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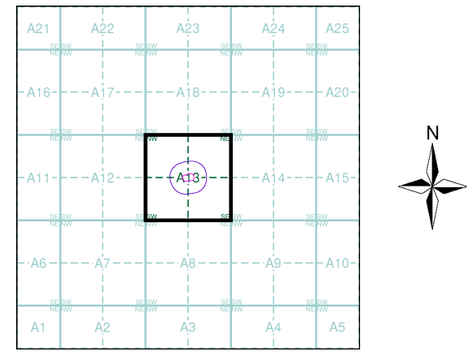
Historical Aerial Photography

Published 1999

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13



Order Details

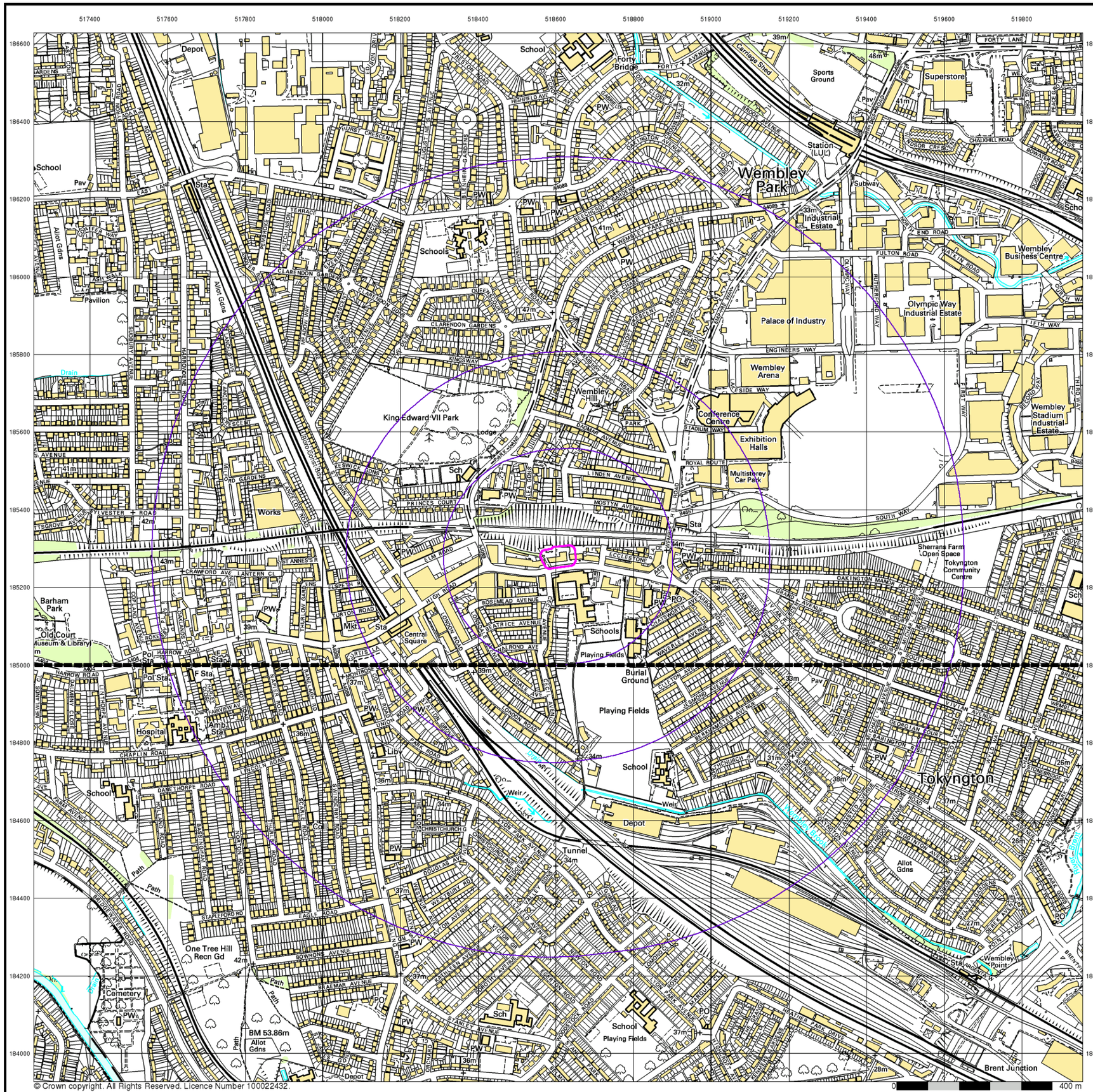
Order Number:	290024127_1_1
Customer Ref:	B080438.100
National Grid Reference:	518610, 185280
Slice:	A
Site Area (Ha):	0.44
Search Buffer (m):	100

Site Details

390-400, High Road, WEMBLEY, HA9 6AS

Landmark INFORMATION GROUP

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



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10k Raster Mapping

Published 2006

Source map scale - 1:10,000

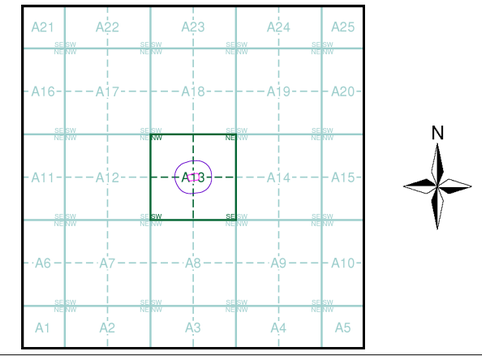
The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks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

Map Name(s) and Date(s)

TQ18NE
2006
1:10,000

TQ18SE
2006
1:10,000

Historical Map - Slice A



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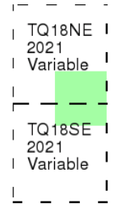
VectorMap Local

Published 2021

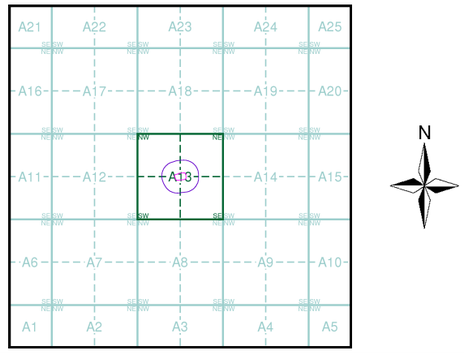
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)



Historical Map - Slice A



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1ST LINE DEFENCE

Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	390-406 High Road, Wembley, London
Client	Curtins Consulting Limited
Site Address	390-406 High Road, Wembley, London HA9 6AL
Report Reference	DA14925-00
Date	31/01/2022
Originator	ERG

Find us on Facebook, Twitter and LinkedIn

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1st Line Defence Ltd

Unit 3, Maple Park, Essex Road, Hoddesdon, Herts. EN11 0EX

Tel: +44 (0)1992 245 020 info@1stlinedefence.co.uk

Executive Summary

Site Location and Description

The site is located in High Road, Wembley, within the London Borough of Brent.

The site is bound to the north by a section of vegetation just off a railway line between Wembley Stadium Station and Sudbury and Harrow Road Station. To the east the site is bordered by a multi-story structure and hard-standing ground, to the south by High Road and to the west by residential and commercial style buildings and undeveloped land.

Recent aerial imagery indicates that the site is currently occupied by a hard-standing carpark to the north and multiple multi-story commercial buildings to the south.

The site is approximately centred on the OS grid reference: **TQ 18605 85275**.

Proposed Works

According to information provided by Curtins Consulting Limited, the final development will comprise two joined blocks of 15 and 11 storeys and is anticipated to be supported by piled foundations and excavations.

Works at this stage are understood to comprise a ground investigation consisting of two sonic drill boreholes up to 35.0m bgl and four window sample boreholes to 5.0m bgl.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation – clay silt and sand. The Sedimentary Bedrock was formed approximately 48 and 56 million years ago in the Palaeogene Period. The local environment was previously dominated by deep seas.

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 **Negligible Risk** from Allied UXO across the site. This assessment is based on the following factors:

German UXO Risk:

- During WWII, the site was located within the Municipal Borough of Wembley. According to official Home Office statistics, Wembley received an overall moderate-high density of bombing, with an average of 86.5 items of ordnance per 1,000 acres. Wembley was bombed largely due to its close proximity to Luftwaffe targets, including a Stores Depot located approximately 1km north-east of the site and its positon in relation to Central London, which was systematically bombed throughout WWII.
- Pre- WWII OS mapping suggests that the site predominantly occupied a section of open ground during wartime, with a square shaped feature to the centre/east. The site appears to have been redeveloped post-WWII, with a new structure labelled as *Depot* present in 1956-1958 mapping, in addition to a section of a Garage within the east of the site.
- London Bomb Census mapping does not record any bomb strikes to have affected the site directly. However, bombs are recorded within the surrounding area of the site. Two HE bomb strikes are recorded to the east of the site along High Road and a section of railway track, and one HE bomb strike is recorded to the south of the site along Cecil Avenue. These strikes are recorded on both consolidated and weekly London Bomb Census mapping. A further HE bomb strike and incendiary bombing shower is recorded in weekly mapping to the north-east and west of the site respectively.
- The MCC Log Book of Air Raid incidents for Wembley also records HE bombing incidents in the surrounding area, although no reference was found to the site itself. An anecdotal report given by John Dyer potentially refers to a HE

UXO Risk Assessment

bomb strike to the former Wembley Hill School south of the site, which is also recorded on 7th November 1940 in the weekly bomb map.

