

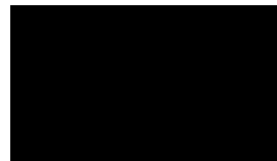
**REPORT ON
GROUND INVESTIGATION
AT
COLDHARBOUR ROAD
GRAVESEND**



REPORT STATUS SHEET

Client:	Frontier Estates Ltd
Report Title:	Report on Ground Investigation at Coldharbour Road, Gravesend.
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- Site Location Plan, ref AG3309-21-01
- Exploratory Hole Location Plan, ref AG3309-21-02
- Trial Trench Diagrams, ref AG3309-21-03 Sheets 1-3
- Harris Irwin Architects Proposed Site Plan, drawing no. 0102, rev. P9
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LABORATORY TEST RESULTS & DATA SHEETS
STANDARD FIELDWORK AND ASSESSMENT PROCEDURES

1.0 INTRODUCTION

1.1 Objectives and Scope of Investigation

An area of land off Coldharbour Road, Gravesend (the Site) is being considered for redevelopment by Frontier Estates Ltd (the Client). The proposals for the site comprise the construction of a 65 bed care home, with associated car parking, access road and areas of accessible soft landscaping.

Applied Geology was appointed by the Client to undertake a desk study/Phase I assessment and combined geotechnical and geoenvironmental investigation in order to:

- assess the potential for hazardous substances or conditions to exist at the site that might warrant mitigation or remediation appropriate to the intended end use proposed by the Client.
- establish geological conditions and geotechnical parameters to assist in the safe and economic engineering design of the proposed redevelopment.
- support a Planning Application.

The terms of reference/brief for the works were mutually developed between Applied Geology and Fed3 Projects (Project Managers to the Client) and are outlined in our proposal and estimate referenced AG21-7734let001, dated the 13th of July 2021. At the time, these were based on a proposed residential development scheme which has since been changed to the current Care Home scheme.

The scope of works undertaken by Applied Geology comprised:

- A site inspection and walkover survey
- A review of the following desk study sources:
 - ❑ GroundSure – GeoInsight & EnviroInsight environmental databases.
 - ❑ GroundSure – MapInsight historical maps.
 - ❑ British Geological Survey (BGS) - published information & on-line borehole database.
 - ❑ Multi-Agency Geographical Information for the Countryside (MAGIC) on-line database.
 - ❑ Review of the Local Authority Planning Portal.
- Ground investigation together with sampling, monitoring and a programme of laboratory testing.
- Assessment and reporting of the results of the works.

Statutory service plans for the site were obtained by Applied Geology between the 6th and 27th of July 2021. A topographic survey of the site by Survey Solutions, Drawing No. 18496SE-01 Rev -, was provided by the Client.

1.2 Report Layout

This report presents a brief description of the site, the desk study data and the factual results of the intrusive investigations carried out. An interpretation of the

ground conditions and a discussion/assessment of the findings is presented in the later report text sections. The main text of the report has been produced in a concise format, including the use of data tables to summarise key information where possible. The report should be read in conjunction with the general procedures detailed in Appendix F and General Notes given at the end of the main text, which provide details of investigation techniques, assessment methodology and standards, health & safety and limitations and exceptions of the report. Drawings and factual data including exploratory hole records, laboratory testing results and desk study records are presented in the other Appendices. This report supersedes previous versions of the report.

2.0 SITE DESCRIPTION AND PROPOSALS

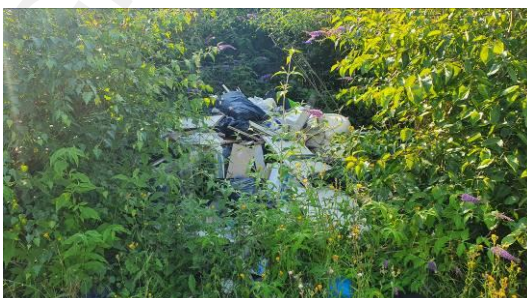
2.1 Site Description

The site is located at 8 Coldharbour Road, Gravesend, Kent, approximately 2km southwest of Gravesend town centre. The Ordnance Survey grid reference for the centre of the site is 563662, 172272 as shown on the Site Location Plan in Appendix A.

The site is approximately rectangular in plan shape with dimensions of approximately 70m by 50m (0.35Ha) and is relatively flat topographically at c. 40m to 41m AOD. The site then falls from an elevation of c. 40m to c. 38m AOD in the north of the site, suggesting there has been some cut to accommodate New House Lane to the north.

A site inspection/walkover was undertaken by Applied Geology on 5th August 2021. Access to the site was gained via a padlocked gate off Coldharbour Road, Gravesend. The site entrance was also secured with concrete bollards, which were moved and reinstated during the fieldwork. The perimeter of the site was secured with wooden fencing. At the time of the inspection, the site comprised a disused parcel of land. The northern margin and eastern half of the site was surfaced with asphalt hardstanding whilst overgrown vegetation was present across the remainder of the site. Several piles of fly tipped material were noted on the site, predominantly located in the margins of the site. The piles predominantly comprised demolition material, such as cupboards (wood), doors (plastic and glass) and bricks.

The site was bound to the north west by New House Lane, to the south west by Coldharbour road, to the south east by Saint Clements Church and to the east by Shears Green Infant School and associated playing field. Beyond the boundaries of the site the surrounding area was predominantly residential. A number of semi-mature and mature trees were located along all boundaries to the site.



Overgrown vegetation in the east of the site.



View along the northern margin of the site facing west towards the site entrance.



Examples of the fly tipped demolition material encountered across the site.

2.2 Site Proposals

The proposals for the site comprise the construction of a 65-bed care home bordering New House Lane in the north and Coldharbour Road in the west of the site with associated car parking in the east. An access road is proposed off New House Lane and areas of accessible soft landscaping are proposed in the centre and peripheries. The location and layout of the proposed development is detailed on the Harris Irwin Architects Proposed Site Plan, drawing no. 0102, rev. P9, dated 14th November 2022, a copy of which is included in Appendix A.

3.0 DESK STUDY INFORMATION

The desk study findings are summarised below with the full Groundsure Report and selected Historical Ordnance Survey Maps included in Appendix B.

Site History	• 1865 – The site and surrounding area are predominantly agricultural fields with New House Lane aligning the northern boundary of the site and an unnamed road (later known as Old Perry Street and then Coldharbour Lane) aligning the western boundary. The site is labelled as Shears Green, and a Guidepost is mapped in the north-western corner. Coldharbour Farm and several associated outbuildings and pond are mapped c.150m to the north, whilst Durndale Farm, outbuildings and pond are mapped c.300m to the south-west. Gravesend town centre is mapped c.750m to the north-east. • 1895 to 1898 – There are no further significant changes noted on site. A garden Nursey is mapped to the immediate east/ south-east and a second Nursery is mapped c. 250m to the north-east, off New House Lane. The buildings/ outbuildings associated with Coldharbour Farm no longer appear on mapping and have likely been demolished, only the pond remains. An unspecified Shaft is mapped c.600m to the north-west and an 'Old Chalk Pit' is mapped c.500m to the south-east. • 1907 to 1909 – There are at least two unspecified structures mapped within the central regions of the site, one rectangular and one 'L' shaped. The Nursery to the north-east (off New House Lane) has extended up to Old Perry Street to the west. The pond c.150m to the north (formerly in the grounds of Coldharbour Farm) and the Old Chalk Pit c.500m to the south-east, no longer appear on mapping. • 1931 to 1932 – There are no further significant changes noted on site. Old Perry Street to the adjacent west of the site is renamed Coldharbour Road. The Nursery to the north and north-east is renamed as Coldharbour Nurseries and an allotment is mapped c.450m to the east. There has been significant expansion to the west and south of Gravesend, primarily with terraced style residential dwellings. Mid Kent Golf Course is mapped c.700m east of the site. • 1938 - There are no further significant changes noted on site. The Nursery to the adjacent east and Coldharbour Nurseries to the north are no longer
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	present on mapping. The site of the allotment c.500m to the east has been redeveloped to comprise a school. • 1952 to 1953- The two onsite structures appear to be separate businesses, with the western most (rectangular structure) labelled as Shears Green House and the eastern most (L shaped structure) labelled as the Battle of Britain Public House. A rectangular extension has been added to the frontage of the Public House. An embankment (slope) aligns the northern boundary of the site, which continues along New House Lane, with further embanking noted to the immediate south-east. The settlement of Gravesend has undergone significant expansion, with residential housing mapped to the adjacent north (beyond New House Road) and c.150m to the south and c.250m to the east. The Old Shaft c.600m to the north-west no longer appears on mapping. • 1960 to 1962 – The two onsite structures are now adjoining and labelled as the Battle of Britain Public House. Shears Green County Primary School and associated playing fields are mapped c.100m south-east of the site. Further residential dwellings are mapped c. 100m to the north-west. • 1968 to 1971 – The extension fronting onto the L shaped section of the Public House no longer appears on mapping and has likely been demolished. A Fire Station and Ambulance Station are mapped c. 50m and c.100m south of the site respectively. Further residential dwellings have been constructed c.500m to the south-west and c.750m to the west. • 1973 to 1978 – There are no further significant changes noted on site. A rectangular structure labelled as Coldharbour Catholic Hall is mapped to the adjacent south/ south-east of the site. The outbuildings and farm associated with Durndale Farm c.300m to the south-west no longer appear on mapping. The construction of the residential estates to the south-east and south-west/west is largely complete. • 1983 to 1987 - There are no further significant changes noted on site. The undeveloped land to the adjacent east is labelled Coldharbour Ward, with recently constructed residential dwellings mapped immediately beyond. • 2001 to 2003 - There are no further significant changes noted on site. The Catholic Hall to the adjacent south/ south-east of the site has been replaced by a series of semi-detached residential dwellings and St Clements Church is mapped to the adjacent south. A playground and playing field are mapped to the adjacent south-west of the site, beyond Coldharbour Road. • 2010 – There are no further significant changes noted on site or within the immediate area. • 2021- The Battle of Britain Public House is no longer mapped on site and has likely been demolished. The Mid Kent Golf Course is no longer labelled. • Aerial Imagery 1999 – The Public House is mapped within the central and north-western regions of the site. Hardstanding and/or car parking is noted along the northern and western boundaries, with soft landscaping mapped in the south-west. The surrounding area is similar to that of the present day, with residential housing mapped in the north and west (beyond New House Lane and Coldharbour Road), a Primary School mapped to the south-east and residential housing a fire station and ambulance station to the south. • Aerial Imagery 2009 to 2015 – The Public House is still mapped on site, however there are several large vehicles and temporary structures, which would suggest the Public House is no longer operational. • Aerial Imagery 2021 – The Public House is no longer mapped on site. It is understood that the Public House was demolished without formal permission. Demolition ceased part way through and then subsequently fully demolished due to structural safety concerns. Hardstanding remains along the northern and western boundaries, whilst overgrown, soft landscaping is mapped across the remaining areas of the site.
Anticipated Geology and Ground	• The Published BGS Map indicates the site to be underlain by Solid Geology of the Cretaceous Thanet Sand Formation over the Cretaceous Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation, herein referred to as Undifferentiated Chalk. Superficial

Conditions	Deposits are not shown on site, however, Head Deposits and River Terrace Deposits are shown nearby. • There are no records of ground works or Made Ground within the boundaries of the site, however, due to the previous phases of development and subsequent demolition, a variable thickness of Made Ground is anticipated. • A search of BGS records indicates that there are four available archived boreholes located c.0.7km and 0.8km to the north-west of the site, either positioned within the grounds of Cygnet Leisure Centre or along Hall Road. The boreholes were advanced by a Cable Percussion rig between May 1984 and July 1998 and typically encountered either a nominal covering of hardstanding or Topsoil over silty sands associated with the Thanet Sand Formation. Undifferentiated Chalk strata was encountered in the grounds of the Leisure Centre at depths of 13.35m and 14.60m bgl and was proven to the full depth of the investigation (17.20m bgl). Groundwater was not encountered. • The site is not in a radon affected area, with <1% of homes above the Action Level. No radon protection measures are, therefore, considered necessary for new properties. • The Groundsure Report indicates that the Undifferentiated Chalk is soluble, however, the hazard rating of ground dissolution is indicated to be 'negligible'. The risk from running sands within the Thanet Sand Formation is also assessed as being low risk.
Mining/Quarrying	• The site is not indicated to be within an area of underground coal mining activities. • There are no recorded surface ground workings within 250m of the site. • The Groundsure report indicates that a BritPit (British Pit) was formerly located c.447m south-east of the site and operated primarily for chalk commodities (Durndale Chalk Pit). Reference to the available historical mapping suggests that the site of the BritPit was recently redeveloped (2021) to comprise residential housing estate. • There are also records for an unspecified shaft located c.576m west of the site, which appeared on the available historical mapping between 1895 and 1931, after which it was denoted as 'Old Shaft'. By 1971 the area was redeveloped to comprise residential dwellings. • Whilst there are no records of underground chalk mining within the boundaries of the site, the Groundsure Report acknowledges that sporadic, undocumented chalk mining may have previously occurred. • There are no recorded naturally occurring or man-made dissolution features/ cavities within the boundaries of the site. However, reference to the Groundsure Report (which contains information from the updated Stantec UK Ltd database of known natural and man-made chalk solution features) indicates that there are records for six solution pipe features (naturally occurring cavity), all of which are located c.408m south-west of the site. There are also records for three mining cavities/ crown holes, located c.231m to the north-east, 531m to the west and 670m to the south-west. These are present in areas where the Thanet Sand is either not anticipated or anticipated thinner than on site.
Hydrology	• There are no surface water features within 0.5km of the site. • The site is outside of River and Coastal Flood Zones 2 and 3. The risk of flooding from rivers and sea is rated 'very low, with less than 1 in 1000 chance of flooding per year from either source. • There are no Licensed Discharge consents within 0.5km of the site. • There are no surface water abstraction licenses within 2km of the site. • The associated risk from surface water flooding is noted to be negligible.
Hydrogeology	• The Thanet Sand Formation is classified as a Secondary A Aquifer, whilst the underlying Undifferentiated Chalk strata is classified as a Principal Aquifer. • The site lies in a Total Catchment Zone 2 Source Protection Zone. • The nearest recorded active groundwater abstraction license is located c.742m south-east of the site, held by Mid Kent Golf Club Ltd for spray irrigation purposes. Approximately 10,000m³ of water is abstracted per annum.

	- There are no potable abstraction licences within 1km of the site. - The associated risk from groundwater flooding is noted to be negligible.
Other Environmental data	- There are no records held for any historic/operational landfills and other waste sites within 250m of the site. - There are four waste exemption licenses within 0.5km of the site, the nearest is located c.322m north-east of the site and is for the sorting and de-naturing of controlled drugs for disposal. - There are no historic/operational petrol and fuel sites within 0.5km of the site. - There are records for two historical unspecified tanks, which were previously located c. 239m south-west and 476m north-east of the site. There are also records for two historical garages, which were located c. 382m and c.415m north of the site, respectively. - There are currently nine industrial land usages within 250m of the site. There is an unspecified mast c.25m south of the site, a Fire Station and Ambulance Station c.77m and 112m south-east of the site, and three electricity substations c.113m to the south-east, 173m to the north-east and 185m to the west. - There are no sites determined as Contaminated Land under Part 2a of the Environmental Protection Act 1990, within 500m of the site. - There are no EA pollution incidents within 0.5km of the site. - There are no listed buildings or cultural designations with 2km of the site.
Railways/Tunnels	There are no current or proposed railway or tunnels within 250m of the site.
Unexploded Ordnance Threat	The site has undergone a Detailed Unexploded Ordnance (UXO) Risk Assessment by specialist contractor 1st Line Defence who consider there to be a Low-Risk form UXO on the site. Therefore, a UXO presence during the intrusive investigation and the subsequent groundworks/construction activities is not considered necessary.
Planning Application Search	Upon review of the Local Authority Planning Portal (Gravesend Borough Council) there are several applications/permissions applicable to the site, including approval to demolish the former Public House. The most recent and applicable permission is for the outline planning permission for the current redevelopment scheme under reference number (20171245). The application was granted on the 9th of December 2020, subject to compliance of thirty-two conditions. Planning Condition 5 relating to Contamination and Remediation, states that no development should take place until a site investigation with preliminary risk assessment has been undertaken, together with a remediation and verification plan (if required) being approved.

4.0 CONCEPTUAL SITE MODEL

In developing a Conceptual Model for the site, pollutant linkages are determined by identifying likely sources of contamination from previous and current site uses, possible targets such as site users, neighbouring site users and Controlled Waters and linkages between them. These are discussed below.

4.1 Sources

The site has been identified as being occupied, historically, by an assumed residential dwelling (later known as Shear Green House), which was gradually converted into a Public House between 1953 and 1962. The Public House was demolished between 2015 and 2021. The following potential sources of contamination have been identified.

- Made Ground soils on site associated with historical site development (e.g. metals, PAH compounds, hydrocarbons, asbestos);

- Contaminants within offsite Made Ground soils (Inc. the adjacent south residential dwellings, adjacent south Fire station and ambulance station);
- Possible fuel leaks/ spillages associated with the former plant which worked on the demolition of the onsite structures and from vehicles which utilised the Public Houses car park;
- Onsite and offsite ground gases and volatile organic vapours associated with decomposition of organic material in Made Ground and hydrocarbon leaks/spillages;
- Sulphates in Made Ground or underlying natural strata.

The electricity sub-stations located c.113m south-east, 173m north-east and 185m west, have not been considered a viable source of contamination due to the fact that PCBs have low mobility and any form of contamination would be localised to the immediate area of the sub-station.

4.2 Pathways

- Human dermal contact (within areas of soft landscaping);
- Human ingestion (within areas of soft landscaping);
- Human inhalation of dust or volatile vapours (within areas of soft landscaping and within ground floor building spaces);
- Direct contact with buried concrete/water supply services;
- Leaching and/or migration through permeable soils (granular Made Ground and/or natural strata).

4.3 Receptors

- End user residents (Human Health);
- Thanet Sand Formation and Undifferentiated Chalk – Secondary A Aquifer and Principal Aquifer, respectively (Controlled Waters);
- Buried foundation/substructure concrete (Building Materials);
- Water supply services (Building Materials).

4.4 Source/Pathway/Receptor Linkage and Assessed Risk

Source-pathway-receptor (SPR) linkages are tabulated below together with the qualitatively assessed risk. The risk to ground workers and construction workers is not included here due to the short-term exposure times that they will be subject to and the assumption that good hygiene practices will be adopted on site and the appropriate use of relevant PPE/RPE will be adhered to when exposed to potentially contaminated soils. Comments regarding contamination issues with respect to ground workers and construction workers are included in the health and safety section of the Standard Procedures included as Appendix F.

Source	Pathway	Receptor	Risk*
Potential contamination within Made Ground (on site) associated with former site usage (e.g. Metals, PAH compounds, Hydrocarbons, solvents,	Inhalation, ingestion, dermal contact within areas of soft landscaping	End users	Low to Medium
	Vertical and lateral migration and leaching	Secondary A and Principal Aquifers (Controlled Waters)	Low to Medium

Source	Pathway	Receptor	Risk*
Asbestos)	Direct contact	Water supply pipes	Low
Potential contaminants within Made Ground associated with offsite industrial site usage (hydrocarbons and volatile organic compounds)	Vertical and lateral migration and leaching	Secondary A and Principal Aquifers (Controlled Waters)	Low to Medium
Hydrocarbon contaminants within soils associated with leaks/spillages	Inhalation, ingestion, dermal contact within areas of soft landscaping	End users	Low
	Vertical and lateral migration and leaching	Secondary A and Principal Aquifers (Controlled Waters)	Low to Medium
	Direct contact	Water supply pipes	Low to Medium
Soil gas from onsite Made Ground and offsite industrial usages (methane, carbon dioxide)	Migration into buildings, service ducts, etc (inhalation/explosion)	End Users	Low-Medium
Elevated sulphates in Made Ground/natural soils (on site)	Direct contact	Buried concrete	Low-Medium

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

5.0 GROUND INVESTIGATION WORKS

5.1 Fieldwork

The following scope of fieldwork was undertaken by Applied Geology between the 5th and the 7th of August 2021. This was based on the proposed development layout at the time of investigation.

- 2 No 150mm diameter Cable Percussion boreholes (ref. BH1 and BH2) to depths of 12.00m and 12.45m below ground level (bgl);
- 5 No Driven Continuous Sampling (DCS) boreholes (ref DCS1 to DCS5) to depths of between 3.43m and 4.45m bgl;
- 7 No Machine Excavated Trial Pits (ref. TP1 to TP7) to depths of between 1.70m and 3.00m bgl;
- 3 No Machine Excavated Trial Trenches (ref. TT1 to TT3) to depths of between 0.50 and 2.50m bgl;
- Soakaway infiltration tests within TP6 and TP7;

- 4 No TRL DCP test (ref TRL 1 to TRL4) to depths of between 0.97m and 0.98m bgl.

Fieldwork was generally carried out, where relevant, in accordance with BS5930 (2015) "Code of Practice for Site Investigations" and was supervised by an experienced Geoenvironmental Engineer.

The borehole, trial pit and trial trench records are included in Appendix C, together with an SPT summary and calibration certificate. The soakaway and TRL DCP records are included in Appendix D.

Prior to the works, a Detailed Unexploded Ordnance Risk Assessment for the site was undertaken by 1st Line Defence on behalf of Applied Geology. The assessment concluded that the potential risk for unexploded WWI and WWII ordnance was Low and, therefore, no further action was warranted. On site UXO supervision was, therefore, not provided during the ground investigation works.

The locations of the exploratory holes were selected by Applied Geology Limited and set out on site and cleared for the presence of underground services by specialist contractor Midland Survey Limited. The fieldwork was designed based on the proposed development at the time (October 2021), which was initially a residential development, comprising 2-3 storey houses with associated gardens. The Cable Percussion and DCS boreholes were positioned approximately within the footprint of the proposed structures for geotechnical purposes. The trial pit excavations were located in areas of proposed car parking/ hardstanding and/or soft landscaping, to provide a general site coverage and to obtain samples for subsequent contamination analysis. Although the proposed structures have changed in location and layout, the location of the exploratory holes remain relevant to the current proposals (dated November 2022).

The trial trenches were positioned within the footprint of the former onsite Public House in order to confirm or otherwise the presence of a former cellar and/ or concrete obstructions, such as relict foundations. In addition to the logs, diagrammatic representation of the findings of the trial trenches are presented on drawing no: AG3309-21-03 Sheets 1-3 in Appendix A.

Four California Bearing Ratio tests (CBR) tests (ref TRL1 to TRL4) were undertaken using a Transport Research Laboratory Dynamic Cone Penetrometer (TRL DCP) in order to determine the in-situ CBR profile of the soils within areas of proposed hardstanding (access roads/ car parking). The results are plotted as a number of blows versus depth penetrated bgl with equivalent CBR values for individual layers. The results are included in Appendix D.

The positions of the exploratory holes were surveyed to National Grid and levelled to Ordnance Datum by Midland Survey Ltd. The locations of the exploratory holes are presented on the Exploratory Hole Location Plan (AG3309-21-02) included in Appendix A and the co-ordinates and levels are included on the exploratory hole records in Appendix C.

5.2 Instrumentation and Monitoring

On completion of boring, 50mm diameter standpipes were installed in each of the Driven Continuous Sampling boreholes as follows, with further details included in the relevant borehole logs in Appendix C:

Location	Standpipe installation response zone	Stratum
DCS1	1.00 to 4.00	Thanet Sand Formation
DCS2	1.00 to 4.00	Thanet Sand Formation
DCS3	1.00 to 3.00	Thanet Sand Formation
DCS4	1.50 to 4.00	Thanet Sand Formation
DCS5	0.50 to 1.50	Made Ground

Washed silica gravel (2-6mm) was used as the filter medium. Each standpipe was fitted with a push-in bung and single gas tap and was finished with a flush metal cover concreted in place.

Ground gas and groundwater monitoring visits were undertaken on four occasions from the 16th of August 2021 to the 16th of September 2021. Each monitoring well was monitored for concentrations of carbon dioxide, methane, VOCs, oxygen, flow rate, differential pressure and groundwater level. The monitoring results are presented in Appendix D.

5.3 Laboratory Testing

Geotechnical laboratory testing was undertaken by specialist laboratory Terra Tek Limited (UKAS lab no. 0126) on selected samples and comprised the following:

- 3 No natural moisture content tests;
- 3 No Atterberg limit tests;
- 4 No Particle Size Distribution tests (sieve);
- 3 No Particle Size Distribution tests (sieve and hydro);
- 6 No BRE SD1 natural ground suite tests;
- 2 No BRE SD1 Brownfield tests.

Chemical testing was undertaken by specialist laboratory Chemtest (UKAS lab no. 2183). The scope of testing was based on the desk study, walkover and site observations made during the fieldwork.

Made Ground

Six samples of Made ground were analysed for the following suite of contaminants;

- Selected metals suite [arsenic, boron, beryllium, cadmium, chromium (total, trivalent and hexavalent), copper, mercury, nickel, lead, zinc, selenium, vanadium];
- Chromium trivalent and hexavalent (5 samples);
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- Phenols (total);
- pH;
- Water soluble sulphate;
- Asbestos Containing Materials (ACM) Screen (nine samples);
- Soil organic matter;
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) (four samples);
- Total Petroleum Hydrocarbons 9 band (two samples);
- BTEX and MTBE (four samples).

Natural Soils

One sample of the Head Deposits and two samples of the Thanet Sand Formation were analysed for the following suite of contaminants;

- Selected metals suite [arsenic, cadmium, chromium (total), copper, mercury, nickel, lead, zinc, selenium, boron, beryllium, vanadium];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- pH;
- Water soluble sulphate;
- Soil organic matter;
- TPH CWG (one samples);
- TPH (9 band) (one samples);
- BTEX an MTBE (one samples).

Leachate

Leachate analysis was carried out on one sample of Made Ground and two samples of the Thanet Sand Formation, for the following suite of contaminants:

- Selected metals suite [arsenic, cadmium, chromium (total, trivalent and hexavalent), copper, mercury, nickel, lead, zinc, selenium, vanadium];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- pH.

Laboratory test results are included in Appendix E.

6.0 GROUND CONDITIONS

6.1 Strata Encountered

The ground investigation has typically identified a variable and locally significant thickness of Made Ground, overlying predominantly granular soils of the Thanet Sand Formation. Locally in the north-western corner of the site, cohesive Head Deposits were noted above the Thanet Sand Formation.

Strata associated with the Undifferentiated Chalk was not encountered as part of this current investigation, suggesting this stratum is at a depth in excess of 12m.

Full details of the strata encountered are given on the borehole records presented in Appendix C.

A generalised ground profile is presented below to summarise the information. An SPT 'N' value versus depth plot is presented in Appendix A.

Diagrammatic representations of the findings of the Trial Trenches are presented as Drawing AG3309-21-03 Sheets 1-3, in Appendix A.

Stratum	Depth to Top of Strata (m bgl)	Thickness (range) (m)	Comments
Hardstanding	GL	0.10 to 0.20	Encountered across the north-western, northern and eastern regions of the site.
Made Ground	GL	0.15 to 2.30	Encountered in all exploratory holes across the site. Greater thicknesses of Made Ground present within the central regions of the site, in the footprint of the former Public House.
Head Deposits	0.50	2.00	Encountered in the north-western corner of the site in BH1 only.
Thanet Sand Formation	0.15 to 2.20	Proven to the full depth of the investigation (12.45m bgl)	Encountered in all exploratory holes across the site.

6.2 Hardstanding

Asphalt hardstanding was encountered from surface along the north-western, northern and eastern regions of the site and was proven to depths of between 0.10m and 0.20m bgl. Prior to advancement, the asphalt hardstanding was broken out using the excavator mounted hydraulic breaker.

6.3 Made Ground

Made Ground was encountered in all exploratory holes across the site, either from surface or beneath a covering of hardstanding. The thickness of the Made Ground varied significantly across the site, between depths of 0.15m (TP6) and 2.30m bgl (TT1), although the Made Ground was generally proven to shallow depths between 0.15m and 0.60m bgl. The greater thicknesses of Made Ground (c.1.70m to 2.30m bgl) were generally encountered within the central regions of the site in the location of the former Public House and possibly indicative of the location of a former cellar. It should be acknowledged that as the site has been subject to previous phases of development and subsequent demolition, it is therefore probable that deeper Made Ground than that identified in the investigation, may be encountered locally.

The Made Ground generally comprised horizons of brown sandy slightly silty/clayey gravels and/ or brown slightly gravelly silty/clayey fine to medium sands, locally, horizons of soft brown slightly gravelly sandy clays were encountered. Collectively, the gravel content generally comprised fine to coarse subangular to subrounded quartzite, chalk, sandstone, asphalt, clinker, brick and concrete. The granular Made Ground in DCS4 had a notably higher organic content and a slightly natural organic odour.

A concrete obstruction was encountered across the full extent of TP3 (located in the north of the site) at a depth of between 0.30m to 0.50m bgl. The concrete was easily broken out by the onsite excavator (JCB 3CX) and the trial pit was progressed.

Due to the nominal thickness of the Made Ground, particularly within borehole positions, a single Standard Penetration Tests (SPTs) was undertaken. An SPT 'N' value of 19 (medium dense) was recorded in DCS5 at 1.2m bgl.

6.4 Head Deposits

Strata considered to represent Superficial Head Deposits were encountered in a single exploratory hole (BH1) in the north-western corner of the site directly beneath the Made Ground from 0.50m bgl to 2.00m bgl. The Head Deposits comprised soft becoming firm brown mottled grey sandy clay, with fine to coarse subangular to subrounded quartzite gravel.

Due to the nominal thickness of the Head Deposits in BH1 and its absence elsewhere onsite, a single SPT was carried out in these soils, recording an 'N' value of N=16 (medium strength) at 1.20m bgl.

6.5 Thanet Sand Formation

Strata considered to represent the Thanet Sand Formation were recorded directly beneath the Made Ground and Head Deposits (where encountered) from depths of between 0.15m (TP6) and 2.20m bgl (TT1) and were proven to the full depth of the investigation (12.45m bgl).

The stratum generally comprised medium dense becoming dense (light) brown slightly clayey/silty, slightly gravelly fine to medium sand. Locally, nominal horizons of firm becoming stiff orangish brown slightly sandy, slightly gravelly clay/ silt were recorded. Collectively, the gravel content comprised fine to coarse subangular to subrounded flint gravel, whilst iron staining was also often recorded with depth.

The results of three Atterberg Limit tests undertaken on the cohesive Thanet Sand strata have indicated plasticity indices of 27% and 32% (corrected to 7.6% and 32%) indicating these soils to be of low to medium shrinkability as defined by NHBC Standards. Uncorrected Liquid Limits of 45% and 47%, plastic limits of 15% and 18% and moisture contents of between 13.2% and 21.1% were also recorded. These results indicate the clays to be of medium plasticity. It should be noted that the sample obtained from DCS2 at 2.60m bgl was noted to be non-plastic.

Seven particle size distribution tests were undertaken on bulk samples of the Thanet Sand strata, six samples were taken from granular horizons and one sample was taken from cohesive silty strata (TP4 at 0.40m bgl). The results from the

granular material indicated the following proportions: 0.0% cobble, 0.2% and 34.6% gravel, 41.7% and 93.5% sand, 5.2% and 18.6% fines, 12% and 17% silt, 6.7% and 12.1% clay. The sample obtained from a cohesive horizon of Thanet Sand strata indicated the following proportions: 0.0% cobble 22.8% gravel, 51.0% sand, 20.2% silt and 6.1% clay.

Thirty-five in-situ SPTs were carried out within the Thanet Sand strata, thirty-one in the granular soils and four in the cohesive soils. Uncorrected 'N' values of N=4 to N=24 (low to medium strength) were recorded at a depth of 1.20m bgl in the granular soils, increasing to 'N' values of N=17 and N=43 (medium to high strength) at 2.00m bgl. Whilst, uncorrected 'N' values of N=13 and N=25 (medium strength) were recorded at depths of between 1.20m and 3.00m bgl in the cohesive soils. The SPT vs depth plot generally shows a prominent increase in strength with depth.

6.6 Groundwater and Soakaway Tests

Groundwater strikes were encountered at depth within the deeper cable percussion boreholes and within some DCS boreholes, as detailed in the table below.

Location	Stratum	Depth of strike (m bgl)	Groundwater level after 20min	Comments
BH1	Thanet Sand Formation	4.30	4.30	Strike
BH2	Thanet Sand Formation	4.30	4.30	Strike
DCS1	Thanet Sand Formation	3.80	3.80	Strike
DCS4	Thanet Sand Formation	3.80	3.80	Seepage

Groundwater levels may fluctuate for a number of reasons, including in the short term the prevailing weather conditions immediately before and during investigation and monitoring works and longer-term seasonal variations should be expected.

During the subsequent monitoring programme groundwater was not encountered in any of the standpipes.

Preliminary soakaway tests were carried out in two open trial pits located in the south (TP6) and central (TP7) regions of the site. The trial pits were terminated shallow at depths of 1.70m (TP6) and 2.00m bgl (TP7) within the Thanet Sand strata. The soakaway tests were carried out in general accordance with BRE Digest DG365 methodology, however, only one filling was undertaken. The results of the tests are included in Appendix D, including the calculations in accordance with BS 5930 (BSI, 1999) and summarised in the table below:

Test ID	Stratum	Test results (m/s)
TP6	Thanet Sand Formation	1.10×10^{-5}
TP7		4.70×10^{-6}

Supplementary infiltration testing was undertaken in September 2022 in accordance with BRE 365. A separate report detailing the findings of this work was issued in October 2022, ref AG3309A-22-AP31.

6.7 Contamination

Aside from the gravel sized fragments of asphalt and clinker within the Made Ground soils, there was no obvious visual or olfactory evidence of any significant contamination observed in the boreholes, trial pits or the trial trenches.

6.8 Soil Gas

The results of the ground gas monitoring undertaken indicated methane concentrations below the limit of detection (<0.1%) together with carbon dioxide concentrations of between <0.1% and 3.1%. Oxygen concentrations were recorded between 16.9% and 19.2% and average flow rates were recorded at below the limit of detection (<0.1l/hr). All VOC concentrations were noted to be below the limit of detection (<0.1ppm) and therefore are of no significant concern.

Based on the highest recorded steady carbon dioxide and methane concentrations and the highest average flow rate from the three visits, gas screening values have been calculated in accordance with CIRIA C665 of 0.0031l/hr (carbon dioxide) and 0.0001l/hr (methane).

7.0 GEOENVIRONMENTAL ASSESSMENT

7.1 Human Health Risk Assessment

The results of the chemical testing on soils have been assessed as described in Appendix F, with specific details as follows:

- Proposed end-use – Care Home with associated garden space;
- Screening criteria – Residential without Plant Uptake, based on 2.5% SOM;
- Assuming a single dataset based on the size of the site, current land-use and the proposed redevelopment.

There are no published generic screening criteria for a care home facility end use. It could be argued that the critical receptor is an adult worker present on site from the age of 16 to 65. Therefore, a commercial end use criteria would be considered appropriate. However, given the amount of landscaping present on the proposed development plan (Appendix A) and to reflect the end use as a care home, conservative residential without plant uptake criteria has been used to provide an initial screen.

The spreadsheets summarising the laboratory results and relevant screening values for each dataset are presented in Appendix E. A review of the chemical testing undertaken on the soil samples analysed has indicated all metals to be significantly below the screening criteria, whilst BTEX, MTBE and Phenol concentrations were below laboratory detection limits. TPH concentrations exceeded screening values in one carbon fraction in two samples as outlined below:

- Aromatic TPH – C21 to C35 exceedance in TP3 at 0.20m bgl (5000mg/kg against a screening value of 1900mg/kg);
- Aromatic TPH – C21 to C35 exceedance in TP4 at 0.15m bgl (3200mg/kg against a screening value of 1900mg/kg).

A number of PAH determinands were also noted to exceed screening values and together with the TPH exceedance, these were noted to be from samples predominantly within the upper granular Made Ground directly beneath the asphalt hardstanding and in exploratory positions located along the northern, north-western and north-eastern boundaries of the site, in areas of former car parking.

Subsequent chromatogram analysis was undertaken on the soil samples from TP3 (0.20m bgl) and TP4 (0.15m bgl), which indicated the potential source/origin of the elevated TPH to likely be PAH and/or heavy oil. It is considered plausible that these and the other elevated concentrations of hydrocarbons recorded are potentially from spills/leakages as these areas of the site were used as car parking for the former Public House, or associated with leaching from the overlying asphalt.

Laboratory screening for asbestos did not detect any Asbestos Containing Materials (ACM) within any of the samples tested.

7.2 Controlled Waters Risk Assessment

The Secondary A (Thanet Sand Formation) and Principal (Undifferentiated Chalk) aquifers beneath the site are considered to be the key Controlled Water receptors. The potential for complete pollutant linkages associated with leaching and vertical migration from impacted soils has, therefore, been semi-quantitatively assessed using the results of the soil leachate analysis detailed below:

Three samples obtained from either the Made Ground or the natural strata marginally beneath the Made Ground were analysed for their metal and PAH leaching potential. The results were compared directly to the Controlled Water screening values based on the conservative UK Drinking Water Standards 2010 (UK DWS). In the absence of a relevant screening value, EQS and the laboratory limit of detection have been used as an initial screen. The results are tabulated and presented in Appendix E.

Following the initial screening, all determinands were at concentrations below screening values.

7.3 Disposal of Soil Arisings

General comments regarding the procedures for the assessment of waste soil for off-site disposal purposes is included in Appendix F. Under the Waste Framework Directive, naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development. The comments below only apply if surplus soil is sent off-site for disposal.

With regards to potential waste disposal of the Made Ground, the samples tested indicate contaminants at concentrations that would likely be classified as non-hazardous waste. However, where localised elevated hydrocarbon concentrations are present, as is the case for TP3 at 0.20m bgl (Total TPH of 7000mg/kg) and TP4 at 0.15m bgl (Total TPH of 6000mg/kg), hazardous WAC testing may be required if

the material is to be disposed of at landfill. This would need to be discussed with the receiving landfill facility and the results of this investigation provided.

The chemical testing undertaken on the Thanet Sand Formation strata underlying the site suggests that the majority of these soils would likely be classified as inert waste, subject to appropriate WAC testing and acceptance by the receiving landfill.

Topsoil was not encountered at the site; therefore, it is assumed that a clean imported Subsoil/Topsoil will be required for proposed gardens and other areas of soft landscaping.

7.4 Conclusions and Recommendations

Elevated concentrations of PAH and TPH have been identified within the upper granular Made Ground, beneath surface asphalt along the north-western, northern and north-eastern boundaries of the site. Only localised elevated concentrations of Dibenzo[a,h]anthracene were recorded in the underlying Thanet Sand Formation in TP2 at 0.15m and TP6 at 0.20m bgl. Elevated TPH & PAH concentrations were not recorded elsewhere.

Given the potential risk to site end users from elevated PAH and TPH contaminants in the shallow Made Ground in areas of existing hardstanding, consideration could be given to removing shallow Made Ground (incl asphalt) from areas currently beneath the asphalt hardstanding during the groundworks, hence removing the source of potential elevated contaminants. Appropriate validation to confirm removal of the source of contamination would be necessary if this approach is adopted. Given the potential uncertainties in fully removing the sources of contamination and the likely requirement for some placement of subsoil/topsoil in landscaping/garden areas to meet Landscape Architect requirements, placement of a cover layer may be more straightforward to implement on site.

If it is preferred to leave in situ or it cannot be ensured that full removal of impacted soils can be achieved and validated, it would be necessary to place a suitable inert cover layer (including appropriate thickness of subsoil/topsoil as specified by the Landscape Architect) in proposed garden spaces and within other areas of soft landscaping where hardstanding is currently present. The thickness of the cover layer should not be less than 450mm in thickness in garden/landscaping areas associated with individual resident rooms and not less than 300mm in communal or general landscaped areas, with a hard to dig separator layer or non-woven geotextile separator between existing Made Ground & imported clean cover. This should be documented in a Remediation Strategy and any imported material would need to be carried out in accordance with Gravesham Borough Council's validation criteria. It is also recommended that a Discovery Strategy and watching brief is implemented during the groundworks to confirm the absence of any unidentified contamination.

In areas not currently underlain by asphalt or hardstanding, no evidence of elevated concentrations of contaminants has been identified hence in these areas, no specific cover layers are considered necessary to mitigate risk to Human Health. It would however be necessary to ensure that Made Ground identified as impacted by contaminants elsewhere on site was not spread across other unaffected areas of the site during groundworks and in this regard, given that placement of subsoil/topsoil is likely to be required in garden/landscaping across the whole site to

support growth and meet the Landscape Architects specification, consideration should be given to adopting the proposed cover layer strategy to all garden/landscaping areas of the site.

Given the limited extent of shallow exceedences, the site is not considered to pose a plausible significant risk to Controlled Waters.

Issues with respect to ground gas and potential effects of contaminants on buried concrete and water supply pipework are included in Section 8.0.

8.0 GEOTECHNICAL ASSESSMENT

8.1 General

The proposals for the site comprise the construction of a 65-bed care home with associated car parking, access road, small areas of garden/landscaping associated with some ground floor individual resident rooms and areas of accessible general and communal soft landscaping. No loading information was available at the time of writing.

The ground investigation has identified a predominantly granular Made Ground from surface, proven to depths of between 0.15m and 2.20m bgl, although the Made ground was generally proven to shallow depths of 0.15m and 0.60m bgl. Upon proving the base of the Made Ground, strata considered to represent the Thanet Sand Formation were generally encountered and proven to the full depth of the investigation (12.45m bgl). However, locally in BH1 strata interpreted as cohesive Head Deposits were encountered directly beneath the Made Ground and were proven to a base of 2.00m bgl.

Chalk was not encountered as part of this current investigation, indicating this stratum is at a depth in excess of 12m.

Groundwater strikes were recorded in the Cable Percussion and DCS boreholes at depths of 3.80m and 4.30m bgl during drilling, however the installed standpipes were notably dry during the return monitoring programme.

8.2 Foundation Design

It is considered that the granular strata of the Thanet Sand Formation encountered at the site are suitable to support conventional strip/trench fill or pad foundations. These must be placed below any Made Ground or disturbed ground and embedded within the in-situ medium dense or better sand strata beneath these materials.

Although a minimum founding depth of 0.9m bgl will apply to allow for seasonal effects, the borehole data suggests that founding depths of around 1.0m to 2.3m are likely to be required to ensure that the above deepening criteria are met. The boundaries of the site were lined with semi mature and mature trees and, therefore, localised deepening of foundations may be necessary within the zones of influence of these trees. Minimum foundation depths should initially be based on the depths given within published guidance, such as NHBC standards. Foundations would not need to be deepened beneath the depth where granular Thanet Sand is present.

Strip/trench fill (up to 1m wide) and pad foundations (up to 2m x 2m) competently designed to the above requirements may adopt safe net design bearing pressures up to 175kN/m². This is based on a typical N value of 10 over the influencing depth of foundations and using traditional methods of bearing capacity calculations e.g. as set out in Tomlinson 7th Edition and a factor of safety of 3 against bearing capacity failure. If required, a greater safe net design pressure of up to 250kN/m² is considered achievable for foundations deepened to 2.0m bgl (based on a typical N value of 20 at that depth).

Given the ground conditions encountered and the findings of the Phase I assessment, it is considered that there is a negligible risk of ground dissolution of soluble rocks. Further assessment is, therefore, not considered necessary. Should the ground conditions differ locally during the groundworks to those encountered during this investigation, this assessment may need to be reviewed.

If conditions, significantly at variance to those described herein are encountered, specialist geotechnical advice should be sought to make appropriate assessment and recommendations.

8.3 Floor Slab and Gas Protection

It is an NHBC requirement that suspended ground floor slabs are adopted where Made Ground exceeds 600mm in thickness. Where Made Ground is less than 600mm thick ground bearing slabs may be adopted, subject to proof rolling, removal of soft spots and replacement with a suitable compacted granular material. Due to the depth and nature of the Made Ground encountered on this site and likelihood of some near surface disturbance following removal of old foundations etc, suspended ground floor slabs may be necessary locally. Elsewhere, ground bearing slabs would be feasible where the above criteria are satisfied.

Based on the calculated gas screening values the site can be characterised as Characteristic Situation 1 (CIRIA C665), for which no precautionary gas protection measures are required in line with BS8485:2015+A1:2019.

Radon protection measures are also not considered necessary.

8.4 Excavations

All trial pits and trial trenches advanced as part of this investigation remained stable during excavation. However, due to the predominant granular nature of the Made Ground and underlying Thanet Sands across the site, excavations may be prone to some instability. As such, excavations may need to be graded back to a stable angle or trench support should be provided. Trench support or angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions. Any trenches requiring man access will require appropriate supports and assessments in line with current guidance and legislation.

Groundwater was encountered in the Thanet Sand Formation at depths of between 3.80m (DCS1 and DCS4) and 4.30m bgl (BH1 and BH2). Therefore, significant groundwater ingress is not expected in excavations, although it is recommended that some provision for sump pumping equipment is made available to control seepages or run-off in wet weather conditions.

As stated in Section 6.3, a shallow concrete obstruction was encountered in TP3 at a depth of 0.30m to 0.50m bgl. The obstruction was easily broken out using the onsite excavator, however it is envisaged that as part of the redevelopment, further relict obstructions, foundations, former utilities and other features may remain, which could pose a constraint with regards to the redevelopment and require breaking out.

8.5 Pavement Design

In-situ testing by TRL DCP has indicated approximate CBR values of between 4% and >100% in the Made Ground, 7% and 16% in the Head Deposits and 6% to 20% in the Thanet Sand Formation. The full results are presented in Appendix D. Collectively, the lower CBR values indicated should be considered as indicative short-term CBR values, with higher values probably influenced by the presence of gravel and cobble sized fragments.

Where Made Ground soils are encountered at formation, it is recommended that pavement design is based on a long-term equilibrium CBR design value of <2%, subject to proof rolling and the removal of soft/organic materials.

Equilibrium CBR values of 3% are recommended for the cohesive Thanet Sand Strata and the Head Deposits and a CBR value of 5% is recommended for the granular Thanet Sand strata.

Based on the visual description of the Made Ground during the intrusive investigation, this material is considered likely to be frost susceptible. Additionally, based on the laboratory analysis, the cohesive and granular Thanet Sand Formation strata are considered likely to be frost susceptible and, therefore, should not be present within the top 450mm of pavement construction.

8.6 Soakaways

The soakaway test results undertaken within the predominantly granular Thanet Sand Formation strata, recorded infiltrations rates in the region of 10^{-5} and 10^{-6} , which indicate relatively good infiltration potential and typically correlate with the upper limits of a silty/clayey sand. It is, therefore, considered likely that the granular Thanet Sand Formation strata encountered across the site may be suitable for the discharge of surface run-off water into conventional soakaways.

If infiltration drainage is considered further, trial pit soakaways fully compliant with the BRE Digest DG365 methodology (i.e., three consecutive fills) should be considered so that a representative infiltration rate can be determined for long term design purposes.

8.7 Buried Concrete and Services

As defined by BRE Special Digest 1, Concrete Aggressive Ground, 2005 the Design Sulphate Class and the Aggressive Chemical Environment for Concrete (ACEC) has been assessed for each of the strata encountered. Characteristic values for each stratum have been determined and are detailed in the table below:

Strata	No of samples tested	Soluble Sulphate (g/l)*1	Potentially Pyritic	pH	Design Sulphate Class	ACEC*2
Made Ground	7	0.5	None (0 of 7)	7.8	DS2	AC1s
Head Deposits	1	<0.1	None (0 of 1)	8.5	DS1	AC1s
Thanet Sands	9	0.2	None (0 of 9)	7.5	DS1	AC1s

Notes:

*1: Characteristic values are rounded to the nearest 0.1%.

*2: Assumes static groundwater.

In accordance with the guidance in BRE SD1, the characteristic values for each stratum have been determined based on the highest result (where less than 5 samples tested) or the mean average of the highest 2no. results (where 5-9 samples test).

The Design Sulphate Class for the Made Ground is DS-2 and AC-1s. All samples tested from the Head Deposits and Thanet Sand were found to be non-pyritic with a Design Sulphate Class of DS-1 and AC-1s.

Further reference should be made to BRE Special Digest 1 for requirements in respect of types of cement and aggregate to be used and variations in type of concrete construction.

The soil testing undertaken on the site wide Made Ground identified localised elevated concentrations of TPH in TP3 (total TPH of 7500mg/kg) and TP4 (total TPH of 6000mg/kg) that would exceed the UKWIR limit for the use of polyurethane (PE) water supply pipes. Therefore, the use of barrier pipes or an alternate pipe material (such as PVC, steel, copper etc.) may be required depending on the location of the routes. It should be noted, however, that the full suite of testing required by the UKWIR guidance has not been undertaken as part of this investigation and such testing may be required by the Water Authority once the pipeline routes are known. Further guidance on this subject is included within Appendix F.

8.8 Conclusions and Recommendations

Conventional strip/trench fill or pad foundations bearing within the Thanet Sand strata and designed in accordance with the recommendations stated within Section 8.2, may adopt safe net design pressures up to 175kN/m². A greater safe net design pressure of up to 250kN/m² is considered achievable for foundations deepened to 2.0m bgl (placed within Thanet Sand).

In areas where Made Ground in excess of 0.6m is encountered, it is recommended that floor slabs are suspended. Where Made Ground is encountered to shallower depths, ground bearing floor slabs may be adopted. Gas protection measures are not considered necessary.

Infiltration drainage is likely to be feasible on site.

Special measures relating to buried concrete are not required for foundations placed within the natural strata, however, sulphate resisting concrete appropriate to DS-2, AC-1s will be required for the Made Ground.

It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements with respect to water supply pipework and materials.

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GENERAL NOTES

- A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.
- B) The services provided are defined within our proposal and are carried out in line with the terms of appointment between Applied Geology and the Client.
- C) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.
- D) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.
- E) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.
- F) The copyright of this report and other plans (and documents prepared by Applied Geology) is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.
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- H) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.
- I) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.
- J) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.
- K) The works performed are not a comprehensive site characterisation and should not be construed as being such.
- L) The findings of the geo-environmental risk assessment are based on information obtained from a variety of sources which Applied Geology believe to be correct. Applied Geology cannot and does not guarantee the authenticity or reliability of the information it has relied upon.
- M) The report represents the findings and opinions of experienced geo-environmental consultants. Applied Geology does not provide legal advice and the advice of lawyers may be required.
- N) Conditions at the site are subject to change from the time of the site inspection.
- O) It is possible that researches carried out by Applied Geology, whilst fully appropriate for a phase 1 desk study, failed to indicate the existence of important information sources. Assuming such indicators actually exist, their information could not have been considered in the formulation of Applied Geology findings and opinions.
- P) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.
- Q) Applied Geology operates as a Consultancy and does not operate its own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

LIST OF REFERENCES COMMONLY USED BY APPLIED GEOLOGY IN REPORTS

SECTION/TITLE	AUTHOR/PUBLICATION
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PLANNING	
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HEALTH & SAFETY ASPECTS	
A Guide for Safe Working on Contaminated Sites (Report 132)	CIRIA
Protection of Workers and the General Public During the Development of Contaminated Land (HSG66)	Health & Safety Executive
Construction (Design & Management) Regulations 2015 (CDM)	Health & Safety Executive
Control of Substances Hazardous to Health Regulations 2002	Health & Safety Executive
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Trenching Practice. Guidance on Groundwater Control (Report 97)	CIRIA
Control of Groundwater for Temporary Works (Report 113)	CIRIA
Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks. C733. 2014.	CIRIA

APPENDIX A



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APPLIED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client:

FRONTIER ESTATES LTD

Project:

COLDHARBOUR ROAD
GRAVESEND

Drawn By:

KR

Checked By:

JD

Paper Size:

A4

Scale:

NTS

Date:

31.08.2021

NGR:

563662,172272

Title:

SITE LOCATION PLAN

Drawing No:

AG3309-21-01

Revision:

0



KEY:



Trial Pit



TP1



Driven Continuous Sampling Borehole



DCS1



Cone Penetration Test



BH1



Transport Research Laboratory Dynamic Cone Penetrometer



TRL1



Trial Trenches



A/B



TT1

Drawing based on Survey Solutions drawing No 18496se01 dated 26/10/2016.

APPLIED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

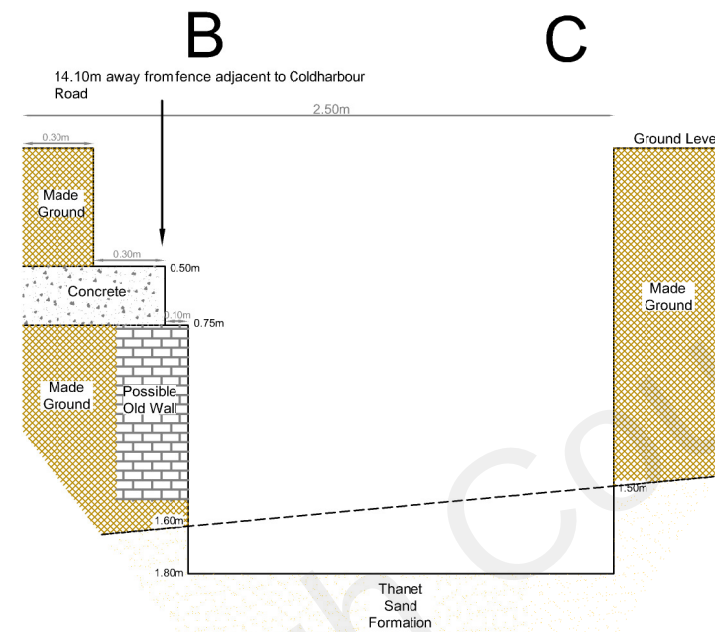
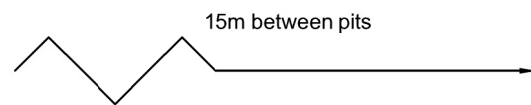
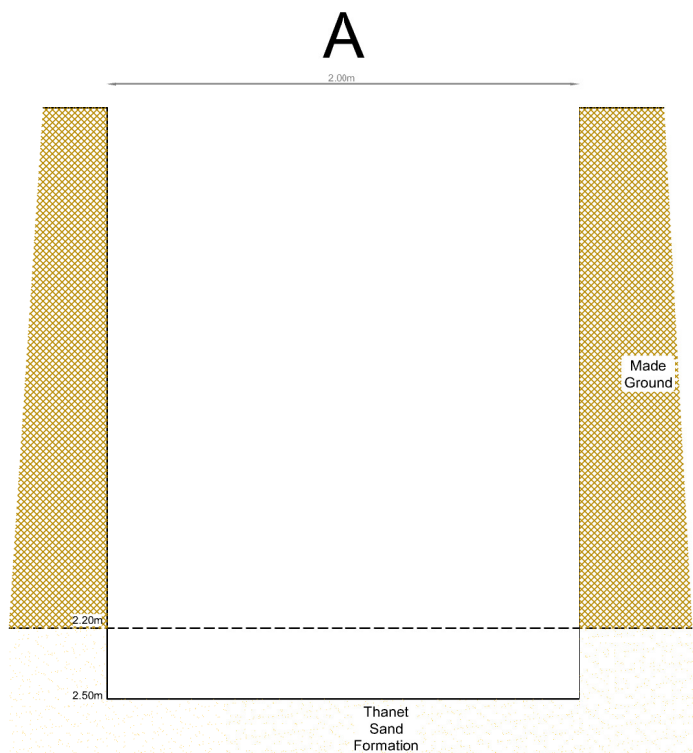
Client: FRONTIER ESTATES LTD

Project: COLDHARBOUR ROAD
GRAVESEND

Title: EXPLORATORY HOLE LOCATION PLAN

Drawn By: KR	Checked By: JD	Paper Size: A3
Scale: 1:500	Date: 26.08.2021	
Drawing No: AG3309-21-02		Revision: 0

TT1



APPLIED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client:
FRONTIER ESTATES LTD

Project:
COLDHARBOUR ROAD, GRAVESEND

Title:
TRIAL TRENCH DIAGRAMS

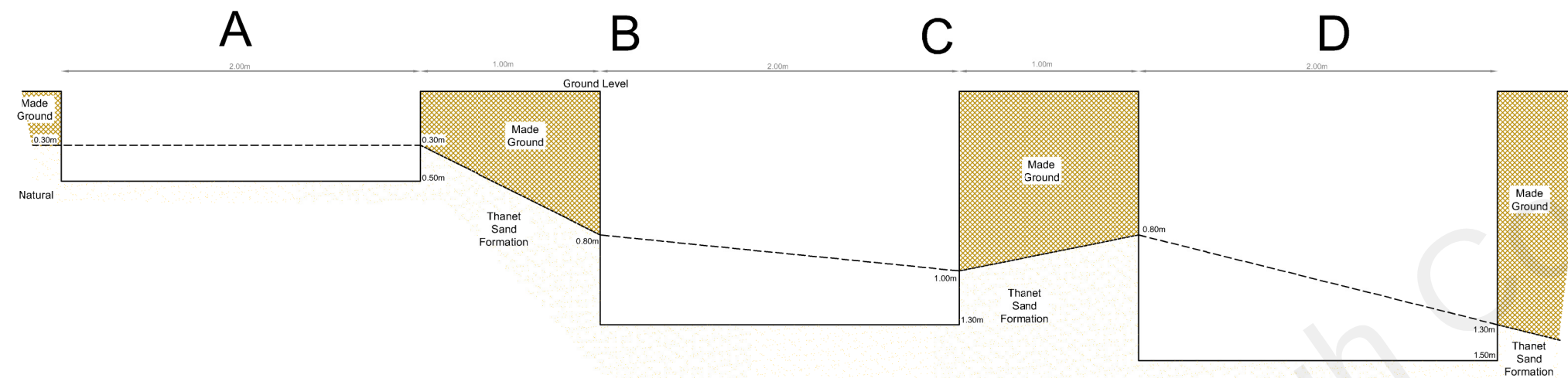
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Scale: NTS	Date: 19.08.2021
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Drawing No: AG3309-21-03	Revision: 0
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Sheet 1 of 3

TT2



APPLIED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client:
FRONTIER ESTATES LTD

Project:
COLDHARBOUR ROAD, GRAVESEND

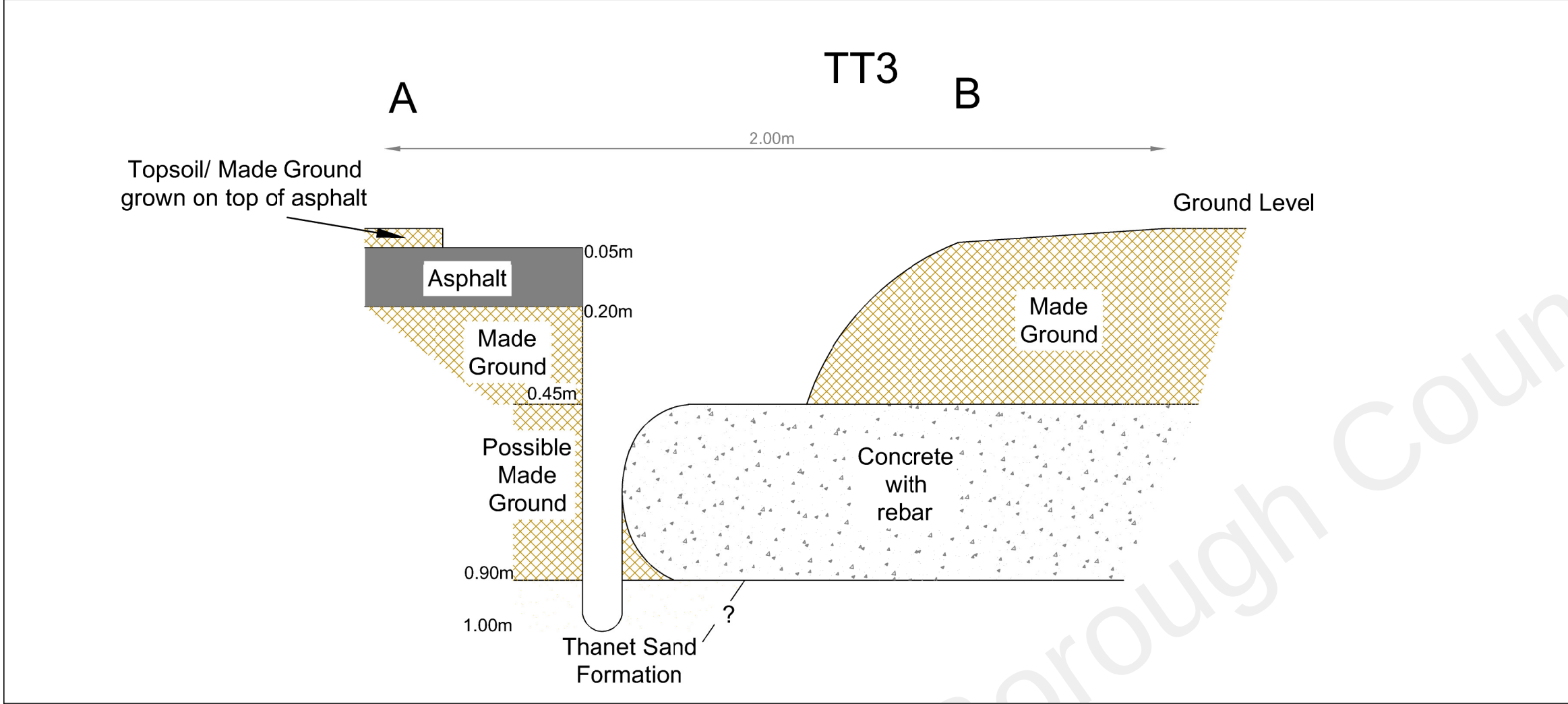
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Drawing No: AG3309-21-03	Revision: 0
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Sheet 2 of 3



APPLIED GEOLOGY Unit 23 Abbey Park Stareton Kenilworth CV8 2LY Tel: 02476 511822 email: admin@appliedgeology.co.uk		
Client: FRONTIER ESTATES LTD		
Project: COLDHARBOUR ROAD, GRAVESEND		
Title: TRIAL TRENCH DIAGRAMS		
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Scale: NTS	Date: 19.08.2021	
Drawing No: AG3309-21-03		Revision: 0
Sheet 3 of 3		



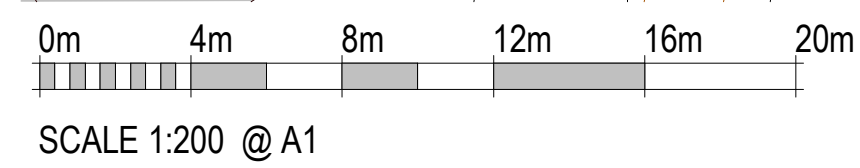
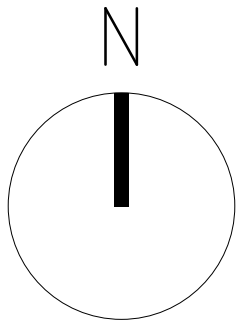
NOTES

All dimensions are in millimetres unless stated otherwise.

Drawings are not to be scaled for Construction purposes.

This drawing is to be read in conjunction with all other relevant drawings and specifications.

