

PHASE 1 DESK STUDY AND PHASE 2 SITE INVESTIGATION REPORT

Site

**CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT DA12 4LG**

Client

WILLMOTT DIXON CONSTRUCTION LTD

Report Ref

25/13244/KJC REV 1

Issued

NOVEMBER 2025

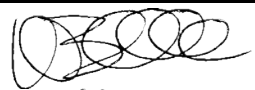
ALBURY S.I. LTD

Geotechnical & Environmental Specialists

Miltons Yard,
Petworth Road,
Witley,
Surrey GU8 5LH

01428 684 836
info@alburysi.co.uk
www.alburysi.co.uk



DOCUMENT CONTROL				
Report Title	Phase 1 Desk Study and Phase 2 Site Investigation Report			
Contract	Thong Lane, Gravesend			
Client	Willmott Dixon Construction Ltd			
Report Reference	25/13244/KJC REV 1			
Prepared by	K J Clark BSc Hons Director			
Approved by	G C D Owens BSc MSc FGS MEnvSc Director			
DOCUMENT HISTORY				
Revision	Status	Date	Issued by	Revision Detail
0	Final	21/11/2025		
1	Final	01/12/2025		Revised plan added

Albury S.I. Limited has prepared this Report with reasonable skill and care for the sole use of the Client in accordance with the terms and conditions of the contract under which our services were provided. No duty of care and no contractual obligation (whether expressed or implied) is owed to any third party. Should any third party rely on this Report then they do so at their own risk and Albury S.I. Limited shall have no liability whether in contract or in tort, in negligence, for breach of statutory duty or otherwise to any such party. No warranty, expressed or implied, is made as to the professional advice included in this Report or any services provided by Albury S.I. Limited.

The following foreword should be read in conjunction with this report. Any variations on the general procedures outlined below are indicated in the text.

FOREWORD

The recommendations made and opinions expressed in this Report are based on the strata conditions revealed by the fieldworks as indicated on the exploratory records, together with an assessment of the data from in situ and laboratory tests. No liability can be accepted for conditions which have not been revealed by the fieldworks, for example, between exploratory positions. While this Report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. The data obtained relate to the conditions which are relevant at the time of the investigation.

The groundwater observations entered on exploratory records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. It should be noted that groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the exploratory hole upon completion.

It should be appreciated that this report does not constitute a Geotechnical Design Report (GDR) as defined in Eurocode 7 and no aspect of this report constitutes a design. Specific sections of this report are generally in line with the guidance set out in Eurocode 7 for a Ground Investigation Report (GIR), as defined within BS EN 1997:-2 (2024). This provides guidance on the number and spacing of investigation positions, methods of investigation and sample quality class to be achieved which may not have been met by this investigation.

This Report is prepared for the specific purpose stated and in relation to the development proposals or usage indicated to Albury S.I. Limited at the time of preparation. The recommendations should not be used for adjacent schemes and may not be appropriate for alternative proposals.

This Report is the Copyright of Albury S.I. Limited with whom the master copy resides. Further electronic copies can be obtained subject to the clients permission.

REPORT REF: 25/13244/KJC REV1
CONTRACT: THONG LANE, GRAVESEND

TABLE OF CONTENTS

DOCUMENT CONTROL
FOREWORD

1 INTRODUCTION..... 1

2 PHASE 1 DESK STUDY - THE SITE 2

3 SITE HISTORY 2

4 GEOLOGY 6

5 ENVIRONMENTAL SETTING 7

6 SITE RECONNAISSANCE 8

7 PRELIMINARY RISK ASSESSMENT..... 8

8 PHASE 2 INVESTIGATION - FIELDWORKS..... 10

9 GROUND CONDITIONS 11

10 LABORATORY TESTING 12

11 GROUND CONTAMINATION 12

REFERENCES
LIST OF ABBREVIATIONS

FIGURES

- 1 Site Layout Plan
- 2 Proposed Layout
- 3 Airfield Layout
- 4 Aerial View (1940)
- 5 Site Photographs

APPENDICES

- 1 Groundsure Data
- 2 UXO map
- 3 Exploratory Records
- 4 Laboratory Test Results
- 5 Waste
- 6 Ground Gas Monitoring Data

1 INTRODUCTION

1.1 Phase 1 - Objectives

The desk study comprises a review of the readily available geological, historical and environmental sources for information about the site, together with a walkover survey of the area. This includes the commissioning of an Enviro+Geo Insight report supplied by Groundsure Ltd. This report presents the findings of the Desk Study together with an outline Conceptual Site Model and preliminary risk assessment, based upon identified potential sources of contamination which may pose a significant risk to receptors or end-users of the site.

In preparing this report reference has been made to relevant guidance, which includes the 'Investigation of potentially contaminated sites. Code of Practice.' (BSI, 2011) and the Land Contamination: risk management (LCRM) guidance (2020).

1.2 Proposed Development

It is understood that it is proposed to demolish the existing Cascades Leisure Centre and develop a new build leisure centre on "the site". The existing site layout is included as Figure 1 and the proposed layout is shown in Figure 2.

Consequently, following the desk study review a site investigation has been undertaken in order to ascertain the nature of the soils underlying the proposed development site and complete a geo-environmental appraisal of the site. At the time of the works, the site was operational and the existing buildings were still present.

1.3 Scope of Phase 2 Investigation

The programme of this investigation initially comprised the completion of a desk study, which includes an Enviro+Geo Insight by Groundsure Ltd. The subsequent intrusive investigation included the construction of thirty one boreholes using hand-held window sampling techniques. During this work samples were recovered for further examination and geochemical testing. Upon completion of six of the boreholes, standpipes were installed to facilitate long-term ground gas monitoring. This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to the long-term risk from potential land contamination and ground gases.

2 PHASE 1 DESK STUDY - THE SITE

2.1 Site Location

The site covers an area of approximately 3.8ha and is located at Ordnance Survey National grid reference 567033, 171710. The site comprises the Cascades Leisure. A residential area is present to the west of Thong Lane. An area of car parking, a miniature railway and a golf centre lie to the north of the site area. Legend Sports and Riverview Football Club comprising two large domed buildings and a rectangular single storey building are present to the east and a golf course is present to the south east of the site.

2.2 Site Topography

The recent OS mapping indicates that levels within Thong Lane rise from 65.0mAOD in the west to 69.5mAOD in the south.

3 SITE HISTORY

3.1 Historical Mapping

The historical Ordnance Survey mapping contained within the Groundsure report has been reviewed. The maps reviewed are included in Appendix 1.

Table 1 - Historical Mapping Summary			
Date	Source Scale	Relevant Information	
		On Site	Off Site
1864 1865	1:2500 1:10560	The site forms part of a large area of open land. Stone noted in the far north west corner.	Thong Road is present on the western site boundary.
1888	1:10560	No significant change.	West Wood Farm now present to the west of Thong Road. Old chalk pits are recorded 350m and just over 500m south.
1895	1:2500 1:10560	No significant change.	No significant change.
1909 1907	1:2500 1:10560	No significant change.	Old chalk pits no longer referenced as such.
1933 1932	1:2500 1:10560	No significant change.	Thong Road now Thong Lane.