- A V-1 pilotless aircraft bomb is recorded directly to the south of the site at the location of Wembley Hill School on V-1 mapping. This incident is referenced within the MCC Log Book of Air Raid Incidents and can be confirmed by anecdotal reference of the school during the war. While it is conceivable that this V-1 strike may have resulted in damage across the site locality, it is not anticipated to have significantly affected the site area. Furthermore, due to its occurrence in July 1944, after the vast majority of conventional air raids had occurred in the region, it is not considered to elevate the risk of UXO contamination.
- During the war, the site was largely occupied by an area of undeveloped land adjacent to a rail line and a fenced storage yard. Although OS mapping records this as a structure, there is no damage category attributed to the site on MCC War Damage Mapping. No damage is recorded on this resource to any structures immediately bordering the site.
- WWII-era aerial photography shows the site to be occupied by scrubby open ground, however, no obvious signs of bomb damage are identifiable, such as cratering. The same photography does show extensive bomb damage and clearance to an area to the south of the site, across High Road, where Wembley Hill School once stood. However, this is largely believed to be the result of the aforementioned V-weapon strike in 1944 and is not anticipated to have affected the site directly.
- In summary, no positive evidence has been found to suggest that the site was directly bombed or damaged during WWII. A number of bomb incidents have been identified in the site locality, most notably including a HE strike and a V-1 strike at the former Wembley Hill School to the south of the site. However none of the incidents found are considered close enough to have had a significant impact on the condition or usage of the site. While the risk of UXO contamination within the site footprint cannot be discounted completely due to its largely open nature during wartime and the presence of bombing in the proximity, it is not considered to be a significant risk due to the site's size, the lack of damage it sustained and its general usage and monitor.

Allied UXO Risk:

- 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 analogous to those regarding aerial delivered ordnance

Post-WWII Redevelopment:

- Since the war the site has seen significant development with the construction of multiple multi-story commercial buildings and an associated hard-standing carpark area.
- 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 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.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at 390-406 High Road, Wembley, London:

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: 390-406 High Road, Wembley, London
Client: Curtins Consulting Limited

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Curtins Consulting Limited to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at 390-406 High Road, Wembley, London.

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 390-406 High Road, Wembley, London. 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 London Metropolitan Archives.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Curtins Consulting Limited
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 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 London Metropolitan Archives.

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 located in High Road, Wembley, within the London Borough of Brent.

The site is bound to the north by a section of vegetation just off a railway line between Wembley Stadium Station and Sudbury and Harrow Road Station. To the east the site is bordered by a multi-story structure and hard-standing ground, to the south by High Road and to the west by residential and commercial style buildings and undeveloped land.

The site is approximately centred on the OS grid reference: **TQ 18605 85275**.

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

6.2. Site Description

Recent aerial imagery indicates that the site is currently occupied by a hard-standing carpark to the north and multiple multi-story commercial buildings to the south.

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

According to information provided by Curtins Consulting Limited, the final development will comprise two joined blocks of 15 and 11 storeys and is anticipated to be supported by piled foundations and excavations.

Works at this stage are understood to comprise a ground investigation consisting of two sonic drill boreholes up to 35.0m bgl and four window sample boreholes to 5.0m bgl.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation – clay silt and sand. The Sedimentary Bedrock was formed approximately 48 and 56 million years ago in the Palaeogene Period. The local environment was previously dominated by deep seas.

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**
1935-36	1:2,500	Pre-WWII OS mapping indicates that the site comprised an area of open land with a structure depicted in the centre/east of the site. The site is bound by a section of railway embankment and railway track to the north, a further structure and open land to the east, *High Road Tramway, Wembley House* and *School* to the south and residential structures and open land to the west.

Post-WWII		
Date	**Scale**	**Description**
1956-58	1:1,250	Post-WWII OS mapping indicates that the site now comprises open land, a new structure within the pre-WWII structure now named *Depot* and a section of a *Garage* to the east. The site is bound by a *Garage* to the east, and *High Road* roadway and *Copland County Secondary School* to the south.

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 the London Clay Formation.
- 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 2,419 V-1s and 517 V-2s were recorded in the London Civil Defence region alone.

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 1,000kg 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 bomb plot map of London 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 Municipal Borough of Wembley

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 Municipal Borough of Wembley, which sustained an overall moderate-high density of bombing, as represented by bomb density data figures and maps, see **Annex H**. This was mainly due to the areas close proximity to a number of Luftwaffe targets. This included a Stores Depot, located approximately 1km north-east of the site, as depicted in a Luftwaffe target/reconnaissance photography presented in **Annex I**. Nearby areas to Luftwaffe targets would often by affected by the Luftwaffe's attempt to bomb such targets, partly due to the fact that the Luftwaffe bomber aircraft would often deploy any remaining bombs on adjacent areas. Wembley is also within close proximity to the centre of London, which was systematically bombed throughout WWII. Much of the bombing on the region can be attributed to potential targets in the region and any bombing inflicted upon the civilian population.

Records of bombing incidents in the civilian areas of the Municipal Borough of Wembley 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 Municipal Borough of Wembley between 1940 and 1945.

Record of German Ordnance Dropped on the Municipal Borough of Wembley		
Area Acreage		**6,290**
Weapons	High Explosive bombs (all types)	493
	Parachute mines	4
	Oil bombs	23
	Phosphorus bombs	9
	Fire pots	0
	Pilotless aircraft (V-1)	14
	Long range rocket bombs (V-2)	1
Total		**544**
Number of Items per 1,000 acres		**86.5**

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. London Civil Defence Region Bomb Census Maps

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced both consolidated and weekly bomb census maps for the London Civil Defence Region, as well as census mapping of V-1 pilotless aircraft. These maps collectively show the approximate locations of bombs, mines and rockets dropped in the region. The site area was checked on each available map sheet. Those showing bomb incidents on and in the immediate vicinity of the site are discussed below and are presented in **Annex J**.

Consolidated London Bomb Census Maps – Annex J1	
Date Range	**Comments**
Night Bombing Up to 7th October 1940	No bomb strikes area recorded on or directly bordering the site or within the surrounding area.
Night Bombing 7th October 1940 to 6th June 1941	No bomb strikes area recorded on or directly bordering the site. Bomb strikes are recorded in the surrounding area. One bomb strike is recorded to the east of the site, further along *High Road* and one bomb strike is recorded to the south of the site, along *Cecil Avenue*.

Weekly London Bomb Census Maps – Annex J2	
Date Range	**Comments**
4th – 11th November 1940	No bomb strikes are recorded on or directly bordering the site. Two HE bomb strikes are recorded approximately 200m and 250m to the east of the site, along *High Road* and a section of railway track, and one HE bomb strike is recorded approximately 60m to the south of the site along *Cecil Avenue.* All of these strikes occurred on Thursday 7th November 1940.
11th – 18th November 1940	No bomb strikes are recorded on or directly bordering the site. Bomb strikes are recorded in the surrounding area. One bomb is recorded approximately 250m north-east of the site near a section of railway and an incendiary bombing shower is recorded in the vicinity of the site to the west. These incidents occurred on Friday 15th November 1940.

V-1 Pilotless Flying Bomb Census Map – Annex K	
Date Range	**Comments**
1944-45	The closest recorded V1 Pilotless Aircraft bomb was recorded at *Wembley Hill School*, approximately 95m from the site boundary. The date of this strike was 30th or 31st July 1944.

** See Section 11.7 for anecdotal references to this V-1 bombing incident.*

11.5. London Bomb Census Reports

Bomb census reports compiled by the Research and Experiments Branch of the Ministry of Home Security during WWII were consulted at The National Archives. These reports recorded information such as the date, time, type and damage caused by bomb incidents for a selected time period in the region and are therefore not often comprehensive.

This record set was checked, and no references to the site were found within it.

11.6. MCC Log Book of Air Raid Incidents

Written ARP Incident Records were obtained from the London Metropolitan Archives. This record was compiled by local Air Raid Precaution (ARP) personnel and volunteers during the war and records the location, date and time of bombing raids, as well as the types of bomb used and the damage caused.

A transcript of the associated written records of bomb incidents in the site area is presented in the table below. Only those recorded incidents on or in close proximity to the site have been highlighted. Imagery of this record is presented in **Annex L**.

MCC Log Book of Air Raid Incidents – Annex L	
Date	**Comments**
3rd October 1940	Major Damage H.E. LNER lines blocked near Wembley Stadium. Details not yet available. *This incident could be in relation to any section of railway track near Wembley Stadium, the closest being approximately 50m from the site.*
8th November 1940	Major Damage H.E. on LNER track 60 yards west of Wembley Hill Station. Slight dislocation of traffic on overflow line only. Other tracks not affected. Traffic can be conveyed on…line between Park Lane Bridge and Wembley Hill Station. No casualties. *This incident is approximately 250m from the site; but indicates that the immediate site area itself was not affected on this occasion.*
12th November 1940	Damage H.E. Clayton Ave, Park Rd + 127 High Road. *This incident refers to an incident 150m to the east of the site along High Road.*
31st July 1944	"FLY" damage Oakington Mount Drive junction Harrow Road. Extensive damage to Wembley Hill School. (Fire now extinguished) partly demolished…Wembley Hill Cinema partly demolished. Casualties 1 killed, 1 severely injured, 2 slightly injured*. *This incident is approximately 50m south of the site.*

** See Section 11.7 for anecdotal references to this HE bombing incident.*

11.7. Anecdotal Reports

Various online resources have been consulted during the production of this report in an attempt to find additional sources of information regarding bombing incidents which occurred across the site and in the immediate vicinity. Two anecdotal accounts concerning the bombing of the former Wembley Hill School nearby are presented below.

