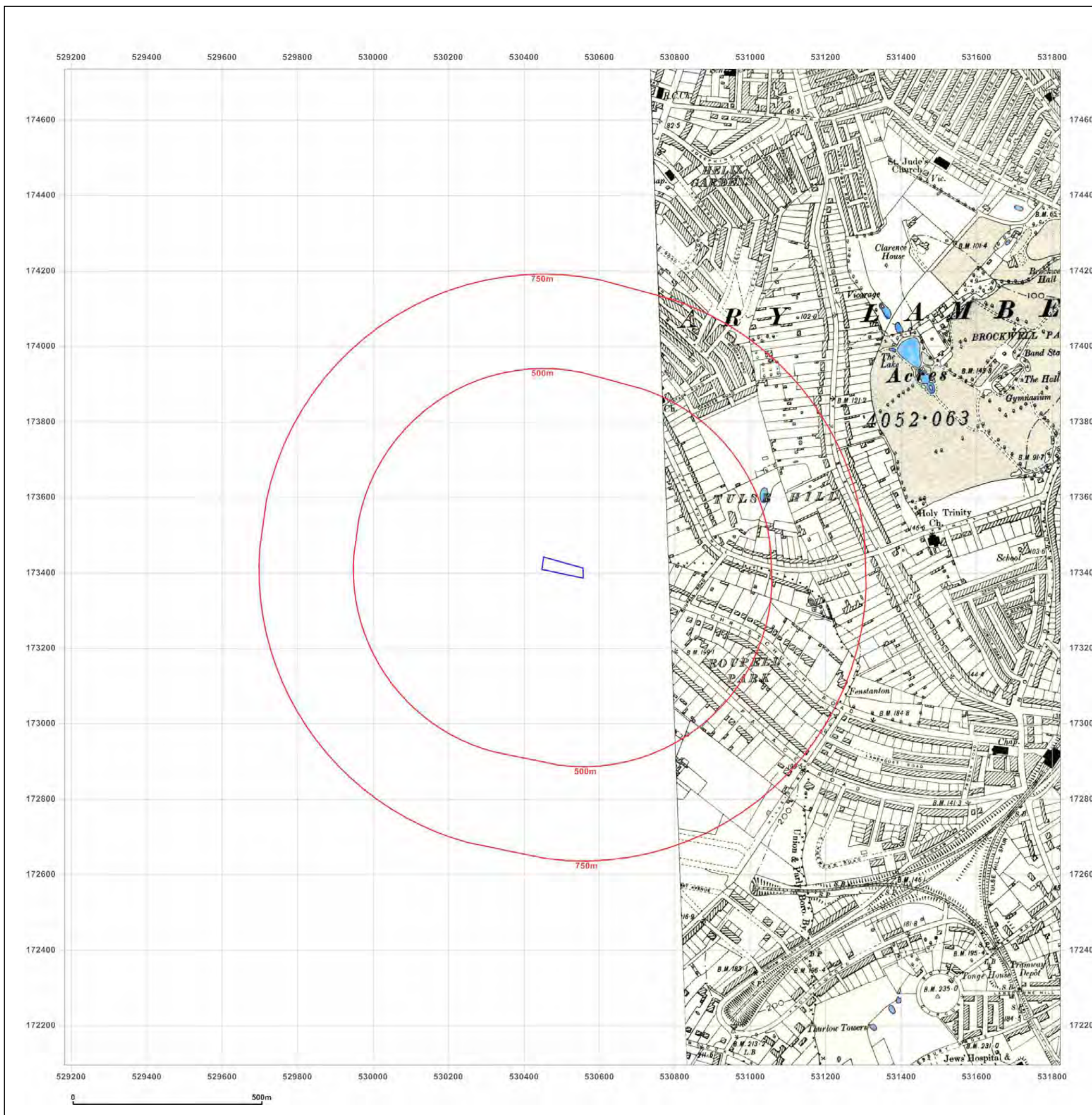


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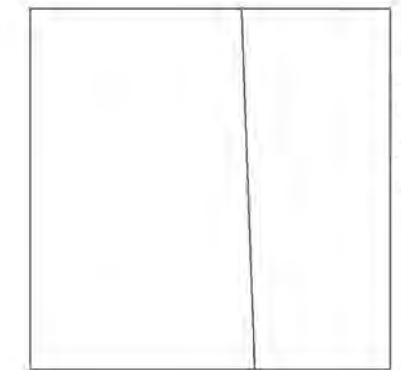
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: County Series

Map date: 1898

Scale: 1:10,560

Printed at: 1:10,560



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

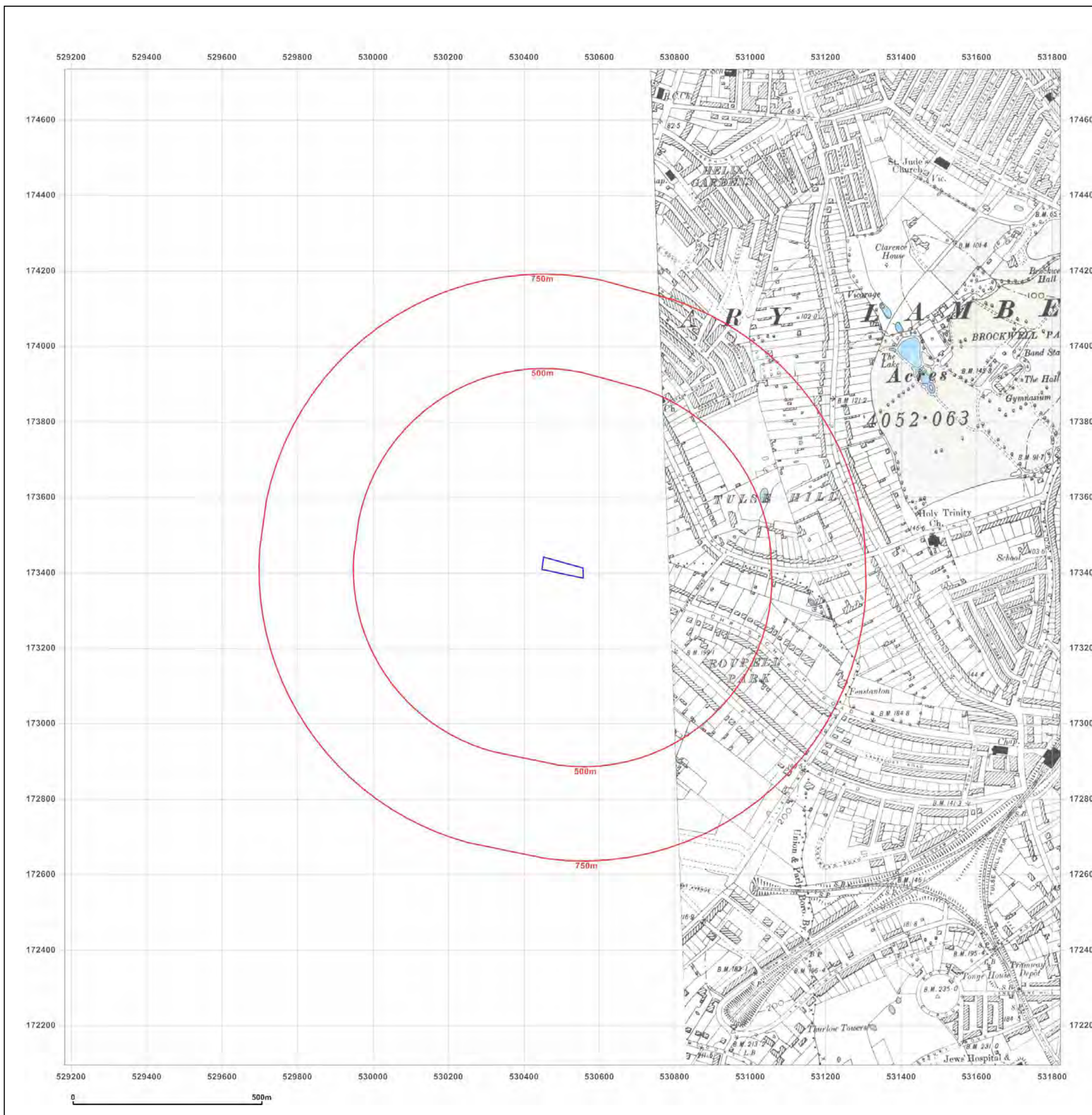


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Site Details:

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

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

Map Name: 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

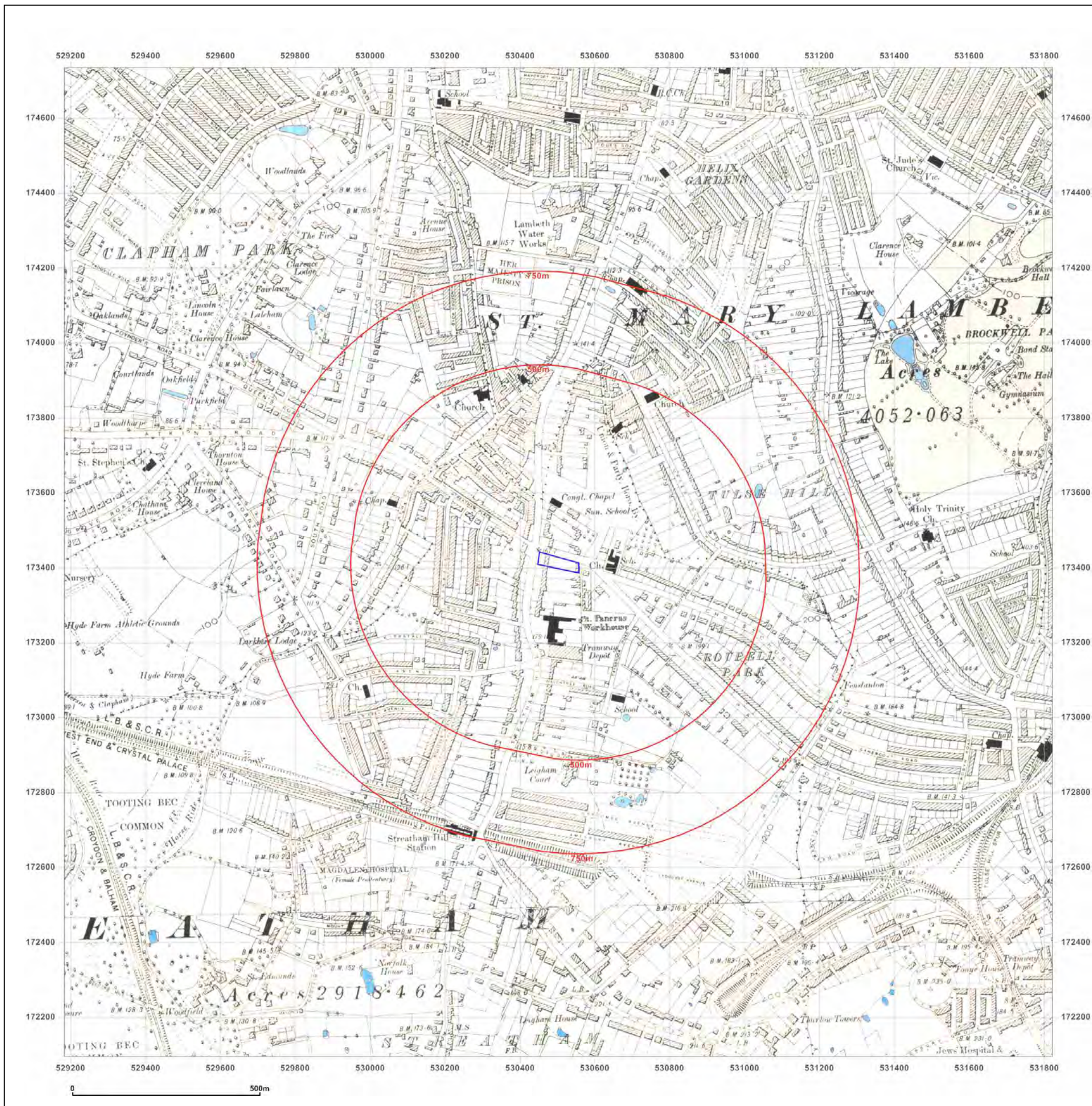


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Site Details:

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

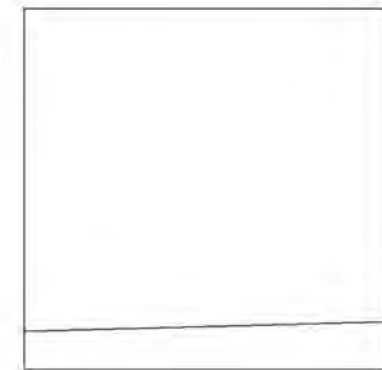
Map date: 1919-1920

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
 Copyright N/A
 Levelled N/A

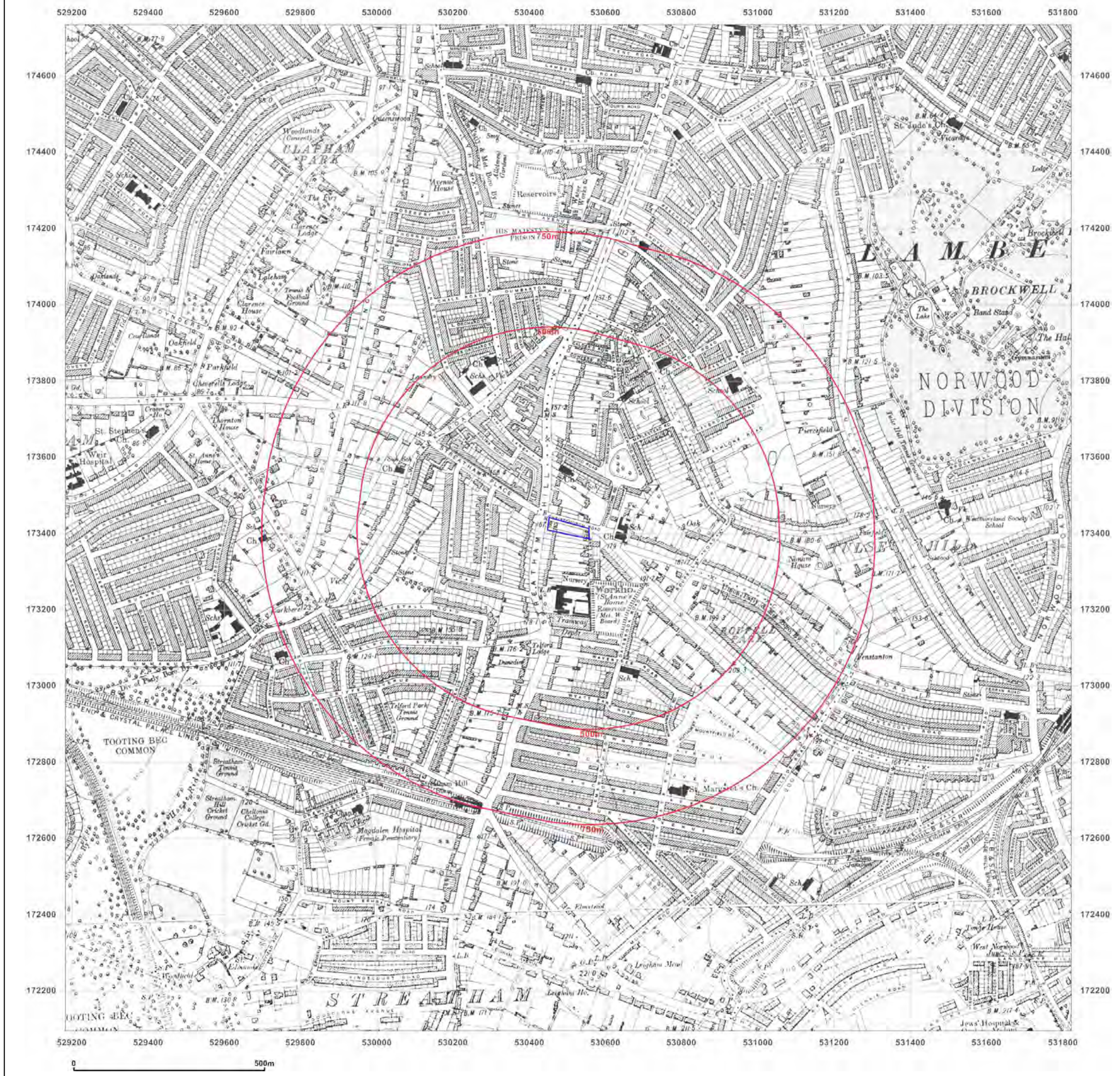


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Site Details:

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

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

Map Name: County Series

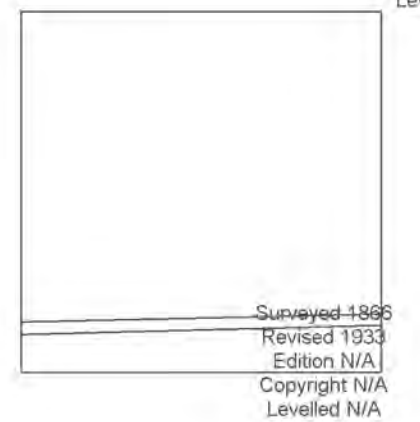
Map date: 1933-1938

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

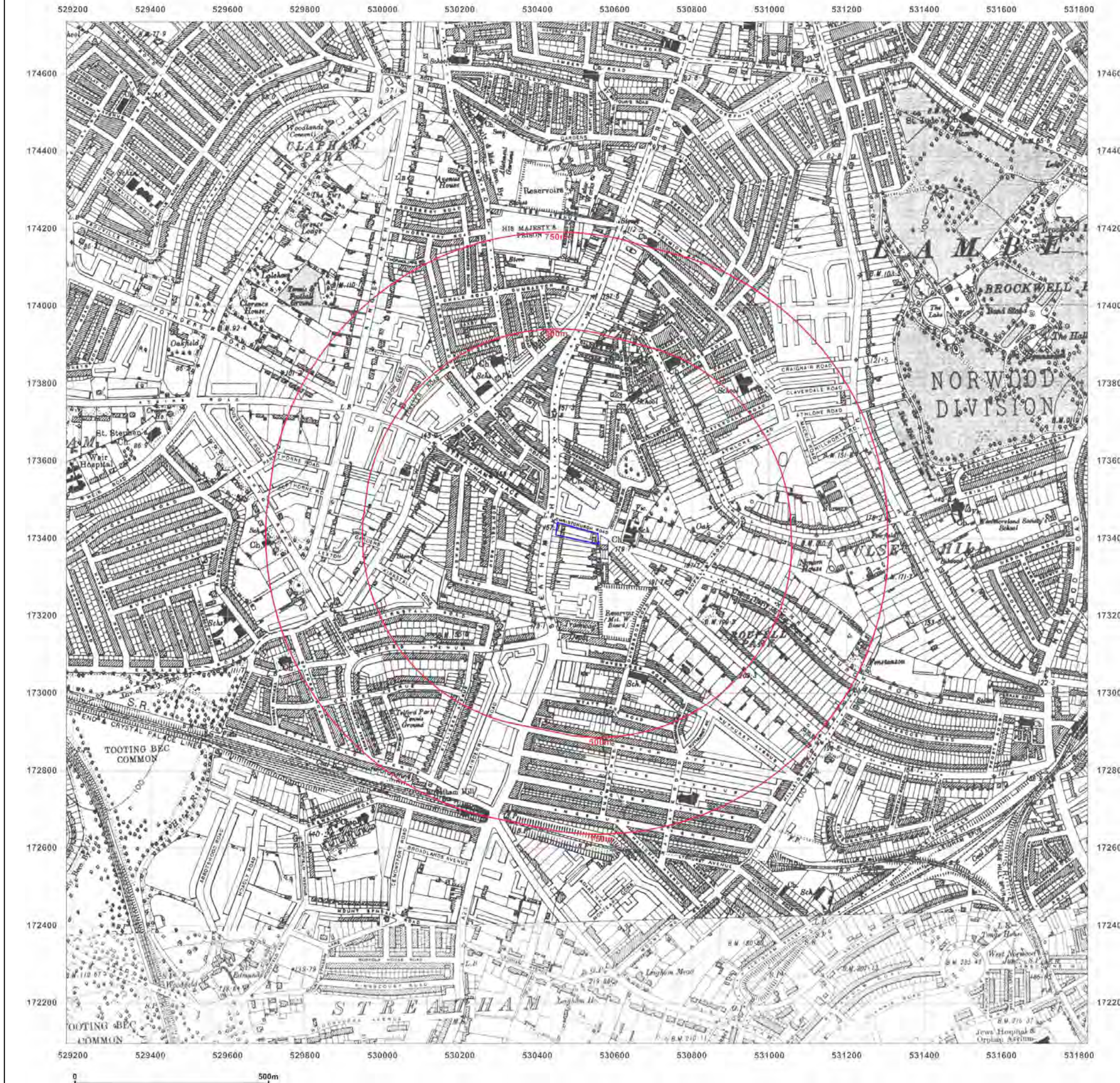


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Site Details:

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

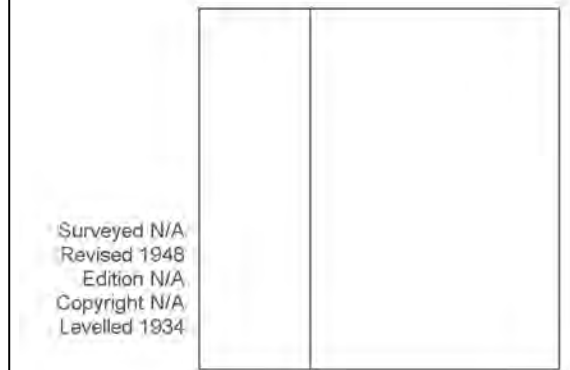
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

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

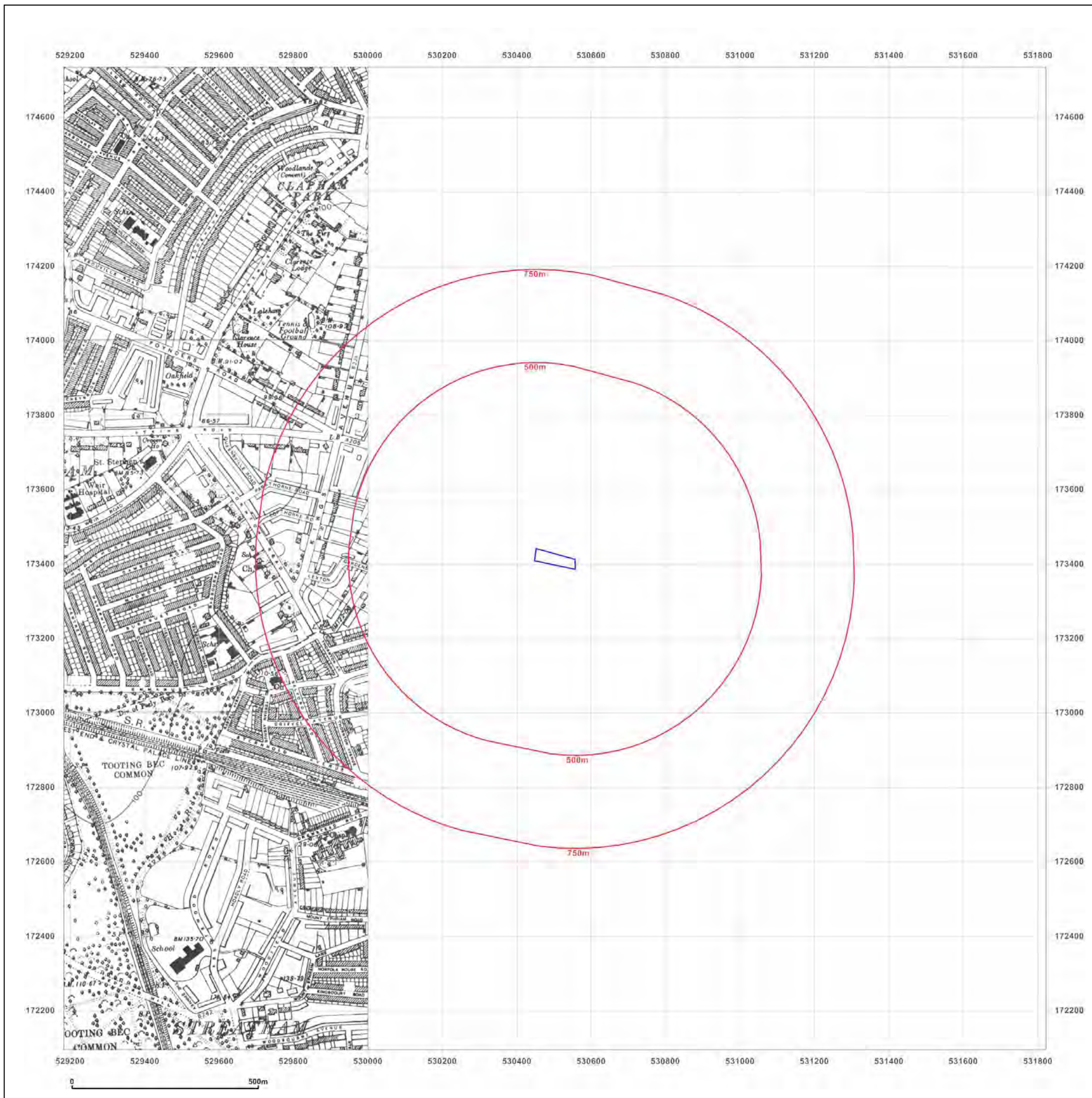


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Site Details:

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

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

Map Name: Provisional

Map date: 1954-1955

Scale: 1:10,560

Printed at: 1:10,560



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

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

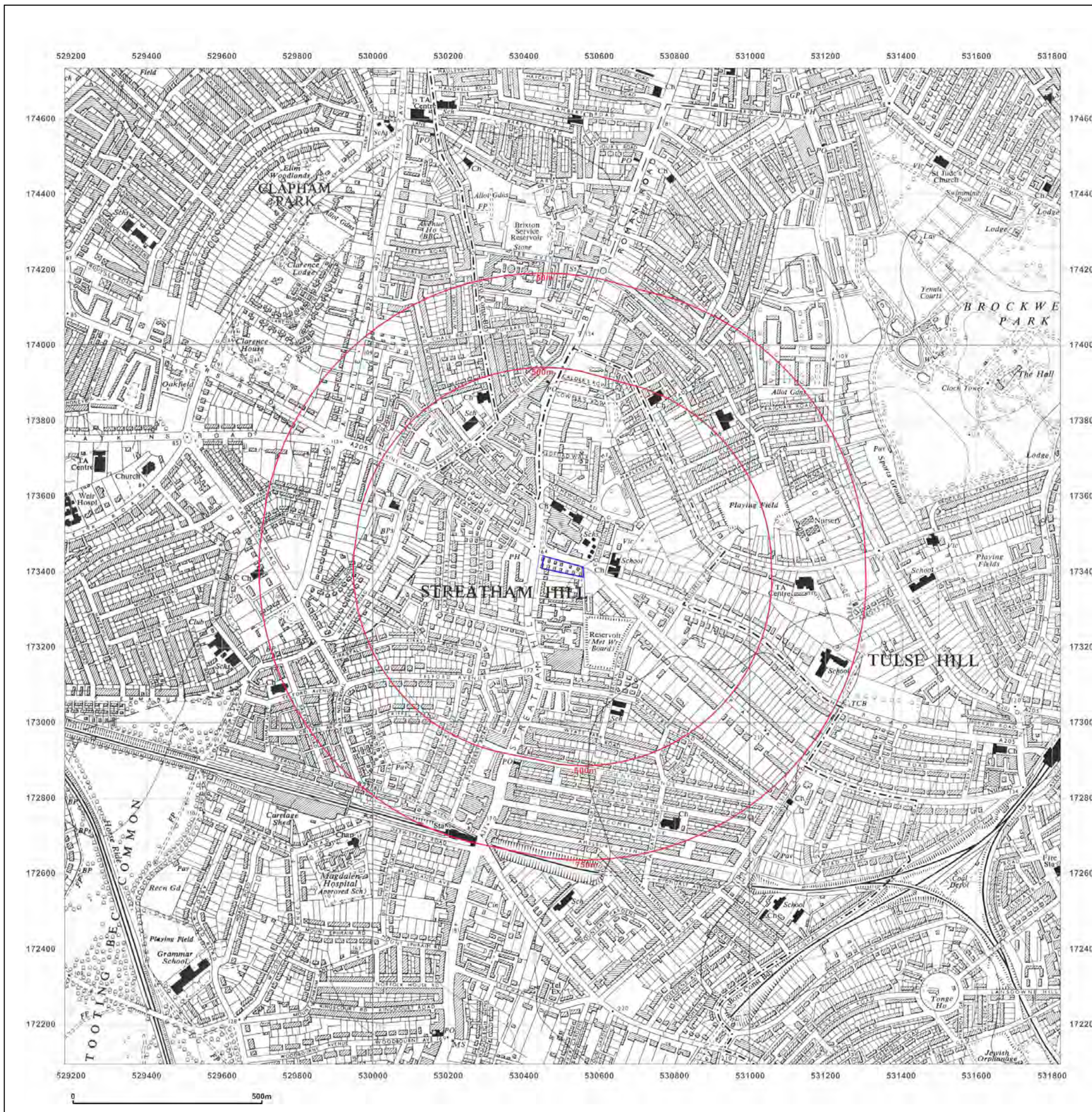


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Site Details:

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

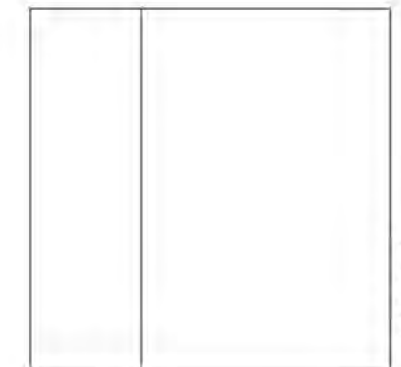
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: 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

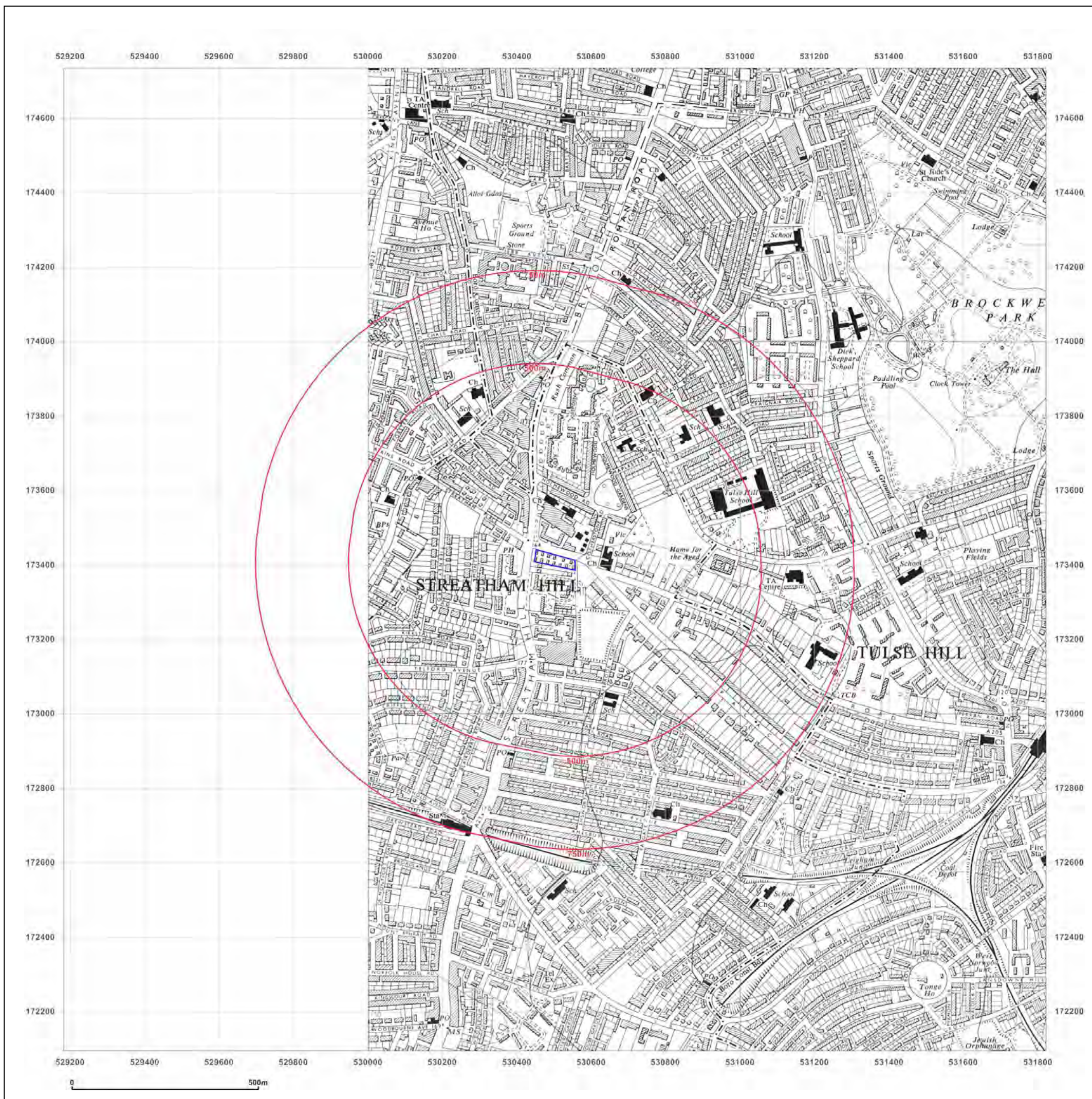


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Site Details:

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

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

Map Name: 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

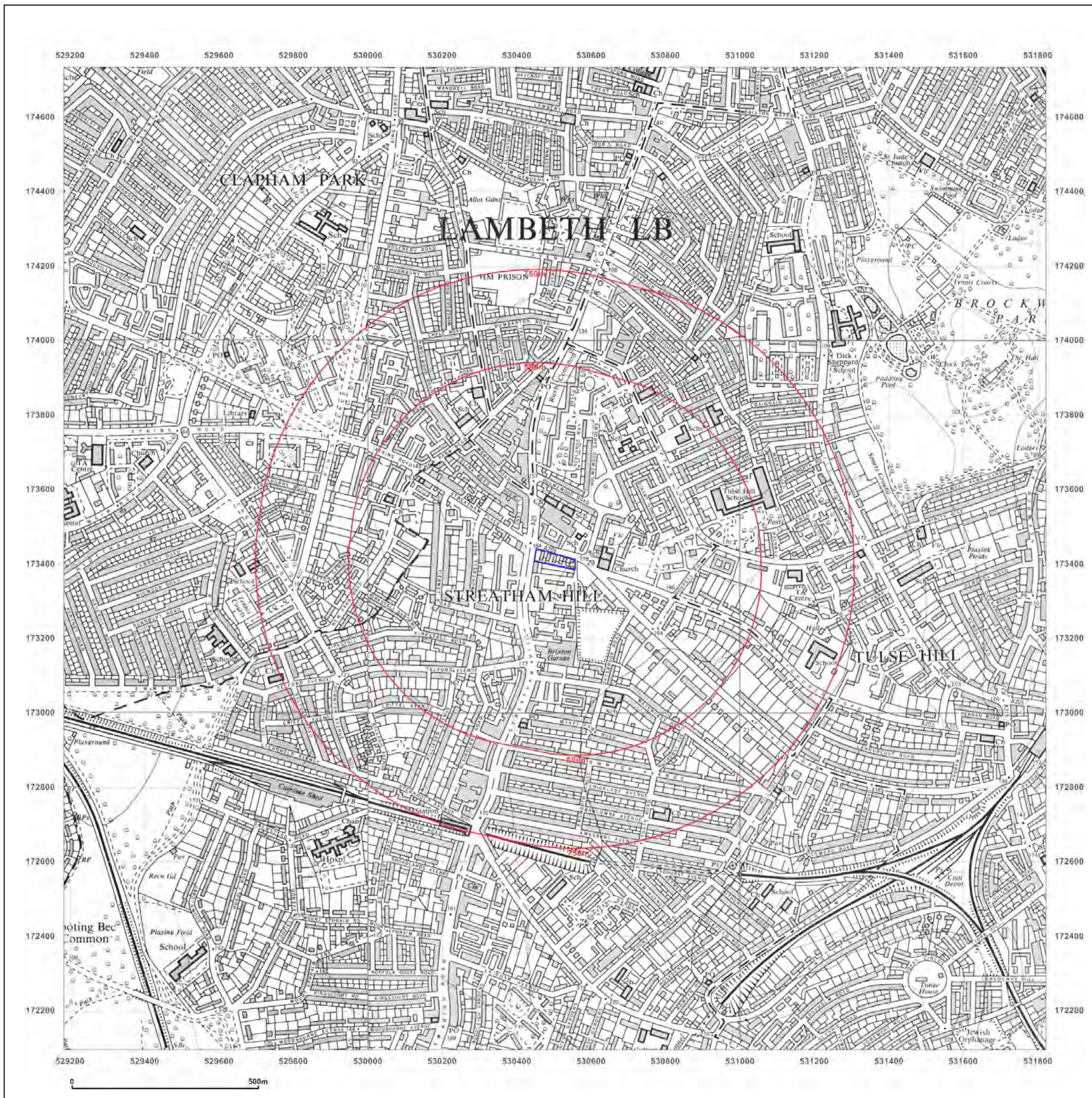


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Site Details:

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

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

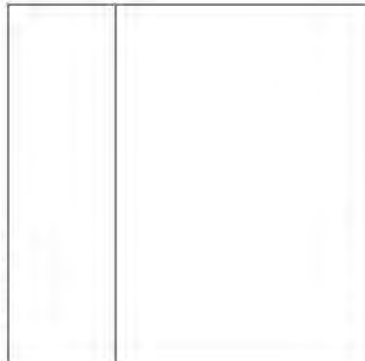
Map Name: National Grid

Map date: 1973-1974

Scale: 1:10,000

Printed at: 1:10,000





Surveyed 1973
 Revised 1974
 Edition N/A
 Copyright N/A
 Levelled N/A

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

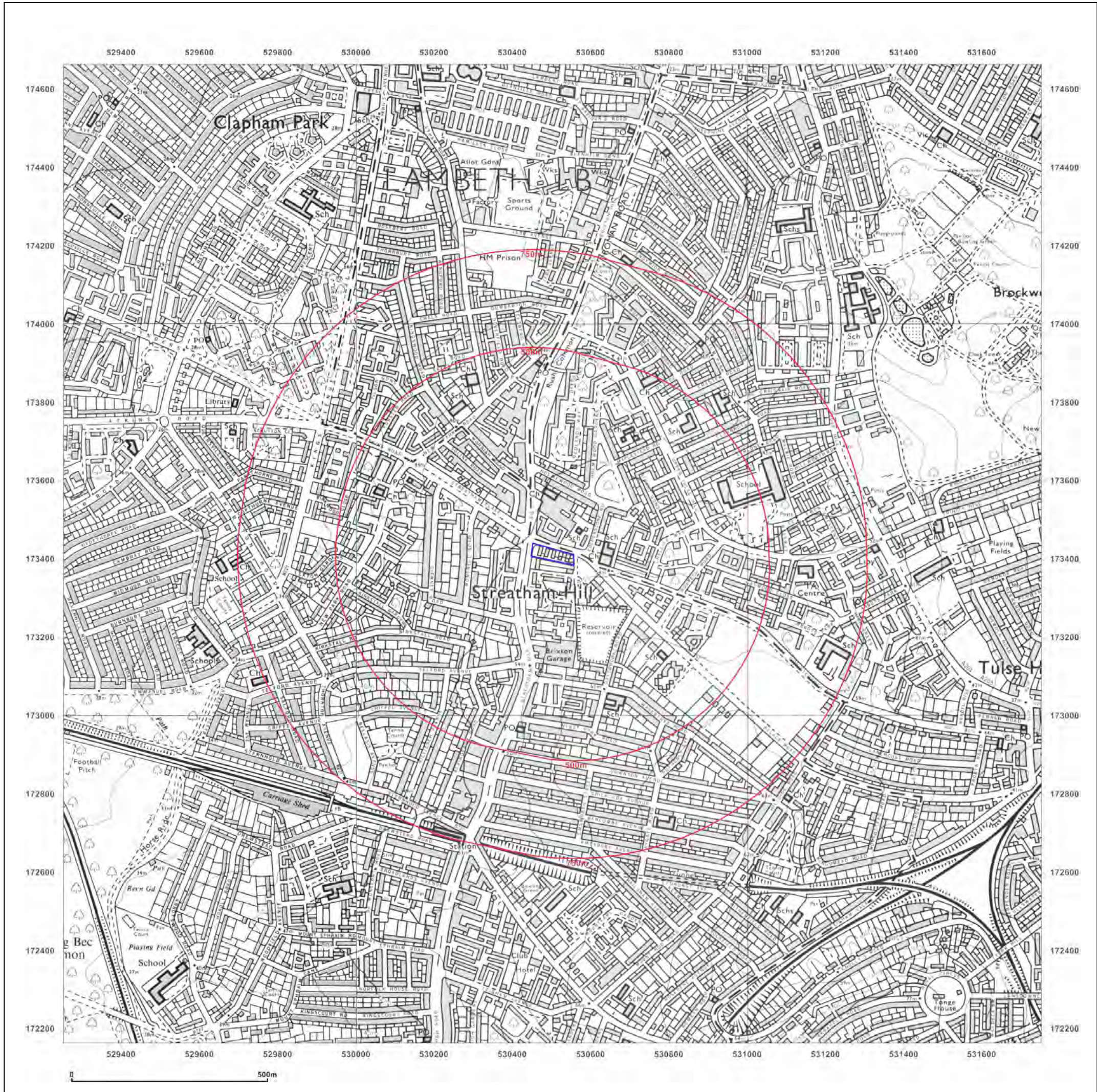


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Site Details:

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: 1982-1987

Scale: 1:10,000

Printed at: 1:10,000



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Surveyed 1982
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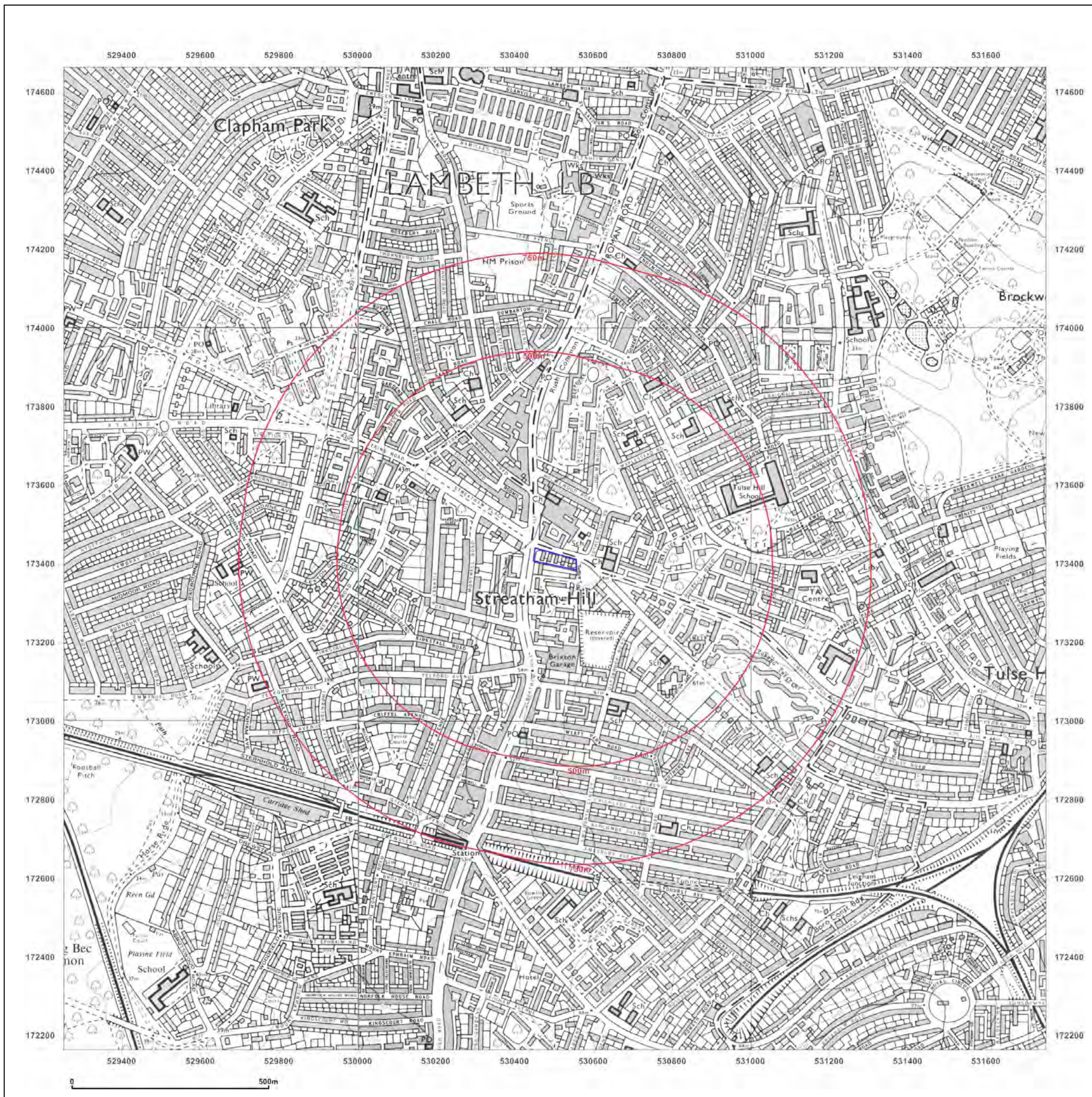


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Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

Map date: 1987-1992

Scale: 1:10,000

Printed at: 1:10,000



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 Revised 1992
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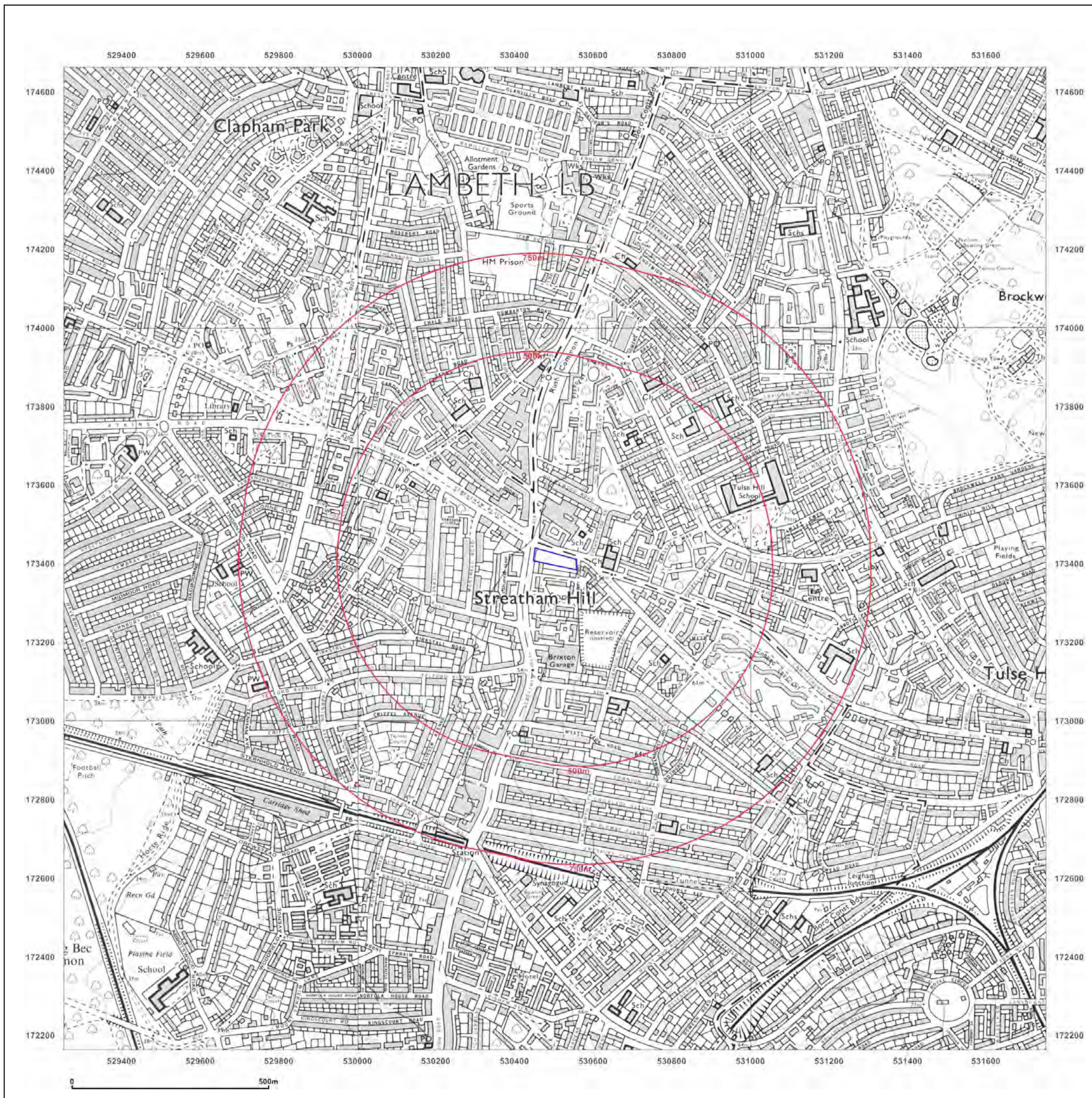


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Site Details:

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



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Site Details:

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

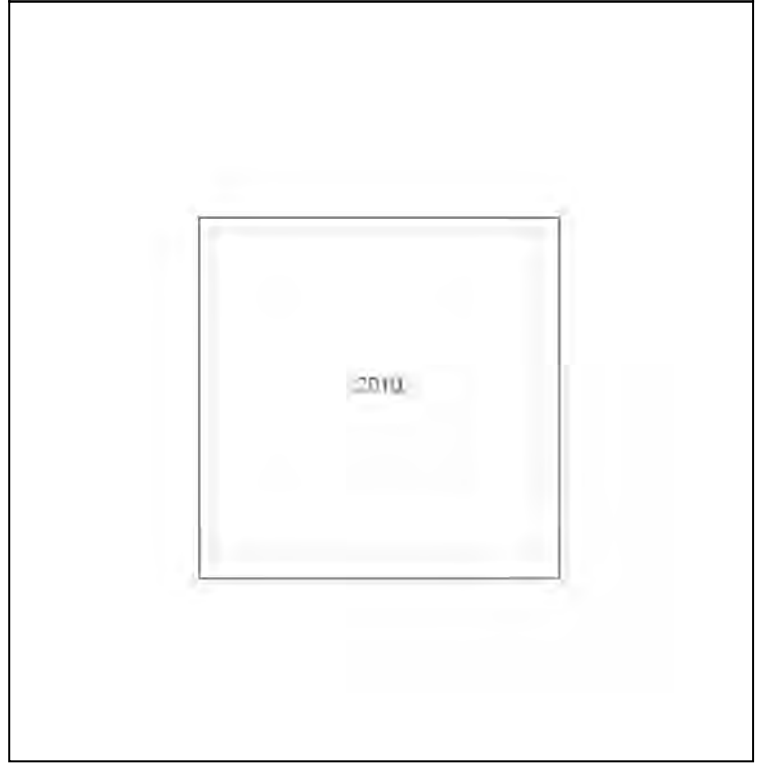
Client Ref: PO0067007-1
Report Ref: GS-3884845
Grid Ref: 530502, 173414

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000



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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

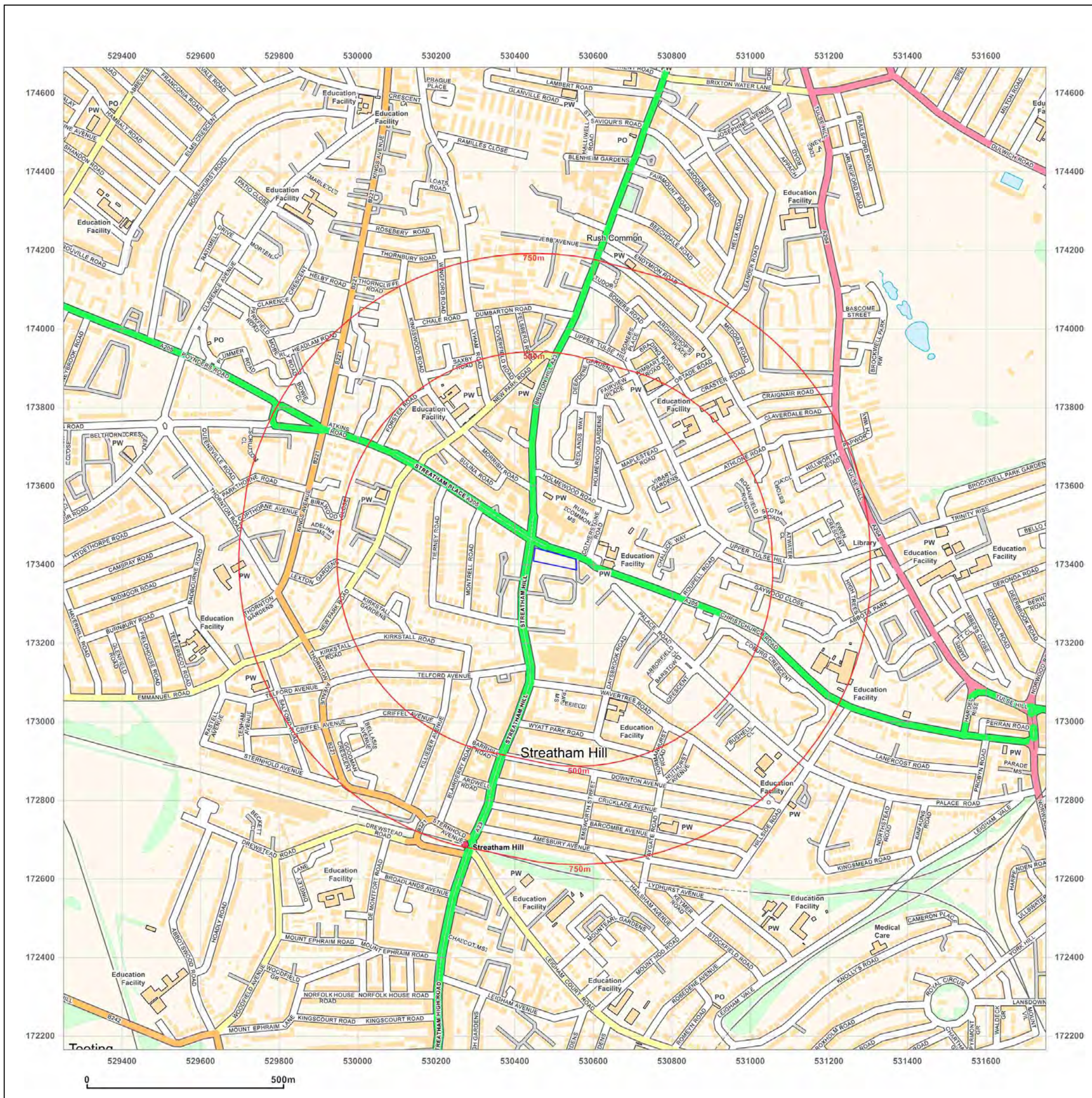


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APPENDIX B

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.