1936	1:2500	No significant change.	Westwood Cottages now noted to the west.
1938	1:10560	No significant change.	No significant change.
1946	1:10560	A track now traverses the site area.	Buildings now present to the west of the site replacing West Wood Farm.
1955	1:10560	No change.	A factory is now present to the west.
1962/ 1964	1:2500	A number of building are now present on the western boundary. Ruins are noted in the north east and south west.	Airfield (Disused) present to the east of the site. Houses now present to the west and south west of Thong Lane.
1970	1:2500	Site is now part of a sports ground.	More house now present to the west of Thong Lane.
1980- 1982	1:2500 1:10000	Thong Lane Sports Centre now present on site.	No significant change.
1990	1:2500	The former Thong Lane Sports centre has been extended to form Cascades Leisure Centre. Electricity substation now present on site.	No change.
2003 2001	1:1250 1:10000	No change.	No change. Golf Centre now present to the north west. Golf course present to the east and south east.
2022	1:10000	No change.	Golf centre and golf course no longer recorded.

An examination of the layout of RAF Gravesend during WWII indicates that the perimeter taxiway traversed the development site. An anti-aircraft gun was also sited to the north east, and a broadcasting house and workshops were present on the western boundary. These three features are noted on the site plan in Figure 1.

3.2 Aerial Imagery

Consideration of the modern aerial imagery contained within Google Earth has been made and is included in the table below.

Table 2 - Modern Aerials Summary		
Date	Relevant Information	
	On Site	Off Site
1940	It is apparent that a concrete taxi way associated with an airfield traverses the site with a number of spurs off the main route to the north.	Number of aircraft are present on the area to the west of Thong Lane.
1960	The airfield appears disused.	Housing now present to the west of Thong Lane.
1990	The site is now developed by a sports centre.	Further houses now present to the west of Thong Lane.

An aerial view of the airfield forms part of an exhibition at Cascades Leisure Centre, provided by the Airfields of Britain Conservation Trust, gives further information and an extract forms Figure 3. An extract of the 1940 aerial view from Google Earth is included as Figure 4. Both images confirm that a perimeter taxiway traversed the site with a number of off shoots. The airfield had two grass runways, one to the west and the second to the south and south east of the site.

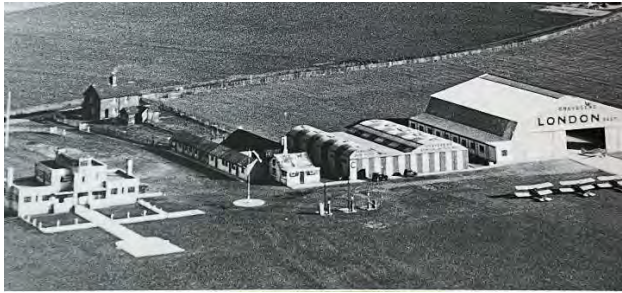
3.3 Internet & Planning Database Review

A review of the historical planning records stored on the Gravesham Borough Council Planning website has been carried out. A number of entries have been found, none of which relate to any significant development of the site.

3.4 UXO Risk

The website operated by Zetica has been accessed and an Unexploded Bomb Risk Map has been obtained for the site, which is included as Appendix 2. The report records a UXO find to the north of the site and shows that the site is in a high risk area, as the site was part of RAF Gravesend during WWII. The Airfields of Britain Conservation Trust website indicates that the area was first used as a landing field in 1932.

The exhibition at the Leisure Centre also indicates that Gravesend School of Flying operated from the airfield prior to WWII. Images are presented below.



In 1940 the first fighter squadron arrived and the airfield is noted to have managed to avoid significant damage from attacks by the Luftwaffe. It is unlikely that any unexploded bomb strikes would have gone unnoticed and undealt with at the time. It is assumed that any such incidents would have been dealt with in order to keep the airfield operational.

In addition, the site was developed post WWII by a sports centre, latterly the Cascades Leisure Centre. It would be safe to assume that any unexploded ordnance within the footprint of the sports/leisure centre is likely to have been encountered during the development. It is considered, therefore, that the actual risk of the presence of unexploded ordnance is thought to be low.

Nevertheless, a detailed UXO risk assessment should be undertaken by a specialist company. Typically, unwanted and unused ordnance would be disposed on airfield sites in burn/burial pits. Given that the majority of the site has been subject to redevelopment for the existing Leisure Centre, the risk of buried UXO being present is significantly reduce

Airfield runways were also mined with 'Canadian Pipelines' to deny the runway to invading military. These were 50-70mm diameter steel pipes laid at 6ft in a criss cross pattern.

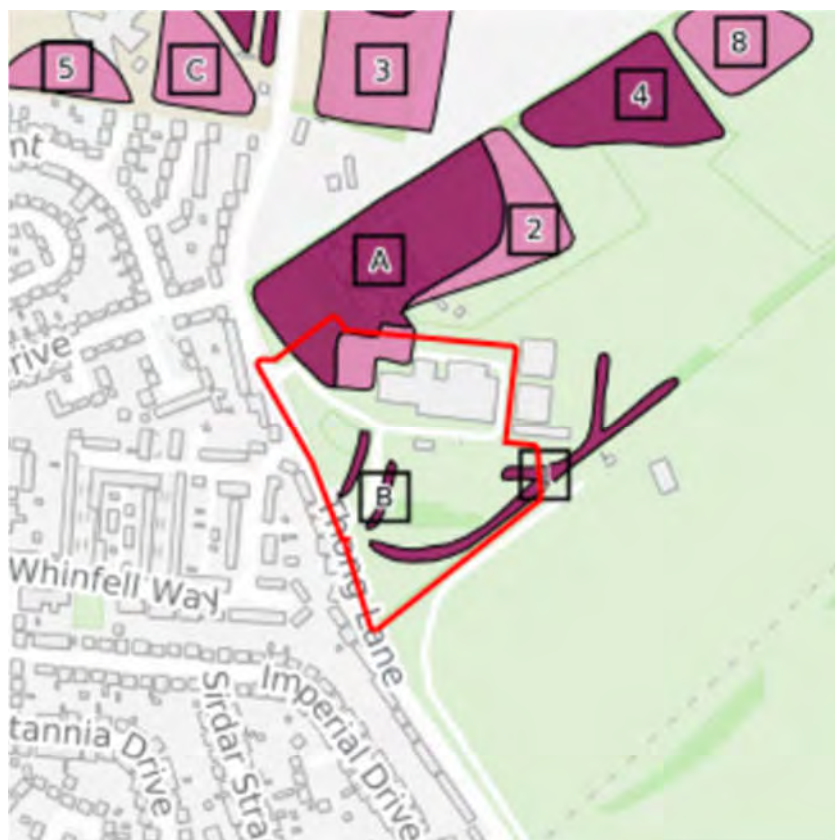
4 GEOLOGY

4.1 Published Geology

An examination of the 1:50,000 British Geological Survey (BGS) digital mapping and the data contained within the Enviro+Geo Insight report indicates that the majority of the site is underlain by the Seaford Chalk Formation. The Thanet Sand Formation, which overlies the Seaford Chalk, outcrops in the southern tip of the site.