Wembley Hill School – 50m to the south of the site

[Words of John Dyer] "I was 11 when the war broke out attending Wembley Hill School and often when the register was call there would be no answer and someone would say 'he was bombed out last night sir'. **The school had a direct hit** one night just before I was 14 so that was the end of my education."[2]

[Blog post by Philip Grant of Wembley History Society] "Wembley House itself was acquired in 1915 for use as a private school, with both "Boys" and "ladies" sections. A council school for both primary and secondary pupils was built next door in the 1920's, and in the late 1930's Wembley House was acquired by Middlesex County Council, and demolished, with a view to extending this. As it was, **Wembley Hill School was badly damaged by a V-1 flying bomb in 1944**, so a brand new secondary school was built on both sites in the early 1950's, opening as Copland School in 1952, on the corner of Wembley High Road and Cecil Avenue".[3]

[2] *https://www.bbc.co.uk/history/ww2peopleswar/stories/41/a5177441.shtml*

[3] *https://brentmuseumandarchives.wordpress.com/2016/10/28/what-would-a-victorian-gentleman-think-about-wembley-now/*

11.8. Middlesex County Council War Damage Map

Map sheets compiled by Middlesex County Council (MCC) showing the extent of wartime bomb damage over the area of the site were consulted at London Metropolitan Archives. The section showing the area of the site is described in the table below and presented in **Annex M**.

It should be highlighted that this source only records the following damage categories: 'Category 1: Total damage, building to be demolished', 'Category 2: Some repairs possible, but could become Cat 1' and 'Category 3: Borderline areas, uncertain whether repairs possible, might have to be demolished'. The lesser damage categories, such as seriously damaged but repairable at cost and general blast damage, were not used.

MCC War Damage Map – Annex M	
Date Range	**Comments**
1940-1945	During the war the site largely comprised an area of open land which would not have been recorded on damage mapping. The feature denoted within the site boundary is not attributed any damage category. Buildings in the surrounding area to the east, south and south-west of the site are given the damage category ranging from category 2 "some repairs possible, but could become Cat 1" and Category 3 "border line areas, uncertain whether repairs possible, might have to be demolished". None of these structures immediately border the site.

11.9. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from National Monuments Record Office (Historic England). 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 Annex N**).

WWII-Era Aerial Photography – Annex N-O	
Date	**Description**
20th April 1946	RAF aerial photography dated 1946 shows the site to largely comprise an area of open land, with a fenced storage area/depot to the east. The site appears scrubby and not very well maintained. Land to the south of the site, across High Road, appears to have suffered extensive bomb damage. A large area of clearance is visible, with a single solitary structure remaining. Prefabricated housing have also been placed to the west of this area of clearance. Areas of notable damage in the site locality are highlighted in **Annex O**.

11.10. 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.

11.11. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) 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, Curtins Consulting Limited will be advised.

11.12. Evaluation of German Aerial Delivered UXO Records

Factors	Conclusion
Density of Bombing *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.*	During WWII, the site was located within the Municipal Borough of Wembley. According to official Home Office bombing statistics, Wembley was subject to an overall moderate-high density of bombing, with an average of 86.5 items of ordnance per 1,000 acres. Available evidence suggests that Wembley was bombed due to its close proximity to Luftwaffe targets, including a Stores Depot located approximately 1km north-east of the site and position in relation to Central London, which was systematically bombed throughout WWII. London Bomb Census mapping does not record any bomb strikes to have directly affected the site, however bombs are recorded in the surrounding area. On 7th November 1940, two HE bomb strikes are recorded to the east of the site, along *High Road* and a section of railway track, and one HE bomb strike is recorded to the south of the site along *Cecil Avenue.* These strikes area recorded on both consolidated and weekly mapping. A further HE bomb strike and incendiary bombing shower is recorded on Friday 15th November 1940 to the north-east of the site near a section of railway and to the west of the site respectively. MCC Log Books of Air Raid Incidents also records further bombing in the surrounding area. A V-1 bomb strike is recorded to the south of the site at Wembley Hill School on London V-1 mapping, the MCC Log Book of Air Raid Incidents on the 31st July 1944 and is also found in an anecdotal report. This incident occurred approximately 100m from the site. A visual overlay showing the approximate locations of selected recorded bomb strikes in relation to the site is presented in **Annex O2**.
Damage *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.*	During the war the site predominately comprised an area of open land which would not have been recorded on damage mapping. The feature within the site boundary (a fenced storage yard) is not attributed to any damage category on MCC War Damage mapping. WWII-era photography shows the site to be partly occupied by a scrubby, not particularly maintained area of ground, however no obvious signs of bomb damage are identifiable, such as bomb cratering. MCC War Damage mapping also does not record any damage to *Wembley House* or *School* to the south of the site, even though bombing records record HE and V-1 bombing strikes to this area. WWII-era photography was able to corroborate this bombing, depicting extensive clearance to this area, and the construction of prefabricated housing, which would often be placed on areas of bomb clearance. It should be noted however that this damaged area is not anticipated to have affected the site directly. See **Annex O2** for a visual overlay of notable damaged areas in the site locality.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	During WWII, the site was primarily occupied by an area of open ground and a fenced area of storage, which does not look very well maintained. Areas of undeveloped ground are generally considered less conductive to the detection of evidence of UXO indicators, although the condition of the groundcover present does appear to vary across the site footprint.

Access Frequency *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.*	Undeveloped areas of land are generally believed to have been subject to less frequent access than developed areas of land. However, during WWII, the site was situated within the a residential area of Wembley and adjacent to a major road, which would have improved monitor of the site and increased the likelihood that evidence of UXO would have been spotted, reported and dealt with as opposed to more rural sections of land. The fenced storage area on-site may have also increased the site access frequency.
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.

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.

12.1.1. 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 *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	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 3km south-west of the site, in the vicinity of Ealing Golf Club. 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 *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	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 *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges *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.*	No evidence of training or firing ranges could be found within the site or surrounding area.
Defensive Minefields *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.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.

Military Related Airfields *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.*	The site was not situated within the perimeters or vicinity of a military airfield.

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, London WWI bomb plot maps, WWII bomb density maps, Luftwaffe reconnaissance imagery, consolidated London Bomb Census mapping, Weekly Bomb Census mapping, the London V-1 Flying Bomb map, MCC War Damage mapping, MCC Log Book of Air Raid Incidents, anecdotal reports and WWII-era photography. The record set is of generally good quality. HE and V-1 bombing incidents are documented consistently throughout the sources and a variety of records were available. Minor discrepancies/limitations were found, such as some bombing recorded on Weekly Bomb Census mapping, but not on Consolidated Bomb Census mapping; with further additional incidents recorded in MCC Log Book of Air Raid Incidents. Supplementary sources in the form of anecdotal reports allowed the collection of further specific bombing incidents that affected the surrounding area of the site. Additionally, post-WWII aerial photography permitted a general assessment of the post-war damage/conditions of the site and surrounding area.
German Aerial Delivered Ordnance	• During WWII, the site was located within the Municipal Borough of Wembley. According to official Home Office statistics, Wembley received an overall moderate-high density of bombing, with an average of 86.5 items of ordnance per 1,000 acres. Wembley was bombed largely due to its close proximity to Luftwaffe targets, including a Stores Depot located approximately 1km north-east of the site and its positon in relation to Central London, which was systematically bombed throughout WWII. • Pre- WWII OS mapping suggests that the site predominantly occupied a section of open ground during wartime, with a square shaped feature to the centre/east. The site appears to have redeveloped post-WWII, with a new structure labelled as *Depot* present in 1956-1958 mapping, in addition to a section of a *Garage* within the east of the site. • London Bomb Census mapping does not record any bomb strikes to have affected the site directly. However, bombs are recorded within the surrounding area of the site. Two HE bomb strikes are recorded to the east of the site along *High Road* and a section of railway track, and one HE bomb strike is recorded to the south of the site along *Cecil Avenue*. These strikes are recorded on both consolidated and weekly London Bomb Census mapping. A further HE bomb strike and incendiary bombing shower is recorded in weekly mapping to the north-east and west of the site respectively. • The MCC Log Book of Air Raid incidents for Wembley also records HE bombing incidents in the surrounding area, although no reference was found to the site itself. An anecdotal report given by John Dyer potentially refers to a HE bomb strike to the former Wembley Hill School south of the site, which is also recorded on 7th November 1940 in the weekly bomb map. • A V-1 pilotless aircraft bomb is recorded directly to the south of the site at the location of *Wembley Hill School* on V-1 mapping. This incident is referenced within the MCC Log Book of Air Raid Incidents and can be confirmed by anecdotal reference of the school during the war. While it is conceivable that this V-1 strike may have resulted in damage across the site locality, it is not anticipated to have significantly affected the site area. Furthermore, due to its occurrence in July 1944, after the vast majority of conventional air raids had occurred in the region, it is not considered to elevate the risk of UXO contamination.

	• During the war, the site was largely occupied by an area of undeveloped land adjacent to a rail line and a fenced storage yard. Although OS mapping records this as a structure, there is no damage category attributed to the site on MCC War Damage Mapping. No damage is recorded on this resource to any structures immediately bordering the site. • WWII-era aerial photography shows the site to be occupied by scrubby open ground, however, no obvious signs of bomb damage are identifiable, such as cratering. The same photography does show extensive bomb damage and clearance to an area to the south of the site, across *High Road*, where *Wembley Hill School* once stood. However, this is largely believed to be the result of the aforementioned V-weapon strike in 1944 and is not anticipated to have affected the site directly. • In summary, no positive evidence has been found to suggest that the site was directly bombed or damaged during WWII. A number of bomb incidents have been identified in the site locality, most notably including a HE strike and a V-1 strike at the former Wembley Hill School to the south of the site. However none of the incidents found are considered close enough to have had a significant impact on the condition or usage of the site. While the risk of UXO contamination within the site footprint cannot be discounted completely due to its largely open nature during wartime and the presence of bombing in the proximity, it is not considered to be a significant risk due to the site's size, the lack of damage it sustained and its general usage and monitor.
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 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 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group 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

Since the war the site has seen significant development with the construction of multiple multi-story commercial buildings and an associated hard-standing carpark area.