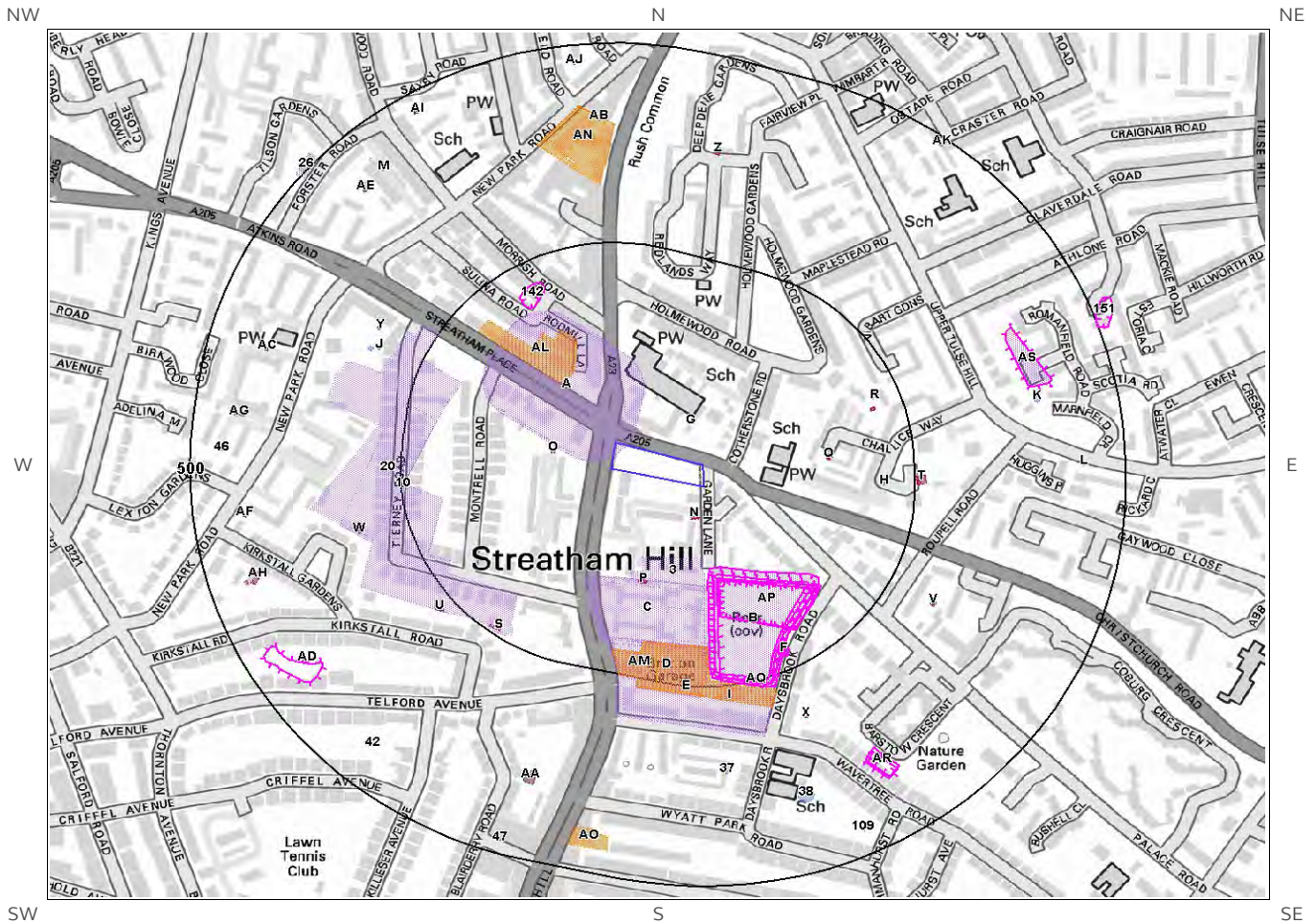
Note: Maps

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



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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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- | | | | | | |
|---|--------------------|---|-------------------------------|---|--|
|  | Site Outline |  | Recorded Pollution Incident |  | RAS 3 & 4 Authorisations |
|  | Search Buffers (m) |  | Dangerous Substances (List 1) |  | Part A(1) Authorised Processes and Historic IPC Authorisations |
|  | 500 |  | Dangerous Substances (List 2) |  | Part A(2) and Part B Authorised Processes |
| | |  | Water Industry Referrals |  | COMAH / NIHHS Sites |
| | |  | Licensed Discharge Consents |  | Sites Determined as Contaminated Land |
| | |  | Red List Discharge Consents |  | Hazardous Substance Consents and Enforcements |

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

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.

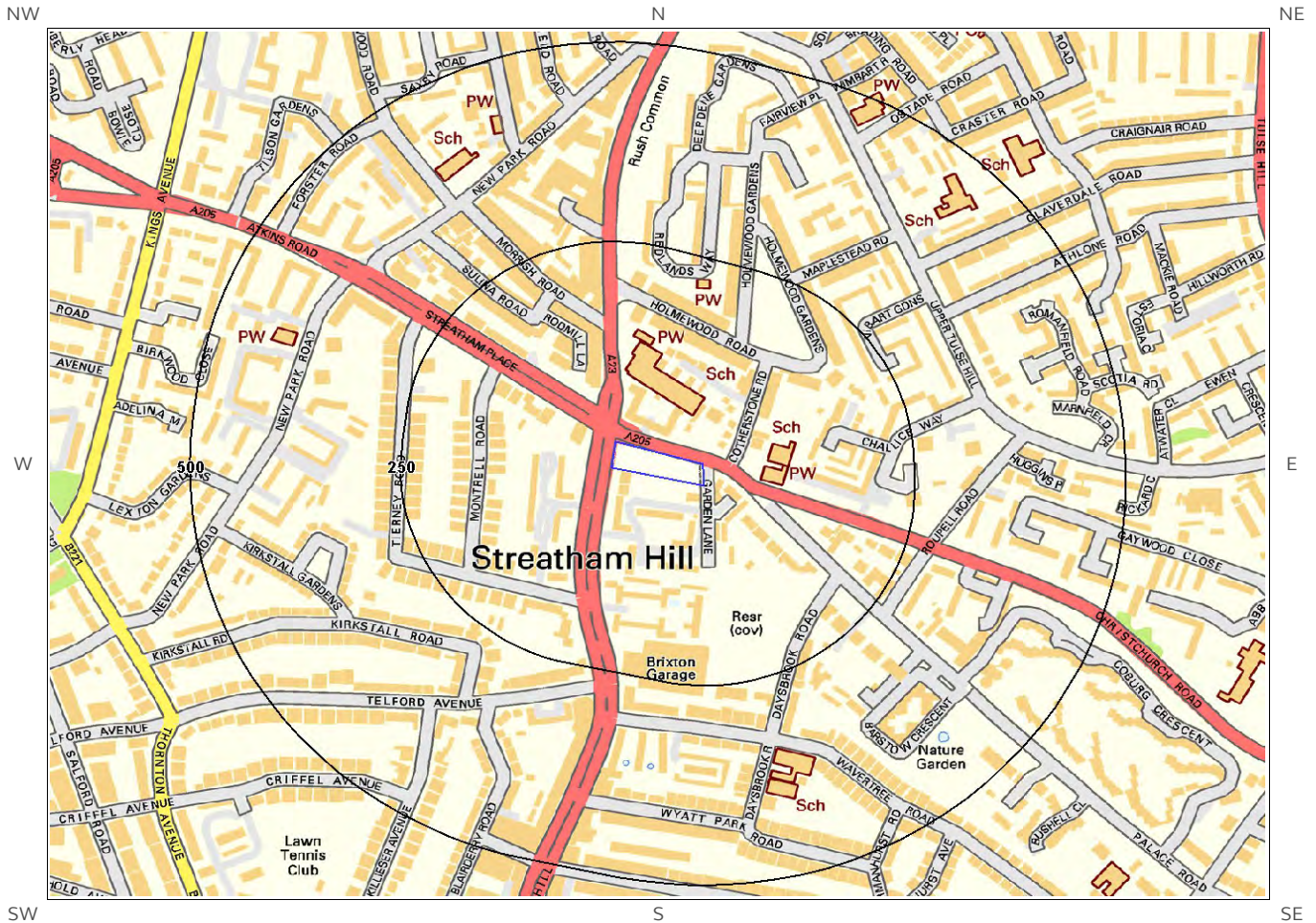
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

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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- | | | | | | |
|---|------------------------|---|---------------------------|---|---|
|  | Site Outline |  | EA/NRW Active Landfill |  | Historic and Planned Waste Sites |
|  | 250 Search Buffers (m) |  | EA/NRW Historic Landfill |  | EA/NRW Licensed Waste Site |
|  | 500 Search Buffers (m) |  | BGS / DoE Survey Landfill |  | Local Authority/Historical Mapping Landfill Records |

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.

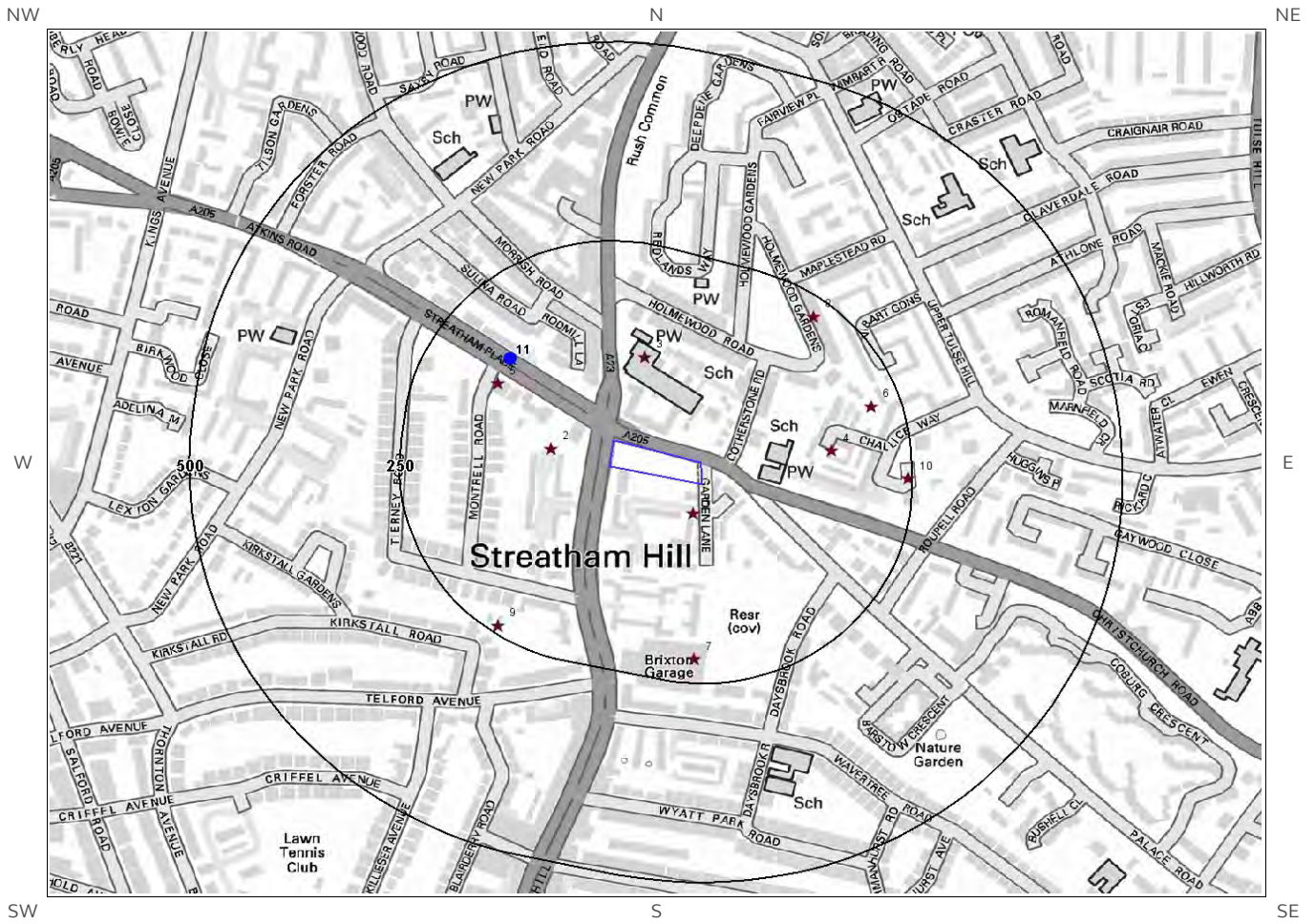
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

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 & Industrial Waste T Stn</p> <p>Size: >= 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 Use Map



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-  Site Outline
-  Current Industrial Sites
-  Electricity Transmission Cables
-  Search Buffers (m)
-  Petrol & Fuel Sites
-  Gas Transmission Pipelines

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

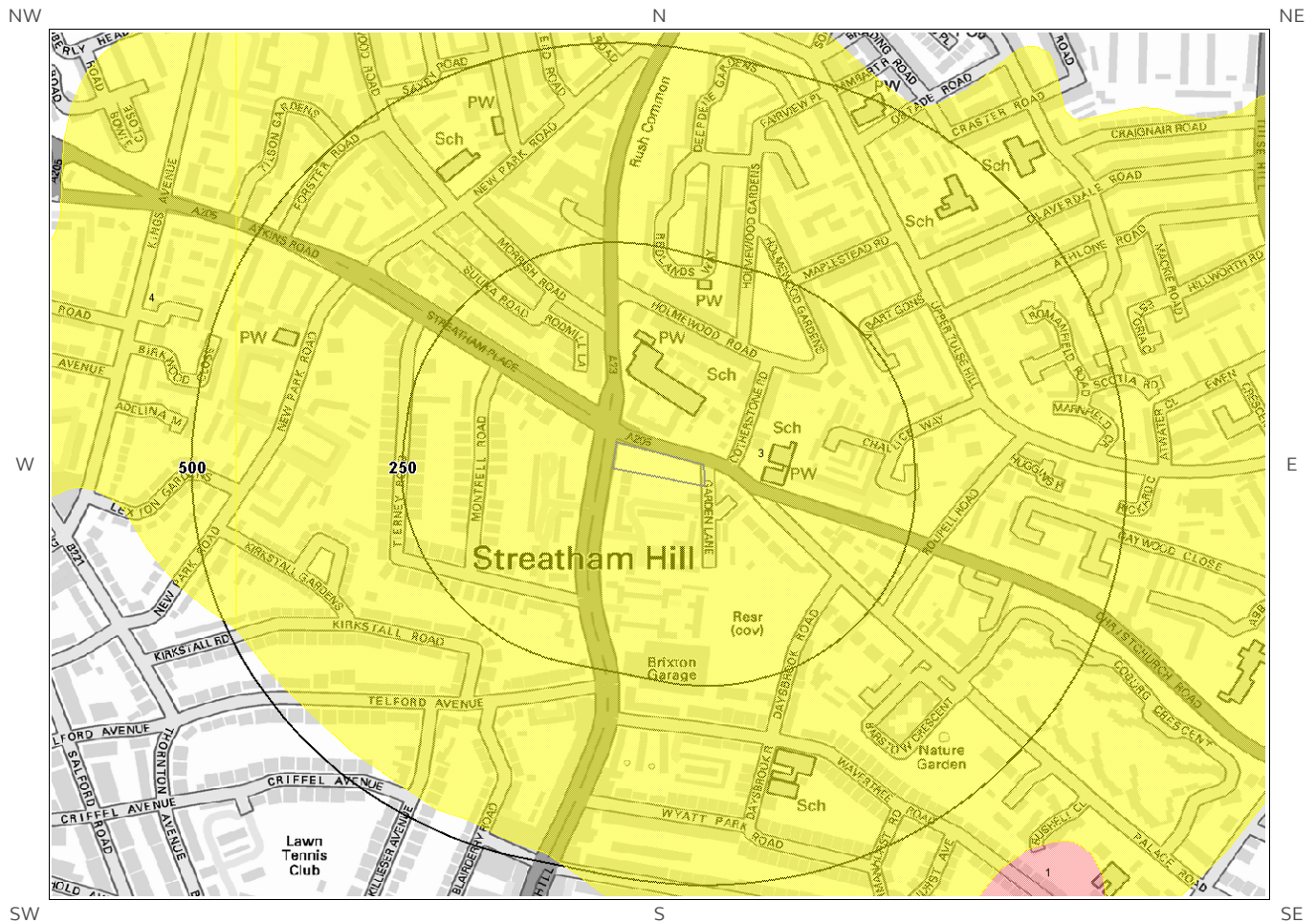
The database has been searched on site, including a 50m buffer.

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

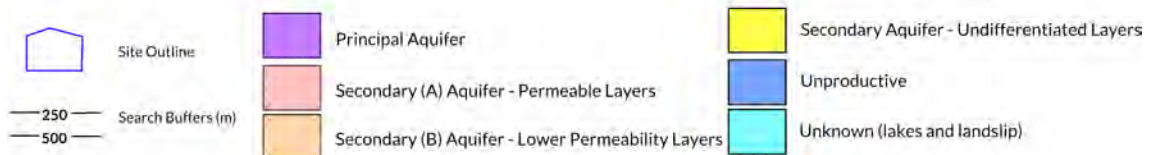
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

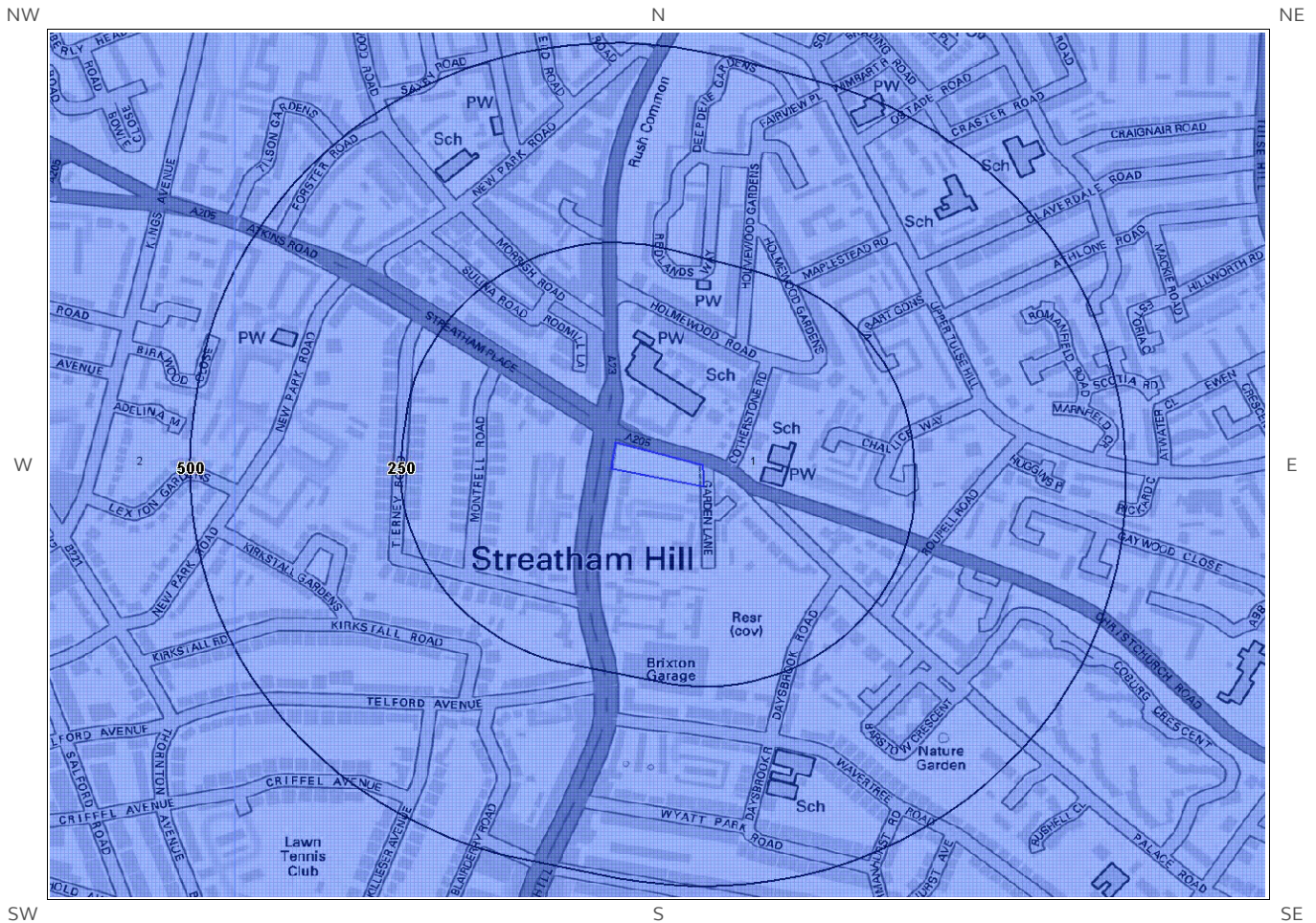
6a. Aquifer Within Superficial Geology



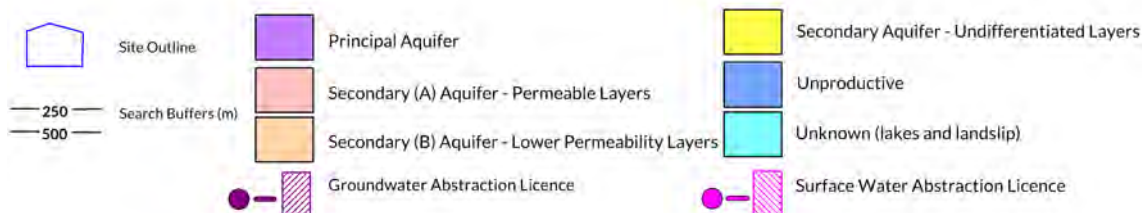
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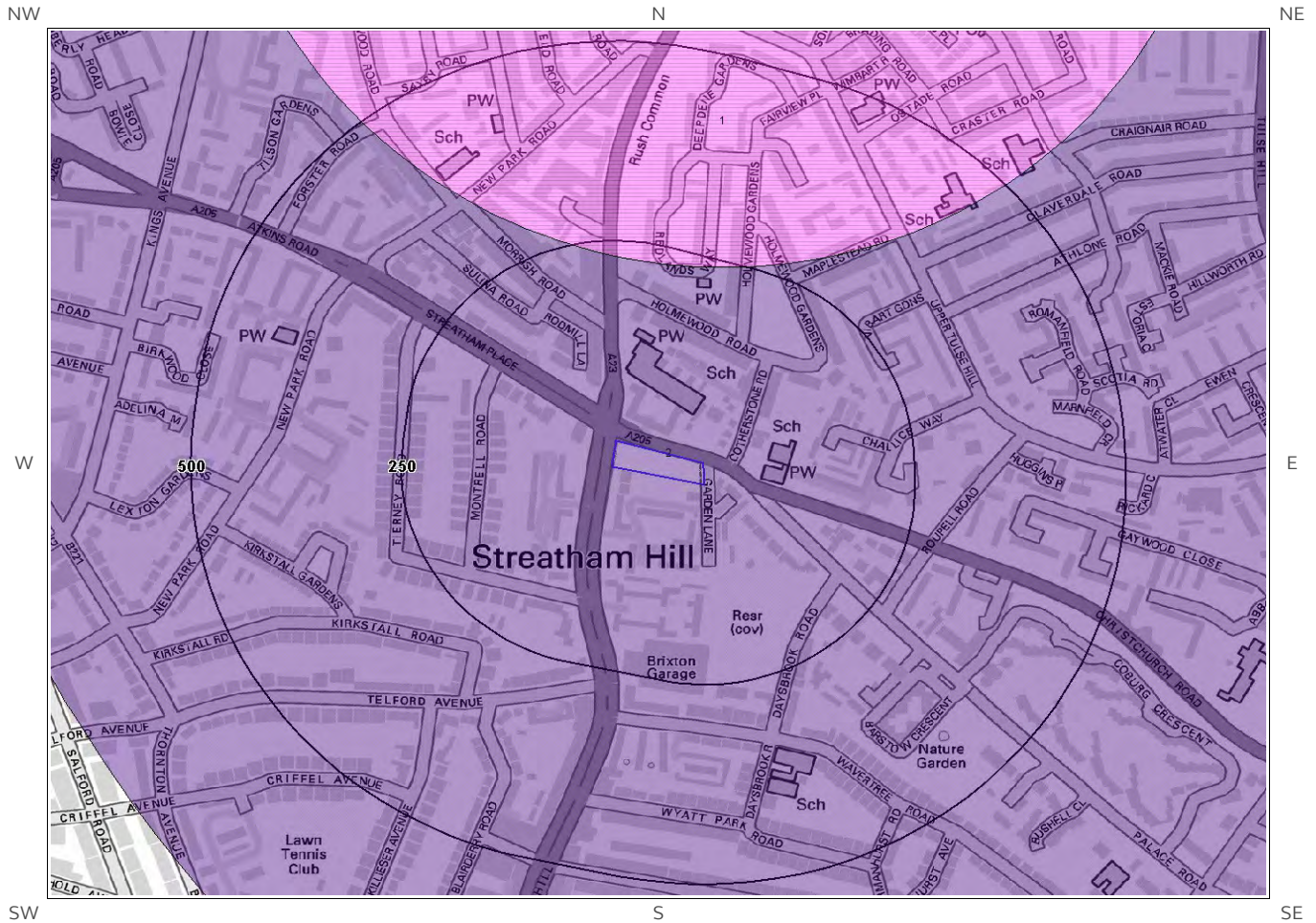
6b. Aquifer Within Bedrock Geology and Abstraction Licenses