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SCALE 1:200 @ A1

PS	14/11/22	Ambulance bay footprint	SL	AP
PS	19/10/22	Parking adjusted	SL	AP
PT	26/09/22	Bin store and cycle stands added	ER	AP
PS	19/09/22	Road Lane Amended	SL	AP
PS	30/05/22	2nd Draft Issue	SL	AP
Rev	Date	Description	Drawn	Checked
			By	By

HARRIS IRWIN
architects

Aske Stables, Aske, Richmond,
North Yorkshire, DL10 5HG
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w: www.harrisirwin.com

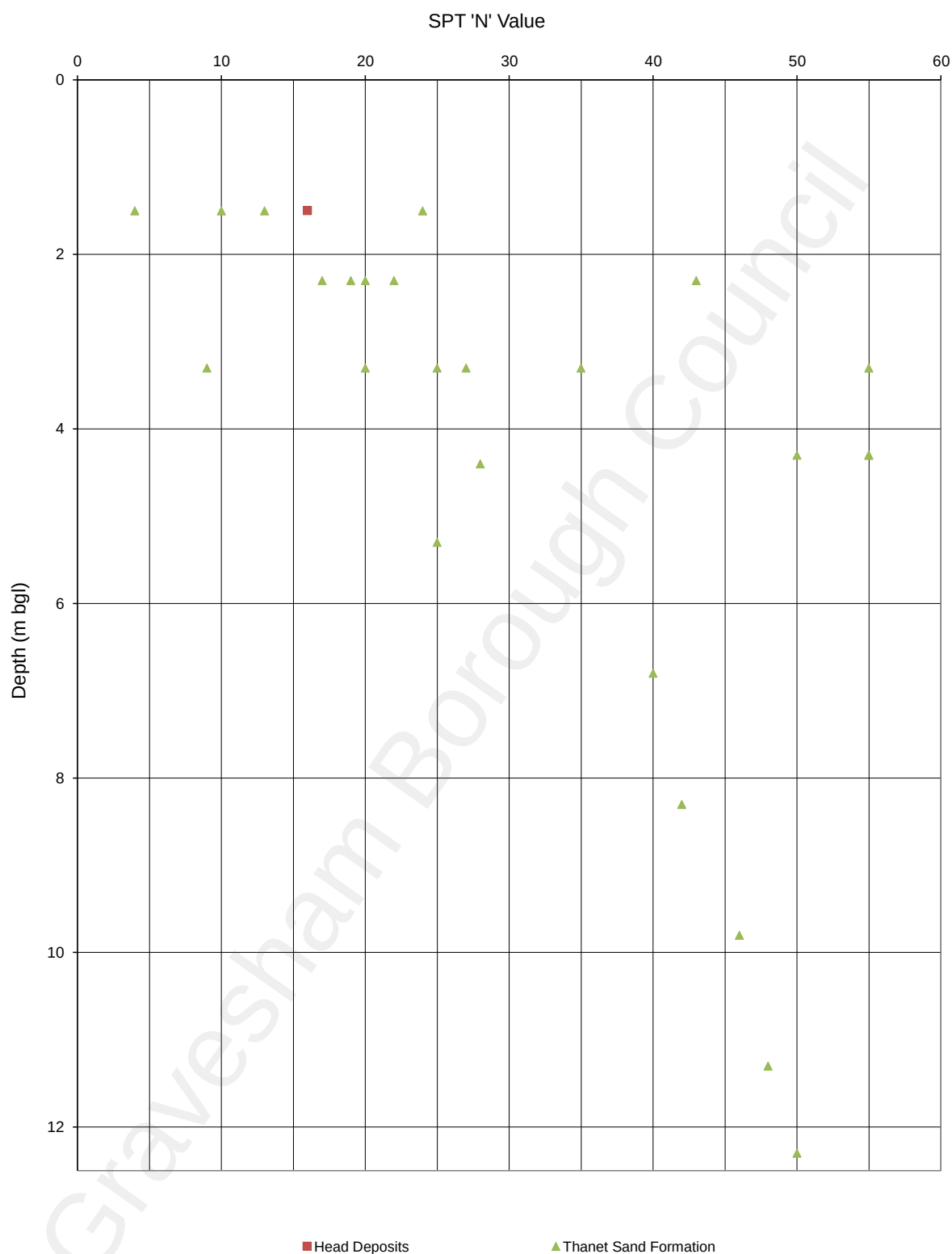
Project:
Project Name
Former Battle of Britain Site,
Coldharbour Road,
Gravesend, DA11 8NT
Client: Frontier Estates

Drawing Title:
Proposed Site Plan

For Review and Comment

MR Project Number	Scale	Sheet
3172	1:200	S3
Project	Originator	Volume
3172 - HIA	- ZZ	- XX
DR	- A	- 0102

Uncorrected SPT 'N' Value versus depth



Notes: 1. Uncorrected N values plotted.
2. SPT N values limited at 100

Client:	Frontier Estates Ltd	APPLIED GEOLOGY
Project:	Coldharbour Road, Gravesend	
Project No.	AG3309-21	

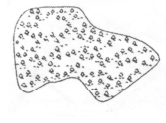
APPENDIX B

County Series 1:10,560 scale

VEGETATION



Fir Wood



Deciduous Wood



Mixed Wood



Brushwood



Orchard



Reeds



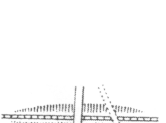
Rough Pasture



Furze

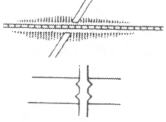


Marsh

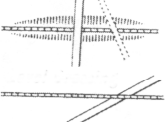


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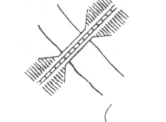
ROADS



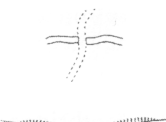
Railway over Road



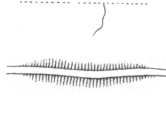
Road over Railway



Road over River or Canal



Level Crossing



Railway over River



Road over Stream



Road over Stream



Sunken Road

RAILWAYS



Double Lines of Railway

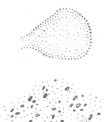


Single Lines of Railway and Tramway

GENERAL FEATURES



Gravel Pit



Sand Pit



Quarry



Shingle



Other Pits



Antiquities, Site of

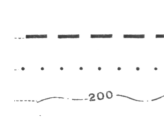


Arrow, showing direction of flow of water



Trigonometrical Station

BOUNDARIES



County Boundary



Parish Boundary



Contours



Parliamentary Division Boundary



Union Boundary



Rural District Boundary

National Grid 1:10,000 scale

HEIGHTS (METRES)

Values are given in metres above mean sea level at Newlyn.

Surface heights determined by ground survey 163m air survey 164m

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

Contours are at 5 metres vertical interval.

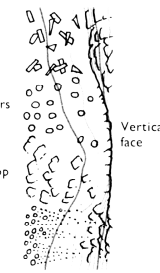
ROCK FEATURES

Loose rock

Boulders

Outcrop

Scree



CONVERSION SCALE

Metres - Feet

2000 Metres 6500 Feet

6000

5000

4000

ABBREVIATIONS

BP,BS Boundary Post or Stone
Ch Church
CH Club House
F Sta Fire Station
FB Foot Bridge
Fn Fountain
GP Guide Post
MP,MS Mile Post or Stone
P Pole or Post
Pol Sta Police Station

PO Post Office
PC Public Convenience
PH Public House
S Stone
Spr Spring
TCB Telephone Call Box
TCP Telephone Call Post
TH Town Hall
W Well
Y Youth hostel

ROADS

Road

Track
Where unfenced shown by pecked lines.

Path

RAILWAYS

Cutting Embankment Multiple track
Single track
Siding, tramway or mineral line
Narrow gauge
Road over
Level crossing
Foot Bridge
Road under

GENERAL FEATURES

Antiquity, (site of)

Boulders

Building

Pylon
Pole
Electricity transmission line

Glasshouse

Triangulation station

Lake, loch or pond

Sloping masonry

= Chalk pit, clay pit or quarry

= Gravel pit

= Sand pit

Refuse or slag heap

Direction of flow of water

Shingle

Sand

VEGETATION

Bracken, rough grassland

Scrub

Heath

Marsh

Saltings

Reeds

Coppice

Orchard

Coniferous trees

Non-coniferous trees

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



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Historical Map Pack Legend

County Series & National Grid 1:10,560 scale

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

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Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1865

Scale: 1:10,560

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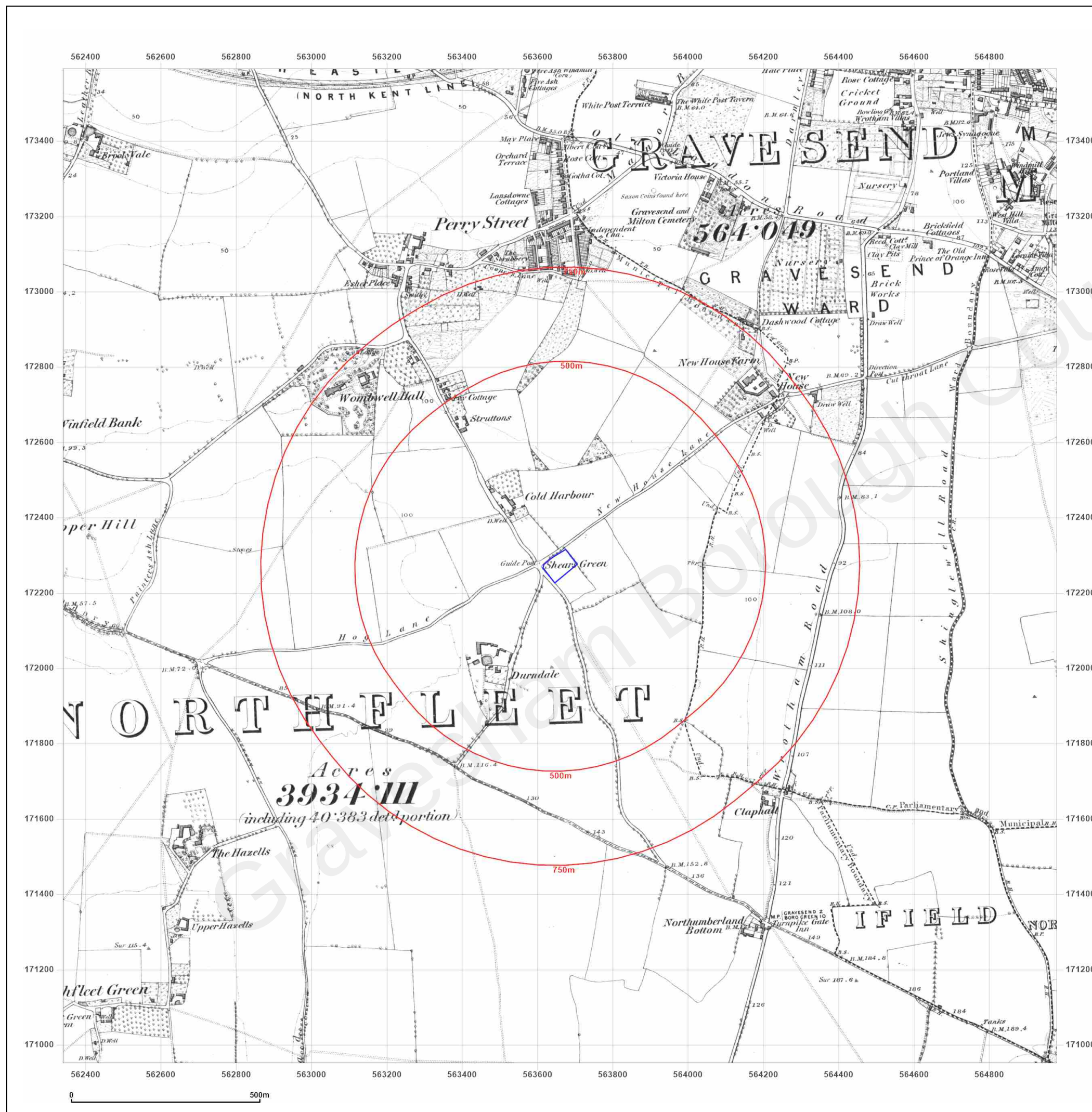


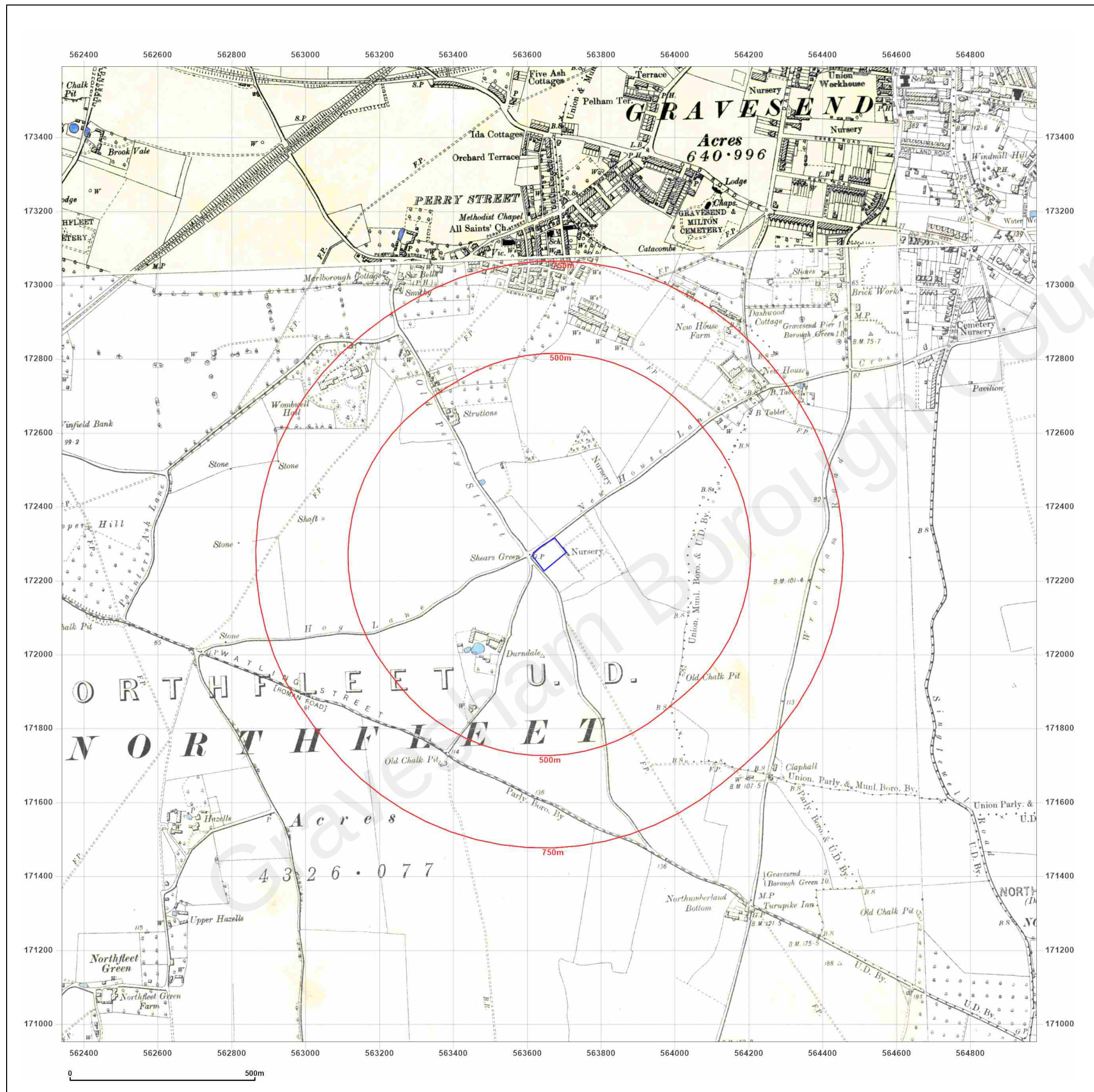
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Client Ref: EMS_713375_931813
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Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1895

Scale: 1:10,560

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Report Ref: EMS-713375_931813

Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1895-1898

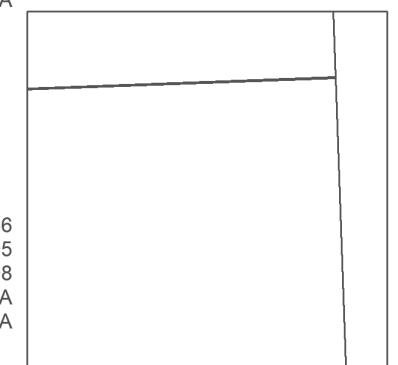
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Site Details:

Coldharbour Road, Gravesend

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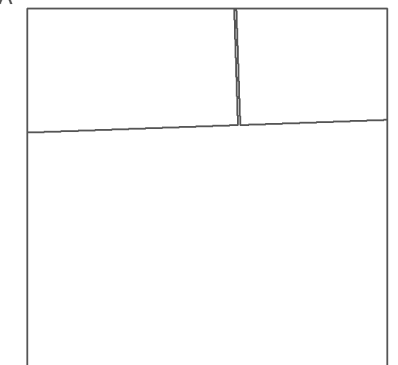
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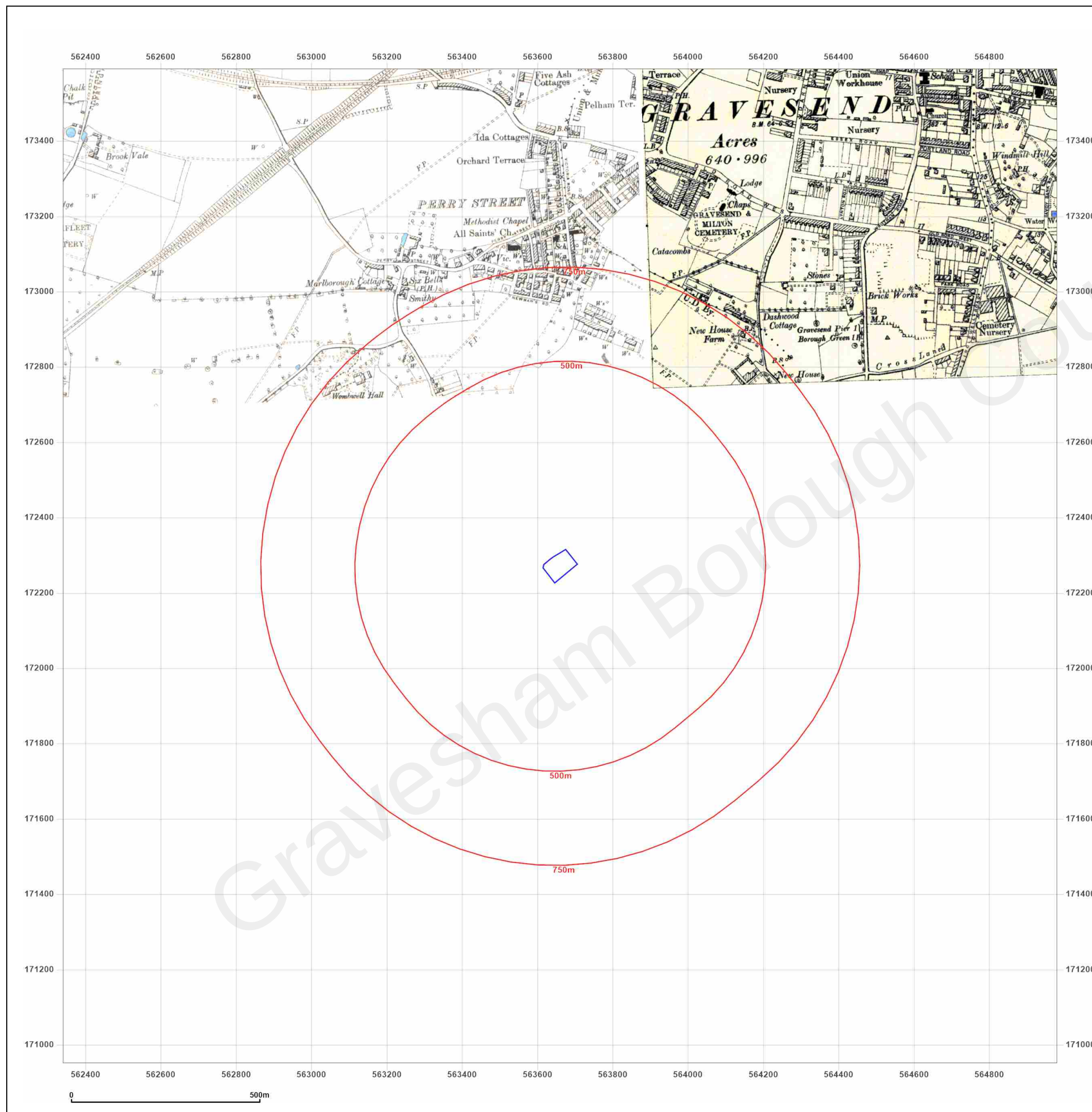


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Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1907

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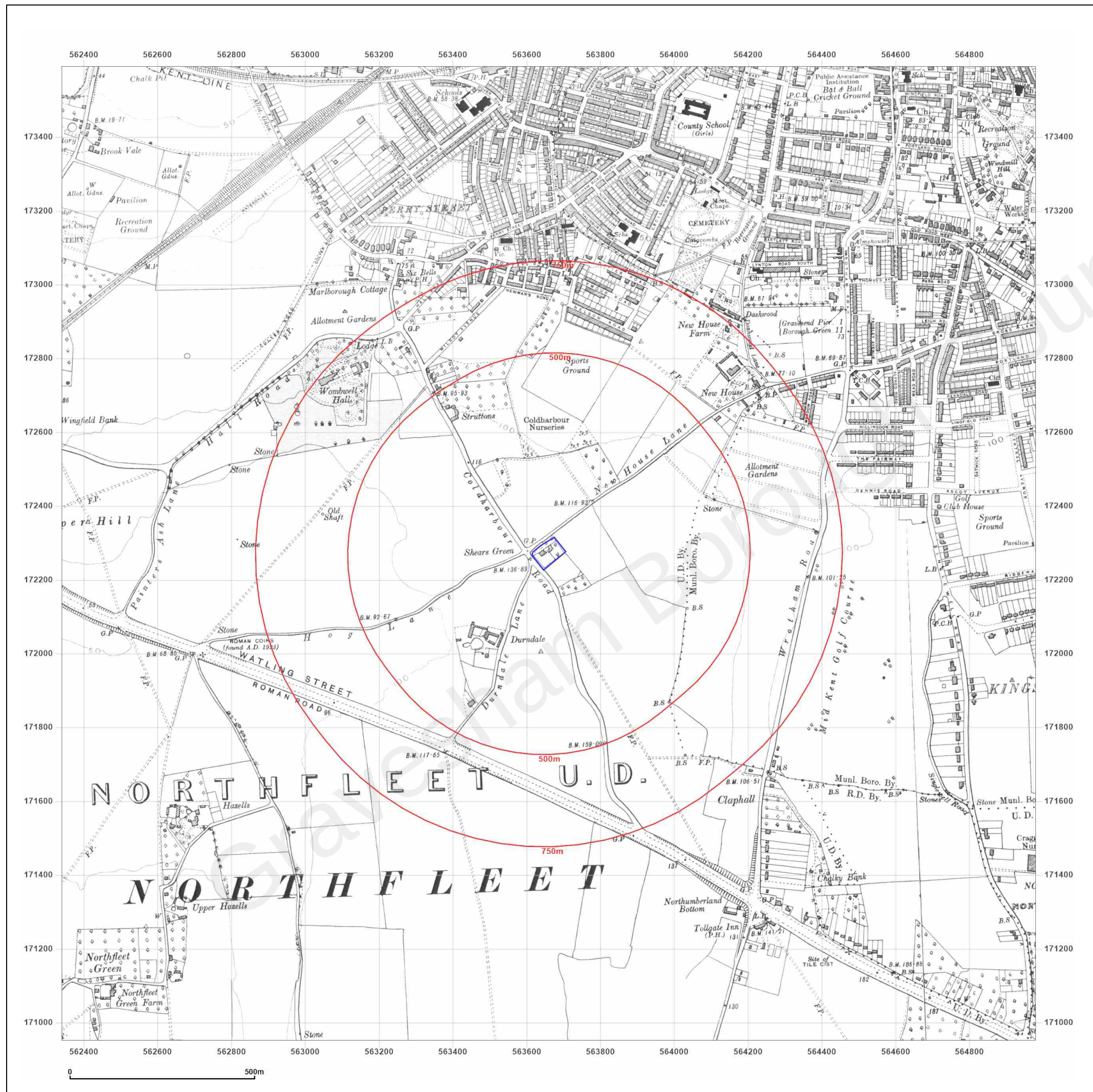


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Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1931-1932

Scale: 1:10,560

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Edition N/A
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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1938

Scale: 1:10,560

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Scale: 1:10,560

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: Provisional

Map date: 1955

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: Provisional

Map date: 1966

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Site Details:

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Client Ref: EMS_713375_931813

Report Ref: EMS-713375_931813

Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1971

Scale: 1:10,000

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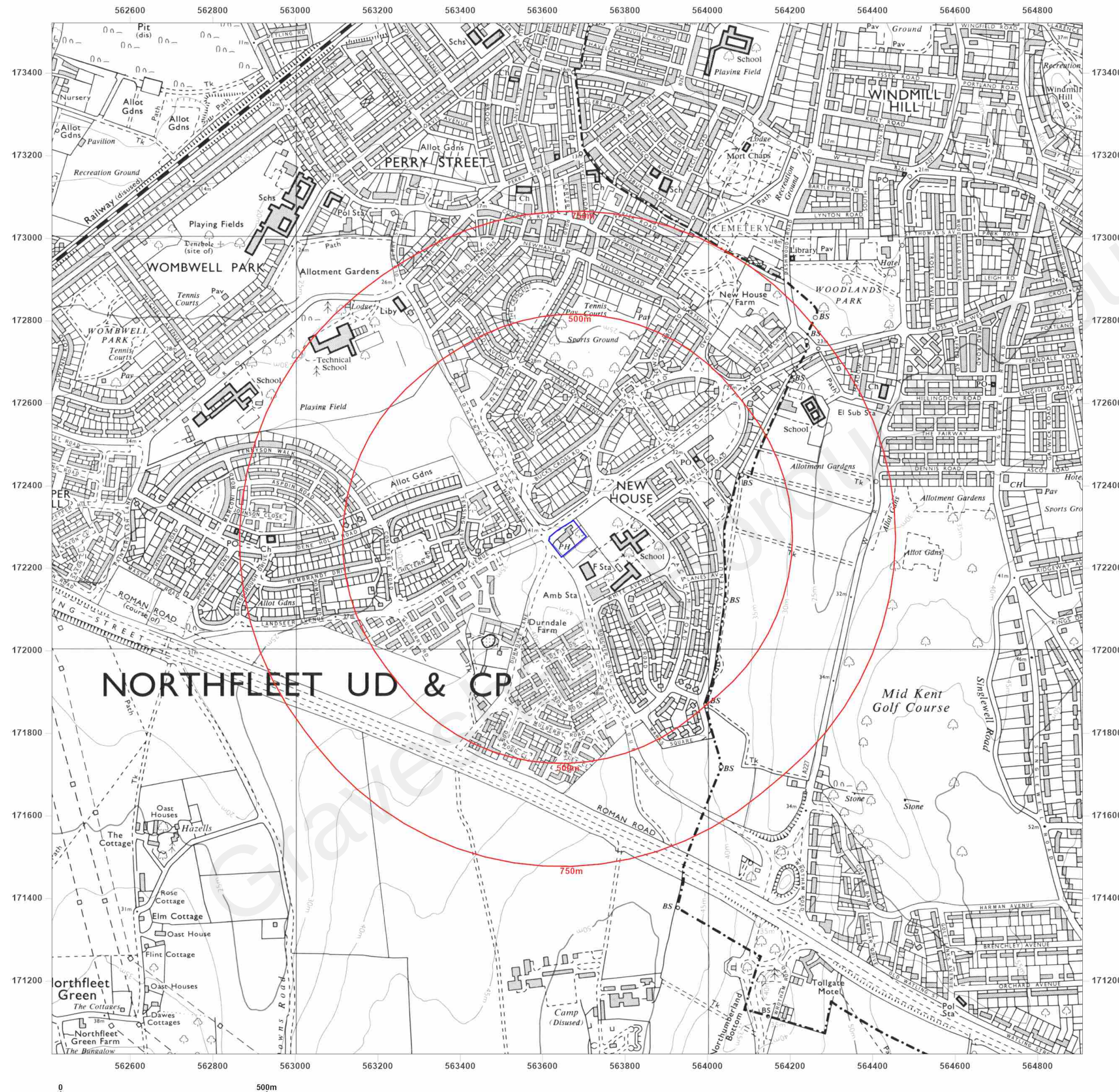


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1977

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1977
 Revised 1977
 Edition N/A
 Copyright N/A
 Levelled N/A



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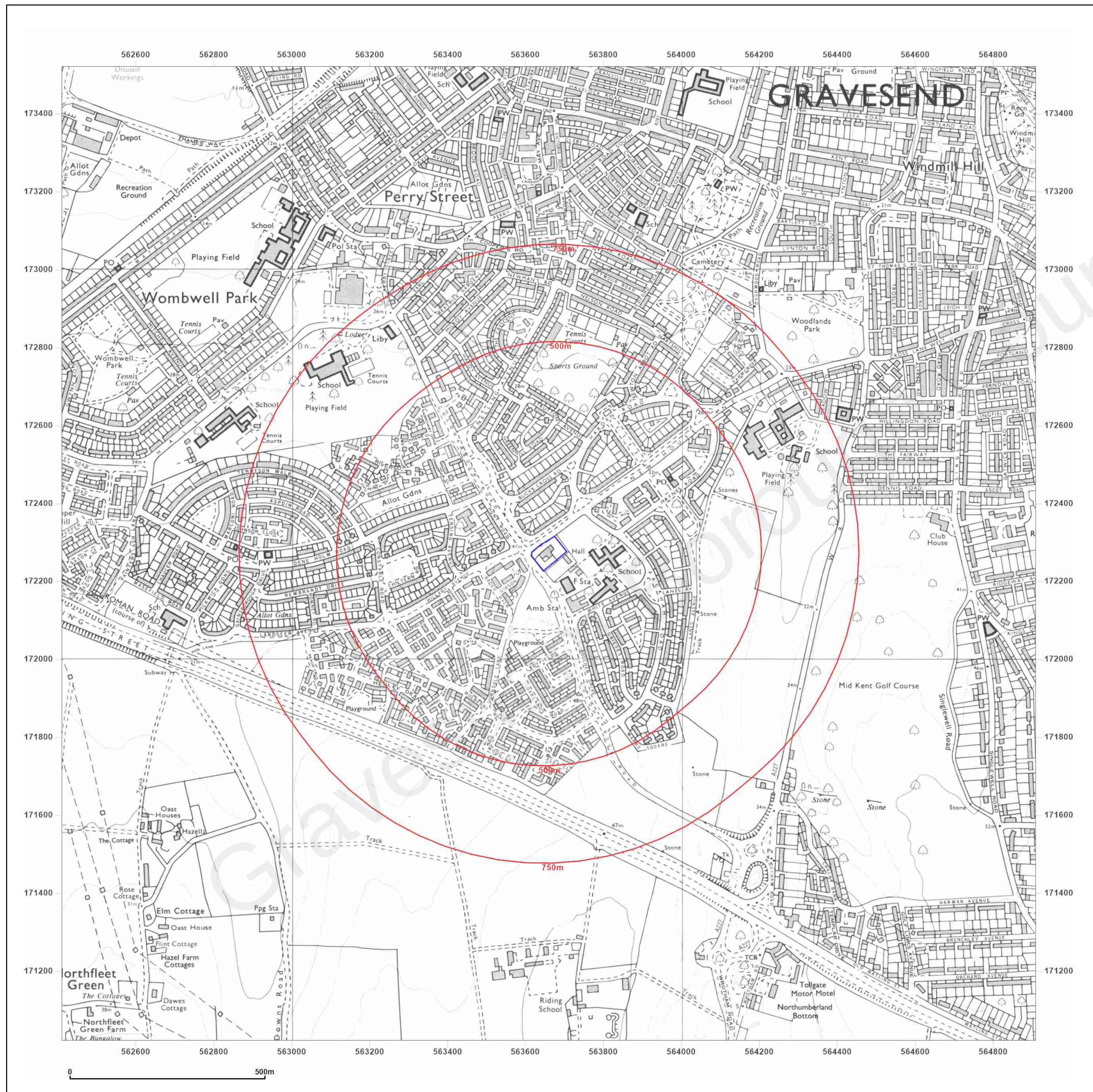
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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1990

Scale: 1:10,000

Printed at: 1:10,000



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Edition N/A
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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 2001

Scale: 1:10,000

Printed at: 1:10,000



2001



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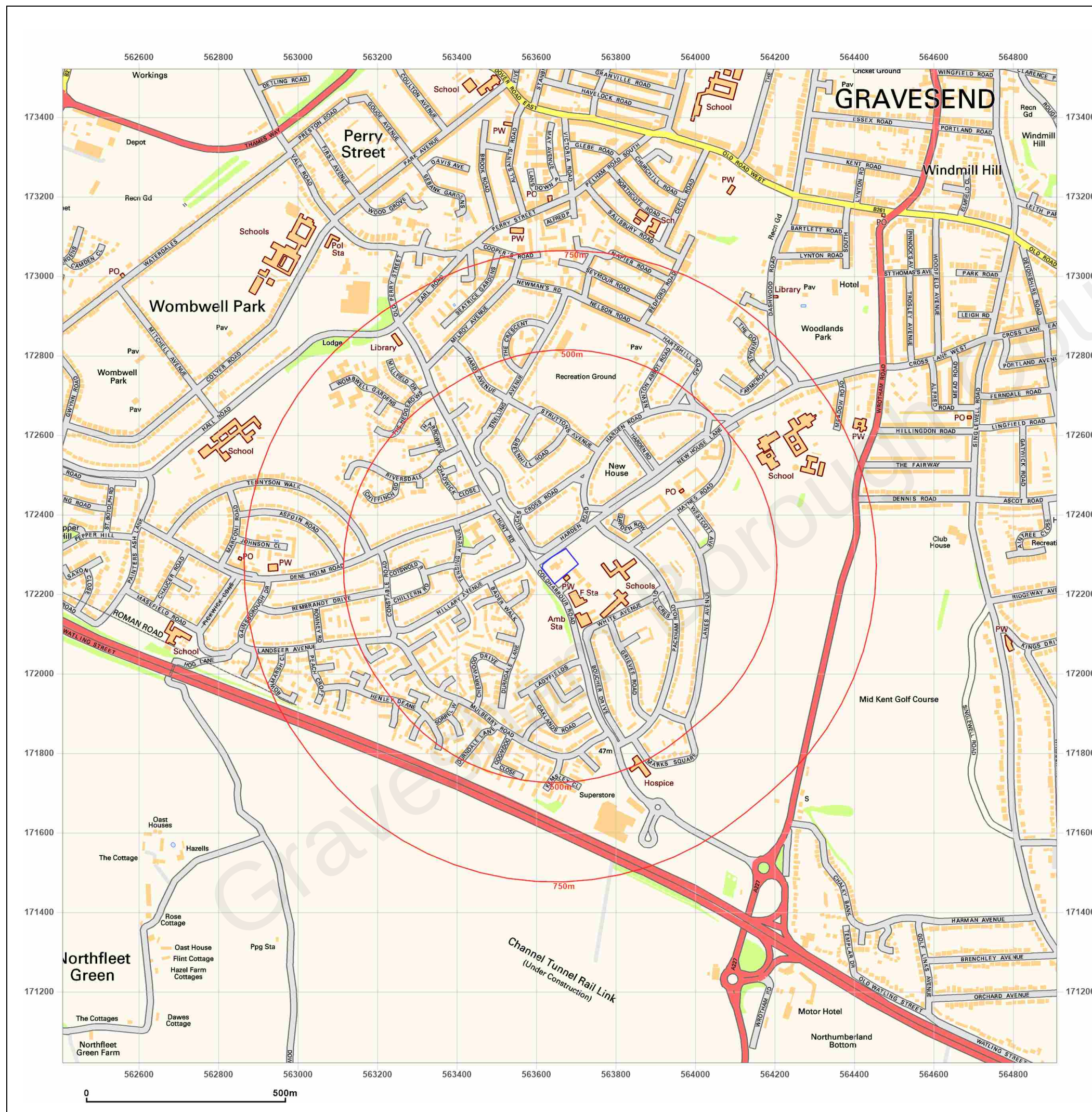


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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000



2010



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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 2021

Scale: 1:10,000

Printed at: 1:10,000



2021



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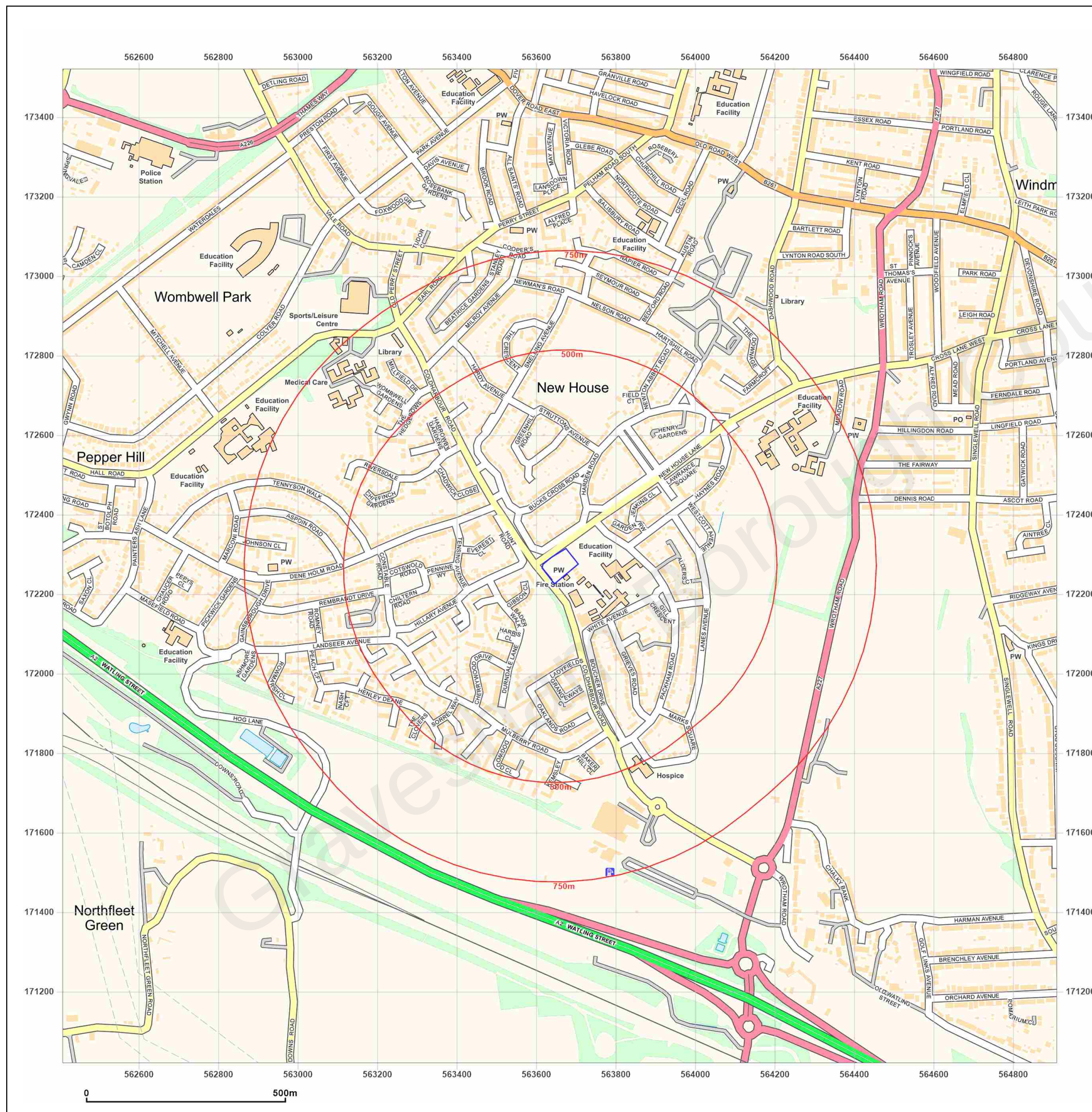


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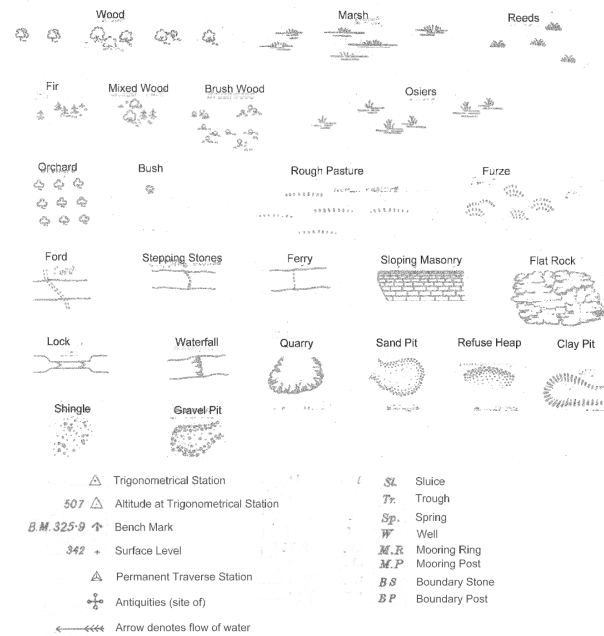
County Series 1:2,500 scale

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

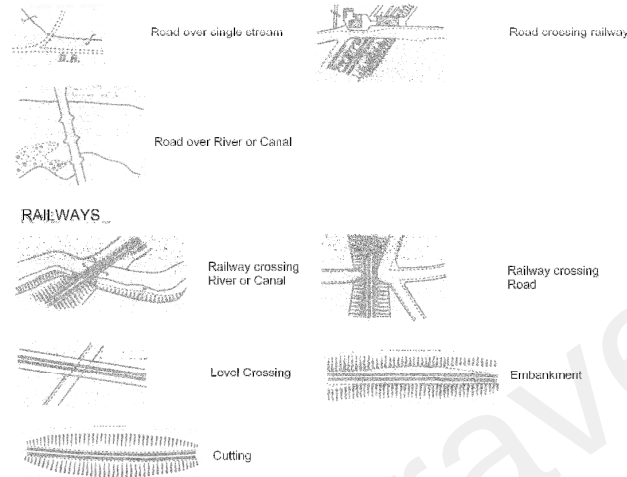


Historical Map Pack Legend

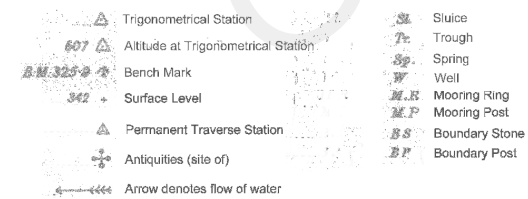
GENERAL FEATURES



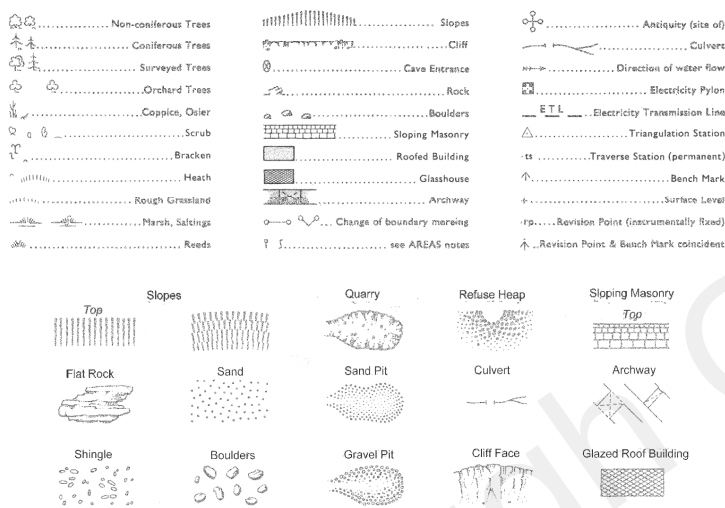
ROADS



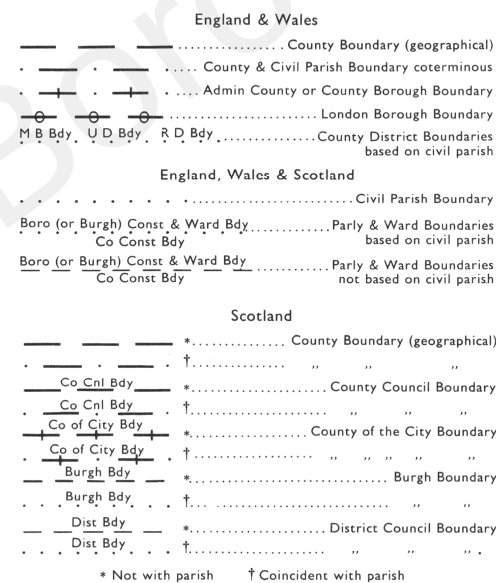
ABBREVIATIONS



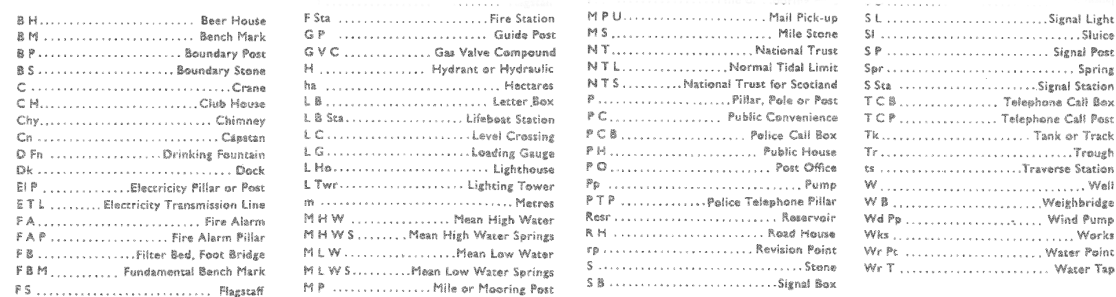
GENERAL FEATURES



BOUNDARIES



ABBREVIATIONS



County Series

1:1,250 scale

~

County Series & National Grid

1:2,500 scale

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Technical Helpline:

Tel 08444159000

groundsurreinsight@groundsurre.com
www.groundsure.com

Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1865

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1865
 Revised 1865
 Edition N/A
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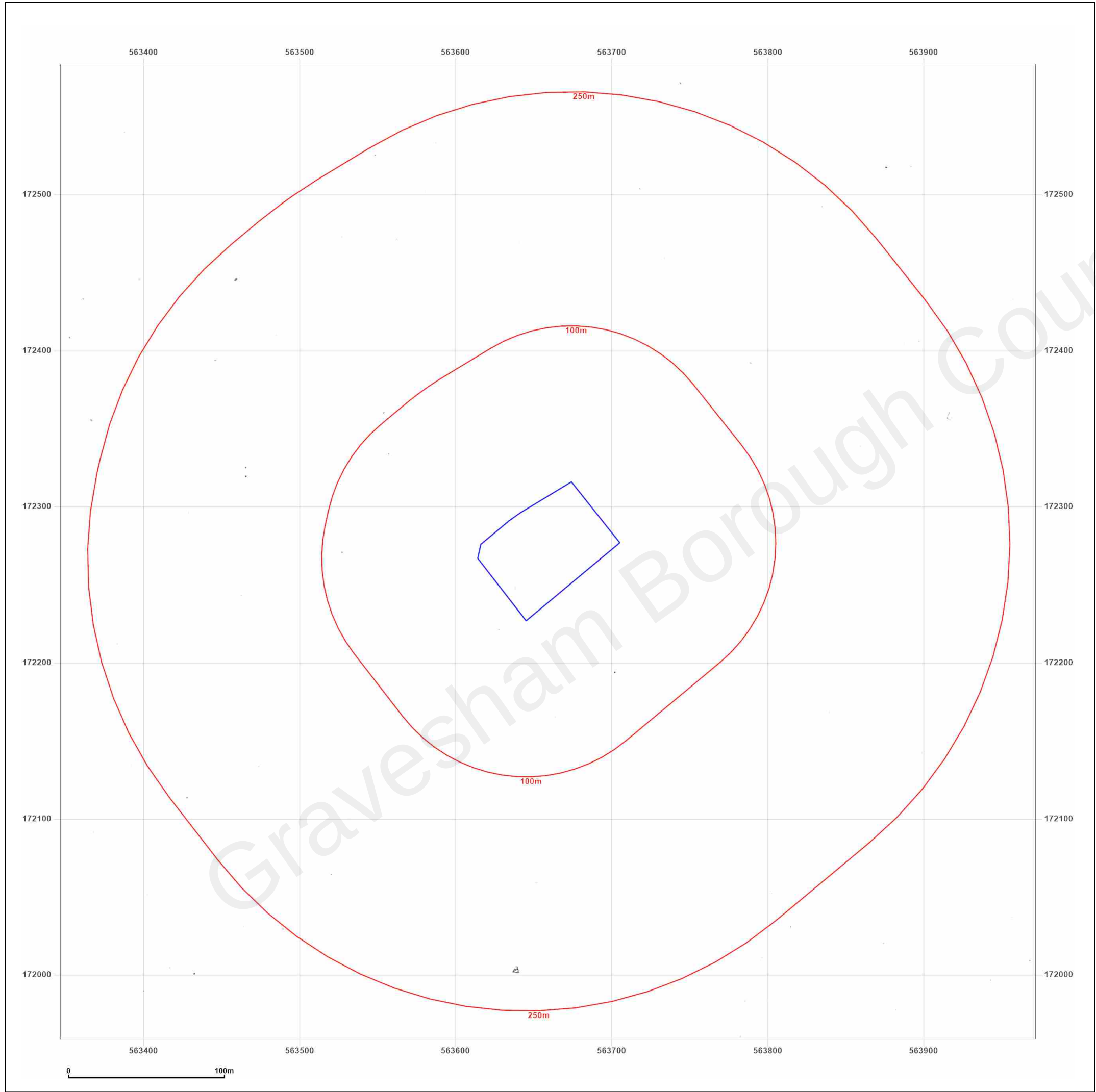
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Site Details:

Coldharbour Road, Gravesend

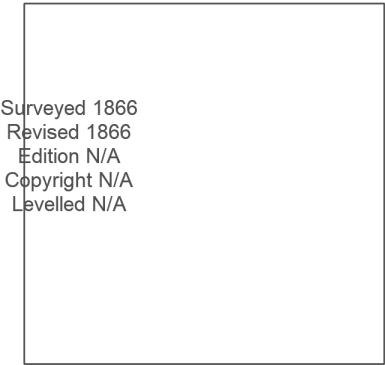
Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1866

Scale: 1:2,500

Printed at: 1:2,500



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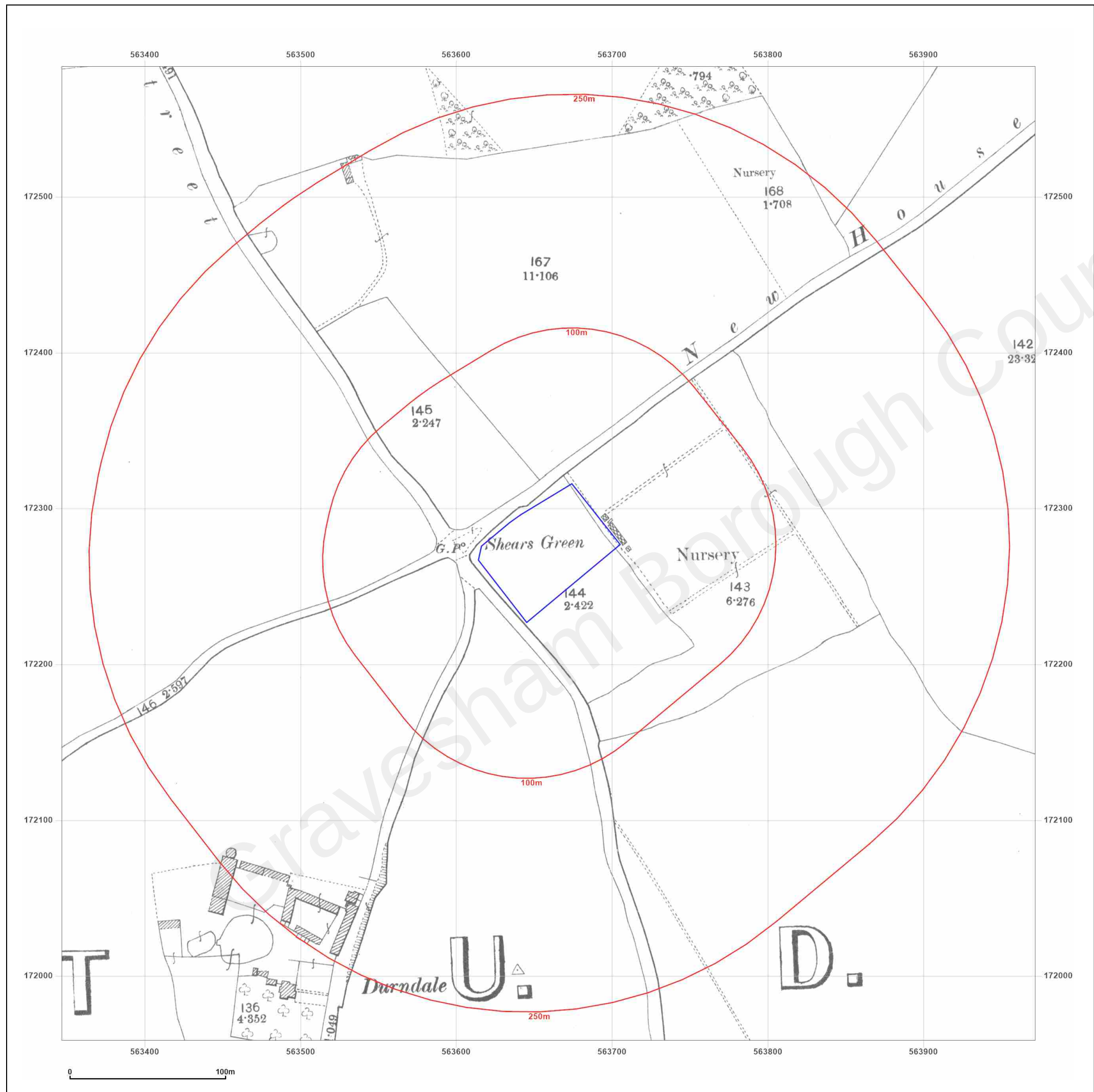


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1897

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1897
Revised 1897
Edition N/A
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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1909

Scale: 1:2,500

Printed at: 1:2,500



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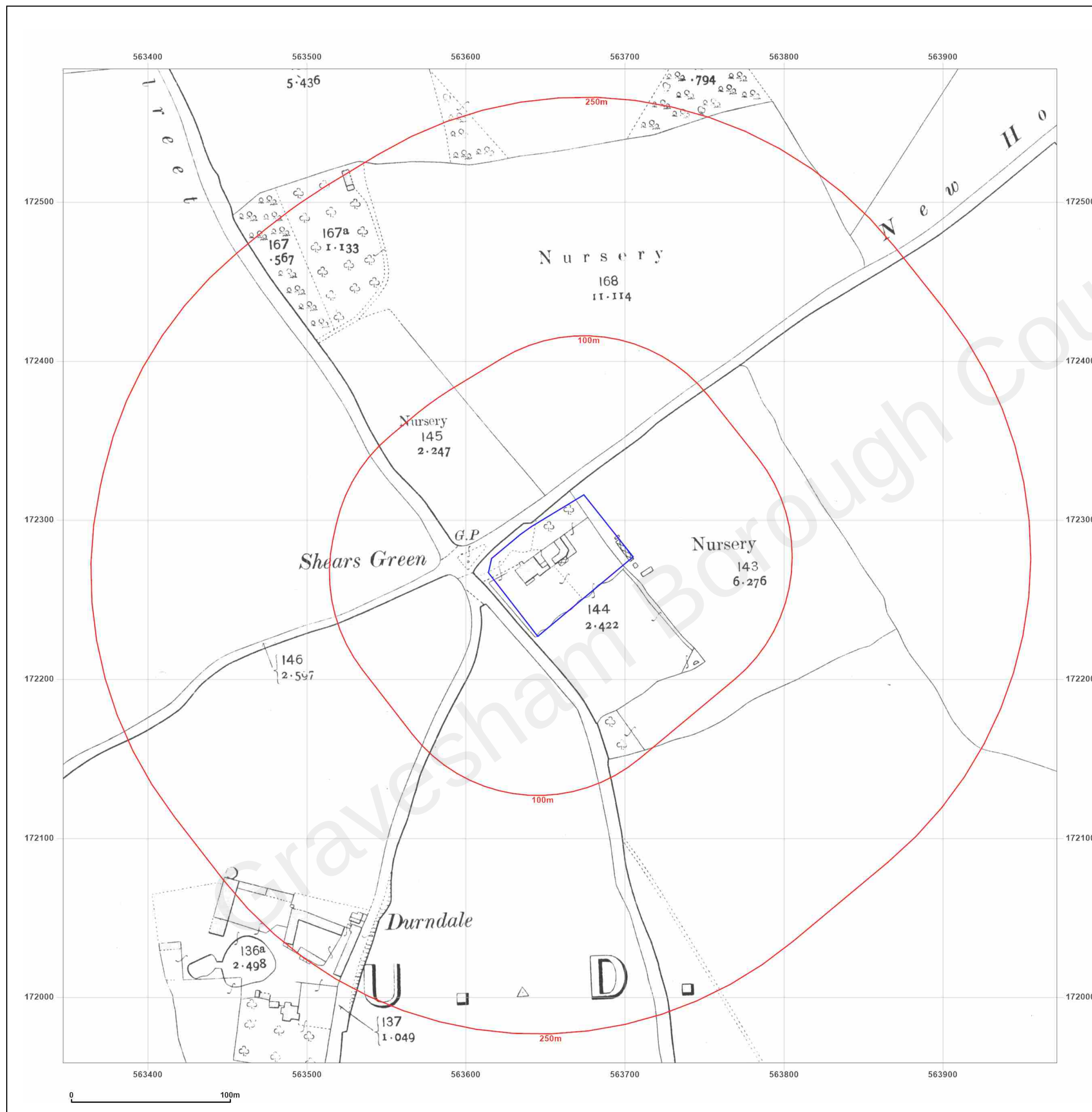


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1931

Scale: 1:2,500

Printed at: 1:2,500



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



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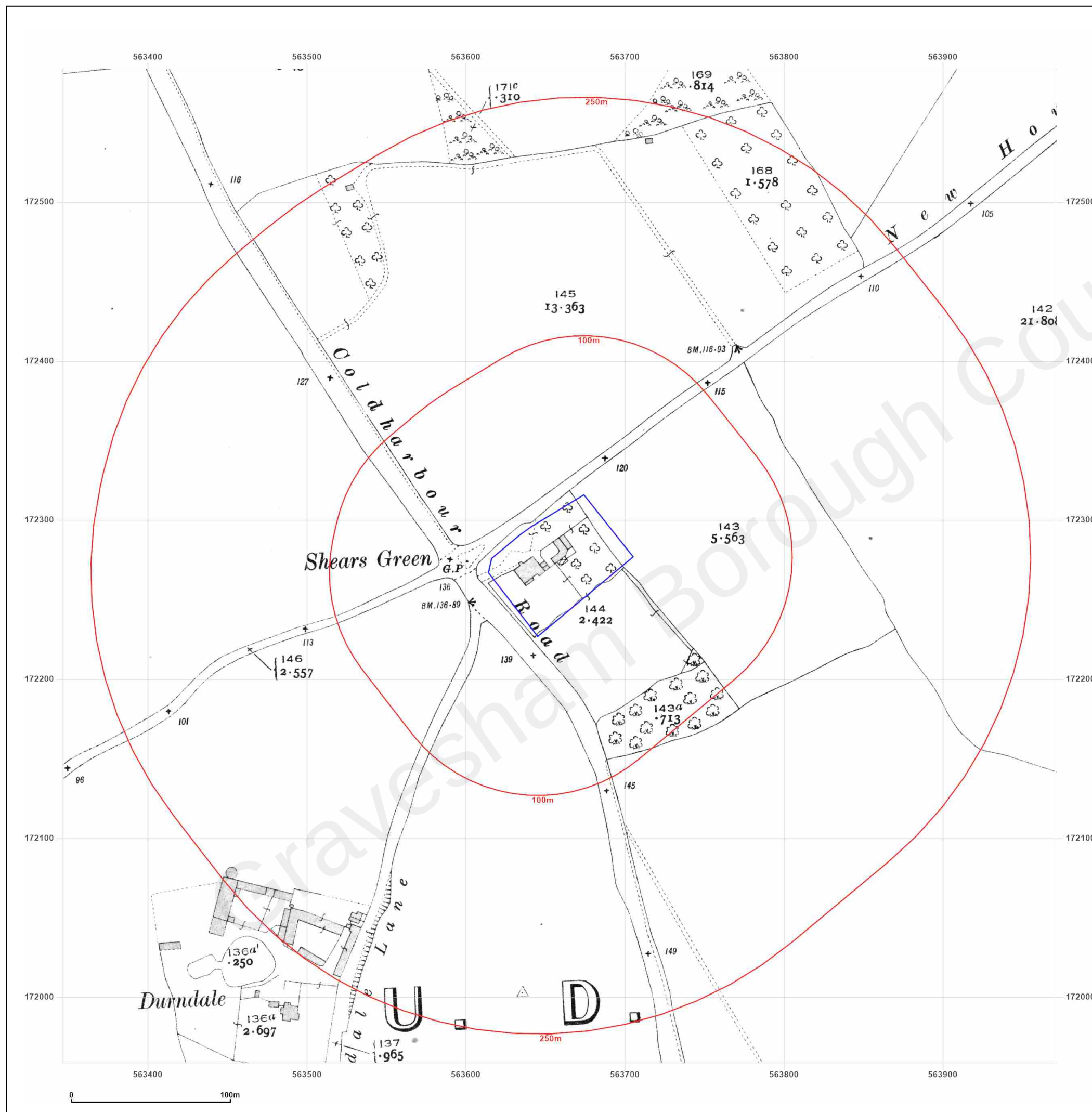


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813

Report Ref: EMS-713375_931813

Grid Ref: 563659, 172271

Map Name: County Series

Map date: 1938

Scale: 1:2,500

Printed at: 1:2,500



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



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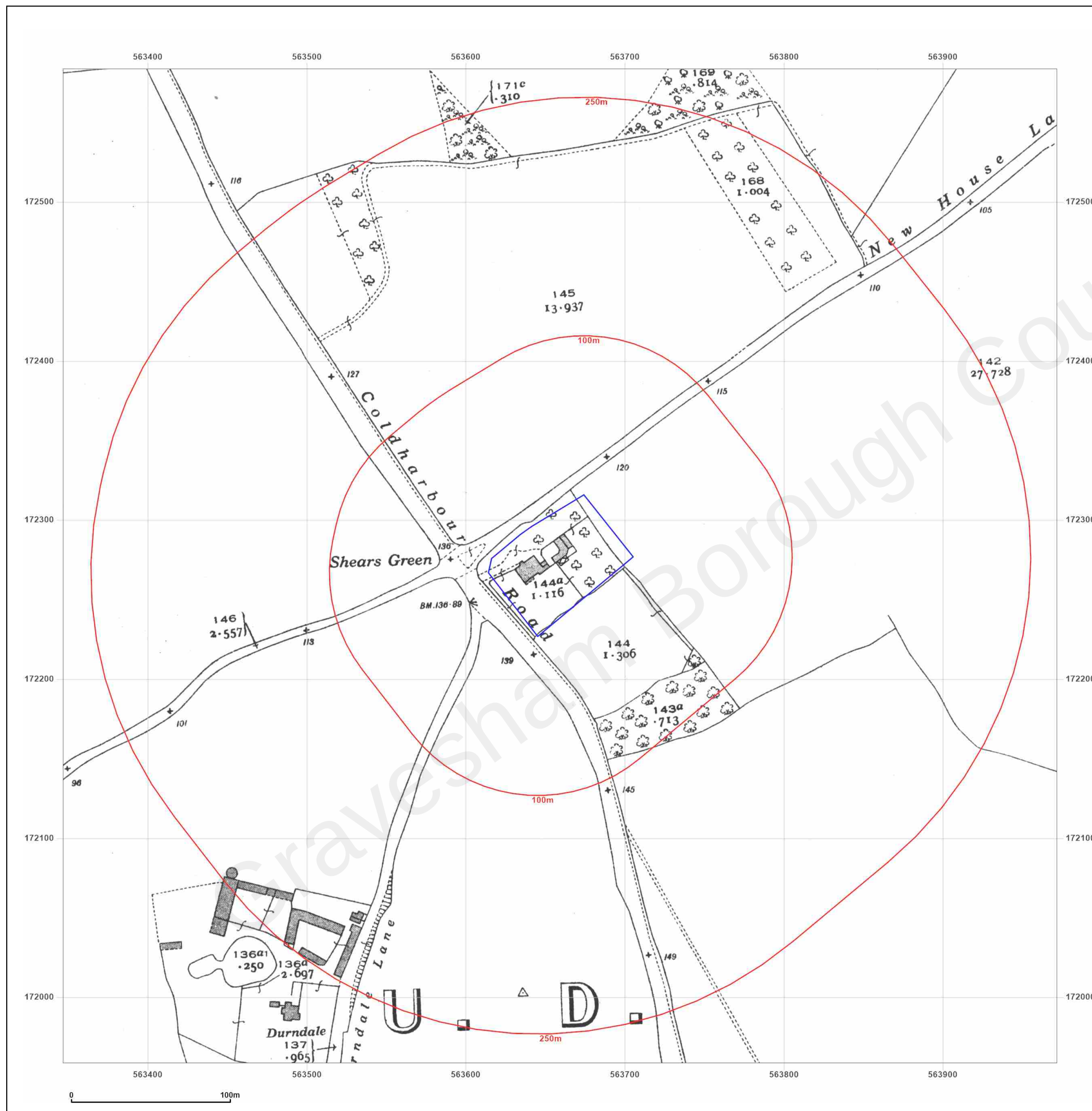