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 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 an assessed **Negligible Risk** from Allied ordnance.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Allied 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 390-406 High Road, Wembley, London:

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 **31/01/22**

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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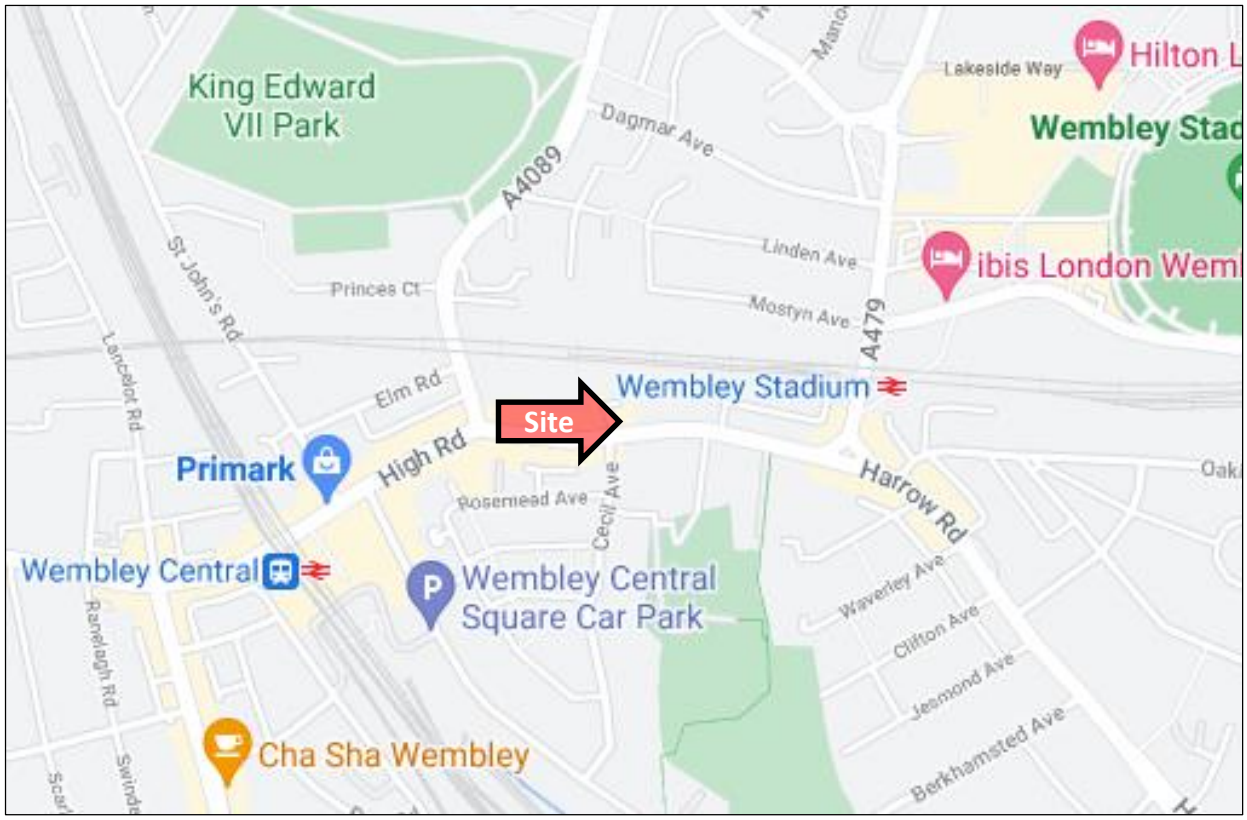
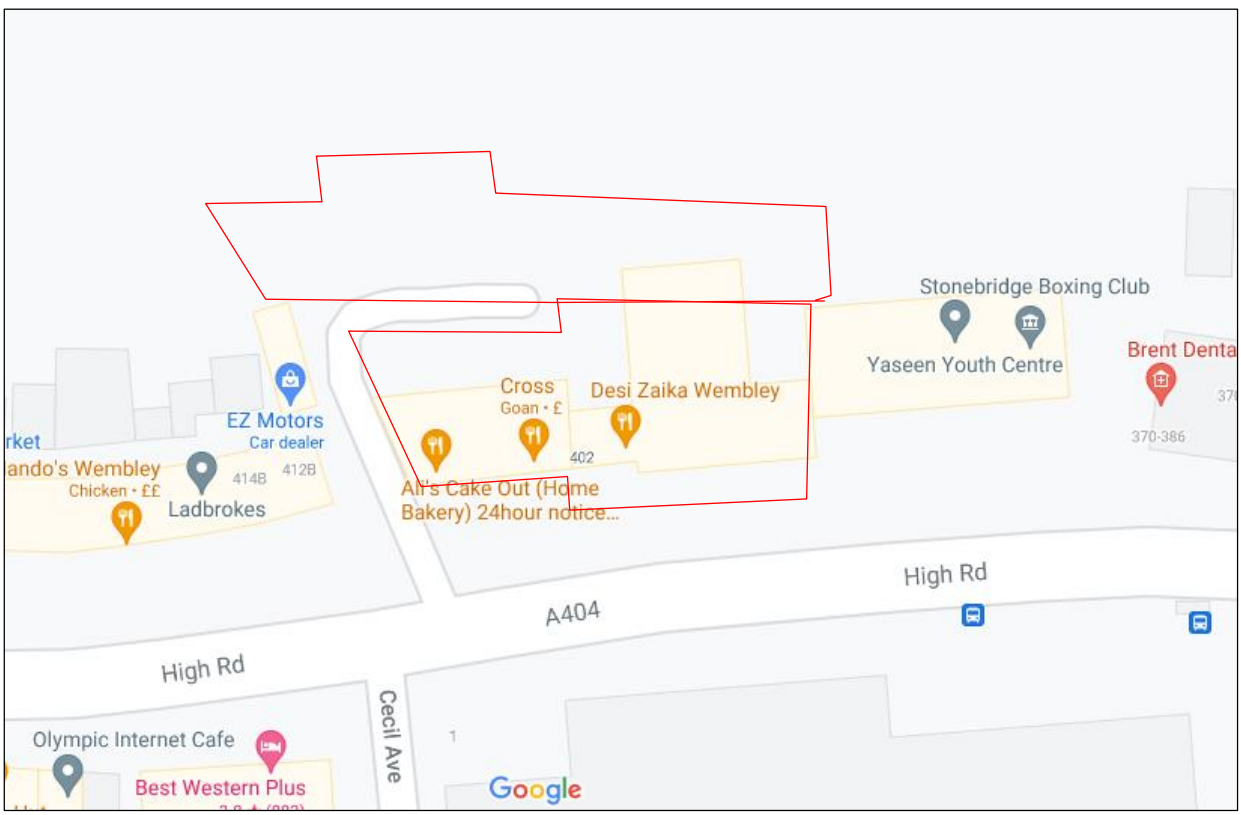
This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be 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.

Site Location Maps

Annex: **A**





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Tel: +44 (0)1992 245 020

Client: **Curtins Consulting Limited**

Approximate site boundary

N

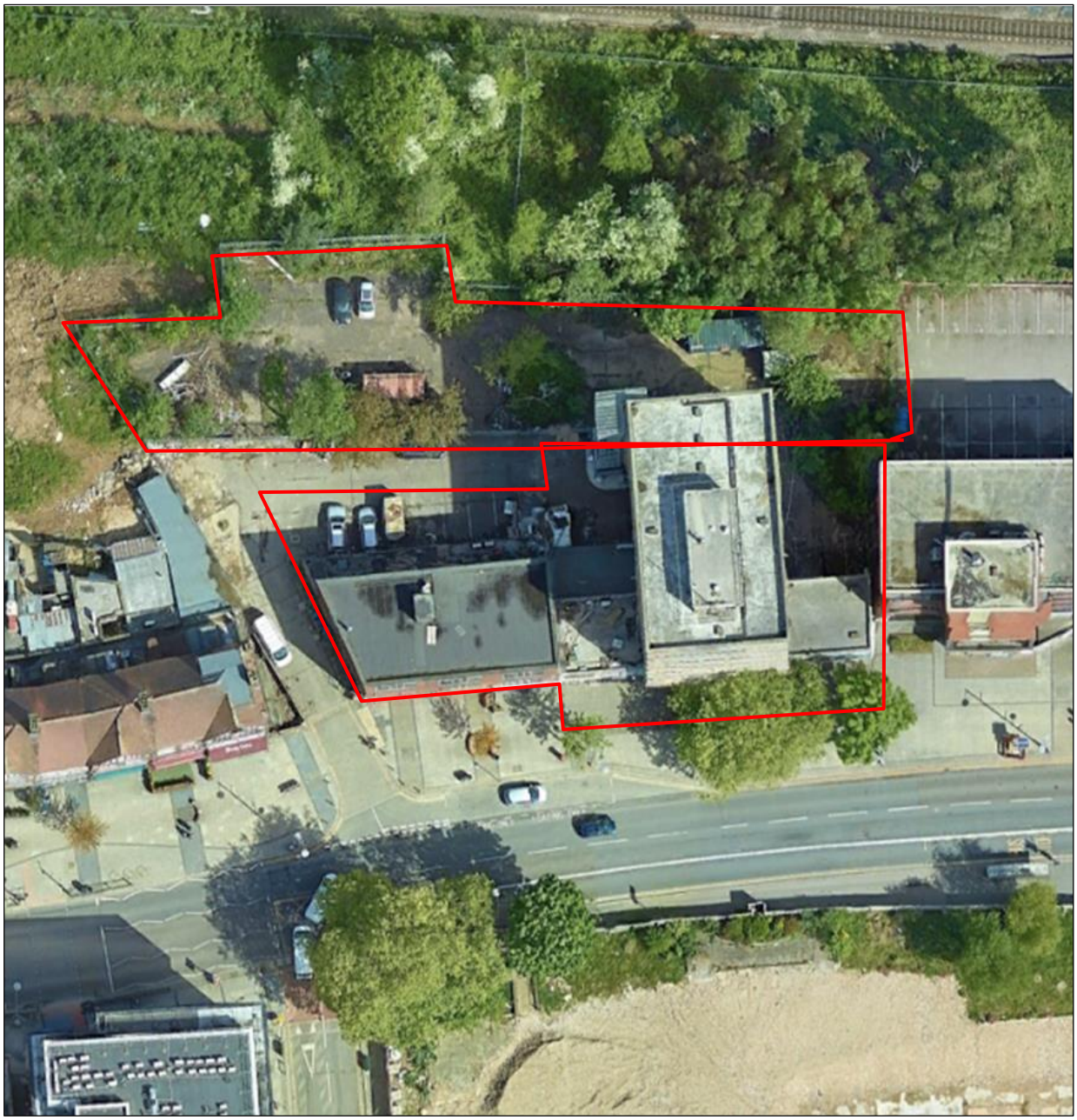
Project: **390-406 High Road, Wembley HA9 6AL**