The Enviro+Geo Insight report also indicates that made or worked ground is present in the northern corner of the site.

The 1:10,000 scale mapping indicates further areas of made ground and an extract is provided below:



4.2 Historical Borehole Records

The records of the BGS have been reviewed and a number of entries have been found to the west of the site. The records note made ground of variable thickness overlying cohesive soils probably associated with an unmapped outcrop of Head or Downwash, which in turn overlie

the Seaford Chalk Formation. No groundwater data was noted. The maximum depth was 5.00m. Remarks include that the investigatory locations are in a BDA category RED site.

4.3 Hydrogeology

The site is underlain by a Principal aquifer of high vulnerability appertaining to the Seaford Chalk Formation. The Thanet Sand Formation is a Secondary A aquifer. The site is not underlain by a drinking water Source Protection Zone [SPZ]. There are no groundwater abstraction points within 1700m of the site.

4.4 Radon

The Enviro+Geo Insight report indicates that the majority of the site is an area where between 1% and 3% of properties are above the action level. Nevertheless, Radon protection measures are not necessary in the construction of the proposed structure.

5 ENVIRONMENTAL SETTING

5.1 Hydrology & Flood Risk

There are no surface water features within 500m of the site. However, there is some limited potential for flooding from surface waters in the south of the site. The site is at negligible risk from groundwater flooding.

5.2 Landfill Data

There are no active or inactive registered landfill sites listed in the Enviro+Geo Insight report within 500m of the site. However, the records from boreholes constructed to the south east of the site suggest that made ground is present in this area up to 1.80m in thickness. Harts Hill Chalk Pit is also recorded 340m south east of the site.

5.3 Recent & Current Land Use

The site has historically been used as a sports facility and prior to that was an airfield (1932-1956). No other relevant trade directory information is available for the site or immediate area. An electrical substation is present on site immediately to the north of the leisure centre. An obsolete fuel station is noted 357m south west of the site.

5.4 Ecologically Sensitive Receptors

There are no sensitive environmental or ecological receptors highlighted within the Enviro+Geo Insight within 500m of the site.

6 SITE RECONNAISSANCE

A visit to site was made on 13th October 2025 using the procedures outlined in CLR 2. At the time of the survey the conditions were dry with low sun and some cloud.

The existing leisure centre occupies the north and north east of the site area. Two tennis courts and an area with macadam surfacing is present to the west of the centre. Car parks are present in the north west of the site and to the south of the centre. An access road to the centre is present at the north east corner, which follows a one way system to cross to the south of the centre, accessing the southern parking area. A bus stop and shelter are noted within the eastern part of the site. A children's play area is noted in the west of the site within soft landscaping. Two other grassed areas are present in the east and south of the site. An electrical sub-station was present in the north of the site to the rear of the centre.

No obvious potential sources of contamination were noted externally during the walkover survey. It is understood that the heating system for the centre is gas fired. The leisure centre includes a number of pools which are heated. It is assumed that water is also treated to maintain a safe environment for swimming and that the necessary chemicals are stored in a suitable manner.

During the visit a number of photographs were taken, which include close ups of areas of concern. An index to the photographs taken and the photographs are presented in Figure 5 drawing no's 25/13244/5 to 25/13244/9 attached to this report.

7 PRELIMINARY RISK ASSESSMENT

7.1 Conceptual Site Model

In accordance with current LCRM guidance, a Conceptual Site Model has been prepared for this site. The model prepared for the site in tabular format below lists potential sources of contamination, identified receptors on and within the immediate vicinity of the site, together with the pathways between them. A pathway must exist for an identified source to pose a risk to a receptor, thereby forming an active pollutant linkage. The primary receptors are considered to be future residents (human health), surrounding ecology (plants and animals),

controlled waters and proposed buildings. Reference has also been made to the DoE industry profile for Airports.

A qualitative assessment of the risk of each potential pollutant linkage is given based upon the CIRIA guidance document 'Contaminated Land Risk Assessment: A Guide to Good Practice' (Rudland, Lancefield and Mayell, 2001). The risk is a combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

Table 3 – Preliminary Conceptual Site Model

Source(s)	Potential Pathway(s)	Receptor(s)	Risk Level
Asbestos and ACM within existing building fabric	Inhalation	Site workers and end-users	Low - it is recommended that an asbestos survey is completed prior to demolition of the existing structures. Any ACM should be removed prior to demolition
Vehicular activity past and present - <i>Hydrocarbons, Heavy Metals</i>	Migration, ingestion, inhalation and dermal contact	Site workers and end-users	Low
Former Airfield Workshop & Broadcasting House - made ground associated with demolition of structures - <i>PAH, Hydrocarbons, Heavy Metals</i> Cleaners/Degreasers (TCE/PCE)	Migration, ingestion, inhalation and dermal contact	Site workers and end-users	Low to moderate
	Leaching	Principal Aquifer and SP2	Low
Pool chemicals (pH extremes)	Migration, ingestion, inhalation and dermal contact	Site workers and end-users	Low to moderate - chemicals are stored in secure bunded areas on a concrete base. Risk is mitigated by use of appropriate PPE
	Leaching	Principal Aquifer	Very low
Ground gas (possible infilled area to the south east) - <i>ground gas</i> Made Ground (on site)	Migration, ingress and accumulation	Proposed buildings (asphyxiation or explosion)	Low to moderate

Electrical substation - PCB's	Migration, ingestion, inhalation and dermal contact	Site workers and end-users	Very low - the substation appears on the 1990 OS map and it is considered that PCB's would not have been used
UXO	Explosion	Site workers, SI personnel and end- users	To be assessed by specialised UXO risk assessment

It is known that aircraft instrument panels can contain low levels of radioactive materials and if waste materials were buried on site, then radium would also be a potential contaminant of concern.

7.2 Groundwater

The anticipated groundwater profile is thought to be in excess of 20m below ground level. Hence, the proposed redevelopment is unlikely pose a threat.

7.3 Geotechnical Hazards

The majority of the northern part of the site is indicated as being within an area at very low risk of ground dissolution features. However, the southern part of the site is in areas of moderate risk. No natural cavities are recorded within 500m of the site.

7.4 Further Investigation

It would be prudent to carry out an intrusive investigation to prove the underlying natural strata and absence of any made ground and confirm that the near surface soils are suitable for their intended setting. This should target historical features such as former structures, AA gun site and workshops, as well as areas of made ground highlighted on geological mapping.

The proposed scope of testing should include for contaminants identified within the CSM, which includes heavy metals and hydrocarbons. It would also be advisable to complete ground gas monitoring in view of the possible presence of made ground on site and to the south east of the site.

8 PHASE 2 INVESTIGATION - FIELDWORKS

8.1 Site Works

The boreholes were constructed during the period 13th to 15th October, 2025, at locations as shown on the site plan, which is presented as Figure 1. The exploratory positions were located

in order to provide adequate site coverage and to target the areas where former structures were present.