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1952-1953

Scale: 1:1,250

Printed at: 1:2,000



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

Surveyed 1953
 Revised 1953
 Edition N/A
 Copyright N/A
 Levelled 1952

Surveyed 1952
 Revised 1952
 Edition N/A
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Surveyed 1953
 Revised 1953
 Edition N/A
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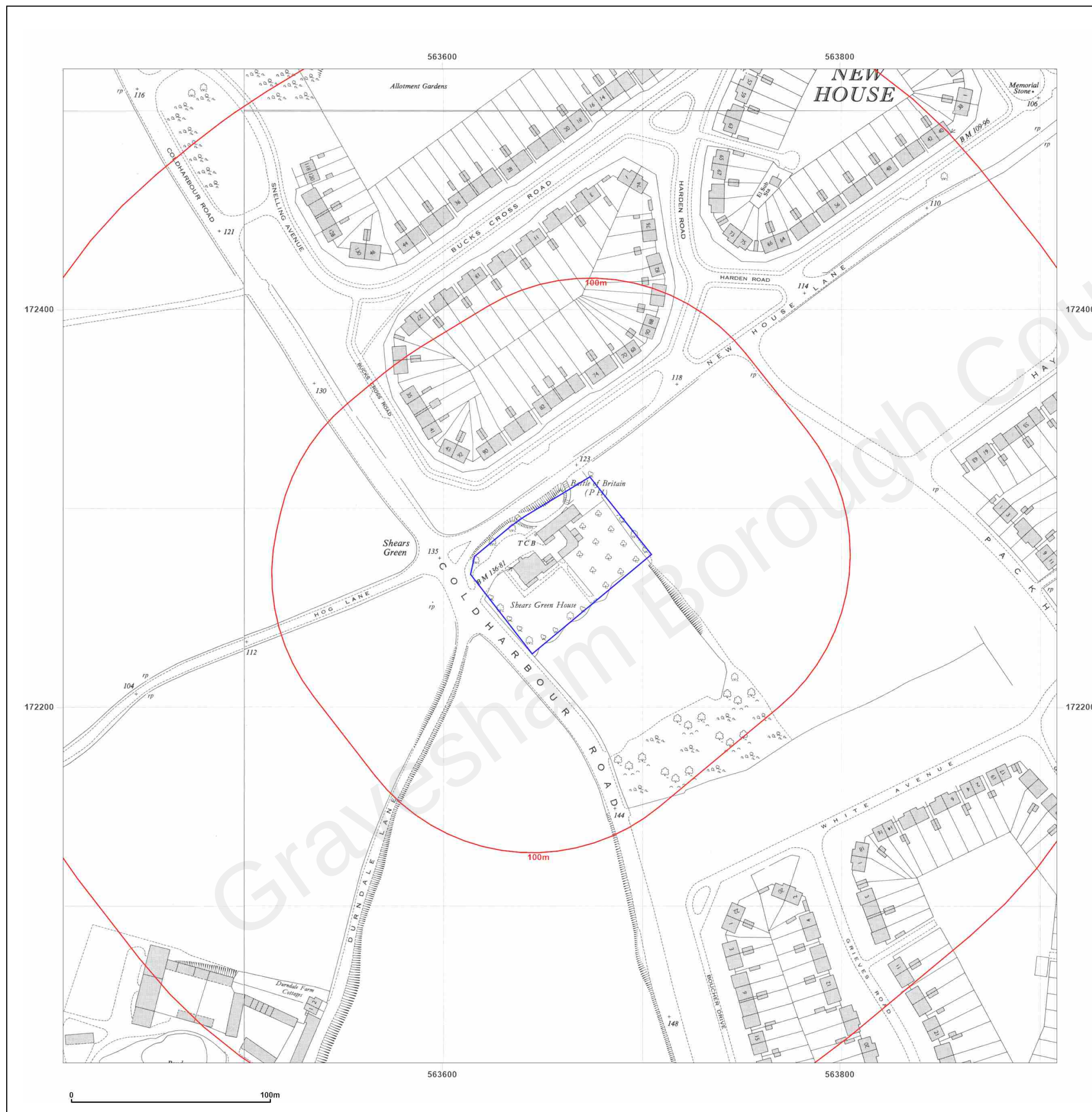


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813

Report Ref: EMS-713375_931813

Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1953

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1953
Revised 1953
Edition 1954
Copyright N/A
Levelled 1952



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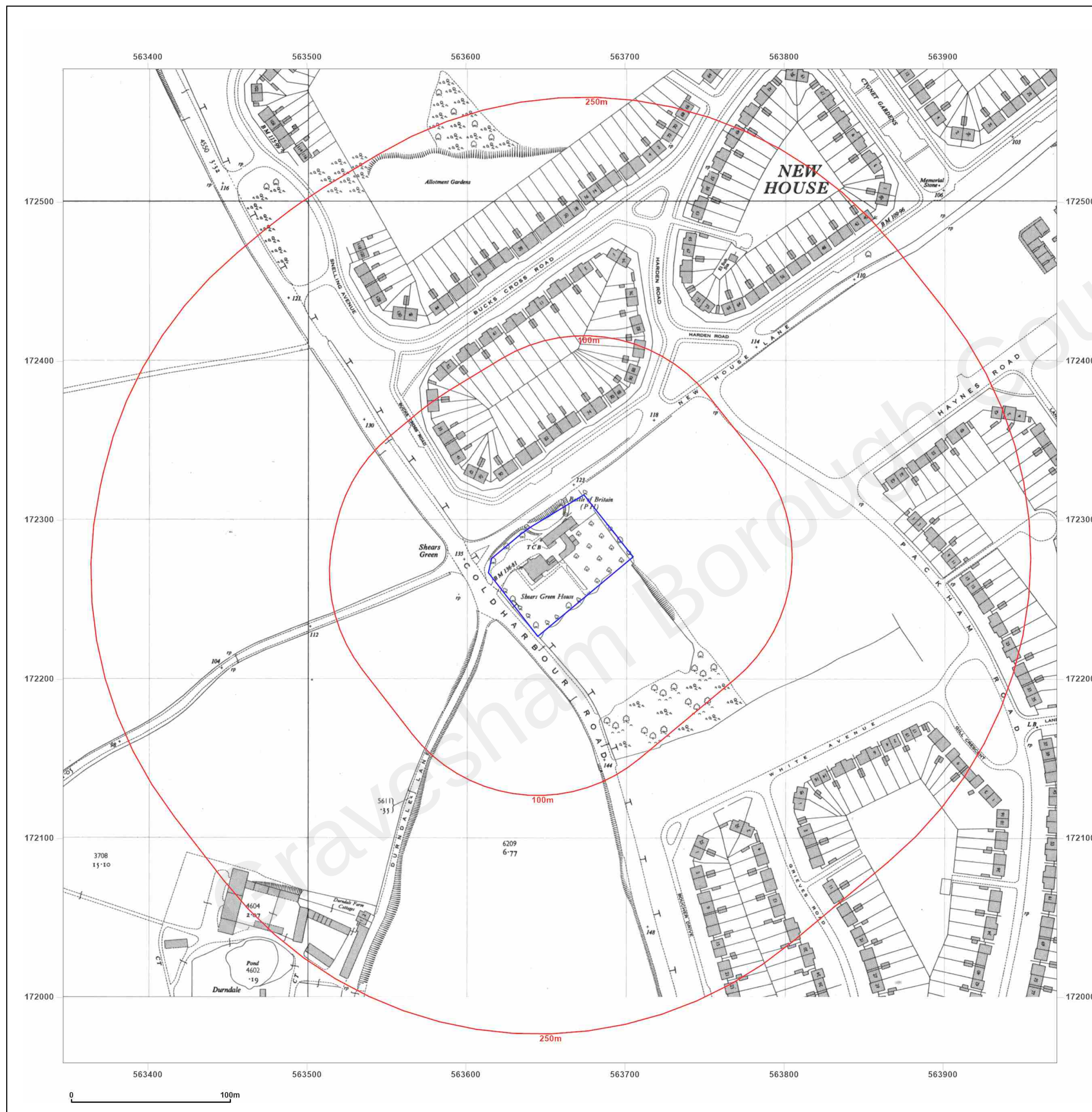


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1960-1962

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1952
 Revised 1961
 Edition N/A
 Copyright 1962
 Levelled 1953

Surveyed 1953
 Revised 1959
 Edition N/A
 Copyright 1960
 Levelled 1952



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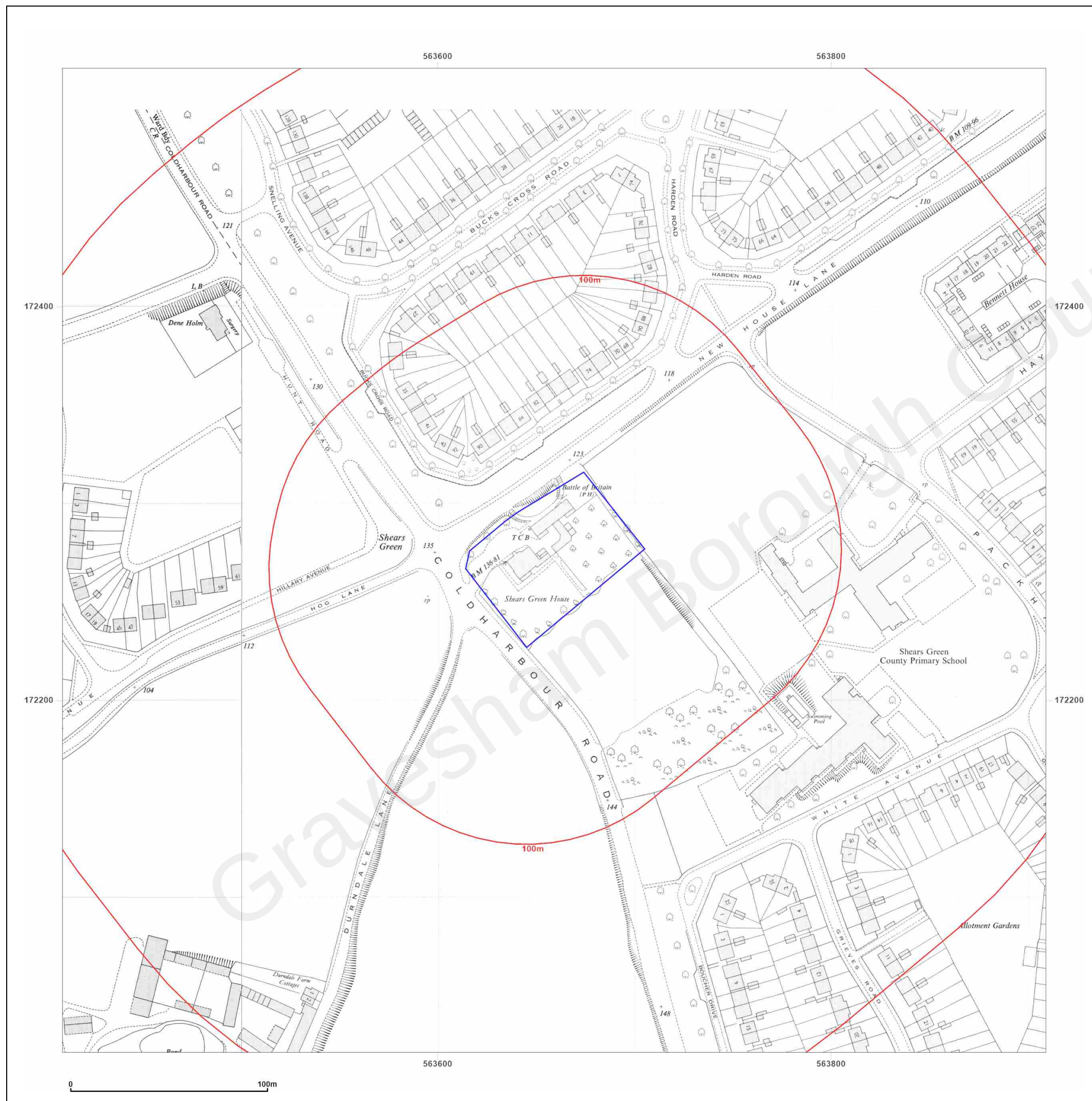


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1962

Scale: 1:1,250

Printed at: 1:2,000



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

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1961-1966

Scale: 1:1,250

Printed at: 1:2,000



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 Revised 1965
 Edition N/A
 Copyright 1966
 Levelled 1952

Surveyed 1953
 Revised 1961
 Edition N/A
 Copyright 1962
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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1968-1971

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1952
 Revised 1967
 Edition N/A
 Copyright 1968
 Levelled 1952

Surveyed 1952
 Revised 1970
 Edition N/A
 Copyright 1971
 Levelled 1952

Surveyed 1953
 Revised 1970
 Edition N/A
 Copyright 1971
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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1973-1974

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1952
 Revised 1974
 Edition N/A
 Copyright 1974
 Levelled 1952

Surveyed 1953
 Revised 1973
 Edition N/A
 Copyright 1974
 Levelled 1952

Surveyed N/A
 Revised N/A
 Edition N/A
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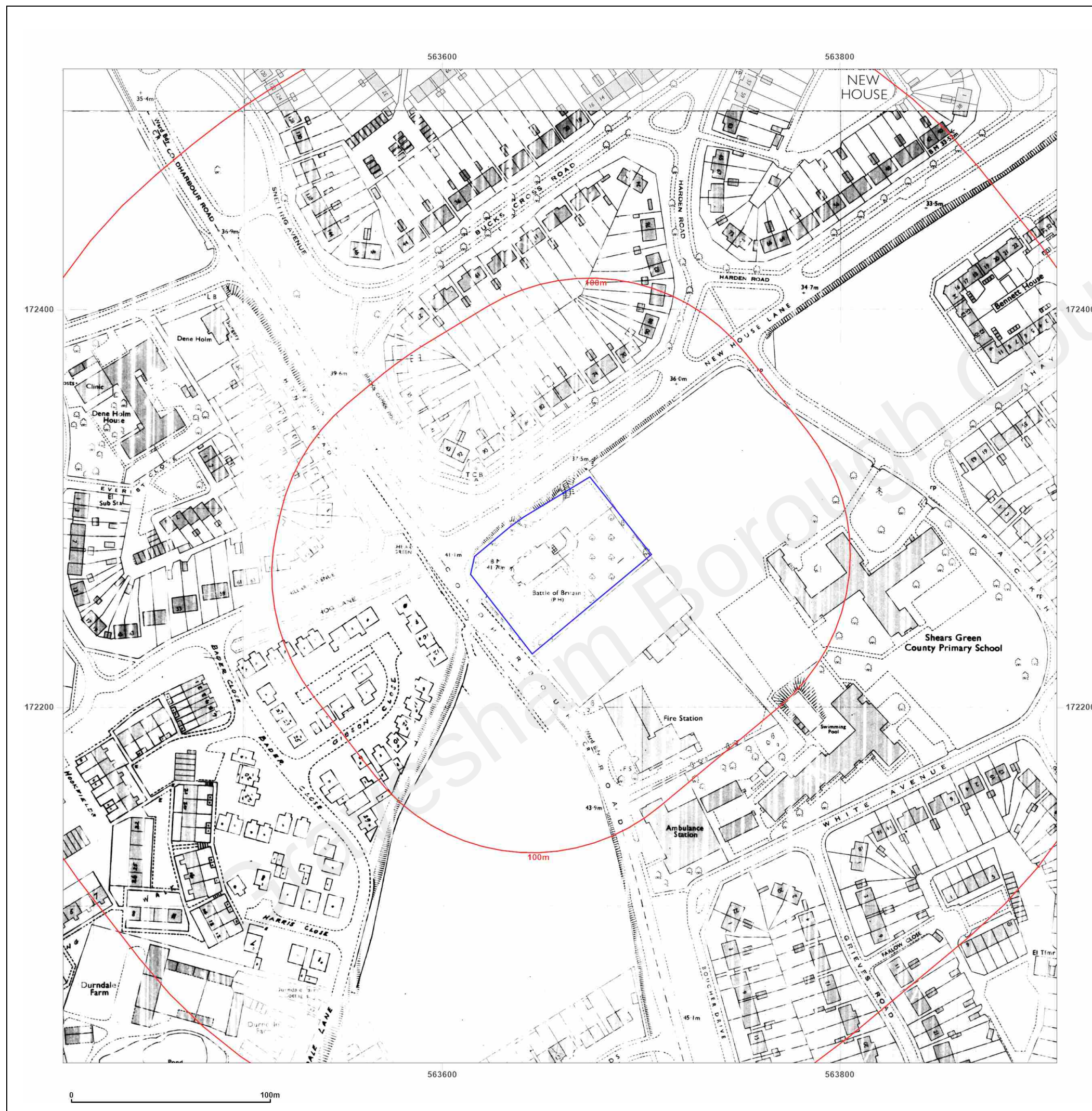


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1974-1978

Scale: 1:1,250

Printed at: 1:2,000



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

Surveyed 1953
 Revised 1974
 Edition N/A
 Copyright 1974
 Levelled 1952



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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1983

Scale: 1:1,250

Printed at: 1:2,000



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 Edition N/A
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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1981-1984

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1952
 Revised 1984
 Edition N/A
 Copyright 1984
 Levelled 1952

Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright 1981
 Levelled 1952

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

Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright 1982
 Levelled 1952



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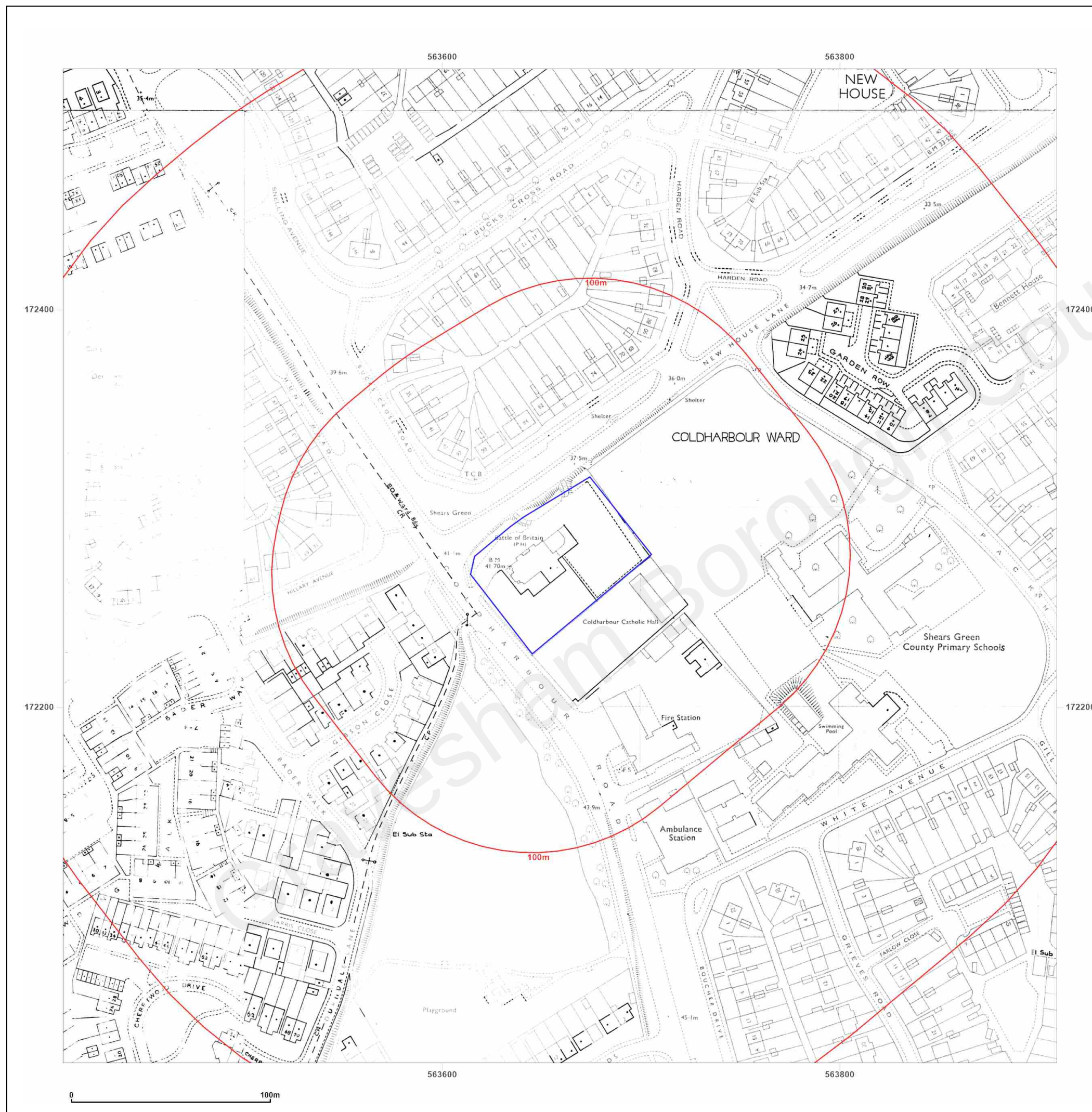


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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1983-1987

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1983
 Revised 1987
 Edition N/A
 Copyright 1987
 Levelled 1983

Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright 1983
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Site Details:

Coldharbour Road, Gravesend

Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: National Grid

Map date: 1983-1987

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1983
 Revised 1987
 Edition N/A
 Copyright 1987
 Levelled 1983

Surveyed 1983
 Revised 1986
 Edition N/A
 Copyright 1986
 Levelled 1983

Surveyed 1952
 Revised 1983
 Edition N/A
 Copyright 1983
 Levelled 1952



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Site Details:

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Client Ref: EMS_713375_931813
Report Ref: EMS-713375_931813
Grid Ref: 563659, 172271

Map Name: LandLine

Map date: 2003

Scale: 1:1,250

Printed at: 1:1,250



2003



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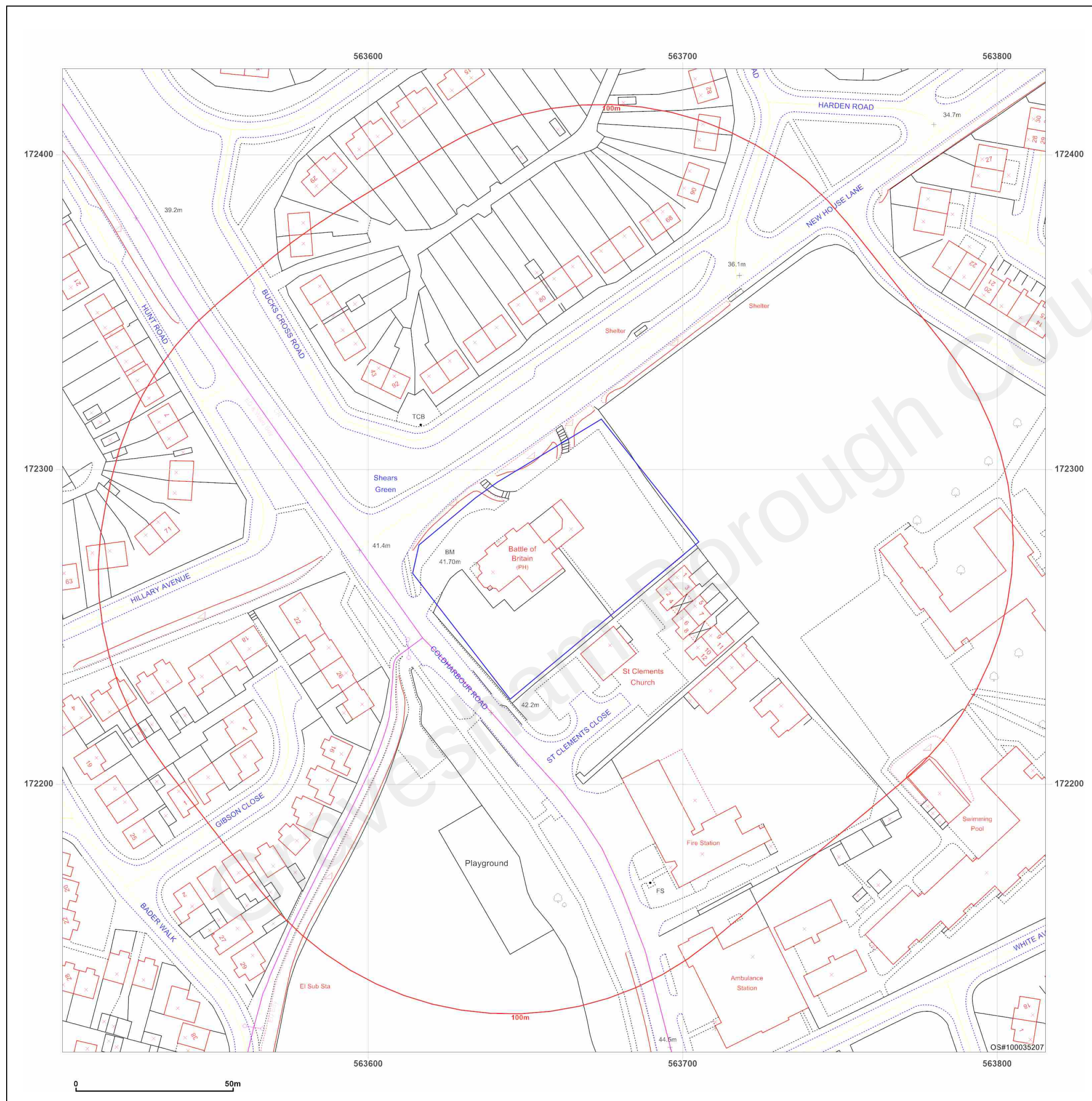


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Coldharbour Road, Gravesend

Order Details

Date: 04/08/2021
Your ref: EMS_713375_931814
Our Ref: EMS-713375_931814
Client: emapsite

Site Details

Location: 563657 172272
Area: 0.42 ha
Authority: [Gravesham Borough Council](#)



Summary of findings

p. 2

Aerial image

p. 8

OS MasterMap site plan

p.13

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Contact us with any questions at:

info@groundsure.com

08444 159 000

Summary of findings

Page	Section	Past land use	On site	0-50m	50-250m	250-500m	500-2000m
14	1.1	<u>Historical industrial land uses</u>	3	3	2	2	-
15	1.2	<u>Historical tanks</u>	0	0	1	1	-
15	1.3	<u>Historical energy features</u>	0	0	5	15	-
16	1.4	Historical petrol stations	0	0	0	0	-
17	1.5	<u>Historical garages</u>	0	0	0	1	-
17	1.6	Historical military land	0	0	0	0	-
Page	Section	Past land use - un-grouped	On site	0-50m	50-250m	250-500m	500-2000m
18	2.1	<u>Historical industrial land uses</u>	3	5	5	3	-
19	2.2	<u>Historical tanks</u>	0	0	2	1	-
20	2.3	<u>Historical energy features</u>	0	0	14	26	-
21	2.4	Historical petrol stations	0	0	0	0	-
22	2.5	<u>Historical garages</u>	0	0	0	2	-
Page	Section	Waste and landfill	On site	0-50m	50-250m	250-500m	500-2000m
23	3.1	Active or recent landfill	0	0	0	0	-
23	3.2	Historical landfill (BGS records)	0	0	0	0	-
24	3.3	Historical landfill (LA/mapping records)	0	0	0	0	-
24	3.4	Historical landfill (EA/NRW records)	0	0	0	0	-
24	3.5	Historical waste sites	0	0	0	0	-
24	3.6	Licensed waste sites	0	0	0	0	-
24	3.7	<u>Waste exemptions</u>	0	0	0	4	-
Page	Section	Current industrial land use	On site	0-50m	50-250m	250-500m	500-2000m
26	4.1	<u>Recent industrial land uses</u>	0	1	8	-	-
27	4.2	Current or recent petrol stations	0	0	0	0	-
27	4.3	Electricity cables	0	0	0	0	-
27	4.4	Gas pipelines	0	0	0	0	-
28	4.5	Sites determined as Contaminated Land	0	0	0	0	-



28	4.6	Control of Major Accident Hazards (COMAH)	0	0	0	0	-
28	4.7	Regulated explosive sites	0	0	0	0	-
28	4.8	Hazardous substance storage/usage	0	0	0	0	-
28	4.9	Historical licensed industrial activities (IPC)	0	0	0	0	-
29	4.10	Licensed industrial activities (Part A(1))	0	0	0	0	-
29	4.11	Licensed pollutant release (Part A(2)/B)	0	0	0	0	-
29	4.12	Radioactive Substance Authorisations	0	0	0	0	-
29	4.13	Licensed Discharges to controlled waters	0	0	0	0	-
29	4.14	Pollutant release to surface waters (Red List)	0	0	0	0	-
30	4.15	Pollutant release to public sewer	0	0	0	0	-
30	4.16	List 1 Dangerous Substances	0	0	0	0	-
30	4.17	List 2 Dangerous Substances	0	0	0	0	-
30	4.18	Pollution Incidents (EA/NRW)	0	0	0	0	-
30	4.19	Pollution inventory substances	0	0	0	0	-
31	4.20	Pollution inventory waste transfers	0	0	0	0	-
31	4.21	Pollution inventory radioactive waste	0	0	0	0	-
Page	Section	Hydrogeology	On site	0-50m	50-250m	250-500m	500-2000m
32	5.1	Superficial aquifer	None (within 500m)				
33	5.2	<u>Bedrock aquifer</u>	Identified (within 500m)				
35	5.3	<u>Groundwater vulnerability</u>	Identified (within 50m)				
36	5.4	<u>Groundwater vulnerability- soluble rock risk</u>	Identified (within 0m)				
36	5.5	Groundwater vulnerability- local information	None (within 0m)				
37	5.6	<u>Groundwater abstractions</u>	0	0	0	0	14
41	5.7	Surface water abstractions	0	0	0	0	0
41	5.8	<u>Potable abstractions</u>	0	0	0	0	2
42	5.9	<u>Source Protection Zones</u>	1	0	0	1	-
42	5.10	Source Protection Zones (confined aquifer)	0	0	0	0	-
Page	Section	Hydrology	On site	0-50m	50-250m	250-500m	500-2000m
43	6.1	Water Network (OS MasterMap)	0	0	0	-	-

43	6.2	Surface water features	0	0	0	-	-
44	6.3	<u>WFD Surface water body catchments</u>	1	-	-	-	-
44	6.4	WFD Surface water bodies	0	0	0	-	-
44	6.5	<u>WFD Groundwater bodies</u>	1	-	-	-	-
Page	Section	River and coastal flooding	On site	0-50m	50-250m	250-500m	500-2000m
46	7.1	Risk of Flooding from Rivers and Sea (RoFRaS)	None (within 50m)				
46	7.2	Historical Flood Events	0	0	0	-	-
46	7.3	Flood Defences	0	0	0	-	-
46	7.4	Areas Benefiting from Flood Defences	0	0	0	-	-
47	7.5	Flood Storage Areas	0	0	0	-	-
48	7.6	Flood Zone 2	None (within 50m)				
48	7.7	Flood Zone 3	None (within 50m)				
Page	Section	Surface water flooding					
49	8.1	Surface water flooding	Negligible (within 50m)				
Page	Section	Groundwater flooding					
50	9.1	<u>Groundwater flooding</u>	Negligible (within 50m)				
Page	Section	Environmental designations	On site	0-50m	50-250m	250-500m	500-2000m
51	10.1	Sites of Special Scientific Interest (SSSI)	0	0	0	0	0
52	10.2	Conserved wetland sites (Ramsar sites)	0	0	0	0	0
52	10.3	Special Areas of Conservation (SAC)	0	0	0	0	0
52	10.4	Special Protection Areas (SPA)	0	0	0	0	0
52	10.5	National Nature Reserves (NNR)	0	0	0	0	0
53	10.6	Local Nature Reserves (LNR)	0	0	0	0	0
53	10.7	Designated Ancient Woodland	0	0	0	0	0
53	10.8	Biosphere Reserves	0	0	0	0	0
53	10.9	Forest Parks	0	0	0	0	0
54	10.10	Marine Conservation Zones	0	0	0	0	0
54	10.11	<u>Green Belt</u>	0	0	0	0	2
54	10.12	Proposed Ramsar sites	0	0	0	0	0



54	10.13	Possible Special Areas of Conservation (pSAC)	0	0	0	0	0
55	10.14	Potential Special Protection Areas (pSPA)	0	0	0	0	0
55	10.15	Nitrate Sensitive Areas	0	0	0	0	0
55	10.16	<u>Nitrate Vulnerable Zones</u>	0	0	0	1	1
56	10.17	<u>SSSI Impact Risk Zones</u>	1	-	-	-	-
57	10.18	SSSI Units	0	0	0	0	0
Page	Section	Visual and cultural designations	On site	0-50m	50-250m	250-500m	500-2000m
58	11.1	World Heritage Sites	0	0	0	-	-
58	11.2	Area of Outstanding Natural Beauty	0	0	0	-	-
58	11.3	National Parks	0	0	0	-	-
58	11.4	Listed Buildings	0	0	0	-	-
59	11.5	Conservation Areas	0	0	0	-	-
59	11.6	Scheduled Ancient Monuments	0	0	0	-	-
59	11.7	Registered Parks and Gardens	0	0	0	-	-
Page	Section	Agricultural designations	On site	0-50m	50-250m	250-500m	500-2000m
60	12.1	<u>Agricultural Land Classification</u>	Grade 2 (within 250m)				
61	12.2	Open Access Land	0	0	0	-	-
61	12.3	Tree Felling Licences	0	0	0	-	-
61	12.4	Environmental Stewardship Schemes	0	0	0	-	-
62	12.5	Countryside Stewardship Schemes	0	0	0	-	-
Page	Section	Habitat designations	On site	0-50m	50-250m	250-500m	500-2000m
63	13.1	Priority Habitat Inventory	0	0	0	-	-
63	13.2	Habitat Networks	0	0	0	-	-
63	13.3	Open Mosaic Habitat	0	0	0	-	-
63	13.4	Limestone Pavement Orders	0	0	0	-	-
Page	Section	Geology 1:10,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
64	14.1	<u>10k Availability</u>	Identified (within 500m)				
65	14.2	<u>Artificial and made ground (10k)</u>	0	0	1	3	-
67	14.3	Superficial geology (10k)	0	0	0	0	-

67	14.4	Landslip (10k)	0	0	0	0	-
68	14.5	<u>Bedrock geology (10k)</u>	1	0	0	1	-
69	14.6	Bedrock faults and other linear features (10k)	0	0	0	0	-
Page	Section	Geology 1:50,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
70	15.1	<u>50k Availability</u>	Identified (within 500m)				
71	15.2	<u>Artificial and made ground (50k)</u>	0	0	0	3	-
72	15.3	Artificial ground permeability (50k)	0	0	-	-	-
73	15.4	Superficial geology (50k)	0	0	0	0	-
73	15.5	Superficial permeability (50k)	None (within 50m)				
73	15.6	Landslip (50k)	0	0	0	0	-
73	15.7	Landslip permeability (50k)	None (within 50m)				
74	15.8	<u>Bedrock geology (50k)</u>	1	0	0	1	-
75	15.9	<u>Bedrock permeability (50k)</u>	Identified (within 50m)				
75	15.10	Bedrock faults and other linear features (50k)	0	0	0	0	-
Page	Section	Boreholes	On site	0-50m	50-250m	250-500m	500-2000m
76	16.1	BGS Boreholes	0	0	0	-	-
Page	Section	Natural ground subsidence					
77	17.1	<u>Shrink swell clays</u>	Negligible (within 50m)				
78	17.2	<u>Running sands</u>	Low (within 50m)				
79	17.3	<u>Compressible deposits</u>	Negligible (within 50m)				
80	17.4	<u>Collapsible deposits</u>	Very low (within 50m)				
81	17.5	<u>Landslides</u>	Very low (within 50m)				
82	17.6	<u>Ground dissolution of soluble rocks</u>	Negligible (within 50m)				
Page	Section	Mining, ground workings and natural cavities	On site	0-50m	50-250m	250-500m	500-2000m
83	18.1	<u>Natural cavities</u>	0	0	0	1	-
84	18.2	<u>BritPits</u>	0	0	0	1	-
84	18.3	Surface ground workings	0	0	0	-	-
85	18.4	<u>Underground workings</u>	0	0	0	0	3
85	18.5	Historical Mineral Planning Areas	0	0	0	0	-



85	18.6	<u>Non-coal mining</u>	1	0	0	2	4
86	18.7	<u>Mining cavities</u>	0	0	1	0	2
87	18.8	JPB mining areas	None (within 0m)				
87	18.9	Coal mining	None (within 0m)				
87	18.10	Brine areas	None (within 0m)				
87	18.11	Gypsum areas	None (within 0m)				
87	18.12	Tin mining	None (within 0m)				
88	18.13	Clay mining	None (within 0m)				
Page	Section	Radon					
89	19.1	<u>Radon</u>	Between 1% and 3% (within 0m)				
Page	Section	Soil chemistry	On site	0-50m	50-250m	250-500m	500-2000m
90	20.1	<u>BGS Estimated Background Soil Chemistry</u>	1	0	-	-	-
90	20.2	BGS Estimated Urban Soil Chemistry	0	0	-	-	-
90	20.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-
Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
91	21.1	Underground railways (London)	0	0	0	-	-
91	21.2	Underground railways (Non-London)	0	0	0	-	-
91	21.3	Railway tunnels	0	0	0	-	-
91	21.4	Historical railway and tunnel features	0	0	0	-	-
91	21.5	Royal Mail tunnels	0	0	0	-	-
92	21.6	Historical railways	0	0	0	-	-
92	21.7	Railways	0	0	0	-	-
92	21.8	Crossrail 1	0	0	0	0	-
92	21.9	Crossrail 2	0	0	0	0	-
92	21.10	HS2	0	0	0	0	-

Recent aerial photograph



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Capture Date: 01/09/2018

Site Area: 0.42ha



Contact us with any questions at:

info@groundsure.com

08444 159 000

Date: 4 August 2021

Recent site history - 2015 aerial photograph



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Capture Date: 30/06/2015

Site Area: 0.42ha



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Date: 4 August 2021

Recent site history - 2012 aerial photograph



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Capture Date: 25/05/2012

Site Area: 0.42ha



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Date: 4 August 2021

Recent site history - 2009 aerial photograph



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Capture Date: 27/09/2009

Site Area: 0.42ha



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Date: 4 August 2021

Recent site history - 1999 aerial photograph



Capture Date: 03/09/1999

Site Area: 0.42ha



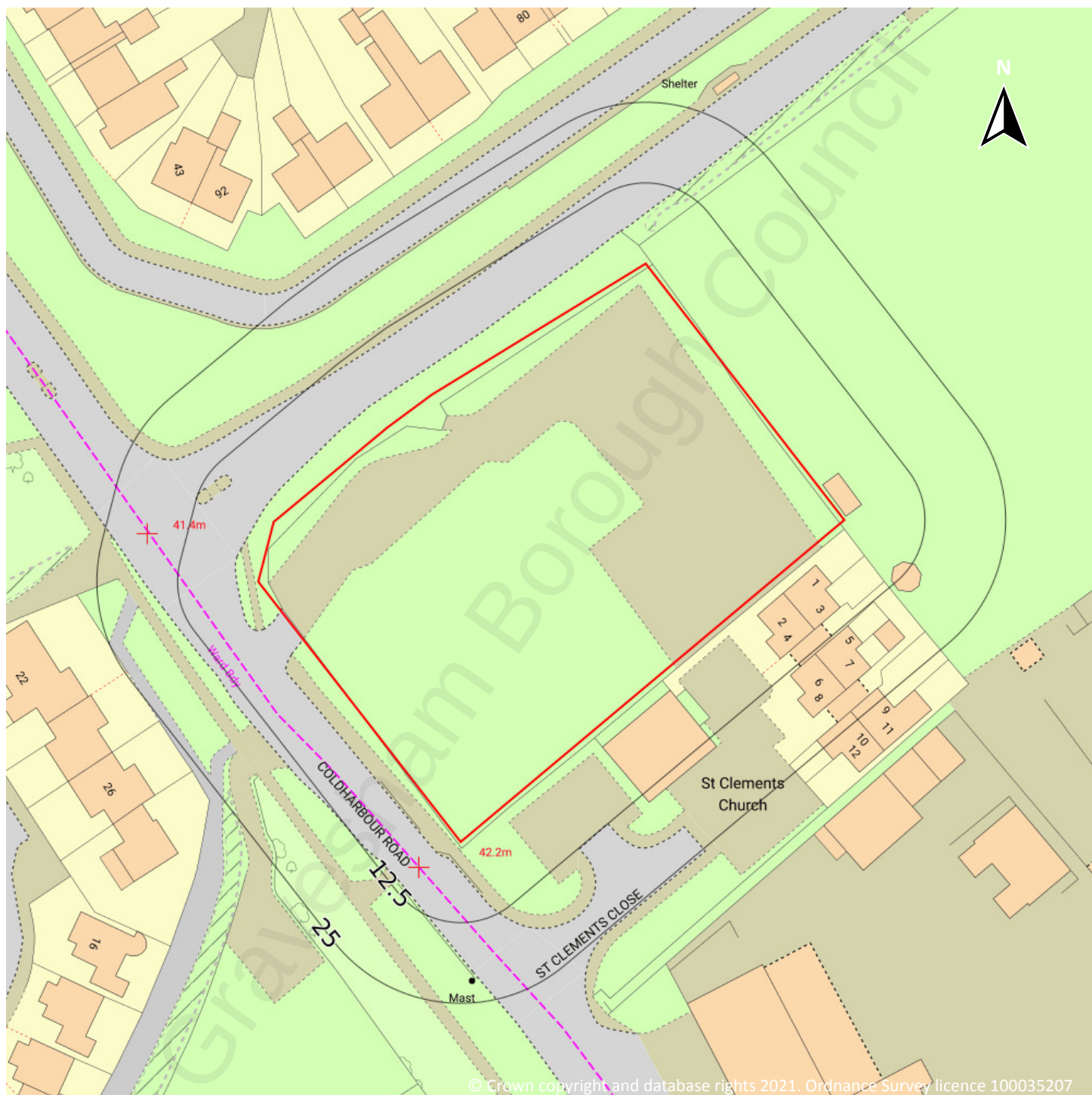
Contact us with any questions at:

info@groundsure.com

08444 159 000

Date: 4 August 2021

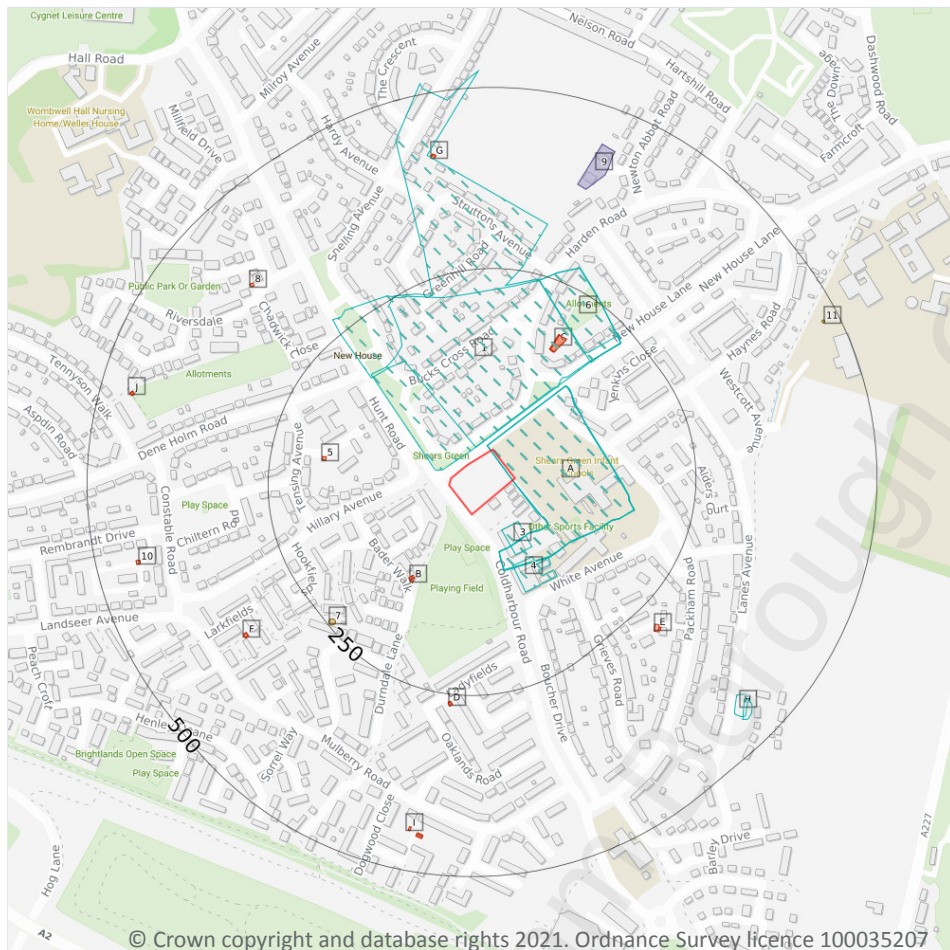
OS MasterMap site plan



Site Area: 0.42ha



1 Past land use



- Site Outline
- Search buffers in metres (m)
- Historical industrial land uses
- Historical tanks
- Historical energy features
- Historical garages

1.1 Historical industrial land uses

Records within 500m

10

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 1:10,560 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
A	On site	Nursery	1888	2201025



ID	Location	Land use	Dates present	Group ID
A	On site	Nursery	1895	2218812
A	On site	Nursery	1907	2280816
1	14m NW	Nurseries	1931	2168313
2	15m NW	Nursery	1907	2270472
3	43m SE	Fire Station	1971 - 1990	2251395
4	91m SE	Ambulance Station	1971 - 1990	2196232
6	181m NE	Nursery	1888 - 1895	2170961
H	428m SE	Old Chalk Pit	1888 - 1895	2194828
H	440m SE	Unspecified Pit	1865	2126189

This data is sourced from Ordnance Survey / Groundsure.

1.2 Historical tanks

Records within 500m

2

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
7	239m SW	Unspecified Tank	1909 - 1938	383856
11	476m NE	Unspecified Tank	1974	369293

This data is sourced from Ordnance Survey / Groundsure.

1.3 Historical energy features

Records within 500m

20

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
B	117m SW	Electricity Transformer	1974	250929
B	117m SW	Electricity Substation	1982 - 1983	284317
C	158m NE	Electricity Substation	1953 - 1983	288241
C	159m NE	Electricity Substation	1953	259191
5	174m W	Electricity Substation	1971 - 1987	269236
D	260m S	Electricity Transformer	1973	250926
D	260m S	Electricity Substation	1988 - 1994	284962
E	279m SE	Electricity Transformer	1971 - 1974	273161
E	286m SE	Electricity Substation	1982 - 1983	281200
F	346m SW	Electricity Substation	1986 - 1987	265647
F	346m SW	Electricity Transformer	1971	250928
8	380m NW	Electricity Substation	1984 - 1990	288451
G	409m N	Electricity Substation	1981	247722
G	409m N	Electricity Transformer	1974	250925
10	439m W	Electricity Substation	1971 - 1987	266479
I	439m S	Electricity Substation	1988	247730
I	446m S	Electricity Transformer	1973	250927
I	447m S	Electricity Substation	1994	247728
J	452m W	Electricity Substation	1986 - 1987	262916
J	453m W	Electricity Transformer	1971	250930

This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m

0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.



This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m

1

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original ungrouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 14**

ID	Location	Land use	Dates present	Group ID
9	382m N	Garages	1953	85862

This data is sourced from Ordnance Survey / Groundsure.

1.6 Historical military land

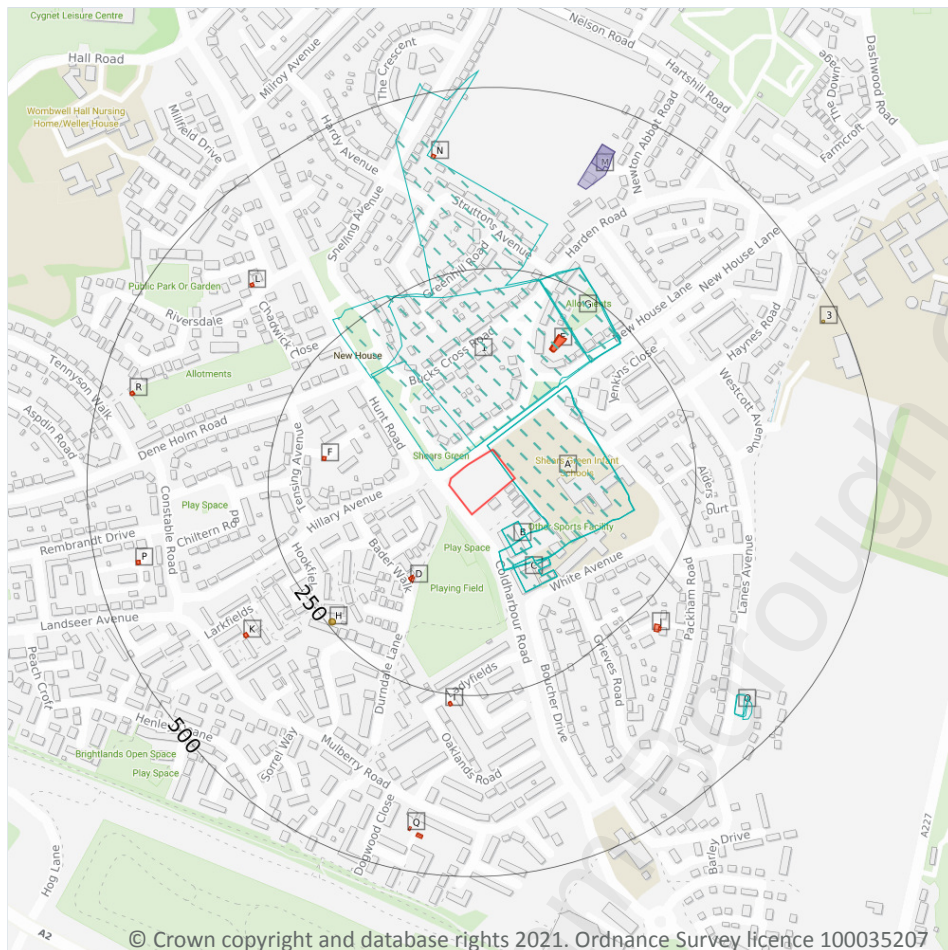
Records within 500m

0

Areas of military land digitised from multiple sources including the National Archives, local records, MOD records and verified other sources, intelligently grouped into contiguous features.

This data is sourced from Ordnance Survey / Groundsure / other sources.

2 Past land use - un-grouped



- Site Outline
- Search buffers in metres (m)
- Historical industrial land uses
- Historical tanks
- Historical energy features
- Historical garages

2.1 Historical industrial land uses

Records within 500m

16

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 10,560 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
A	On site	Nursery	1907	2280816
A	On site	Nursery	1895	2218812
A	On site	Nursery	1888	2201025



ID	Location	Land Use	Date	Group ID
1	14m NW	Nurseries	1931	2168313
2	15m NW	Nursery	1907	2270472
B	43m SE	Fire Station	1990	2251395
B	43m SE	Fire Station	1977	2251395
B	43m SE	Fire Station	1971	2251395
C	91m SE	Ambulance Station	1990	2196232
C	91m SE	Ambulance Station	1977	2196232
C	91m SE	Ambulance Station	1971	2196232
G	181m NE	Nursery	1895	2170961
G	182m NE	Nursery	1888	2170961
O	428m SE	Old Chalk Pit	1888	2194828
O	429m SE	Old Chalk Pit	1895	2194828
O	440m SE	Unspecified Pit	1865	2126189

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m

3

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
H	239m SW	Unspecified Tank	1909	383856
H	239m SW	Unspecified Tank	1938	383856
3	476m NE	Unspecified Tank	1974	369293

This data is sourced from Ordnance Survey / Groundsure.



2.3 Historical energy features

Records within 500m

40

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
D	117m SW	Electricity Transformer	1974	250929
D	117m SW	Electricity Substation	1983	284317
D	117m SW	Electricity Substation	1983	284317
D	117m SW	Electricity Substation	1982	284317
D	117m SW	Electricity Substation	1983	284317
E	158m NE	Electricity Substation	1983	288241
E	158m NE	Electricity Substation	1982	288241
E	158m NE	Electricity Substation	1983	288241
E	159m NE	Electricity Substation	1974	288241
E	159m NE	Electricity Substation	1953	288241
E	159m NE	Electricity Substation	1953	259191
F	174m W	Electricity Substation	1971	269236
F	174m W	Electricity Substation	1987	269236
F	174m W	Electricity Substation	1986	269236
I	260m S	Electricity Transformer	1973	250926
I	260m S	Electricity Substation	1988	284962
I	260m S	Electricity Substation	1994	284962
J	279m SE	Electricity Transformer	1971	273161
J	279m SE	Electricity Transformer	1974	273161
J	286m SE	Electricity Substation	1983	281200
J	286m SE	Electricity Substation	1983	281200
J	286m SE	Electricity Substation	1982	281200
J	286m SE	Electricity Substation	1983	281200



ID	Location	Land Use	Date	Group ID
K	346m SW	Electricity Substation	1987	265647
K	346m SW	Electricity Substation	1986	265647
K	346m SW	Electricity Transformer	1971	250928
L	380m NW	Electricity Substation	1984	288451
L	380m NW	Electricity Substation	1987	288451
L	380m NW	Electricity Substation	1990	288451
N	409m N	Electricity Transformer	1974	250925
N	409m N	Electricity Substation	1981	247722
P	439m W	Electricity Substation	1987	266479
P	439m W	Electricity Substation	1986	266479
Q	439m S	Electricity Substation	1988	247730
P	440m W	Electricity Substation	1971	266479
Q	446m S	Electricity Transformer	1973	250927
Q	447m S	Electricity Substation	1994	247728
R	452m W	Electricity Substation	1987	262916
R	452m W	Electricity Substation	1986	262916
R	453m W	Electricity Transformer	1971	250930

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m

0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.



2.5 Historical garages

Records within 500m

2

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

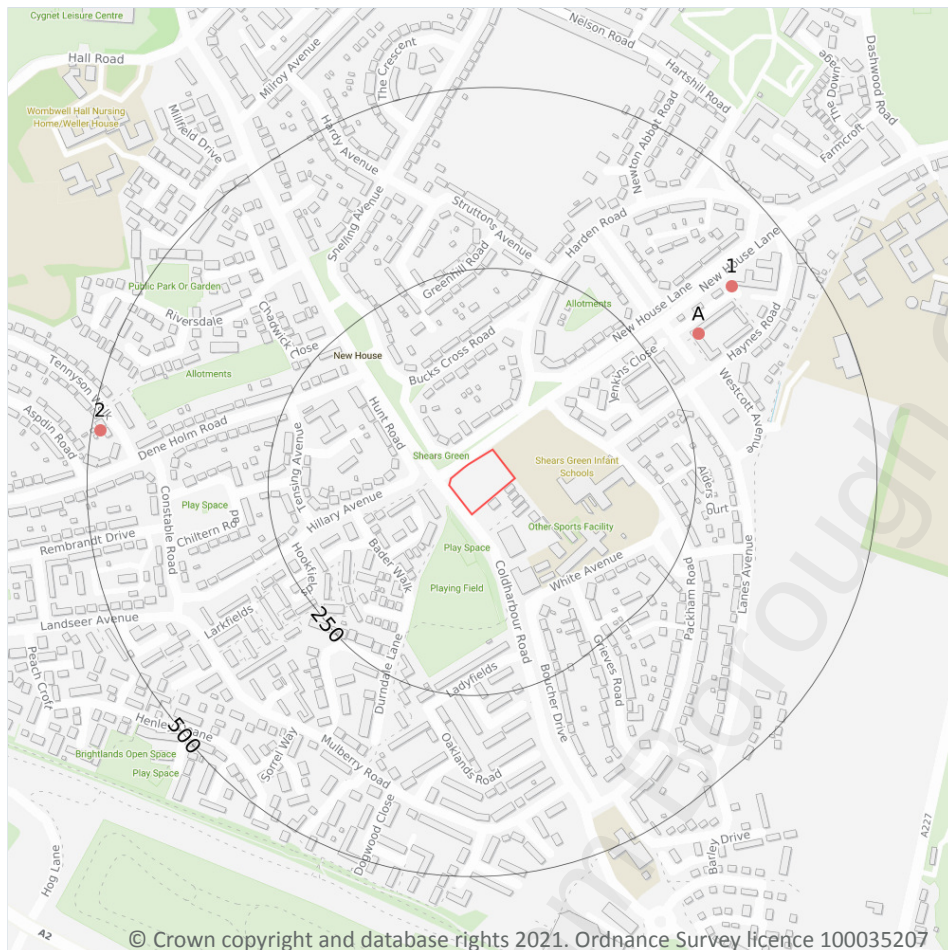
Features are displayed on the Past land use - un-grouped map on **page 18**

ID	Location	Land Use	Date	Group ID
M	382m N	Garages	1953	85862
M	415m N	Garages	1953	85862

This data is sourced from Ordnance Survey / Groundsure.



3 Waste and landfill



— Site Outline
Search buffers in metres (m)
● Waste exemptions

3.1 Active or recent landfill

Records within 500m

0

Active or recently closed landfill sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.2 Historical landfill (BGS records)

Records within 500m

0

Landfill sites identified on a survey carried out on behalf of the DoE in 1973. These sites may have been closed or operational at this time.

This data is sourced from the British Geological Survey.



3.3 Historical landfill (LA/mapping records)

Records within 500m

0

Landfill sites identified from Local Authority records and high detail historical mapping.

This data is sourced from the Ordnance Survey/Groundsure and Local Authority records.

3.4 Historical landfill (EA/NRW records)

Records within 500m

0

Known historical (closed) landfill sites (e.g. sites where there is no PPC permit or waste management licence currently in force). This includes sites that existed before the waste licensing regime and sites that have been licensed in the past but where a licence has been revoked, ceased to exist or surrendered and a certificate of completion has been issued.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.5 Historical waste sites

Records within 500m

0

Waste site records derived from Local Authority planning records and high detail historical mapping.

This data is sourced from Ordnance Survey/Groundsure and Local Authority records.

3.6 Licensed waste sites

Records within 500m

0

Active or recently closed waste sites under Environment Agency/Natural Resources Wales regulation.

This data is sourced from the Environment Agency and Natural Resources Wales.

3.7 Waste exemptions

Records within 500m

4

Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit. Exemptions have specific limits and conditions that must be adhered to.

Features are displayed on the Waste and landfill map on **page 23**

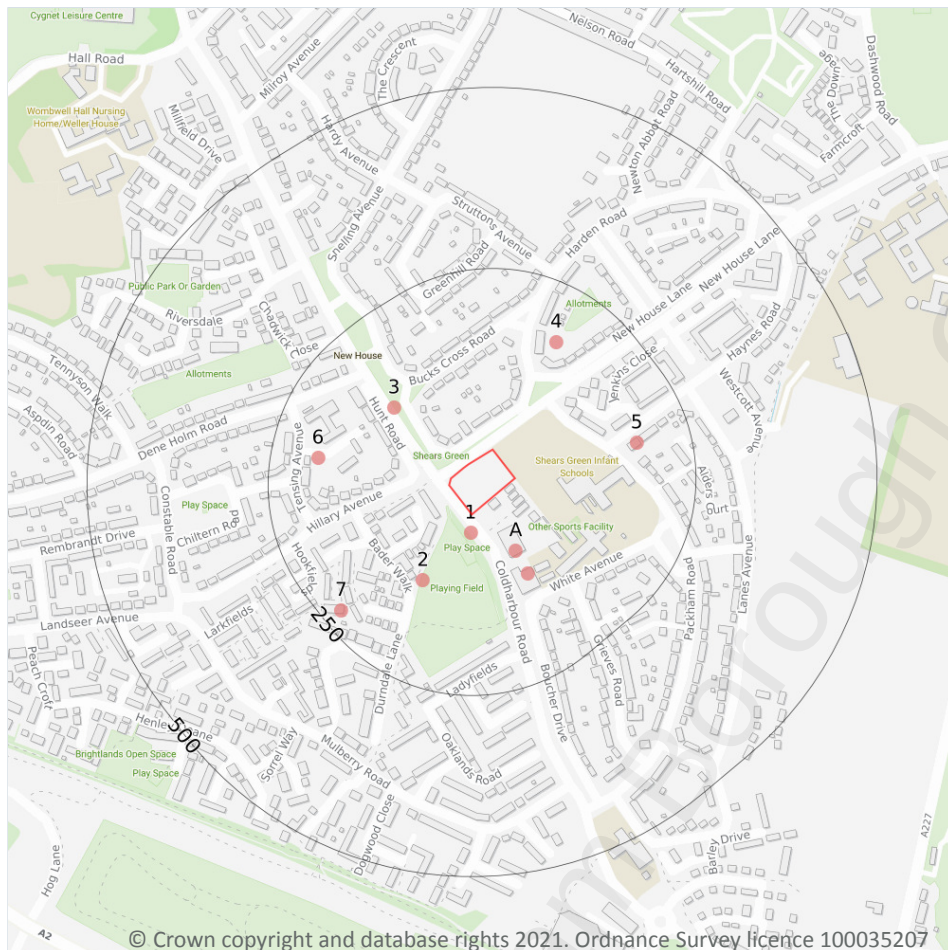
ID	Location	Site	Reference	Category	Sub-Category	Description
A	322m NE	16, LAWRENCE SQUARE, NORTHFLEET, GRAVESEND, DA11 7HW	WEX150674	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal

ID	Location	Site	Reference	Category	Sub-Category	Description
A	322m NE	16, LAWRANCE SQUARE, HAYNES ROAD, NORTHFLEET, GRAVESEND, DA11 7HW	WEX001536	Treating waste exemption	Not on a farm	Sorting and de-naturing of controlled drugs for disposal
1	398m NE	Chadwicks Chemist 16 Lawrence Square Northfleet Kent DA11 7HW	EPR/DE5952ER /A001	Treating waste exemption	Non- Agricultural Waste Only	Sorting and de-naturing of controlled drugs for disposal
2	488m W	Pender Chemist 29 Dene Holm Road Northfleet Kent DA11 8LG	EPR/RE5852E G/A001	Treating waste exemption	Non- Agricultural Waste Only	Sorting and de-naturing of controlled drugs for disposal

This data is sourced from the Environment Agency and Natural Resources Wales.