Ref: **DA14925-00**

Source: Google Maps

Recent Aerial Photography

Annex: **B**



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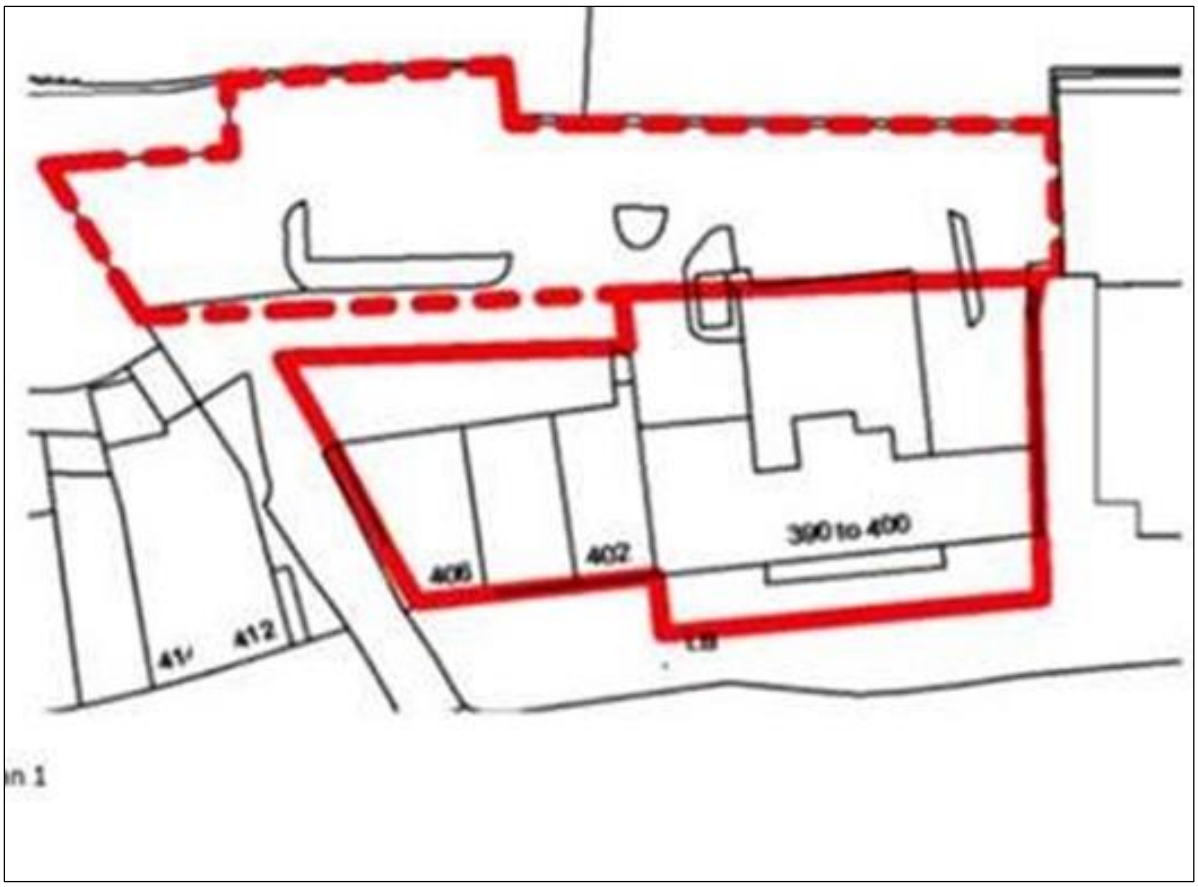
Ref: **DA14925-00**

Source: Google Earth ™ Mapping Services

Client Provided Site Plan

Annex: **C**



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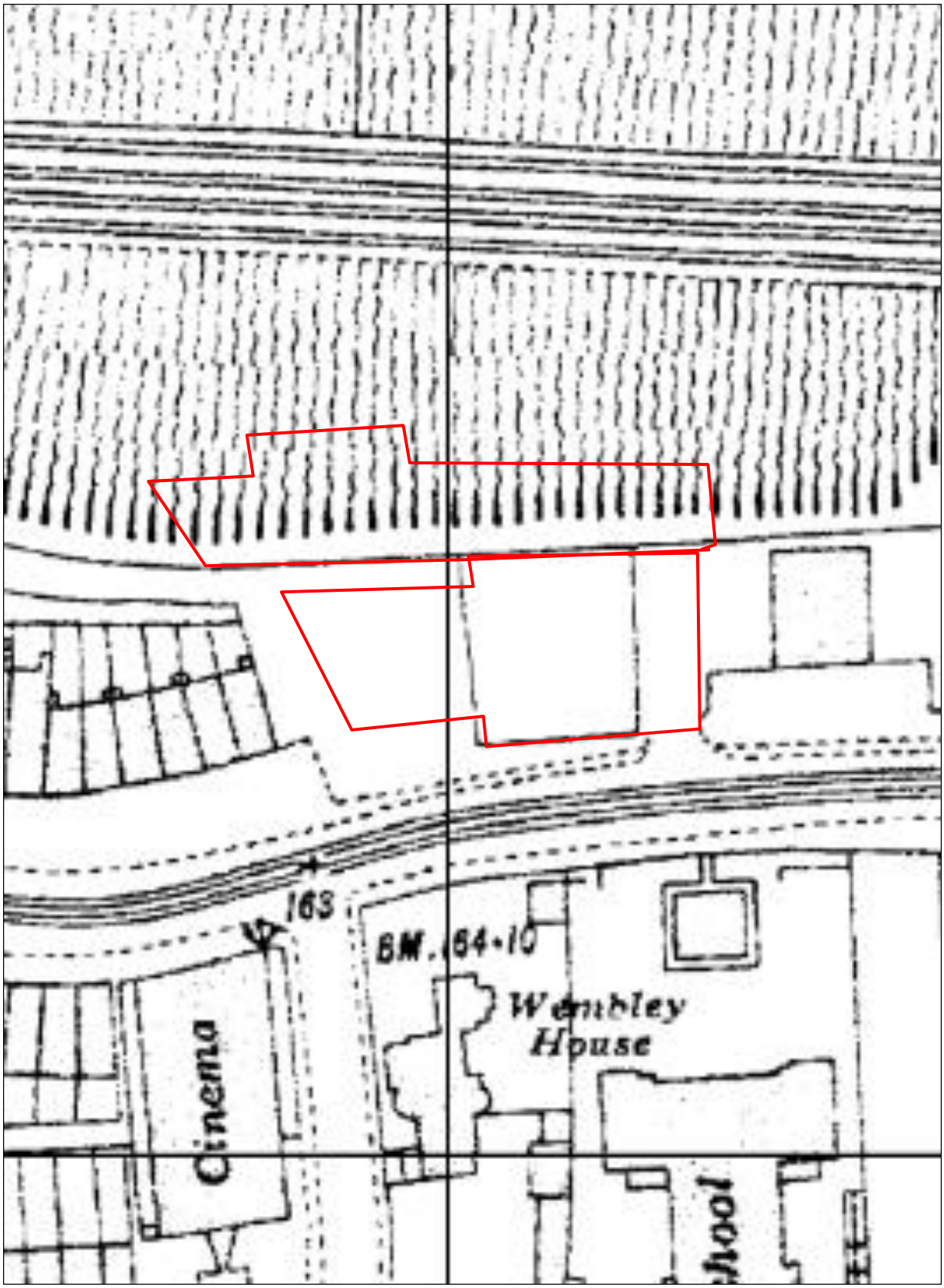
Project: **390-406 High Road, Wembley HA9 6AL**