The depths and descriptions of the strata encountered in the boreholes are given on the exploratory records, which comprise Appendix 3 to this report. These records note the depths at which samples were taken and any groundwater observations noted at the time of the fieldworks.

8.2 Installations

Upon completion of six of the boreholes 15, 17, 18, 25, 26 and 27, standpipes or monitoring wells were installed in order to carry out long-term ground gas monitoring. These comprised of 1.00m plain pipe extended to depths of between 2.50m and 3.10m by geowrapped slotted pipe. Each instrument was provided with a flush metal cover and gas valve.

9 GROUND CONDITIONS

9.1 Stratigraphy

Consideration of the borehole records indicates that made ground varying from macadam overlying brown silty sand with flint gravel to brown/grey very sandy clay with chalk fragments was observed at the investigatory locations and was shown to extend to the concluding depth of borehole 2 (possible presence of services) and borehole 13 due to (obstruction) at 0.75m and 0.40m, and to depths of between 0.20m and 1.20m.

Soils ranging from brown very sandy clay to pale brown silty sand with chalk fragments and flint gravel were observed upon penetration of the made ground in boreholes 1, 3, 7, 9, 10, 14 to 17, 19 to 29 and 31. The geological origin of these soils is unclear. However, it is suggested that they represent unmapped outcrops of locally derived Downwash of Recent age. Boreholes 7, 14, 21 and 28 were concluded with the Downwash at between 1.30m and 1.60m.

Cream-white chalk with rare flints and brown staining was encountered upon penetration of the made ground and Downwash and was proved to the full depth of this investigation at between 1.20m and 3.10m.

No visual or olfactory evidence of contamination was noted during the siteworks with the exception of borehole 20, where a slight odour of hydrocarbons was observed from 0.40m to 0.70m. This location is within a car park. Hence, the slight odour may be associated with leakages from vehicles using this area.

9.2 Groundwater

No groundwater strikes were encountered during the construction of the exploratory positions and all the excavations remained dry throughout.

9.3 Monitoring

Return visits were made on 5th and 17th November 2025 to monitor the standpipes installed as part of the intrusive investigation. The results of the monitoring are included in Appendix 6 and discussed in section 11.5. The instruments were all noted to be dry on each of the visits.

10 LABORATORY TESTING

A sample of the made ground from each of the investigatory locations has been submitted to the UKAS accredited laboratories operated by i2 Analytical Ltd. The testing comprises a suite of typical inorganic and organic priority contaminants including metals, PAH, TPH CWG and an asbestos screen. Three samples from boreholes 11, 13 and 14 at 0.10m depth have also been analysed for VOC's/SVOC's. The results are presented in Appendix 4. Due to positive identification of asbestos screens, quantification analysis was automatically performed on five samples.

11 GROUND CONTAMINATION

11.1 Human Health

A preliminary assessment of the chronic or long-term risk to human health from soil contamination has been made using the available generic screening criteria. The screening values include the Category 4 Screening Levels [C4SLs] (DEFRA, 2014) and Suitable for Use Levels [S4ULs] (LQM/CIEH, 2014) derived using the CLEA software. It should be appreciated that these do not consider the short-term or acute risks, such as to construction workers or SI personnel.

The results obtained have been compared against the GAC for the continued end-use assessment category Public Open Space near Residential Housing and 1% SOM. A study of the data reveals that the majority of the results lie below the GAC, with the exception of elevated concentrations of PAH compounds at the location of boreholes 1 and 4 to 7. Specifically the level of benzo(b)fluoranthene, benzo(a)pyrene and dibenz(a,h)anthracene recorded lie above the S4SL GAC levels of 7.1mg/kg, 5.7mg/kg and 0.57mg/kg. An appraisal of the double ratio

PAH plot infers that these are generally coal or coal tar derived, as opposed to being from a petroleum hydrocarbon source. No significantly elevated levels of VOC's or SVOC's were recorded.

Traces of chrysotile asbestos (loose fibres) at the location of boreholes 4 to 7, at between 0.20m and 0.30m were detected. Asbestos cement (chrysotile) was also noted at 0.10m in borehole 11. Quantification analysis was completed on all the above samples. 0.002% was recorded on the sample from BH4 with <0.001% noted for the samples from BH5 to BH 7. A result of 0.194% was recorded on the sample from borehole 11 at 0.10m, in the form of asbestos cement containing chrysotile.

Due to the fact that these are free fibres and owing to the granular matrix of the made ground, there is still a medium risk to site workers, particularly those forming excavations. Hence appropriate PPE and RPE should be worn by operatives, with manual/localised dust suppression measures employed unless works are undertaken during wet or raining periods. Further information can be found in the recent publication (CL:AIRE, 2016) "Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance".

Whilst the concentrations of zinc are not a risk to human health the result of 1400mg/kg was noted at 0.10m depth in borehole 25, which would be phytotoxic.

In view of the results recorded it is apparent that some localised remedial measures will be required as part of the proposed redevelopment. It should be noted that no investigation has been completed within the existing Leisure Centre. BH's 1, 4, to 7 will be areas of proposed hard cover ie car parking areas which will act to encapsulate. It is considered that in order to accommodate the new pavement construction some 0.50m of material will be removed, which will result in the removal of the asbestos and PAH contaminated soils. Moreover, no pathway will exist between the site receptors and any residual PAH's and asbestos, once the new paving has been implemented.

BH11 is located within the area of the former Broadcasting House. It is understood that the proposed new play area is no longer being considered and that the area will remain as public open space.

It should be noted that an area of soft landscaping is proposed between BH5 and BH6 and to the north of BH7. Further investigation of these areas could be undertaken to delineate the areas and depths of soil requiring remediation. Alternatively, the soils could be removed to a depth of 0.60m and replaced with clean material. A Remediation Method Statement will be required for the remediation of the above area.

11.2 Discovery Strategy

Given areas of the site are covered by existing structures or car parking any visual evidence of historical contamination can be concealed beneath these surfaces. Thus, it would be advisable that the site manager maintain a discovery strategy or watching brief during the lifting of hardstanding. Should any potential sources of contamination be identified following the enabling works, they should be fully investigated by a competent person to ensure that the correct remedial measures are employed if considered necessary.

The watching brief would comprise the regular inspection of all excavations. If any materials suspected of containing contamination, such as oily material or soils of unusual colouration or odour are identified, then the following procedures should be adopted.

- Work to cease in that area.
- Notify the geoenvironmental engineer to attend site and carry out sampling and testing of suspected contaminated material, which should be segregated and stockpiled within a bunded area and covered to prevent rainfall infiltrating.
- Notify the Local Authority Contaminated Land Officer, where appropriate, or if amendments to the remediation plan area are necessary.
- Soil sampling of excavated area from bases and sides to demonstrate the area of contamination has been excavated.
- Photographic evidence of all stages of the development, particularly of any excavations, should be routinely kept and retained. Detailed records of any stockpiled material, its size and location, together with any duty of care transfer notes. Where necessary, this information should be incorporated within the final validation report.

11.3 Groundwater

The groundwater table is known to be at depth. Hence, the groundwater is not at risk from the observed levels of PAH compounds, which are of low mobility and semi-volatile.