4 Current industrial land use



- Site Outline
- Search buffers in metres (m)
- Recent industrial land uses

4.1 Recent industrial land uses

Records within 250m

9

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on **page 26**

ID	Location	Company	Address	Activity	Category
1	25m S	Mast	Kent, DA11	Telecommunications Features	Infrastructure and Facilities
A	77m SE	Thames-Side Fire Station	Coldharbour Road, Northfleet, Gravesend, Kent, DA11 8NT	Fire Brigade Stations	Central and Local Government



ID	Location	Company	Address	Activity	Category
A	112m SE	Thameside Ambulance Station	Coldharbour Road, Northfleet, Gravesend, Kent, DA11 8NT	Ambulance and Medical Transportation Services	Health Support Services
2	113m SW	Electricity Sub Station	Kent, DA11	Electrical Features	Infrastructure and Facilities
3	126m NW	Mast	Kent, DA11	Telecommunications Features	Infrastructure and Facilities
4	173m NE	Electricity Sub Station	Kent, DA11	Electrical Features	Infrastructure and Facilities
5	175m E	Teckno Geek	61, Haynes Road, Northfleet, Gravesend, Kent, DA11 7HZ	Electrical Equipment Repair and Servicing	Repair and Servicing
6	185m W	Electricity Sub Station	Kent, DA11	Electrical Features	Infrastructure and Facilities
7	224m SW	Rainey Makes	11, Dowding Walk, Northfleet, Gravesend, Kent, DA11 8PX	Giftware	Consumer Products

This data is sourced from Ordnance Survey.

4.2 Current or recent petrol stations

Records within 500m	0
----------------------------	----------

Open, closed, under development and obsolete petrol stations.

This data is sourced from Experian.

4.3 Electricity cables

Records within 500m	0
----------------------------	----------

High voltage underground electricity transmission cables.

This data is sourced from National Grid.

4.4 Gas pipelines

Records within 500m	0
----------------------------	----------

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.5 Sites determined as Contaminated Land

Records within 500m**0**

Contaminated Land Register of sites designated under Part 2a of the Environmental Protection Act 1990.

This data is sourced from Local Authority records.

4.6 Control of Major Accident Hazards (COMAH)

Records within 500m**0**

Control of Major Accident Hazards (COMAH) sites. This data includes upper and lower tier sites, and includes a historical archive of COMAH sites and Notification of Installations Handling Hazardous Substances (NIHHS) records.

This data is sourced from the Health and Safety Executive.

4.7 Regulated explosive sites

Records within 500m**0**

Sites registered and licensed by the Health and Safety Executive under the Manufacture and Storage of Explosives Regulations 2005 (MSER). The last update to this data was in April 2011.

This data is sourced from the Health and Safety Executive.

4.8 Hazardous substance storage/usage

Records within 500m**0**

Consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

This data is sourced from Local Authority records.

4.9 Historical licensed industrial activities (IPC)

Records within 500m**0**

Integrated Pollution Control (IPC) records of substance releases to air, land and water. This data represents a historical archive as the IPC regime has been superseded.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.10 Licensed industrial activities (Part A(1))

Records within 500m**0**

Records of Part A(1) installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.11 Licensed pollutant release (Part A(2)/B)

Records within 500m**0**

Records of Part A(2) and Part B installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from Local Authority records.

4.12 Radioactive Substance Authorisations

Records within 500m**0**

Records of the storage, use, accumulation and disposal of radioactive substances regulated under the Radioactive Substances Act 1993.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.13 Licensed Discharges to controlled waters

Records within 500m**0**

Discharges of treated or untreated effluent to controlled waters under the Water Resources Act 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.14 Pollutant release to surface waters (Red List)

Records within 500m**0**

Discharges of specified substances under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.15 Pollutant release to public sewer

Records within 500m**0**

Discharges of Special Category Effluents to the public sewer.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.16 List 1 Dangerous Substances

Records within 500m**0**

Discharges of substances identified on List I of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.17 List 2 Dangerous Substances

Records within 500m**0**

Discharges of substances identified on List II of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.18 Pollution Incidents (EA/NRW)

Records within 500m**0**

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.19 Pollution inventory substances

Records within 500m**0**

The pollution inventory (substances) includes reporting on annual emissions of certain regulated substances to air, controlled waters and land. A reporting threshold for each substance is also included. Where emissions fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.20 Pollution inventory waste transfers

Records within 500m

0

The pollution inventory (waste transfers) includes reporting on annual transfers and recovery/disposal of controlled wastes from a site. A reporting threshold for each waste type is also included. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.21 Pollution inventory radioactive waste

Records within 500m

0

The pollution inventory (radioactive wastes) includes reporting on annual releases of radioactive substances from a site, including the means of release. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

5 Hydrogeology - Superficial aquifer

5.1 Superficial aquifer

Records within 500m

0

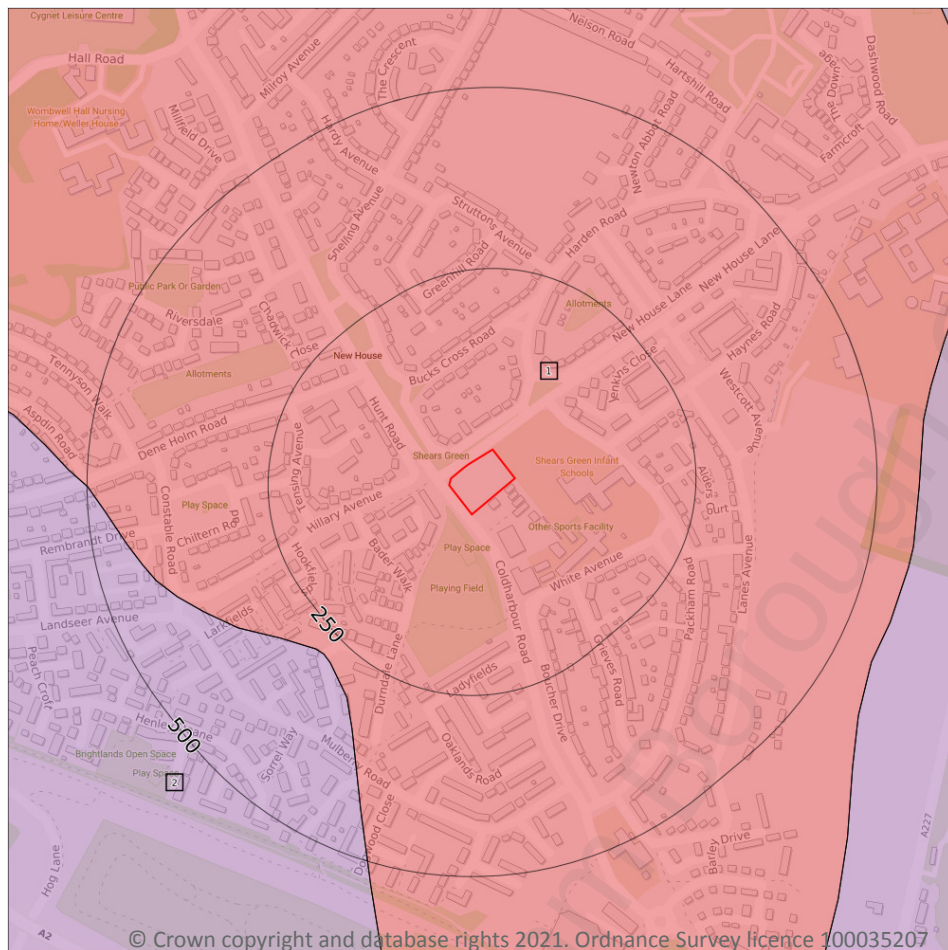
Aquifer status of groundwater held within superficial geology.

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Gravesham Borough Council



Bedrock aquifer



- Site Outline**
- Search buffers in metres (m)**
- Principal
 - Secondary A
 - Secondary B
 - Secondary Undifferentiated
 - Unproductive

5.2 Bedrock aquifer

Records within 500m

2

Aquifer status of groundwater held within bedrock geology.

Features are displayed on the Bedrock aquifer map on **page 33**

ID	Location	Designation	Description
1	On site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	281m SW	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

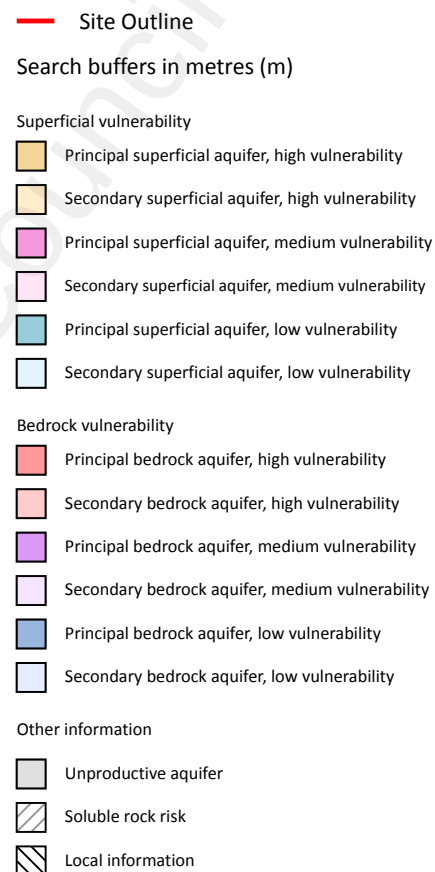
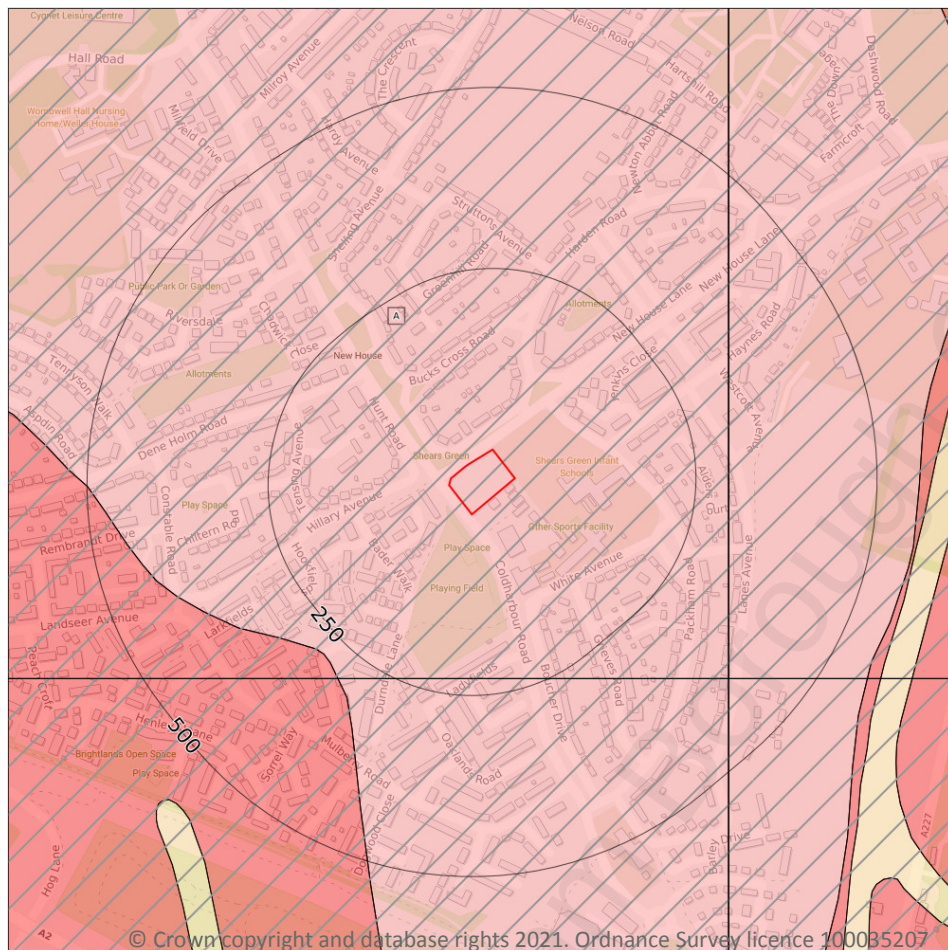


This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Gravesend Borough Council



Groundwater vulnerability



5.3 Groundwater vulnerability

Records within 50m

1

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Features are displayed on the Groundwater vulnerability map on **page 35**



ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
A	On site	Summary Classification: Secondary bedrock aquifer - High Vulnerability Combined classification: Productive Bedrock Aquifer, No Superficial Aquifer	Leaching class: Intermediate Infiltration value: >70% Dilution value: <300mm/year	Vulnerability: - Aquifer type: - Thickness: <3m Patchiness value: <90% Recharge potential: No Data	Vulnerability: High Aquifer type: Secondary Flow mechanism: Well connected fractures

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

5.4 Groundwater vulnerability- soluble rock risk

Records on site	1
------------------------	----------

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

ID	Maximum soluble risk category	Percentage of grid square covered by maximum risk
A	Very significant soluble rocks are likely to be present with a moderate possibility of localised natural subsidence or dissolution-related degradation of bedrock, especially in adverse conditions such as concentrated surface or subsurface water flow.	6.0%

This data is sourced from the British Geological Survey and the Environment Agency.

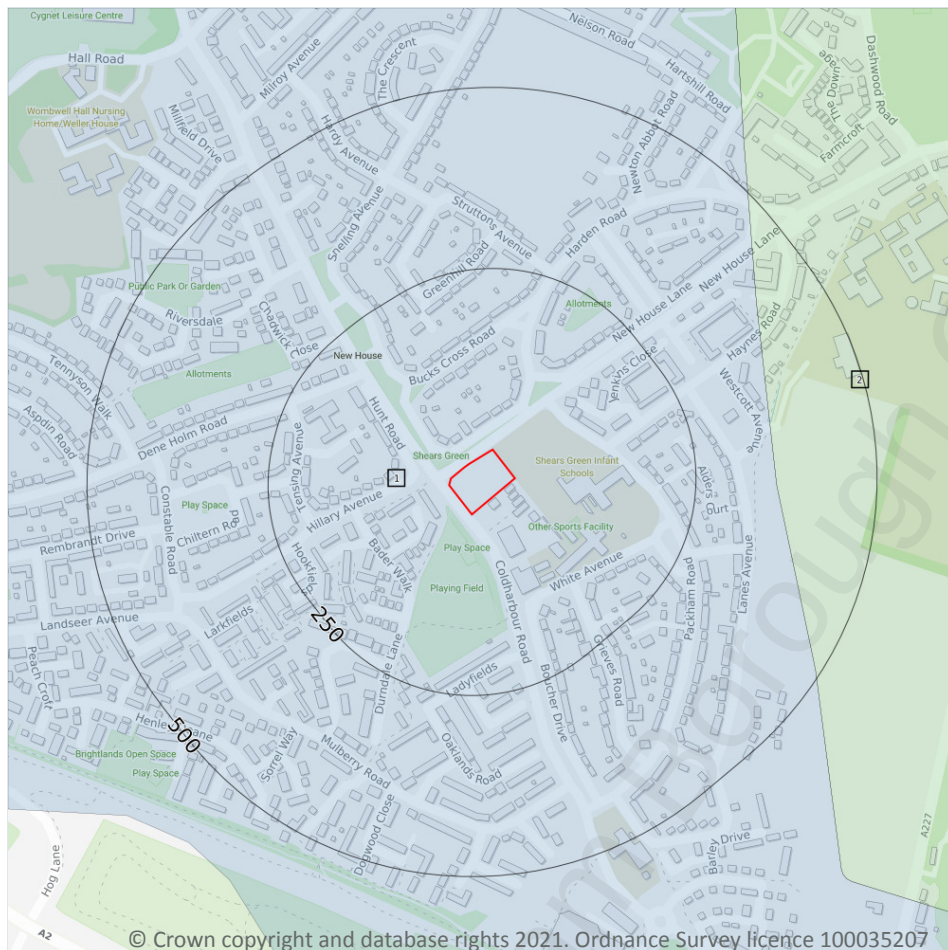
5.5 Groundwater vulnerability- local information

Records on site	0
------------------------	----------

This dataset identifies areas where additional local information affecting vulnerability is held by the Environment Agency. Further information can be obtained by contacting the Environment Agency local Area groundwater team through the Environment Agency National Customer Call Centre on 03798 506 506 or by email on enquiries@environment-agency.gov.uk.

This data is sourced from the British Geological Survey and the Environment Agency.

Abstractions and Source Protection Zones



- Site Outline
- Search buffers in metres (m)**
- Source Protection Zone 1
Inner catchment
- Source Protection Zone 2
Outer catchment
- Source Protection Zone 3
Total catchment
- Source Protection Zone 4
Zone of Special Interest
- Source Protection Zone 1c
Inner catchment - confined aquifer
- Source Protection Zone 2c
Outer catchment - confined aquifer
- Source Protection Zone 3c
Total catchment - confined aquifer
- Drinking water abstraction licences
Polygon features
- Drinking water abstraction licences
Linear features
- Groundwater abstraction licence (point)
- Groundwater abstraction licence (area)
- Groundwater abstraction licence (linear)
- Surface Water Abstractions (point)
- Surface Water Abstractions (area)
- Surface Water Abstractions (linear)

5.6 Groundwater abstractions

Records within 2000m

14

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 37**

ID	Location	Details	
-	742m SE	Status: Active Licence No: SO/040/0001/019 Details: Spray Irrigation - Storage Direct Source: Southern Region Groundwater Point: MID KENT GOLF CLUB BOREHOLE Data Type: Point Name: Mid Kent Golf Club Limited Easting: 564325 Northing: 171869	Annual Volume (m ³): 10,000 Max Daily Volume (m ³): 50 Original Application No: - Original Start Date: 29/10/2014 Expiry Date: 31/03/2024 Issue No: 1 Version Start Date: 29/10/2014 Version End Date: -
-	1009m S	Status: Historical Licence No: 01/164 Details: Dust Suppression Direct Source: Southern Region Groundwater Point: TOLLGATE JUNCTION Data Type: Point Name: Skanska Civil Engineering Easting: 563900 Northing: 171250	Annual Volume (m ³): 38220 Max Daily Volume (m ³): 156 Original Application No: - Original Start Date: 01/11/2007 Expiry Date: 31/10/2008 Issue No: 1 Version Start Date: 01/11/2007 Version End Date: -
-	1126m SW	Status: Active Licence No: 9/40/01/0511/G Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLES, WELLS AND ADITS AT HAZELLS PS, NORTHFLEET Data Type: Poly4 Name: Southern Water Services Ltd Easting: 562950 Northing: 171340	Annual Volume (m ³): 17,700,000 Max Daily Volume (m ³): 92,000 Original Application No: - Original Start Date: 24/03/1986 Expiry Date: - Issue No: 100 Version Start Date: 27/11/2006 Version End Date: -
-	1596m NE	Status: Active Licence No: 9/40/01/0511/G Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLES, ADITS AND CATCHPITS AT WINDMILL HILL PS Data Type: Poly4 Name: Southern Water Services Ltd Easting: 565060 Northing: 173270	Annual Volume (m ³): 17,700,000 Max Daily Volume (m ³): 92,000 Original Application No: - Original Start Date: 24/03/1986 Expiry Date: - Issue No: 100 Version Start Date: 27/11/2006 Version End Date: -
-	1809m NW	Status: Active Licence No: 9/40/01/0092/B/GR Details: Process Water Direct Source: Southern Region Groundwater Point: BOREHOLE 2, H5 CHALK, NORTHFLEET. Data Type: Point Name: Kimberly-Clark Limited Easting: 562450 Northing: 173660	Annual Volume (m ³): 4,710,000 Max Daily Volume (m ³): 19,656 Original Application No: - Original Start Date: 27/05/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/07/1996 Version End Date: -



ID	Location	Details	
-	1816m NW	Status: Historical Licence No: 01/144 Details: Laundry Use Direct Source: Southern Region Groundwater Point: POINT A, BOREHOLE AT SPRINGHEAD ENTERPRISE PARK Data Type: Point Name: Shaws Laundries Ltd Easting: 562230 Northing: 173450	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 28/07/2000 Expiry Date: 05/06/2003 Issue No: 1 Version Start Date: 28/07/2000 Version End Date: -
-	1816m NW	Status: Historical Licence No: 01/154 Details: Laundry Use Direct Source: Southern Region Groundwater Point: POINT A, BOREHOLE AT SPRINGHEAD ENTERPRISE PARK Data Type: Point Name: Berendsen UK Limited Easting: 562230 Northing: 173450	Annual Volume (m ³): 120000 Max Daily Volume (m ³): 400 Original Application No: - Original Start Date: 03/05/2004 Expiry Date: 31/03/2018 Issue No: 5 Version Start Date: 05/12/2014 Version End Date: -
-	1816m NW	Status: Active Licence No: 01/154/R01 Details: Laundry Use Direct Source: Southern Region Groundwater Point: POINT A, BOREHOLE AT SPRINGHEAD ENTERPRISE PARK Data Type: Point Name: Berendsen UK Limited Easting: 562230 Northing: 173450	Annual Volume (m ³): 120,000 Max Daily Volume (m ³): 400 Original Application No: - Original Start Date: 01/04/2018 Expiry Date: 31/03/2030 Issue No: 1 Version Start Date: 01/04/2018 Version End Date: -
-	1835m NW	Status: Active Licence No: 9/40/01/0092/B/GR Details: Process Water Direct Source: Southern Region Groundwater Point: BOREHOLE 1, H5 CHALK, NORTHFLEET. Data Type: Point Name: Kimberly-Clark Limited Easting: 562410 Northing: 173660	Annual Volume (m ³): 4,710,000 Max Daily Volume (m ³): 19,656 Original Application No: - Original Start Date: 27/05/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/07/1996 Version End Date: -

ID	Location	Details	
-	1862m NW	Status: Historical Licence No: 9/40/01/0523/G Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A, WINGFIELD PARK FARM IN SOUTHFLEET. Data Type: Point Name: Beslee Farms Easting: 561900 Northing: 173000	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 12/03/1996 Version End Date: -
-	1862m NW	Status: Historical Licence No: 01/0157 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A, WINGFIELD PARK FARM IN SOUTHFLEET. Data Type: Point Name: Ebbsfleet Investment (GP) Limited Easting: 561900 Northing: 173000	Annual Volume (m ³): 16843 Max Daily Volume (m ³): 682 Original Application No: - Original Start Date: 17/11/2004 Expiry Date: 31/03/2018 Issue No: 2 Version Start Date: 18/07/2014 Version End Date: -
-	1967m W	Status: Historical Licence No: 9/40/01/0504/G Details: General Washing/Process Washing Direct Source: Southern Region Groundwater Point: POINT A, BOREHOLE, H5 CHALK, SOUTHFLEET. Data Type: Point Name: D.T.G. Elliott & Son Ltd. Easting: 561700 Northing: 172720	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 15/05/1978 Version End Date: -
-	1967m W	Status: Historical Licence No: 9/40/01/0504/G Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A, BOREHOLE, H5 CHALK, SOUTHFLEET. Data Type: Point Name: D.T.G. Elliott & Son Ltd. Easting: 561700 Northing: 172720	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 15/05/1978 Version End Date: -
-	1991m NW	Status: Historical Licence No: 9/40/01/0092/A/GR Details: Boiler Feed Direct Source: Southern Region Groundwater Point: POINT 2, GREENSAND BOREHOLE, NORTHFLEET. Data Type: Point Name: Kimberly-Clark Limited Easting: 562830 Northing: 174120	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 27/05/1966 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m

0

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.8 Potable abstractions

Records within 2000m

2

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 37**

ID	Location	Details	
-	1126m SW	Status: Active Licence No: 9/40/01/0511/G Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLES, WELLS AND ADITS AT HAZELLS PS, NORTHFLEET Data Type: Poly4 Name: Southern Water Services Ltd Easting: 562950 Northing: 171340	Annual Volume (m ³): 17,700,000 Max Daily Volume (m ³): 92,000 Original Application No: - Original Start Date: 24/03/1986 Expiry Date: - Issue No: 100 Version Start Date: 27/11/2006 Version End Date: -
-	1596m NE	Status: Active Licence No: 9/40/01/0511/G Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLES, ADITS AND CATCHPITS AT WINDMILL HILL PS Data Type: Poly4 Name: Southern Water Services Ltd Easting: 565060 Northing: 173270	Annual Volume (m ³): 17,700,000 Max Daily Volume (m ³): 92,000 Original Application No: - Original Start Date: 24/03/1986 Expiry Date: - Issue No: 100 Version Start Date: 27/11/2006 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.



5.9 Source Protection Zones

Records within 500m

2

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination. Features are displayed on the Abstractions and Source Protection Zones map on **page 37**

ID	Location	Type	Description
1	On site	2	Outer catchment
2	358m E	3	Total catchment

This data is sourced from the Environment Agency and Natural Resources Wales.

5.10 Source Protection Zones (confined aquifer)

Records within 500m

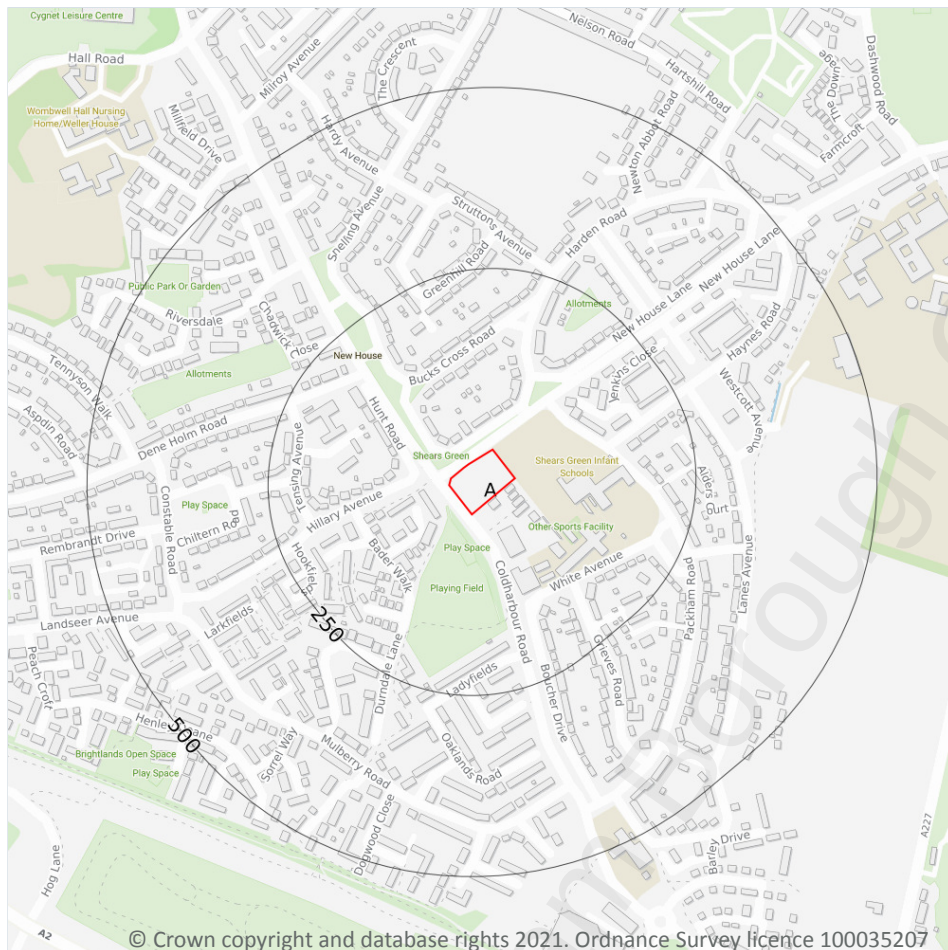
0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.



6 Hydrology



- Site Outline
- Search buffers in metres (m)
- Water Network (OS MasterMap)
- Surface water features (wider than 5m)
- Surface water features (narrower than 5m)
- ⋯ WFD River, canal and surface water transfer water bodies
- WFD Lake water bodies
- WFD Transitional and coastal water bodies
- WFD Surface water body catchments boundaries
- WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m

0

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m

0

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.



This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site	1
------------------------	----------

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on **page 43**

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
A	On site	Coastal Catchment	Not part of a river WB catchment	130	Lower Medway	Medway

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified	0
---------------------------	----------

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed.

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site	1
------------------------	----------

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

Features are displayed on the Hydrology map on **page 43**

ID	Location	Name	Water body ID	Overall rating	Chemical rating	Quantitative	Year
A	On site	North Kent Medway Chalk	<u>GB40601G500300</u>	Poor	Poor	Poor	2015



This data is sourced from the Environment Agency and Natural Resources Wales.

Gravesend Borough Council



7 River and coastal flooding

7.1 Risk of Flooding from Rivers and Sea (RoFRaS)

Records within 50m

0

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance).

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m

0

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m

0

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.4 Areas Benefiting from Flood Defences

Records within 250m

0

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m

0

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.

Gravesham Borough Council



River and coastal flooding - Flood Zones

7.6 Flood Zone 2

Records within 50m
0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.7 Flood Zone 3

Records within 50m
0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

8 Surface water flooding

8.1 Surface water flooding

Highest risk on site

Negligible

Highest risk within 50m

Negligible

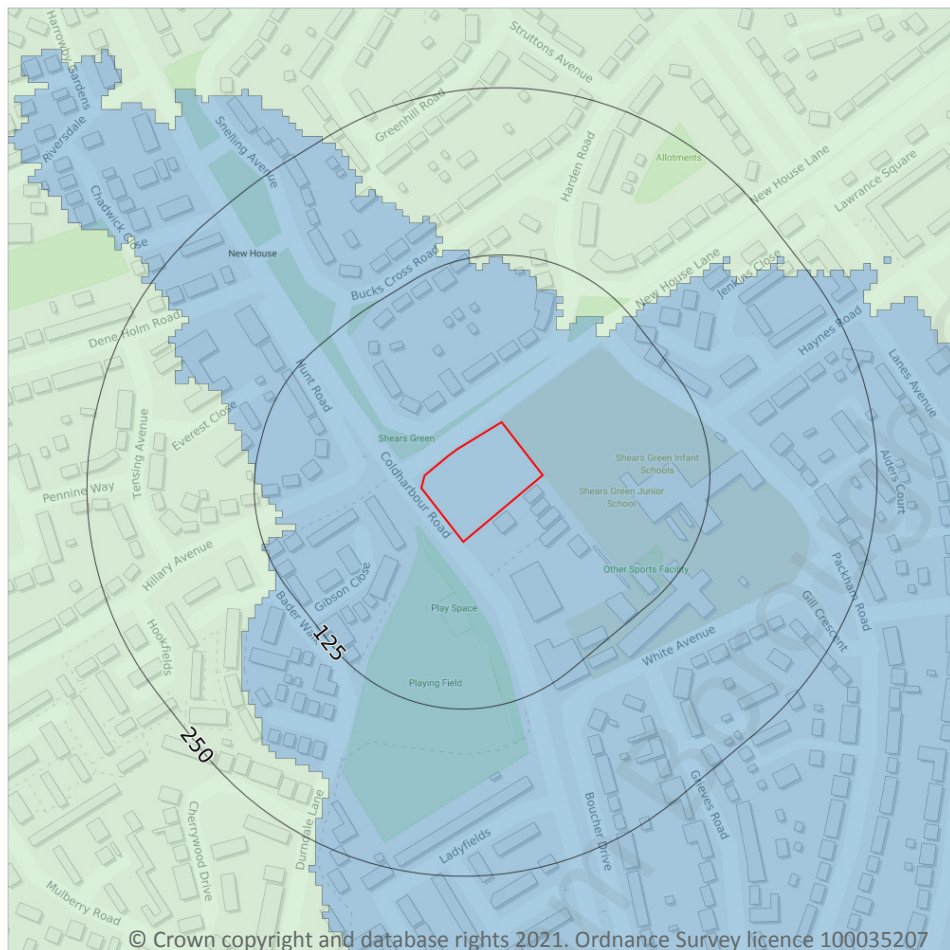
Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site. The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Negligible
1 in 250 year	Negligible
1 in 100 year	Negligible
1 in 30 year	Negligible

This data is sourced from Ambiental Risk Analytics.

9 Groundwater flooding



— Site Outline
Search buffers in metres (m)

- High
- Moderate - High
- Moderate
- Low
- Negligible

9.1 Groundwater flooding

Highest risk on site

Negligible

Highest risk within 50m

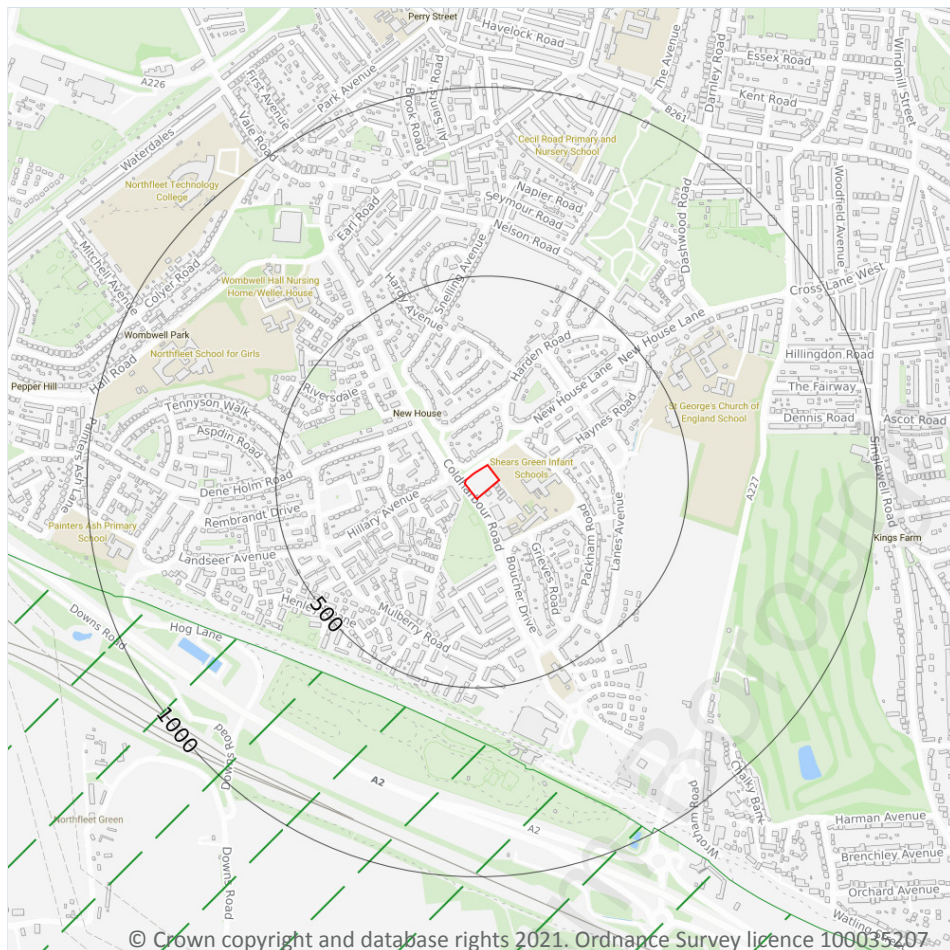
Negligible

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on **page 50**

This data is sourced from Ambiantal Risk Analytics.

10 Environmental designations



- Site Outline
- Search buffers in metres (m)
- Green Belt

10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m

0

Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.



10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m**0**

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. They cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. These sites cover a broad definition of wetland; marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, and even some marine areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.3 Special Areas of Conservation (SAC)

Records within 2000m**0**

Areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.4 Special Protection Areas (SPA)

Records within 2000m**0**

Sites classified by the UK Government under the EC Birds Directive, SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.5 National Nature Reserves (NNR)

Records within 2000m**0**

Sites containing examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats, provide special opportunities for scientific study or to provide public recreation compatible with natural heritage interests.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.6 Local Nature Reserves (LNR)

Records within 2000m

0

Sites managed for nature conservation, and to provide opportunities for research and education, or simply enjoying and having contact with nature. They are declared by local authorities under the National Parks and Access to the Countryside Act 1949 after consultation with the relevant statutory nature conservation agency.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.7 Designated Ancient Woodland

Records within 2000m

0

Ancient woodlands are classified as areas which have been wooded continuously since at least 1600 AD. This includes semi-natural woodland and plantations on ancient woodland sites. 'Wooded continuously' does not mean there is or has previously been continuous tree cover across the whole site, and not all trees within the woodland have to be old.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.8 Biosphere Reserves

Records within 2000m

0

Biosphere Reserves are internationally recognised by UNESCO as sites of excellence to balance conservation and socioeconomic development between nature and people. They are recognised under the Man and the Biosphere (MAB) Programme with the aim of promoting sustainable development founded on the work of the local community.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.9 Forest Parks

Records within 2000m

0

These are areas managed by the Forestry Commission designated on the basis of recreational, conservation or scenic interest.

This data is sourced from the Forestry Commission.

10.10 Marine Conservation Zones

Records within 2000m

0

A type of marine nature reserve in UK waters established under the Marine and Coastal Access Act (2009). They are designated with the aim to protect nationally important, rare or threatened habitats and species.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.11 Green Belt

Records within 2000m

2

Areas designated to prevent urban sprawl by keeping land permanently open.

Features are displayed on the Environmental designations map on **page 51**

ID	Location	Name	Local Authority name
1	580m SW	London	Gravesham
-	1359m W	London	Dartford

This data is sourced from the Ministry of Housing, Communities and Local Government.

10.12 Proposed Ramsar sites

Records within 2000m

0

Ramsar sites are areas listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) 1971. The sites here supplied have a status of 'Proposed' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m

0

Special Areas of Conservation are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive. Those sites supplied here are those with a status of 'Possible' having been identified for potential adoption under the framework.

This data is sourced from Natural England and Natural Resources Wales.

10.14 Potential Special Protection Areas (pSPA)

Records within 2000m

0

Special Protection Areas (SPAs) are areas designated (or 'classified') under the European Union Wild Birds Directive for the protection of nationally and internationally important populations of wild birds. Those sites supplied here are those with a status of 'Potential' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.15 Nitrate Sensitive Areas

Records within 2000m

0

Areas where nitrate concentrations in drinking water sources exceeded or was at risk of exceeding the limit of 50 mg/l set by the 1980 EC Drinking Water Directive. Voluntary agricultural measures as a means of reducing the levels of nitrate were introduced by DEFRA as MAFF, with payments being made to farmers who complied. The scheme was started as a pilot in 1990 in ten areas, later implemented within 32 areas. The scheme was closed to further new entrants in 1998, although existing agreements continued for their full term. All Nitrate Sensitive Areas fell within the areas designated as Nitrate Vulnerable Zones (NVZs) in 1996 under the EC Nitrate Directive (91/676/EEC).

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

Records within 2000m

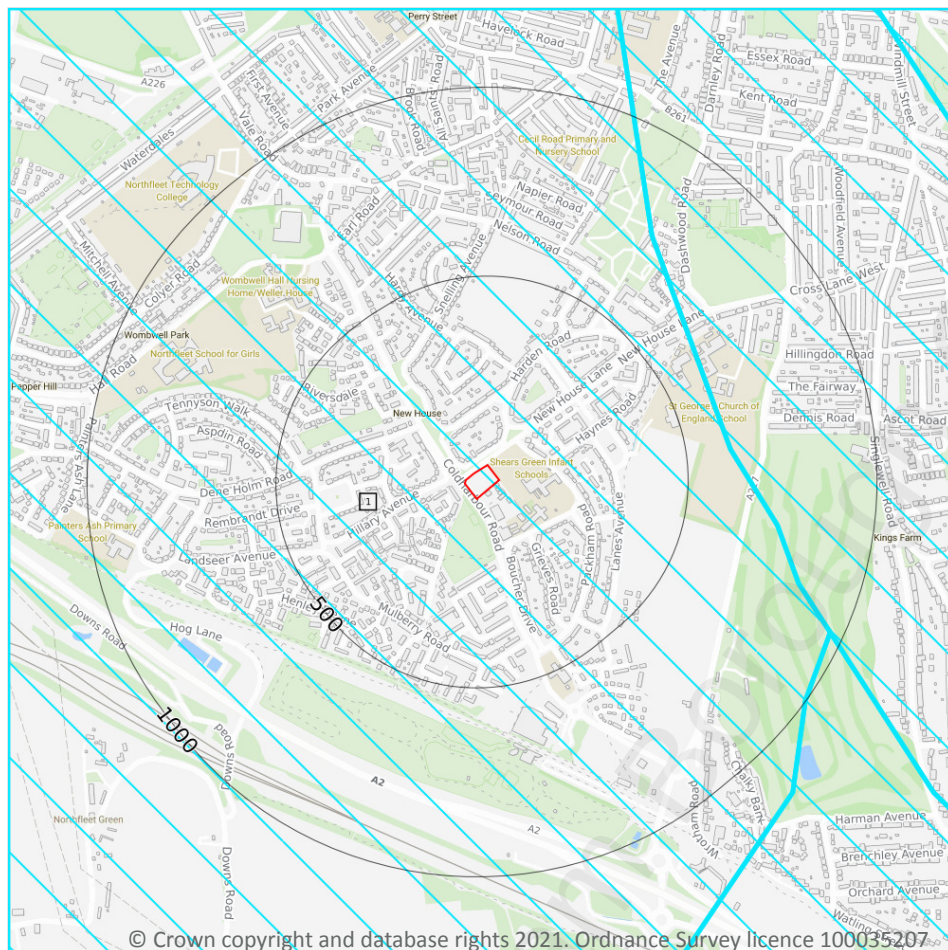
2

Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

Location	Name	Type	NVZ ID	Status
284m W	North Kent	Groundwater	G65	Existing
1017m E	North Kent	Groundwater	G65	Existing

This data is sourced from Natural England and Natural Resources Wales.

SSSI Impact Zones and Units



- Site Outline
- Search buffers in metres (m)
 - SSSI Impact Risk Zones
- SSSI Units
 - Not recorded
 - Favourable
 - Unfavourable - Recovering
 - Unfavourable - No change
 - Unfavourable - Declining
 - Partially destroyed
 - Destroyed

10.17 SSSI Impact Risk Zones

Records on site

1

Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

Features are displayed on the SSSI Impact Zones and Units map on **page 56**

ID	Location	Type of developments requiring consultation
1	On site	Infrastructure - Airports, helipads and other aviation proposals. Residential - Residential development of 500 units or more. Rural residential - Any residential development of 500 or more houses outside existing settlements/urban areas. Air pollution - Livestock & poultry units with floorspace > 500m², slurry lagoons > 750m² & manure stores > 3500t. Combustion - General combustion processes >50MW energy input. Incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion Discharges - Any discharge of water or liquid waste of more than 20m³/day to ground (ie to seep away) or to surface water, such as a beck or stream (NB This does not include discharges to mains sewer which are unlikely to pose a risk at this location) Notes: For new residential development in this area financial contributions are required to mitigate increased recreational disturbance on coastal SPAs and Ramsar Sites. Check with Local Planning Authority.

This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m	0
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Divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment, however, the size of units varies greatly depending on the types of management and the conservation interest.

This data is sourced from Natural England and Natural Resources Wales.



11 Visual and cultural designations

11.1 World Heritage Sites

Records within 250m

0

Sites designated for their globally important cultural or natural interest requiring appropriate management and protection measures. World Heritage Sites are designated to meet the UK's commitments under the World Heritage Convention.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.2 Area of Outstanding Natural Beauty

Records within 250m

0

Areas of Outstanding Natural Beauty (AONB) are conservation areas, chosen because they represent 18% of the finest countryside. Each AONB has been designated for special attention because of the quality of their flora, fauna, historical and cultural associations, and/or scenic views. The National Parks and Access to the Countryside Act of 1949 created AONBs and the Countryside and Rights of Way Act, 2000 added further regulation and protection. There are likely to be restrictions to some developments within these areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

11.3 National Parks

Records within 250m

0

In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well-being of those living within them. In Scotland National Parks have the additional purpose of promoting the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities. The National Parks and Access to the Countryside Act 1949 established the National Park designation in England and Wales, and The National Parks (Scotland) Act 2000 in Scotland.

This data is sourced from Natural England, Natural Resources Wales and the Scottish Government.

11.4 Listed Buildings

Records within 250m

0

Buildings listed for their special architectural or historical interest. Building control in the form of 'listed building consent' is required in order to make any changes to that building which might affect its special interest. Listed buildings are graded to indicate their relative importance, however building controls apply to all buildings equally, irrespective of their grade, and apply to the interior and exterior of the building in its entirety, together with any curtilage structures.



This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.5 Conservation Areas

Records within 250m

0

Local planning authorities are obliged to designate as conservation areas any parts of their own area that are of special architectural or historic interest, the character and appearance of which it is desirable to preserve or enhance. Designation of a conservation area gives broader protection than the listing of individual buildings. All the features within the area, listed or otherwise, are recognised as part of its character. Conservation area designation is the means of recognising the importance of all factors and of ensuring that planning decisions address the quality of the landscape in its broadest sense.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.6 Scheduled Ancient Monuments

Records within 250m

0

A scheduled monument is an historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. The Schedule of Monuments has c.20,000 entries and includes sites such as Roman remains, burial mounds, castles, bridges, earthworks, the remains of deserted villages and industrial sites. Monuments are not graded, but all are, by definition, considered to be of national importance.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.7 Registered Parks and Gardens

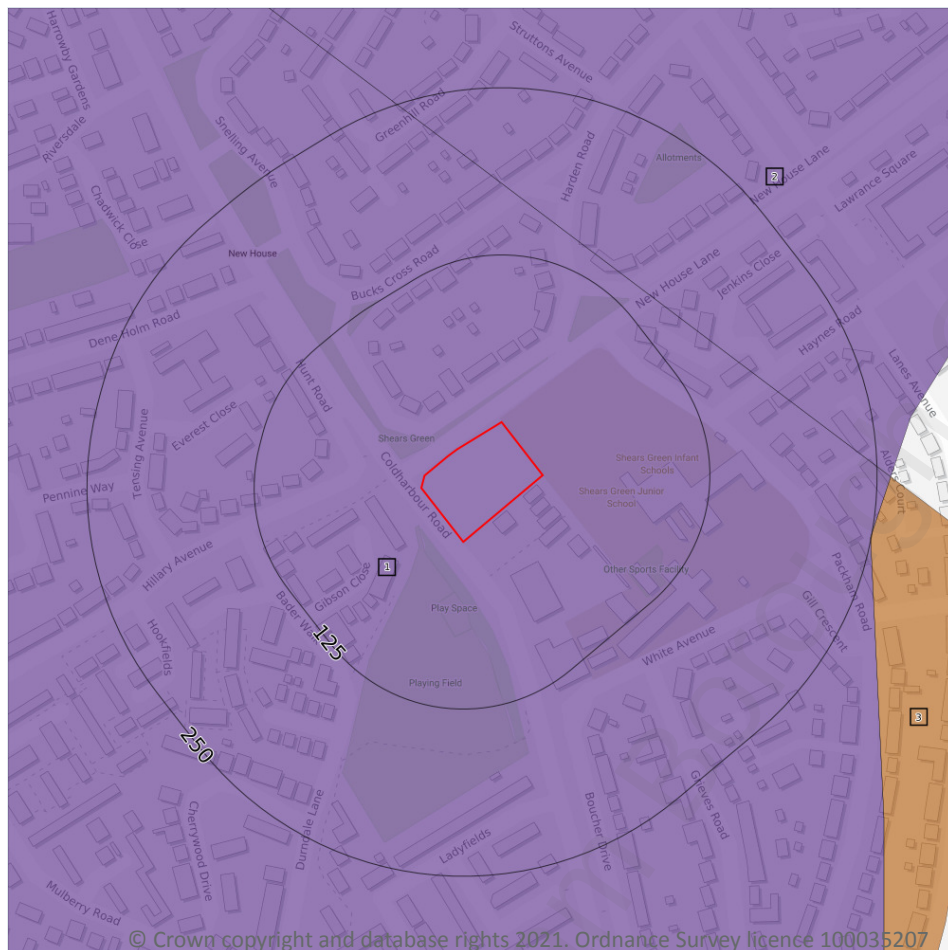
Records within 250m

0

Parks and gardens assessed to be of particular interest and of special historic interest. The emphasis being on 'designed' landscapes, rather than on planting or botanical importance. Registration is a 'material consideration' in the planning process, meaning that planning authorities must consider the impact of any proposed development on the special character of the landscape.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

12 Agricultural designations



- Site Outline
- Search buffers in metres (m)
- Grade 1 - excellent quality
- Grade 2 - very good quality
- Grade 3 - good to moderate quality
- Grade 3a - good quality
- Grade 3b - moderate quality
- Grade 4 - poor quality
- Grade 5 - very poor quality
- Non-agricultural land
- Urban land
- Exclusion land
- Tree felling licences
- Open Access land

12.1 Agricultural Land Classification

Records within 250m

3

Classification of the quality of agricultural land taking into consideration multiple factors including climate, physical geography and soil properties. It should be noted that the categories for the grading of agricultural land are not consistent across England, Wales and Scotland.

Features are displayed on the Agricultural designations map on **page 60**

ID	Location	Classification	Description
1	On site	Urban	-
2	143m NE	Urban	-



ID	Location	Classification	Description
3	250m E	Grade 2	Very good quality agricultural land. Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

This data is sourced from Natural England.

12.2 Open Access Land

Records within 250m	0
----------------------------	----------

The Countryside and Rights of Way Act 2000 (CROW Act) gives a public right of access to land without having to use paths. Access land includes mountains, moors, heaths and downs that are privately owned. It also includes common land registered with the local council and some land around the England Coast Path. Generally permitted activities on access land are walking, running, watching wildlife and climbing.

This data is sourced from Natural England and Natural Resources Wales.

12.3 Tree Felling Licences

Records within 250m	0
----------------------------	----------

Felling Licence Application (FLA) areas approved by Forestry Commission England. Anyone wishing to fell trees must ensure that a licence or permission under a grant scheme has been issued by the Forestry Commission before any felling is carried out or that one of the exceptions apply.

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m	0
----------------------------	----------

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. The schemes identified may be historical schemes that have now expired, or may still be active.

This data is sourced from Natural England.

12.5 Countryside Stewardship Schemes

Records within 250m

0

Countryside Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. Main objectives are to improve the farmed environment for wildlife and to reduce diffuse water pollution.

This data is sourced from Natural England.

Gravesham Borough Council



13 Habitat designations

13.1 Priority Habitat Inventory

Records within 250m

0

Habitats of principal importance as named under Natural Environment and Rural Communities Act (2006) Section 41.

This data is sourced from Natural England.

13.2 Habitat Networks

Records within 250m

0

Habitat networks for 18 priority habitat networks (based primarily, but not exclusively, on the priority habitat inventory) and areas suitable for the expansion of networks through restoration and habitat creation.

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m

0

Sites verified as Open Mosaic Habitat. Mosaic habitats are brownfield sites that are identified under the UK Biodiversity Action Plan as a priority habitat due to the habitat variation within a single site, supporting an array of invertebrates.

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

Records within 250m

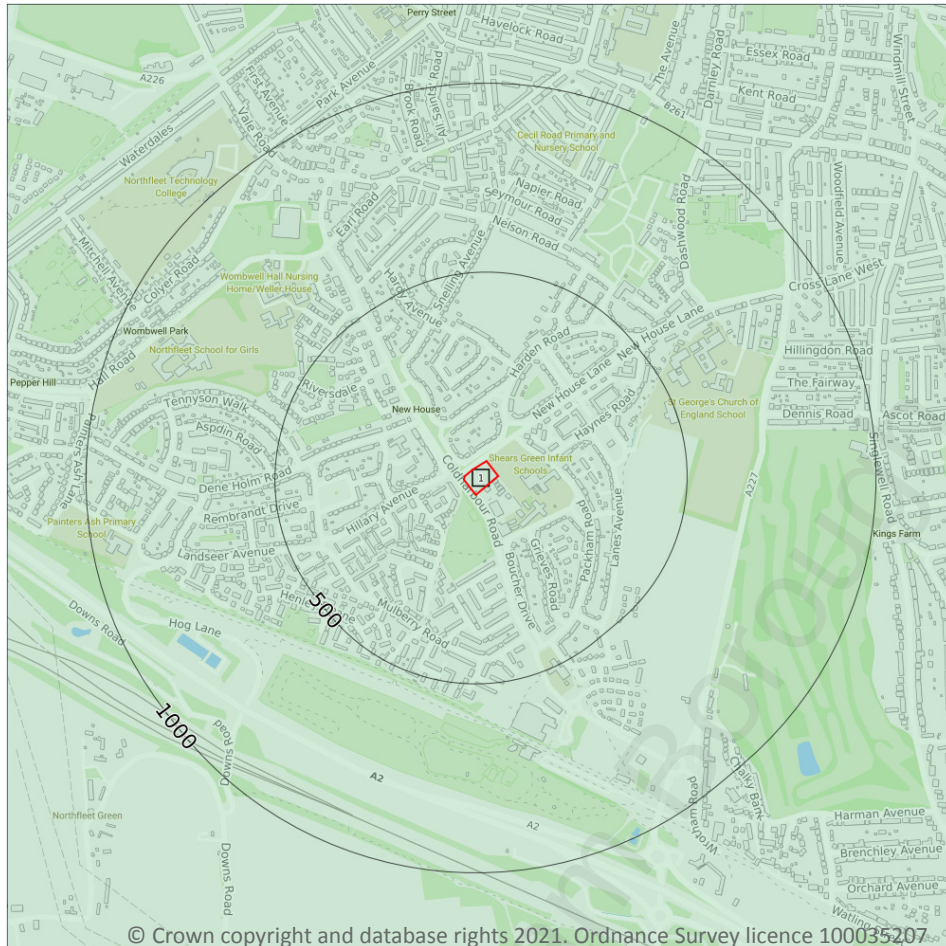
0

Limestone pavements are outcrops of limestone where the surface has been worn away by natural means over millennia. These rocks have the appearance of paving blocks, hence their name. Not only do they have geological interest, they also provide valuable habitats for wildlife. These habitats are threatened due to their removal for use in gardens and water features. Many limestone pavements have been designated as SSSIs which affords them some protection. In addition, Section 34 of the Wildlife and Countryside Act 1981 gave them additional protection via the creation of Limestone Pavement Orders, which made it a criminal offence to remove any part of the outcrop. The associated Limestone Pavement Priority Habitat is part of the UK Biodiversity Action Plan priority habitat in England.

This data is sourced from Natural England.



14 Geology 1:10,000 scale - Availability



— Site Outline
Search buffers in metres (m)

- Full coverage
- Partial coverage
- No coverage

14.1 10k Availability

Records within 500m

1

An indication on the coverage of 1:10,000 scale geology data for the site, the most detailed dataset provided by the British Geological Survey. Either 'Full', 'Partial' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:10,000 scale - Availability map on **page 64**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	TQ67SW

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Artificial and made ground



— Site Outline
Search buffers in metres (m)

- Reclaimed ground
- Made ground
- Worked ground
- Infilled ground
- Disturbed ground
- Landscaped ground

14.2 Artificial and made ground (10k)

Records within 500m

4

Details of made, worked, infilled, disturbed and landscaped ground at 1:10,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:10,000 scale - Artificial and made ground map on **page 65**

ID	Location	LEX Code	Description	Rock description
1	146m E	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	463m S	WGR-VOID	Worked Ground (Undivided)	Void
A	492m E	WGR-VOID	Worked Ground (Undivided)	Void
3	492m S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit



This data is sourced from the British Geological Survey.

Gravesend Borough Council



Geology 1:10,000 scale - Superficial

14.3 Superficial geology (10k)

Records within 500m

0

Superficial geological deposits at 1:10,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

This data is sourced from the British Geological Survey.

14.4 Landslip (10k)

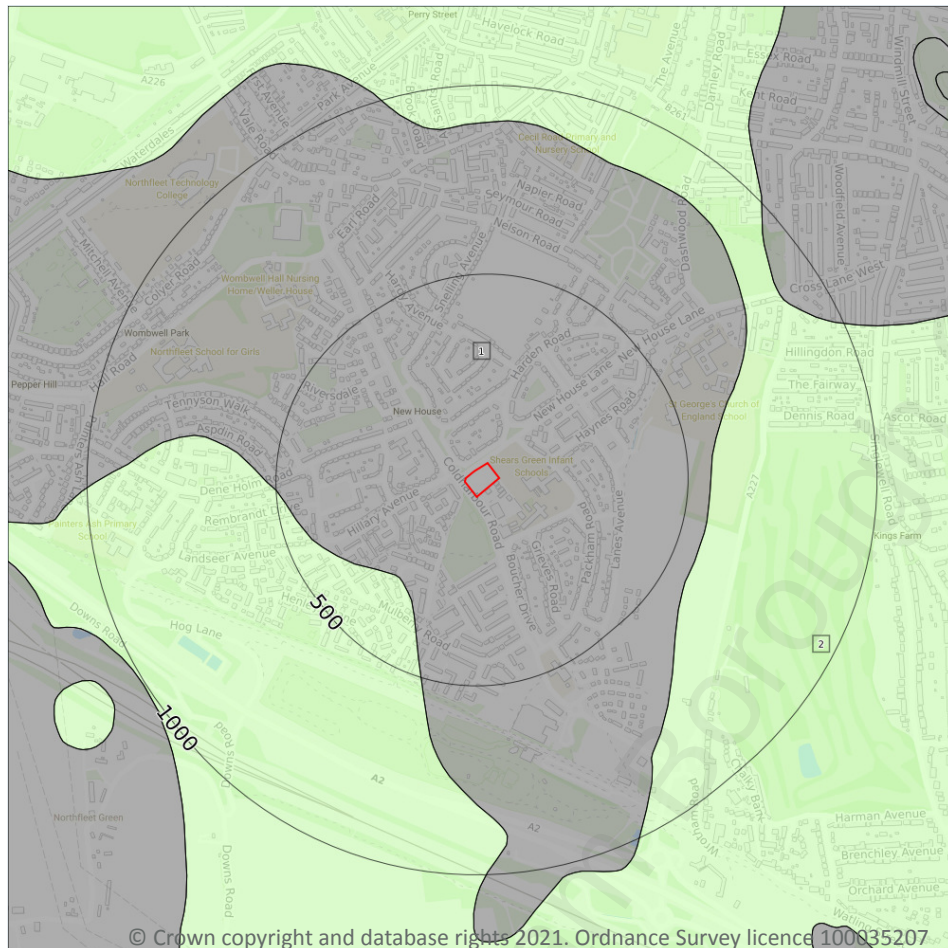
Records within 500m

0

Mass movement deposits on BGS geological maps at 1:10,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

Geology 1:10,000 scale - Bedrock



- Site Outline
- Search buffers in metres (m)
- Bedrock faults and other linear features (10k)
- Bedrock geology (10k)
Please see table for more details.

14.5 Bedrock geology (10k)

Records within 500m

2

Bedrock geology at 1:10,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:10,000 scale - Bedrock map on **page 68**

ID	Location	LEX Code	Description	Rock age
1	On site	TAB-SANDU	Thanet Sand Formation - Sand	Thanetian Age
2	296m SW	SECK-CHLK	Seaford Chalk Formation - Chalk	Santonian Age - Coniacian Age

This data is sourced from the British Geological Survey.



14.6 Bedrock faults and other linear features (10k)

Records within 500m

0

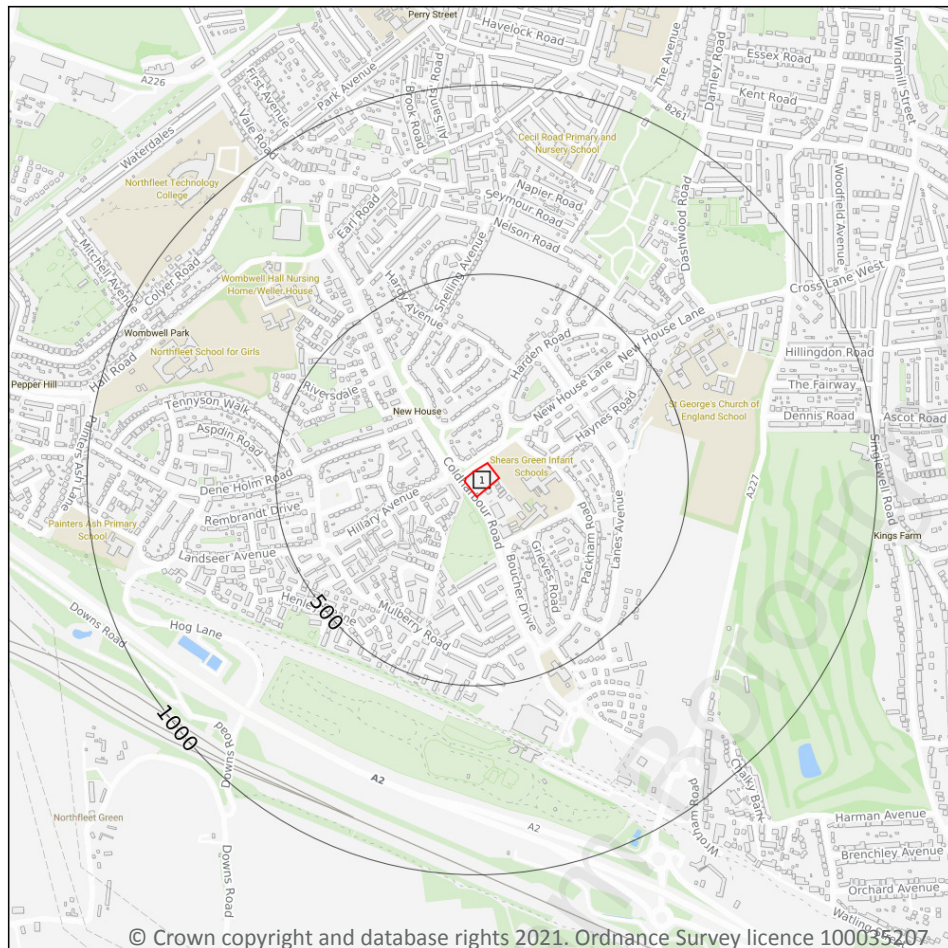
Linear features at the ground or bedrock surface at 1:10,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

Gravesham Borough Council



15 Geology 1:50,000 scale - Availability



- Site Outline
- Search buffers in metres (m)
- Geological map tile

15.1 50k Availability

Records within 500m

1

An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme.

Features are displayed on the Geology 1:50,000 scale - Availability map on **page 70**

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	EW271_dartford_v4

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Artificial and made ground



- Site Outline
- Search buffers in metres (m)
- Made ground
 - Worked ground
 - Infilled ground
 - Disturbed ground
 - Landscaped ground

15.2 Artificial and made ground (50k)

Records within 500m

3

Details of made, worked, infilled, disturbed and landscaped ground at 1:50,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:50,000 scale - Artificial and made ground map on **page 71**

ID	Location	LEX Code	Description	Rock description
1	443m S	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
2	471m S	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
A	488m E	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID

This data is sourced from the British Geological Survey.



15.3 Artificial ground permeability (50k)

Records within 50m

0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any artificial deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Gravesham Borough Council



Geology 1:50,000 scale - Superficial

15.4 Superficial geology (50k)

Records within 500m

0

Superficial geological deposits at 1:50,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

This data is sourced from the British Geological Survey.