Ref: **DA14925-00**

Source: Curtins Consulting Limited

Pre-WWII Historical Map 1935-36

Annex: D1



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Ref: **DA14925-00**

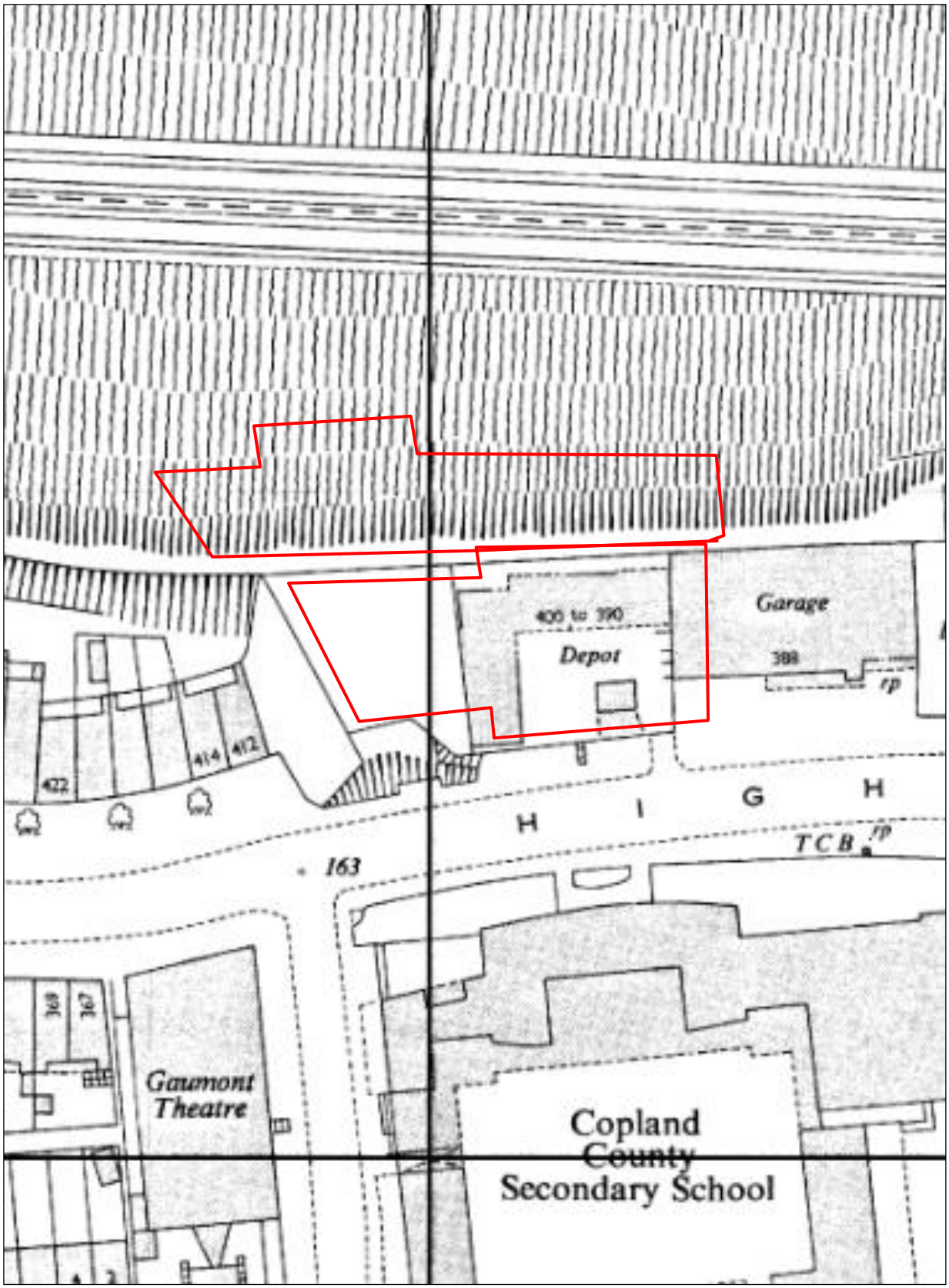
Source: Landmark Maps

Approximate site boundary

N

Post-WWII Historical Map 1956-58

Annex: D2



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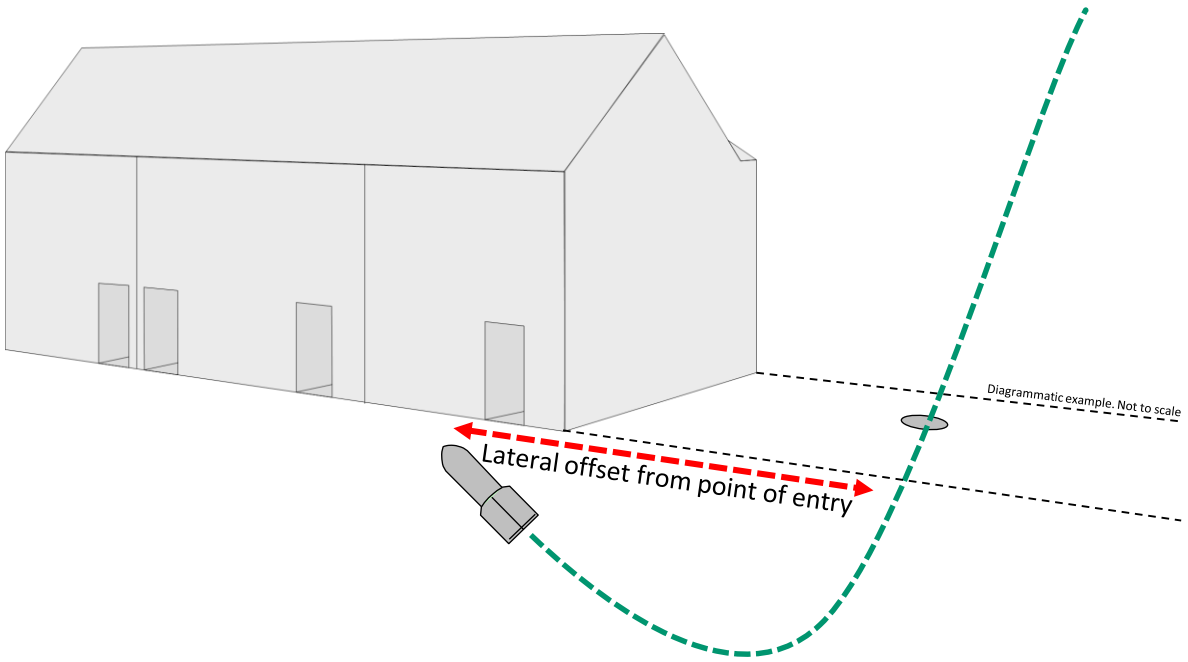
Ref: **DA14925-00**

Source: Landmark Maps

Example of UXO Entry Hole / The 'J-curve' Effect Principle



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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Ref: **DA14925-00** Source: Various sources

BBC NEWS

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

BBC NEWS

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

BBC NEWS

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

BBC NEWS

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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Source: BBC News

Examples of Unexpected Detonation of WWII Bombs

Annex: F2

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

BBC NEWS

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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Ref: **DA14925-00**

Source: Various news sources

Army works to defuse unexploded WWII bomb near Wembley Stadium

A British Army bomb disposal expert inspects the World War II bomb found in Wembley. *Credit: British Army/Sgt Rupert Frere RLC*

Homes have been evacuated as the Army works to defuse an unexploded World War II bomb discovered near Wembley Stadium.

The 50kg explosive, which is believed to have been dropped over London during Nazi bombing raids in the the early 1940s, was discovered by builders working near the stadium.

Bomb disposal experts discuss the best way to dispose of the device. *Credit: British Army/Sgt Rupert Frere RLC*

The British Army has warned of a "genuine risk to life" as homes and businesses, reportedly including the studio in which the ITV show Britain's Got Talent is filmed, were evacuated outside a 400-metre police cordon.

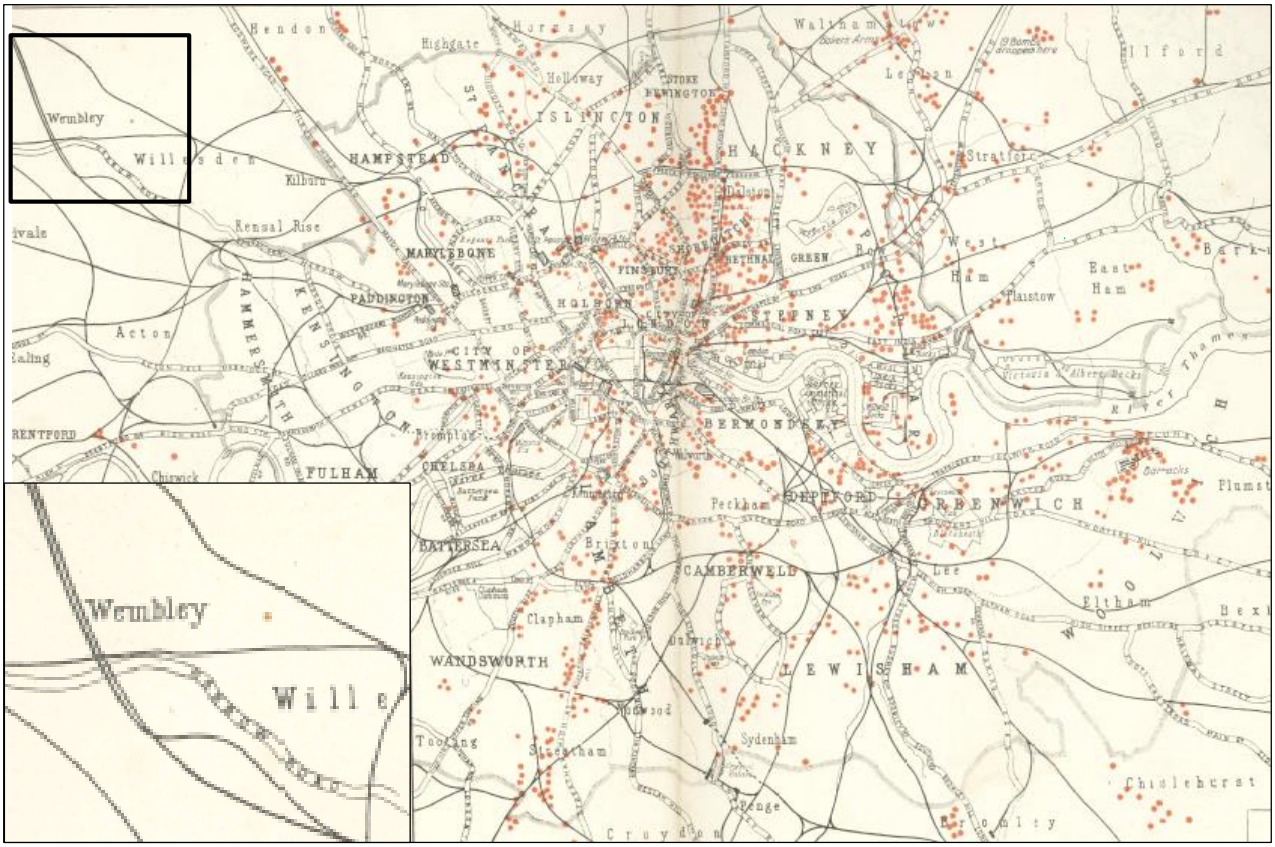
This bomb is a live munition in a potentially dangerous condition so it's important that people listen to the police and evacuate their homes if asked.