11.4 Vegetation

The metals boron, copper, nickel and zinc are phytotoxic at certain levels, with their availability being dependent upon soil pH. These levels may not pose a significant long-term health risk to humans, but could be detrimental to plant growth or function. The results obtained suggest that problems in this regard are not anticipated with the exception of

isolated elevated level of copper of 420mg/kg and zinc of 1000 mg/kg at 0.25m in BH5. This location is within proposed car parking. Hence, these elevated levels will not be of concern. A value of 1400mg/kg for zinc was recorded at 0.10m in BH25. This issue would need to be considered for any proposed planting in this part of the site.

11.5 Preliminary Waste Assessment

It is likely that, if excavated soils cannot be re-used or retained on site, these surplus materials will require off-site disposal. It may be possible to divert the unwanted material to a soil treatment hub where it can be recycled. Where material cannot be re-used or recycled then disposal at a licensed landfill site can be considered. It will then be necessary to classify the spoil as inert, non-hazardous or hazardous. A discussion of the current regime for the classification and treatment of waste soils is included in Appendix 5.

An initial assessment of the geochemical results obtained from this investigation has been carried out to provide a preliminary classification of the surplus materials. The HazWaste Online tool determines whether waste soil should be classified as being non-hazardous or hazardous. The output from the HazWaste assessment is located in Appendix 5. Asbestos was detected in five of the samples screened. Based on the output waste soil arisings from this site at the majority of the investigatory locations have been tentatively identified as being non-hazardous waste. Two hazardous designations were recorded at borehole 6 relating to an elevated level of TPH and borehole 11 where the presence of asbestos is an issue. Moreover, the underlying natural Downwash and chalk are considered to be inert for disposal purposes.

This assessment is preliminary and based upon the information obtained from the investigation. Where made ground is excavated then these materials should be stockpiled and segregated. Further sampling, testing and characterisation to accurately classify waste soil arisings may be required. It should be appreciated that it is the responsibility of the waste producer to sufficiently characterise their waste. Moreover, the agreement of the waste acceptor should be sought.

11.6 Ground Gases

The desk study highlighted a limited potential risk posed by ground gas generation from made ground and historic ground working associated with the former use as an airfield. Consequently, six standpipes were installed across the site and a regime of ground gas monitoring is underway with two visits completed to date.

The monitoring data, which is included in Appendix 6, has not recorded any significant levels of ground gas. The first monitoring visit was during relatively low atmospheric pressure at around 1000mb. No flow has been recorded during the visits. It would be prudent to complete

a third visit. Once completed it is considered that the risk of ground gas will have been suitably investigated and that no special precautions are likely to be required as part of the proposed commercial redevelopment. It should be appreciated that current guidance states a minimum of six visits are required to adequately characterise a site and the agreement of the local Authority would be required.

The results have been reviewed in accordance with BS 8485 (2015) Code of Practice for the characterisation and remediation of ground gas in effected developments.

The hazardous gas flow rate has been determined based upon the worst case from these monitoring visits, which are a carbon dioxide of 2.4% and methane of 0.1% together with a flow of 0.0l/h (zero).

Q_{hg}	=	$(C_{hg}/100)q$
Q_{hg}	=	$(2.4/100) \times 0.0$
Q_{hg}	=	0.0l/h
where:		
Q_{hg}	=	calculated hazardous gas flow rate/gas screening value
C_{hg}	=	measured hazardous gas concentration
Q	=	measured flow rate

Based upon the calculated gas screening value of 0.0 litres/hour, the hazard potential of the site can be considered very low or characteristic gas situation 1. It would be advisable to complete a third visit during a period of low pressure. Thereafter, it should be possible to confirm that the ground gas situation has been suitably investigated and confirm that no remedial or specific protection measures will be required regarding ground gas.

REFERENCES

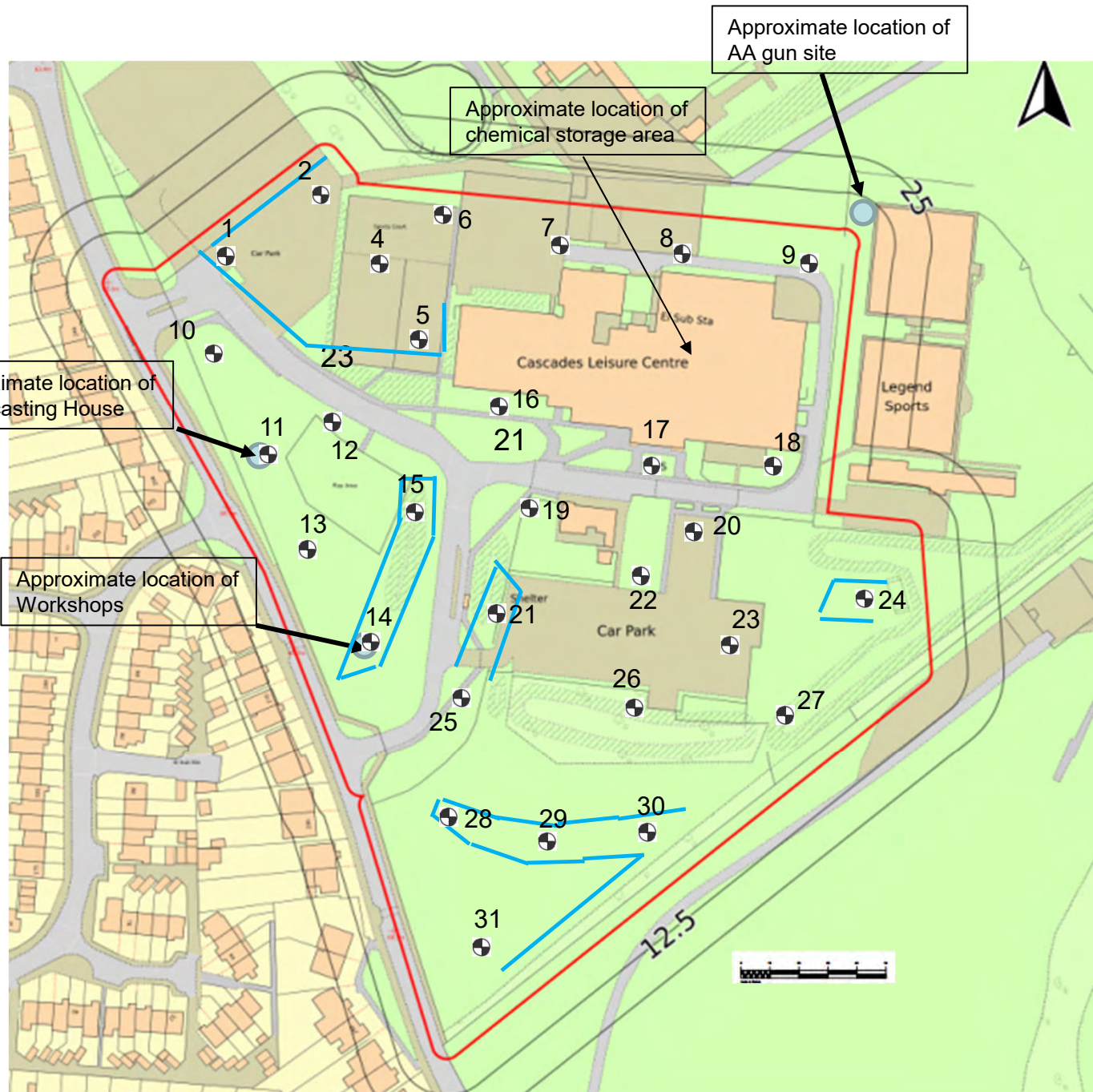
- British Standards (2016). Methods of test for soils for civil engineering purposes, BS 1377-1:2016. *British Standard Institution, London.*
- British Standards (2011). Investigation of potentially contaminated sites. Code of Practice. BS 10175+A2:2017. *British Standard Institution, London.*
- British Standards (2013). Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs). BS 8576. *British Standard Institution, London.*
- British Standards (2015). Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS 8485+A1:2019. *British Standard Institution, London.*
- British Standards (2015). Code of practice for ground investigations, BS 5930:2015. *British Standard Institution, London.*
- Building Research Establishment [BRE] (2004). *Cover systems for land regeneration: Thickness of cover systems for contaminated land (BR 465).* BRE Watford, UK.
- Building Research Establishment [BRE] (2005). *Concrete in aggressive ground: Special Digest 1* (3rd Ed.). BRE Watford, UK.
- Building Research Establishment [BRE] (2015). *Guidance on protective measures for new buildings. (BR 212).* BRE Watford, UK.
- Contaminated land: Applications in Real Environments. (2013). *SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Final Project Report.*
- Chartered Institute of Environmental Health and Contaminated Land: Applications in Real Environments (2008). *The Guidance on Comparing Soil Contamination Data with Critical Concentration.* London, UK.
- Environment Agency (2004). *Model Procedures for the Management of Contaminated Land.* Contaminated Land Report (CLR) 11, SC02000028, Environment Agency, Bristol, UK.
- Environment Agency (2015). Interpretation of the definition and classification of hazardous waste. 1st edition. Technical Guidance WM3. *Environment Agency, UK.*
- Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. (2015). *The LQM/CIEH S4ULs for Human Health Risk Assessment.* Land Quality Press, Nottingham. Publication Number S4UL3073.
- Stroud, M. A. (1974). The standard penetration test in insensitive clays and soft rocks. *Proceedings of the European Symposium on Penetration Testing, Stockholm, 2, 367-375.*