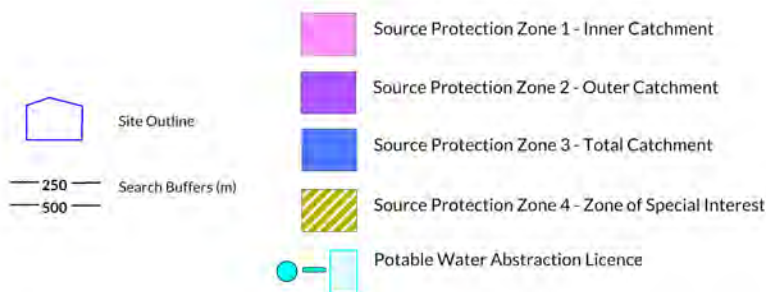
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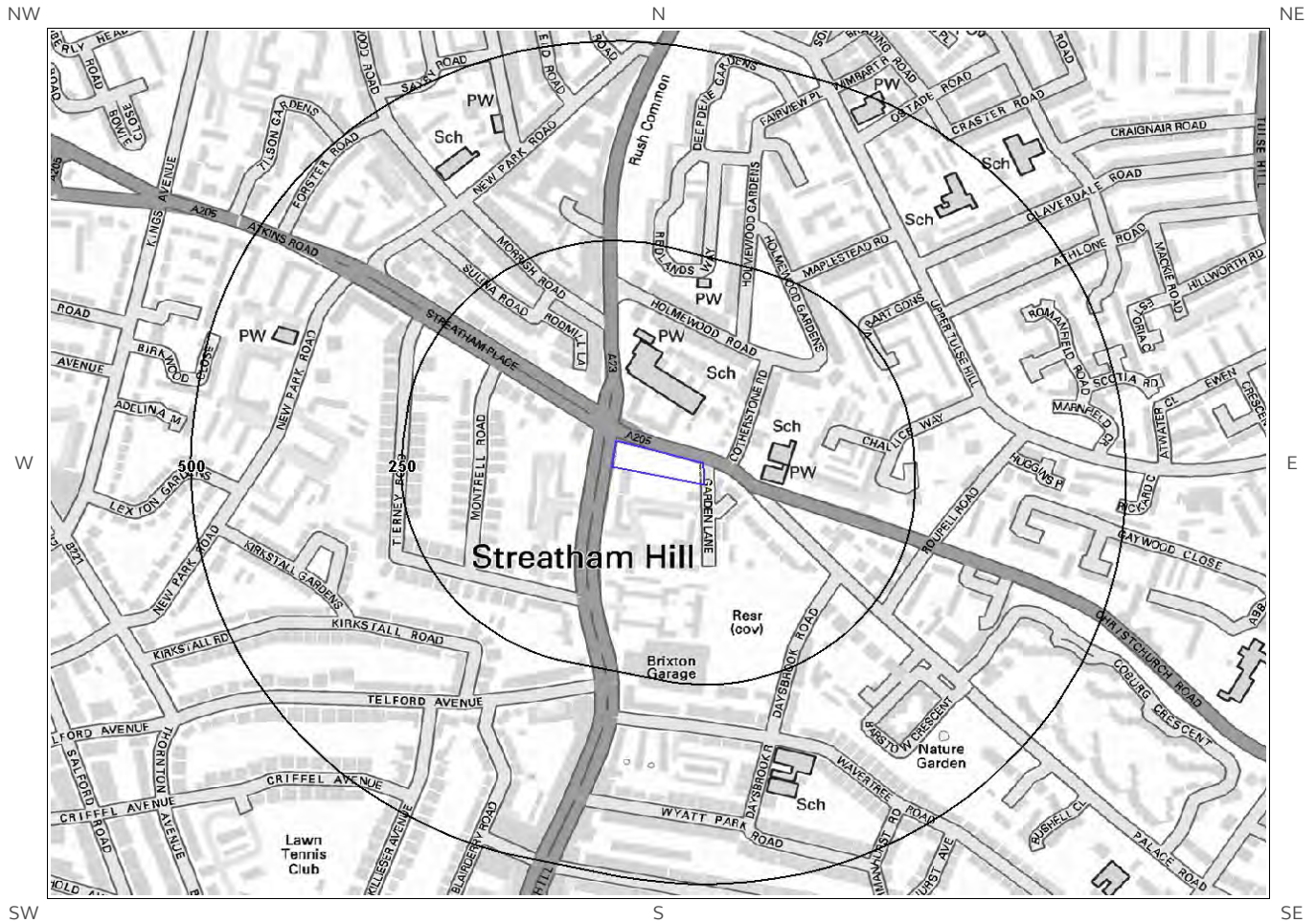
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



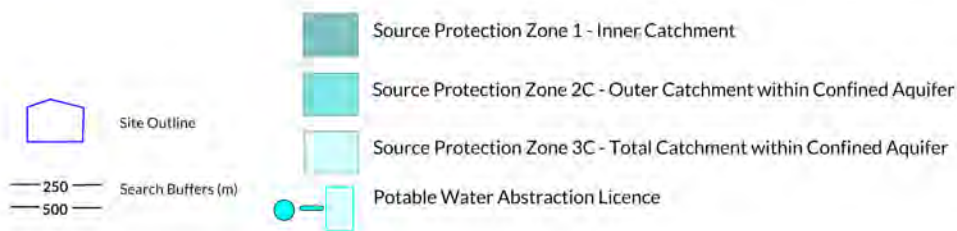
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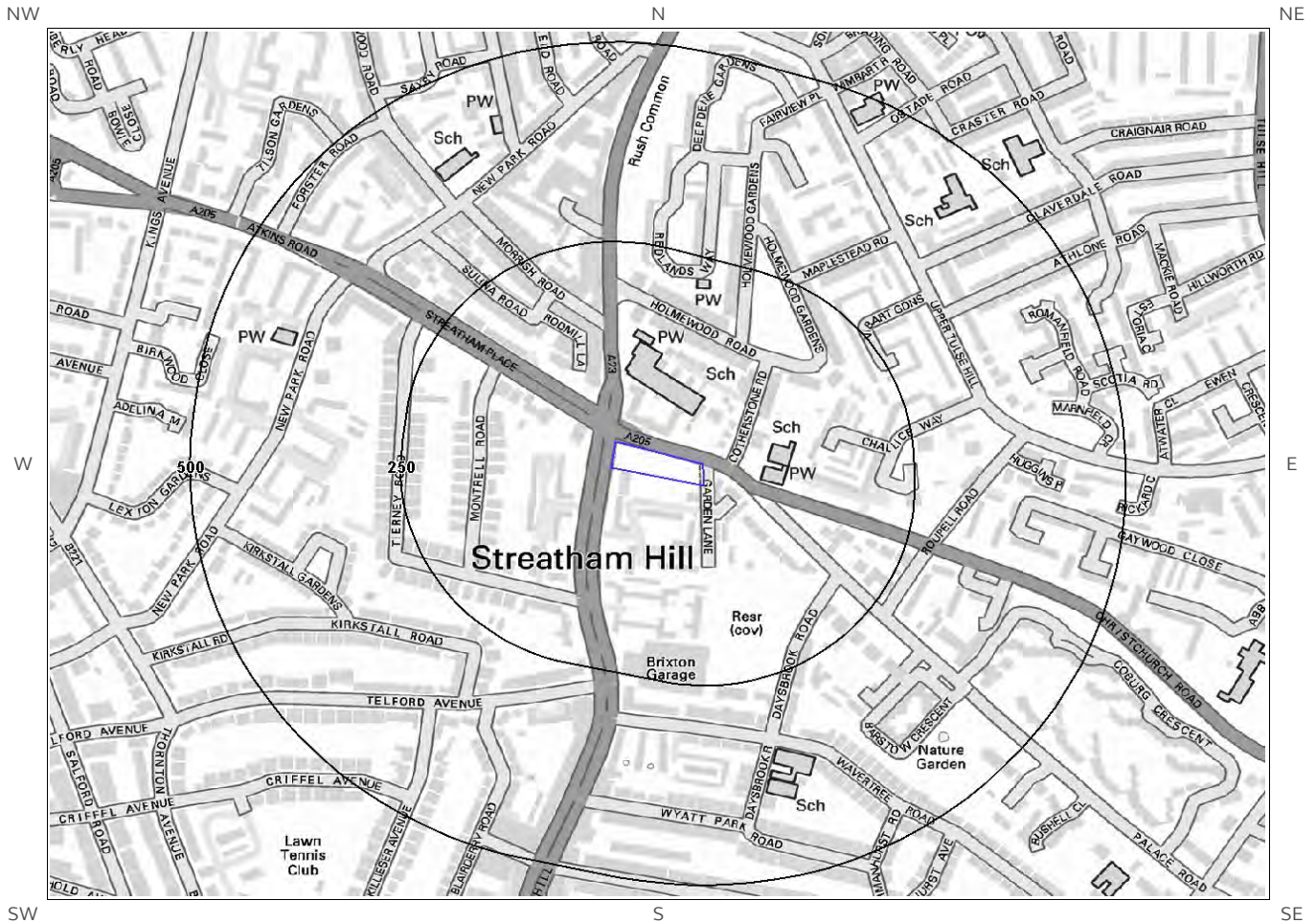
6d. Hydrogeology – Source Protection Zones within confined aquifer



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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 (m ³): 3650000 Max Daily Volume (m ³): 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 (m ³): 3650000 Max Daily Volume (m ³): 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 (m ³): - Max Daily Volume (m ³): - 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 (m ³): 95000 Max Daily Volume (m ³): 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 (m ³): 3650000 Max Daily Volume (m ³): 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 (m ³): 3650000 Max Daily Volume (m ³): 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)



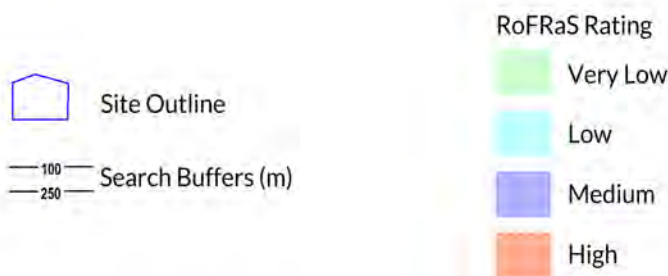
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7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



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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

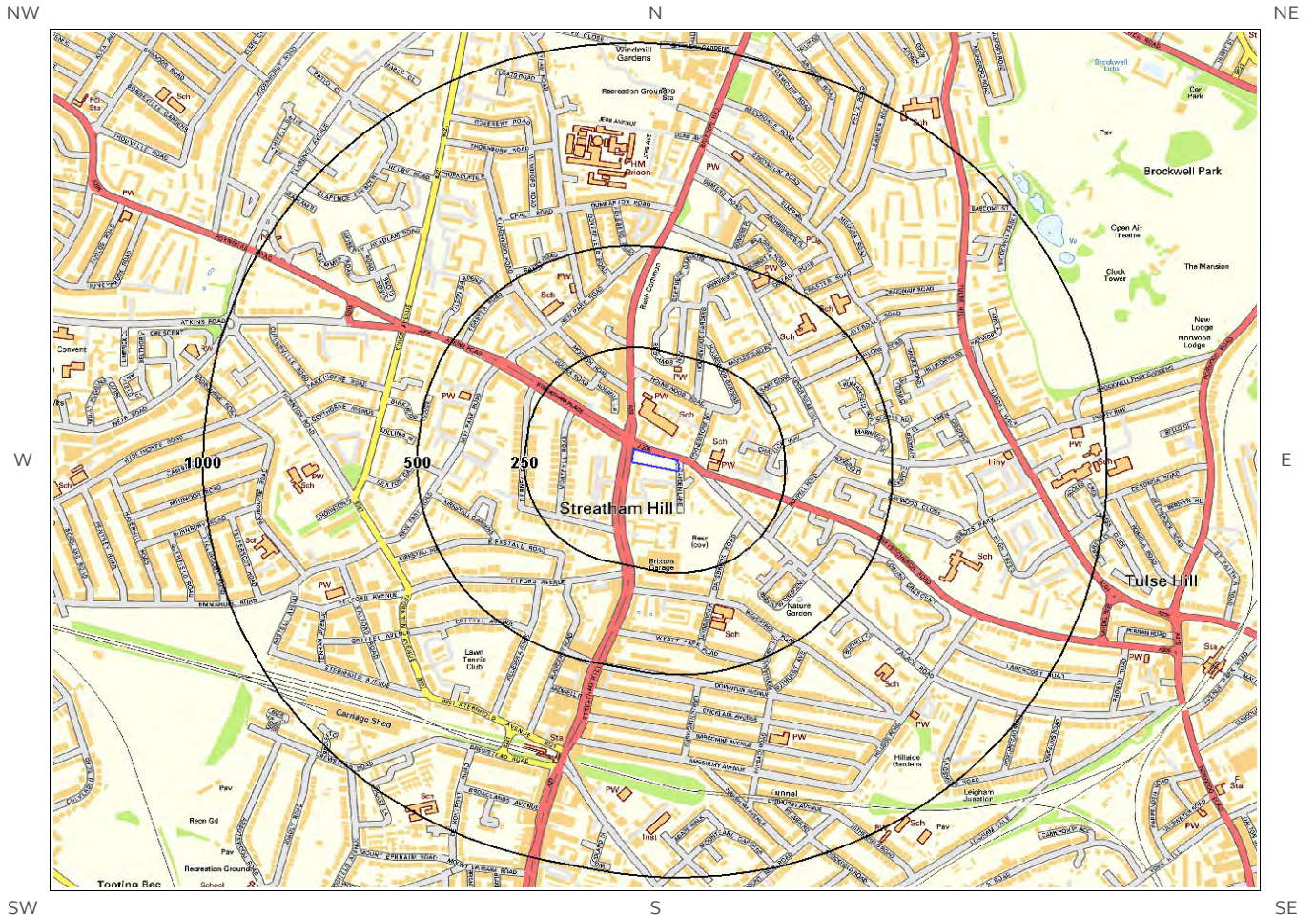
What is the British Geological Survey confidence rating in this result?

High

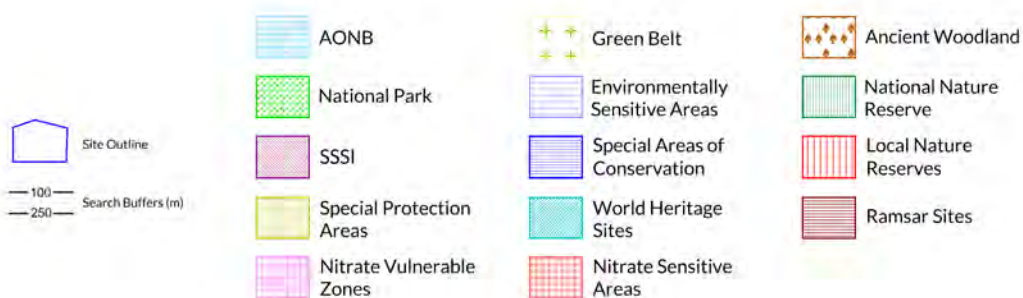
Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

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:

Database searched and no data found.

0

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

Database searched and no data found.

0

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

Database searched and no data found.

0

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

Database searched and no data found.

0

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

Database searched and no data found.

0

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

Database searched and no data found.

0

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

Database searched and no data found.

0

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

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Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:

Web: www.bgs.ac.uk

BGS Geological Hazards Reports and general geological enquiries:
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

Email: enquiries@environment-agency.gov.uk

Public Health England

Public information access office
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133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe

Email: enquiries@phe.gov.uk
Main switchboard: 020 7654 8000

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DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey

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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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Public Health
England



The Coal
Authority



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>



Groundsure

LOCATION INTELLIGENCE

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

NW N NE



SW S SE

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 landslip 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 landslip 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

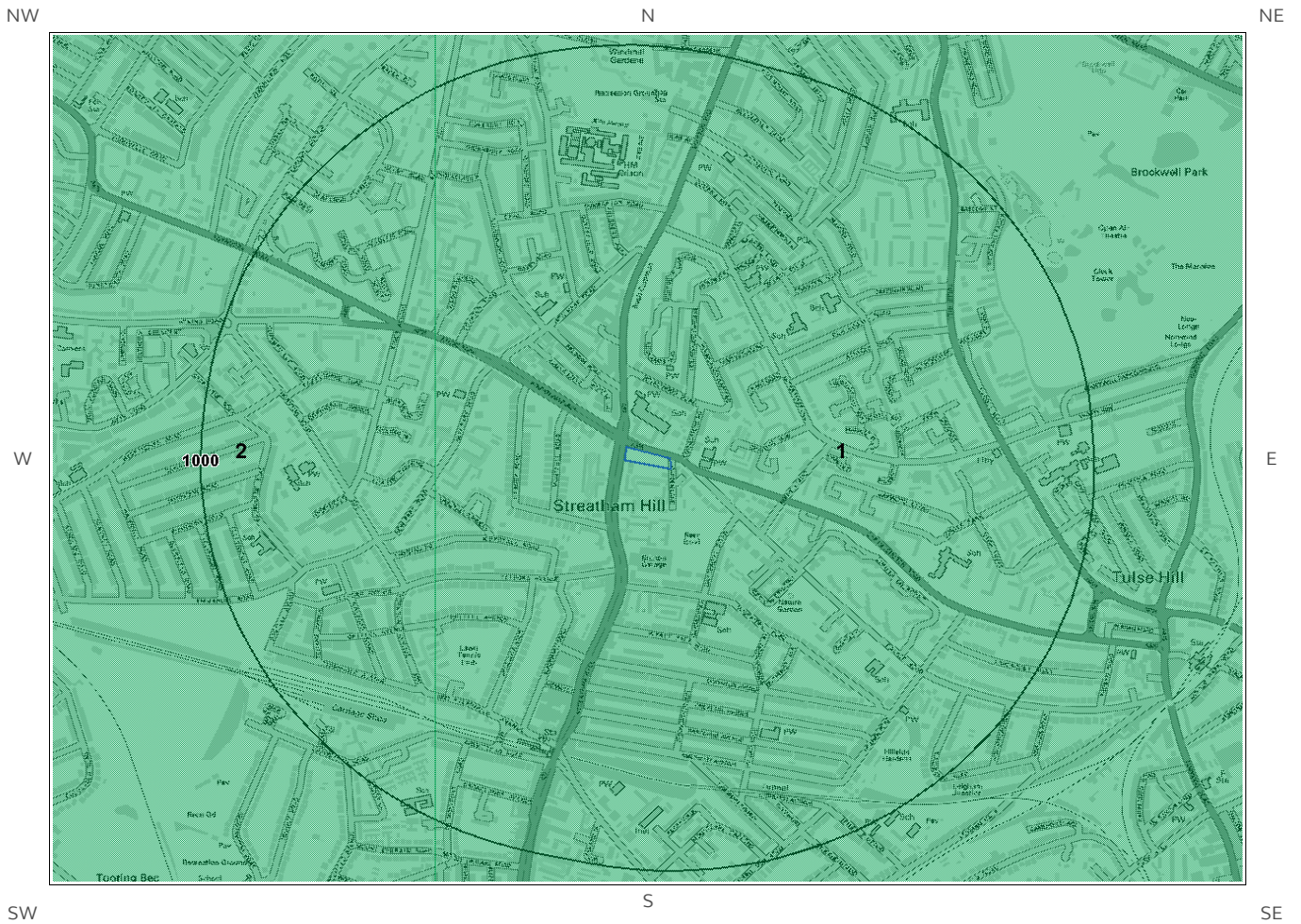
	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	12	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	3	0	8
4.3 Current Ground Workings	0	0	0	0	1

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

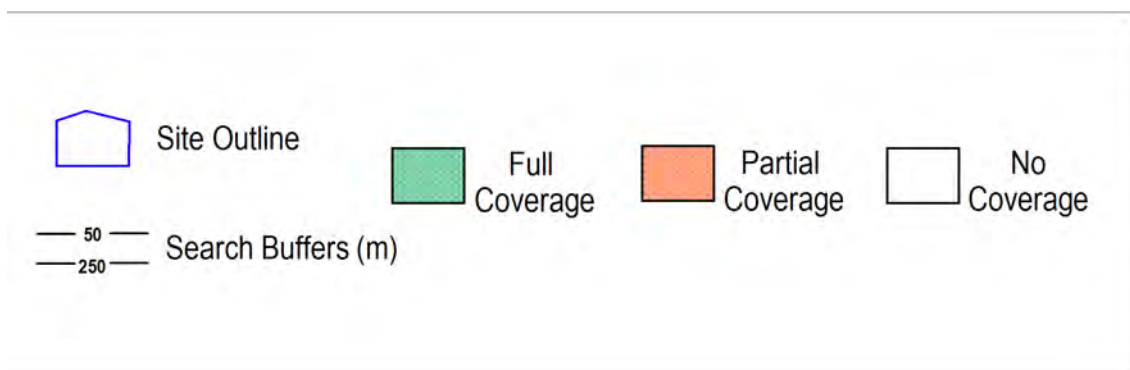
Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence					
	On-site				
6.1 Shrink-Swell Clay	Moderate				
6.2 Landslides	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

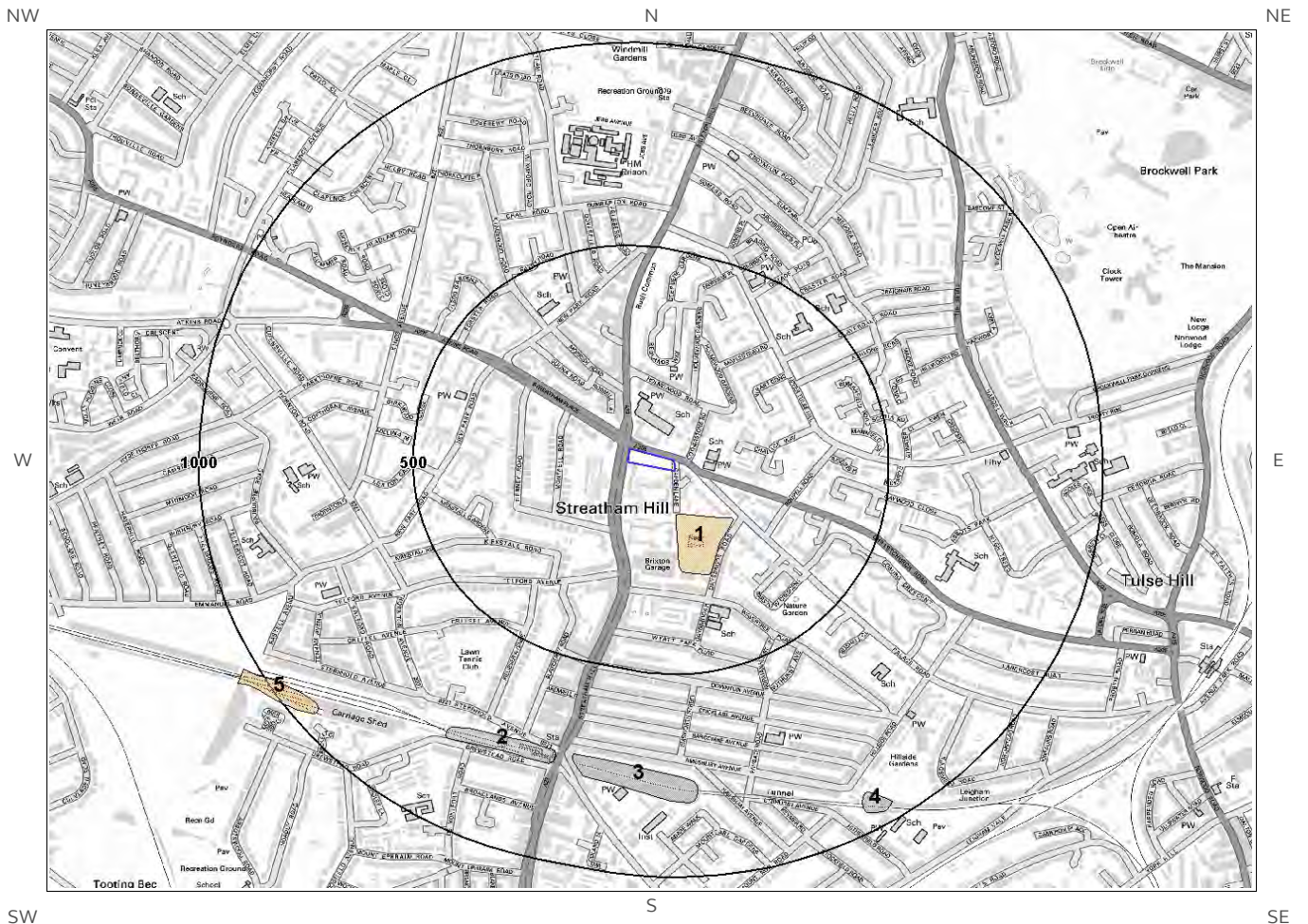
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not 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

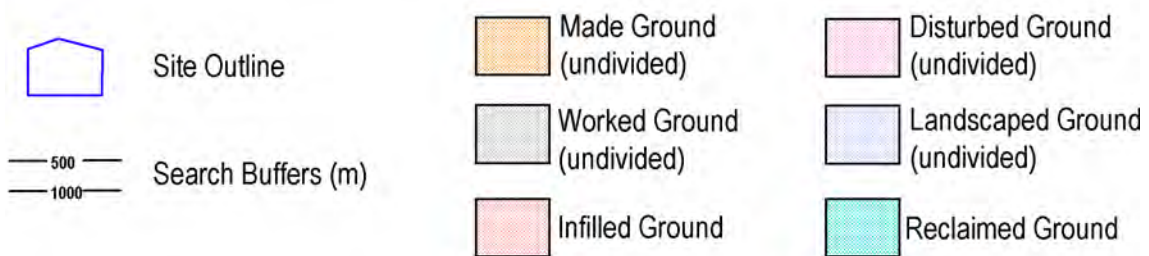
1 Geology (1:10,000 scale).