We will do all we can to minimise the disruption but ask the public to bear with us - any bomb, even under a controlled explosion, could cause significant damage to property and there is a genuine risk to life.

– British Army spokesman

WWI Bomb Plot Map, London

Annex: **G**



Examples of 50 and 100kg German WWI bombs

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Tel: +44 (0)1992 245 020

Client: **Curtins Consulting Limited**

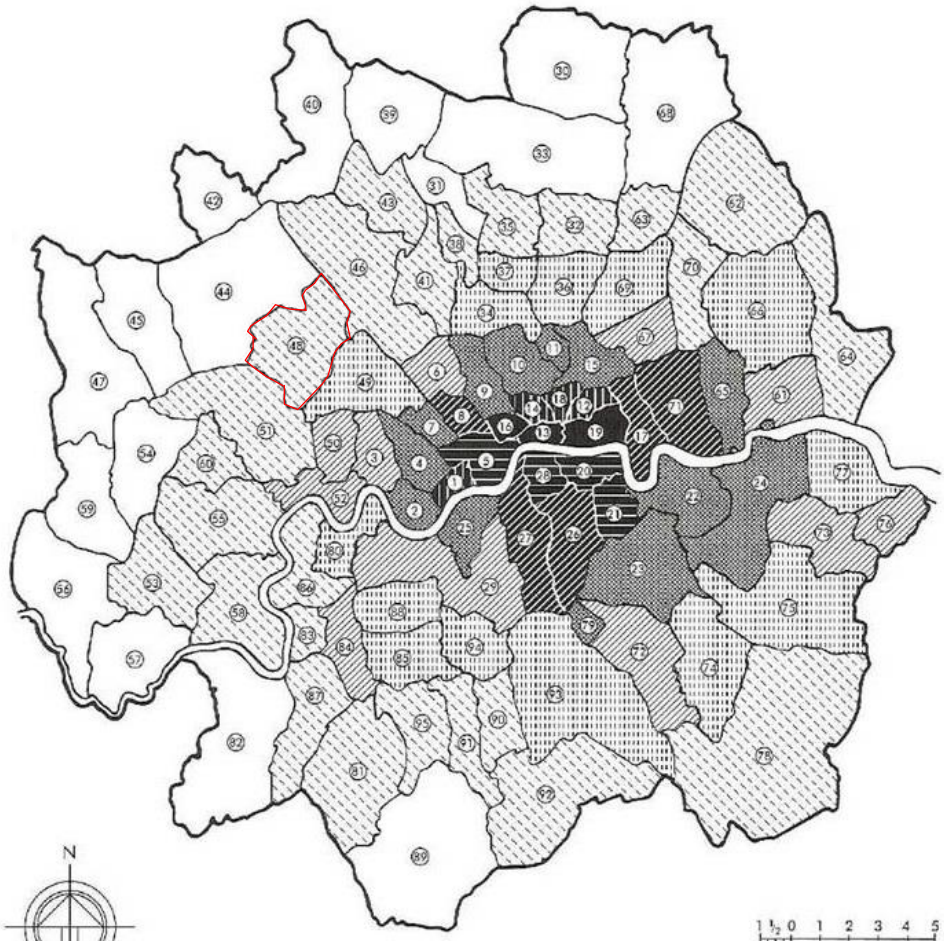
Project: **390-406 High Road, Wembley HA9 6AL**

Ref: **DA14925-00**

Source: The National Archives, Kew

London WWII Bomb Density Map

Annex: **H**



No. OF BOMBS PER 1,000 ACRES

OVER 600	300 – 399	100 – 149
500 – 599	200 – 299	50 – 99
400 – 499	150 – 199	UNDER 50

1	Chelsea	25	Battersea	49	Willesden	72	Beckenham
2	Fulham	26	Camberwell	50	Acton	73	Bexley
3	Hammersmith	27	Lambeth	51	Ealing	74	Bromley
4	Kensington	28	Southwark	52	Brentford and Chiswick	75	Chislehurst and Sidcup
5	Westminster	29	Wandsworth	53	Feltham	76	Crayford
6	Hampstead	30	Cheshunt	54	Hayes and Harlington	77	Erith
7	Paddington	31	East Barnet	55	Heston and Isleworth	78	Orpington
8	St. Marylebone	32	Edmonton	56	Staines	79	Penge
9	St. Pancras	33	Enfield	57	Sunbury	80	Barnes
10	Islington	34	Hornsey	58	Twickenham	81	Epsom and Ewell
11	Stoke Newington	35	Southgate	59	Yiewsley and West Drayton	82	Esher
12	Bethnal Green	36	Tottenham			83	Kingston on Thames
13	City of London	37	Wood Green	60	Southall and Norwood	84	Malden and Coombe
14	Finsbury	38	Friern Barnet	61	Barking	85	Merton and Morden
15	Hackney	39	Potters Bar	62	Chigwell	86	Richmond
16	Holborn	40	Elstree	63	Chingford	87	Surbiton
17	Poplar	41	Finchley	64	Dagenham	88	Wimbledon
18	Shoreditch	42	Bushey	65	East Ham	89	Banstead
19	Stepney	43	Barnet U.D.	66	Ilford	90	Beddington and Wallington
20	Bermondsey	44	Harrow	67	Leyton	91	Carshalton
21	Deptford	45	Ruislip and Northwood	68	Waltham Holy Cross	92	Coulsdon and Purley
22	Greenwich	46	Hendon	69	Walthamstow	93	Croydon
23	Lewisham	47	Uxbridge	70	Wanstead and Woodford	94	Mitcham
24	Woolwich	48	Wembley	71	West Ham	95	Sutton and Cheam

1ST LINE DEFENCE

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Source: The London Metropolitan Archives

Luftwaffe Photograph

London – Wembley
A – Stores Depot

The site located approximately 1km to the south-west of the Stores Depot; just outside the frame of the photograph.

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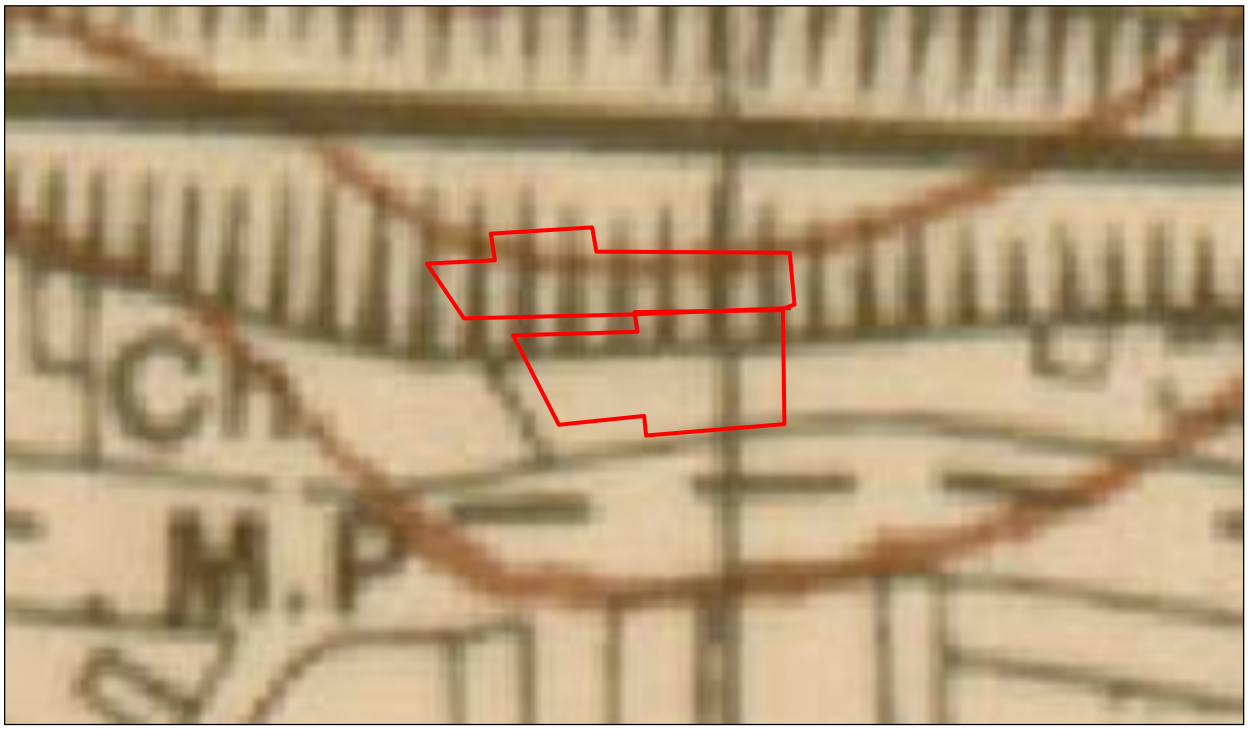
Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