LIST OF ABBREVIATIONS

AOD	-	Above Ordnance Datum
ACM	-	Asbestos-containing Material
AST	-	Above-ground Storage Tank
BGS	-	British Geological Survey
BH	-	Borehole
BRE	-	Building Research Establishment
BSI	-	British Standards Institution
BS	-	British Standard
C4SL	-	Category Four Screening Level
CIRIA	-	Construction Industry Research and Information Association
CP	-	Cable Percussive
DPH	-	Dynamic Probing Heavy
DPSH	-	Dynamic Probing Super Heavy
EA	-	Environment Agency
GAC	-	Generic Assessment Criteria
LL	-	Liquid Limit
mAOD	-	Metres Above Ordnance Datum
mBGL	-	Metres Below Ground Level
mOD	-	Metres Ordnance Datum
OS	-	Ordnance Survey
PAH	-	Polycyclic Aromatic Hydrocarbons
PCB	-	Polychlorinated Biphenyl
PID	-	Photo Ionisation Detector
PL	-	Plastic Limit
PSD	-	Particle Size Distribution
SGV	-	Soil Guideline Value
SOM	-	Soil Organic Matter
SPT	-	Standard Penetration Test
SPZ	-	Source Protection Zone
SVOC	-	Semi-volatile Organic Compounds
TPH	-	Total Petroleum Hydrocarbon
UST	-	Underground Storage Tank
UXB	-	Unexploded Bombs
UXO	-	Unexploded Ordnance
VOC	-	Volatile Organic Compound

FIGURE 1

SITE LAYOUT PLAN



 Worked or made ground

Title: Site Layout Plan
 Dwg No: 25/13244/1
 Drawn by: KJC

Client: Willmott Dixon Construction Ltd
 Contract: Thong Lane, Gravesend

Job Ref: 25/13244/KJC
 Scale: NTS
 Revision: 1
 Issue Date: 21/11/2025

 **ALBURY S.I. LTD**

Miltons Yard, Petworth Rd,
 Witley, Surrey GU8 5LH
www.alburysiltd.co.uk

FIGURE 2

PROPOSED LAYOUT



- KEY LEGEND**
- Property Line
 - Site Area Total - 44528.83 m²
 - Parking spaces
 - Green/Vegetation spaces
 - Car access road
 - Pavement
 - Retaining Wall
 - Gravesend Airfield Memorial
 - Sub-Station
 - Bin Store
 - Gas
 - Car access only for Legend Sports users and Leisure Centre Service Road
 - Proposed Tree
 - Existing Tree
 - Tree to be replanted/demolished
- Car Park numbers**
- 203 car spaces
 - 15 disabled car spaces
 - 14 car spaces (services)
 - Total: 232 spaces**
 - 25 existing car spaces
 - 13 motorcycle spaces
 - 35 bike stands (15 covered ones)

FIGURE 3

AIRFIELD LAYOUT



Title: RAF Gravesend Airfield Layout

Dwg No: 25/13244/3

Client: Willmott Dixon Construction Ltd

Contract: Thong Lane, Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025



ALBURY S.I. LTD

Miltons Yard,
Petworth Road,
Witley,
Surrey GU8 5LH

FIGURE 4

AERIAL VIEW (1940)



Aerial view from Google earth c1940

Title: Aerial view (c1940)
 Dwg No: 25/13244/4
 Client: Willmott Dixon Construction Ltd
 Contract: Thong Lane, Gravesend
 Job Ref: 25/13244/KJC
 Scale: NTS
 Revision: 1
 Issue Date: 21/11/2025