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



Artificial Ground Legend

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1. Geology 1:10,000 scale

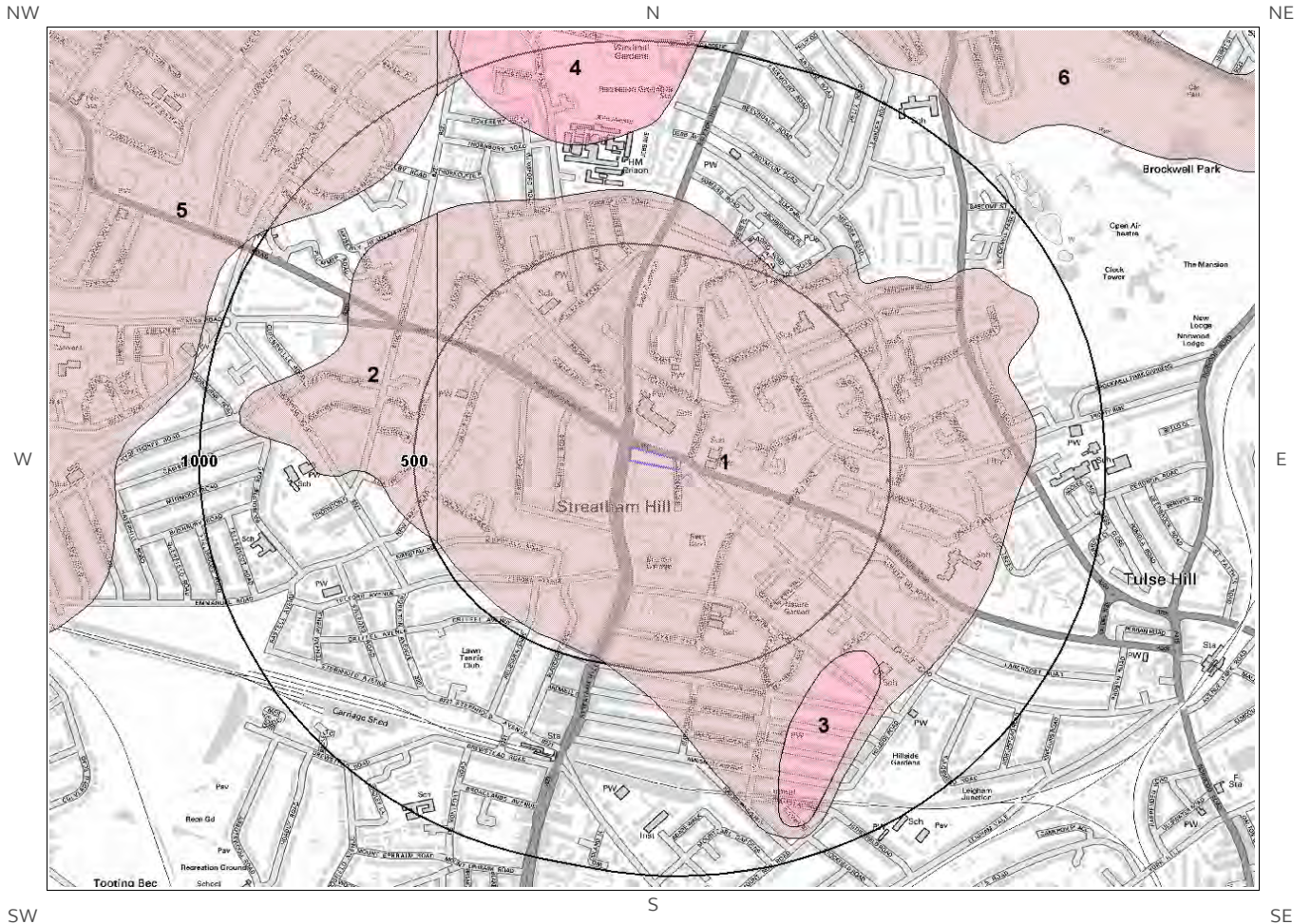
1.1 Artificial Ground

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


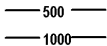
ID	Distance	Direction	LEX Code	Description	Rock Description
1	106.0	S	MGR- UNKNOWN	Made Ground (Undivided)	Unknown/unclassified Entry

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)



Artificial Ground Legend

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-  Site Outline
-  Search Buffers (m)

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

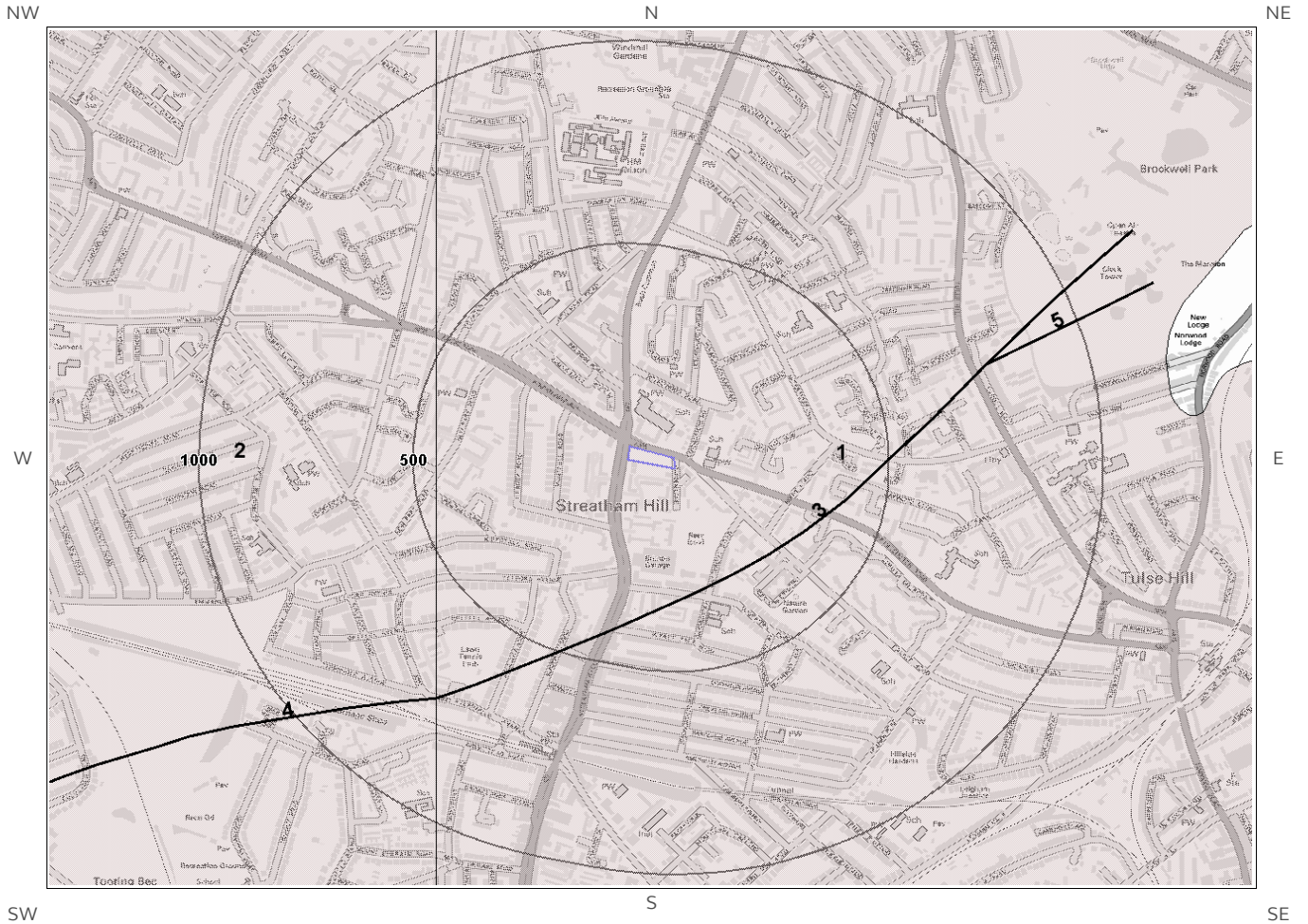
Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale? No

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

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

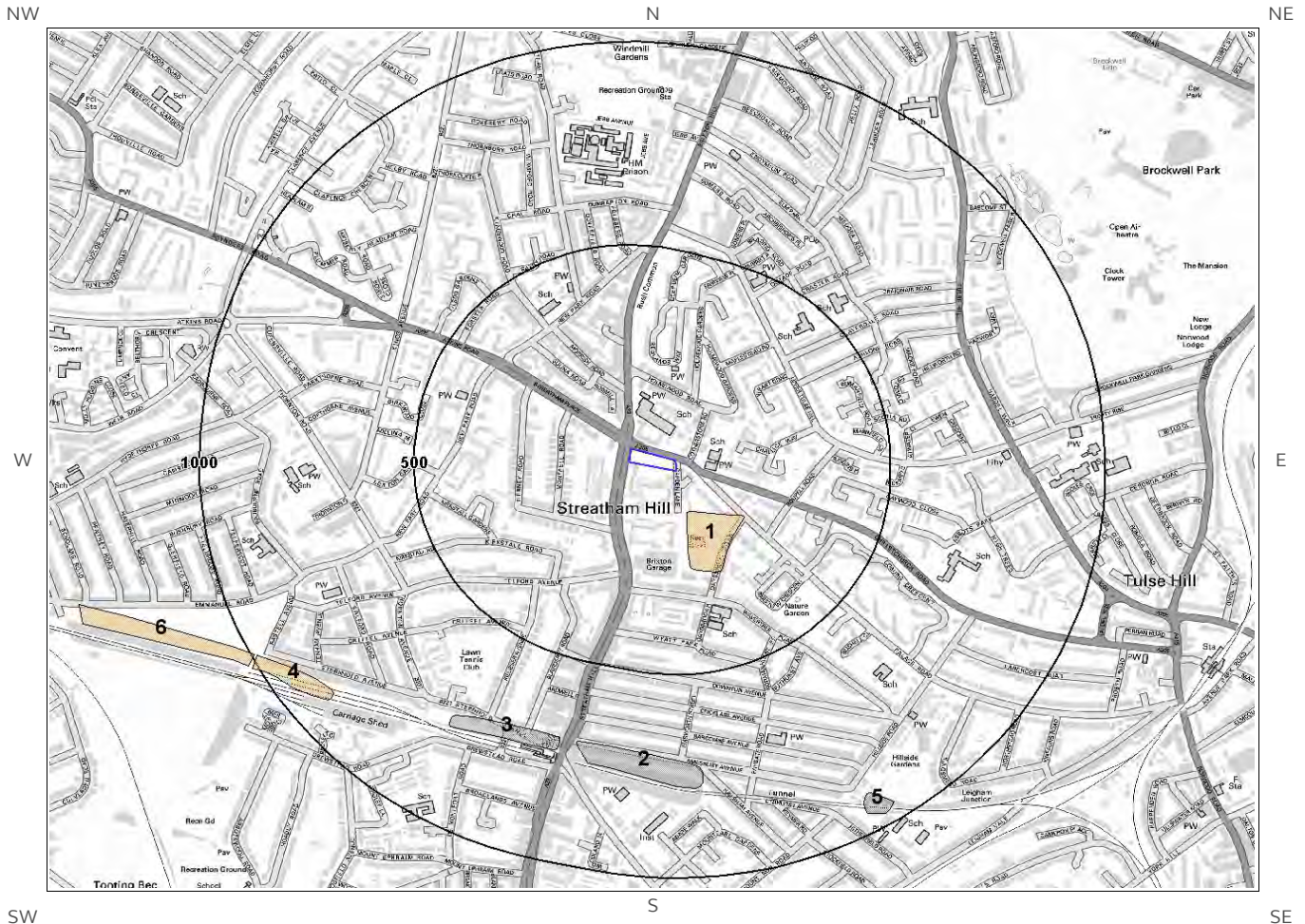
ID	Distance (m)	Direction	Category Description	Feature Description
3	293.0	SE	FAULT	Normal fault, inferred

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.

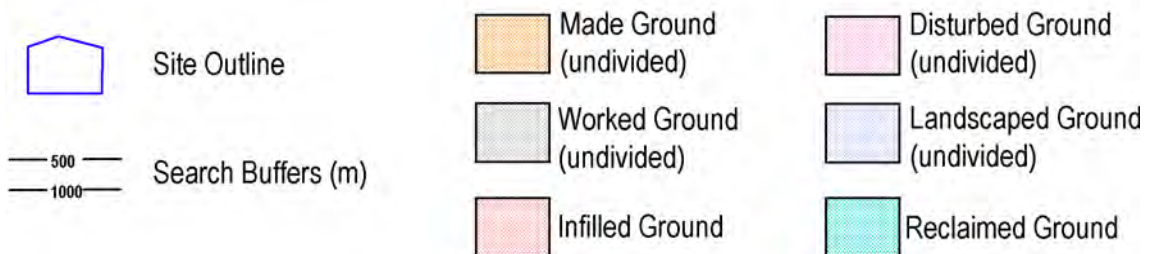
2 Geology 1:50,000 Scale

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

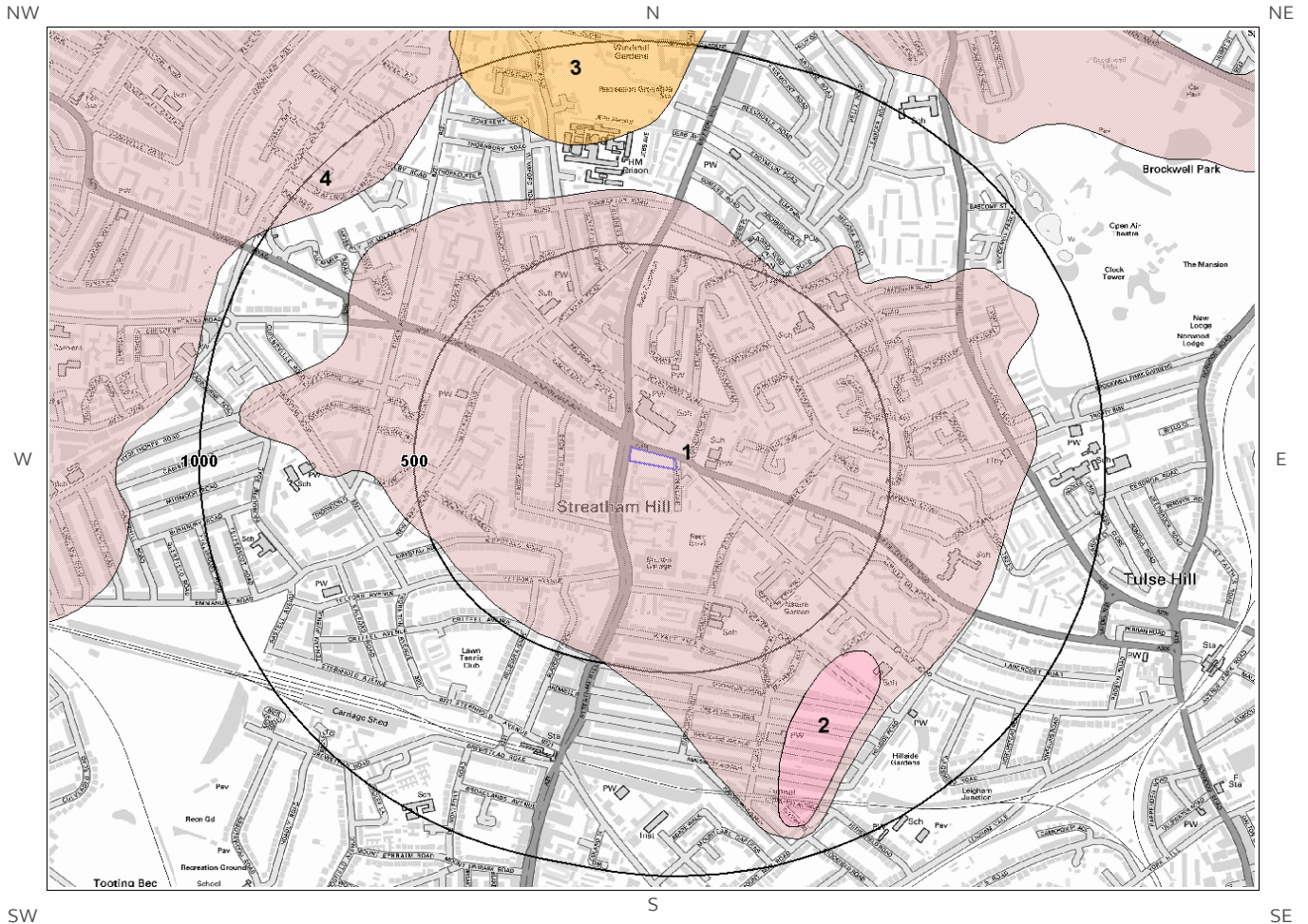
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	104.0	S	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

2.1.2 Permeability of Artificial Ground

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

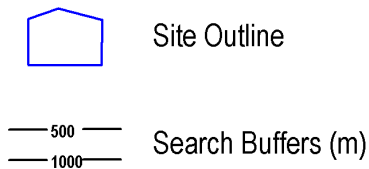
Database searched and no data found.

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.

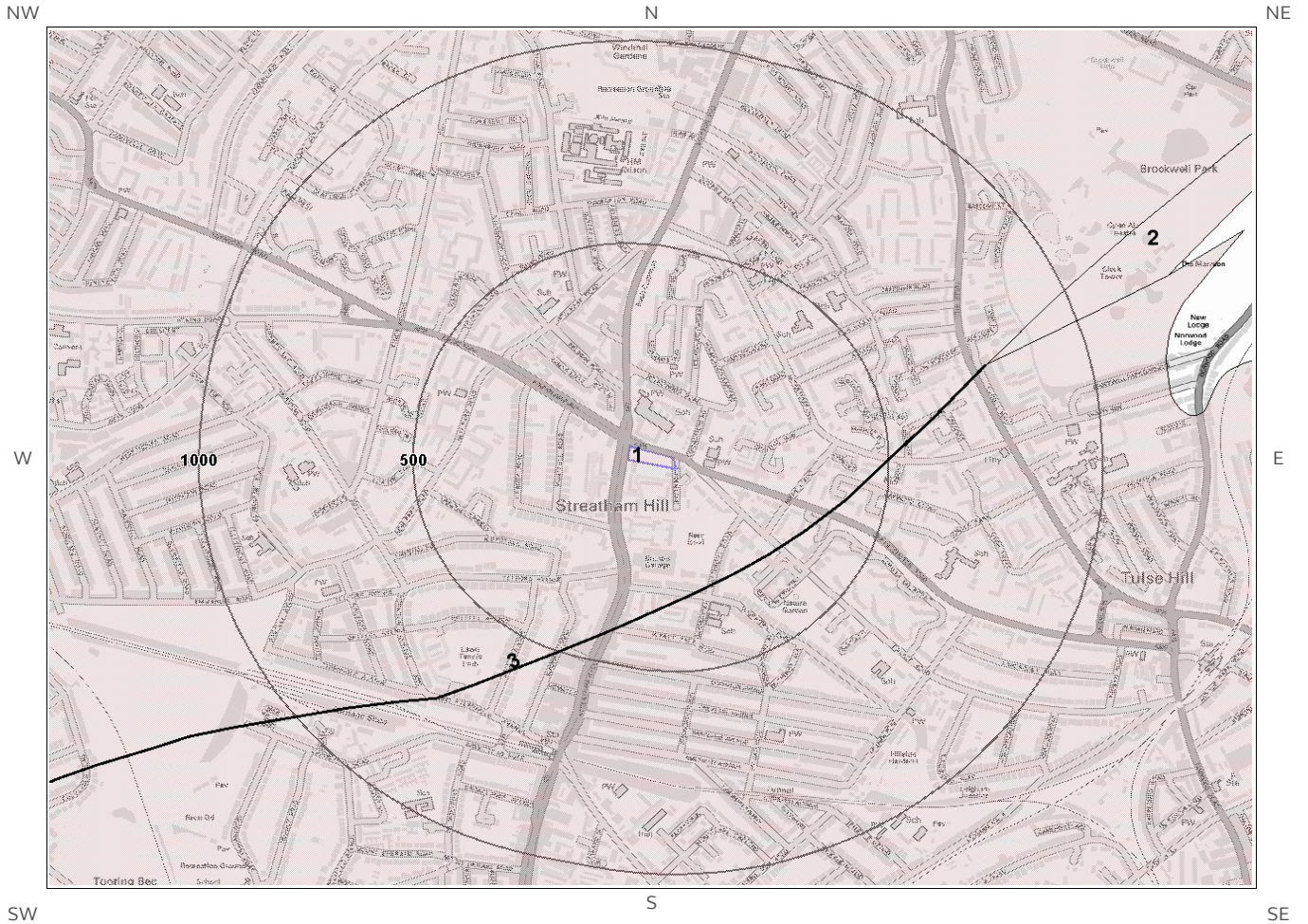
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

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

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





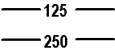
Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

4 Ground Workings Map



Ground Workings Legend

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-  Site Outline
-  Historic Surface Ground Workings
-  Historic Underground Workings
-  Current Ground Workings
-  Search Buffers (m)
125
250

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.

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

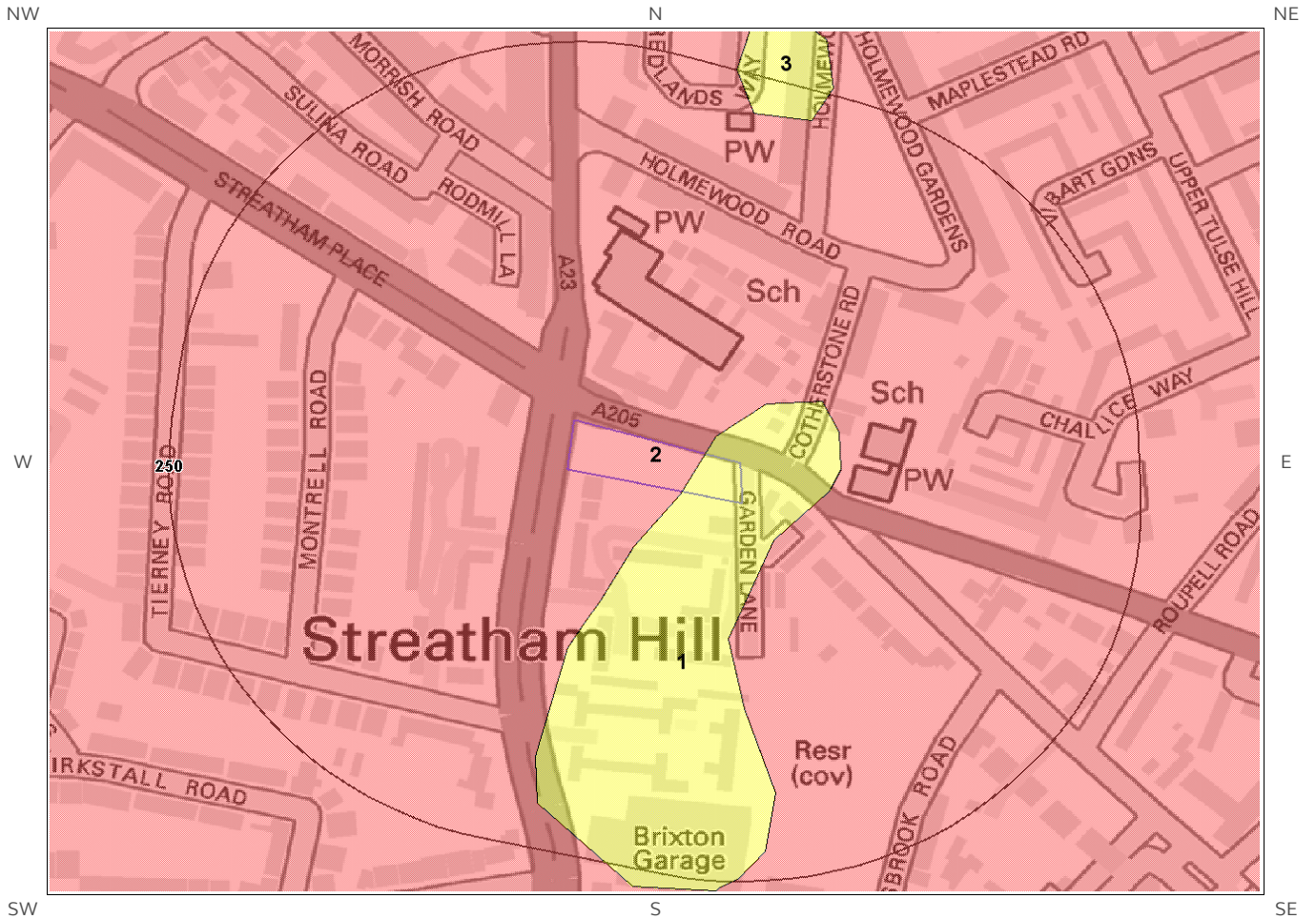
This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

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



Ground Dissolution Soluble Rocks Legend

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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:

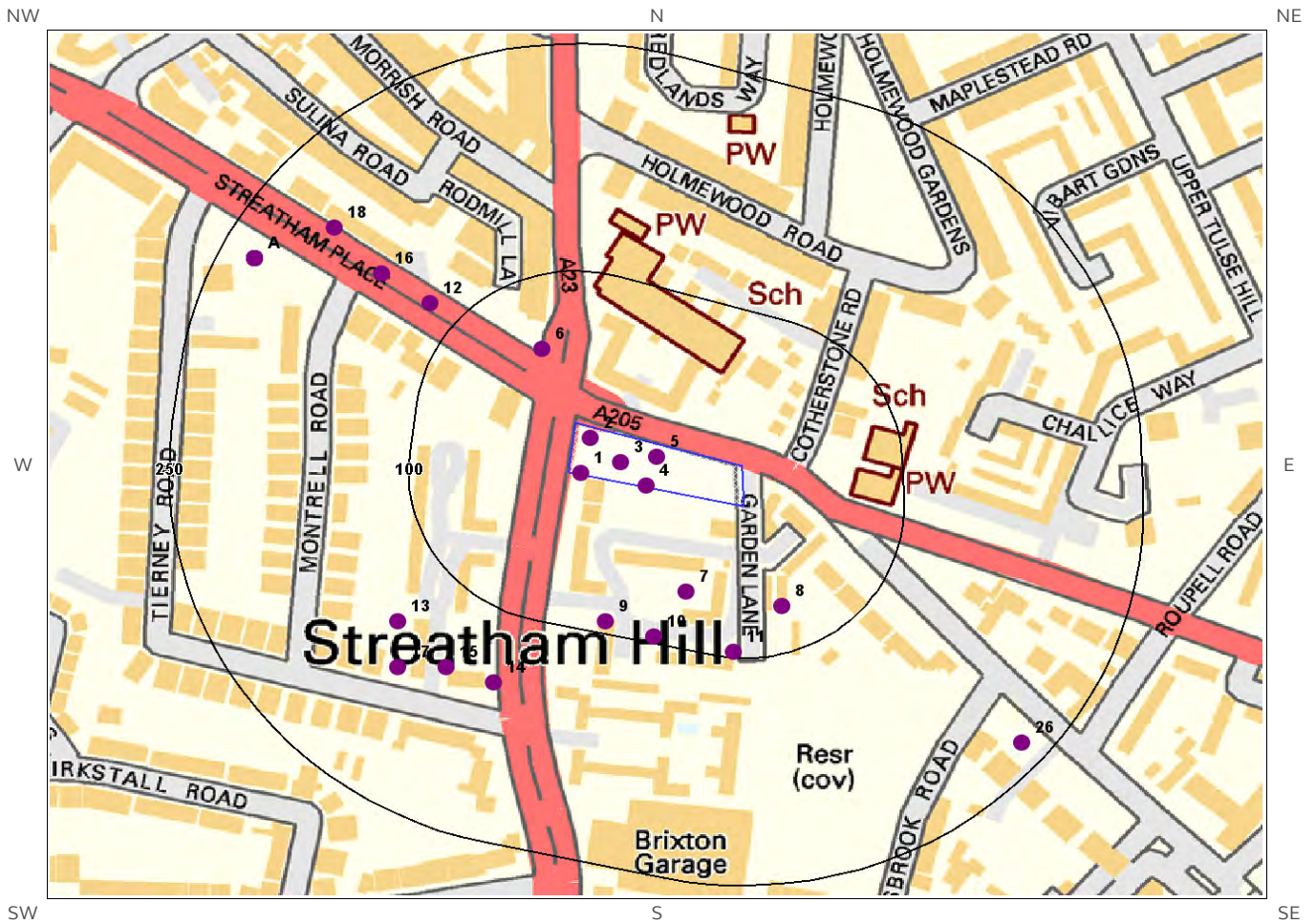
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible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

6.6 Running Sands

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

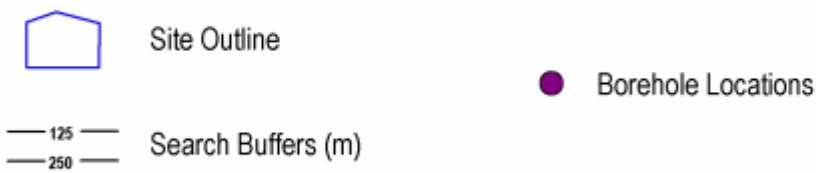
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased 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
- #7: scans.bgs.ac.uk/sobi_scans/boreholes/602778
- #8: scans.bgs.ac.uk/sobi_scans/boreholes/602774
- #9: scans.bgs.ac.uk/sobi_scans/boreholes/602773
- #10: scans.bgs.ac.uk/sobi_scans/boreholes/602780
- #11: scans.bgs.ac.uk/sobi_scans/boreholes/602779
- #12: scans.bgs.ac.uk/sobi_scans/boreholes/602617
- #13: scans.bgs.ac.uk/sobi_scans/boreholes/602775
- #14: scans.bgs.ac.uk/sobi_scans/boreholes/602772
- #15: scans.bgs.ac.uk/sobi_scans/boreholes/602777
- #16: scans.bgs.ac.uk/sobi_scans/boreholes/602616
- #17: scans.bgs.ac.uk/sobi_scans/boreholes/602776
- #18: scans.bgs.ac.uk/sobi_scans/boreholes/602615
- #19A: scans.bgs.ac.uk/sobi_scans/boreholes/602088
- #20A: scans.bgs.ac.uk/sobi_scans/boreholes/602090
- #21A: scans.bgs.ac.uk/sobi_scans/boreholes/602091
- #22A: scans.bgs.ac.uk/sobi_scans/boreholes/602085
- #23A: scans.bgs.ac.uk/sobi_scans/boreholes/602089
- #24A: scans.bgs.ac.uk/sobi_scans/boreholes/602086
- #25A: scans.bgs.ac.uk/sobi_scans/boreholes/602087
- #26: 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:

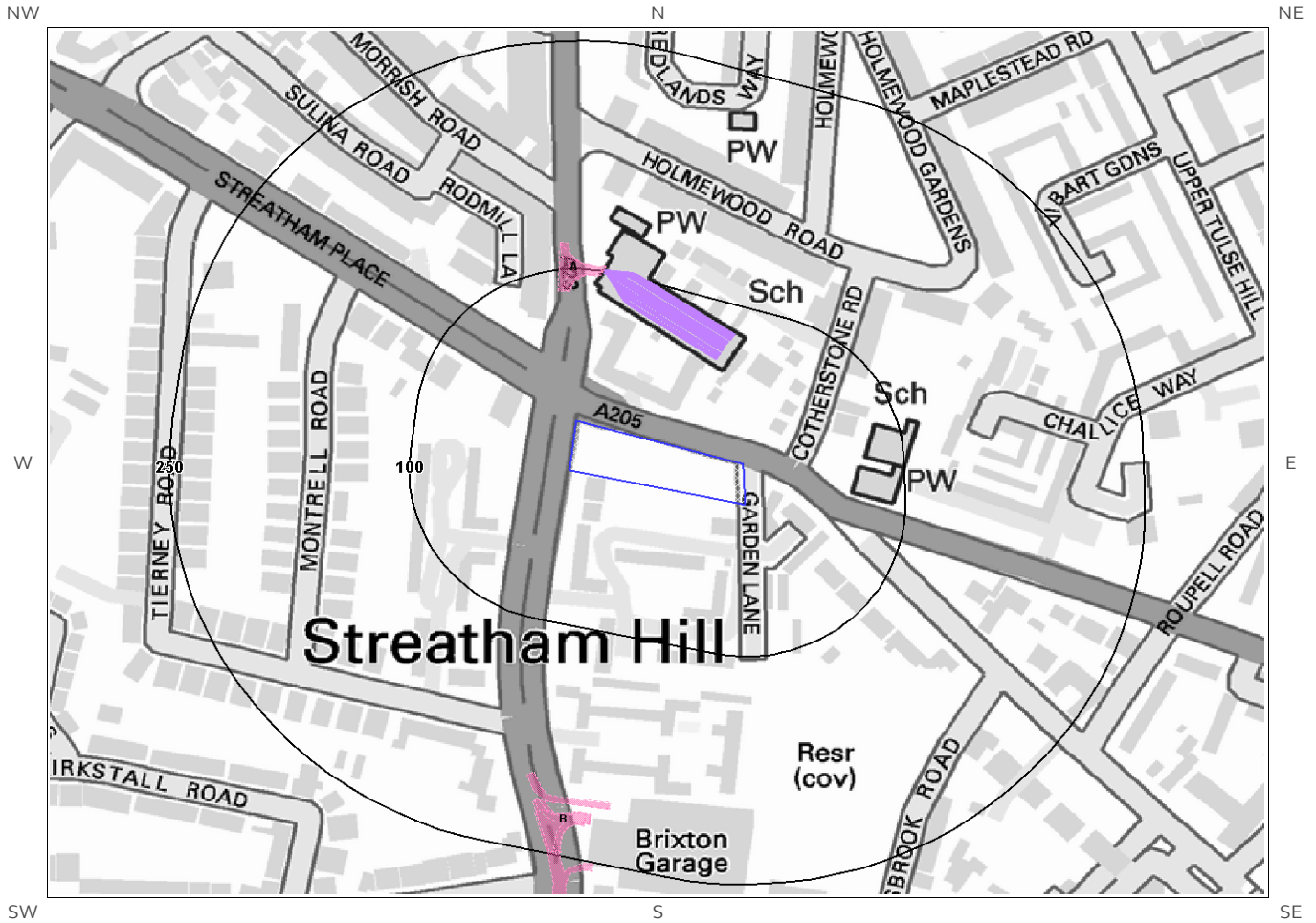
2

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

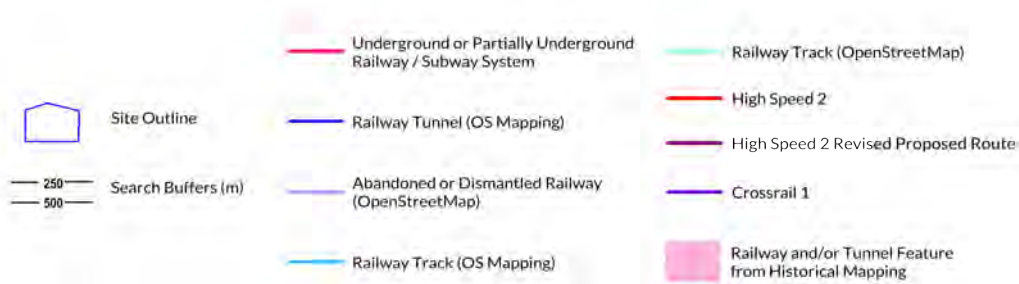
*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

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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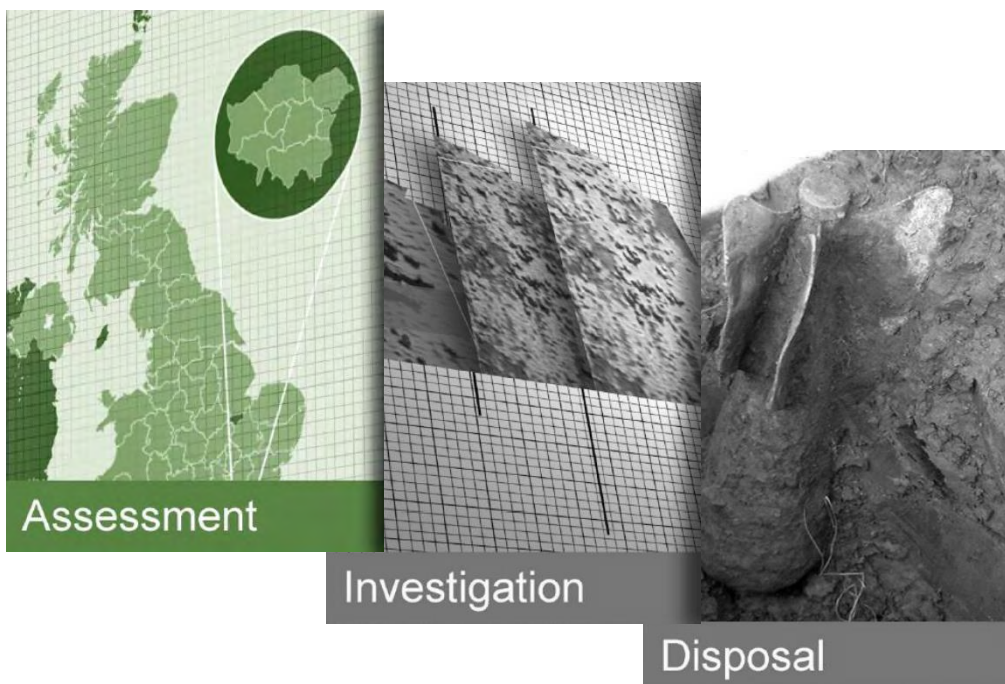
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APPENDIX C

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 13th 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').

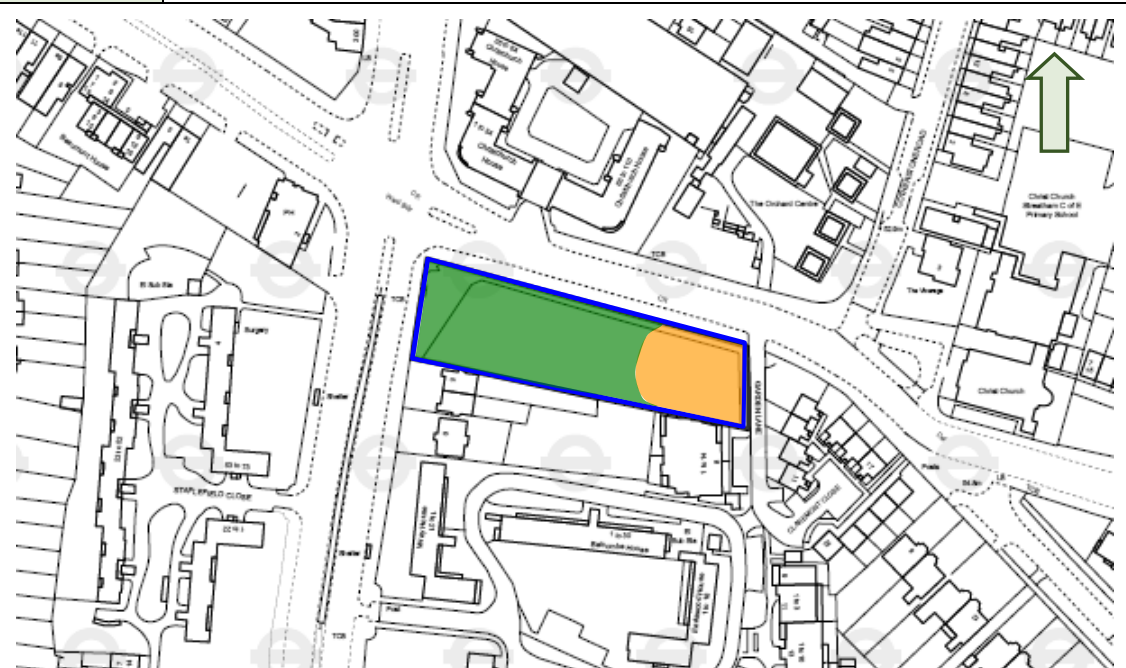
The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

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:									

<p>Low Risk</p>
<p>Excavations</p> <p>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.</p> <p>Boreholes/Piles</p> <p>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.</p>
<p>Moderate Risk</p>
<p>Excavations</p> <p>For those involved in excavations, the raising of awareness (as per low risk) is considered essential.</p> <p>A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.</p> <p>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.</p> <p>The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.</p> <p>Boreholes/Piles</p> <p>Clearance certification for any borehole or pile locations is considered essential.</p> <p>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.</p> <p>Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.</p> <p>Table 5 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.</p> <p>Further advice on the mitigation methods can be provided by Zetica on request.</p>

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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

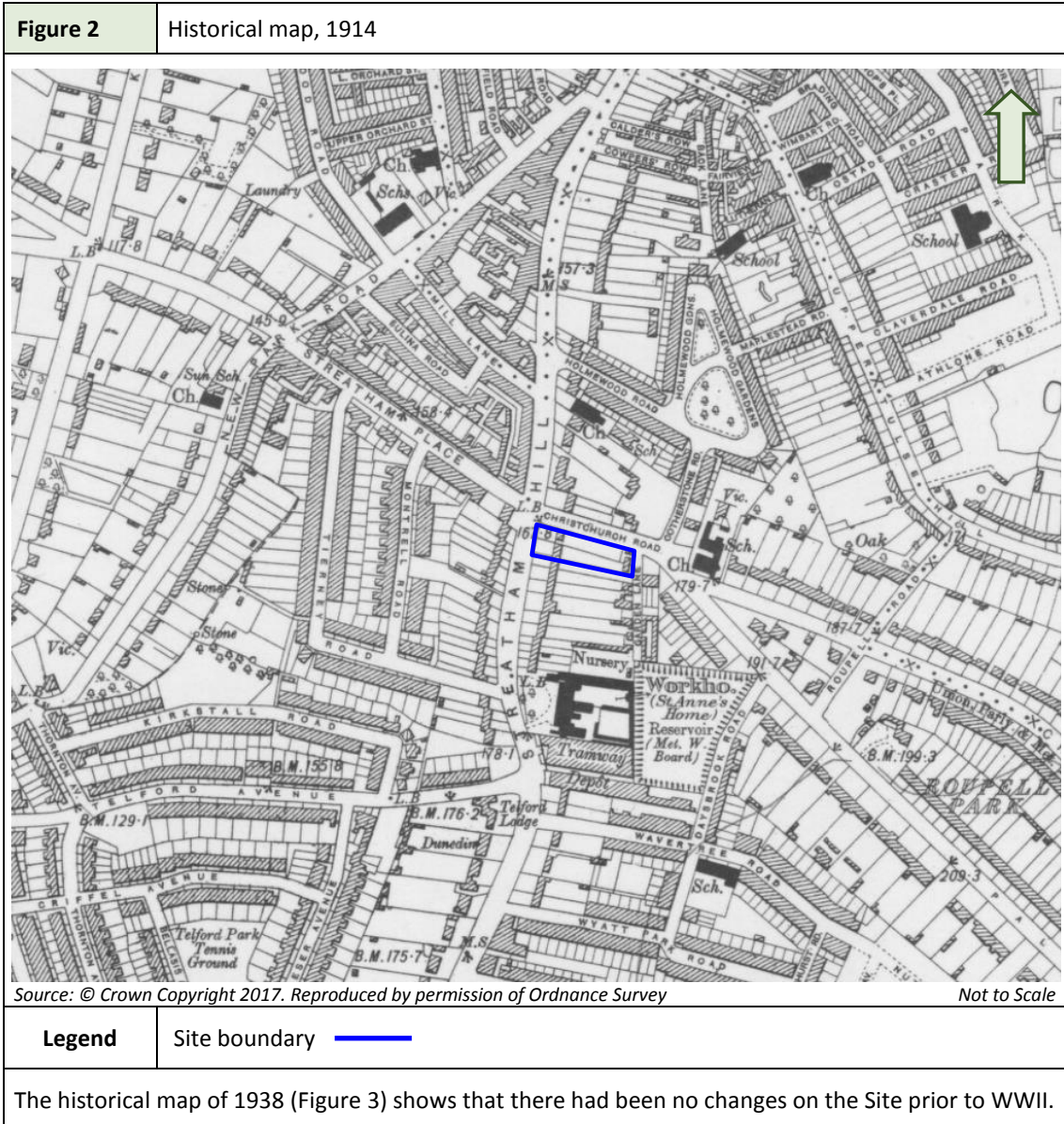
Legend	Site boundary —
---------------	--

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.



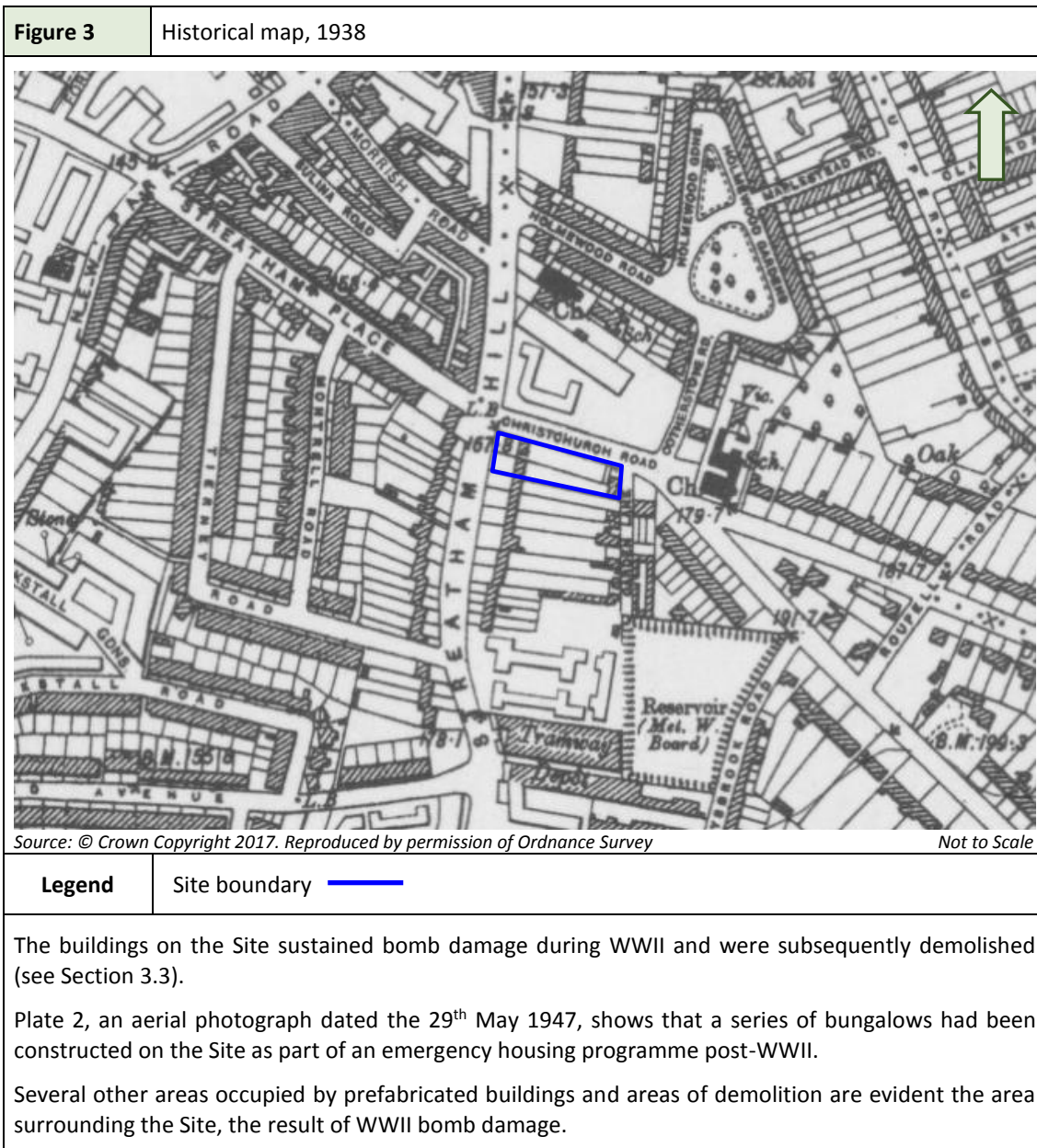
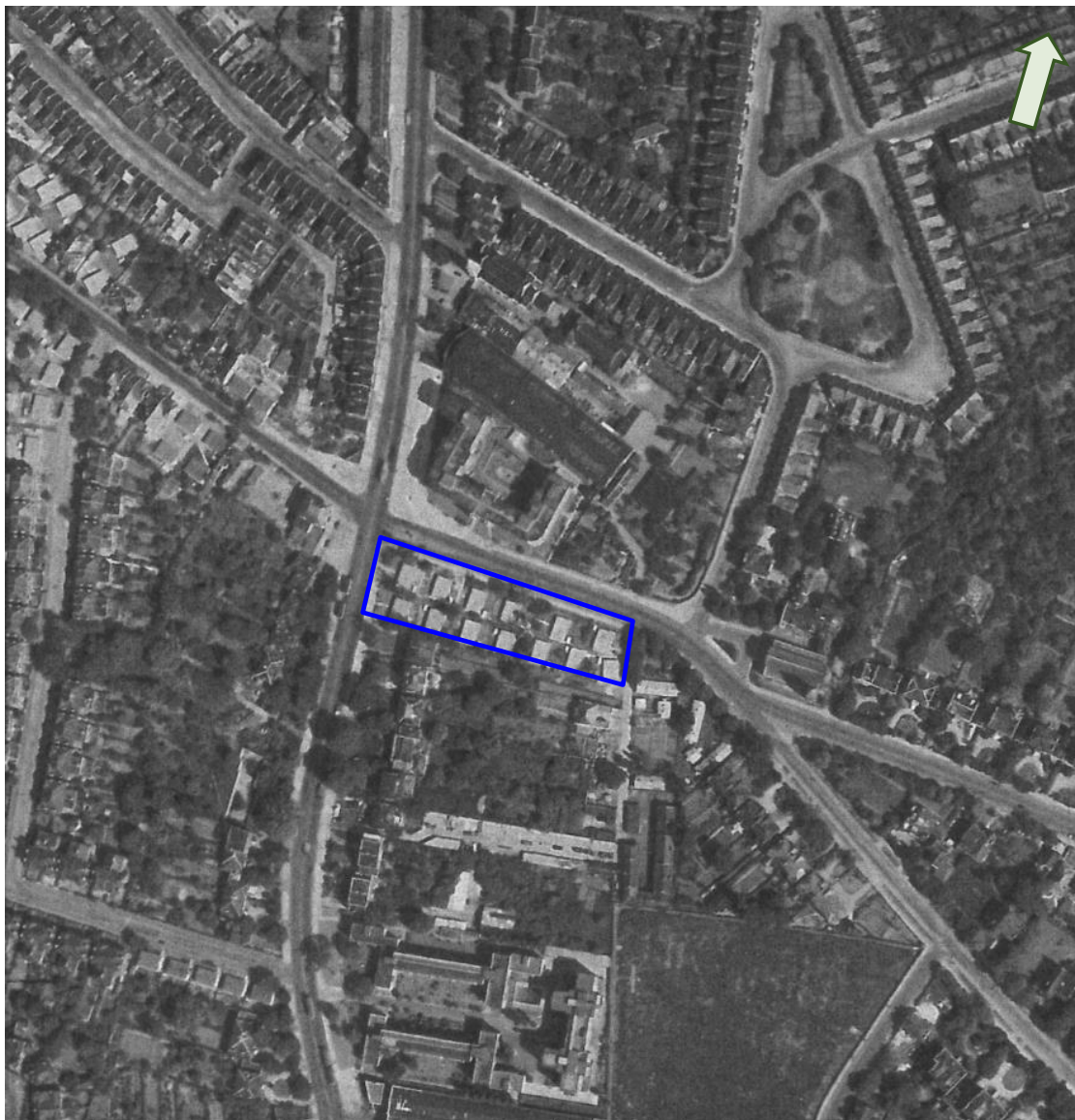


Plate 2 Aerial photograph, 29th May 1947




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 11th July 1987, shows that the Site now comprised heavily vegetated open ground.

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

23rd 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-shiping 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 7th 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 29th December 1940 and 10th 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				Bombs per 405ha (1,000 acres)
	High Explosive	Parachute Mines	Other	Total	
Wandsworth MB	1,437	5	38	1,480	162.3
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.

8th September 1940

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

9th 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.

1st November 1940

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

26th November 1940

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

11th 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.

12th January 1941

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

8th March 1941

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

15th 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.

17th May 1941

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

17th 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

Legend	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 13th 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.

Plate 5	Aerial photograph, 13 th March 1945
<p>Source: Historic England Not to scale</p>	
Legend	Site boundary — Possible bomb damage ○
<p>Records indicate that 16No. bombs fell within 0.1km of the Site, which resulted in severe damage to the buildings on the eastern part of the Site. It is considered that this damage may have masked the impact of a UXB during the heavy air raids in the region.</p> <p>WWII bombing is considered to provide a possible source of UXO hazard to the eastern part of the Site.</p>	
<p>3.4 Geology and Bomb Penetration Depths</p>	
<p>It is important to consider the geological materials present on the Site at the time that a bomb was dropped in order to establish its maximum penetration depth. British Geological Survey (BGS) 1:50,000 Sheet 270 South London (Solid and Drift) was consulted, in addition to BGS borehole records.</p> <p>During WWII the geology of the Site comprised Head Deposits of clay, silt and sand overlying the London Clay Formation.</p>	

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.

Table 3		WWII HAA and ZAA batteries within 10km of the Sites		
Grid Reference	Serial No.	Location	Armament	Approximate Distance and Direction from Site
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 28th, 31st and 52nd (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 13th 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, 13th September 1945



Source: Historic England

Not to Scale

Legend	Rifle Range 
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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 27th 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.

21st 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.

26th 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

8th September 1940

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

9th 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.

1st November 1940

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

26th 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.

11th 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.

12th January 1941

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

8th March 1941

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

15th 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.

17th April 1941

1No. HE bomb fell on 21 Streatham Place, approximately 0.2km northwest of the Site.

19th March 1941

IBs fell on Holmewood Gardens, approximately 0.2km north-northwest of the Site.

23rd April 1941

1No. HE bomb fell on 31 Montrell Road, approximately 0.2km southwest of the Site.

17th May 1941

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

18th June 1944

1No. V1 fell on Downton Avenue, near Streatham High Road, approximately 0.5km south of the Site.

24th June 1944

1No. V1 fell on Streatham High Road, opposite the end of Wyatt Park Road, approximately 0.4km south of the Site.

2nd July 1944

1No. V1 fell on Cornwall House, Stamford Street, approximately 0.5km north of the Site.

3rd July 1944

1No. V1 fell on the Streatham Hill theatre on the Barhill Road side, approximately 0.5km south of the Site.

21st July 1944

1No. V1 fell on Calders Row, Brixton Hill, approximately 0.4km north of the Site.

27th July 1944

1No. V1 fell on the junction between Wavertree Road and Daysbrook Road, approximately 0.3km south-southeast of the Site.

9th 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.

Plate Photographs of a typical and an excavated WWII No. 36 hand grenades



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).

Plate	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.

Plate	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



Source: Imperial War Museum

A2.8 Detonators, Gains and Fuzes

Bomb components such as detonators, gains 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



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.

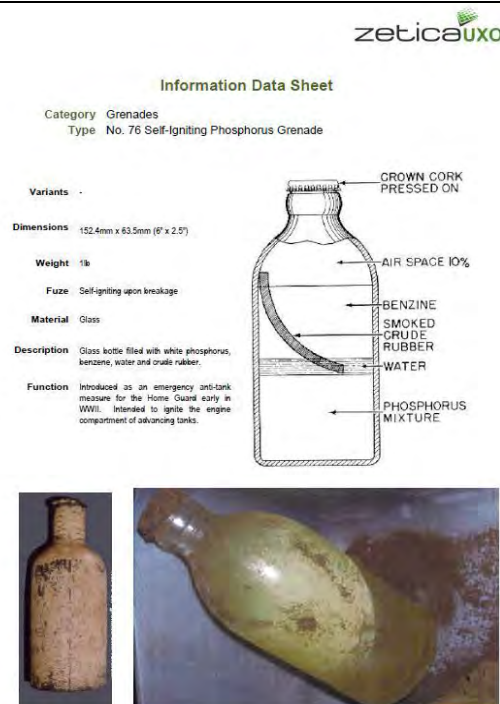
In January 2017, a cache of 24No. SIP grenades was discovered at Derriford, Plymouth and made safe by a Royal Navy Bomb Disposal Unit.

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



zeticauxo

Information Data Sheet

Category Grenades
Type No. 76 Self-Igniting Phosphorus Grenade

Variants -

Dimensions 152.4mm x 63.5mm (6" x 2.5")

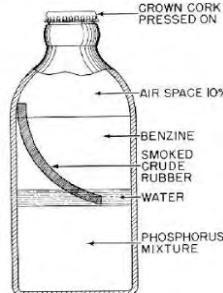

Weight 1lb

Fuze Self-igniting upon breakage

Material Glass

Description Glass bottle filled with white phosphorus, benzene, water and crude rubber.

Function Introduced as an emergency anti-tank measure for the Home Guard early in WWII. Intended to ignite the engine compartment of advancing tanks.

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 16th August 2009, 1No. 250kg WWII bomb was found near Ebberton, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8th 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, 8th March 2010



Source: Zetica Ltd

On the 23rd February 2011, 1No. WWII UXB was found on a building site in Notte Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.

On the 22nd 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 2nd 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.

Plate	Photograph of WWI bomb, Isle of Sheppey, 2 nd August 2012
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Source: Zetica Ltd

On the 23rd 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 21st 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 10th 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 21st 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.

Plate

Photograph of a recently excavated WWII British 500lb GP bomb



Source: Zetica Ltd

On the 12th 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.

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 16th November 2016. These devices were towed out to sea and destroyed in controlled explosions.

On the 19th 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.

On the 25th January 2017, 1No. 250kg UXB and 1No. mortar shell were found in King's Forest, Thetford. They were destroyed in a controlled explosion.

On the 2nd 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.

On the 15th 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 17th May 2017.

There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.

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.

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.

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.

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.

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 6th 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 25th 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	
Abandoned Explosive Ordnance (AXO)	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.
Camouflet	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	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.
Explosive	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.
Explosive Ordnance (EO)	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.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.

Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.
Explosive Substances and Articles (ESA)	Explosive substance are solid or liquid substance (or a mixture of substances), which is either: <ul style="list-style-type: none"> • 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. • 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. Explosive article is an article containing one or more explosive substances.
Fuze	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.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
High Explosive	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).
Munition	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:- <ul style="list-style-type: none"> • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.
Primary Explosive	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.

<p>Propellants</p>	<p>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.</p>
<p>Pyrotechnic</p>	<p>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.</p>
<p>Unexploded Ordnance (UXO)</p>	<p>UXO is explosive ordnance that has been either primed, fuzed, 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.</p>

Appendix 5 Bibliography

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Established for over 25 years, Zetica's services include

- Desk studies
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- Topographic surveys
- Utility services detection
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- Transport infrastructure surveys
- Pipeline & cable route surveys
- Intrusive ground investigations

More details are available at

www.zetica.com



zeticauxo



APPENDIX D

Site Investigation Data

0002-UA009696 Borehole Location Plan

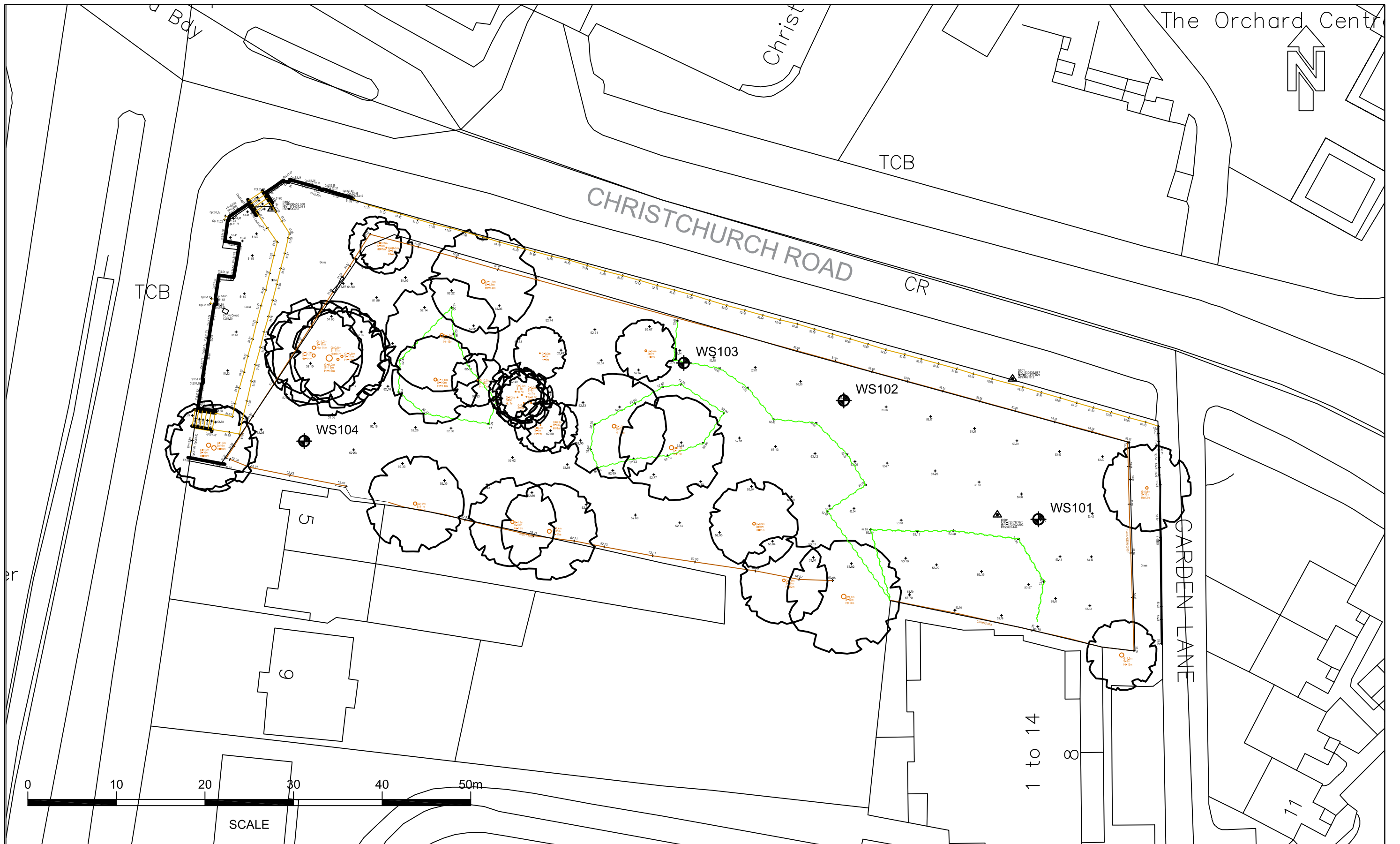
Borehole logs

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:		
Designed	J. RAVEN	Date: 18JUL17
Drawn	J. RAVEN	Date: 18JUL17
Checked	T. AGAPAKIS	Date: 20JUL17
Approved	T. WINDSOR	Date: 21JUL17
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

ARCADIS 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, London, N1 9AB
 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 ³)
()	Denotes residual test value
PID	Photo Ionisation Detector (ppm) *
Kf/Kr	Permeability Test (f = falling head, r = rising head quoted in ms ⁻¹)
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)

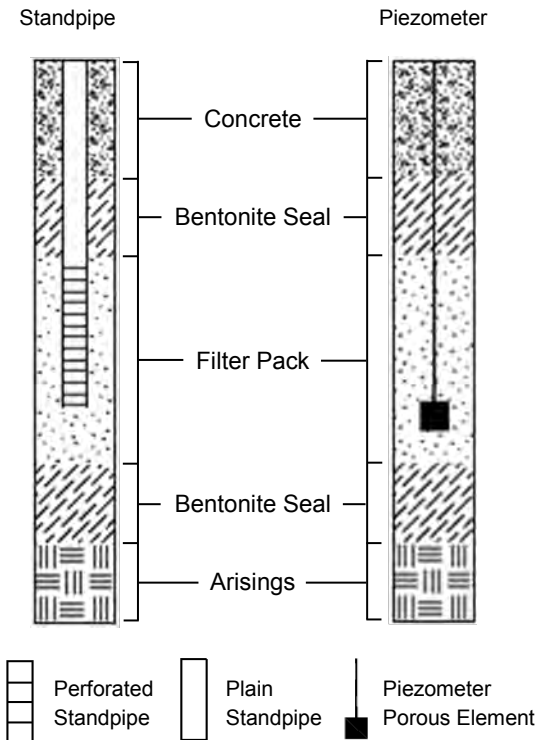
STRATA LEGENDS - Note: Composite strata types are shown by combining symbols

	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
--	---------------

Project
TFL - Land at Christchurch Road & Brixton Hill
Client
Transport for London

Project No.
UA009686-02
Easting (OS mE)
530542.00

Ground Level (mAOD)
53.40
Northing (OS mN)
173402.00

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 brown slightly clayey slightly gravelly fine to coarse SAND with rare ceramic fragments and abundant roots and rootlets. Gravel is subangular to rounded fine to coarse flint, brick, slate and concrete. Plastic bag at 0.1m bgl		(0.60)		
0.50	D3							0.60	52.80	
0.50	ES2							(0.30)		
1.00	D4					MADE GROUND: Brown slightly clayey fine to coarse SAND with rare ceramic fragments.		0.90	52.50	
		1.20	SPT(S)	N=8 (1,1/2,2,2,2)		Soft brown mottled orange slightly gravelly CLAY. Gravel is subangular to well rounded medium to coarse flint. [HEAD DEPOSITS]		(0.90)		
2.00 - 2.20	D5	2.00	SPT(S)	N=8 (1,2/2,2,2,2)		Loose yellowish brown clayey fine to medium SAND. [HEAD DEPOSITS]		1.80	51.60	
								(0.50)		
						Soft brown mottled grey slightly sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is subangular to subrounded fine flint. [HEAD DEPOSITS]		2.30	51.10	
								(0.70)		
3.00 - 3.45	D6	3.00	SPT(S)	N=27 (4,4/5,6,7,9)		No recovery		3.00	50.40	
3.00 - 5.00	B7					Stiff extremely closely fissured brown mottled grey CLAY. Rare selenite crystals and medium gravel sized pockets of orange sand. [WEATHERED LONDON CLAY]				
						becoming stiff				
4.00 - 4.45	D8	4.00	SPT(S)	N=18 (4,4/3,4,5,6)				(2.45)		
5.00 - 5.45	D9	5.00	SPT(S)	N=21 (4,4/5,5,6,5)				5.45	47.95	

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							300	1.20			0.00	0.20	Concrete
1.20	5.45	Dynamic Sample							87	2.00			0.20	1.00	Bentonite
									77	3.00			1.00	3.00	Gravel
									67	5.00			3.00	5.45	Bentonite

Remarks
No groundwater encountered.
Hole terminated at target depth.
50mm HDPE monitoring standpipe with metal flush cover installed to 3.0m bgl.
Coordinates and levels are approximate.

Termination Depth:
5.45m

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.				
0.50	ES2							(0.90)		
0.80	D3							0.90	51.80	
1.20 - 1.65	D4	1.20	SPT(S)	N=9 (1,2/1,2,3,3)		Firm yellowish brown mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of flint. [HEAD DEPOSITS]		(0.75)		
								1.65	51.05	
2.00 - 2.45	D5	2.00	SPT(S)	N=27 (5,5/5,7,7,8)		Medium dense orangish brown slightly gravelly medium to coarse SAND. Gravel is subangular to rounded fine to coarse flint. [HEAD DEPOSITS]		(0.70)		
								2.35	50.35	
								2.65	50.05	
3.00 - 3.45	D6	3.00	SPT(S)	N=13 (6,5/4,3,3,3)		Firm light brown very gravelly CLAY. Gravel is subangular to subrounded fine to coarse of flint. [HEAD DEPOSITS]		(0.25)		
								2.90	49.80	
								(0.40)		
3.50 - 5.00	B7					Light brown slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium flint. [HEAD DEPOSITS]		3.30	49.40	
						Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to well rounded, fine to medium flint. [HEAD DEPOSITS]				
						Firm to stiff extremely closely fissured brown occasionally mottled grey CLAY. [WEATHERED LONDON CLAY]				
4.00 - 4.45	D8	4.00	SPT(S)	N=23 (3,4/5,6,5,7)				(2.15)		
5.00 - 5.45	D9	5.00	SPT(S)	N=25 (4,3/6,6,7,6)				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					

Remarks
Seepage at 2.65m bgl.
Hole terminated at target depth.
Coordinates and levels are approximate.

Termination Depth:
5.45m



Project
TFL - Land at Christchurch Road & Brixton Hill
Client
Transport for London

Project No.
UA009686-02
Easting (OS mE)
530460.00

Ground Level (mAOD)
52.00
Northing (OS mN)
173411.00

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 light brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of brick and flint. MADE GROUND: Buried brick structure and slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of brick and flint. Abundant plant material and rare ceramic fragments.		0.10	51.90	
0.50	ES2							(0.90)		
0.80	D3							1.00	51.00	

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	1.00	Inspection Pit							0	1.00			0.00	1.00	Arisings

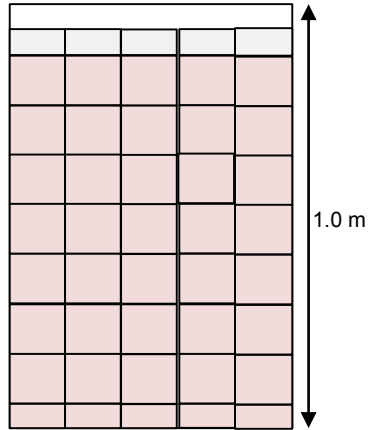
Remarks
 Hole terminated within structure at 1.0m bgl.
 Hole appears to be within relict brick structure. Brick courses visible on at least 3 sides of inspection pit.
 Coordinates and levels are approximate.

Termination Depth:
1.00m

CROSS SECTION

W

E



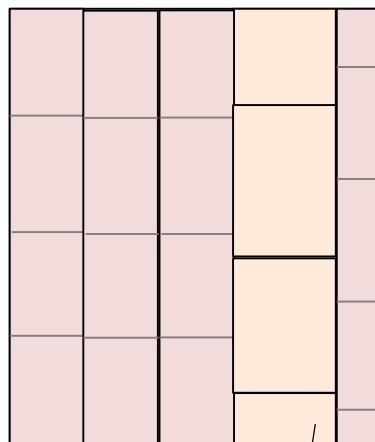
PHOTOGRAPHS



PLAN VIEW

WS104 hand pit
Relic (foundation?)
brick structure

Final depth 1.0m
bgl.



Client	Status FINAL			Project Land at Christchurch Road and Brixton Hill	Arcadis Consulting (UK) Ltd 1 st Floor 2 Glass Wharf Temple Quay Bristol BS2 0FR Tel: 01173 721385 Fax: 01173 721200 	
	Scale NTS		Current Issue Signatures			
	Datum	N/A	Author	J Raven		Title Inspection Pit WS104 Sketch
	Grid	N/A	Checker	T Agapakis		
	© Copyright Reserved		Approver	T Windsor		
Drawing No.	Project No.	Issue No.				
101	UA009686	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 & 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

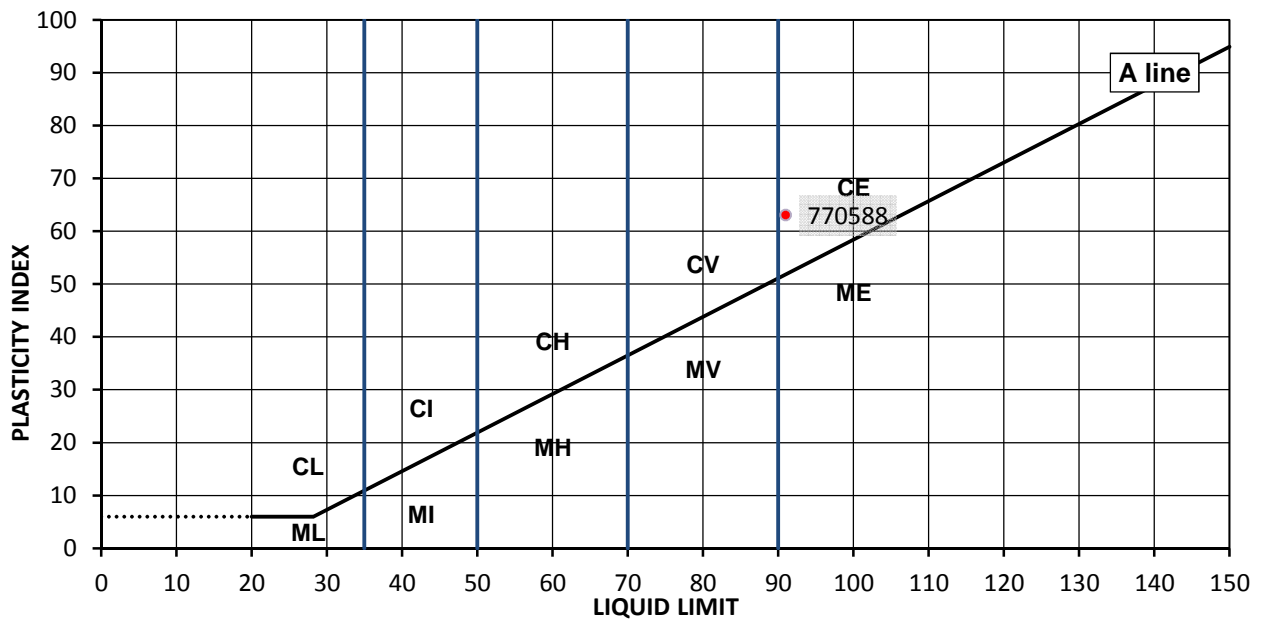
TEST RESULTS

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



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		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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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



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 & 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

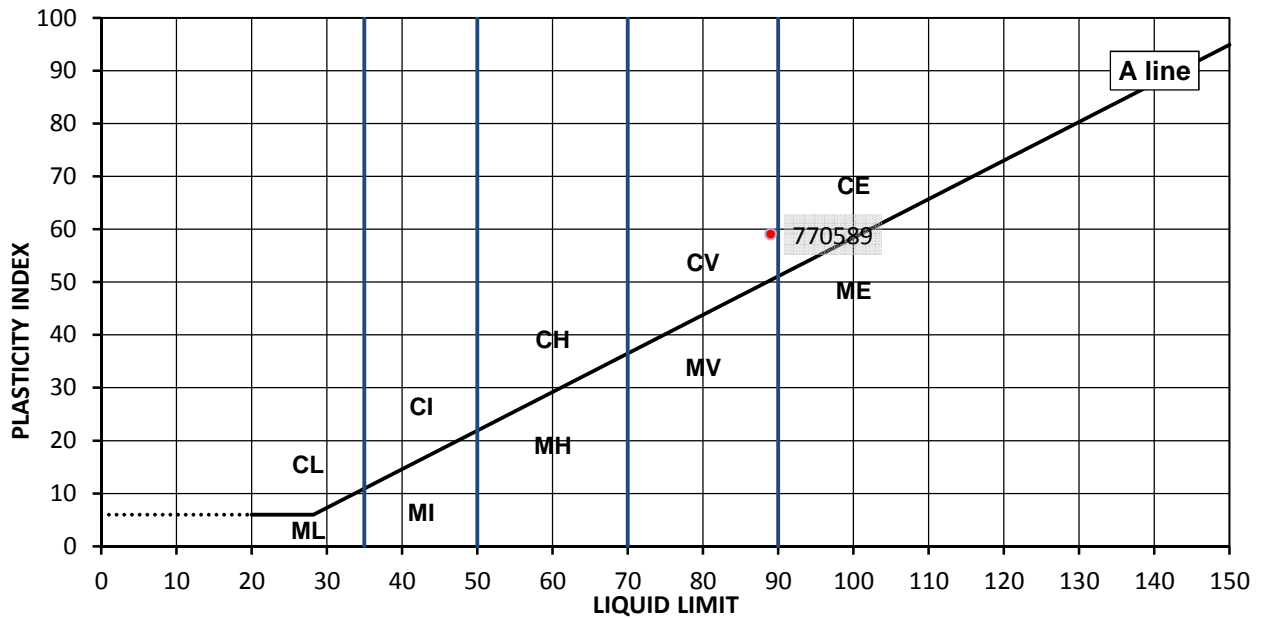
TEST RESULTS

Laboratory Reference: 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

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		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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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



4041

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 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

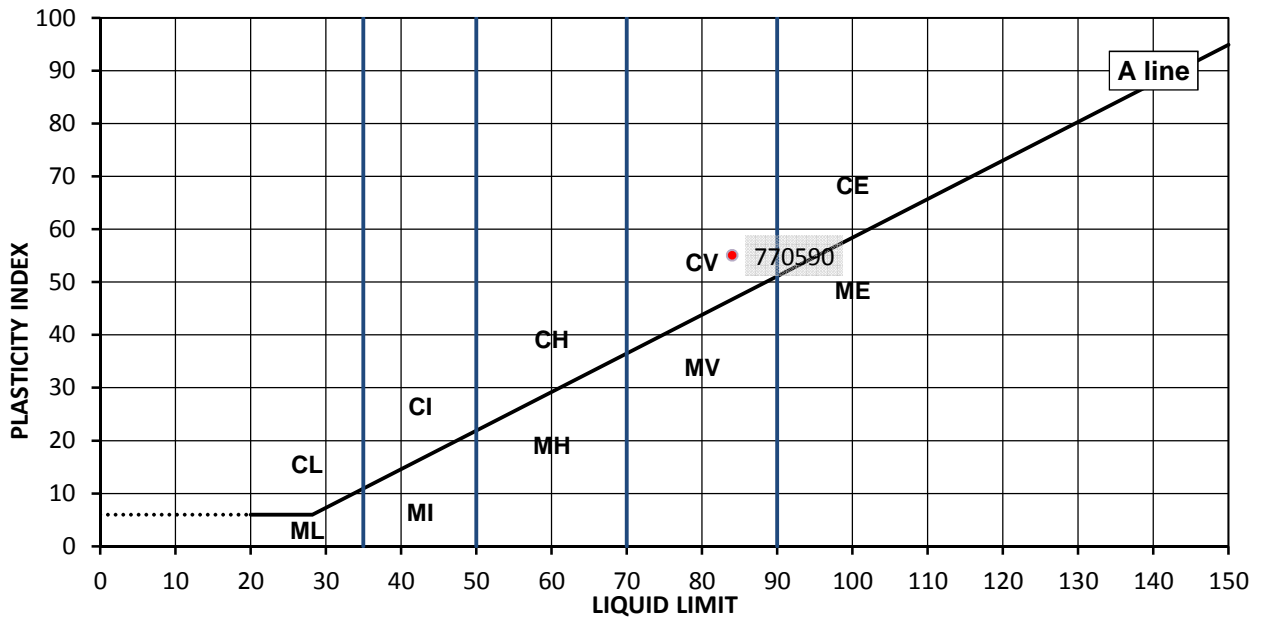
TEST RESULTS

Laboratory Reference: 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

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		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

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 & 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

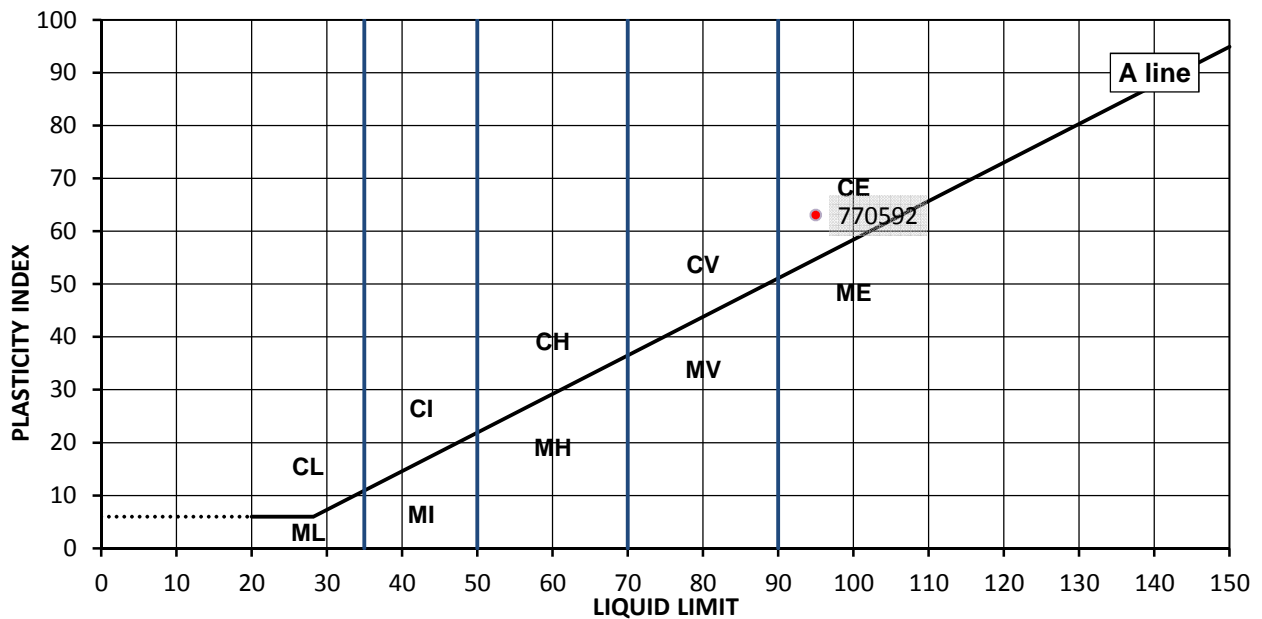
TEST RESULTS

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

C	Clay	L	Low	Liquid Limit	below 35
M	Silt	I	Medium		35 to 50
		H	High		50 to 70
		V	Very high		70 to 90
		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/m ³	Mg/m ³						
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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TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Tested in Accordance with BS1377:Part 2:1990, clause 9.2

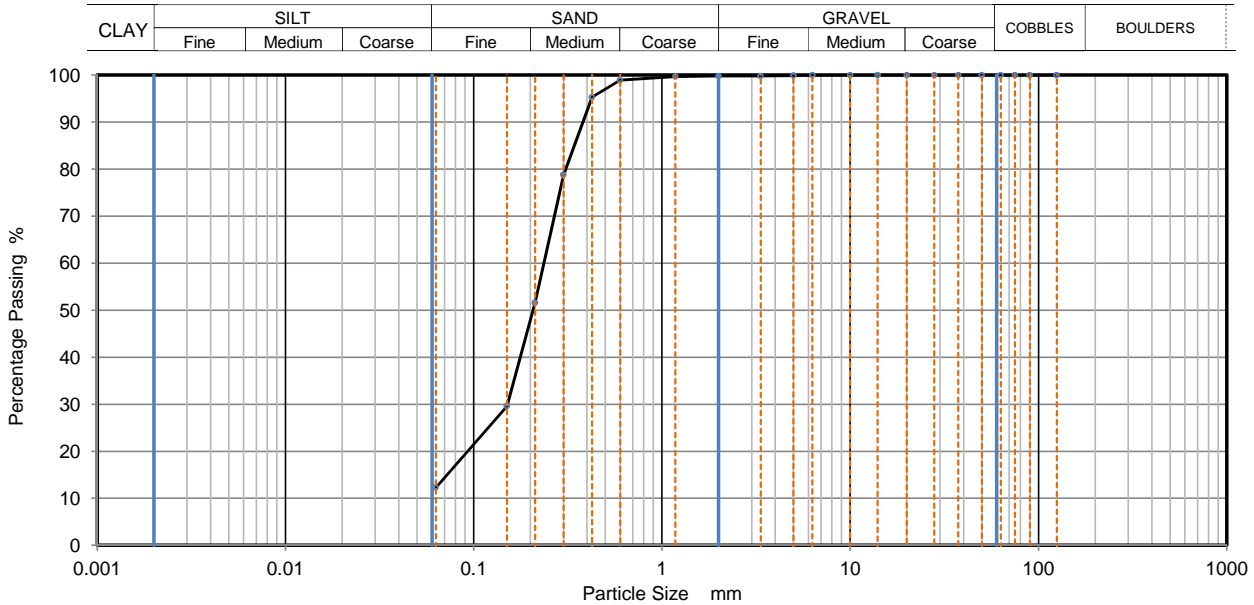
Client: Arcadis Consulting (UK) Ltd
Client Address: 10 Medawar Road
The Surrey Research Park
Guildford
Surrey
GU2 7AR
Contact: Jon Raven
Site Name: Land at Christchurch Road & Brixton Hill
Site Address: Not Given

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: 770587
Sample description: Brown slightly clayey SAND
Location: WS101
Supplier: Not Given

Sample Reference: 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 (assumed) 2.65 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

Grading Analysis		
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

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 Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Tested in Accordance with BS1377:Part 2:1990, clause 9.2

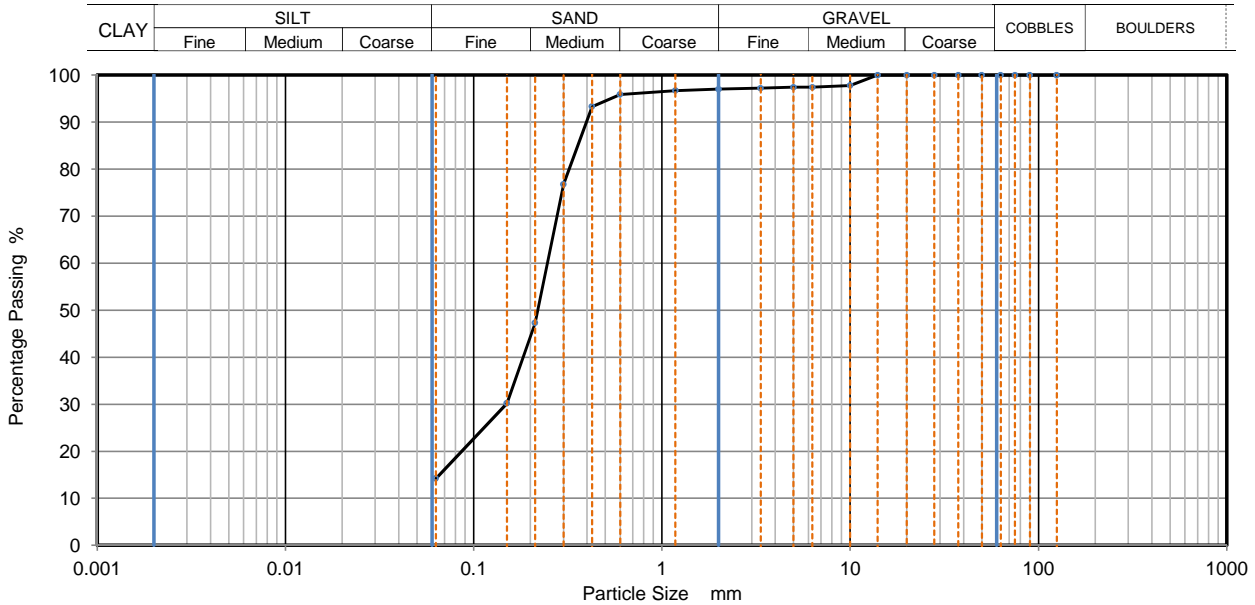
Client: Arcadis Consulting (UK) Ltd
Client Address: 10 Medawar Road
The Surrey Research Park
Guildford
Surrey
GU2 7AR
Contact: Jon Raven
Site Name: Land at Christchurch Road & Brixton Hill
Site Address: Not Given

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 description: Yellowish brown slightly clayey SAND
Location: WS103
Supplier: Not Given

Sample Reference: 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)	
0.425	93	2.65	Mg/m3
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:

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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Jon Raven

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e: jonathan.raven@arcadis.com

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t: 01923 225404
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e: reception@i2analytical.com

Analytical Report Number : 17-52356

Replaces Analytical Report Number : 17-52356, issue no. 1

Project / Site name:	TFL- Land At Christchurch Road And Brixton Hill	Samples received on:	21/06/2017
Your job number:	UA009686-02	Samples instructed on:	22/06/2017
Your order number:	PO0067593	Analysis completed by:	14/07/2017
Report Issue Number:	2	Report issued on:	17/07/2017
Samples Analysed:	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	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.1	9.3	7.5	11	9.8
Total mass of sample received	kg	0.001	NONE	1.8	1.7	1.9	1.9	1.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	7.8	8.2	7.9	8.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	3.5	< 2.5	150	5.8	2.6
Water Soluble SO ₄ 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
-----------------------------	-------	-----	--------	------	------	------	------	------

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: PO0067593

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, Sheeting/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 ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	99	230	36	< 2.5
Water Soluble SO ₄ 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	-
-----------------------------	-------	-----	--------	------	------	------	---

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 diphenylcarbazine 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.