15.5 Superficial permeability (50k)

Records within 50m

0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m

0

Mass movement deposits on BGS geological maps at 1:50,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

15.7 Landslip permeability (50k)

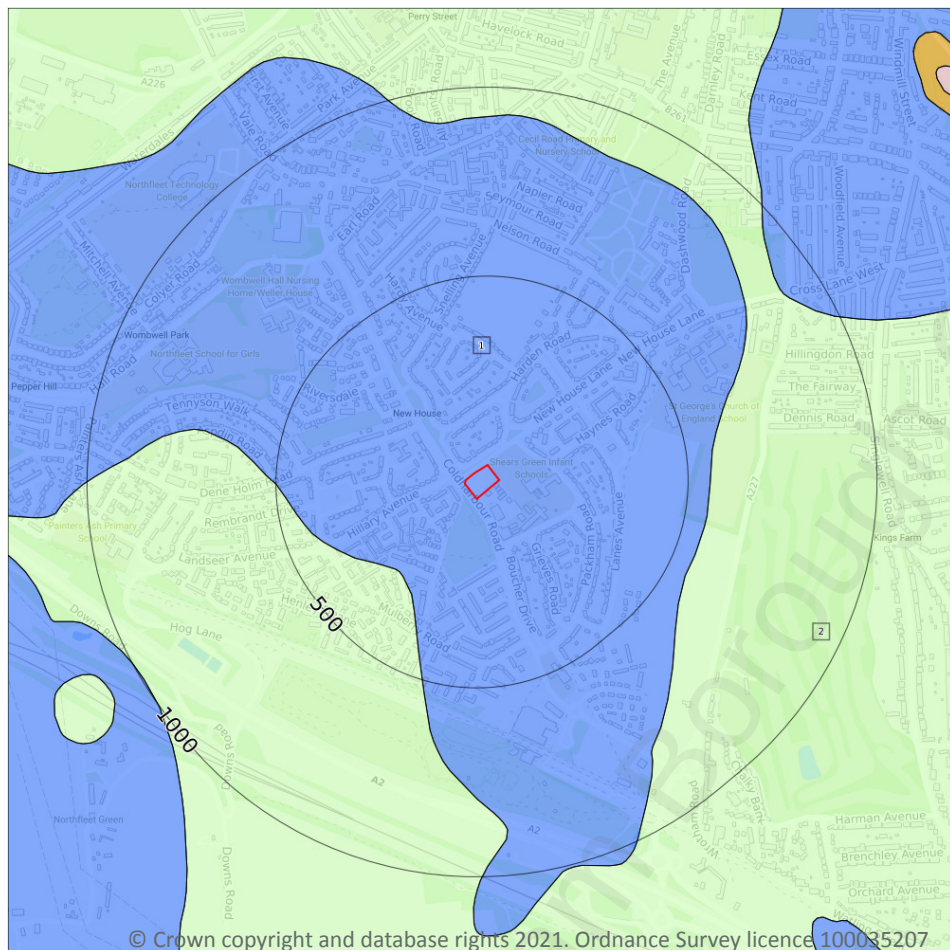
Records within 50m

0

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any landslip deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Bedrock



- Site Outline
- Search buffers in metres (m)
- Bedrock faults and other linear features (50k)
- Bedrock geology (50k)
Please see table for more details.

15.8 Bedrock geology (50k)

Records within 500m

2

Bedrock geology at 1:50,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:50,000 scale - Bedrock map on **page 74**

ID	Location	LEX Code	Description	Rock age
1	On site	TAB-S	THANET FORMATION - SAND	THANETIAN
2	281m SW	LSNCK-CHLK	LEWES NODULAR CHALK FORMATION, SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION (UNDIFFERENTIATED) - CHALK	TURONIAN

This data is sourced from the British Geological Survey.



15.9 Bedrock permeability (50k)

Records within 50m

1

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of bedrock (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Intergranular	High	High

This data is sourced from the British Geological Survey.

15.10 Bedrock faults and other linear features (50k)

Records within 500m

0

Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.

16 Boreholes

16.1 BGS Boreholes

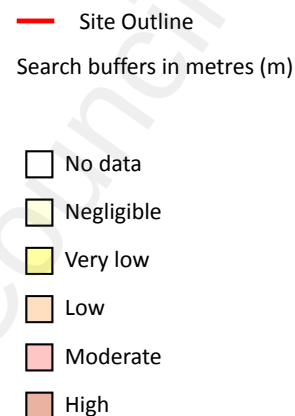
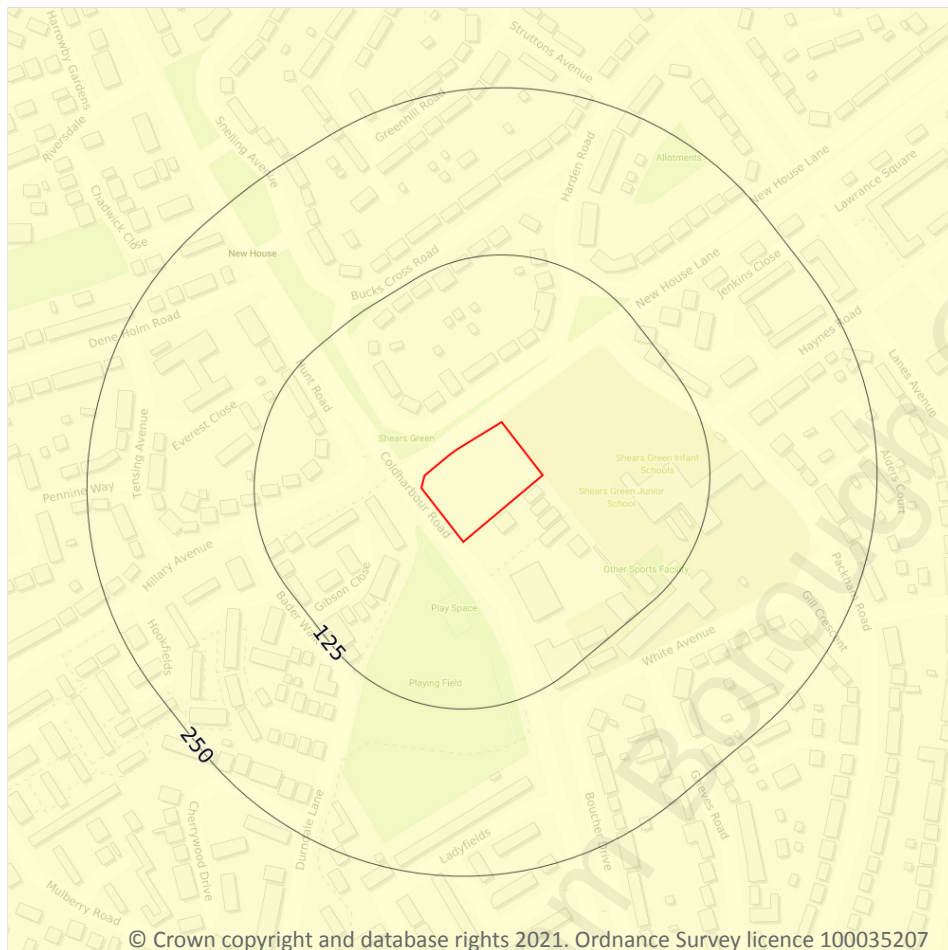
Records within 250m

0

The Single Onshore Boreholes Index (SOBI); an index of over one million records of boreholes, shafts and wells from all forms of drilling and site investigation work held by the British Geological Survey. Covering onshore and nearshore boreholes dating back to at least 1790 and ranging from one to several thousand metres deep.

This data is sourced from the British Geological Survey.

17 Natural ground subsidence - Shrink swell clays



17.1 Shrink swell clays

Records within 50m

1

The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and local drainage).

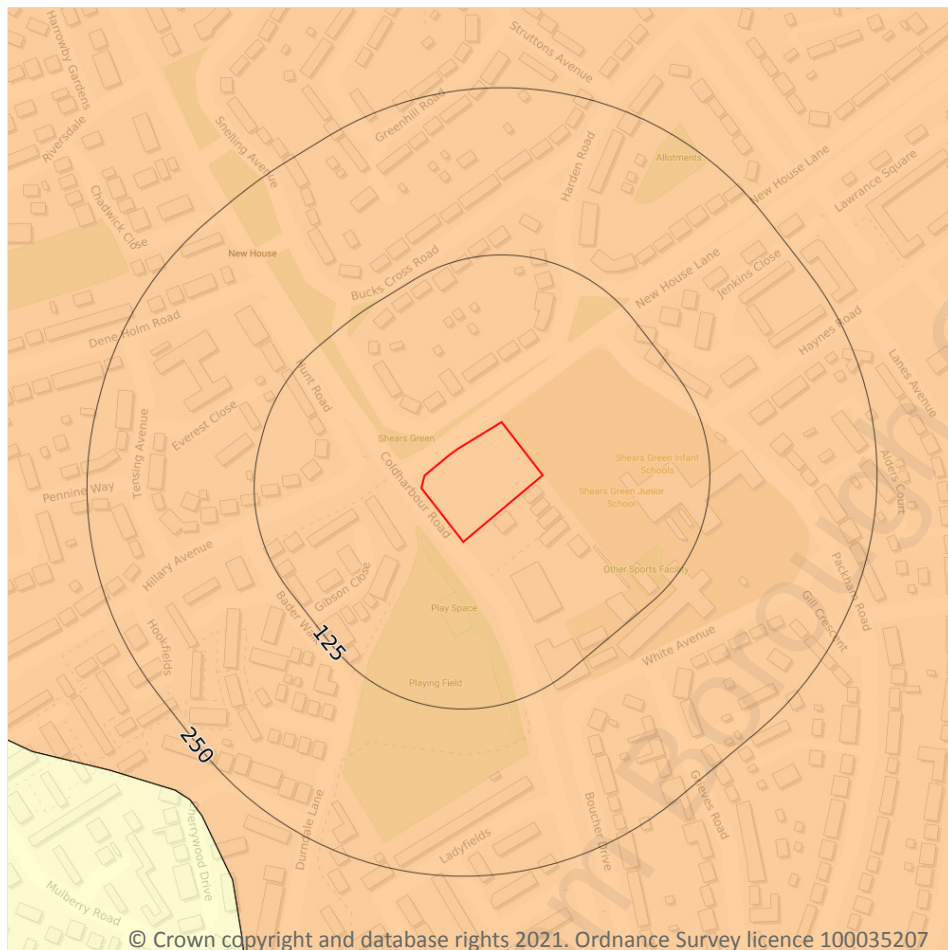
Features are displayed on the Natural ground subsidence - Shrink swell clays map on **page 77**

Location	Hazard rating	Details
On site	Negligible	Ground conditions predominantly non-plastic.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Running sands



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.2 Running sands

Records within 50m

1

The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

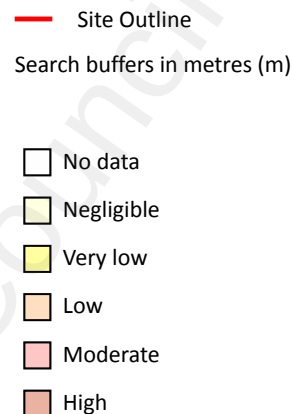
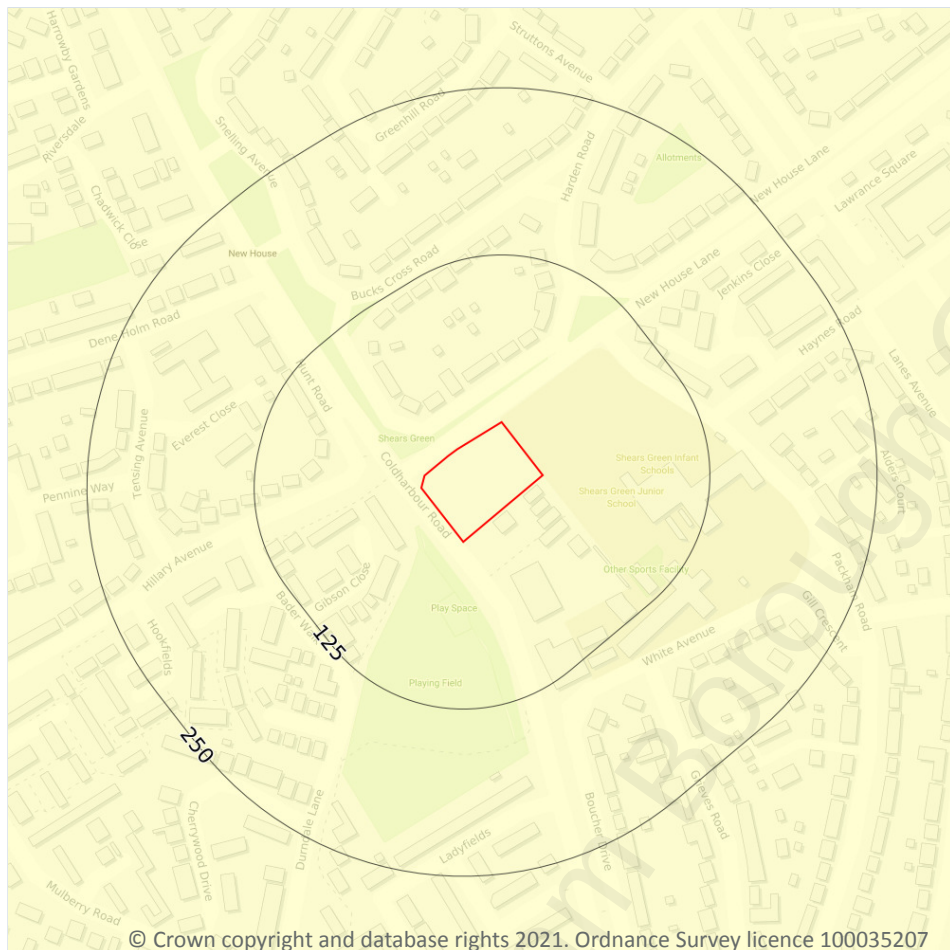
Features are displayed on the Natural ground subsidence - Running sands map on **page 78**

Location	Hazard rating	Details
On site	Low	Running sand conditions may be present. Constraints may apply to land uses involving excavation or the addition or removal of water.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Compressible deposits



17.3 Compressible deposits

Records within 50m

1

The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

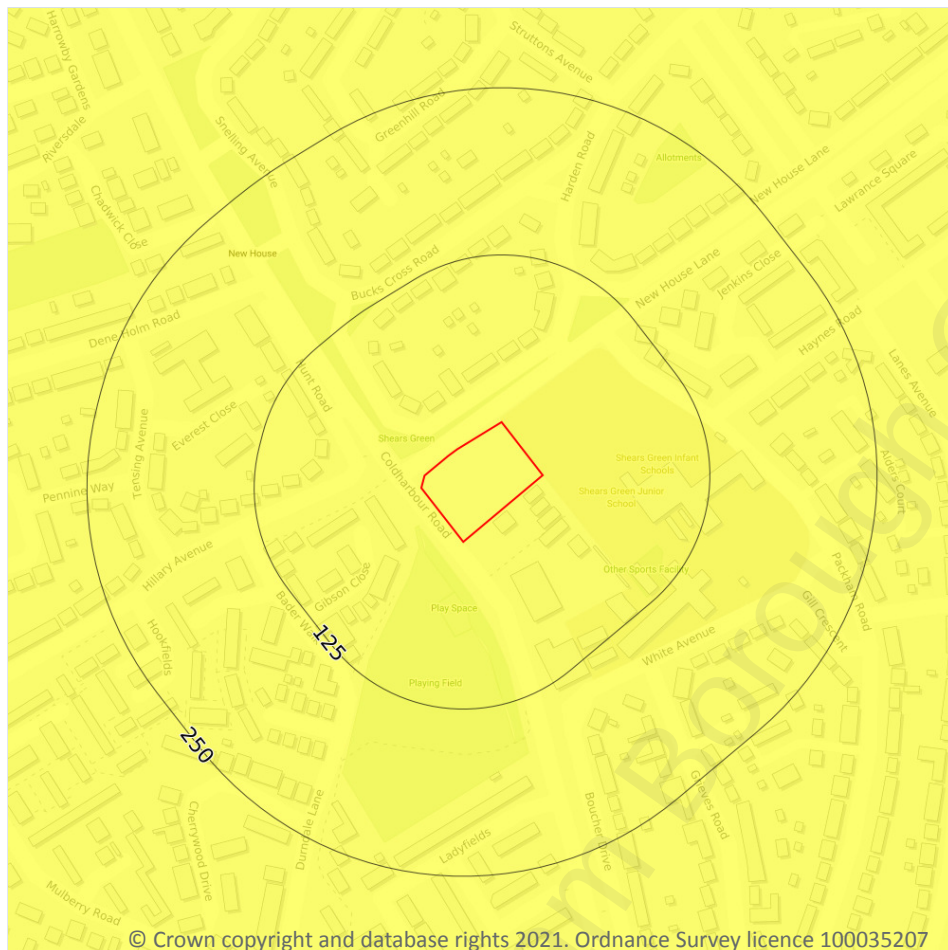
Features are displayed on the Natural ground subsidence - Compressible deposits map on **page 79**

Location	Hazard rating	Details
On site	Negligible	Compressible strata are not thought to occur.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Collapsible deposits



- Site Outline**
- Search buffers in metres (m)**
- ☐ No data
 - ☐ Negligible
 - ☒ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.4 Collapsible deposits

Records within 50m

1

The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

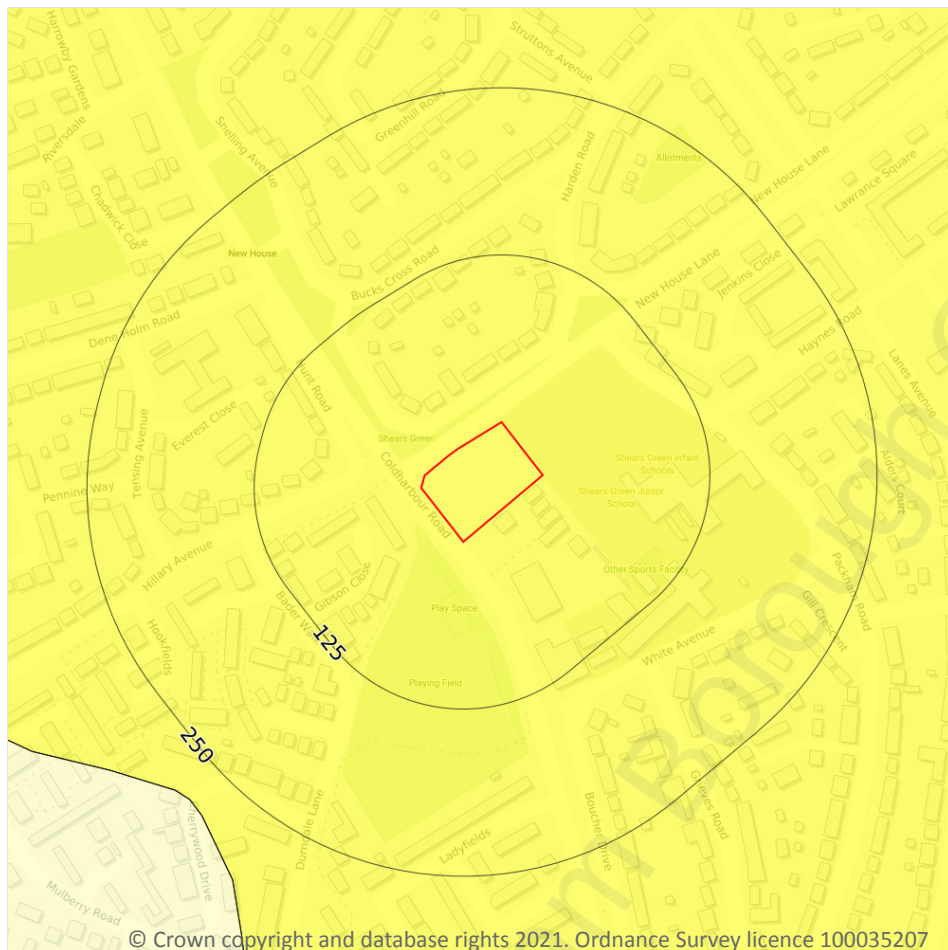
Features are displayed on the Natural ground subsidence - Collapsible deposits map on **page 80**

Location	Hazard rating	Details
On site	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Landslides



- Site Outline
- Search buffers in metres (m)
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.5 Landslides

Records within 50m

1

The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

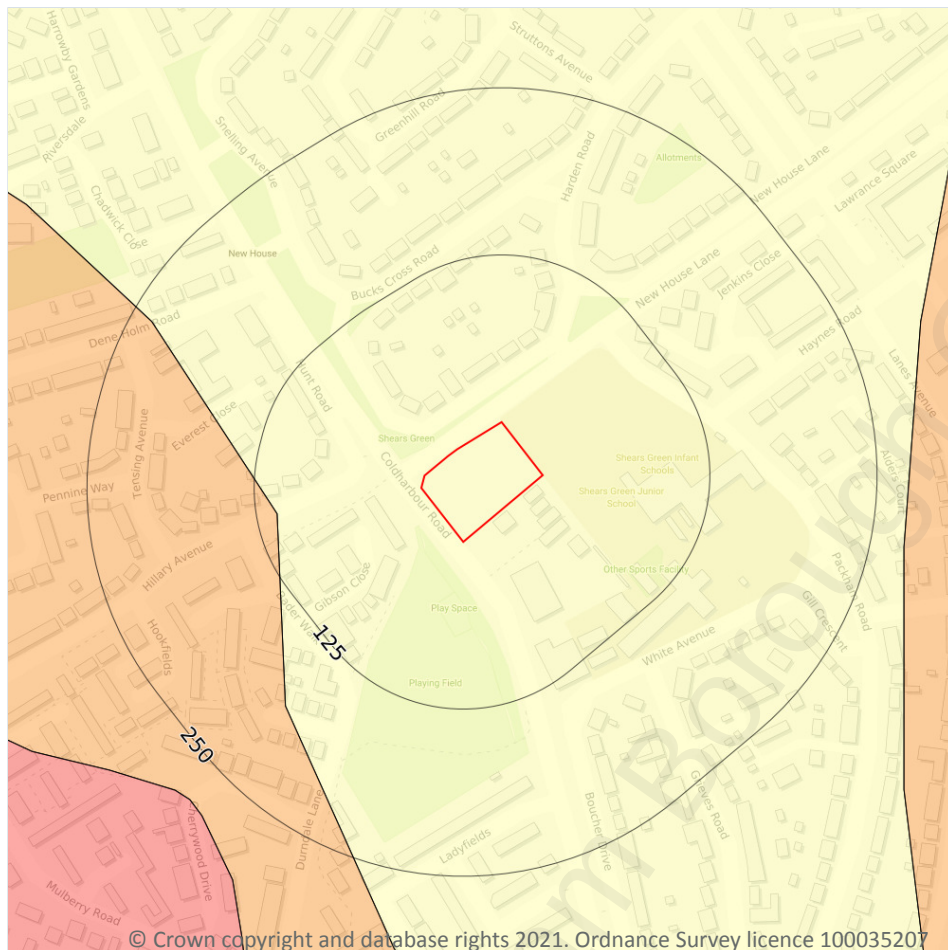
Features are displayed on the Natural ground subsidence - Landslides map on **page 81**

Location	Hazard rating	Details
On site	Very low	Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Ground dissolution of soluble rocks



- Site Outline
- Search buffers in metres (m)
- No data
 - Negligible
 - Very low
 - Low
 - Moderate
 - High

17.6 Ground dissolution of soluble rocks

Records within 50m

1

The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

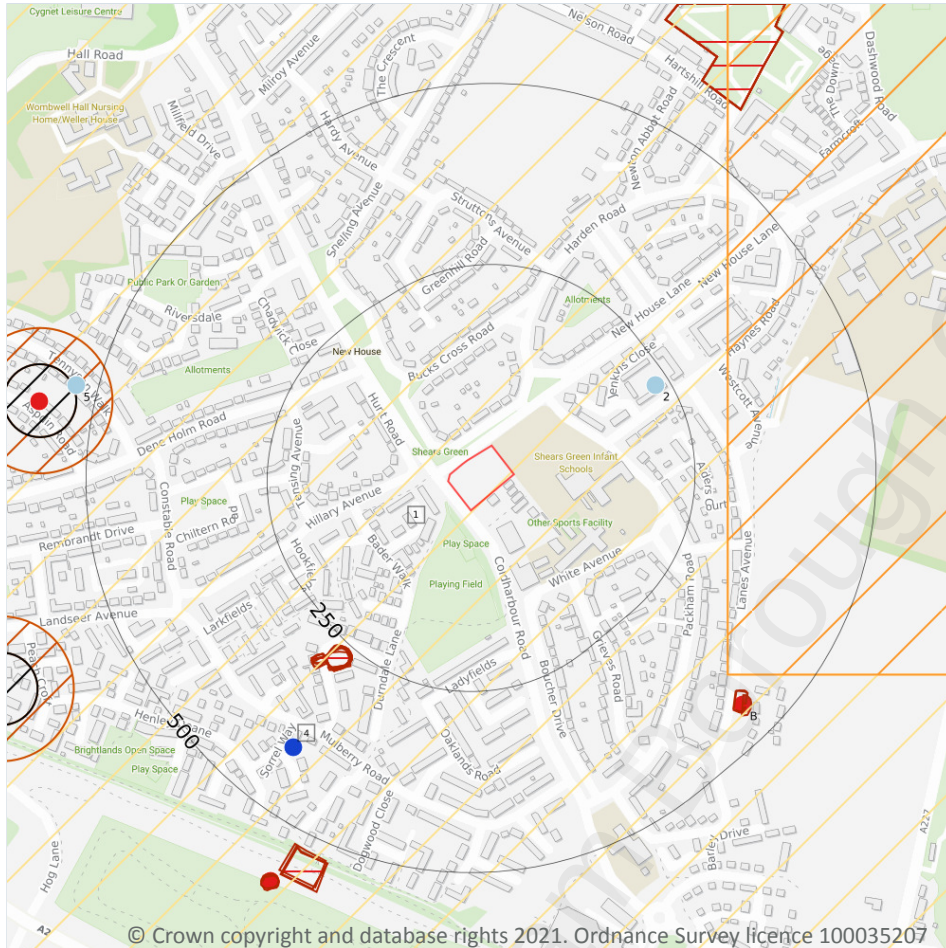
Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on **page 82**

Location	Hazard rating	Details
On site	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.

This data is sourced from the British Geological Survey.



18 Mining, ground workings and natural cavities



- Site Outline
- Search buffers in metres (m)
- ▢ Natural cavities (Area)
- Natural cavities (Point)
- BritPits
- ▢ Surface ground workings
- ▢ Underground workings
- ▢ Historical Mineral Planning Areas
- Mining Cavities
- Non Coal Mining
- ▢ Sporadic underground mining of restricted extent possible
- ▢ Localised small scale underground mining possible
- ▢ Small scale mining possible
- ▢ Underground mining known or likely within or in close proximity
- ▢ Underground mining known within or in very close proximity

18.1 Natural cavities

Records within 500m

1

Industry recognised national database of natural cavities. Sinkholes and caves are formed by the dissolution of soluble rock, such as chalk and limestone, gulls and fissures by cambering. Ground instability can result from movement of loose material contained within these cavities, often triggered by water.

Features are displayed on the Mining, ground workings and natural cavities map on **page 83**

ID	Location	Details	Source
4	408m SW	Type: Solution Pipe x 6 Superficial Geology: - Bedrock Geology: Chalk Group	Simple Bibliography: - Full Bibliography: PRESTWICH, J., On the origin of the sand and gravel-pipes in the chalk of the London Tertiary District., 1855; Quarterly Journal of Geological Society Confidentiality: Data source can be revealed, data can be used freely

This data is sourced from Stantec UK Ltd.

18.2 BritPits

Records within 500m	1
----------------------------	----------

BritPits (an abbreviation of British Pits) is a database maintained by the British Geological Survey of currently active and closed surface and underground mineral workings. Details of major mineral handling sites, such as wharfs and rail depots are also held in the database.

Features are displayed on the Mining, ground workings and natural cavities map on **page 83**

ID	Location	Details	Description
B	447m SE	Name: Durndale Chalk Pit Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority

This data is sourced from the British Geological Survey.

18.3 Surface ground workings

Records within 250m	0
----------------------------	----------

Historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled.

This data is sourced from Ordnance Survey/Groundsure.

18.4 Underground workings

Records within 1000m

3

Historical land uses identified from Ordnance Survey mapping that indicate the presence of underground workings e.g. mine shafts.

Features are displayed on the Mining, ground workings and natural cavities map on **page 83**

ID	Location	Land Use	Year of mapping	Mapping scale
C	576m W	Unspecified Old Shaft	1931	1:10560
C	577m W	Unspecified Shaft	1907	1:10560
C	577m W	Unspecified Shaft	1895	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m

0

Boundaries of mineral planning permissions for England and Wales. This data was collated between the 1940s (and retrospectively to the 1930s) and the mid 1980s. The data includes permitted, withdrawn and refused permissions.

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m

7

The potential for historical non-coal mining to have affected an area. The assessment is drawn from expert knowledge and literature in addition to the digital geological map of Britain. Mineral commodities may be divided into seven general categories - vein minerals, chalk, oil shale, building stone, bedded ores, evaporites and 'other' commodities (including ball clay, jet, black marble, graphite and chert).

Features are displayed on the Mining, ground workings and natural cavities map on **page 83**

ID	Location	Name	Commodity	Class	Likelihood
1	On site	Not available	Chalk	A	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

ID	Location	Name	Commodity	Class	Likelihood
3	295m E	Not available	Chalk	C	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
C	474m W	Not available	Chalk	D	Underground mining is known or considered likely to have occurred within or close to the area. Potential for difficult ground conditions are at a level where they should be considered
C	524m W	Not available	Chalk	E	Underground mining is known to have occurred within or very close to the area. Potential for difficult ground conditions should be investigated. Potential for localised subsidence is at a level where it should be considered
F	580m SW	Not available	Chalk	D	Underground mining is known or considered likely to have occurred within or close to the area. Potential for difficult ground conditions are at a level where they should be considered
F	630m SW	Not available	Chalk	E	Underground mining is known to have occurred within or very close to the area. Potential for difficult ground conditions should be investigated. Potential for localised subsidence is at a level where it should be considered
-	970m NW	Not available	Chalk	D	Underground mining is known or considered likely to have occurred within or close to the area. Potential for difficult ground conditions are at a level where they should be considered

This data is sourced from the British Geological Survey.

18.7 Mining cavities

Records within 1000m

3

Industry recognised national database of mining cavities. Degraded mines may result in hazardous subsidence (crown holes). Climatic conditions and water escape can also trigger subsidence over mine entrances and workings.

Features are displayed on the Mining, ground workings and natural cavities map on **page 83**

ID	Location	Mine Address	Mineral	Data source	Publisher
2	231m NE	Gravesend, Kent	Chalk	-	-
5	531m W	Gravesend, Kent	Chalk	-	-
-	670m SW	Gravesend, Kent	Chalk	-	Chelsea Speleological Society

This data is sourced from Stantec UK Ltd.



18.8 JPB mining areas

Records on site	0
-----------------	---

Areas which could be affected by former coal and other mining. This data includes some mine plans unavailable to the Coal Authority.

This data is sourced from Johnson Poole and Bloomer.

18.9 Coal mining

Records on site	0
-----------------	---

Areas which could be affected by past, current or future coal mining.

This data is sourced from the Coal Authority.

18.10 Brine areas

Records on site	0
-----------------	---

The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

This data is sourced from the Cheshire Brine Subsidence Compensation Board.

18.11 Gypsum areas

Records on site	0
-----------------	---

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.12 Tin mining

Records on site	0
-----------------	---

Generalised areas that may be affected by historical tin mining.

This data is sourced from Mining Searches UK.

18.13 Clay mining

Records on site
0

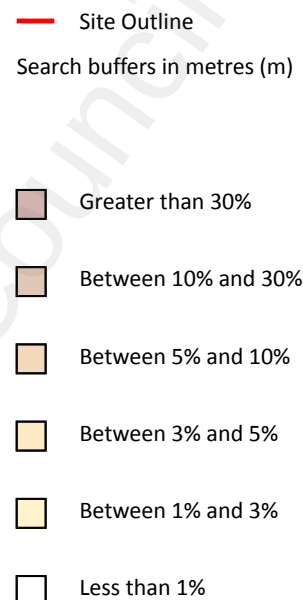
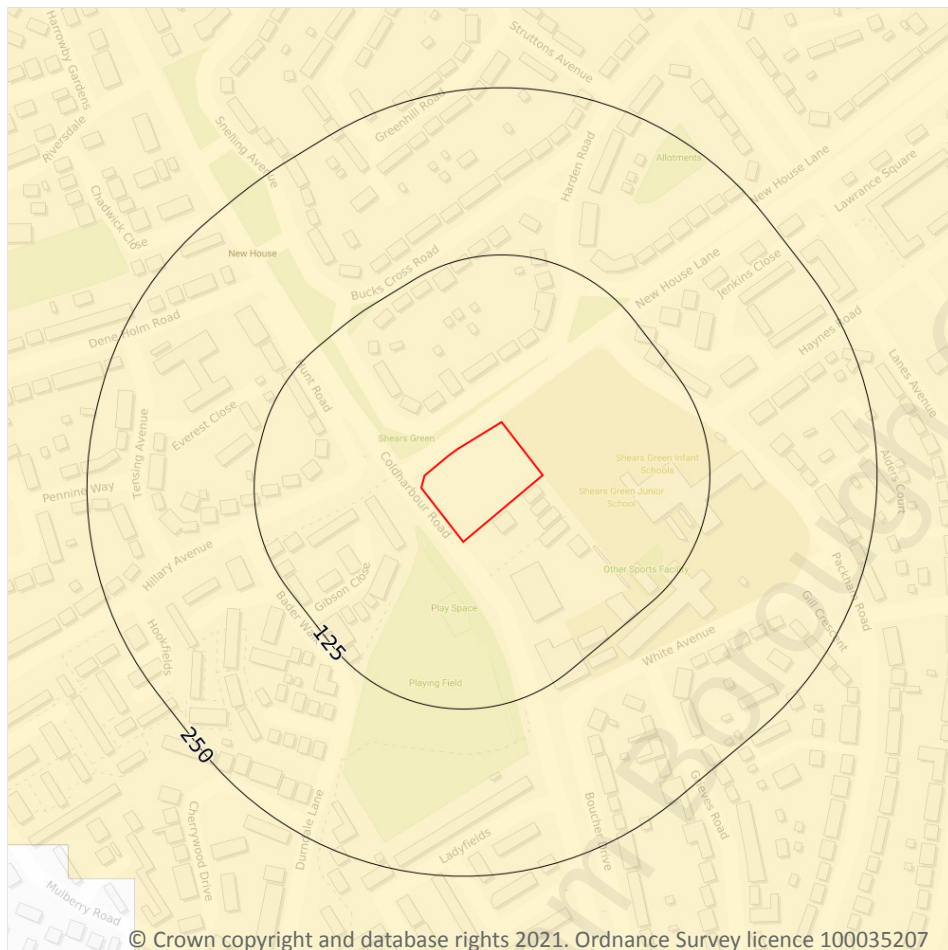
Generalised areas that may be affected by kaolin and ball clay extraction.

This data is sourced from the Kaolin and Ball Clay Association (UK).

Gravesham Borough Council



19 Radon



19.1 Radon

Records on site

1

Estimated percentage of dwellings exceeding the Radon Action Level. This data is the highest resolution radon dataset available for the UK and is produced to a 75m level of accuracy to allow for geological data accuracy and a 'residential property' buffer. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain. The data was derived from both geological assessments and long term measurements of radon in more than 479,000 households.

Features are displayed on the Radon map on **page 89**

Location	Estimated properties affected	Radon Protection Measures required
On site	Between 1% and 3%	None

This data is sourced from the British Geological Survey and Public Health England.



20 Soil chemistry

20.1 BGS Estimated Background Soil Chemistry

Records within 50m

1

The estimated values provide the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km². In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km²; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	15 - 25 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg

This data is sourced from the British Geological Survey.

20.2 BGS Estimated Urban Soil Chemistry

Records within 50m

0

Estimated topsoil chemistry of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc and bioaccessible Arsenic and Lead in 23 urban centres across Great Britain. These estimates are derived from interpolation of the measured urban topsoil data referred to above and provide information across each city between the measured sample locations (4 per km²).

This data is sourced from the British Geological Survey.

20.3 BGS Measured Urban Soil Chemistry

Records within 50m

0

The locations and measured total concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc in urban topsoil samples from 23 urban centres across Great Britain. These are collected at a sample density of 4 per km².

This data is sourced from the British Geological Survey.

21 Railway infrastructure and projects

21.1 Underground railways (London)

Records within 250m

0

Details of all active London Underground lines, including approximate tunnel roof depth and operational hours.

This data is sourced from publicly available information by Groundsure.

21.2 Underground railways (Non-London)

Records within 250m

0

Details of the Merseyrail system, the Tyne and Wear Metro and the Glasgow Subway. Not all parts of all systems are located underground. The data contains location information only and does not include a depth assessment.

This data is sourced from publicly available information by Groundsure.

21.3 Railway tunnels

Records within 250m

0

Railway tunnels taken from contemporary Ordnance Survey mapping.

This data is sourced from the Ordnance Survey.

21.4 Historical railway and tunnel features

Records within 250m

0

Railways and tunnels digitised from historical Ordnance Survey mapping as scales of 1:1,250, 1:2,500, 1:10,000 and 1:10,560.

This data is sourced from Ordnance Survey/Groundsure.

21.5 Royal Mail tunnels

Records within 250m

0

The Post Office Railway, otherwise known as the Mail Rail, is an underground railway running through Central London from Paddington Head District Sorting Office to Whitechapel Eastern Head Sorting Office. The line is 10.5km long. The data includes details of the full extent of the tunnels, the depth of the tunnel, and the depth to track level.

This data is sourced from Groundsure/the Postal Museum.

21.6 Historical railways

Records within 250m

0

Former railway lines, including dismantled lines, abandoned lines, disused lines, historic railways and razed lines.

This data is sourced from OpenStreetMap.

21.7 Railways

Records within 250m

0

Currently existing railway lines, including standard railways, narrow gauge, funicular, trams and light railways.

This data is sourced from Ordnance Survey and OpenStreetMap.

21.8 Crossrail 1

Records within 500m

0

The Crossrail railway project links 41 stations over 100 kilometres from Reading and Heathrow in the west, through underground sections in central London, to Shenfield and Abbey Wood in the east.

This data is sourced from publicly available information by Groundsure.

21.9 Crossrail 2

Records within 500m

0

Crossrail 2 is a proposed railway linking the national rail networks in Surrey and Hertfordshire via an underground tunnel through London.

This data is sourced from publicly available information by Groundsure.

21.10 HS2

Records within 500m

0

HS2 is a proposed high speed rail network running from London to Manchester and Leeds via Birmingham. Main civils construction on Phase 1 (London to Birmingham) of the project began in 2019, and it is currently anticipated that this phase will be fully operational by 2026. Construction on Phase 2a (Birmingham to Crewe) is anticipated to commence in 2021, with the service fully operational by 2027. Construction on Phase 2b (Crewe to Manchester and Birmingham to Leeds) is scheduled to begin in 2023 and be operational by 2033.

This data is sourced from HS2 Ltd.



Data providers

Groundsure works with respected data providers to bring you the most relevant and accurate information. To find out who they are and their areas of expertise see <https://www.groundsure.com/sources-reference>.

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1ST LINE DEFENCE



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Land off Coldharbour Road, Gravesend
Client	Applied Geology Limited
Site Address	Land off Coldharbour Road, Gravesend, DA11 7RU
Report Reference	DA13830-00
Date	17/08/2021
Originator	AS





Executive Summary

Site Location and Description

The site is situated in Gravesend, Kent. It is approximately 2.3km south of the River Thames. The site is bound by Newhouse Lane to the north, the Shears Green Infant Schools to the east and south, and Coldharbour Road to the west.

According to aerial imagery dated 2020, the site comprises a mix of undeveloped, hardstanding ground, and a small road accessed from Coldharbour Road.

The site is approximately centred on the OS grid reference: **TQ 63668 72270**.

Proposed Works

The scope of proposed works was not known at the time of writing.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site to be underlain by Thanet Formation - Sand. Sedimentary Bedrock formed in the Palaeogene Period. Superficial deposits are not recorded for this area.

Site-specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is a **Low Risk** from items of German aerial delivered UXO and a **Low Risk** from Allied UXO across the site. This assessment is based on the following factors:

Risk from German Aerial Delivered Ordnance:

- During WWII the site was situated within the Urban District of Northfleet, which according to official Home Office bombing statistics sustained an overall high density of bombing. This comprised a total of 389 items of ordnance across the 3,770 acre district, or an average of 103.2 items per 1,000 acres.
- The site itself does not appear to be present on available Luftwaffe target photography, however Gravesend, Northfleet, and Tilbury Docks, all along the River Thames/Thames Estuary, are identified as targets, specifically the dockyards and power station (see Annex H). There are multiple references to bombing incidents in the wider site area, as per the Kent Daily and V-1/Shell Bomb Mapping, and the Kent War Diaries also. However, it appears that the localised bombing density around the site was quite low – most of the bombing in the borough occurred further north.
- Kent bomb plot mapping shows H.E and incendiary bomb strikes in the wider area, as well as a V-1 pilotless aircraft bomb to the south of the site. Unfortunately the exact locations of these bomb strikes cannot be identified given that the incidents were plotted on small-scale maps.
- Written records were consulted in the form of the Kent War Diaries and no positive evidence has been found to suggest the site was subject to bomb strikes. The nearest references to bombing incidents were located approximately 300m south of the site and 0.6km south-west of the site. The former is recorded as A.A. (anti-aircraft), though exactly what type is not provided, and this exploded in an open field; the latter a L.R.R (Long Range Rocket/V-2) which exploded in mid-air and caused shrapnel to fall across the district. While the risk of shrapnel falling on site cannot be discounted, no evidence of bombing incidents on site has been found in available record sets.
- Given the site was comprised a mix of features, it is expected both access and groundcover would have differed across the site area. Areas of dense vegetation are unlikely to be conducive to the detection of

**UXO Risk Assessment**

evidence of UXO or to have been accessed regularly; however areas of the site occupied by buildings and associated garden are likely to have been accessed frequently, and it is expected evidence of UXO would have been more obvious in these areas.

- It is likely the site was subject to a degree of monitor, given its proximity to nearby roadways and the fact there were structures within the site boundary.
- Post-WWII OS mapping and aerial photography do not appear to show any obvious indicators of damage, such as missing and ruined buildings, or cratering and scattered earth. While available post-war photography is of poor quality, it is clear enough to suggest the site and immediate surroundings were not subject to damage. Furthermore, the usage of one of the buildings on site as a pub in the immediate post-war years suggests it was in good condition.
- In summary, while bombing records confirm the general area was subject to bomb strikes, no positive evidence has been found in available records to suggest the site or immediate vicinity were subject to bombing incidents. Furthermore, no obvious indicators of bomb damage exist in post-war OS mapping and photography, such as buildings labelled as 'ruin' or evidence of cratering/scattered earth. While it is not possible to entirely discount the risk of UXO on site, it is not believed that the risk is above that of the 'background level' for this area of the UK. It is recommended that a UXO safety and awareness briefing is provided to ground staff, and that a UXO risk management plan is put in place.

Risk from Allied Ordnance:

- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at Land off Coldharbour Road:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.



Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded



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1st Line Defence Limited

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Land off Coldharbour Road

Client: Applied Geology Limited

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Applied Geology Limited to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at Land off Coldharbour Road.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Land off Coldharbour Road. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German aerial delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and the Kent History and Library Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Applied Geology Limited.
- Available material from 33 Engineer Regiment (EOD) Archive (now 28 Regt).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to The National Archives and the Kent History and Library Centre.

3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'¹

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

¹ <http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/>.

4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII aerial bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is

recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams' judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

The site is situated in Gravesend, Kent. It is approximately 2.3km south of the River Thames. The site is bound by Newhouse Lane to the north, the Shears Green Infant Schools to the east and south, and Coldharbour Road to the west.

The site is approximately centred on the OS grid reference: **TQ 63668 72270**.

Site location maps are presented in **Annex A**.

6.2. Site Description

According to aerial imagery dated 2020, the site comprises a mix of undeveloped, hardstanding ground, and a small road accessed from Coldharbour Road.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

The scope of proposed works was not known at the time of writing.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site to be underlain by Thanet Formation - Sand. Sedimentary Bedrock formed in the Palaeogene Period. Superficial deposits are not recorded for this area.

8.2. Site Specific Geology

Site-specific geotechnical data was not provided by the client during the production of this report.

9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D**. See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	Scale	Description
1938	1:2,500	This map shows the site to comprise a mix of features; two buildings occupy the centre of the site, an area of open land in the north, an orchard in the east, and what appears to be a garden associated with the western structure in the west. The site is bound by <i>New House Lane</i> to the north, open land to the east and south, and <i>Coldharbour Lane</i> to the west.

Post-WWII		
Date	Scale	Description
1954-1962	1:2,500	This map shows the site to have undergone slight development. An additional building/extension to existing building has been constructed adjacent to the eastern structure, now labelled <i>Battle of Britain (PH)</i>; the structure in the west is now labelled <i>Shears Green House</i>. An access road appears to have been added to the north of the site, off <i>New House Lane</i>. The remainder of the site is occupied by an orchard, open land and garden. The sites surroundings remain unchanged, however development in the form of a housing estate is visible to the north, on the other side of <i>New House Lane</i>.

10. Introduction to German Aerial Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German aerial delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Aerial Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German aerial delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Appendices i-iii**.

Generic Types of WWII German Aerial Delivered Ordnance		
Type	Frequency	Likelihood of detection
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex E). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

10.3. Failure Rate of German Aerial Delivered Ordnance

It has been estimated that 10% of WWII German aerial delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex F**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Effect Principle

J-curve is the term used to describe the characteristic curve commonly followed by an aerial delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex E**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – The BGS map shows the site to be underlain by Thanet Formation – Sand, formed in the Palaeogene Period.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the *flying bomb* or *pilotless aircraft*, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today. Even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time. Therefore, V-weapons are referenced in this report not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

11. The Likelihood of Contamination from German Aerial Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex G**. This source does not record any WWI bombing incidents to have affected the site area.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the Urban District of Northfleet

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing, as represented by bomb density data figures below. This was mainly due to Kent's position in the south-east of England; being directly under the Luftwaffe's flight path to London or the north of England, it was subject to 'tip-and-run' raids, whereby surplus ordnance was jettisoned by German bombers on their way home, as well as air raids on targets identified by the Luftwaffe, primarily along the coast and Thames Estuary, Gravesend included.

While the site itself was not identified as a target by the Luftwaffe, Gravesend, Northfleet and Tilbury Docks, all north of the site, were photographed by the Luftwaffe; with Tilbury Docks and a Power Station between Northfleet and Gravesend labelled on this photography (see **Annex H**).

Records of bombing incidents in the civilian areas of the Urban District of Northfleet were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German aerial delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Urban District of Northfleet between 1940 and 1945.

Record of German Ordnance Dropped on the Urban District of Northfleet		
Area Acreage		3,770
Weapons	High Explosive bombs (all types)	364
	Parachute mines	3
	Oil bombs	7
	Phosphorus bombs	0
	Fire pots	9
	Pilotless aircraft (V-1)	5
	Long range rocket bombs (V-2)	1
Total		389
Number of Items per 1,000 acres		103.2

Source: Home Office Statistics

This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Kent Daily and V-1/Shells Bomb Census Maps (1940-1944)

Bomb census mapping compiled by Kent Council was obtained from the Kent History and Library Centre. These maps recorded daily bombing incidents at the beginning of the war, however from 1942 onwards tended to be consolidated. Incidents plotted on these maps include H.E strikes, incendiary bombing, crashed German and British planes, shells, and aerial mines. As well as these, an additional map set was compiled by Kent Council using a similar format, however to record V-1 and shells.

The bombing incidents on these map editions were plotted on small scale maps, and bomb strikes for the whole county of Kent were recorded on single map sheets. The plotted bomb locations therefore cannot be considered accurate, and it has not been possible to determine the exact locations of individual strikes beyond identifying the general area within which the bomb fell. Maps that show bomb strikes within the site locality have been presented in **Annex I** and discussed below.

Kent Daily Bomb Maps	
Date	Comments
16 th August 1940	One H.E bomb is recorded to the west of the site.
14 th September 1940	One H.E bomb is recorded across the wider site area, and one incendiary bomb is recorded to the south-west of the site.
5 th October 1940	One incendiary bomb is recorded across the wider site area, and one H.E bomb is recorded to the west of the site.
12 th January 1941	One H.E and one incendiary bomb are recorded to the north of the site.

Kent V-1 and Shells Bomb Maps	
Date	Comments
21 st January 1944	One H.E bomb is recorded across the wider site area.
29 th July 1944	One V-1 pilotless aircraft bomb is recorded to the south-west of the site.

11.5. Kent War Diaries – Northfleet

Written incident records were obtained from the Kent History and Library Centre. The War Diaries comprise a set of written records that detail the date, time, location, type of bomb, and damage caused for bombing incidents across Kent. Wartime Cassini grid references are often used within this record set in order to give an approximate location of incidents. Excerpts of relevant bombing incidents are presented in **Annex J** and transcribed below.

Kent War Diaries – Northfleet		
Date	Type of Bomb	Comments
28 th July 1941	A.A	Exploded in open field approx. M.R 079906. Nil casualties. <i>This incident occurred approximately 300m south of the site.</i>
4 th January 1944	L.R.R	Violent explosion in mid-air. Many pieces of shrapnel fell throughout the district – 075905. Nil casualties. <i>This incident occurred approximately 0.6km south-west of the site.</i>

11.6. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England) and Google™ Mapping Services. This photography provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (see **Annexes K and L**).

WWII-Era Aerial Photography	
Date	Description
18 th August 1944 (Annex K)	This photograph is poor quality, but shows the site in its entirety and structures within the site boundary are distinguishable despite the quality. The site is occupied by structures in the centre, with dense vegetation to the north and east, and a garden in the west. There does not appear to be any obvious signs of bomb damage, such as cratering or scattered earth, within or in the immediate vicinity of the site.
1940s-Era - exact date unknown (Annex L)	This photograph is also of poor quality, however again confirms the site's composition. There do not appear to be any indicators of bomb damage present in this photograph either.

11.7. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.8. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) (now 29 Regt) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, Applied Geology Limited will be advised.

11.9. Evaluation of German Aerial Delivered UXO Records

Factors	Conclusion
Density of Bombing <i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.</i>	During WWII the site was situated within the Urban District of Northfleet, which according to official Home Office bombing statistics sustained an overall high density of bombing. This comprised a total of 389 items of ordnance across the 3,770 acre district, or an average of 103.2 items per 1,000 acres. Areas of Gravesend, Northfleet, and Tilbury Docks all appear on Luftwaffe target photography – notably the targets such as the dockyards and power station close to the Thames Estuary (see Annex H). Kent Daily Bomb maps plot a number of bombing incidents in the wider site area, however given that exact locations are not identifiable these maps are better used to gauge localised bombing density rather than site specific. Written records were also consulted and no positive evidence has been found to suggest the site was subject to bomb strikes. It appears that the localised bombing density was therefore quite low, with most of the bombing in the borough occurring further to the north.



Damage <i>If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.</i>	The site was comprised open land, an orchard, and two structures occupied the centre. Post-WWII OS mapping does not show the structures on site to be missing or labelled as 'Ruin', which are common indicators of bomb damage. Furthermore, low-resolution post-war photography does not appear to possess indicators of bomb damage, such as cratering or scattered earth. It is understood the <i>Battle of Britain</i> pub was opened on site in 1947 in one of the existing buildings, and remained in that location until 1961 when the owners purchased <i>Shears Green House</i>, also on site.² Both of these structures were present pre-war. The usage of the western structure as a pub in the immediate post-war years suggests it was in good condition.
Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	Given the site comprised a mix of features, it is expected groundcover across the site area would have differed. In areas of dense vegetation/orchard it is expected groundcover would not have been conducive to the detection of evidence of UXO, however where the site was occupied by buildings and associated garden evidence of UXO would likely have been more obvious.
Access Frequency <i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.</i>	As with groundcover, access frequency may also have differed across the site area, with areas of dense vegetation experiencing infrequent access, and areas occupied by buildings likely being accessed on a more regular basis. However, it is likely the site would have been subject to monitor given the structures on site and its proximity to roadways.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

² <http://www.dover-kent.com/2014-project-a/Battle-of-Britain-Northfleet.html>

12. Introduction to Allied Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.2.1. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery	
Item	Description
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.



LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LSA Ammunition	Gun type	Calibre	Shell Weight	Shell Dimensions
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as "Z" batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Aerial Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Appendix iv**.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Allied UXO Contamination	Conclusion
Military Camps <i>Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.</i>	1 st Line Defence could find no evidence of a military camp within the site. The nearest military camp was located approximately 1.2km south of the site, <i>Northumberland Bottom Camp</i> .



Anti-Aircraft Defences <i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i>	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 1.2km south of the site. Despite this distance the maximum effective range of an AA projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.
Home Guard Activity <i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i>	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.
Defensive Positions <i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i>	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges <i>Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.</i>	No evidence of training or firing ranges could be found within the site or surrounding area.
Defensive Minefields <i>Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.</i>	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture <i>Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.</i>	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields <i>Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.</i>	The site was not situated within the perimeters or vicinity of a military airfield. The nearest airfield was RAF Gravesend, located approximately 3.2km south-east of the site.



14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German aerial delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe target photography, Kent Daily and V-1/Shells Bomb Census Maps, Kent War Diary entries from Northfleet, and aerial photography from the 1940's era and 1944. The record set is of generally poor quality. Kent daily bomb maps are not considered to be accurate representations of bombing locations, given the bombs were plotted on small-scale maps for the whole county. The written records obtained for the production of this report are more reliable in terms of location, however given the use of Cassini grid referencing and the error margin in plotting locations these are also considered to be somewhat vague when identifying the position of incidents. Therefore, the record sets consulted provide a better idea of localised bombing, as opposed to site-specific.
German Aerial Delivered Ordnance	- During WWII the site was situated within the Urban District of Northfleet, which according to official Home Office bombing statistics sustained an overall high density of bombing. This comprised a total of 389 items of ordnance across the 3,770 acre district, or an average of 103.2 items per 1,000 acres. - The site itself does not appear to be present on available Luftwaffe target photography, however Gravesend, Northfleet, and Tilbury Docks, all along the River Thames/Thames Estuary, are identified as targets, specifically the dockyards and power station (see Annex H). There are multiple references to bombing incidents in the wider site area, as per the Kent Daily and V-1/Shell Bomb Mapping, and the Kent War Diaries also. However, it appears that the localised bombing density around the site was quite low – most of the bombing in the borough occurred further north. - Kent bomb plot mapping shows H.E and incendiary bomb strikes in the wider area, as well as a V-1 pilotless aircraft bomb to the south of the site. Unfortunately the exact locations of these bomb strikes cannot be identified given that the incidents were plotted on small-scale maps. - Written records were consulted in the form of the Kent War Diaries and no positive evidence has been found to suggest the site was subject to bomb strikes. The nearest references to bombing incidents were located approximately 300m south of the site and 0.6km south-west of the site. The former is recorded as A.A. (anti-aircraft), though exactly what type is not provided, and this exploded in an open field; the latter a L.R.R (Long Range Rocket/V-2) which exploded in mid-air and caused shrapnel to fall across the district. While the risk of shrapnel falling on site cannot be discounted, no evidence of bombing incidents on site has been found in available record sets. - Given the site was comprised a mix of features, it is expected both access and groundcover would have differed across the site area. Areas of dense vegetation are unlikely to be conducive to the detection of evidence of UXO or to have been accessed regularly; however areas of the site occupied by buildings and associated garden are likely to have been accessed frequently, and it is expected evidence of UXO would have been more obvious in these areas. - It is likely the site was subject to a degree of monitor, given its proximity to nearby roadways and the fact there were structures within the site boundary. - Post-WWII OS mapping and aerial photography do not appear to show any obvious indicators of damage, such as missing and ruined buildings, or cratering and scattered earth. While available post-war photography is of poor quality, it is clear enough to suggest the site and immediate surroundings were not subject to

	damage. Furthermore, the usage of one of the buildings on site as a pub in the immediate post-war years suggests it was in good condition. In summary, while bombing records confirm the general area was subject to bomb strikes, no positive evidence has been found in available records to suggest the site or immediate vicinity were subject to bombing incidents. Furthermore, no obvious indicators of bomb damage exist in post-war OS mapping and photography, such as buildings labelled as 'ruin' or evidence of cratering/scattered earth. While it is not possible to entirely discount the risk of UXO on site, it is not believed that the risk is above that of the 'background level' for this area of the UK. It is recommended that a UXO safety and awareness briefing is provided to ground staff, and that a UXO risk management plan is put in place.
Allied Ordnance	There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 Regt). It should also be noted that in addition to 29 Regt archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

Post-WWII mapping shows the site had undergone slight development, whereby an additional building/extension to existing building has been constructed adjacent to the eastern structure, now labelled *Battle of Britain (PH)*; the structure in the west is now labelled *Shears Green House*. An access road appears to have been added to the north of the site, off *New House Lane*. The remainder of the site is occupied by an orchard, open land and garden. It does not appear the site has undergone any further development since this point.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement

levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed works would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Aerial Delivered Ordnance

Since an aerial delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Aerial Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall **Low Risk** from German and anti-aircraft unexploded ordnance at the site of proposed works. There is also an assessed **Low Risk** from Allied unexploded ordnance.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Land Service and Small Arms Ammunition		✓		

Please note – although the risk from unexploded ordnance on this site has been assessed as ‘Low’, this does not mean there is ‘no’ risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the ‘Proposed Works’ section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. **Proposed Risk Mitigation Methodology**

20.1. **General**

The following risk mitigation measures are recommended to support the proposed works at Land off Coldharbour Road:

Type of Work	Recommended Mitigation Measure
All Works	UXO Risk Management Plan It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. Site Specific UXO Awareness Briefings to all personnel conducting intrusive works. As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

17/08/2021

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

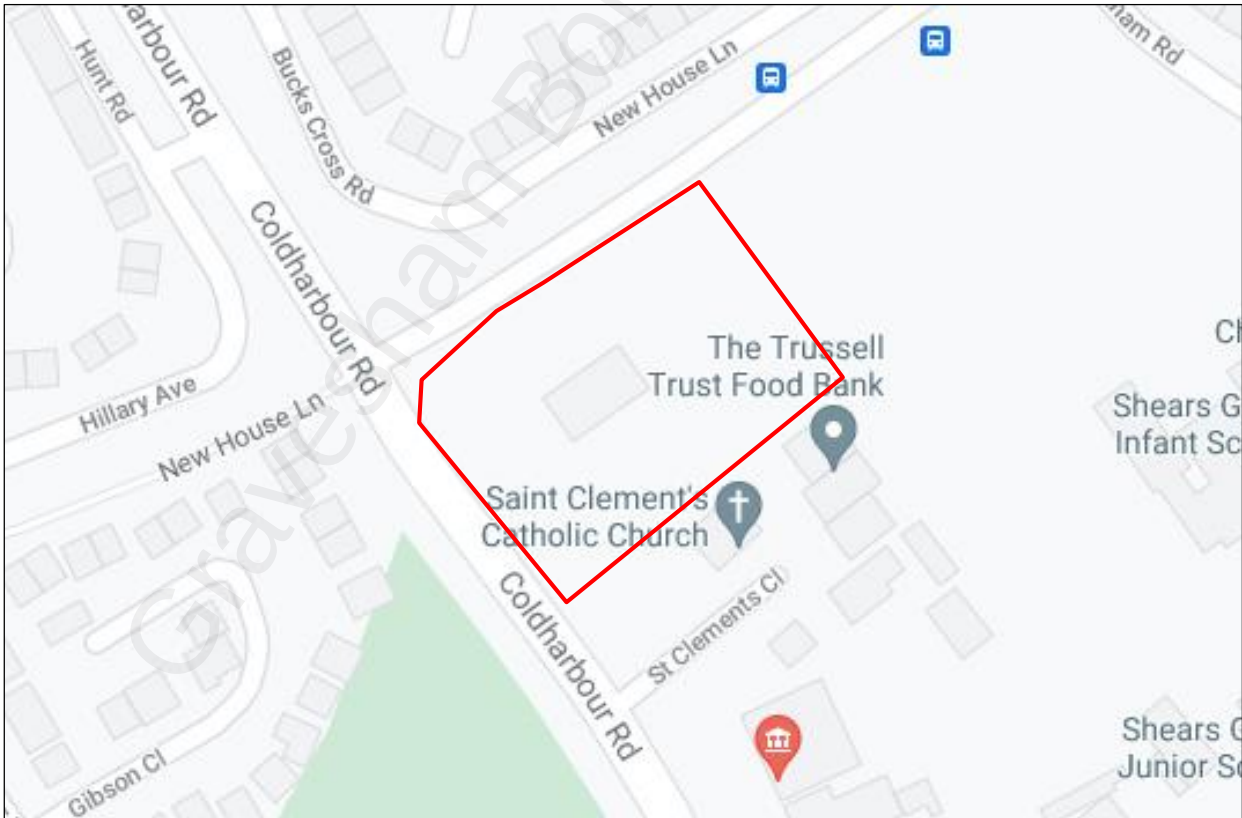
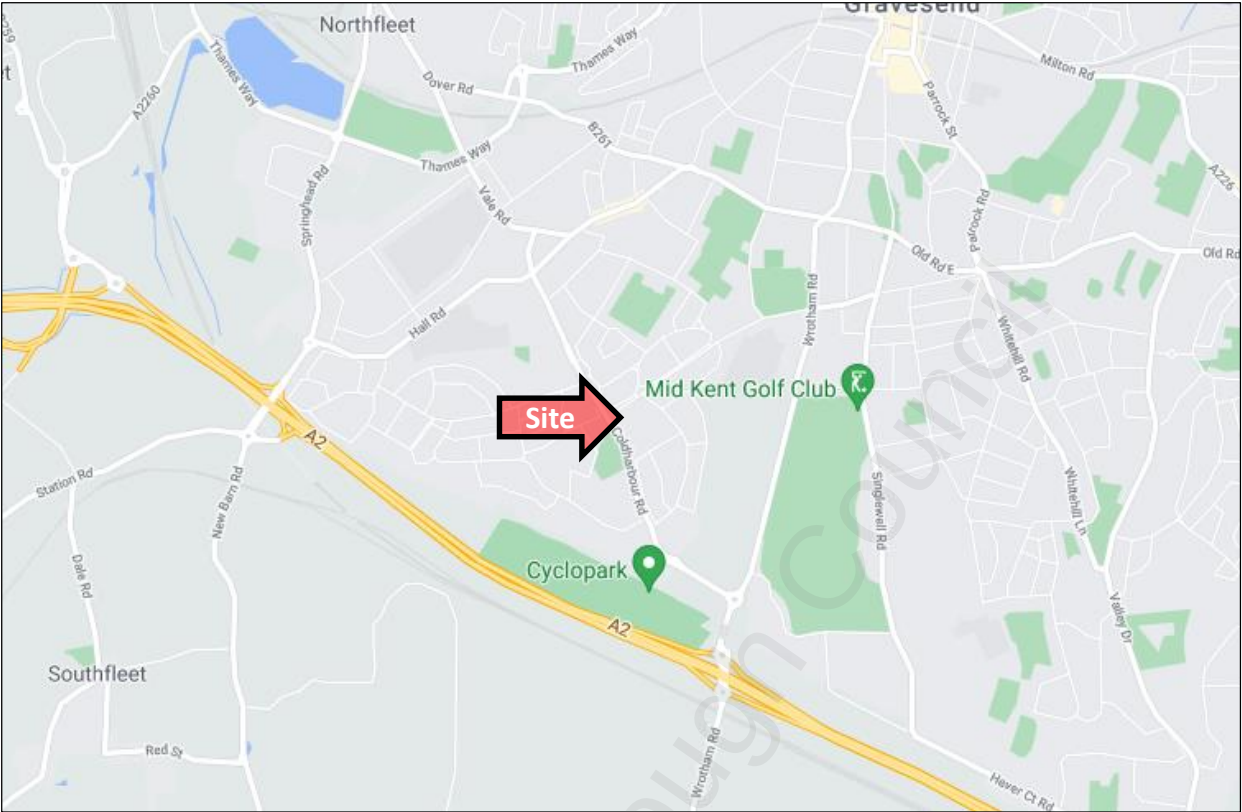
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This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

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Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: Google Maps