ALBURY S.I. LTD

Miltons Yard,
 Petworth Road,
 Witley,
 Surrey GU8 5LH

FIGURE 5

SITE PHOTOGRAPHS



Car park in north west corner



Existing children's play area

Title: Site Photographs

Dwg No: 25/13244/5

Drawn by: KJC

Client: Willmott Dixon
Construction Ltd

Contract: Thong Lane,
Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025



ALBURY S.I. LTD

Miltons Yard, Petworth Rd,
Witley, Surrey GU8 5LH
www.alburysi.co.uk



WWII Memorial stone



Front of Leisure Centre



Disused Cafe

Title: Site Photographs

Dwg No: 25/13244/6

Drawn by: KJC

Client: Willmott Dixon
Construction Ltd

Contract: Thong Lane,
Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025

 **ALBURY S.I. LTD**

Miltons Yard, Petworth Rd,
Witley, Surrey GU8 5LH
www.alburysl.co.uk



North west corner



Rear of Leisure Centre

Title: Site Photographs

Dwg No: 25/13244/7

Drawn by: KJC

Client: Willmott Dixon
Construction Ltd

Contract: Thong Lane,
Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025



ALBURY S.I. LTD

Miltons Yard, Petworth Rd,
Witley, Surrey GU8 5LH
www.alburysi.co.uk



Play areas and tennis courts

Title: Site Photographs

Dwg No: 25/13244/8

Drawn by: KJC

Client: Willmott Dixon
Construction Ltd

Contract: Thong Lane,
Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025



ALBURY S.I. LTD

Miltons Yard, Petworth Rd,
Witley, Surrey GU8 5LH
www.alburysi.co.uk



Southern car park



Southern part of site

Title: Site Photographs

Dwg No: 25/13244/9

Drawn by: KJC

Client: Willmott Dixon
Construction Ltd

Contract: Thong Lane,
Gravesend

Job Ref: 25/13244/KJC

Scale: NTS

Revision: 1

Issue Date: 21/11/2025

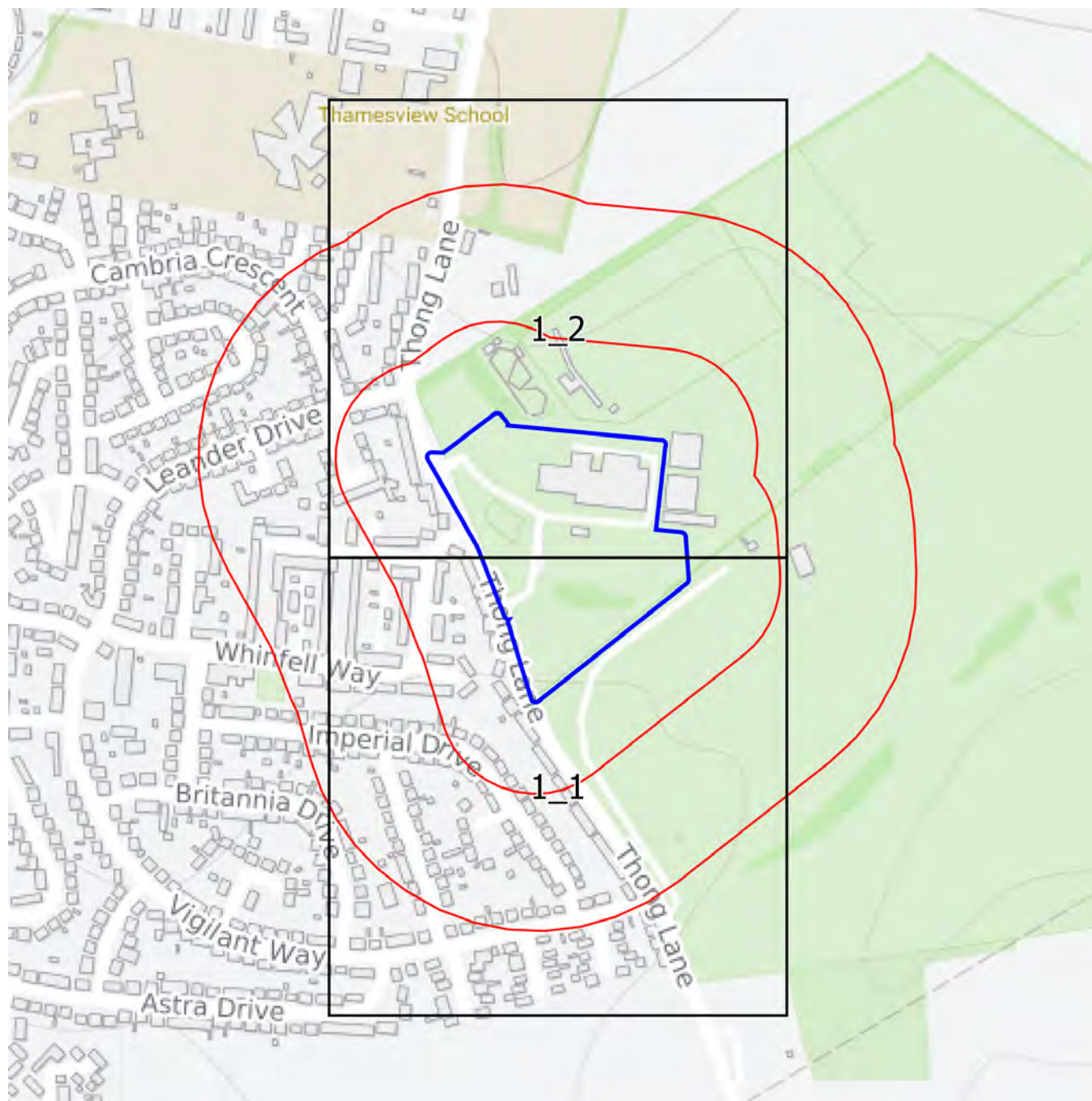


ALBURY S.I. LTD

Miltons Yard, Petworth Rd,
Witley, Surrey GU8 5LH
www.alburysi.co.uk

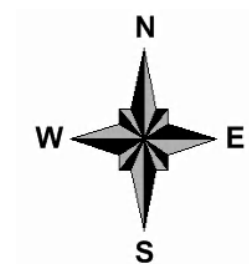
APPENDIX 1

GROUNDSURE DATA



Groundsure
INSIGHTS

1:1,250 Scale Grid Index



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_1
Grid Ref: 567023, 171413

Map Name: National Grid

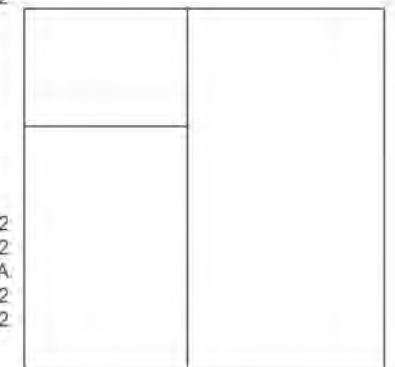
Map date: 1962

Scale: 1:1,250

Printed at: 1:2,000



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



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



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_1
Grid Ref: 567023, 171413

Map Name: National Grid

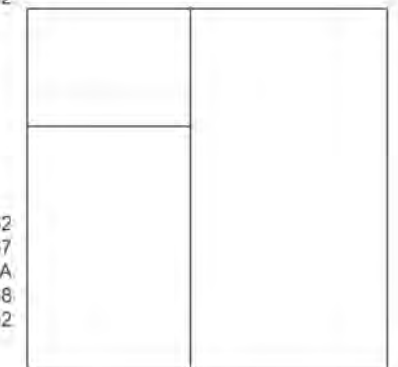
Map date: 1968

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1962
Revised 1967
Edition N/A
Copyright 1968
Levelled 1952