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Analytical Report Number : 17-52408

Project / Site name:	TFL - Land At Chrstrchurch Road & Brixton Hill	Samples received on:	21/06/2017
Your job number:	UA009686-02	Samples instructed on:	22/06/2017
Your order number:		Analysis completed by:	03/07/2017
Report Issue Number:	1	Report issued on:	03/07/2017
Samples Analysed:	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 Units	N/A	MCERTS	7.2	8.2			
Total Sulphate as SO ₄	%	0.005	MCERTS	0.046	0.028			
Water Soluble SO ₄ as SO ₄ (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	Acceptation Status						
Stone Content	%	0.1	NONE	< 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	13
Total mass of sample received	kg	0.001	NONE	1.8	1.7	1.9	1.9	1.8	1.3

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, Sheetting/Board Debris	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	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
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	3.5	< 2.5	150	5.8	2.6	99	230	36	< 2.5
Water Soluble SO ₄ 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

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 & Brixton Hill

Description/Comments

Project

TFL

Site

Land at Christchurch Road & Brixton Hill

Waste Stream Template

TFL Sites

Classified by

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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:	WS101	LoW Code:	
Sample Depth:	0.30 m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	7.1% (no correction)	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

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		
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 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 }				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:	
WS101[1]	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)
0.50 m		
Moisture content:		
9.3%		
(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		
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:	WS102	LoW Code:	
Sample Depth:	0.30 m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	7.5% (no correction)	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

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		
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 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 }				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:	
WS102[1]	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)
0.50 m		
Moisture content:		
11%		
(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:	
WS103	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)
0.30 m		
Moisture content:		
9.8%		
(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:	
WS103[1]	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)
0.50 m		
Moisture content:		
11%		
(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		
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 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:								0.0915 %		

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:
WS104	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 03 * (Soil and stones containing hazardous substances)
0.30 m	
Moisture content:	
9%	
(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		
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 601-036-00-5 205-916-6 207-08-9				0.49 mg/kg		0.49 mg/kg	0.000049 %		
14	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3 200-028-5 50-32-8				0.69 mg/kg		0.69 mg/kg	0.000069 %		
15	indeno[123-cd]pyrene 205-893-2 193-39-5				0.5 mg/kg		0.5 mg/kg	0.00005 %		
16	dibenz[a,h]anthracene 601-041-00-2 200-181-8 53-70-3				0.11 mg/kg		0.11 mg/kg	0.000011 %		
17	benzo[ghi]perylene 205-883-8 191-24-2				0.59 mg/kg		0.59 mg/kg	0.000059 %		
18	arsenic { arsenic trioxide } 033-003-00-0 215-481-4 1327-53-3				14 mg/kg	1.32	18.485 mg/kg	0.00185 %		
19	boron { boron tribromide/trichloride/trifluoride (combined) } 10294-33-4, 10294-34-5, 7637-07-2				1.4 mg/kg	13.43	18.802 mg/kg	0.00188 %		
20	cadmium { cadmium sulfide } 048-010-00-4 215-147-8 1306-23-6			1	<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				23 mg/kg	1.462	33.616 mg/kg	0.00336 %		
23	copper { dicopper oxide; copper (I) oxide } 029-002-00-X 215-270-7 1317-39-1				41 mg/kg	1.126	46.161 mg/kg	0.00462 %		
24	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) } 082-001-00-6			1	2000 mg/kg		2000 mg/kg	0.2 %		
25	mercury { mercury dichloride } 080-010-00-X 231-299-8 7487-94-7				<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] 12054-48-7 [1] 234-348-1 [2] 11113-74-9 [2]				14 mg/kg	1.579	22.113 mg/kg	0.00221 %		
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 1314-13-2				150 mg/kg	1.245	186.707 mg/kg	0.0187 %		
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:
WS104[1]	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 03 * (Soil and stones containing hazardous substances)
0.50 m	
Moisture content:	
9.6%	
(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%)

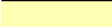
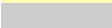



Determinands

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		
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	56-55-3	0.69 mg/kg		0.69 mg/kg	0.000069 %		
11	chrysene	601-048-00-0	205-923-4	218-01-9	0.65 mg/kg		0.65 mg/kg	0.000065 %		
12	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.71 mg/kg		0.71 mg/kg	0.000071 %		
13	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.54 mg/kg		0.54 mg/kg	0.000054 %		
14	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	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	53-70-3	<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	1327-53-3	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	1306-23-6	<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	1317-39-1	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	7487-94-7	<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]	12054-48-7 [1] 11113-74-9 [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	1314-13-2	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
<LOD	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:	
WS101[2]	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)
1.00 m		
Moisture content:		
13%		
(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		PH		8 pH		8 pH	8pH		
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3	12 mg/kg	1.32	15.844 mg/kg	0.00158 %		
3	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2	1.7 mg/kg	13.43	22.831 mg/kg	0.00228 %		
4	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
5	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
6	chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9	30 mg/kg	1.462	43.847 mg/kg	0.00438 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	18 mg/kg	1.126	20.266 mg/kg	0.00203 %		
8	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			120 mg/kg		120 mg/kg	0.012 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
10	nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]	12 mg/kg	1.579	18.954 mg/kg	0.0019 %		
11	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

#	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 (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.

Appendix C: Version

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:

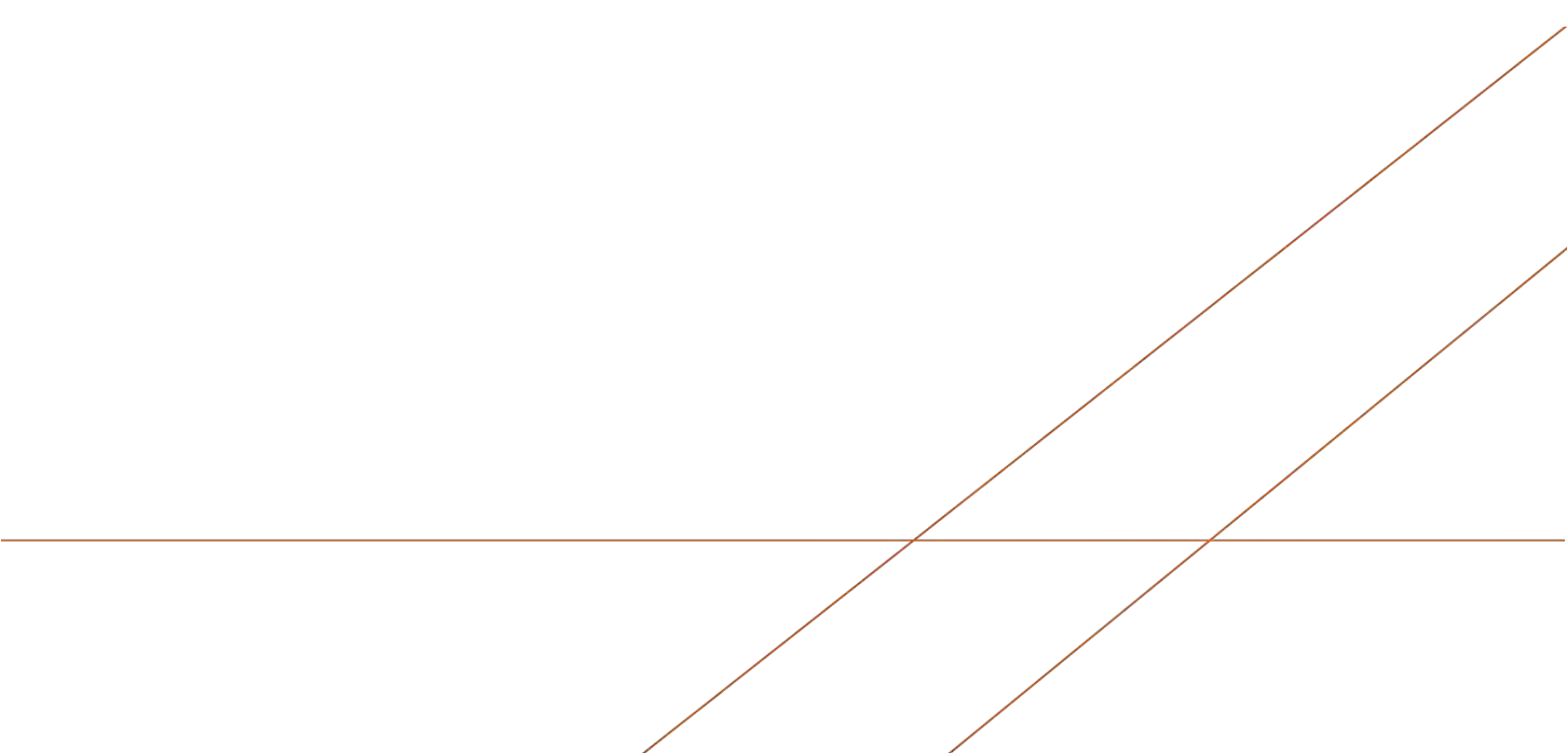
Asbestos fibres have been identified in the sample but not yet quantified. When WAC testing is undertaken by a waste carrier prior to removal of arisings, the waste will be classed as hazardous if greater than 0.1% loose asbestos fibres are found. If large individual pieces of asbestos tile are found they must be assessed separately. Therefore without quantification the waste has been assessed as potentially hazardous.

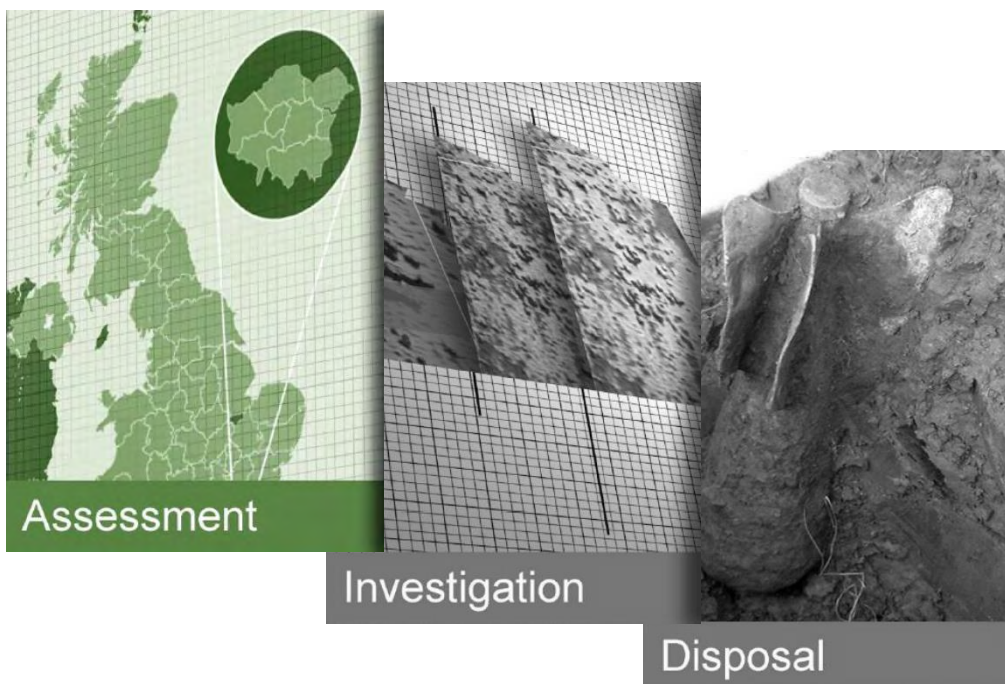
Note: even if less than 0.1% asbestos fibres are found the landfill operator may decline to accept the waste."

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Christchurch Road, Brixton - UXO Desk Study & Risk Assessment

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Checked by Stefan Lang
Authorised by Mike Sainsbury

Document Title UXO Desk Study & Risk Assessment
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Revision A
Project Location Christchurch Road, Brixton
Client Arcadis
Date 13th 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



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:									

<p>Low Risk</p>
<p>Excavations</p> <p>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.</p> <p>Boreholes/Piles</p> <p>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.</p>
<p>Moderate Risk</p>
<p>Excavations</p> <p>For those involved in excavations, the raising of awareness (as per low risk) is considered essential.</p> <p>A non-intrusive UXO detection survey and intrusive investigation of identified targets is recommended as the most proactive way to mitigate the risk.</p> <p>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.</p> <p>The EOC Engineer will carry out a visual assessment on any suspect items uncovered and classify them as potential UXO or other material.</p> <p>Boreholes/Piles</p> <p>Clearance certification for any borehole or pile locations is considered essential.</p> <p>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.</p> <p>Assuming no objects comparable to the UXB detection range are identified, then the borehole or pile position can be considered clear of UXB.</p> <p>Table 5 in the main report gives recommended actions in relation to the potential UXO risk level and the anticipated Site activity.</p> <p>Further advice on the mitigation methods can be provided by Zetica on request.</p>

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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.

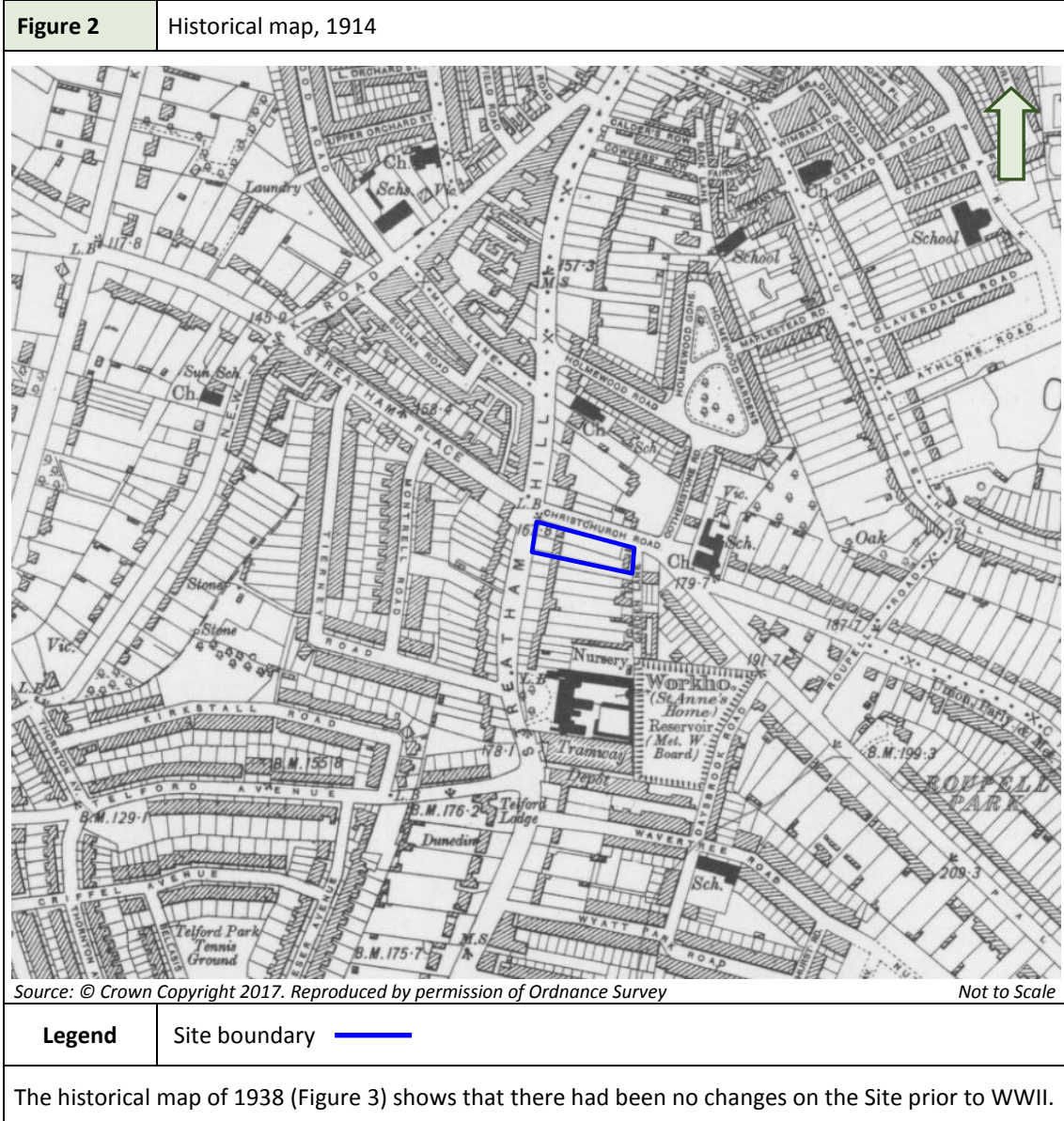


Figure 3 Historical map, 1938



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 29th 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, 29th 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 11th July 1987, shows that the Site now comprised heavily vegetated open ground.

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

23rd 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-shiping 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 7th 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 29th December 1940 and 10th 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				Bombs per 405ha (1,000 acres)
	High Explosive	Parachute Mines	Other	Total	
Wandsworth MB	1,437	5	38	1,480	162.3
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.

8th September 1940

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

9th 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.

1st November 1940

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

26th November 1940

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

11th 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.

12th January 1941

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

8th March 1941

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

15th 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.

17th May 1941

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

17th 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

Legend	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 13th 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.

Plate 5	Aerial photograph, 13 th March 1945
<p>Source: Historic England Not to scale</p>	
Legend	Site boundary — Possible bomb damage ○
<p>Records indicate that 16No. bombs fell within 0.1km of the Site, which resulted in severe damage to the buildings on the eastern part of the Site. It is considered that this damage may have masked the impact of a UXB during the heavy air raids in the region.</p> <p>WWII bombing is considered to provide a possible source of UXO hazard to the eastern part of the Site.</p>	
<p>3.4 Geology and Bomb Penetration Depths</p>	
<p>It is important to consider the geological materials present on the Site at the time that a bomb was dropped in order to establish its maximum penetration depth. British Geological Survey (BGS) 1:50,000 Sheet 270 South London (Solid and Drift) was consulted, in addition to BGS borehole records.</p> <p>During WWII the geology of the Site comprised Head Deposits of clay, silt and sand overlying the London Clay Formation.</p>	

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.

Table 3		WWII HAA and ZAA batteries within 10km of the Sites		
Grid Reference	Serial No.	Location	Armament	Approximate Distance and Direction from Site
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 28th, 31st and 52nd (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 13th 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, 13th September 1945



Source: Historic England

Not to Scale

Legend	Rifle Range 
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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 27th 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.

21st 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.

26th 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

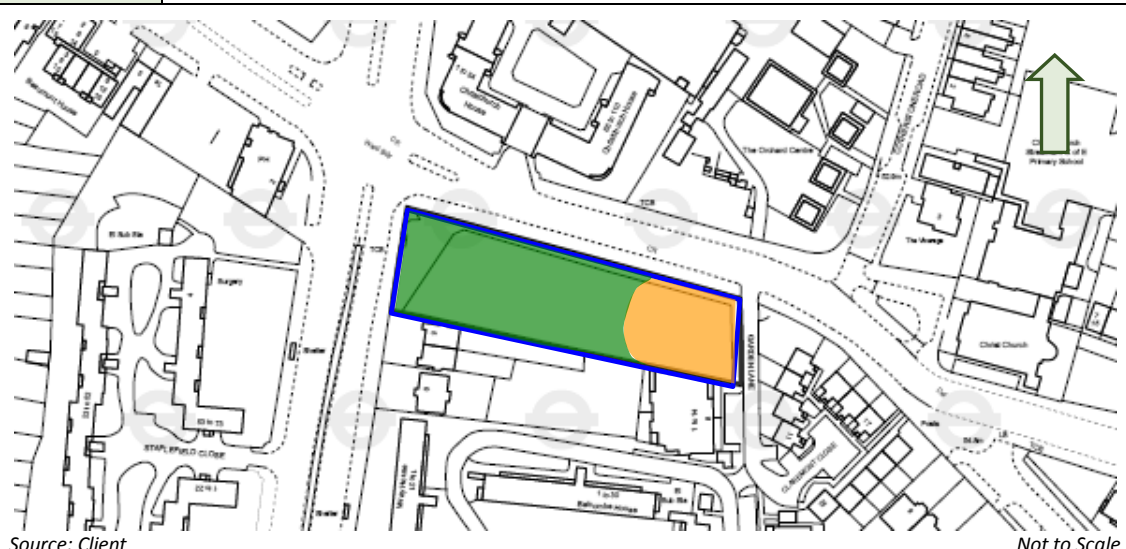
Hazard Level	Definition
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present and 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

8th September 1940

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

9th 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.

1st November 1940

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

26th 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.

11th 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.

12th January 1941

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

8th March 1941

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

15th 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.

17th April 1941

1No. HE bomb fell on 21 Streatham Place, approximately 0.2km northwest of the Site.

19th March 1941

IBs fell on Holmewood Gardens, approximately 0.2km north-northwest of the Site.

23rd April 1941

1No. HE bomb fell on 31 Montrell Road, approximately 0.2km southwest of the Site.

17th May 1941

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

18th June 1944

1No. V1 fell on Downton Avenue, near Streatham High Road, approximately 0.5km south of the Site.

24th June 1944

1No. V1 fell on Streatham High Road, opposite the end of Wyatt Park Road, approximately 0.4km south of the Site.

2nd July 1944

1No. V1 fell on Cornwall House, Stamford Street, approximately 0.5km north of the Site.

3rd July 1944

1No. V1 fell on the Streatham Hill theatre on the Barhill Road side, approximately 0.5km south of the Site.

21st July 1944

1No. V1 fell on Calders Row, Brixton Hill, approximately 0.4km north of the Site.

27th July 1944

1No. V1 fell on the junction between Wavertree Road and Daysbrook Road, approximately 0.3km south-southeast of the Site.

9th 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.

Plate Photographs of a typical and an excavated WWII No. 36 hand grenades



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).

Plate	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.

Plate	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



Source: Imperial War Museum

A2.8 Detonators, Gains and Fuzes

Bomb components such as detonators, gains 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



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



Information Data Sheet

Category Grenades
Type No. 76 Self-Igniting Phosphorus Grenade

Variants -

Dimensions 152.4mm x 63.5mm (6" x 2.5")

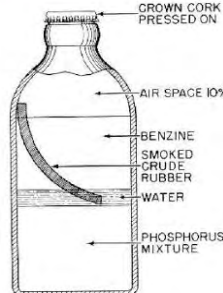

Weight 1lb

Fuze Self-igniting upon breakage

Material Glass

Description Glass bottle filled with white phosphorus, benzene, water and crude rubber.

Function Introduced as an emergency anti-tank measure for the Home Guard early in WWII. Intended to ignite the engine compartment of advancing tanks.

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 16th August 2009, 1No. 250kg WWII bomb was found near Ebberton, North Yorkshire. Both of these were destroyed in controlled explosions by Bomb Disposal Units.

On the 8th 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, 8th March 2010



Source: Zetica Ltd

On the 23rd February 2011, 1No. WWII UXB was found on a building site in Notte Street in Plymouth City centre. The bomb was removed by EOD personnel and demolished at sea.

On the 22nd 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 2nd 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.

Plate	Photograph of WWI bomb, Isle of Sheppey, 2 nd August 2012
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Source: Zetica Ltd

On the 23rd 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 21st 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 10th 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 21st 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.

Plate

Photograph of a recently excavated WWII British 500lb GP bomb



Source: Zetica Ltd

On the 12th 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.

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 16th November 2016. These devices were towed out to sea and destroyed in controlled explosions.

On the 19th 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.

On the 25th January 2017, 1No. 250kg UXB and 1No. mortar shell were found in King's Forest, Thetford. They were destroyed in a controlled explosion.

On the 2nd 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.

On the 15th 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 17th May 2017.

There is a long list of incidents during construction work in Germany that in some cases have led to the deaths of workers.

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.

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.

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.

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.

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 6th 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 25th 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	
Abandoned Explosive Ordnance (AXO)	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.
Camouflet	The type of cavity produced when a charge explodes underground without breaking the surface of the earth to form a crater.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	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.
Explosive	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.
Explosive Ordnance (EO)	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.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.

Explosive Remnants of War (ERW)	<p>Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.</p>
Explosive Substances and Articles (ESA)	<p>Explosive substance are solid or liquid substance (or a mixture of substances), which is either:</p> <ul style="list-style-type: none"> • 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. • 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. <p>Explosive article is an article containing one or more explosive substances.</p>
Fuze	<p>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.</p>
Gaine	<p>Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.</p>
High Explosive	<p>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).</p>
Munition	<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"> • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.
Primary Explosive	<p>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.</p>

<p>Propellants</p>	<p>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.</p>
<p>Pyrotechnic</p>	<p>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.</p>
<p>Unexploded Ordnance (UXO)</p>	<p>UXO is explosive ordnance that has been either primed, fuzed, 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.</p>

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