 **Approximate site boundary**





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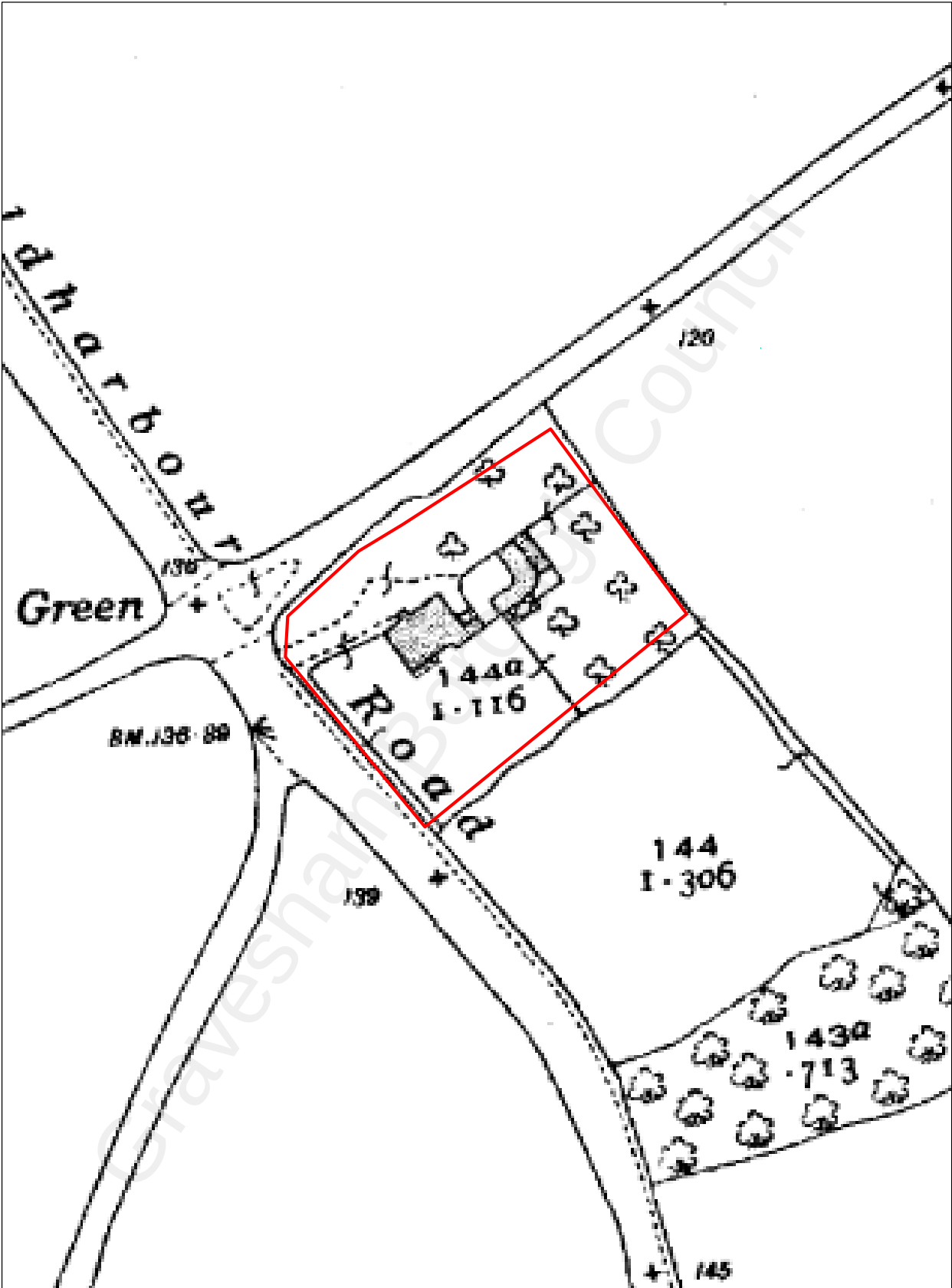
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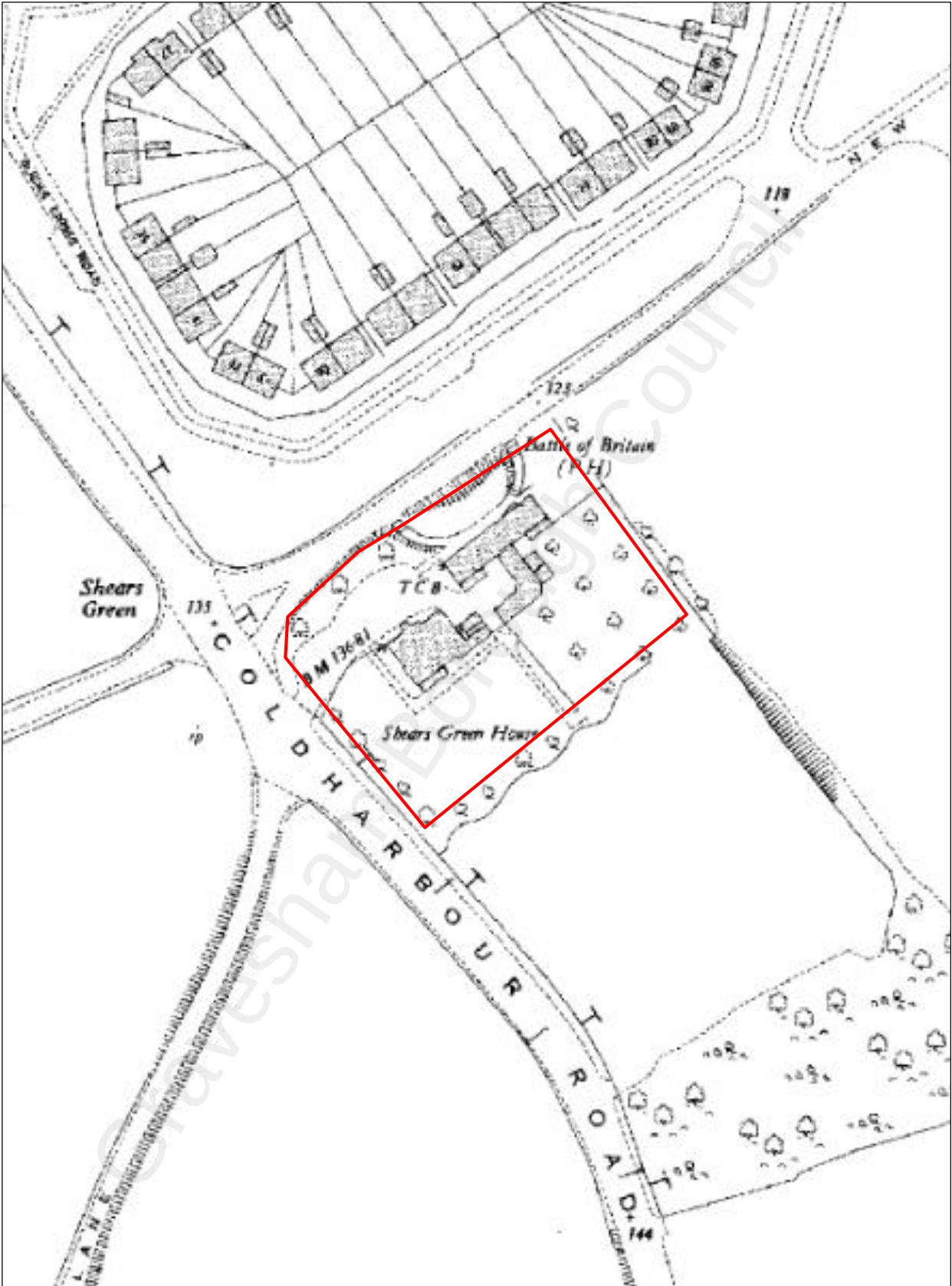
 **Approximate site boundary**

Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: **Landmark Maps**





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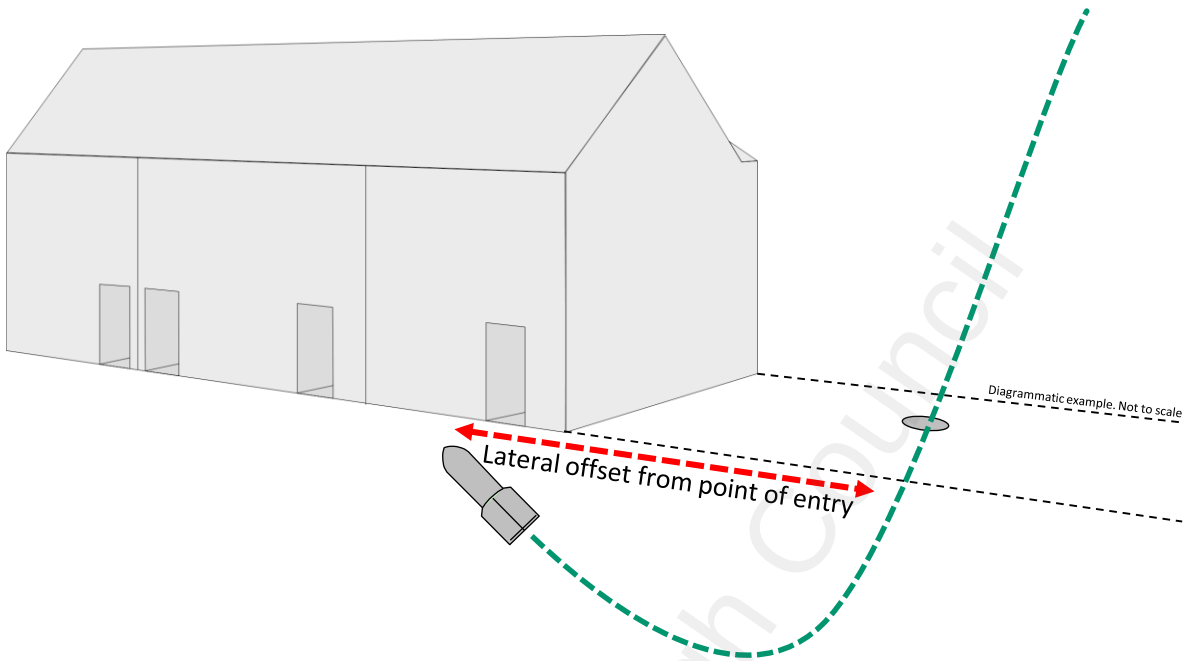
Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: **Landmark Maps**

 **Approximate site boundary**









Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows 250kg bomb found in Bermondsey pointing upwards, demonstrating ‘J-curve’



One of the most common scenarios for UXO going unnoticed was when a UXB fell into a ‘bomb site’ (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).



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Source: Various sources

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Bermondsey bomb: World War Two device safely removed



An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

March 2015



Bethnal Green WW2 bomb: Experts remove unexploded device



An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

A 200m (650ft) exclusion zone was set up around the device.

August 2016



Bath WW2 bomb scare: Device defused, police say



A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The discovery of the bomb on Thursday led to the evacuation of hundreds of homes and many road closures in the Lansdown area of the city.

A cordon around the site was lifted on Friday evening, more than 24 hours after residents were asked to leave their homes.

May 2016



London City Airport reopens after WW2 bomb moved



London City Airport has reopened after an unexploded 500kg World War Two bomb was safely moved from the area.

The device was discovered at the King George V Dock on Sunday during planned work at the east London airport.

All flights were cancelled on Monday after an exclusion zone was put in place, with the closure affecting up to 16,000 passengers and nearby residents being evacuated from their homes.

May 2015



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Project: Land off Coldharbour Road, Gravesend

Ref: DA13830-00

Source: BBC News

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BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

SPIEGEL ONLINE

Blast Kills One
World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013



World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006



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Project:	Land off Coldharbour Road, Gravesend		
Ref:	DA13830-00	Source: Various news sources	
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Unexploded Second World War bomb discovered under Somerset footpath

By Western Daily Press | Posted: January 21, 2014



The unexploded bomb was found in Somerset.

Comments (8)

An unexploded bomb dropped in Britain during the Second World War has finally been discovered – underneath a popular footpath in Somerset.



21 August 2014 Last updated at 15:01

Unexploded WW2 bomb found at Kenfig Pool, Bridgend



Dean Smith believes the shell was made in Germany

Bomb experts have been called to a south Wales nature reserve after an unexploded World War Two shell was discovered by a walker in Bridgend.

Dean Smith, 38, of Pyle, was walking near Kenfig Pool on Saturday when he saw a fin sticking out of the sand.

He reached down to pick it up, but ending up falling and landed with the 25-long (0.6m) bomb on top of him.

The site has been cordoned off by police and the Royal Logistics Corps will carry out a controlled explosion.

Related Stories

'Panik' as dog nearly thrown grenade

WW2 bomb found at wind farm exploded

WWII bomb found in kitchen cupboard

Unexploded bomb found in farmer's field

17 May 2010



A live Second World War mortar shell was blown up by Army experts after a farmer found it in his field. The discovery was made in the field alongside the A20 between Folkestone and Dover.

The mortar shell, which was around a foot long and 3in in diameter, was around 50ft from the main road.

The farmer alerted police and PC Trevor Moody and PCSO Michelle Brady went to the field.

PC Moody contacted the Army who sent in a bomb disposal unit.

An Army officer confirmed the live shell was from the Second World War and was packed with high explosives.

They moved it a safe distance away from the A20 and carried out a controlled explosion.

PC Moody said: "Given that we live in an area that saw much action during the Second World War, it is not uncommon for us to be alerted about unexploded bombs."

The incident was on Thursday.

Click here for more news from Kent.

Royal Navy bomb disposal experts remove a World War Two shell discovered in a nature reserve

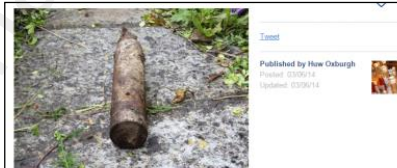
- A World War Two bomb was discovered in a Plymouth nature reserve
- Amateur metal detector found the shell and partially dug it up
- Royal Navy experts carried the explosive away before disposing of it

By VALERIE EDWARDS FOR MAILONLINE
PUBLISHED: 01:29, 13 January 2016 | UPDATED: 09:51, 13 January 2016

A World War Two bomb was reportedly found at Efford Nature Reserve in Plymouth after a member of the public was metal detecting and partially dug it up.

The Royal Navy Bomb Disposal team was called in to remove the bomb and police have closed off Military Lane, with the possibility of Military Road also being closed.

Police were called at around 1.30pm yesterday after what appeared to be a shell was discovered and partially dug up near Military Lane, Efford.



Unexploded bomb found in Axminster

Update: The bomb disposal unit has made the device safe and the road has re-opened

Six homes have been evacuated today after the discovery of an unexploded device in Axminster.

A Royal Navy bomb disposal team have been called to the scene after a 'historic German device' was discovered in a garden.

Police have set up a 20m cordon around the garden in Alexandra Road and evacuated homes in the surrounding area as a precaution.

Mortar thought to be from WWII found on Oshawa's Camp-X grounds

August 24, 2016 | 5:42 am



What is believed to be a World War II mortar has been discovered in south Oshawa. A man out in Interprik Park, the site of the Camp-X Second World War training grounds, discovered the round with his metal detector on Tuesday evening. Durham police are held the scene overnight awaiting military officials from Trenton to come and properly detonate the mortar.

Holiday beach cordoned off after landslide sends more than a THOUSAND Second World War bombs and rockets tumbling onto the sands

- Bad weather led to ground movement which exposed the huge arsenal at Mappleton, East Riding
- A dog walker stumbled across the deadly find on Saturday and 15 controlled explosions were carried out
- Rockets, mortar bombs and 25-pounder bombs were recovered after they were fired into the cliffs by RAF aircraft during the war
- Most of the devices were dummy rounds used for bombing practice but contain enough explosives to cause terrible injuries



Bomb Beach Alley: Rockets were found after a landslide on Mappleton beach in 2012

Storms and floods unearth unexploded wartime bombs

By Claire Marshall
BBC environment correspondent

There has been a dramatic increase in the number of wartime bombs unearthed because of the winter storms and flooding.

Bomb disposal teams in the South West have dealt with double the number of unexploded ordnance than in the same period last year.

Since mid-December, the Royal Navy's Southern Dive Unit has recovered or disposed of 244 items of ordnance.

During the same period last year, they dealt with just 108 items.

Almost 70 years after the end of WWII, one legacy of that conflict continues to turn up on beaches and harbours around Britain.

Unexploded shells, bombs and mines continue to be discovered every year, and the Royal Navy's Southern Dive Unit is tasked with making these devices safe.

Its area of responsibility stretches for some 2,250km (1,400 miles). It begins from the highwater mark in Hull and proceeds seaward to the territorial limit, and then runs clockwise around the British Isles - including the Isle of Wight, Channel Islands, and Isles of Scilly - to finish in Liverpool.



The storms have uncovered a lethal past

Related Stories

Ancient trees revealed by storms



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Reporter, April 26, 1990

CRIME-LINE

GRENADE FOUND BY KIDS ON ESTATE

GRAVESEND REPORTER

CRIME-LINE

OUR FIGHT FOR YOUR TOWN

ANSWER PHONE 564444

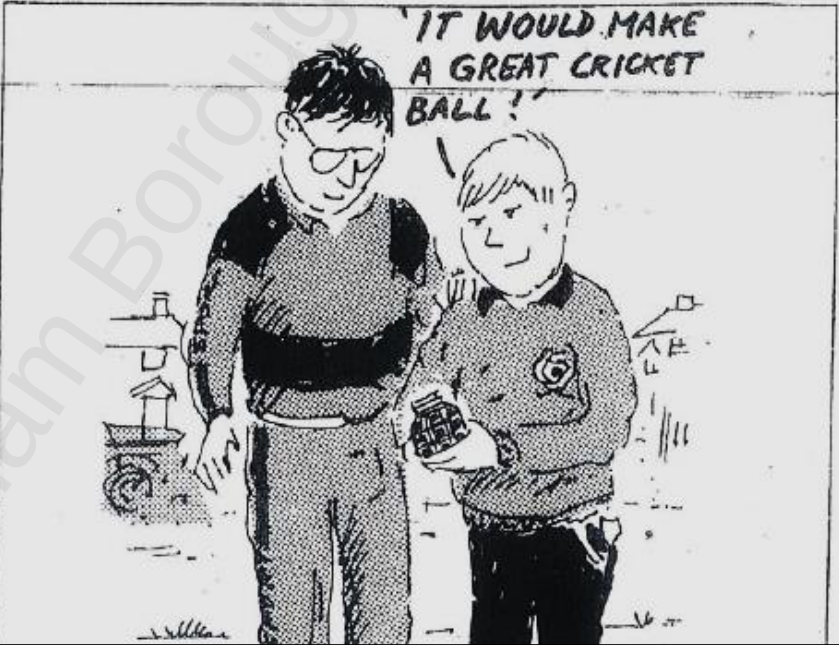
TWO youngsters playing on a building site wrenched a grenade from the ground and carried it to a nearby house.

The young boys found the World War II explosive without its safety pin at the McLeans Homes site, Coldharbour Road, Northfleet, on Sunday.

The device is believed to have been buried beneath the former school playing field for nearly 50 years.

And the find has sparked renewed calls from police and army for the public to be wary of explosives.

Earlier this month two boys were officially cautioned by police for possession of illegal weapons after picking up a mortar bomb at a munitions dump in Vin...

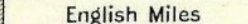




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Ref:	DA13830-00	Source: Gravesend Reporter



Luftwaffe Photograph



Gravesend – Kent

TN 1590

4th June 1939

A. GB 50 93 – Kraftwerk (Power Station)

The site located approximately 2.4km south-east of the Power Station.



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Ref: DA13830-00

Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"



16th August 1940



14th September 1940



5th October 1940



Incendiary Bomb



H.E Bomb



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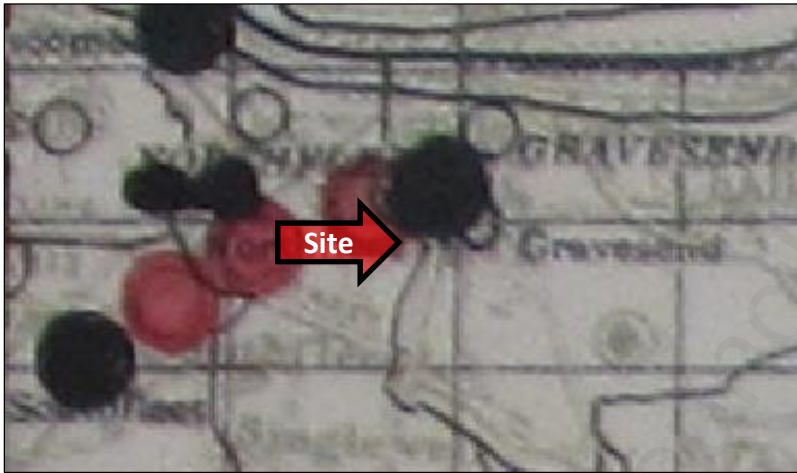
Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: **Kent History and Library Centre**

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12th January 1941



Incendiary Bomb



H.E Bomb



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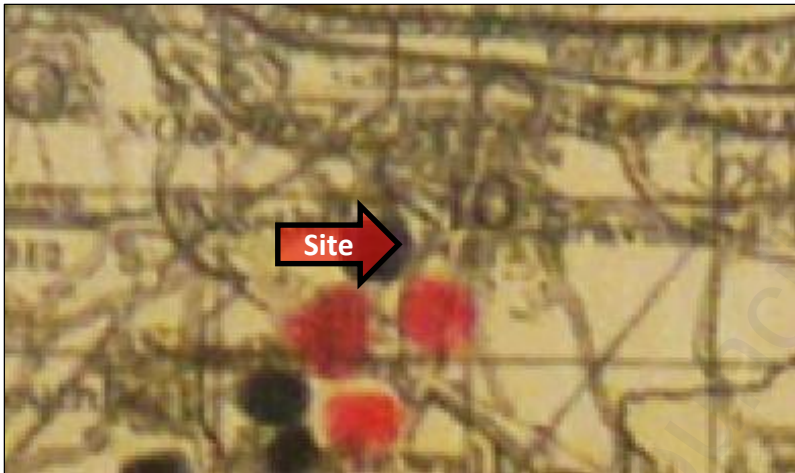
Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: Kent History and Library Centre

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21st January 1944



29th July 1944



Incendiary Bomb



H.E Bomb



Pilotless Aircraft (V-1) Bomb



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28th July 1941

NORTH FLEET INCIDENTS.												WAR DIARY.				Date. 28.7.41	
Date	Time		Local Authority	Time of Incident	Type of Bomb	No.	Information	Casualties			Damage	Action Taken and Remarks					
	Origin	Receipt						K.	S.I.	S.L.							
28.7.41	1645	1650	NORTH FLEET	02.15	RA.	1	EXPLODED IN OPEN FIELD APPROX. M.R. 079906				NIL REPORTED NIL REPORTED	REGION 1658					

This incident occurred approximately 300m south of the site

4th January 1944

NORTH FLEET			INCIDENTS.		WAR DIARY.		Date.....4-1-44.....					
Date	Time		Parish	Time of Incident	Type of Bomb	No.	Information	Casualties			Damage	Action taken and remarks
	Origin	Receipt						K.	S.I.	S.L.I.		
4-1-44	17.05	17.09		APPROX 16.20	LRR		VIOLENT EXPLOSION. W. MID. AIR. MANY. PIECES OF SHRAPNEL FELL THROUGHOUT THE DISTRICT. - 075905 App.	2	1	1		R. 17.14 ✓

This incident occurred approximately 0.6km south-west of the site



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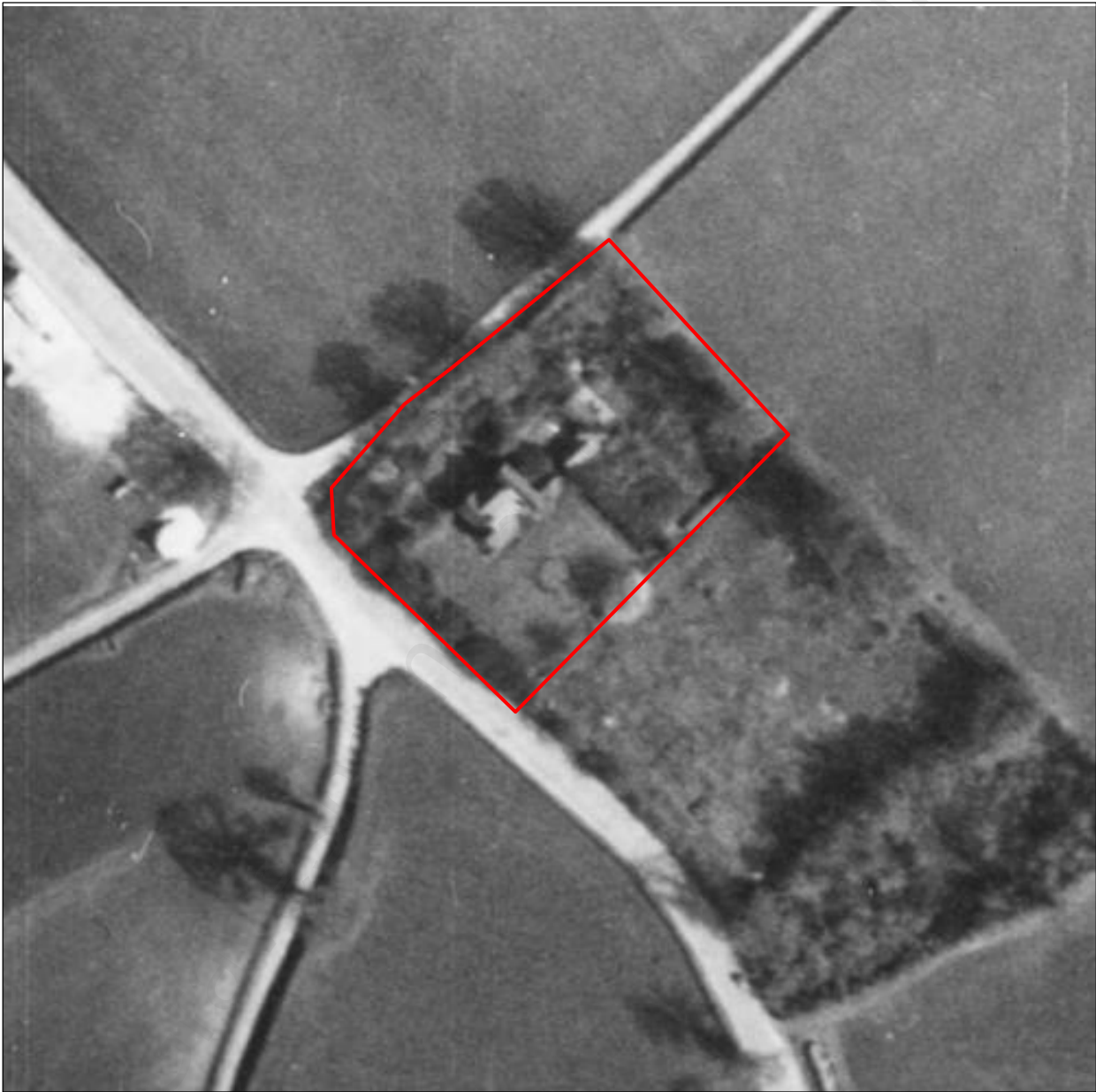
Client: Applied Geology Limited

Project: Land off Coldharbour Road, Gravesend

Ref: DA13830-00

Source: Kent History and Library Centre







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 **Approximate site boundary**



Project: **Land off Coldharbour Road, Gravesend**

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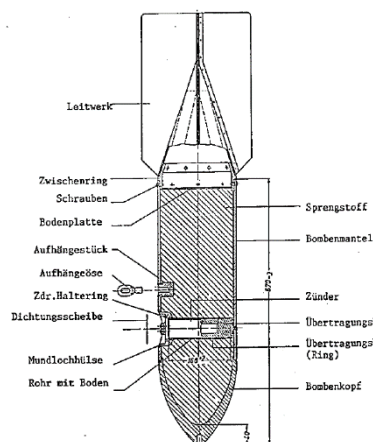
Source: Google™ Mapping Services

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Examples of German Bombs - HE

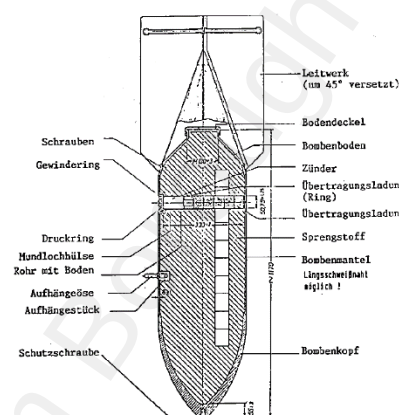
SC 50kg

Bomb Weight	40-54kg (110-119lb)
Explosive Weight	c25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



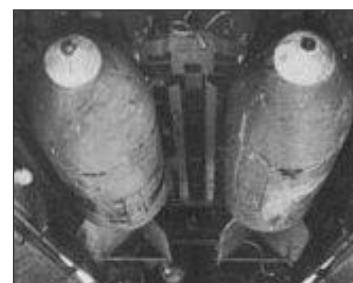
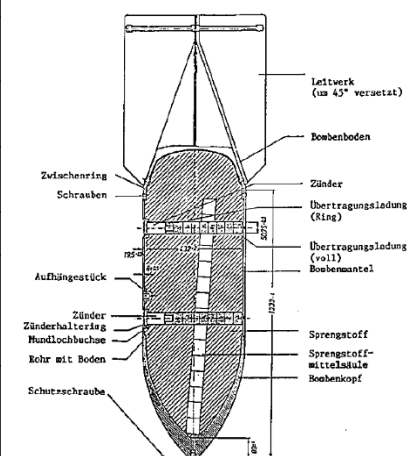
SC 250kg

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).



SC 500kg

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialene filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming


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Source: Various sources

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Bomb Weight	2kg (4.41lb)
Explosive Weight	7.5oz (212.6 grams) of TNT surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Bomb Dimensions	Length 240 mm Width 140 mm Height 310 mm
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	It was designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers that opened at a predetermined height, thus scattering the bombs.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

Bomb Weight	987.017kg (2176lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against civilian, military and industrial targets. Designed to detonate above ground level to maximise damage to a wider area.
Remarks	Parachute Mines were normally carried by HE 115 (Naval operations), HE 111 and JU 88 aircraft types. Deployed a parachute when dropped in order to control its descent.

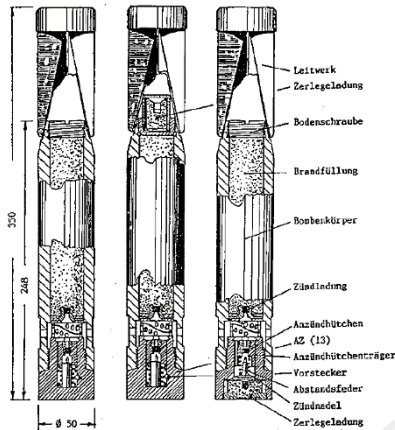
SC

Bomb Weight	996-1061kg (1,058-1,146lb)
Explosive Weight	530-620kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (77 x 25.2in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction



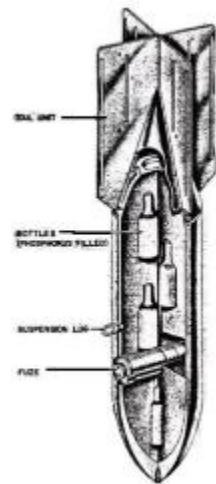
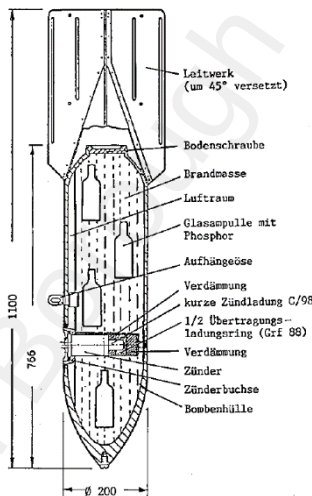
1kg Incendiary Bomb

Bomb Weight	1.0 and 1.3kg (2.2 and 2.87lb)
Explosive Weight	680gm (1.3lb) Thermite
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters against towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



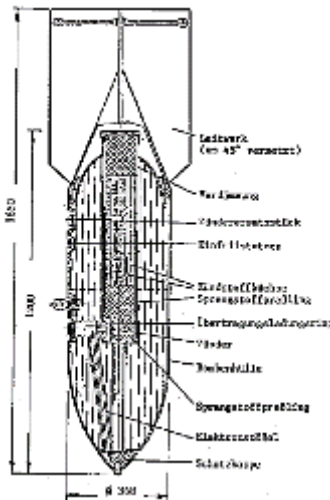
C50 A Incendiary Bomb

Bomb Weight	c41kg (90.4lb)
Explosive Weight	0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against all targets where an incendiary effect is to be expected
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture



Flam C-250 Oil Bomb

Bomb Weight	125kg (276lb)
Explosive Weight	1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on living targets, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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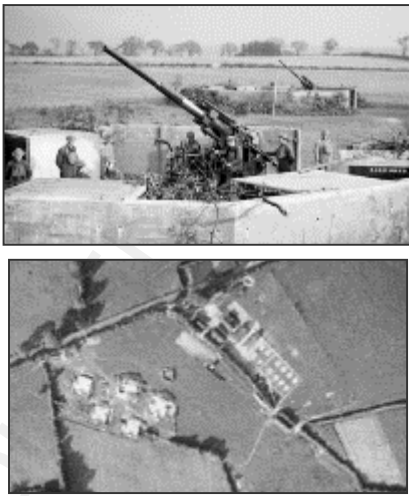
Ref: **DA13830-00**

Source: Various sources

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QF 3.7 Inch WWII Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	High Explosive Anti-Aircraft projectile. 4.5in projectiles were also used in this role.
Ceiling	30,000ft to 59,000ft



40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Proximity and Mechanical Time Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40mm x 310mm (1.6in x 12.2in)
Ceiling	23,000ft (7000m)



Unrotated Projectile (UP) – Z Battery

Projectile Weight	84lb (24.5kg)
Warhead Weight	4.28lb (1.94kg)
Warhead	Aerial Mine with a No. 700 / 720 fuze
Filling	High Explosive
Dimensions	1930mm x 82.6mm (76 x 3.25in)
Use	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries.



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Client: **Applied Geology Limited**

Project: **Land off Coldharbour Road, Gravesend**

Ref: **DA13830-00**

Source: Various sources

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APPENDIX C

BOREHOLE LOG - CABLE PERCUSSION

BH1

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 2

Start 07/08/2021

Coordinates E 563630.36 N 172271.81

Scale

1:50

End 07/08/2021

Ground Level 41.14m AOD

Total Depth

12.00m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.20			40.99	(0.15)	Asphalt.			
ES	0.30				0.15	(MADE GROUND)			
D	0.50			40.64	(0.35)	Soft brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite and chalk.			
ES	0.60				0.50	(POSSIBLE MADE GROUND)			
						Soft becoming firm brown occasionally mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded quartzite.			
D	1.20				(1.50)	(HEAD DEPOSITS)			
S	1.20	N = 16	1.20						
D	1.80								
D	2.00			39.14	2.00	Light brown slightly clayey silty fine SAND.			
					(0.50)	(THANET SAND FORMATION)			
D	2.30								
S	2.30	N = 23	2.30	38.64	2.50	Medium dense becoming dense brown silty fine to medium SAND.			
						(THANET SAND FORMATION)			
D	3.30								
C	3.30	N = 24	3.30						
C	4.30	N = 26	4.30						
D	4.50								
D	5.50								
C	5.50	N = 31	5.50			Below 5.50m bgl: dense.			
D	6.50								
C	7.00	N = 35	7.00						
					(9.50)				
D	7.60								
C	8.50	N = 37	8.00						
B	8.60								
B	9.50								

Continued next sheet

Chiselling			Groundwater Strikes					Drilled: TS
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			4.30	4.30		4.00		Logged: JD
								Checked: FHJ

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Water added to aid drilling from 2.30m bgl to 11.50m bgl. Borehole backfilled with bentonite and arisings on completion.

Installation:

Diameter: 150mm to 12.00m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

BH1

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

2 of 2

Start 07/08/2021

Coordinates E 563630.36 N 172271.81

Scale

1:50

End 07/08/2021

Ground Level 41.14m AOD

Total Depth

12.00m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
C	10.10	N = 39	10.00			Medium dense becoming dense brown silty fine to medium SAND. (THANET SAND FORMATION)			
D	10.50								
B	11.50								
C	11.50	N = 45	10.00						
				29.14	12.00	End of Borehole at 12.00m			

Chiselling			Groundwater Strikes					Drilled: TS
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			4.30	4.30		4.00		Logged: JD
								Checked: FHJ

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Water added to aid drilling from 2.30m bgl to 11.50m bgl. Borehole backfilled with bentonite and arisings on completion.

Installation:

Diameter: 150mm to 12.00m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

BH2

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 2

Start 06/08/2021

Coordinates E 563679.22 N 172281.30

Scale

1:50

End 06/08/2021

Ground Level 40.28m AOD

Total Depth

12.45m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.10			40.18	(0.10)	Asphalt.			
ES	0.15			39.98	0.10	(MADE GROUND)			
D	0.40			39.78	(0.20)	Dark blackish brown sandy slightly clayey GRAVEL. Gravel is fine to coarse subangular to subrounded quartzite and rare brick.			
D	0.60				0.30	(MADE GROUND)			
ES	0.70				(0.20)				
D	1.00			39.28	0.50	Brown slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subangular to subrounded quartzite.			
D	1.20				(0.50)	(MADE GROUND)			
S	1.20	N = 13	1.20		1.00	Brown slightly gravelly slightly clayey silty fine SAND. Gravel is fine to coarse subangular to subrounded quartzite.			
						(POSSIBLE MADE GROUND)			
D	1.80					Firm becoming stiff orangish brown occasionally mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded flint.			
D	2.10					(THANET SAND FORMATION)			
S	2.10	N = 17	2.00		(2.90)	Below 2.10m bgl: stiff.			
D	2.70								
B	3.00								
C	3.00	N = 25	3.00						
D	3.90			36.38	3.90	Medium dense light greyish brown slightly gravelly silty fine to medium SAND. Gravel is fine to coarse angular to subangular flint.			
D	4.10				(0.40)	(THANET SAND FORMATION)			
S	4.10	N = 28	4.00	35.98	4.30	Medium dense becoming dense brown silty fine to medium SAND.			
B	4.50					(THANET SAND FORMATION)			
C	5.00	N = 35	5.00			Below 5.00m bgl: dense.			
D	5.60								
C	6.50	N = 40	6.50						
D	7.30					At 7.30m bgl: slightly gravelly. Gravel is fine to medium subangular to subrounded quartzite.			
C	8.00	N = 42	8.00		(7.40)				
B	8.30								
D	9.50								
S	9.50	N = 46	9.50						

Continued next sheet

Chiselling			Groundwater Strikes					Drilled: TS
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			4.30	4.30		4.30		Logged: JD
								Checked: FHJ

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Water added to aid drilling from 1.20m bgl to 12.00m bgl. Borehole backfilled with bentonite and arisings on completion.

Installation:

Diameter: 150mm to 12.45m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - CABLE PERCUSSION

BH2

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

2 of 2

Start 06/08/2021

Coordinates E 563679.22 N 172281.30

Scale

1:50

End 06/08/2021

Ground Level 40.28m AOD

Total Depth

12.45m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	10.50					Medium dense becoming dense brown silty fine to medium SAND. (THANET SAND FORMATION)			
C	11.00	N = 48	11.00						
D	11.50			28.58	11.70				
C	12.00	N = 50	11.50						
						End of Borehole at 12.45m			

Chiselling			Groundwater Strikes					Drilled: TS
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			4.30	4.30		4.30		Logged: JD
								Checked: FHJ

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Water added to aid drilling from 1.20m bgl to 12.00m bgl. Borehole backfilled with bentonite and arisings on completion.

Installation:

Diameter: 150mm to 12.45m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS1

Project

Coldharbour Road, Gravesend

Client

Frontier Estates Ltd

Start

05/08/2021

End

05/08/2021

Coordinates

E 563645.15 N 172285.84

Ground Level

40.53m AOD

Project No.

AG3309-21

Sheet

1 of 1

Scale

1:25

Total Depth

4.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
ES	0.30	N = 13		40.34	(0.20)	Asphalt. (MADE GROUND)			
					0.20	Dark brown gravelly slightly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded quartzite, brick, asphalt and concrete. (MADE GROUND)			
D	0.50			40.14	(0.20)				
					0.40				
D	1.00				(0.50)	Brown slightly gravelly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded quartzite. (POSSIBLE MADE GROUND)			
				39.64	0.90				
S	1.20					Medium dense light brown with occasional orangish brown surface staining slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subangular to subrounded flint. (THANET SAND FORMATION) <i>Below 1.20m bgl: clayey.</i>			
D	1.60			101mm /80%					
S	2.00			N = 20					
D	2.60				92mm /90%				
S	3.00	N = 9							
D	3.50		79mm /90%						
D	3.90	N = 50		36.74	3.80	Dense light orangish brown sandy slightly silty GRAVEL. Gravel is fine to coarse angular to subangular flint. (THANET SAND FORMATION)			
C	4.00				(0.65)				
				36.08	4.45	End of Borehole at 4.45m			

Installation: 50mm diameter standpipe installed to 4.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
3.80	3.80	Strike			Logged: JD
					Checked: FHJ

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS2

Project

Coldharbour Road, Gravesend

Client

Frontier Estates Ltd

Start

05/08/2021

End

05/08/2021

Coordinates

E 563671.64 N 172297.65

Ground Level

39.96m AOD

Project No.

AG3309-21

Sheet

1 of 1

Scale

1:25

Total Depth

4.43m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
B	0.20	N = 4		39.81	(0.15)	Asphalt.			
D	0.20				0.15	(MADE GROUND)			
ES	0.20				(0.25)	Brown gravelly slightly silty fine to medium SAND. gravel is fine to coarse subangular to subrounded quartzite, brick, asphalt and sandstone.			
D	0.40			39.56	0.40	(MADE GROUND)			
		N = 22	101mm /80%	39.46	(0.10)	Dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded quartzite.			
B	0.70				0.50	(POSSIBLE MADE GROUND)			
						Brown slightly gravelly silty fine SAND. Gravel is fine to coarse subangular to subrounded flint.			
					(0.95)	(THANET SAND FORMATION)			
S	1.20	N = 35				Below 1.20m bgl: very loose.			
D	1.30								
				38.51	1.45	Firm becoming stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint.			
D	1.60				(0.85)	(THANET SAND FORMATION)			
S	2.00	N >50	92mm /90%			Below 2.00m bgl: gravelly.			
				37.66	2.30	Medium dense becoming dense light brown occasionally brown mottled brown silty fine to medium SAND.			
D	2.60					(THANET SAND FORMATION)			
						Below 3.00m bgl: dense.			
B	3.00		79mm /-%						
S	3.00								
					(2.13)				
D	3.60								
S	4.00								
				35.53	4.43	End of Borehole at 4.43m			

Installation: 50mm diameter standpipe installed to 4.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH Logged: JD Checked: FHJ
Depth Strike	Rose to	Remarks	Cased	Sealed	

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS3

Project

Coldharbour Road, Gravesend

Client

Frontier Estates Ltd

Start

05/08/2021

End

05/08/2021

Coordinates

E 563650.73 N 172249.72

Ground Level

41.23m AOD

Project No.

AG3309-21

Sheet

1 of 1

Scale

1:25

Total Depth

3.43m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
ES	0.20				(0.60)	Brown gravelly fine to coarse SAND with a medium cobble content. Gravel is fine to coarse subangular to subrounded brick, concrete, quartzite. Cobbles are subrounded concrete and subangular brick. (MADE GROUND)			
D	0.60			40.63	0.60	Brown mottled orangish brown slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subangular to subrounded flint. (THANET SAND FORMATION)			
B	1.20								
S	1.20	N = 24				Below 1.20m bgl: medium dense becoming dense.			
D	1.60		101mm /80%						
S	2.00	N = 43			(2.83)	Below 2.00m bgl: dense with occasional iron weathering layer (reddish brown).			
D	2.60		92mm /100%						
S	3.00	N >50							
				37.80	3.43	End of Borehole at 3.43m			

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH Logged: JD Checked: FHJ
Depth Strike	Rose to	Remarks	Cased	Sealed	

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS4

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Start 05/08/2021

Coordinates

Scale

1:25

End 05/08/2021

Ground Level

Total Depth

4.43m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
ES	0.20				(0.10) 0.10	Asphalt. (MADE GROUND)			
D	0.50				(0.30) 0.40	Dark brown gravelly slightly clayey fine to coarse SAND. Gravel is fine to coarse subangular to subrounded quartzite, brick, asphalt, concrete and sandstone. Slight organic odour. (MADE GROUND)			
					(0.90)	Brown slightly clayey silty fine SAND slightly gravelly. Gravel is fine to coarse subangular to subrounded flint. (THANET SAND FORMATION)			
S	1.20	N = 10			1.30	Medium dense becoming dense light brown silty fine to medium SAND. (THANET SAND FORMATION)			
D	1.60		101mm /80%			Below 1.50m bgl: occasional orangish brown surface staining/sand layer (1mm thick).			
B S D	2.00 2.00 2.20	N = 17				Between 2.20m and 2.30m bgl: slightly gravelly. Gravel is fine to coarse subangular to subrounded quartzite.			
D	2.60		92mm /90%		(3.13)				
B S	3.00 3.00	N = 27				Between 3.40m and 3.60m bgl: gravelly. Gravel is fine to coarse subangular to subrounded quartzite.			
D	3.50		79mm /90%			Between 3.70m and 3.80m bgl: gravelly. Gravel is fine to coarse subangular to subrounded quartzite.			
C	4.00	N >50			4.43	End of Borehole at 4.43m			

Installation: 50mm diameter standpipe installed to 4.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
3.80	3.80	Seepage			Logged: JD
					Checked: FHJ

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS5

Project

Coldharbour Road, Gravesend

Project No.

AG3309-21

Client

Frontier Estates Ltd

Sheet

1 of 1

Start

06/08/2021

Coordinates

E 563644.84 N 172268.01

Scale

1:25

End

06/08/2021

Ground Level

41.01m AOD

Total Depth

4.00m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
ES	0.50					Light brown sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to subrounded brick, quartzite and concrete. (MADE GROUND)			
S	1.20	N = 19			(1.70)				
			101mm /80%	39.31	1.70	Below 1.20m bgl: medium dense.			
ES	1.80					Medium dense light orangish brown silty fine to medium SAND. (THANET SAND FORMATION)			
D	1.90								
S	2.00	N = 19				Below 2.00m bgl: light brown.			
			101mm /80%						
D	2.60					Below 2.80m bgl: occasional iron/reddish brown staining.			
S	3.00	N = 20			(2.30)				
			92mm /-%			Below 3.20m bgl: slightly gravelly. Gravel is fine to coarse subangular to subrounded flint.			
D	3.60								
				37.01	4.00	End of Borehole at 4.00m			

Installation: 50mm diameter standpipe installed to 1.50m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH Logged: JD Checked: FHJ
Depth Strike	Rose to	Remarks	Cased	Sealed	

TRIAL PIT LOG

TP1

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 41.42m AOD

Coordinates

E 563621.78 N 172271.64

Total Depth

2.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.20		41.32	(0.10)		Asphalt.		
				0.10		(MADE GROUND)		
D	0.40		41.17	(0.15)		Brown sandy slightly silty GRAVEL with a medium cobble content. Gravel is fine to coarse subangular to subrounded brick and concrete. Cobbles are subangular brick and concrete.		
				0.25		(MADE GROUND)		
				(0.55)		Brown occasionally mottled grey fine silty SAND. (THANET SAND FORMATION)		
			40.62	0.80		Brown silty slightly gravelly fine to coarse SAND. Gravel is fine to coarse subangular to subrounded flint. (THANET SAND FORMATION)		
D	1.00							
				(1.90)		Below 1.80m bgl: light brown.		
D	2.00					Below 2.10m bgl: rare ironstone medium to coarse subangular gravel.		
B	2.60		38.72	2.70		End of Trial Pit at 2.70m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	3.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TP2

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 40.71m AOD

Coordinates

E 563638.08 N 172285.71

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.15		40.61	(0.10)		Asphalt. (MADE GROUND)		
D	0.30		40.46	0.10		Dark brown sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to subrounded asphalt and clinker.		
ES	0.30			(0.15)		(MADE GROUND)		
D	0.60			0.25		Soft brown sandy slightly gravelly SILT. Gravel is fine to coarse subangular to subrounded flint.		
				(0.75)		(THANET SAND FORMATION) <i>Below 0.40m bgl: gravelly.</i>		
D	1.20		39.71	1.00		Light brown clayey fine to medium SAND. (THANET SAND FORMATION)		
						<i>Below 1.80m bgl: slightly gravelly. Gravel is fine to coarse subangular to subrounded quartzite and possible ironstone.</i>		
B	2.20			(2.00)		<i>Below 2.60m bgl: light grey slightly silty fine to medium sand.</i>		
D	2.80		37.71	3.00		End of Trial Pit at 3.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length: 2.20m

Width: 0.60m

Logged: JD

Checked: FHJ

TRIAL PIT LOG

TP3

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 40.07m AOD

Coordinates

E 563660.36 N 172298.86

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.20		39.97	(0.10)		Asphalt.		
				0.10		(MADE GROUND)		
			39.77	(0.20)		Brown sandy slightly silty GRAVEL with a medium cobble content. Gravel is fine to coarse subangular to subrounded brick and concrete. Cobbles are subangular brick and concrete.		
				0.30		(MADE GROUND)		
			39.57	(0.20)		CONCRETE.		
				0.50		(MADE GROUND)		
D	0.70					Soft brown slightly gravelly sandy SILT. (THANET SAND FORMATION)		
				(1.30)				
D	1.90		38.27	1.80		Brown mottled grey clayey fine to medium SAND with iron staining. (THANET SAND FORMATION)		
				(0.80)				
B	2.40							
			37.47	2.60		<i>Below 2.50m bgl: slightly gravelly. Gravel is fine to coarse subangular to subrounded quartzite, flint, occasional ironstone and sandstone.</i>		
D	2.70					Light brown slightly gravelly silty fine SAND. Gravel is fine to coarse subangular to subrounded flint.		
B	2.80			(0.40)		(THANET SAND FORMATION)		
			37.07	3.00		End of Trial Pit at 3.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length: 2.50m

Width: 0.60m

Logged: JD

Checked: FHJ

TRIAL PIT LOG

TP4

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 40.41m AOD

Coordinates

E 563695.13 N 172275.03

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.15		40.31	(0.10)		Asphalt.		
				0.10		(MADE GROUND)		
B	0.40		40.11	(0.20)		Dark brown slightly gravelly slightly clayey fine SAND with a low cobble content. Gravel is fine to coarse subangular to subrounded brick, concrete, asphalt and quartzite. Cobbles are subangular brick and concrete.		
D	0.40			0.30		(MADE GROUND)		
						Soft brown sandy slightly gravelly SILT. Gravel is fine to coarse subangular to subrounded flint.		
				(0.70)		(THANET SAND FORMATION)		
			39.41	1.00		Firm brown occasionally mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint.		
D	1.20					(THANET SAND FORMATION)		
				(1.30)				
D	2.00					Below 2.00m bgl: gravelly.		
			38.11	2.30		Brown slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subangular to subrounded flint and sandstone/ironstone.		
D	2.40		37.91	(0.20)		(THANET SAND FORMATION)		
B	2.60			2.50		Light brown silty fine to medium SAND.		
D	2.70			(0.50)		(THANET FORMATION)		
			37.41	3.00		End of Trial Pit at 3.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.20m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TP5

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 41.22m AOD

Coordinates

E 563649.30 N 172234.91

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D	0.10			(0.15)		Light brown gravelly slightly silty fine to medium SAND with a low cobble content. Gravel is fine to coarse subangular to subrounded quartzite, brick and concrete. Cobbles are subangular brick.		
ES	0.10		41.07	0.15		(MADE GROUND)		
D	0.40			(0.35)		Soft dark brown slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded quartzite and brick.		
			40.72	0.50		(MADE GROUND)		
D	0.70					Soft to firm light brown slightly gravelly sandy CLAY. (THANET SAND FORMATION)		
D	1.20							
D	1.40			(1.70)		Below 1.40m bgl: clayey sand with occasional surface staining/iron staining layers.		
D	2.20		39.02	2.20		Light brown slightly gravelly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded flint. (THANET SAND FORMATION)		
				(0.80)		Below 2.20m bgl: slightly gravelly. Gravel is medium to coarse subrounded quartzite.		
D	2.90		38.22	3.00		End of Trial Pit at 3.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length: 2.50m

Width: 0.60m

Logged: JD

Checked: FHJ

TP6

Project No. AG3309-21

Sheet 1 of 1

Scale 1:25

Total Depth 1.70m

	(MADE GROUND) Light brown silty fine to medium SAND. (THANET SAND FORMATION)
	End of Trial Pit at 1.70m

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.40m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TP7

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 06/08/2021

Scale

1:25

Ground Level 41.19m AOD

Coordinates

E 563661.19 N 172260.21

Total Depth

2.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D ES	0.20 0.20			(0.50)		Brown gravelly slightly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded quartzite, brick and concrete. (MADE GROUND)		
			40.69	0.50				
			40.59	(0.10)		Light brown slightly gravelly silty fine to coarse SAND. (THANET SAND FORMATION)		
D ES	0.70 0.70			0.60		Soft light orangish brown occasionally mottled grey sandy CLAY. (THANET SAND FORMATION)		
B	1.00			(1.00)				
D	1.50					Below 1.50m bgl: clayey fine sand.		
D	1.70		39.59	1.60		Light brown silty fine SAND. (THANET SAND FORMATION)		
B	1.80			(0.40)				
			39.19	2.00		End of Trial Pit at 2.00m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length: 2.10m

Width: 0.60m

Logged: JD

Checked: FHJ

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
						Brown gravelly fine to coarse SAND with medium cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded brick, quartzite, concrete and plastic. (MADE GROUND)		
				(2.30)	M			
			38.71	2.30				
			38.51	(0.20)	M	Light brown silty fine SAND. (THANET FORMATION)		
				2.50		End of Trial Pit at 2.50m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length: 2.50m

Width: 0.60m

Logged: JD

Checked: FHJ

TRIAL PIT LOG

TT1B

Project Coldharbour Road, Gravesend
Client Frontier Estates Ltd
Date 05/08/2021

Project No. AG3309-21
Sheet 1 of 1
Scale 1:25

Ground Level **Coordinates** **Total Depth** 1.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.50)	M	Brown gravelly silty fine to coarse SAND with medium cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded brick, quartzite, concrete and plastic. (MADE GROUND)		
				0.50				
				(0.25)	VH	CONCRETE. (MADE GROUND)		
				0.75				
				(0.85)	M	Brown sandy silty GRAVEL with a high cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded quartzite, brick and concrete. (MADE GROUND)		
				1.60				
				(0.20)	M	Light brown silty fine SAND. (THANET FORMATION)		
				1.80				
						End of Trial Pit at 1.80m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation. Undertaken 15m southwest of TT1A.

Length:	1.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT1C

Project Coldharbour Road, Gravesend
Client Frontier Estates Ltd
Date 05/08/2021

Project No. AG3309-21
Sheet 1 of 1
Scale 1:25

Ground Level **Coordinates** **Total Depth** 1.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(1.50)	M	Brown gravelly silty fine to coarse SAND with medium cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded brick, quartzite, concrete and plastic. (MADE GROUND)		
				1.50 (0.30)	m	Light brown silty fine SAND.		
				1.80		End of Trial Pit at 1.80m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	1.50m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT2A

Project Coldharbour Road, Gravesend

Project No. AG3309-21

Client Frontier Estates Ltd

Sheet 1 of 1

Date 05/08/2021

Scale 1:25

Ground Level 41.19m AOD

Coordinates

Total Depth

0.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)	M	Brown gravelly silty fine to coarse SAND with a low cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded quartzite, brick, plastic and concrete. (MADE GROUND)		
			40.89	0.30				
				(0.20)	M	Light brown silty fine SAND. (THANET FORMATION)		
			40.69	0.50				
						End of Trial Pit at 0.50m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	2.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT2B

Project Coldharbour Road, Gravesend

Project No.

AG3309-21

Client Frontier Estates Ltd

Sheet

1 of 1

Date 05/08/2021

Scale

1:25

Ground Level 41.19m AOD

Coordinates

Total Depth

1.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.80)	M	Brown gravelly silty fine to coarse SAND with a low cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded quartzite, brick, plastic and concrete. (MADE GROUND)		
			40.39	0.80				
				(0.50)	M	Light brown silty fine SAND. (THANET FORMATION)		
			39.89	1.30				
						End of Trial Pit at 1.30m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	2.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT2C

Project Coldharbour Road, Gravesend

Project No. AG3309-21

Client Frontier Estates Ltd

Sheet 1 of 1

Date 05/08/2021

Scale 1:25

Ground Level 41.19m AOD

Coordinates

Total Depth 1.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(1.00)	M	Brown gravelly silty fine to coarse SAND with a low cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded quartzite, brick, plastic and concrete. (MADE GROUND)		
			40.19	1.00				
				(0.30)	M	Light brown silty fine SAND. (THANET FORMATION)		
			39.89	1.30				
						End of Trial Pit at 1.30m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	2.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT2D

Project Coldharbour Road, Gravesend
Client Frontier Estates Ltd
Date 05/08/2021

Project No. AG3309-21
Sheet 1 of 1
Scale 1:25

Ground Level 41.19m AOD **Coordinates** **Total Depth** 1.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(1.30)		Brown gravelly silty fine to coarse SAND with a low cobble content of subangular brick. Gravel is fine to coarse subangular to subrounded quartzite, brick, plastic and concrete. (MADE GROUND)		
			39.89	1.30		Light brown silty fine SAND. (THANET SAND FORMATION)		
			39.69	1.50		End of Trial Pit at 1.50m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	2.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT3A

Project Coldharbour Road, Gravesend

Project No. AG3309-21

Client Frontier Estates Ltd

Sheet 1 of 1

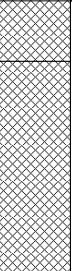
Date 05/08/2021

Scale 1:25

Ground Level 40.42m AOD

Coordinates E 563668.38 N 172281.07

Total Depth 0.90m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
			40.22	(0.20) 0.20	VH	Asphalt. (MADE GROUND)		
						Brown gravelly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded asphalt and brick. (MADE GROUND)		
				(0.70)	M			
			39.52	0.90	M	Light brown silty fine SAND. (THANET FORMATION)		
			39.42	(0.10) 1.00				
						End of Trial Pit at 0.90m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	1.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

TRIAL PIT LOG

TT3B

Project Coldharbour Road, Gravesend

Project No. AG3309-21

Client Frontier Estates Ltd

Sheet 1 of 1

Date 05/08/2021

Scale 1:25

Ground Level 40.42m AOD

Coordinates E 563668.38 N 172281.07

Total Depth 0.90m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.45)	M	Brown gravelly silty fine to coarse SAND. Gravel is fine to coarse subangular to subrounded asphalt and brick. (MADE GROUND)		
			39.97	0.45				
				(0.45)	VH	CONCRETE. (MADE GROUND)		
			39.52	0.90				
			39.42	(0.10)	M	<i>At 0.90m bgl: light brown silty fine SAND.</i> Light brown silty fine SAND. (THANET FORMATION)		
				1.00				
						End of Trial Pit at 0.90m		

Method: Backhoe excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial trench backfilled with arisings on completion. See drawing No. AG3309-21-03 for diagrammatic representation.

Length:	1.00m
Width:	0.60m
Logged:	JD
Checked:	FHJ

SPT SUMMARY SHEET

Project: Coldharbour Road, Gravesend
 Client: Frontier Estates Ltd
 Project No: AG3309-21

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive					Test Type	N Value
						Blows	Pen (mm)	Blows		Pen (mm)		Total Pen (mm)		
BH1	1.20	1.65	1.20	DRY	AR1752	3 4	75 75	4 4 4 4	75 75 75 75	300	S	16		
BH1	2.30	2.75	2.30	2.30	AR1752	4 5	75 75	5 5 6 7	75 75 75 75	300	S	23		
BH1	3.30	3.75	3.30	3.00	AR1752	5 5	75 75	5 6 6 7	75 75 75 75	300	C	24		
BH1	4.30	4.75	4.30	4.00	AR1752	5 6	75 75	6 6 7 7	75 75 75 75	300	C	26		
BH1	5.50	5.95	5.50	4.30	AR1752	6 6	75 75	6 7 8 10	75 75 75 75	300	C	31		
BH1	7.00	7.45	7.00	5.50	AR1752	6 7	75 75	7 8 10 10	75 75 75 75	300	C	35		
BH1	8.50	8.95	8.00	6.00	AR1752	8 8	75 75	8 9 10 10	75 75 75 75	300	C	37		
BH1	10.10	10.55	10.00	6.50	AR1752	9 9	75 75	9 10 9 11	75 75 75 75	300	C	39		
BH1	11.50	11.95	10.00	6.00	AR1752	9 9	75 75	10 11 12 12	75 75 75 75	300	C	45		
BH2	1.20	1.65	1.20	DRY	AR1752	2 3	75 75	3 3 3 4	75 75 75 75	300	S	13		
BH2	2.10	2.55	2.00	DRY	AR1752	3 3	75 75	4 4 4 5	75 75 75 75	300	S	17		
BH2	3.00	3.45	3.00	DRY	AR1752	3 4	75 75	4 5 7 9	75 75 75 75	300	C	25		
BH2	4.10	4.55	4.00	4.00	AR1752	4 5	75 75	5 6 8 9	75 75 75 75	300	S	28		
BH2	5.00	5.45	5.00	4.00	AR1752	6 7	75 75	7 9 9 10	75 75 75 75	300	C	35		
BH2	6.50	6.95	6.50	5.00	AR1752	7 8	75 75	8 9 11 12	75 75 75 75	300	C	40		
BH2	8.00	8.45	8.00	6.00	AR1752	8 8	75 75	9 9 10 14	75 75 75 75	300	C	42		
BH2	9.50	9.95	9.50	6.00	AR1752	8 9	75 75	9 11 12 14	75 75 75 75	300	S	46		
BH2	11.00	11.45	11.00	6.50	AR1752	9 10	75 75	10 12 12 14	75 75 75 75	300	C	48		
BH2	12.00	12.45	11.50	5.50	AR1752	10 10	75 75	11 12 13 14	75 75 75 75	300	C	50		
DCS1	1.20	1.65			110.119	1 2	75 75	3 3 3 4	75 75 75 75	300	S	13		
DCS1	2.00	2.45			110.119	2 4	75 75	3 5 6 6	75 75 75 75	300	S	20		
DCS1	3.00	3.45			110.119	1 2	75 75	2 2 2 3	75 75 75 75	300	S	9		
DCS1	4.00	4.45			110.119	8 10	75 75	12 14 14 10	75 75 75 75	300	C	50		
DCS2	1.20	1.65			110.119	0 0	75 75	0 0 2 2	75 75 75 75	300	S	4		
DCS2	2.00	2.45			110.119	2 2	75 75	4 5 6 7	75 75 75 75	300	S	22		
DCS2	3.00	3.45			110.119	4 7	75 75	7 8 9 11	75 75 75 75	300	S	35		
DCS2	4.00	4.43			110.119	4 7	75 75	9 13 15 13	75 75 75 50	275	S	>50		
DCS3	1.20	1.65			110.119	1 2	75 75	3 5 7 9	75 75 75 75	300	S	24		
DCS3	2.00	2.45			110.119	4 7	75 75	9 10 12 12	75 75 75 75	300	S	43		
DCS3	3.00	3.43			110.119	6 10	75 75	12 14 14 10	75 75 75 50	275	S	>50		
DCS4	1.20	1.65			110.119	1 2	75 75	2 2 3 3	75 75 75 75	300	S	10		
DCS4	2.00	2.45			110.119	3 4	75 75	4 3 5 5	75 75 75 75	300	S	17		
DCS4	3.00	3.45			110.119	3 6	75 75	6 8 6 7	75 75 75 75	300	S	27		
DCS4	4.00	4.42			110.119	12 13	75 70	13 13 14 10	75 75 75 50	275	C	>50		

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

SPT SUMMARY SHEET

Project: Coldharbour Road, Gravesend
Client: Frontier Estates Ltd
Project No: AG3309-21

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive							Test Type	N Value				
						Blows	Pen (mm)	Blows				Pen (mm)					Total Pen (mm)			
DCS5	1.20	1.65			110.119	3	4	75	75	4	6	4	5	75	75	75	75	300	S	19
DCS5	2.00	2.45			110.119	3	4	75	75	4	6	4	5	75	75	75	75	300	S	19
DCS5	3.00	3.45			110.119	3	4	75	75	4	5	5	6	75	75	75	75	300	S	20

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.



SPT Calibration Report

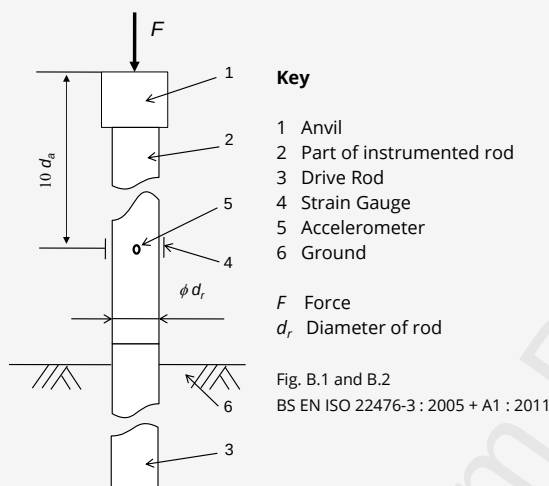
Hammer Energy Measurement Report

Type of Hammer SPT HAMMER
 Test No EQU2791_2
 Client APPLIED GEO

Test Depth (m) 9.80
 Mass of hammer $m = 63.5\text{kg}$
 Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

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



DATE OF TEST VALID UNTIL HAMMER ID

01/03/2021 01/03/2022 AR1752

$E_{\text{meas}} = 0.316\text{ kN-m}$

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

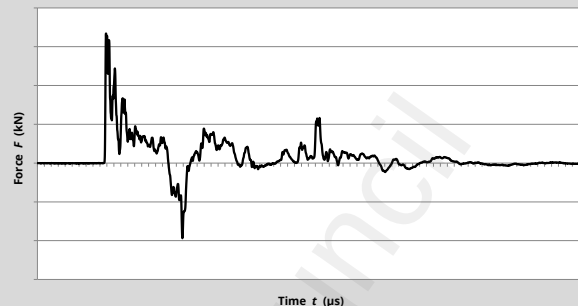
Comments

$$\text{Energy Ratio (Er)} = \frac{E_{\text{meas}}}{E_{\text{theor}}}$$

66.84%

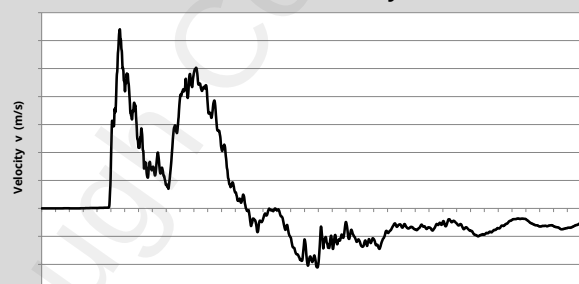
© COPYRIGHT 2021

Force



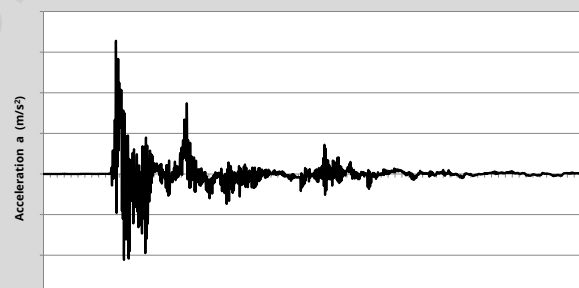
Time t (μs)

Particle Velocity



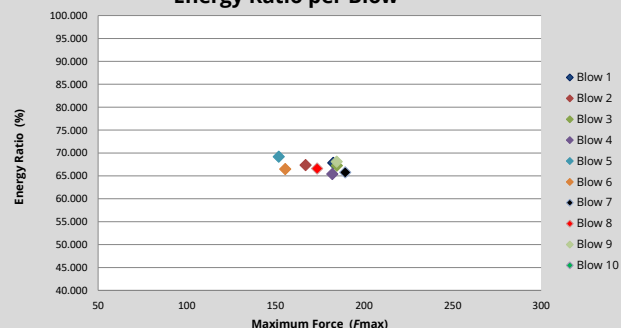
Time t (μs)

Acceleration



Time t (μs)

Energy Ratio per Blow



Equipe SPT Analyzer Operator

KS

Certificate prepared by

Certificate checked by

Certificate date

03/03/2021



Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling

Unit 8

Victory parkway

Victory rd

Derby

DE24 8ZF

Hammer Ref: 110.119

Test Date: 05/03/2021

Report Date: 08/03/2021

File Name: 110.119.spt

Test Operator: AP

Instrumented Rod Data

Diameter d_r (mm): 54Wall Thickness t_r (mm): 6.0Assumed Modulus E_a (GPa): 208

Accelerometer No.1: 62901

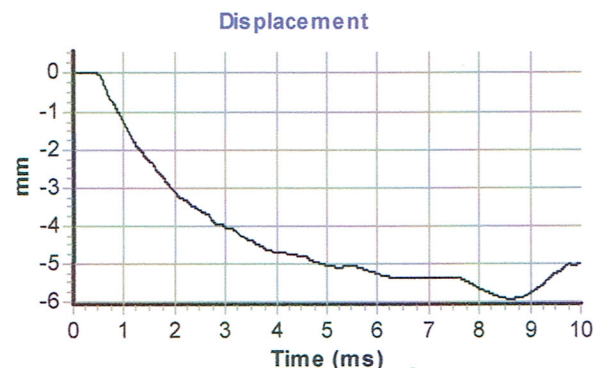
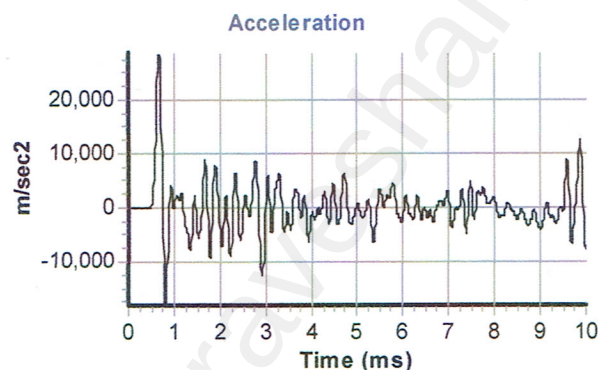
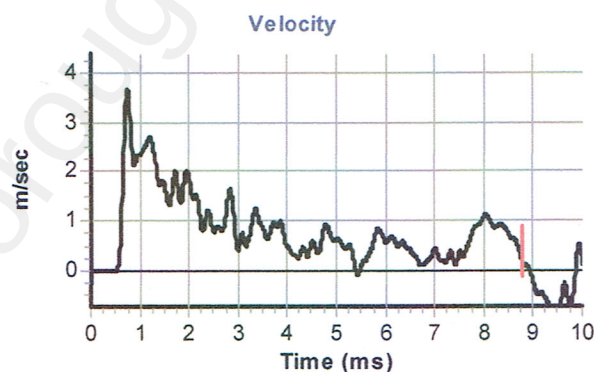
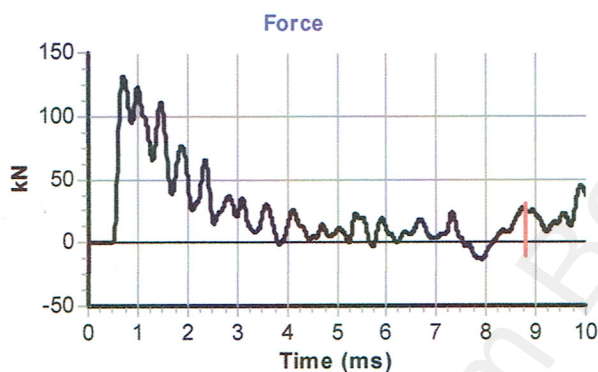
Accelerometer No.2: 62902

Hammer Information

Hammer Mass m (kg): 63.5Falling Height h (mm): 760String Length L (m): 15.0

Comments / Location

Hammer tested at Dynamic samplings yard.



Calculations

Area of Rod A (mm^2): 905Theoretical Energy E_{theor} (J): 473Measured Energy E_{meas} (J): 362
Energy Ratio E_r (%): 76

Title: Associate Director

The recommended calibration interval is 12 months

Exploratory Hole Log Key Sheet

Sample Test Notation			Backfill Symbols		Legend Symbols	
D	Small Disturbed sample			Sand		Topsoil
B	Bulk Disturbed sample			Gravel		Made Ground
ES	Environmental sample			Concrete		Concrete
U	Undisturbed U100 sample			Bentonite		Clay
UT	Undisturbed UT100 sample			Arisings		Silt
C	Core sample			Grout		Sand
W	Water sample					Gravel
In Situ Test Notation			Installation Symbols			Peat
S	Standard Penetration Test			Plain Standpipe		Cobbles
S (C)	Standard Penetration Test (cone)			Slotted Standpipe		Boulders
HV	Hand Shear Vane Test			Piezometer		Mudstone
PID	Photoionization Detector Test			Vibrating Wire Piezometer		Siltstone
MEXE	Mexecone Cone Penetrometer Test			Inclinometer		Sandstone
PP	Pocket Penetrometer Test			Extensometer (with magnet locations)		Limestone
K	Permeability Test					Chalk
Results Notation			Groundwater (GW)			Coal
Cu	Shear Strength	kN/m ²				Breccia
N	SPT N Value	-				Conglomerate
PID	VOC Concentration	ppm				Shale
()	U/UT Blow Count	-				Igenous Rock
Rotary Core Notation						Metamorphic Rock
TCR	Total Core Recovery			Rise	NR	NR
SCR	Solid Core Recovery			Groundwater Strike - with Recorded Rise	No Recovery	
RQD	Rock Quality Designation			Strike	NR	NR
FI	Fracture Index					
If	Fracture Spacing					
NI	Non Intact					
NR	No Recovery					
NA	Not Applicable					
Ease of Dig						
VE	Very Easy					
E	Easy					
M	Moderate					
H	Hard					
VH	Very Hard					
General Notes						
1. Details of the standpipe/piezometer are given on the log. The 'Install' column shows a graphical representation of the installed including depth of instruments including slotted section or piezometer depth, and backfill details. 2. Standard Penetration Test is defined in BS EN ISO 17892. Total N value is shown on the logs, full details of the test increments, equipment references, water and casing levels shown on the SPT Summary Sheet.			Note: Most soils comprise a mixture of particle sizes. The soil type is graphically represented on the log and may be a combination of these symbols.			

APPENDIX D

Ground Gas Monitoring and Flow Results

Project Number: AG3309-21

Date and Time of Monitoring: 16.08.2021 16.30 to 17.15

Project Name: Coldharbour Road, Gravesend

Phase of Monitoring: 1 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
DCS1	<0.1	0.1	0.1	-0.47	<0.1	<0.1	0.1	0.1	21.1	21.1	50	DRY
DCS2	<0.1	<0.1	<0.1	0.00	<0.1	<0.1	0.6	0.6	20.6	20.6	50	DRY
DCS3	0.1	0.1	0.1	-0.35	<0.1	<0.1	<0.1	<0.1	17.0	17.0	50	DRY
DCS4	-0.2	<0.1	<0.1	-0.19	<0.1	<0.1	0.8	0.8	20.6	20.6	50	DRY

Additional gases (if required)

BH No.	VOCs (ppm)			Diameter of installation (mm)
DCS1	<0.1			50
DCS2	<0.1			50
DCS3	<0.1			50
DCS4	<0.1			50

Borehole specific comments/observations

Pressure trend information taken from Met Office Wow Network

Meteorological Data

Atmospheric Pressure (mb)	Start: 1016
Atmospheric Pressure (mb)	Finish: 1016
Pressure Rising or Falling	Rising
Weather Conditions	Overcast Dry 8/8 Cloud
Atmospheric Oxygen (% vol)	0.2
Wind Speed & Direction	Easterly - 3-7mph
Ambient Air Temperature (°C)	19.0

Site Data

Monitoring Personnel	Tom Collins
GPS Instrument	
Gasmeter Serial Number	G506760
PID Serial Number	115558
Ground Conditions (vegetation stress, visual contamination): Hardstanding - No visual spills or leaks or evidence of putrescible buried contamination. Abundant fly tipped rubbish at ground level.	

General Notes:

- Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3309-21

Project Name: Coldharbour Road, Gravesend

Date and Time of Monitoring: 25.08.2021 14.30

Phase of Monitoring: 2 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
DCS1	<0.1	0.1	0.1	0.05	<0.1	<0.1	2.6	2.6	16.7	16.7	50	DRY
DCS2	<0.1	<0.1	<0.1	0.02	<0.1	<0.1	2.5	2.5	17.5	17.5	50	DRY
DCS3	<0.1	0.1	0.1	-0.05	<0.1	<0.1	2.9	2.9	17.1	17.1	50	DRY
DCS4	<0.1	<0.1	<0.1	0.02	<0.1	<0.1	<0.1	<0.2	15.5	15.5	50	DRY
DCS5	<0.1	0.1	0.1	-0.03	<0.1	<0.1	0.1	1.1	18.4	18.4	50	DRY

Additional gases (if required)

BH No.	VOCs (ppm)			Diameter of installation (mm)
DCS1	<0.1			50
DCS2	<0.1			50
DCS3	<0.1			50
DCS4	<0.1			50
DCS5	<0.1			50

Borehole specific comments/observations

Meteorological Data

Atmospheric Pressure (mb)	Start: 1022
Atmospheric Pressure (mb)	Finish: 1023
Pressure Rising or Falling	Falling
Weather Conditions	Dry, sunny
Atmospheric Oxygen (% vol)	20.3
Wind Speed & Direction	Light breeze
Ambient Air Temperature (°C)	22.0

Site Data

Monitoring Personnel	Malcolm McGlone
GPS Instrument	
Gasmeter Serial Number	G506760
PID Serial Number	108606
Ground Conditions (vegetation stress, visual contamination): Hardstanding - No visual spills or leaks or evidence of putrescible buried contamination. Abundant fly tipped rubbish at ground level.	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3309-21

Project Name: Coldharbour Road, Gravesend

Date and Time of Monitoring: 30.08.2021 12.55

Phase of Monitoring: 3 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
DCS1	<0.1	0.1	0.1	0.03	<0.1	<0.1	2.9	2.9	16.1	16.1	50	DRY
DCS2	<0.1	<0.1	<0.1	0.07	<0.1	<0.1	2.6	2.6	18.2	18.2	50	DRY
DCS3	<0.1	0.1	0.1	0.00	<0.1	<0.1	3.1	3.1	17.6	17.6	50	DRY
DCS4	<0.1	<0.1	<0.1	0.03	<0.1	<0.1	0.2	0.2	16.0	16.0	50	DRY
DCS5	<0.1	0.1	0.1	-0.02	<0.1	<0.1	0.2	0.2	18.1	18.1	50	DRY

Additional gases (if required)

BH No.	VOCs (ppm)			Diameter of installation (mm)
DCS1	<0.1			50
DCS2	<0.1			50
DCS3	<0.1			50
DCS4	<0.1			50
DCS5	<0.1			50

Borehole specific comments/observations

Meteorological Data

Atmospheric Pressure (mb)	Start: 1014
Atmospheric Pressure (mb)	Finish: 1013
Pressure Rising or Falling	Rising
Weather Conditions	cloudy, light rain
Atmospheric Oxygen (% vol)	20.9
Wind Speed & Direction	Light breeze
Ambient Air Temperature (°C)	16.0

Site Data

Monitoring Personnel	Malcolm McGlone
GPS Instrument	
Gasmeter Serial Number	G506760
PID Serial Number	108606
Ground Conditions (vegetation stress, visual contamination): Hardstanding - No visual spills or leaks or evidence of putrescible buried contamination. Abundant fly tipped rubbish at ground level.	

General Notes:

1. Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Ground Gas Monitoring and Flow Results

Project Number: AG3309-21

Date and Time of Monitoring: 16/09/2021 13.50

Project Name: Coldharbour Road, Gravesend

Phase of Monitoring: 4 of 4

BH No.	Flow Range (litres/hr over 3 mins)			Differential Pressure (mb)	Methane % v/v		Carbon dioxide % v/v		Oxygen % v/v		Diameter of installation (mm)	Water level (m bgl)
	Max	Min	Avg		Peak	Steady	Peak	Steady	Min	Steady		
DCS1	<0.1	0.1	0.1	0.04	<0.1	<0.1	2.4	2.4	17.1	17.1	50	DRY
DCS2	<0.1	<0.1	<0.1	0.02	<0.1	<0.1	1.9	1.9	18.3	18.3	50	DRY
DCS3	<0.1	0.1	0.1	0.10	<0.1	<0.1	2.2	2.2	17.9	17.9	50	DRY
DCS4	<0.1	<0.1	<0.1	0.03	<0.1	<0.1	0.1	<0.1	19.1	19.1	50	DRY
DCS5	<0.1	0.1	0.1	-0.02	<0.1	<0.1	0.1	0.1	19.5	19.5	50	DRY

Additional gases (if required)

BH No.	VOCs (ppm)			Diameter of installation (mm)
DCS1	<0.1			50
DCS2	<0.1			50
DCS3	0.1			50
DCS4	<0.1			50
DCS5	<0.1			50

Borehole specific comments/observations

Meteorological Data

Atmospheric Pressure (mb)	Start: 1013
Atmospheric Pressure (mb)	Finish: 1014
Pressure Rising or Falling	Steady
Weather Conditions	sunny
Atmospheric Oxygen (% vol)	20.4
Wind Speed & Direction	light breeze
Ambient Air Temperature (°C)	23.0

Site Data

Monitoring Personnel	Malcolm McGlone
GPS Instrument	
Gasmeter Serial Number	G505737
PID Serial Number	109598
Ground Conditions (vegetation stress, visual contamination): Hardstanding - No visual spills or leaks or evidence of putrescible buried contamination. Abundant fly tipped rubbish at ground level.	

General Notes:

- Instrument specification data and calibration information provided on a separate sheet

APPLIED GEOLOGY

Gas Monitoring Equipment Specification and Accuracy Details

Instrument Specifications

Instrument	Atmospheric Pressure Range	Temperature Range	Flow Range	Flow Resolution	Borehole Pressure Range
GA5000	500-1500 mb +/- 5 mb	-10°C to + 50°C	0-20 lt/hr +/- 0.3 l/hr	0.1l/hr	+.500/-500 mbar +/- 4 mbar
Phocheck Tiger	-	-20 to + 60°C (Certified to -15 to + 45°C)	-	-	-

Instrument Accuracy

Instrument		Methane	Lower Explosive Limit	Carbon Dioxide	Oxygen	Volatile Organic Compounds	Hydrogen Sulphide	Carbon Monoxide
GA5000	Detection Range	0-100%	-	0 -100%	0-25%	NA	0 -50ppm response <30 secs	0 - 1000ppm response <30 Secs
	Detection Accuracy	+/- 0.5% @ 0 to 70%, +/-1.5% @ 70 to 100% Response < 10 secs	N/A	+/- 0.5% @ 0 to 60%, +/-1.5% @ 60 to 100% Response < 10 secs	+/- 1.0% @ 0 to 25%, Response < 20 secs	NA	+/- 1.5% FS	+/- 2% of FS
Phocheck Tiger	Detection Range	N/A	N/A	N/A	N/A	1 ppb - 10,000 ppm	N/A	N/A
	Detection Accuracy	N/A	N/A	N/A	N/A	+/- 1ppb +/- 5% of actual displayed accuracy +/- One digit Response < 2sec	N/A	N/A

Calibration Frequency

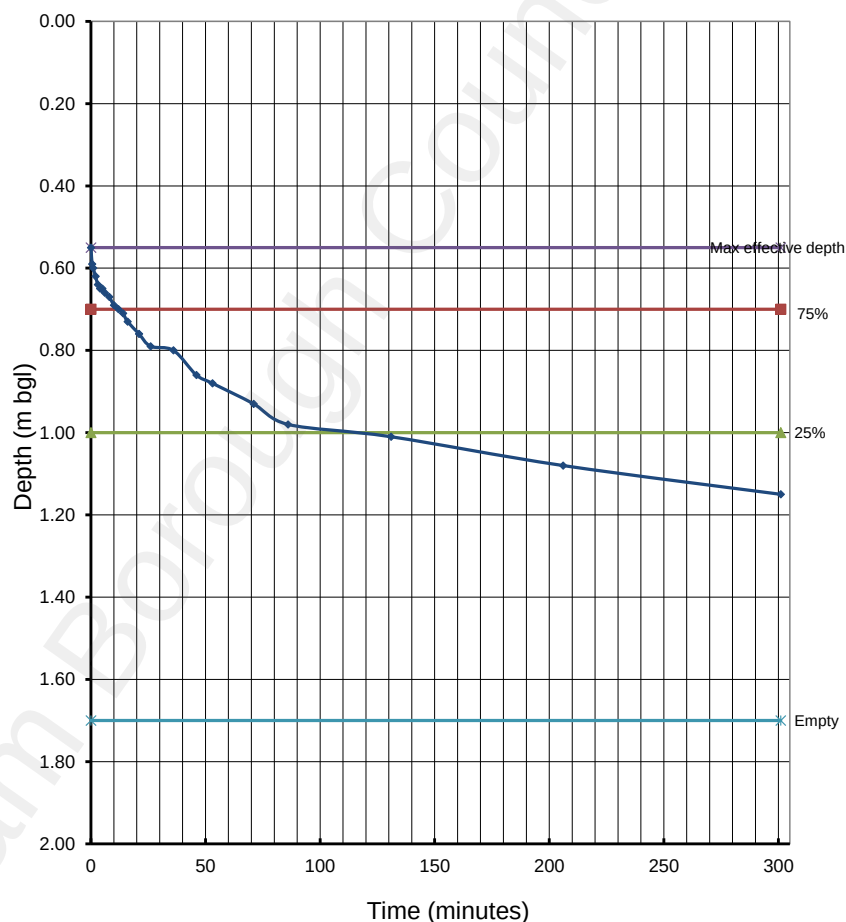
Equipment Serial Numbers

Instruments are calibrated annually. Details of the instrument calibration certificates and service records are available if required.		
	GA5000 (G503948, G505383, G505737)	
	Phocheck Tiger - (T-108308, T-109597, T-109598, T-110423)	

IN SITU SOAKAWAY TEST RESULT

Trial Pit No.	TP6
Date	06/08/2021
Operator	DH
Test Strata	Thanet Sand
Stability of pit	Stable
Backfill used	None

Filling	1 of 1
Trial Pit Length (m)	2.40
Trial Pit Width (m)	0.60
Trial Pit Depth (m)	1.70
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

[illegible]

Initial Water Level (m)	0.55	Total internal surface area of pit (m ²)	11.64
Final Water Level (m)	1.15	Effective area of loss (m ²)	6.54
Change in Water Level (m)	0.60	Volume outflowing between 75% and 25% effective depth (m ³)	0.43
Effective Depth at 25% (tp25) (m)	1.00	Time at 25% (tp25) (minutes)	115
Effective Depth at 75% (tp75) (m)	0.70	Time at 75% (tp75) (minutes)	12

Soil Infiltration Rate (m/s)	1.1E-05
------------------------------	---------

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Based on actual drop in water level recorded

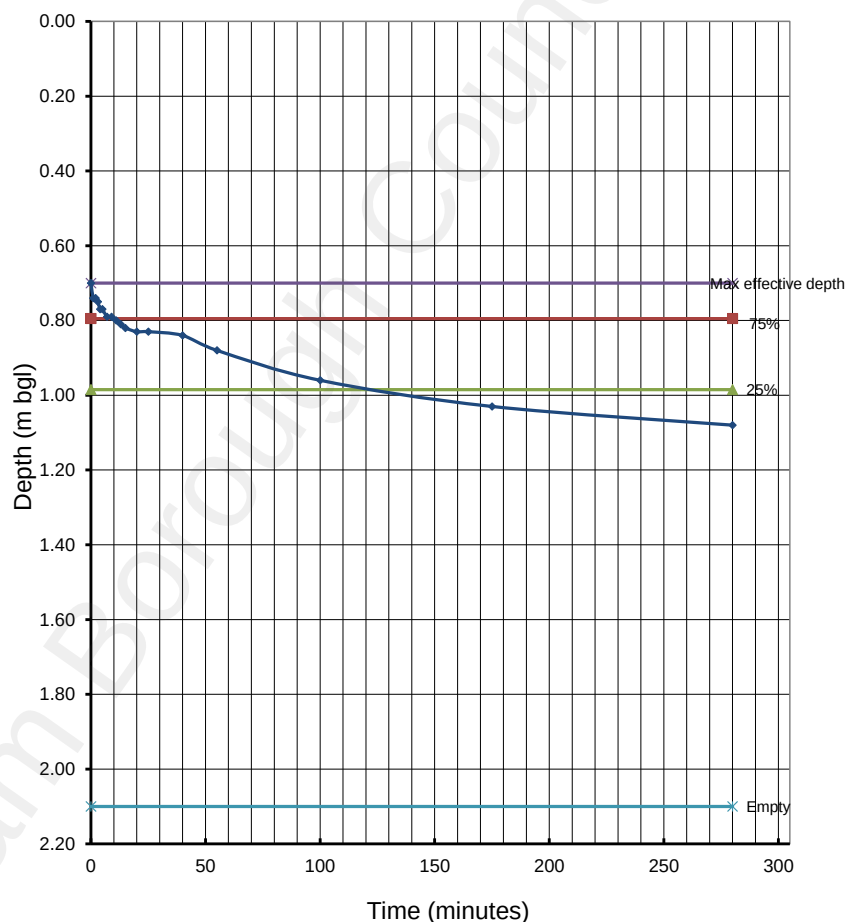
Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

APPLiED GEOLOGY

IN SITU SOAKAWAY TEST RESULT

Trial Pit No.	TP7
Date	06/08/2021
Operator	DH
Test Strata	Thanet Sand
Stability of pit	Stable
Backfill used	None

Filling	1 of 1
Trial Pit Length (m)	2.20
Trial Pit Width (m)	0.60
Trial Pit Depth (m)	2.10
Amount of Backfill placed (m)	0
Assumed Backfill Void Ratio	N/A

[illegible]

Initial Water Level (m)	0.70	Total internal surface area of pit (m ²)	13.08
Final Water Level (m)	1.08	Effective area of loss (m ²)	8.10
Change in Water Level (m)	0.38	Volume outflowing between 75% and 25% effective depth (m ³)	0.25
Effective Depth at 25% (tp25) (m)	0.99	Time at 25% (tp25) (minutes)	120
Effective Depth at 75% (tp75) (m)	0.80	Time at 75% (tp75) (minutes)	11

Soil Infiltration Rate (m/s)	4.7E-06
------------------------------	---------

Notes: 1. Undertaken in general accordance with BRE DG 365 method
2. Based on extrapolated data NO

* Based on actual drop in water level recorded

Client:	Frontier Estates Ltd	
Project:	Coldharbour Road, Gravesend	
Project No.	AG3309-21	

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Date _____

Start Depth (mm bgl)

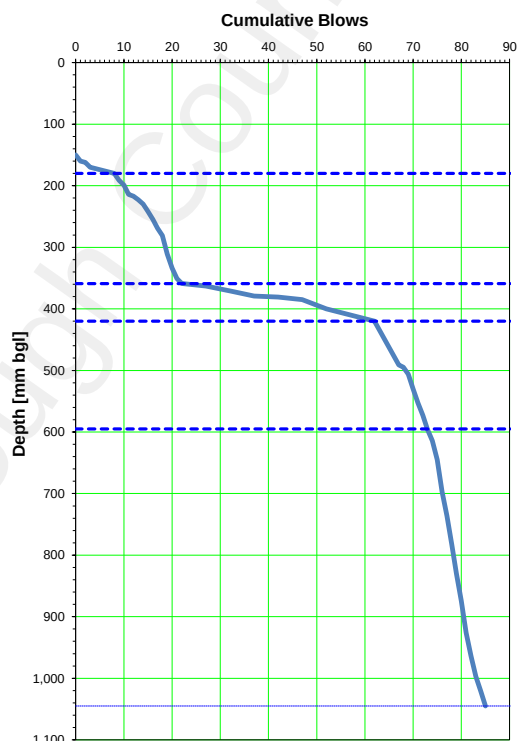
TRL 1

06/08/2021

KS

150

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Asphalt hardstanding over Made Ground.

Test commenced immediately below asphalt in area of BH1

Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

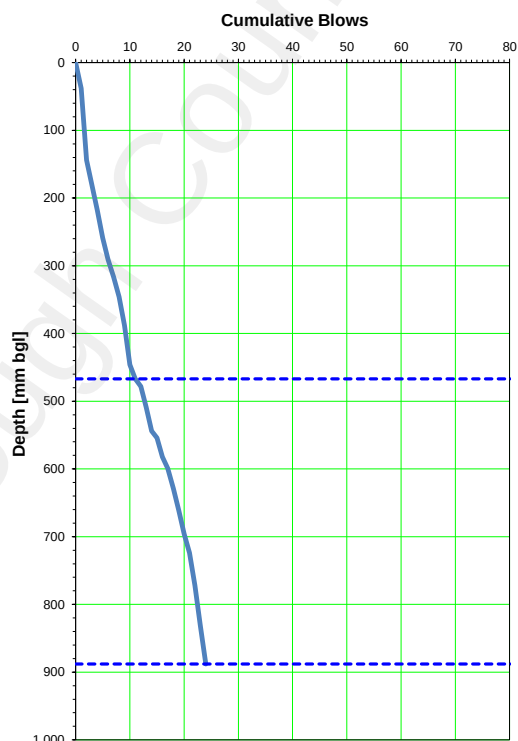
APPLIED GEOLOGY

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Start Depth (mm bgl)

TRL 2
06/08/2021
KS
Ground Level

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Gravelly sand

Undertaken from ground level

Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

APPLIED GEOLOGY

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Date _____

Start Depth (mm bgl)

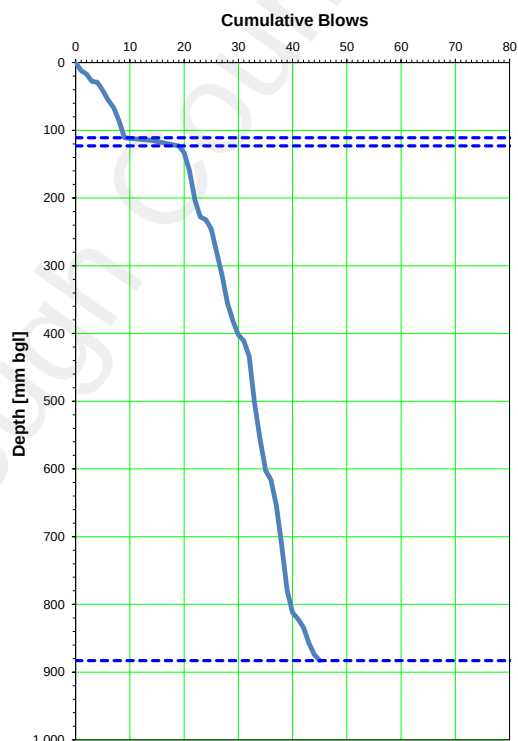
TRL 3

06/08/2021

KS

Ground Level

Checked by: SD

[illegible]

Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Made Ground over Thanet Sand Formation.

Undertaken from surface in area of TP6.

Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

APPLIED GEOLOGY

TRL DYNAMIC CONE PENETROMETER TEST RESULT

Test Location

TRL4

Date

06/08/2021

Operator

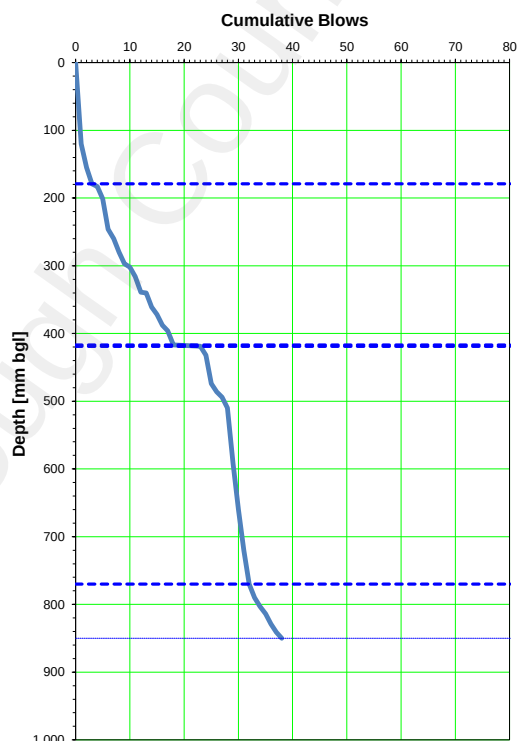
KS

Start Depth (mm bgl)

Ground Level

Checked by: SD

Layer	No of Blows	Cumulative Blows	CBR [%]	Layer Thickness [mm]	Total Depth [mm]
Layer 1	3	3	4	179	179
Layer 2	15	18	16	238	417
Layer 3	5	23	>100	2	419
Layer 4	9	32	6	351	770
Layer 5	6	38	20	80	850



Notes: TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$ from IAN 73/06 Revision 1 (2009)
Tested in accordance with in house method, based upon TRL Road Note 31 & 8

Surface materials / condition:

Made Ground over Thanet Sand Formation

Remarks:

Undertaken from surface in area of TP7.

Client:	Frontier Estates Ltd
Project:	Coldharbour Road, Gravesend
Project No.	AG3309-21

APPLIED GEOLOGY

APPENDIX E

SOIL CHEMICAL RESULTS COMPARED AGAINST SCREENING VALUES FOR HUMAN HEALTH

Site: Coldharbour Road, Gravesend
Job No: AG3309-21

Land Use: Residential without Plant Uptake
Dataset: Entire Data Set
Soil Organic Matter (%): 2.5 %

Exploratory Hole Reference		DCS5	TP6	TP3	TP4	TP2	TP7	BH1	DCS3	TP5	BH1	DCS5	TP2	No. of samples (n)	Residential without Plant Uptake	Source/Justification
Depth (m)		0.5	0.1	0.2	0.15	0.15	0.2	0.3	0.2	0.1	0.60	1.80	0.3			
Strata		Made Ground										Head Deposits	Thanet Sand Formation			
	Units															
Organic Matter (%)	%		4.4	2.6	5.6	5.5	2.3	0.48			0.57	0.4	0.98	9		
pH			6.8	9.9	8	7.7	7.9	8.5			8.5	7.9	7.7	9		
		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected				9		
Asbestos Identification														9		
Arsenic	mg/kg		4.3	17	12	8.8	5.9	3.2			1.5	1.1	10	9	40	LQM/CIEH S4UL (2015)
Cadmium	mg/kg		0.14	0.18	0.36	0.17	0.19	0.1			0.1	0.1	0.1	9	85	LQM/CIEH S4UL (2015)
Chromium	mg/kg		13	18	11	13	11	16			12	6.8	12	9	910	LQM/CIEH S4UL (2015)
Chromium (Hexavalent)	mg/kg			0.5	0.5	0.5	0.5	0.5						5	21	C4SL (2014)
Copper	mg/kg		12	17	23	46	20	5.2			4.1	4.1	7.6	9	7100	LQM/CIEH S4UL (2015)
Lead	mg/kg		40	200	150	25	50	6.6			3.3	4.9	8.5	9	310	C4SL (2014)
Mercury	mg/kg		0.13	0.15	0.14	0.1	0.21	0.1			0.1	0.1	0.1	9	56	LQM/CIEH S4UL (2015)
Nickel	mg/kg		11	23	17	20	11	8.9			8.6	5.4	11	9	180	LQM/CIEH S4UL (2015)
Selenium	mg/kg		0.2	0.2	0.2	0.2	0.2	0.2			0.2	0.2	0.2	9	430	LQM/CIEH S4UL (2015)
Zinc	mg/kg		48	95	100	40	39	17			13	14	21	9	40000	LQM/CIEH S4UL (2015)
Boron	mg/kg		5	8.3	6.2	5.6	3.9	3.6			2.5	2.8	2	9	11000	
Beryllium	mg/kg		1	1	1	1.1	1	1			1	1	1	9	2	
Vanadium	mg/kg		18	25	17	28	18	13			13	8.8	19	9	1200	
Naphthalene	mg/kg		0.1	0.41	1.3	0.32	0.1	0.1			0.1	0.1	0.1	9	5.6	LQM/CIEH S4UL (2015)
Acenaphthylene	mg/kg		0.1	1.7	2.4	0.48	0.1	0.1			0.1	0.1	0.1	9	4700	LQM/CIEH S4UL (2015)
Acenaphthene	mg/kg		0.1	1.8	3	0.55	0.1	0.1			0.1	0.1	0.1	9	4600	LQM/CIEH S4UL (2015)
Fluorene	mg/kg		0.1	2.3	3.8	0.53	0.1	0.1			0.1	0.1	0.1	9	3800	LQM/CIEH S4UL (2015)
Phenanthrene	mg/kg		0.31	24	12	8.8	1.9	1.6			0.1	0.1	0.39	9	1500	LQM/CIEH S4UL (2015)
Anthracene	mg/kg		0.11	8.6	5	2.9	0.28	0.73			0.1	0.1	0.24	9	35000	LQM/CIEH S4UL (2015)
Fluoranthene	mg/kg		0.98	73	31	23	2.4	5.7			0.73	0.3	0.99	9	1600	LQM/CIEH S4UL (2015)
Pyrene	mg/kg		1.1	75	35	25	2	6.1			0.81	0.29	0.87	9	3800	LQM/CIEH S4UL (2015)
Benzo[a]anthracene	mg/kg		0.56	36	15	13	0.86	2.8			0.37	0.1	0.51	9	14	LQM/CIEH S4UL (2015)
Chrysene	mg/kg		0.84	31	12	14	1.3	3.2			0.6	0.1	0.51	9	31	LQM/CIEH S4UL (2015)
Benzo[b]fluoranthene	mg/kg		0.67	48	22	19	1.9	4.1			0.1	0.1	0.47	9	4.0	LQM/CIEH S4UL (2015)
Benzo[k]fluoranthene	mg/kg		0.66	20	9.4	7.6	0.57	1.7			0.1	0.1	1.1	9	110	LQM/CIEH S4UL (2015)
Benzo[a]pyrene	mg/kg		0.62	34	18	14	0.91	2.8			0.1	0.1	0.51	9	3.2	LQM/CIEH S4UL (2015)
Dibenzo[a,h]anthracene	mg/kg		0.46	8.6	4.4	3.3	0.19	0.63			0.1	0.1	0.8	9	0.32	LQM/CIEH S4UL (2015)
Indeno[1,2,3-cd]pyrene	mg/kg		0.48	28	15	12	0.69	2.2			0.1	0.1	0.63	9	46	LQM/CIEH S4UL (2015)
Benzo[g,h,i]perylene	mg/kg		0.47	23	15	11	0.72	2			0.1	0.1	0.5	9	360	LQM/CIEH S4UL (2015)
Total of 16 PAHs	mg/kg		7.3	420	200	160	14	34			2.5	2	7.5	9		
Phenols (Total)	mg/kg			0.1	0.1	0.1	0.1	0.1						5		LQM/CIEH S4UL (2015)
Benzene	mg/kg	0.001	0.001	0.001	0.001								0.001	5	0.7	LQM/CIEH S4UL (2015)
Toluene	mg/kg	0.001	0.001	0.001	0.001								0.001	5	1900	LQM/CIEH S4UL (2015)
Ethylbenzene	mg/kg	0.001	0.001	0.001	0.001								0.001	5	190	LQM/CIEH S4UL (2015)
m&p Xylene	mg/kg	0.001	0.001	0.001	0.001								0.001	5	180	LQM/CIEH S4UL (2015)
o-Xylene	mg/kg	0.001	0.001	0.001	0.001								0.001	5	210	LQM/CIEH S4UL (2015)
TPH >C5-C6	mg/kg						1	1				1		3	78	LQM/CIEH S4UL (2015)
TPH >C6-C7	mg/kg						1	1				1		3	230	LQM/CIEH S4UL (2015)
TPH >C7-C8	mg/kg						1	1				1		3	1800	LQM/CIEH S4UL (2015)
TPH >C8-C10	mg/kg						8.5	9				1		3	65	LQM/CIEH S4UL (2015)
TPH >C10-C12	mg/kg						7	7.3				1		3	330	LQM/CIEH S4UL (2015)
TPH >C12-C16	mg/kg						16	14				1		3	2300	LQM/CIEH S4UL (2015)
TPH >C16-C21	mg/kg						31	28				1		3	1900	LQM/CIEH S4UL (2015)
TPH >C21-C35	mg/kg						77	63				1		3	1900	LQM/CIEH S4UL (2015)
TPH >C35-C44	mg/kg						12	4.9				1		3	1900	LQM/CIEH S4UL (2015)
Total TPH >C5-C44	mg/kg						150	130				10		3		LQM/CIEH S4UL (2015)
Aliphatic TPH >C5-C6	mg/kg	1	1	1	1								1	5	78	LQM/CIEH S4UL (2015)
Aliphatic TPH >C6-C8	mg/kg	1	1	1	1								1	5	230	LQM/CIEH S4UL (2015)
Aliphatic TPH >C8-C10	mg/kg	1	1	1	1								1	5	65	LQM/CIEH S4UL (2015)
Aliphatic TPH >C10-C12	mg/kg	1	1	1	130								1	5	330	LQM/CIEH S4UL (2015)
Aliphatic TPH >C12-C16	mg/kg	1	1	3.6	300								1	5	2400	LQM/CIEH S4UL (2015)
Aliphatic TPH >C16-C21	mg/kg	1	1	67	420								1	5	-	-
Aliphatic TPH >C21-C35	mg/kg	1	1	300	690								1	5	92000	LQM/CIEH S4UL (2015)
Aliphatic TPH >C35-C44	mg/kg	1	1	170	140								1	5	92000	LQM/CIEH S4UL (2015)
Total Aliphatic Hydrocarbons	mg/kg	5	5	540	1700								5	5		
Aromatic TPH >C5-C7	mg/kg	1	1	1	1								1	5	690	LQM/CIEH S4UL (2015)
Aromatic TPH >C7-C8	mg/kg	1	1	1	1								1	5	1800	LQM/CIEH S4UL (2015)
Aromatic TPH >C8-C10	mg/kg	1	1	1	1								1	5	110	LQM/CIEH S4UL (2015)
Aromatic TPH >C10-C12	mg/kg	1	1	1	1								1	5	590	LQM/CIEH S4UL (2015)
Aromatic TPH >C12-C16	mg/kg	5.1	1	150	230								1	5	2300	LQM/CIEH S4UL (2015)
Aromatic TPH >C16-C21	mg/kg	41	1	1500	760								1	5	1900	LQM/CIEH S4UL (2015)
Aromatic TPH >C21-C35	mg/kg	68	1	5000	3200								1	5	1900	LQM/CIEH S4UL (2015)
Aromatic TPH >C35-C44	mg/kg	1	1	270	73								1	5	1900	LQM/CIEH S4UL (2015)
Total Aromatic Hydrocarbons	mg/kg	110	5	7000	4300								5	5		
Total Petroleum Hydrocarbons	mg/kg	110	10	7500	6000								10	5		
Methyl Tert-Butyl Ether	µg/kg	1	1	1	1								1	5		Limit of Detection

Key -

Value within sample set exceeds screening value

LQM/CIEH S4UL Reference No. S4UL3159 (2015)

Values in bold are reported at the laboratory limit of detection

Benzo(a)pyrene has been used as a 'surrogate marker for genotoxic PAH' as discussed in Appendix E of CL:AIRE SP1010 'Development of C4SL for Assessment of Land Affected by Contamination', December 2013.

This allows assessment of the combined carcinogenic risk associated with genotoxic PAH using only b(a)p. Genotoxic PAHs include Benz(a)pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(ah)anthracene, Indeno(123cd)pyrene, Benzo(gh)perylene and have been marked with a * on the table.

SUMMARY OF LEACHATE TEST RESULTS

Site Coldharbour Road, Gravesend
Job Number AG3309-21
Type of Water Leachate

Determinand	Limit of Detection	Hazardous or Non-Hazardous^	Sample Identity Depth Sampled Date	DCS5 1.8 06/08/2021	TP6 0.1 06/08/2021	BH1 0.6 07/08/2021	No. of samples (n)	Waters Screening Value	Source & Justification
pH		-	-	9.1	8.6	9	3	-	-
Arsenic		Haz	µg l ⁻¹	1.9	1.5	2.5	3	10	Detection Limit
Cadmium		Non Haz	µg l ⁻¹	0.11	0.11	0.11	3	5	UK Drinking Water Standards (2010)
Chromium (Total)		Non Haz	µg l ⁻¹	0.5	0.5	1.3	3	50	UK Drinking Water Standards (2010)
Copper		Non Haz	µg l ⁻¹	0.93	4.4	2.6	3	2000	UK Drinking Water Standards (2010)
Lead		Haz	µg l ⁻¹	0.5	0.64	1.6	3	10	UK Drinking Water Standards (2010)
Mercury		Haz	µg l ⁻¹	0.05	0.05	0.05	3	0.5	Detection limit
Nickel		Non Haz	µg l ⁻¹	0.5	0.94	1.7	3	20	UK Drinking Water Standards (2010)
Selenium		Non Haz	µg l ⁻¹	0.64	0.56	1.1	3	10	UK Drinking Water Standards (2010)
Zinc		Non Haz	µg l ⁻¹	2.5	2.5	2.5	3	5000	UK Drinking Water Standards (2010)
Boron		Non Haz	µg l ⁻¹	46	10	10	3	1000	UK Drinking Water Standards (2010)
Beryllium		Non Haz	µg l ⁻¹	1	1	1	3	-	Not of health concern at the levels found in drinking water
Vanadium		Non Haz	µg l ⁻¹	2.2	1.9	5.7	3	20	EQS
Sulphate		Non Haz	mg l ⁻¹	30	1	1	3	250	UK Drinking Water Standards (2010)
Naphthalene		Non Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Acenaphthylene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Acenaphthene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Fluorene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Phenanthrene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Anthracene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Fluoranthene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Pyrene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Benzo[a]anthracene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Chrysene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Benzo[b]fluoranthene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Benzo[k]fluoranthene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Benzo[a]pyrene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Dibenz(a,h)Anthracene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Indeno(1,2,3-c,d)Pyrene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit
Benzo[g,h,i]perylene		Haz	µg l ⁻¹	0.1	0.1	0.1	3	0.1	Detection limit

Key-
Result exceeds test Detection Limit (for Haz determinands)
Result exceeds Screening Value (for Non Haz determinands)
Values in bold at the limit of detection

^ Note:

Hazardous and non-hazardous substances determined by JAGDAG (Jan 2017) and published at <http://www.wfduk.org/sites/default/files/Media/170116%20Substance%20Determinationsfinal.pdf>. These are marked as hazardous or non-hazardous. For substances not assessed by JAGDAG, Applied Geology has assumed a determination based on our understanding of the behaviour of the chemical. These determinations are highlighted in yellow.



Amended Report

Report No.: 21-28057-2

Initial Date of Issue: 23-Aug-2021 **Date of Re-Issue:** 25-Aug-2021

Client Applied Geology

Client Address: Unit 23, Abbey Park
Stareton
Kenilworth
Warwickshire
CV8 2LY

Contact(s): Frankie Hadley Jones
Lab Results

Project AG3309-21 Coldharbour Road,
Gravesend

Quotation No.: **Date Received:** 13-Aug-2021

Order No.: 17226 **Date Instructed:** 13-Aug-2021

No. of Samples: 12

Turnaround (Wkdays): 7 **Results Due:** 23-Aug-2021

Date Approved: 23-Aug-2021

Approved By:


Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:					21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:					1260040	1260041	1260046
	Sample Location:					DCS5	TP6	BH1
	Sample Type:					SOIL	SOIL	SOIL
	Top Depth (m):					1.8	0.2	0.6
	Bottom Depth (m):					1.8	0.2	0.6
	Date Sampled:					06-Aug-2021	06-Aug-2021	07-Aug-2021
Determinand	Accred.	SOP	Type	Units	LOD			
pH	U	1010	10:1		N/A	9.1	8.6	9.0
Sulphate	U	1220	10:1	mg/l	1.0	30	< 1.0	< 1.0
Magnesium	U	1455	10:1	mg/l	0.20	0.21	1.1	0.42
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.9	1.5	2.5
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	46	< 10	< 10
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	0.93	4.4	2.6
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.94	1.7
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.64	1.6
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.64	0.56	1.1
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	2.2	1.9	5.7
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	< 2.5	< 2.5
Chromium (Total)	N	1455	10:1	µg/l	0.50	< 0.50	< 0.50	1.3
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260039	1260040	1260041	1260042	1260043	1260044	1260045	1260046
	Sample Location:				DCS5	DCS5	TP6	TP3	TP4	TP2	TP2	BH1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	1.8	0.2	0.2	0.15	0.15	0.3	0.6
	Bottom Depth (m):				0.5	1.8	0.2	0.2	0.2	0.15	0.3	0.6
	Date Sampled:				06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	07-Aug-2021
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD								
Organic Matter	M	2625	%	0.40		< 0.40	4.4	2.6	5.6	5.5	0.98	0.57
Arsenic	M	2450	mg/kg	1.0		1.1	4.3	17	12	8.8	10	1.5
Cadmium	M	2450	mg/kg	0.10		< 0.10	0.14	0.18	0.36	0.17	< 0.10	< 0.10
Chromium	M	2450	mg/kg	1.0		6.8	13	18	11	13	12	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50				< 0.50	< 0.50	< 0.50		
Chromium (Trivalent)	N	2490	mg/kg	1.0				18	11	13		
Copper	M	2450	mg/kg	0.50		4.1	12	17	23	46	7.6	4.1
Lead	M	2450	mg/kg	0.50		4.9	40	200	150	25	8.5	3.3
Magnesium (Water Soluble)	N	2120	g/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mercury	M	2450	mg/kg	0.10		< 0.10	0.13	0.15	0.14	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50		5.4	11	23	17	20	11	8.6
Selenium	M	2450	mg/kg	0.20		< 0.20	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0		8.8	18	25	17	28	19	13
Zinc	M	2450	mg/kg	0.50		14	48	95	100	40	21	13
Naphthalene	M	2700	mg/kg	0.10		< 0.10	< 0.10	0.41	1.3	0.32	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10		< 0.10	< 0.10	1.7	2.4	0.48	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10		< 0.10	< 0.10	1.8	3.0	0.55	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10		< 0.10	< 0.10	2.3	3.8	0.53	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10		< 0.10	0.31	24	12	8.8	0.39	< 0.10
Anthracene	M	2700	mg/kg	0.10		< 0.10	0.11	8.6	5.0	2.9	0.24	< 0.10
Fluoranthene	M	2700	mg/kg	0.10		0.30	0.98	73	31	23	0.99	0.73
Pyrene	M	2700	mg/kg	0.10		0.29	1.1	75	35	25	0.87	0.81
Benzo[a]anthracene	M	2700	mg/kg	0.10		< 0.10	0.56	36	15	13	0.51	0.37
Chrysene	M	2700	mg/kg	0.10		< 0.10	0.84	31	12	14	0.51	0.60
Benzo[b]fluoranthene	M	2700	mg/kg	0.10		< 0.10	0.67	48	22	19	0.47	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10		< 0.10	0.66	20	9.4	7.6	1.1	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10		< 0.10	0.62	34	18	14	0.51	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10		< 0.10	0.46	8.6	4.4	3.3	0.80	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10		< 0.10	0.48	28	15	12	0.63	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10		< 0.10	0.47	23	15	11	0.50	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0		< 2.0	7.3	420	200	160	7.5	2.5
Phenol	M	2920	mg/kg	0.020				< 0.020	0.083	< 0.020		
Resorcinol	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Cresols	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
1-Naphthol	N	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Trimethylphenols	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Total Phenols	M	2920	mg/kg	0.10				< 0.10	< 0.10	< 0.10		
Benzene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:					21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:					1260039	1260040	1260041	1260042	1260043	1260044	1260045
	Sample Location:					DCS5	DCS5	TP6	TP3	TP4	TP2	BH1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.8	0.2	0.2	0.15	0.15	0.3
	Bottom Depth (m):					0.5	1.8	0.2	0.2	0.2	0.15	0.3
	Date Sampled:					06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021
	Asbestos Lab:					COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD								
Toluene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
o-Xylene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
TPH >C5-C6	N	2670	mg/kg	1.0		< 1.0						
TPH >C6-C7	N	2670	mg/kg	1.0		< 1.0						
TPH >C7-C8	N	2670	mg/kg	1.0		< 1.0						
TPH >C8-C10	N	2670	mg/kg	1.0		< 1.0						
TPH >C10-C12	N	2670	mg/kg	1.0		< 1.0						
TPH >C12-C16	N	2670	mg/kg	1.0		< 1.0						
TPH >C16-C21	N	2670	mg/kg	1.0		< 1.0						
TPH >C21-C35	N	2670	mg/kg	1.0		< 1.0						
TPH >C35-C44	N	2670	mg/kg	1.0		< 1.0						
Total TPH >C5-C44	N	2670	mg/kg	10		< 10						
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	130		< 1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0		< 1.0	3.6	300		< 1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0		< 1.0	67	420		< 1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0		< 1.0	300	690		< 1.0	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0		< 1.0	170	140		< 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0		< 5.0	540	1700		< 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	5.1		< 1.0	150	230		< 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	41		< 1.0	1500	760		< 1.0	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	68		< 1.0	5000	3200		< 1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0		< 1.0	270	73		< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	110		< 5.0	7000	4300		< 5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	110		< 10	7500	6000		< 10	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		0.15	0.041	0.27	0.21	0.018	< 0.010	< 0.010
ACM Type	U	2192		N/A	-		-	-	-	-		
Asbestos Identification	U	2192		N/A	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		
Moisture	N	2030	%	0.020	6.8	9.1	22	11	12	13	13	17

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:					21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:					1260039	1260040	1260041	1260042	1260043	1260044	1260045	1260046
	Sample Location:					DCS5	DCS5	TP6	TP3	TP4	TP2	TP2	BH1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.8	0.2	0.2	0.15	0.15	0.3	0.6
	Bottom Depth (m):					0.5	1.8	0.2	0.2	0.2	0.15	0.3	0.6
	Date Sampled:					06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	07-Aug-2021
	Asbestos Lab:					COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD									
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones and Roots	Stones	Stones	Stones	Stones and Roots	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Clay	Sand	Clay	Clay
Chromatogram (TPH)	N			N/A				See Attached	See Attached				
pH	M	2010		4.0		7.9	6.8	9.9	8.0	7.7	7.7	8.5	
Boron	N	2450	mg/kg	0.40		2.8	5.0	8.3	6.2	5.6	2.0	2.5	
Beryllium	U	2450	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	
Diesel Present	N	2670		N/A				False	False				
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0		

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Organic Matter	M	2625	%	0.40	2.3	0.48		
Arsenic	M	2450	mg/kg	1.0	5.9	3.2		
Cadmium	M	2450	mg/kg	0.10	0.19	< 0.10		
Chromium	M	2450	mg/kg	1.0	11	16		
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		
Chromium (Trivalent)	N	2490	mg/kg	1.0	11	16		
Copper	M	2450	mg/kg	0.50	20	5.2		
Lead	M	2450	mg/kg	0.50	50	6.6		
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010	< 0.010		
Mercury	M	2450	mg/kg	0.10	0.21	< 0.10		
Nickel	M	2450	mg/kg	0.50	11	8.9		
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20		
Vanadium	U	2450	mg/kg	5.0	18	13		
Zinc	M	2450	mg/kg	0.50	39	17		
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Phenanthrene	M	2700	mg/kg	0.10	1.9	1.6		
Anthracene	M	2700	mg/kg	0.10	0.28	0.73		
Fluoranthene	M	2700	mg/kg	0.10	2.4	5.7		
Pyrene	M	2700	mg/kg	0.10	2.0	6.1		
Benzo[a]anthracene	M	2700	mg/kg	0.10	0.86	2.8		
Chrysene	M	2700	mg/kg	0.10	1.3	3.2		
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	1.9	4.1		
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	0.57	1.7		
Benzo[a]pyrene	M	2700	mg/kg	0.10	0.91	2.8		
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.19	0.63		
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.69	2.2		
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.72	2.0		
Total Of 16 PAH's	M	2700	mg/kg	2.0	14	34		
Phenol	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Resorcinol	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Cresols	M	2920	mg/kg	0.020	< 0.020	< 0.020		
1-Naphthol	N	2920	mg/kg	0.020	< 0.020	< 0.020		
Trimethylphenols	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10		
Benzene	M	2760	µg/kg	1.0				

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

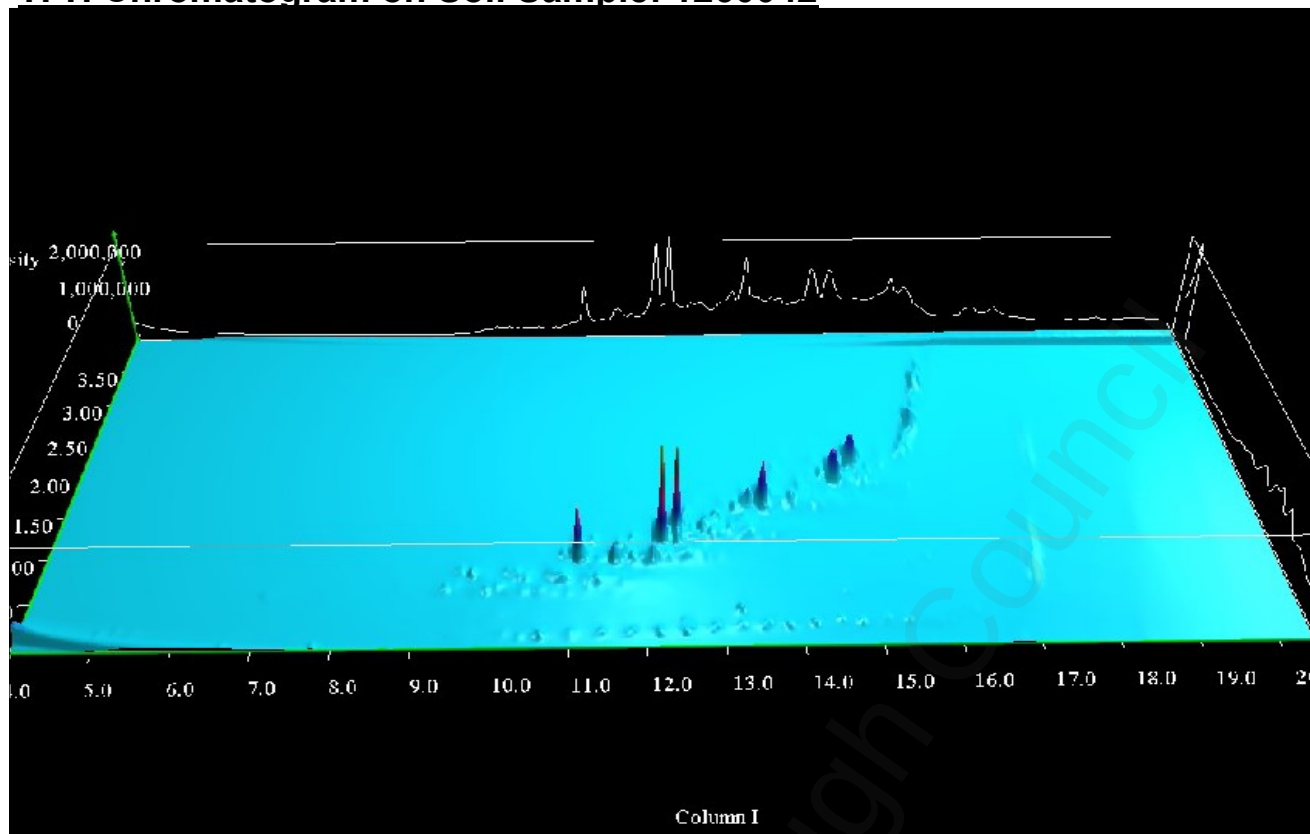
Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Toluene	M	2760	µg/kg	1.0				
Ethylbenzene	M	2760	µg/kg	1.0				
m & p-Xylene	M	2760	µg/kg	1.0				
o-Xylene	M	2760	µg/kg	1.0				
TPH >C5-C6	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C6-C7	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C7-C8	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C8-C10	N	2670	mg/kg	1.0	8.5	9.0		
TPH >C10-C12	N	2670	mg/kg	1.0	7.0	7.3		
TPH >C12-C16	N	2670	mg/kg	1.0	16	14		
TPH >C16-C21	N	2670	mg/kg	1.0	31	28		
TPH >C21-C35	N	2670	mg/kg	1.0	77	63		
TPH >C35-C44	N	2670	mg/kg	1.0	12	4.9		
Total TPH >C5-C44	N	2670	mg/kg	10	150	130		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0				
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0				
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0				
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0				
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0				
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0				
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0				
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0				
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0				
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0				
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0				
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0				
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0				
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0				
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0				
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0				
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0				
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0				
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0				
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.29	< 0.010		
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	12	16		

Results - Soil

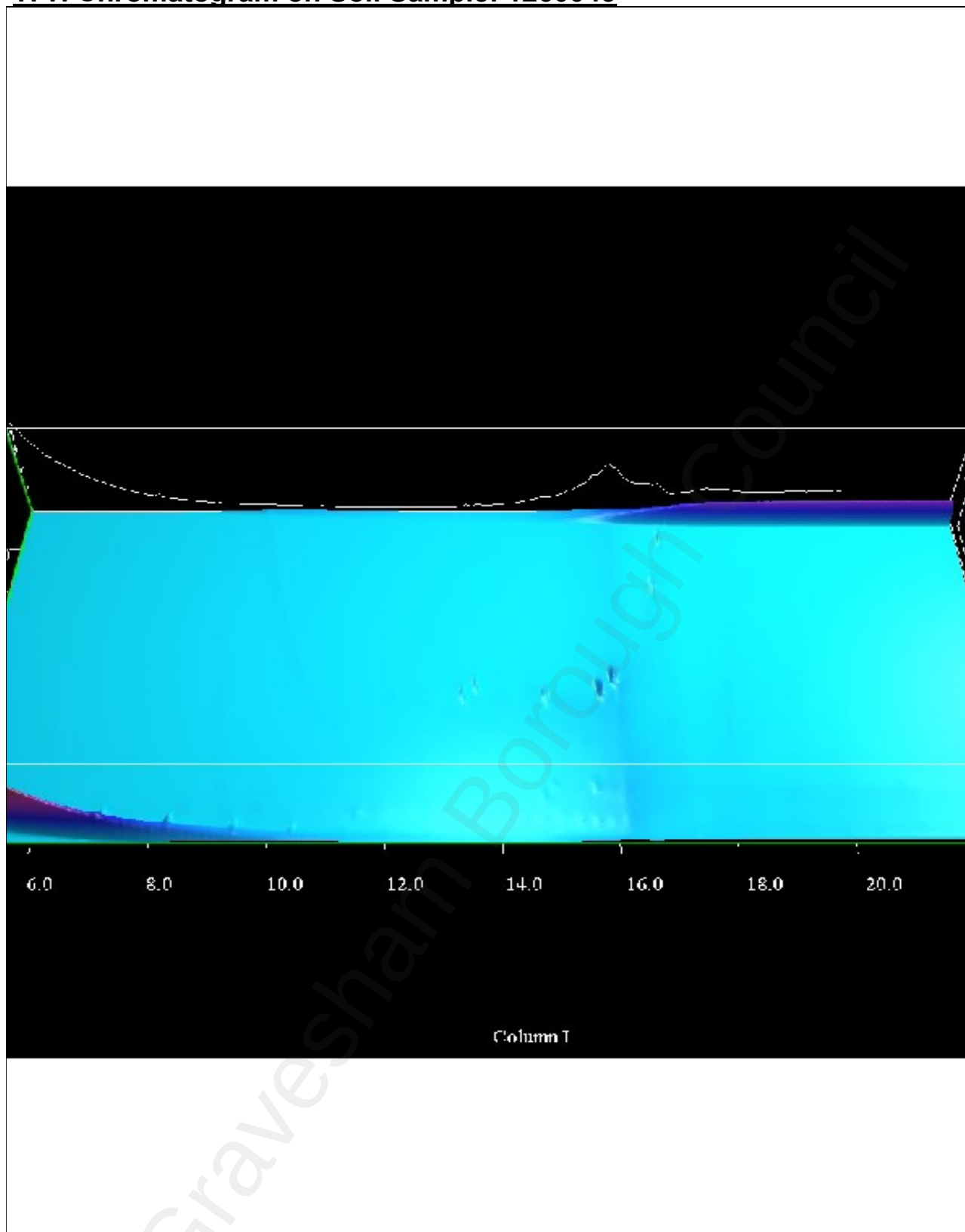
Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones, Roots and Wood	Stones and Roots
Soil Texture	N	2040		N/A	Sand	Clay	Sand	Sand
Chromatogram (TPH)	N			N/A				
pH	M	2010		4.0	7.9	8.5		
Boron	N	2450	mg/kg	0.40	3.9	3.6		
Beryllium	U	2450	mg/kg	1.0	< 1.0	< 1.0		
Diesel Present	N	2670		N/A				
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0				

TPH Chromatogram on Soil Sample: 1260042



TPH Chromatogram on Soil Sample: 1260043



TPH Interpretation

Job	Sample	Matrix	Location	Sample Ref	Sample ID	Sample Depth (m)	Gasoline / Diesel Present	TPH Interpretation
21-28057	1260042	S	TP3			0.2	No	PAH and Heavy Oil
21-28057	1260043	S	TP4			0.15	No	PAH and Heavy Oil

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

Test Methods

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Amended Report

Report No.: 21-28057-3

Initial Date of Issue: 23-Aug-2021 **Date of Re-Issue:** 18-Oct-2021

Client Applied Geology

Client Address: The Old Barn
Fulbrook Lane
Sherbourne
Warwick
Warwickshire
CV35 8AR

Contact(s): Frankie Hadley Jones
Lab Results

Project AG3309-21 Coldharbour Road,
Gravesend

Quotation No.: **Date Received:** 13-Aug-2021

Order No.: 17226 **Date Instructed:** 13-Aug-2021

No. of Samples: 12

Turnaround (Wkdays): 7 **Results Due:** 23-Aug-2021

Date Approved: 23-Aug-2021

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:					21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:					1260040	1260041	1260046
	Sample Location:					DCS5	TP6	BH1
	Sample Type:					SOIL	SOIL	SOIL
	Top Depth (m):					1.8	0.2	0.6
	Bottom Depth (m):					1.8	0.1	0.6
	Date Sampled:					06-Aug-2021	06-Aug-2021	07-Aug-2021
Determinand	Accred.	SOP	Type	Units	LOD			
pH	U	1010	10:1		N/A	9.1	8.6	9.0
Sulphate	U	1220	10:1	mg/l	1.0	30	< 1.0	< 1.0
Magnesium	U	1455	10:1	mg/l	0.20	0.21	1.1	0.42
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.9	1.5	2.5
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	46	< 10	< 10
Beryllium (Dissolved)	U	1455	10:1	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	0.93	4.4	2.6
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.94	1.7
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.64	1.6
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.64	0.56	1.1
Vanadium (Dissolved)	U	1455	10:1	µg/l	0.50	2.2	1.9	5.7
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	< 2.5	< 2.5
Chromium (Total)	N	1455	10:1	µg/l	0.50	< 0.50	< 0.50	1.3
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260039	1260040	1260041	1260042	1260043	1260044	1260045	1260046
	Sample Location:				DCS5	DCS5	TP6	TP3	TP4	TP2	TP2	BH1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	1.8	0.2	0.2	0.15	0.15	0.3	0.6
	Bottom Depth (m):				0.5	1.8	0.1	0.2	0.2	0.15	0.3	0.6
	Date Sampled:				06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	07-Aug-2021
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD								
Organic Matter	M	2625	%	0.40		< 0.40	4.4	2.6	5.6	5.5	0.98	0.57
Arsenic	M	2450	mg/kg	1.0		1.1	4.3	17	12	8.8	10	1.5
Cadmium	M	2450	mg/kg	0.10		< 0.10	0.14	0.18	0.36	0.17	< 0.10	< 0.10
Chromium	M	2450	mg/kg	1.0		6.8	13	18	11	13	12	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50				< 0.50	< 0.50	< 0.50		
Chromium (Trivalent)	N	2490	mg/kg	1.0				18	11	13		
Copper	M	2450	mg/kg	0.50		4.1	12	17	23	46	7.6	4.1
Lead	M	2450	mg/kg	0.50		4.9	40	200	150	25	8.5	3.3
Magnesium (Water Soluble)	N	2120	g/l	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mercury	M	2450	mg/kg	0.10		< 0.10	0.13	0.15	0.14	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50		5.4	11	23	17	20	11	8.6
Selenium	M	2450	mg/kg	0.20		< 0.20	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0		8.8	18	25	17	28	19	13
Zinc	M	2450	mg/kg	0.50		14	48	95	100	40	21	13
Naphthalene	M	2700	mg/kg	0.10		< 0.10	< 0.10	0.41	1.3	0.32	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10		< 0.10	< 0.10	1.7	2.4	0.48	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10		< 0.10	< 0.10	1.8	3.0	0.55	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10		< 0.10	< 0.10	2.3	3.8	0.53	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10		< 0.10	0.31	24	12	8.8	0.39	< 0.10
Anthracene	M	2700	mg/kg	0.10		< 0.10	0.11	8.6	5.0	2.9	0.24	< 0.10
Fluoranthene	M	2700	mg/kg	0.10		0.30	0.98	73	31	23	0.99	0.73
Pyrene	M	2700	mg/kg	0.10		0.29	1.1	75	35	25	0.87	0.81
Benzo[a]anthracene	M	2700	mg/kg	0.10		< 0.10	0.56	36	15	13	0.51	0.37
Chrysene	M	2700	mg/kg	0.10		< 0.10	0.84	31	12	14	0.51	0.60
Benzo[b]fluoranthene	M	2700	mg/kg	0.10		< 0.10	0.67	48	22	19	0.47	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10		< 0.10	0.66	20	9.4	7.6	1.1	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10		< 0.10	0.62	34	18	14	0.51	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10		< 0.10	0.46	8.6	4.4	3.3	0.80	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10		< 0.10	0.48	28	15	12	0.63	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10		< 0.10	0.47	23	15	11	0.50	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0		< 2.0	7.3	420	200	160	7.5	2.5
Phenol	M	2920	mg/kg	0.020				< 0.020	0.083	< 0.020		
Resorcinol	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Cresols	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
1-Naphthol	N	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Trimethylphenols	M	2920	mg/kg	0.020				< 0.020	< 0.020	< 0.020		
Total Phenols	M	2920	mg/kg	0.10				< 0.10	< 0.10	< 0.10		
Benzene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260039	1260040	1260041	1260042	1260043	1260044	1260045	1260046
	Sample Location:				DCS5	DCS5	TP6	TP3	TP4	TP2	TP2	BH1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.5	1.8	0.2	0.2	0.15	0.15	0.3	0.6
	Bottom Depth (m):				0.5	1.8	0.1	0.2	0.2	0.15	0.3	0.6
	Date Sampled:				06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	07-Aug-2021
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD								
Toluene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
o-Xylene	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
TPH >C5-C6	N	2670	mg/kg	1.0		< 1.0						
TPH >C6-C7	N	2670	mg/kg	1.0		< 1.0						
TPH >C7-C8	N	2670	mg/kg	1.0		< 1.0						
TPH >C8-C10	N	2670	mg/kg	1.0		< 1.0						
TPH >C10-C12	N	2670	mg/kg	1.0		< 1.0						
TPH >C12-C16	N	2670	mg/kg	1.0		< 1.0						
TPH >C16-C21	N	2670	mg/kg	1.0		< 1.0						
TPH >C21-C35	N	2670	mg/kg	1.0		< 1.0						
TPH >C35-C44	N	2670	mg/kg	1.0		< 1.0						
Total TPH >C5-C44	N	2670	mg/kg	10		< 10						
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	130		< 1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0		< 1.0	3.6	300		< 1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0		< 1.0	67	420		< 1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0		< 1.0	300	690		< 1.0	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0		< 1.0	170	140		< 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0		< 5.0	540	1700		< 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	5.1		< 1.0	150	230		< 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	41		< 1.0	1500	760		< 1.0	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	68		< 1.0	5000	3200		< 1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0		< 1.0	270	73		< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	110		< 5.0	7000	4300		< 5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	110		< 10	7500	6000		< 10	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		0.15	0.041	0.27	0.21	0.018	< 0.010	< 0.010
ACM Type	U	2192		N/A	-		-	-	-	-		
Asbestos Identification	U	2192		N/A	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		
Moisture	N	2030	%	0.020	6.8	9.1	22	11	12	13	13	17

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:					21-28057	21-28057	21-28057	21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:					1260039	1260040	1260041	1260042	1260043	1260044	1260045
	Sample Location:					DCS5	DCS5	TP6	TP3	TP4	TP2	BH1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.5	1.8	0.2	0.2	0.15	0.15	0.3
	Bottom Depth (m):					0.5	1.8	0.1	0.2	0.2	0.15	0.3
	Date Sampled:					06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	06-Aug-2021	07-Aug-2021
	Asbestos Lab:					COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD								
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones and Roots	Stones	Stones	Stones	Stones and Roots	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Clay	Sand	Clay
Chromatogram (TPH)	N			N/A				See Attached	See Attached			
pH	M	2010		4.0		7.9	6.8	9.9	8.0	7.7	7.7	8.5
Boron	N	2450	mg/kg	0.40		2.8	5.0	8.3	6.2	5.6	2.0	2.5
Beryllium	U	2450	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0
Diesel Present	N	2670		N/A				False	False			
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0		< 1.0	

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Organic Matter	M	2625	%	0.40	2.3	0.48		
Arsenic	M	2450	mg/kg	1.0	5.9	3.2		
Cadmium	M	2450	mg/kg	0.10	0.19	< 0.10		
Chromium	M	2450	mg/kg	1.0	11	16		
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		
Chromium (Trivalent)	N	2490	mg/kg	1.0	11	16		
Copper	M	2450	mg/kg	0.50	20	5.2		
Lead	M	2450	mg/kg	0.50	50	6.6		
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010	< 0.010		
Mercury	M	2450	mg/kg	0.10	0.21	< 0.10		
Nickel	M	2450	mg/kg	0.50	11	8.9		
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20		
Vanadium	U	2450	mg/kg	5.0	18	13		
Zinc	M	2450	mg/kg	0.50	39	17		
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10		
Phenanthrene	M	2700	mg/kg	0.10	1.9	1.6		
Anthracene	M	2700	mg/kg	0.10	0.28	0.73		
Fluoranthene	M	2700	mg/kg	0.10	2.4	5.7		
Pyrene	M	2700	mg/kg	0.10	2.0	6.1		
Benzo[a]anthracene	M	2700	mg/kg	0.10	0.86	2.8		
Chrysene	M	2700	mg/kg	0.10	1.3	3.2		
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	1.9	4.1		
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	0.57	1.7		
Benzo[a]pyrene	M	2700	mg/kg	0.10	0.91	2.8		
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.19	0.63		
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.69	2.2		
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.72	2.0		
Total Of 16 PAH's	M	2700	mg/kg	2.0	14	34		
Phenol	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Resorcinol	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Cresols	M	2920	mg/kg	0.020	< 0.020	< 0.020		
1-Naphthol	N	2920	mg/kg	0.020	< 0.020	< 0.020		
Trimethylphenols	M	2920	mg/kg	0.020	< 0.020	< 0.020		
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10		
Benzene	M	2760	µg/kg	1.0				

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Toluene	M	2760	µg/kg	1.0				
Ethylbenzene	M	2760	µg/kg	1.0				
m & p-Xylene	M	2760	µg/kg	1.0				
o-Xylene	M	2760	µg/kg	1.0				
TPH >C5-C6	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C6-C7	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C7-C8	N	2670	mg/kg	1.0	< 1.0	< 1.0		
TPH >C8-C10	N	2670	mg/kg	1.0	8.5	9.0		
TPH >C10-C12	N	2670	mg/kg	1.0	7.0	7.3		
TPH >C12-C16	N	2670	mg/kg	1.0	16	14		
TPH >C16-C21	N	2670	mg/kg	1.0	31	28		
TPH >C21-C35	N	2670	mg/kg	1.0	77	63		
TPH >C35-C44	N	2670	mg/kg	1.0	12	4.9		
Total TPH >C5-C44	N	2670	mg/kg	10	150	130		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0				
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0				
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0				
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0				
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0				
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0				
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0				
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0				
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0				
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0				
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0				
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0				
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0				
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0				
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0				
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0				
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0				
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0				
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0				
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.29	< 0.010		
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	12	16		

Results - Soil

Project: AG3309-21 Coldharbour Road, Gravesend

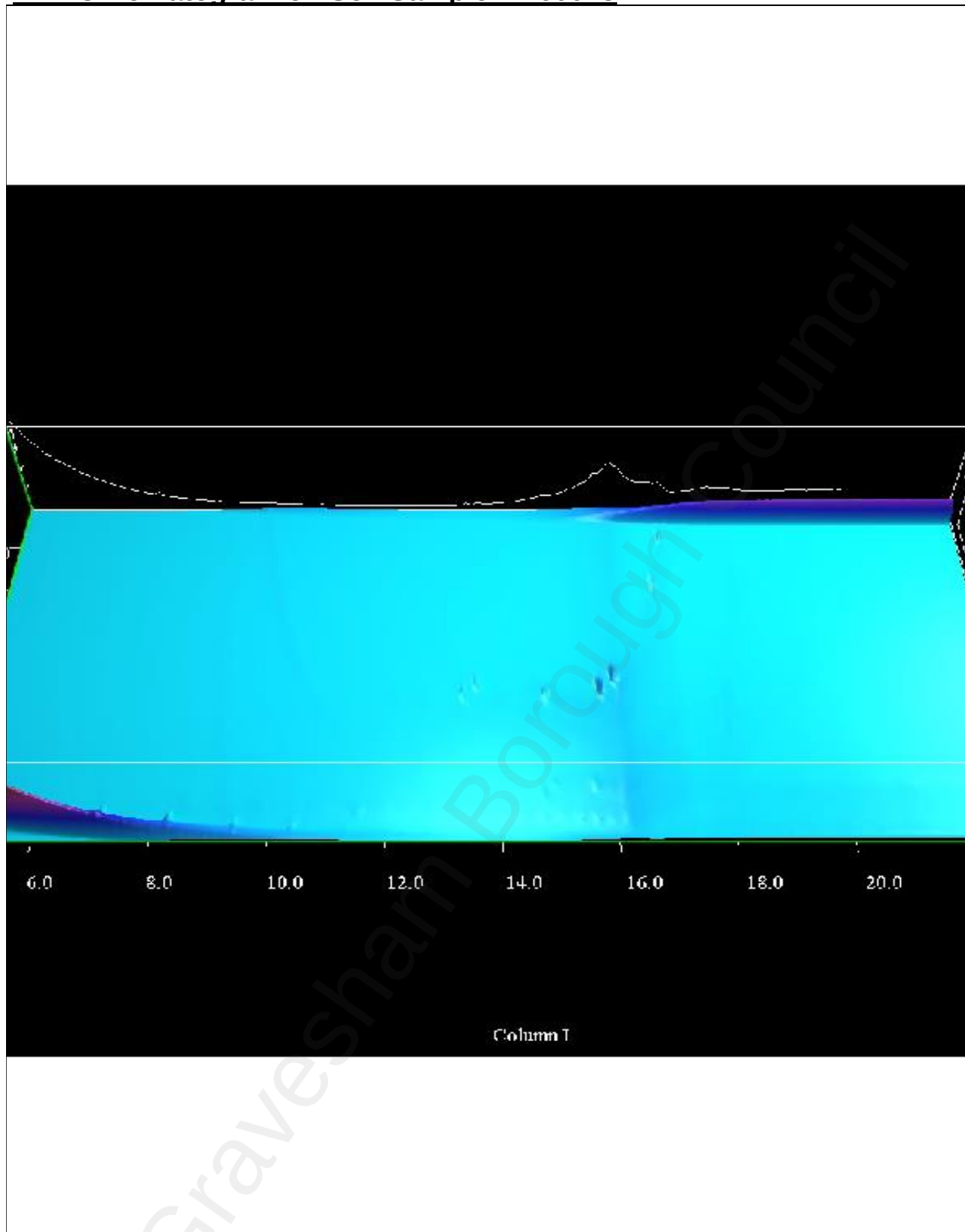
Client: Applied Geology	Chemtest Job No.:				21-28057	21-28057	21-28057	21-28057
Quotation No.:	Chemtest Sample ID.:				1260047	1260048	1260049	1260050
	Sample Location:				TP7	BH1	DCS3	TP5
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.2	0.3	0.2	0.1
	Bottom Depth (m):				0.2	0.3	0.2	0.1
	Date Sampled:				06-Aug-2021	07-Aug-2021	05-Aug-2021	06-Aug-2021
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones, Roots and Wood	Stones and Roots
Soil Texture	N	2040		N/A	Sand	Clay	Sand	Sand
Chromatogram (TPH)	N			N/A				
pH	M	2010		4.0	7.9	8.5		
Boron	N	2450	mg/kg	0.40	3.9	3.6		
Beryllium	U	2450	mg/kg	1.0	< 1.0	< 1.0		
Diesel Present	N	2670		N/A				
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0				

TPH Chromatogram on Soil Sample: 1260042

\\NM-FILESERVER\Job Paperwork\SampData\SOIL\1260042.PDF

Gravesham Borough Council

TPH Chromatogram on Soil Sample: 1260043



TPH Interpretation

Job	Sample	Matrix	Location	Sample Ref	Sample ID	Sample Depth (m)	Gasoline / Diesel Present	TPH Interpretation
21-28057	1260042	S	TP3			0.2	No	PAH and Heavy Oil
21-28057	1260043	S	TP4			0.15	No	PAH and Heavy Oil

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

Test Methods

SOP	Title	Parameters included	Method summary
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Applied Geology Ltd

Unit 23 Abbey Park

Stareton

Kenilworth

Warwickshire

CV8 2LY

For the attention of Frankie Hadley-Jones

Report No: B27235

Issue No 02

LABORATORY TEST REPORT

Project Name		COLDHARBOUR ROAD, GRAVESEND	
Project Number		B27235	Date samples received
Your Ref			Date written instructions received
Purchase Order		17264	Date testing commenced
			24/08/2021
			24/08/2021
			24/08/2021
Please find enclosed the results as summarised below			
Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	8	BRE Suite - Soil	Yes
Remarks :			
Issued by : Stephen Langman		Date of Issue : 07/09/2021	Key to symbols used in this report
Approved Signatories : 			S/C : Testing was sub-contracted
S Langman (Laboratory Coordinator), D Bowen (Production Manager)			
Unless we are notified to the contrary, samples will be disposed after a period of one month from this date. The results reported relate to samples received in the laboratory only. All results contained in this report are provisional unless signed by an approved signatory This report should not be reproduced except in full without the written approval of the laboratory. Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory. The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw our report if we have not received cleared funds in accordance with our standard terms and conditions Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation. Feedback on the this report may be left via our website www.terratek.co.uk/contact-us			



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Terra Tek Ltd is registered in Scotland No. 121594
Offices in Airdrie, Birmingham, Belfast and Aston Clinton

Head Office : 62 Rochsolloch Road, Airdrie, ML6 9BG

 TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES				Site COLDHARBOUR ROAD, GRAVESEND																Contract No B27235			
				Client Applied Geology Ltd																			
				Engineer																			
Sample Identification				Lab Sample ID	pH	Sulphate (soluble in 2:1 water extract) as SO4 g/l																	
Hole	Depth m	Sample Ref	Sample Type																				
BH1	7.60		T	789247	8.3	0.03																	
DCS3	1.60		T	789248	7.2	0.19																	
DCS2	1.30		T	789249	7.9	0.04																	
DCS1	1.00		T	789250	8.3	0.02																	
BH2	5.60		T	789251	8.8	0.03																	
BH2	10.50		T	789252	8.4	0.04																	
DCS2	0.20		T	789253	9.2	0.05																	
TP07	0.20		T	789254	8.2	0.55																	
Limits of Detection Terra Tek Analysis Method					~ TP019 M	0.01 TP169 M																	
Accreditation M=Mcerts U=UKAS N=No accreditation																							
Originator	Checked & Approved		BRE SUITE																			 Figure 1 Sheet 1 of 1	
DAB	07/09/2021																						

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES				Site COLDHARBOUR ROAD, GRAVESEND				Contract No B27235			
				Client Applied Geology Ltd							
				Engineer							
Sample Identification				Lab Sample ID	Date Sampled	Temperature on receipt °C	PRIMARY MATRIX	Secondary Matrix	Additional matrix	% Loss at 30C	% Retained 2mm
Exploratory Hole	Depth m	Sample Ref	Sample Type								
BH1	7.60		T	789247	07/08/21		Sandy CLAY			24.2	~
DCS3	1.60		T	789248	05/08/21		SAND			14.3	~
DCS2	1.30		T	789249	05/08/21		CLAY	Fine to medium gravel		13.8	32.7
DCS1	1.00		T	789250	05/08/21		SAND	Fine to medium gravel		8.9	41.8
BH2	5.60		T	789251	06/08/21		Sandy CLAY			23.9	~
BH2	10.50		T	789252	06/08/21		SAND	Fine to medium gravel		28.5	10.5
DCS2	0.20		T	789253	05/08/21		SAND	Fine to medium gravel		8.9	51.7
TP07	0.20		T	789254	06/08/21		SAND	Fine to medium gravel		12.3	21.7
Notes											
Terra Tek are accredited for clay, sand and loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials such as gravel, are not accredited where they comprise the major component of the sample. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated. Samples for asbestos testing are dried at 85°C. With the exception of samples analysed for asbestos, the laboratory removes any material > 2mm prior to analysis. The quantity and nature of the material is shown as the secondary and additional matrix types in the above table. Where a parameter cannot be determined in house it is our policy to use a UKAS/MCERTS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS/MCERTS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors List, which is subject to performance assessment, will be selected.											
Originator		Checked & Approved		SAMPLE DESCRIPTIONS						Appendix S1	
DAB		07/09/2021									
										Sheet 1 of 1	

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES				Site COLDHARBOUR ROAD, GRAVESEND		Contract No B27235						
				Client Applied Geology Ltd								
				Engineer								
Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximum holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
BH1	7.60		T	789247	07/08/21							
DCS3	1.60		T	789248	05/08/21							
DCS2	1.30		T	789249	05/08/21							
DCS1	1.00		T	789250	05/08/21							
BH2	5.60		T	789251	06/08/21							
BH2	10.50		T	789252	06/08/21							
DCS2	0.20		T	789253	05/08/21							
TP07	0.20		T	789254	06/08/21							
NOTES 1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above. 2 The absence of "X" or "Yes" in the table above indicates no reported deviations. 3 Deviations due to use of incorrect sample container are shown on result tables. 4 Deviating results are indicated within result tables.												
Originator		Checked & Approved		DEVIATING SAMPLES - SOIL					 Appendix S2 Sheet 1 of 1			
DAB		 07/09/2021										

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES		Site COLDHARBOUR ROAD, GRAVESEND		Contract No B27235	
		Client Applied Geology Ltd			
		Engineer			
Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
GP001	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Preparation of soil samples for chemical analysis	Yes	Yes	N/A
GP012	BS EN 12457-3: Characterisation of Waste - Compliance test for leaching of granular waste materials and sludges (two-stage batch test)	Preparation of soil samples for two-stage leachate test			Dry
TP019	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of pH in 2.5:1 water/soil extract using pH meter.	Yes	Yes	Dry
TP032	MAFF Book 427: The Analysis of Agricultural Materials: Method 8	Determination of water soluble boron by ICP-OES	Yes		Dry
TP040	APHA/AWWA, 19th edition: Method 3500Cr-D	Determination of hexavalent chromium by colorimetry.	Yes		Dry
TP041	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of organic matter by titrimetry.	Yes		Dry
TP042	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of loss on ignition at 50-440°C by gravimetry	Yes	Yes	Dry
TP045	GACHAMJA A.M. Chromatography and Analysis: 1992 9-11 (modified)	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS	Yes	Yes	Dry
TP046	MEWAM method: Phenols in water and Effluents: 4-aminoantipyrine method	Determination of monohydric phenols by steam distillation/colorimetry	Yes	Yes	Dry
TP047	MEWAM method: Cyanide in Waters etc	Determination of free cyanide by steam distillation/colorimetry	Yes		Dry
TP048	MEWAM method: Cyanide in Waters etc	Determination of total cyanide by steam distillation/colorimetry.	Yes	Yes	Dry
TP049	MEWAM method: Cyanide in Waters etc	Determination of complex cyanide by calculation	Yes		Dry
TP050	MEWAM method: Determination of Thiocyanate ,1985	Determination of thiocyanate by colorimetry	Yes	Yes	Dry
TP051	USEPA Method 9030B	Determination of acid soluble sulphides by steam distillation/colorimetry.	Yes	Yes	Wet
TP067	TNRCC Method 1005: 2001 (modified)	Determination of pentane/acetone extractable petroleum hydrocarbons (C8 - C40) by GC/FID	Yes	Yes	Wet
TP072	In-house documented method	Determination of ammoniacal nitrogen by colorimetry			Dry
TP074	In-house documented method	Determination of water soluble fluoride by ion selective electrode			Dry
TP098	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of acid soluble chloride by titrimetry			Dry
TP099	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP100	Wisconsin DNR Modified GRO method, Method for Determining Gasoline Range Organics	Determination of Volatile Petroleum Hydrocarbons/GRO.	Yes	Yes	Wet
Notes 1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample. 2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated. 3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request. 4. The laboratory records the date of analysis of each parameter. This information is available on request. 5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.					
Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)			Tk Appendix S3
N/A	N/A				
Sheet 1 of 2					

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES		Site COLDHARBOUR ROAD, GRAVESEND		Contract No B27235	
		Client Applied Geology Ltd			
		Engineer			
Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
TP110	USEPA Methods 8082A & 3665A	Determination of Total & Speciated 7 PCB Congeners by GC/MS SIM	Yes	Yes	Wet
TP114	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of carbonate in soil (rapid titration method)			Dry
TP126	TNRCC Method 1006 (modified)	Extracted petroleum hydrocarbons from TP067 split into aromatic and aliphatic fractions. Analysed by GC/FID.	Yes		Wet
TP129	In-house documented method	Determination of total sulphur by ICP-OES spectroscopy	Yes	Yes	Dry
TP134	In-house documented method	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP135	USEPA Methods 8100 & 8270D. In-house method TP045	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS (with concentration stage)			Dry
TP137	BS7755: Section 3.9: 1995/ISO 11466:1995	Determination of acid extractable metals in soil by ICP-OES	Selected	Selected	Dry
TP145	USEPA Methods 3550C & 8270D	Determination of Semi-Volatile Organic Compounds by GC/MS	Yes	Yes	Wet
TP147	USEPA Methods 8082A & 3665A	Determination of total & speciated WHO 12 PCB Congeners by GC/MS SIM.			Wet
TP150	USEPA Methods 8081B & 8141B	Determination of pesticides and herbicides in soil by GC/MS SIM			Dry
TP152	USEPA Method 556	Determination of carbonyls by GC/MS.			Wet
TP154	USEPA Method 5021. Wisconsin DNR modified GRO method	Determination of volatiles in by GC/MS headspace	Yes	Selected	Wet
TP158	USEPA Method 1671	Determination of glycols by GC/FID DI			Wet
TP169	In-house documented method	Determination of water soluble sulphate in 2:1 water/soil extract by ICP-OES spectroscopy	Yes	Yes	Wet
TP171	In-house documented method	Determination of acid soluble sulphate by ICP-OES spectroscopy	Yes	Yes	Dry
TP174	In-house documented method	Determination of Total Organic Carbon in soils by high temperature combustion & NDIR detection	Yes		Dry
TP178	In-house documented method	Determination of water soluble nitrate by ion selective electrode			Dry
TP181	HSG 248 Asbestos: The Analysts Guide (Appendix 2)	Asbestos Identification in bulk materials	Yes	No	Dry
TP183	HSG 248 Asbestos: The Analysts Guide (Appendix 2) & Standing Committee of Analysts: The Quantification of Asbestos in Soil (2017)	Asbestos Identification & Quantification in soils	Yes	No	Dry
TP185	In-house documented method	Determination of loss on ignition at 150-440°C by gravimetry	No	No	Dry
Notes 1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample. 2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated. 3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request. 4. The laboratory records the date of analysis of each parameter. This information is available on request. 5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.					
Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)		Tk	Appendix S3
N/A	N/A				
Sheet 2 of 2					

Applied Geology Ltd

Unit 23 Abbey Park

Stareton

Kenilworth

Warwickshire

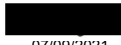
CV8 2LY

For the attention of Frankie Hadley-Jones

Report No: B27235

Issue No 01

LABORATORY TEST REPORT

Project Name		COLDHARBOUR ROAD, GRAVESEND	
Project Number		B27235	Date samples received
Your Ref			Date written instructions received
Purchase Order		17264	Date testing commenced
			24/08/2021
			24/08/2021
			24/08/2021
Please find enclosed the results as summarised below			
Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	3	Summary of Geotechnical Tests	See report
2 - 4	3	Atterberg Limit	Yes
5 - 11	7	Particle Size Distribution	Yes
Remarks :			
Issued by : Stephen Langman		Date of Issue : 07/09/2021	Key to symbols used in this report
Approved Signatories : 			S/C : Testing was sub-contracted
S Langman (Laboratory Coordinator), D Bowen (Production Manager)			
Unless we are notified to the contrary, samples will be disposed after a period of one month from this date. The results reported relate to samples received in the laboratory only. All results contained in this report are provisional unless signed by an approved signatory This report should not be reproduced except in full without the written approval of the laboratory. Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory. The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw our report if we have not received cleared funds in accordance with our standard terms and conditions Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation. Feedback on the this report may be left via our website www.terratek.co.uk/contact-us			



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Head Office : 62 Rochsolloch Road, Airdrie, ML6 9BG

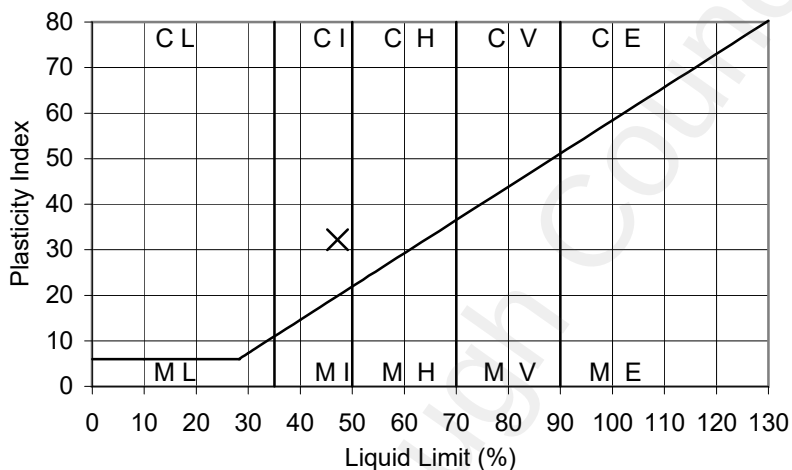
TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES				Site COLDHARBOUR ROAD, GRAVESEND												Contract No B27235					
				Client Applied Geology Ltd																	
				Engineer																	
Sample Identification					Non Engineering Sample Description	Water Content	Atterberg limits					Particle Density	Density		Total Stress				Thermal Conductivity	Electrical Resistivity	
Exploratory Hole	Depth m	Sample Ref	Sample Type				Lab Sample ID	Liquid Limit	Plastic Limit	Plasticity Index	Percentage retained 425µm		Atterberg Classification	Bulk	Dry	Shear Strength (Hand Vane)	Shear Strength (Triaxial)	Apparent Cohesion C			Angle of Shearing Resistance Phi
BH2	1.80		T	789243	Light brown mottled dark brown slightly sandy CLAY.	16.4	47	15	32	0	CI										
DCS2	2.60		T	789244	Light brown clayey SAND.	13.2		NP	~	0											
TP4	2.00		T	789245	Brown fine to coarse GRAVEL with much silty, sandy clay.	21.1	45	18	27	72	CI										
Notes				Opinions and interpretations are outside the scope of UKAS accreditation		UKAS Accredited Test Y/N		Test details are given on the 'Notes on Laboratory Procedures' sheet													
						Y	Y	Y	Y	Y	-	Y	Y	Y	N	Y	-	-	N	N	
Originator		Checked & Approved		SUMMARY OF GEOTECHNICAL TESTS																Tk Figure 1	
CR		07/09/2021																			
																		Sheet 1 of 1			



Site	COLDHARBOUR ROAD, GRAVESEND	Contract No.	B27235
Client	Applied Geology Ltd	Hole ID	BH2
Engineer		Sample Ref	
		Depth (m)	1.80
		Sample Type	T

Non Engineering Description : Light brown mottled dark brown slightly sandy CLAY.

Preparation : Sample as received



Results :

As Received Moisture Content : (BS1377:Part 2:Clause 3:1990) 16 %
 Percentage retained on 425µm sieve : 0 %
 Liquid Limit : 47 %
 Plastic Limit : 15 %
 Plasticity Index : 32

Equivalent moisture content of material passing 425µm sieve : 16 %
 Liquidity Index : 0.03

Originator	Checked & Approved	Liquid Limit (One Point Cone Penetrometer Method) Plastic Limit, Plasticity Index & Liquidity Index BS 1377:Part 2:Clause 4.4:1990 BS 1377:Part 2:Clause 5:1990	Figure 2 Sheet 1 of 1
NF	07/09/2021		



Site COLDHARBOUR ROAD, GRAVESEND

Client Applied Geology Ltd

Engineer

Contract No. **B27235**

Hole ID DCS2

Sample Ref

Depth (m) 2.60

Sample Type T

Non Engineering Description : Light brown clayey SAND.

Preparation : Sample as received

Sample was determined to be Non-Plastic after preparation

Results :

As Received Moisture Content : (BS1377:Part 2:Clause 3:1990)

13 %

Percentage retained on 425µm sieve :

0 %

Equivalent moisture content of material passing 425µm sieve :

13 %

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IG

07/09/2021

Plastic Limit

BS 1377:Part 2:Clause 5:1990



Figure 3

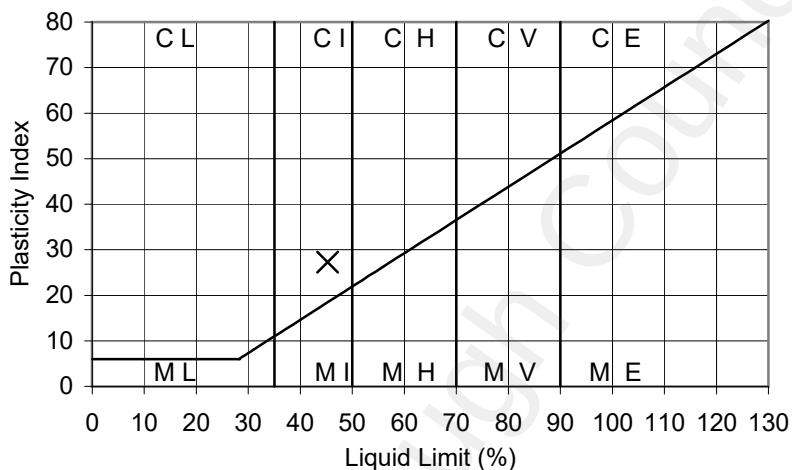
Sheet 1 of 1



Site	COLDHARBOUR ROAD, GRAVESEND	Contract No.	B27235
Client	Applied Geology Ltd	Hole ID	TP4
Engineer		Sample Ref	
		Depth (m)	2.00
		Sample Type	T

Non Engineering Description : Brown fine to coarse GRAVEL with much silty, sandy clay.

Preparation : Sample as received



Results :

As Received Moisture Content : (BS1377:Part 2:Clause 3:1990)	21 %
Percentage retained on 425µm sieve :	72 %
Liquid Limit :	45 %
Plastic Limit :	18 %
Plasticity Index :	27
Equivalent moisture content of material passing 425µm sieve :	74 %
Liquidity Index :	2.07

Originator	Checked & Approved	Liquid Limit (One Point Cone Penetrometer Method) Plastic Limit, Plasticity Index & Liquidity Index BS 1377:Part 2:Clause 4.4:1990 BS 1377:Part 2:Clause 5:1990	Figure 4 Sheet 1 of 1
IG	07/09/2021		

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES	Site	COLDHARBOUR ROAD, GRAVESEND	Contract No	B27235
	Client	Applied Geology Ltd	Hole	BH1
	Engineer		Sample Ref	
			Depth (m)	8.60
			Sample Type	B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	100
630 µm	99
425 µm	99
300 µm	98
200 µm	98
150 µm	96
63 µm	19

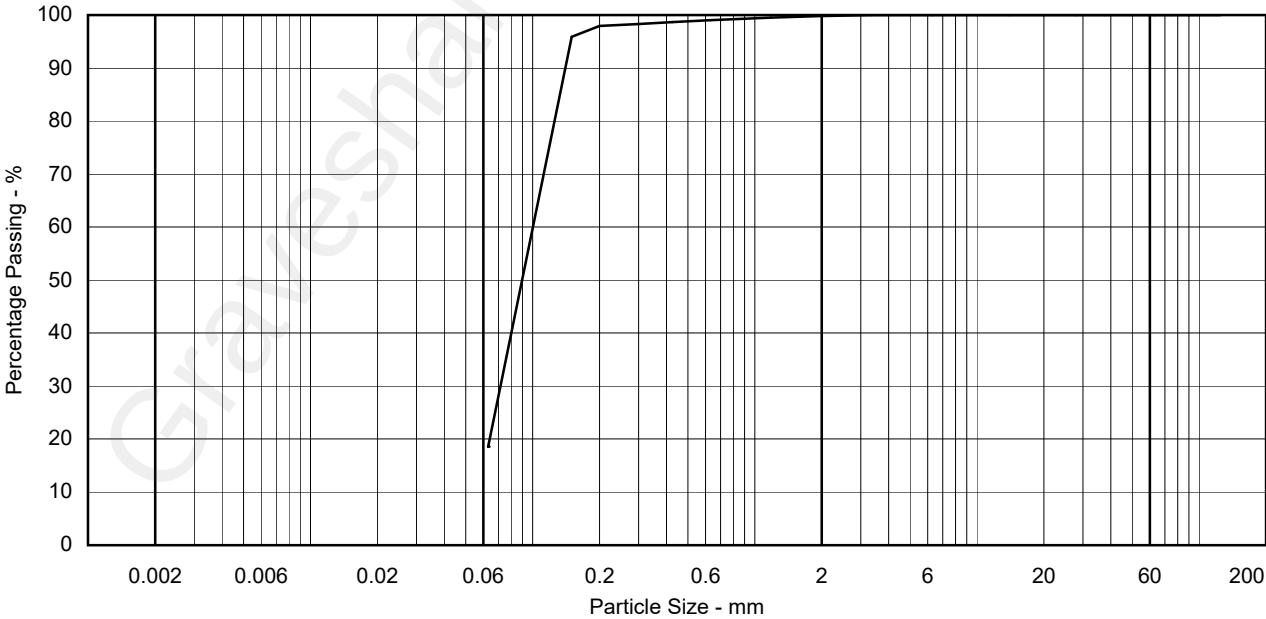
Non Engineering Description
Brown silty SAND.

Sample Proportions - %	
Cobbles	0.0
Gravel	0.2
Sand	81.2
Silt & Clay	18.6

Particle Diameter - mm	
D100	3.4
D60	0.10
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
	Silt			Sand			Gravel			



Originator	Checked & Approved	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method	Tk Figure 5 Sheet 1 of 1
DS	07/09/2021		

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES	Site	COLDHARBOUR ROAD, GRAVESEND	Contract No	B27235
	Client	Applied Geology Ltd	Hole	DCS3
	Engineer		Sample Ref	
			Depth (m)	1.20
			Sample Type	B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	99
1.18 mm	98
630 µm	98
425 µm	97
300 µm	97
200 µm	95
150 µm	81
63 µm	5

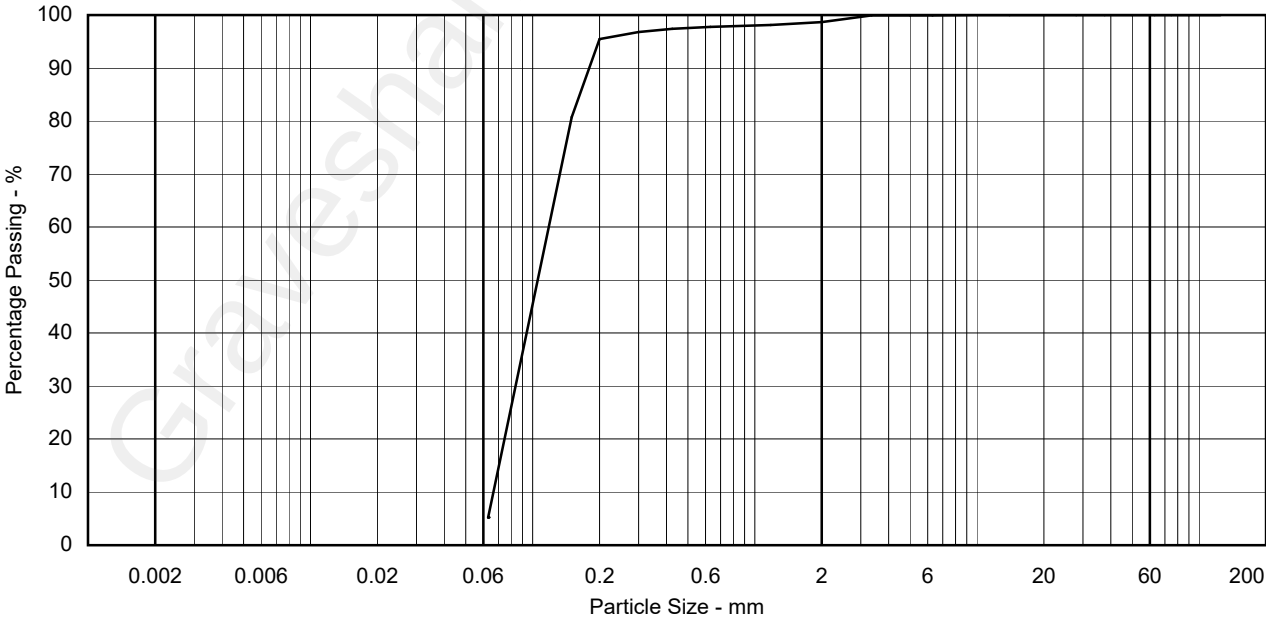
Non Engineering Description
Brown/ grey slightly clayey, slightly silty SAND.

Sample Proportions - %	
Cobbles	0.0
Gravel	1.3
Sand	93.5
Silt & Clay	5.2

Particle Diameter - mm	
D100	10
D60	0.12
D10	0.067
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	1.8

Notes

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
	Silt			Sand			Gravel			



Originator	Checked & Approved	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method	Tk Figure 7
DS	07/09/2021		
Sheet 1 of 1			

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES	SiteCOLDHARBOUR ROAD, GRAVESEND		Contract NoB27235	
	ClientApplied Geology Ltd		HoleTP02	
	Engineer		Sample Ref	
			Depth (m)	2.80
			Sample Type	B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	99
5.00 mm	99
3.35 mm	97
2.00 mm	96
1.18 mm	96
630 µm	95
425 µm	94
300 µm	91
200 µm	76
150 µm	64
63 µm	25
20 µm	16
6 µm	14
2 µm	12

Non Engineering Description	
Grey / brown clayey silty SAND with occasional gravel. Gravel is fine to medium.	

Sample Proportions - %	
Cobbles	0.0
Gravel	3.8
Sand	72.1
Silt	12.0
Clay	12.1

Particle Diameter - mm	
D100	10
D60	0.14
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes	
Sedimentation sample not pre-treated	

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
Silt			Sand			Gravel				

Percentage Passing - %

Particle Size - mm	0.002	0.006	0.02	0.06	0.2	0.6	2	6	20	60	200
Percentage Passing - %	12	14	16	25	75	90	95	98	100	100	100

Originator	Checked & Approved	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method BS EN ISO 17892-4 2016 Clause 5.4 - Pipette Method	Tk Figure 8 Sheet 1 of 1
DS	07/09/2021		

Site COLDHARBOUR ROAD, GRAVESEND

Contract No **B27235**

Hole TP04

Client Applied Geology Ltd

Sample Ref

Depth (m) 0.40

Engineer

Sample Type B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	99
28.0 mm	98
20.0 mm	96
14.0 mm	91
10.0 mm	89
6.30 mm	84
5.00 mm	83
3.35 mm	79
2.00 mm	77
1.18 mm	76
630 µm	74
425 µm	72
300 µm	68
200 µm	61
150 µm	56
63 µm	27
20 µm	13
6 µm	8
2 µm	6

Non Engineering Description

Brown silty clayey SAND with some gravel. Gravel is fine to coarse.

Sample Proportions - %

Cobbles	0.0
Gravel	22.8
Sand	51.0
Silt	20.2
Clay	6.1

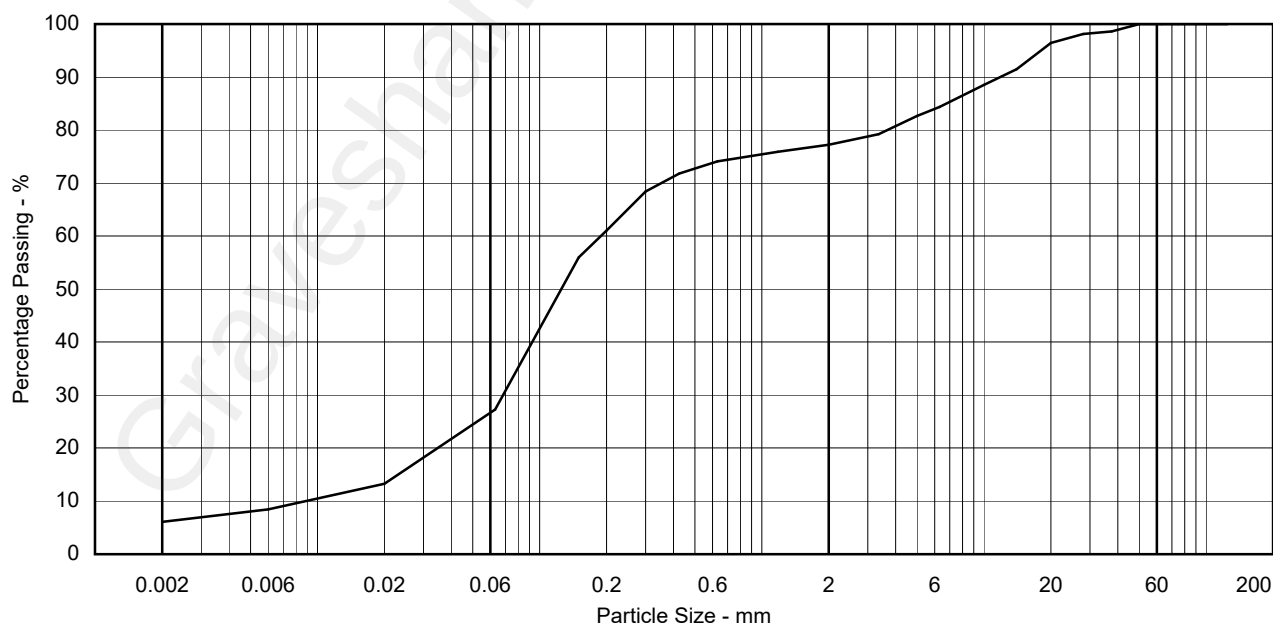
Particle Diameter - mm

D100	50
D60	0.19
D10	0.0089
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	21.3

Notes

Sedimentation sample not pre-treated

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
	Silt			Sand			Gravel			



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PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method
BS EN ISO 17892-4 2016 Clause 5.4 - Pipette Method

Figure 9

Sheet 1 of 1

Site COLDHARBOUR ROAD, GRAVESEND

Contract No **B27235**

Hole TP3

Client Applied Geology Ltd

Sample Ref

Depth (m) 2.80

Engineer

Sample Type B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	95
28.0 mm	90
20.0 mm	89
14.0 mm	87
10.0 mm	85
6.30 mm	83
5.00 mm	82
3.35 mm	80
2.00 mm	79
1.18 mm	78
630 µm	77
425 µm	76
300 µm	75
200 µm	67
150 µm	53
63 µm	12

Non Engineering Description

Brown clayey, silty SAND with some gravel. Gravel is fine to coarse.

Sample Proportions - %

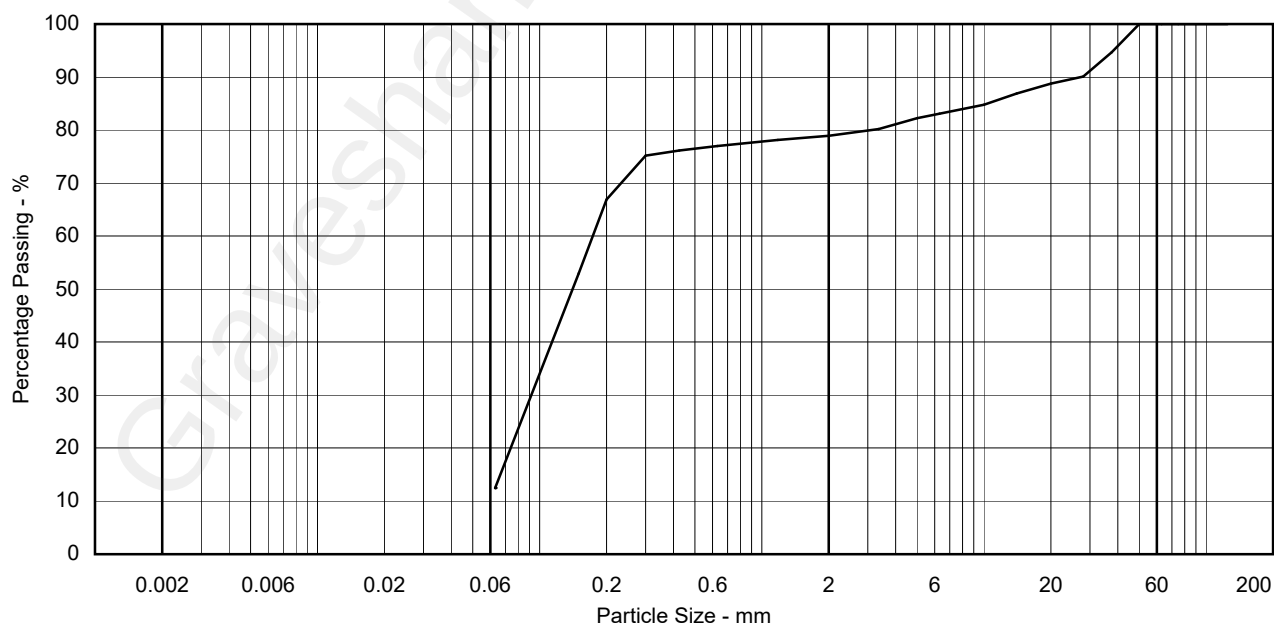
Cobbles	0.0
Gravel	21.1
Sand	66.5
Silt & Clay	12.4

Particle Diameter - mm

D100	50
D60	0.17
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
	Silt			Sand			Gravel			



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PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method


Figure 10

Sheet 1 of 1

TERRA TEK

SITE INVESTIGATION AND LABORATORY SERVICES

Site

COLDHARBOUR ROAD, GRAVESEND

Contract No

B27235

Client

Applied Geology Ltd

Engineer

Hole

TP6

Sample Ref

Depth (m)

0.50

Sample Type

B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	100
1.18 mm	99
630 µm	98
425 µm	98
300 µm	97
200 µm	96
150 µm	86
63 µm	8

Non Engineering Description

Brown silty clayey SAND.

Sample Proportions - %

Cobbles	0.0
Gravel	0.4
Sand	91.3
Silt & Clay	8.4

Particle Diameter - mm

D100	10
D60	0.11
D10	0.064
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	1.7

Notes

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles
	Silt			Sand			Gravel			

Percentage Passing - %

Particle Size (mm)	Percentage Passing (%)
0.06	8
0.075	10
0.15	85
0.25	95
0.5	98
1.0	99
2.0	100
6.3	100
20.0	100
63.0	100
125.0	100

Particle Size - mm

Originator

DS

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PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method

Tk

Figure 11

Sheet 1 of 1

APPENDIX F

APPENDIX F

STANDARD FIELDWORK AND ASSESSMENT PROCEDURES

Scope of Work

The scope of work undertaken is defined in Section 1 of the Report. It should be noted that Applied Geology Limited does not provide arboricultural surveys, specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife. Information from environmental and ecological datasets is included from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website, however, if a full assessment of Environmental or Ecological aspects is required, it is recommended that other specialists are consulted. Similarly, information on flood risk is included; obtained from the Environment Agency Web site and the GroundSure report; but this is not intended to be a full hydrological study and, if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development. Also, whilst our field staff have undergone asbestos awareness training, Applied Geology does not undertake asbestos surveys or provide specific advice relating to asbestos-containing materials. Any suspected asbestos-containing materials observed by our field staff will be mentioned in the report but further assessment by others may be required.

Fieldwork

Fieldwork is generally carried out in accordance with BS5930 (2015) "Code of Practice for Site Investigations" and BS10175 (2011) Investigation of Potentially Contaminated Sites, unless otherwise stated.

Prior to commencement on site, statutory services plans are generally obtained and verbal enquiries are also made regarding the positions of private or statutory services on site. Prior to excavation or drilling, locations are scanned with a cable avoidance tool (CAT) and service pits are generally excavated at borehole positions, where possible.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in the report appendices, together with sample depths, the results of in-situ testing, comments on groundwater inflows, and any other pertinent information. The strata descriptions are in general accordance with BS5930:2015. Disturbed plastic pot and glass amber jar samples are recovered from the various strata and stored and transported in cool boxes, where relevant, for possible future laboratory testing.

Light cable percussion boreholes are generally drilled using a Pilcon Wayfarer or Dando rig and are advanced using equipment to bore 200/150mm diameter boreholes. Disturbed plastic pot samples are recovered from all deposits encountered to allow examination and laboratory testing. Certain strata are cased off due to their tendency to collapse, particularly in the presence of groundwater inflows and/or to reduce the risk of cross contamination. In situ Standard Penetration Tests, using Split Spoon (SPT) and Cone (CPT) are undertaken in the boreholes to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Within the fine grained (cohesive) deposits, "undisturbed" 100mm driven open tube samples were recovered from the various deposits to provide samples for examination and laboratory testing. On encountering groundwater, boring is usually suspended for 20 minutes while any rise in water level is recorded. Full details of the groundwater observations and monitoring results during boring operations are included on the borehole records. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion, unless otherwise stated on the individual logs.

Unless otherwise stated on the relevant logs, trial pits are excavated using a wheeled backhoe excavator, usually with a 0.6m wide bucket. The excavations are logged from the ground surface by an Engineering Geologist / Geo-environmental Engineer and relevant field testing, appropriate to the soils encountered, is carried out on samples brought to the surface. Representative disturbed soil

samples are collected from selected horizons for subsequent laboratory testing. The trial pits are usually unshored and where reasonable, left open for a period of time to allow observations of pit stability and depth and inflow rate of any groundwater ingress. The excavations are backfilled with arisings prior to moving on to the next position. Any trial pits carried out as part of this or previous investigations may represent soft spots and conduits/sumps for groundwater or surface water. In excavations, such materials may also be loose and unstable.

Driven Continuous Sampling (DCS) boreholes are drilled using a track mounted Global mini-rig or similar using sampling tubes of varying diameter (decreasing with depth). Samples of the deposits encountered are recovered in 1m long clear plastic liners, which are logged and sub-sampled on site by an Engineering Geologist. Generally for geotechnical investigations, during the drilling process in-situ Standard Penetration Tests (SPTs) are undertaken at selected depths to provide a measure of the relative density of the granular (coarse grained) deposits or shear strength of the clay/chalk/ weathered rock deposits using industry recognised correlation guidelines of shear strength against SPT "N" value results. Groundwater seepages are noted during drilling if encountered. All boreholes without monitoring wells installed are usually backfilled with arisings upon completion.

Unless specifically stated in the report, exploratory hole locations should be regarded as approximate. Consideration should be given to accurate location of the exploratory holes where it is considered they may impact on proposed development.

It should be noted that groundwater levels at any particular site may fluctuate due to rainfall, seasonal variations etc and, therefore, levels may be different to those measured during the course of the fieldwork and monitoring period.

Laboratory Testing

The geotechnical testing was carried out in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and was undertaken by a UKAS accredited specialist laboratory. Chemical testing was undertaken by a UKAS accredited specialist chemical testing laboratory and MCERTS accredited methods, in accordance with Environment Agency recommendations, were specified where available.

Contamination Assessment – Human Health

Applied Geology Limited has followed the guidance given in the CLR 11 publication and other available guidance to assess the contaminant concentrations. Details of the methodology followed are briefly outlined below.

The available chemical data is sorted into appropriate datasets depending on sampling regime and ground conditions. An initial generic quantitative risk assessment is undertaken on this data using statistical tests, where appropriate, and relevant screening values. Risk to human health has been initially assessed by comparing soil results against various published screening criteria. These have been sourced from the following, in order of preference:

- DEFRA. Category 4 Screening Levels (C4SL), March 2014;
- LQM/CIEH S4UL for Human Health Risk Assessment (S4UL), 2015*;
- Environment Agency/DEFRA, Soil Guideline Values (SGV) published in 2009;
- EIC/AGS/CL:AIRE Soil Generic Assessment Criteria (GAC), 2010.

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Except for lead and benzo(a)pyrene, the assessments will be carried out by comparing results against the LQM/CIEH S4UL in the first instance, where these values are exceeded, then reference will be made to the C4SLs where such exist. Lead will only be compared to the C4SL because no S4UL exists for lead. For Benzo(a)pyrene, Applied Geology has chosen to adopt the approach presented by the C4SL committee rather than the approach proposed by LQM/CIEH. Further discussion on this is presented below.

It is our view, and the view of others in the industry, that the C4SL were derived for use in both the Part IIA system and through the planning system, as they allow identification of those sites that fall within Category 4 (not contaminated) and are therefore able to be developed with no further remedial action. The C4SLs are considered to represent a contamination level that is 'low' from a toxicological view point, which we therefore consider to be 'acceptable' under planning.

Historically, the level of contamination has been assessed with reference to SGV values which were derived to represent a 'minimal' level of contamination. The SGVs are still valid and can be used alongside C4SL, however both screening values are only intended to provide guidance as to the level of contamination and, where concentrations fall below these screening values, the site is not contaminated (and is within Category 4). Exceedance of a SGV/S4UL/C4SL does not automatically indicate that an 'unacceptable' risk exists at a site; simply that further consideration of that particular contaminant is required.

At this time, there are two toxicological methodologies that can be used in the derivation of screening criteria for PAHs; Relative Potency Factor (RPFs) or the Surrogate Marker approach. Applied Geology has chosen (based on the latest guidance from the Health Protection Agency (HPA) to use the surrogate marker approach proposed in the C4SL methodology, whereby benzo(a)pyrene can be used as a surrogate marker for all 'genotoxic' (gene damaging) PAHs. The surrogate marker approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using data from toxicity studies in which a PAH mixture of known composition was tested. Exposure to the surrogate marker benzo(a)pyrene is assumed to represent exposure to all the PAHs in the environmental matrix. Thus, the level of toxicity ascribed to the surrogate represents the toxicity of the PAH mixture. This allows an assessment of the combined carcinogenic risk associated with genotoxic PAHs using only benzo(a)pyrene. In order to confirm that the mixture of genotoxic PAH in the soil is similar to the coal tar mixture used in the toxicological study, various PAH ratios are plotted and checked to see that they fall within the limits set in HPA, 2010.

Contamination Assessment – Water Quality

Risks to water quality has been assessed by following the Environment Agency guidance on groundwater protection (previously known as GP3), updated on their website in March 2017, see <https://www.gov.uk/government/policies/water-quality> and 'The Environment Agency's approach to groundwater protection' (March 2017 Version 1.0).

For hazardous substances, which should be prevented from entering groundwater, the screening criteria are initially set as the limit of detection, however, if groundwater has already been impacted, an appropriate environmental standard will then be used. For hazardous substances, background quality may also be taken into account.

For non-hazardous compounds, their release should not result in any pollution or significant risk of pollution in the future, as such comparison with UK DWS or EQS standards will allow determination of whether pollution could occur. Typically screening criteria will be sourced from the following:

- Environmental Standards (ES), which are defined in European legislation such as the Water Framework Directive (WFD) (2000/60/EC) and the Priority Substances Directive (PSD) (2008/105/EC) a daughter directive of the WFD.
- The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction, 2010.
- UK Water Supply (Water Quality) Regulations, 2010.
- UK quality standards for water to be used for direct abstraction to potable supply e.g. Surface Water (Abstraction for Drinking Water) (Classification) Regulations, 1996.
- World Health Organisation (WHO) Guidelines for Drinking Water Quality.

Re-use of Soils and Waste Soil Disposal

It is noted that if any excavated material is to be reused on site, a Waste Management Plan (WMP) and / or a Materials Management Plan (MMP) will probably be required. Any such materials must be suitable for re-use without further treatment, and only the quantity necessary for the specified works should be used. Any materials not within these definitions may need to be considered as waste whereby a Waste Management Licence Exemption may also be required.

A specific categorisation and assessment of potential waste soils arising from the proposed development has not been undertaken as part of the investigation, unless otherwise detailed in the report text. However, generic comments and advice are made below for the reader.

All waste soils should be sorted to prevent mixtures of waste types. Where possible, any waste soil should be recycled and the volume of soil to be disposed of should be minimised. Any excavated soil material and excess spoil disposed of off-site should be treated as Waste and classified as Inert, Non-hazardous or Hazardous, prior to removal from site, as required by the "Duty of Care" (Environmental Protection Act, 1990) legislation together with Annex II of Directive 1999/31/EC ("Landfill Directive"). Initially, Basic Characterisation of the waste is required whereby the material should be described and its source of origin recorded (a site plan, exploratory hole records and the certificates of chemical analysis in this report should be included). This should also include data on its composition and leaching behaviour, its European Waste Catalogue (EWC) code, and where relevant any hazardous properties according to Annex III of Directive 91/689/EEC. This information should be provided to the licensed waste contractor.

Soils excavated on many sites would generally fall under the EWC description "Soil and Stones", EWC code 17 05 04. Waste Acceptance Criteria (WAC) testing is required for many Inert wastes and generally for all Hazardous Waste but not for non-hazardous waste. There are certain restrictions for inert wastes regarding topsoil and peat. Any asbestos must be disposed of by suitably licensed contractors to a suitably licensed facility.

Health & Safety Aspects

As outlined within the HSE publication 'Successful Health and Safety Management - HSG65', this report should inform your development of safe systems of work and information as an input into the safety management system.

When developing risk control systems we suggest making reference to the CIRIA report 132 "A guide for safe working on contaminated sites" and the HSE document "Protection of workers and the general public during the development of contaminated land – HSG66". All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.

The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations.

Where excavations are undertaken on site, trench support or the angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions. Care should be taken when digging excavations to prevent undermining or causing loss of support to the foundations of the nearby adjoining structures. Surcharging such as from spoil or vehicle movements close to excavation sides should be avoided. Practical guidance on trench excavation is given in CIRIA Report 97 Trenching Practice. Guidance on groundwater control is given in CIRIA Report 113 Control of groundwater for temporary works. Temporary works should be designed by a suitably qualified engineer or a competent person particularly where personnel access is necessary, in accordance with the requirements of the Construction (Design and Management) (CDM) Regulations.