Surveyed 1962
Revised 1967
Edition N/A
Copyright 1968
Levelled 1952



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_1
Grid Ref: 567023, 171413

Map Name: National Grid

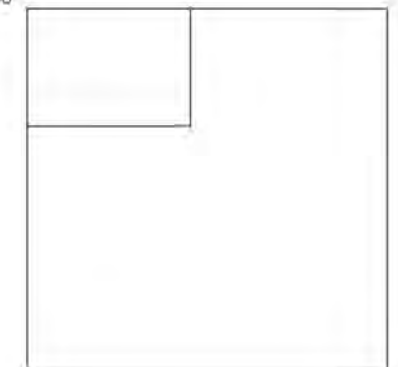
Map date: 1982

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1982
Levelled 1980



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_1
Grid Ref: 567023, 171413

Map Name: National Grid

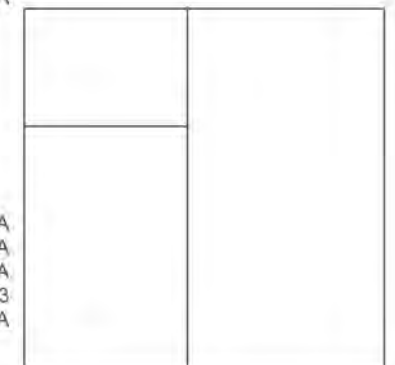
Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_2
Grid Ref: 567023, 171913

Map Name: National Grid

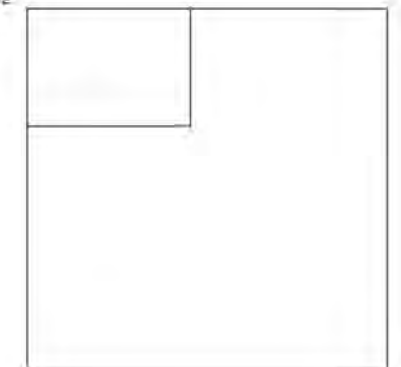
Map date: 1953

Scale: 1:1,250

Printed at: 1:2,000



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



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_2
Grid Ref: 567023, 171913

Map Name: National Grid

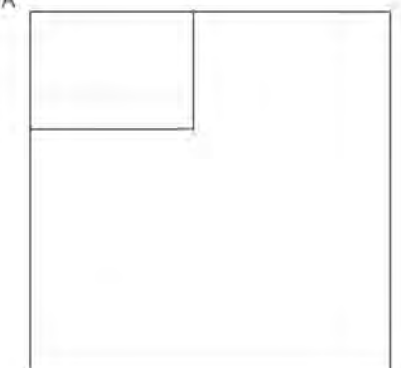
Map date: 1954

Scale: 1:1,250

Printed at: 1:2,000



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

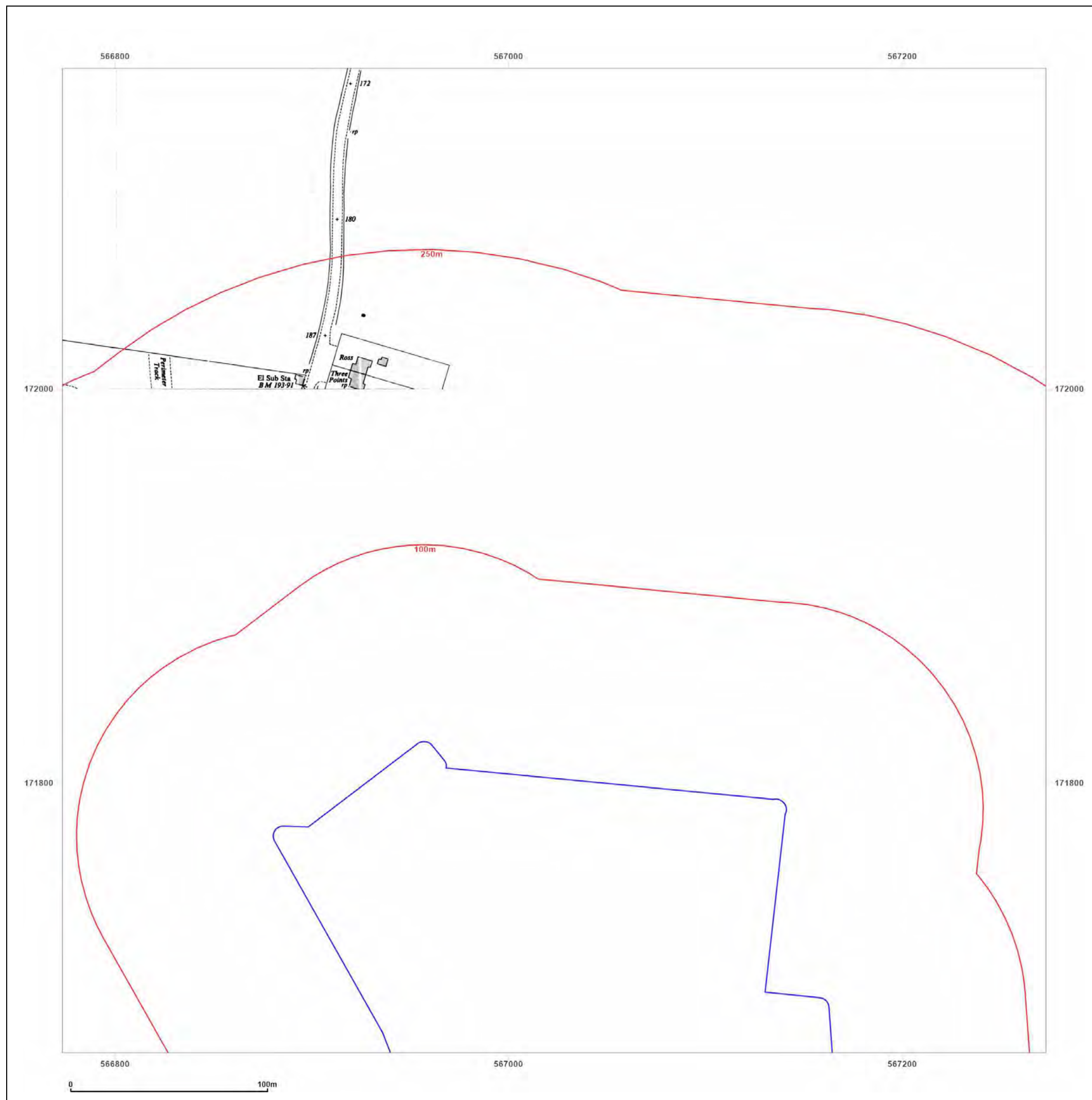


Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



Site Details:

CASCADES LEISURE CENTRE,
THONG LANE, GRAVESEND,
KENT, DA12 4LG

Client Ref: 25 13244 KJC 15788
Report Ref: ALB-NYA-6UT-SP3-CWF_1250_1_2
Grid Ref: 567023, 171913

Map Name: National Grid

Map date: 1960-1962

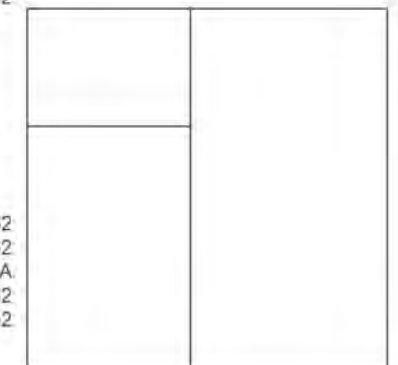
Scale: 1:1,250

Printed at: 1:2,000



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

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



Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2024 Ordnance Survey 100035207

Production date: 16 October 2025

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf