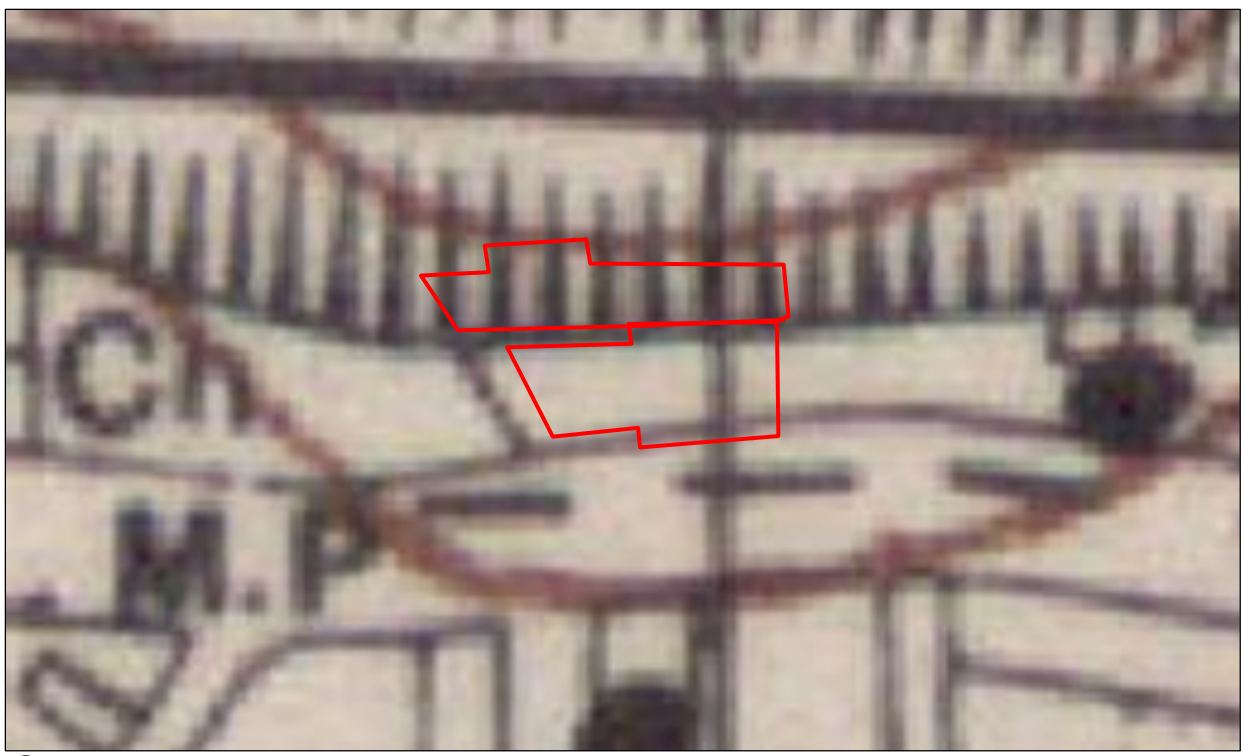
Consolidated London Bomb Census Mapping

Annex: J1

Night Bombing Up to 7th October 1940



Night Bombing - 7th October 1940 to 6h June 1941



● Recorded bomb strike

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Source: The National Archives, Kew

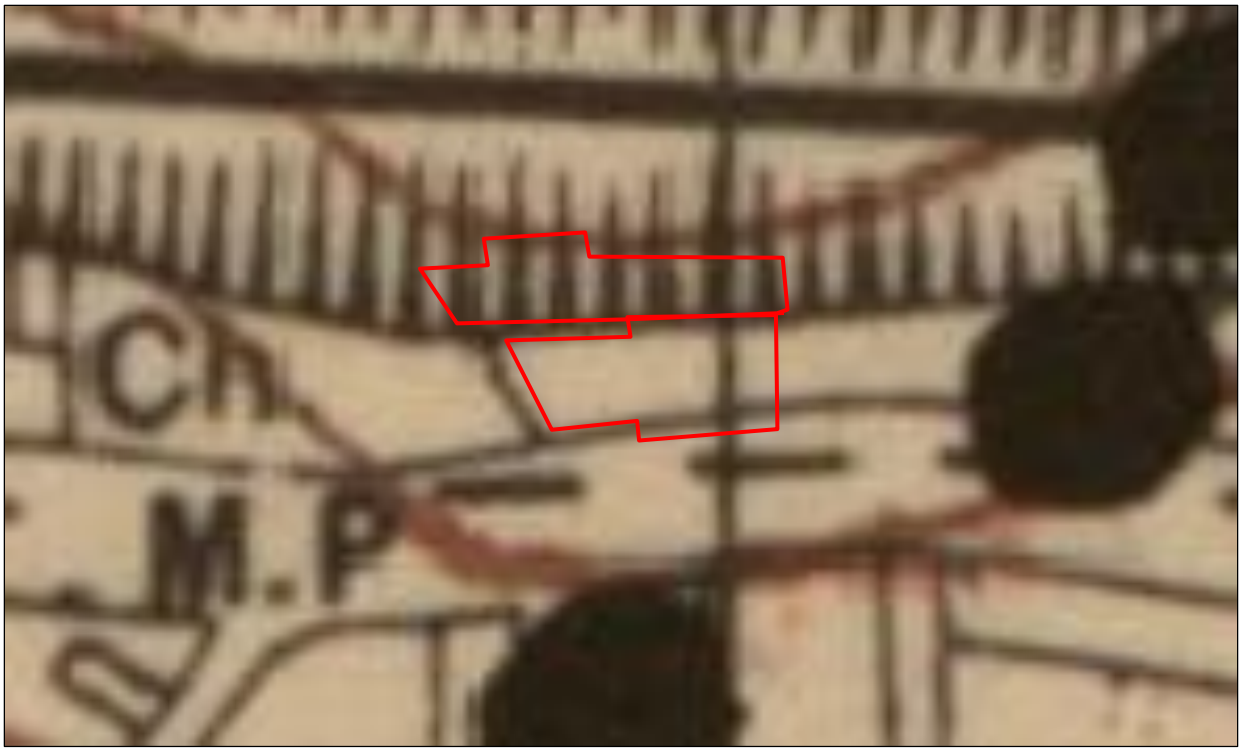
— **Approximate site boundary**

N

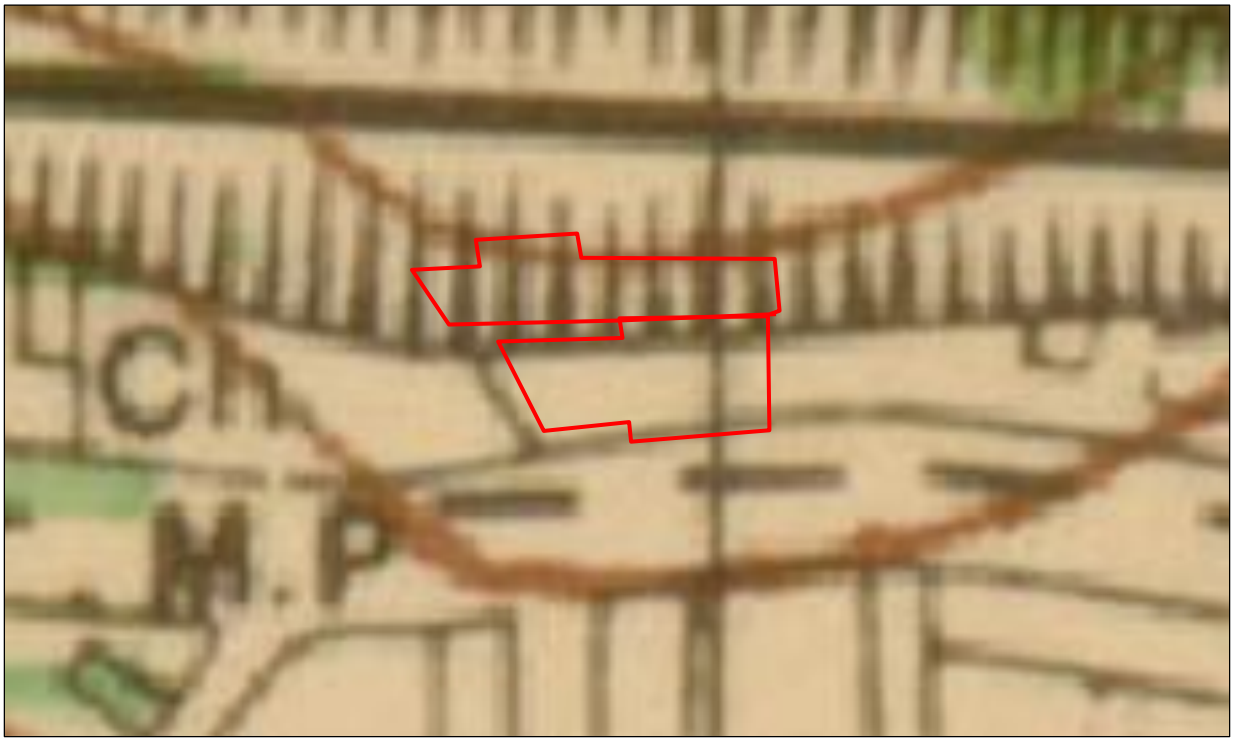
Weekly London Bomb Census Mapping

Annex: J2

4th – 11h November 1940



11th – 18th November 1940



Recorded HE bomb strike

Recorded UXB strike

Recorded incendiary bomb shower

Recorded oil bomb strike

Key to weekly map symbol colours

Monday - Brown
Tuesday - Vermilion
Wednesday - Blue
Thursday - Black
Friday - Green
Saturday - Violet
Sunday - Yellow

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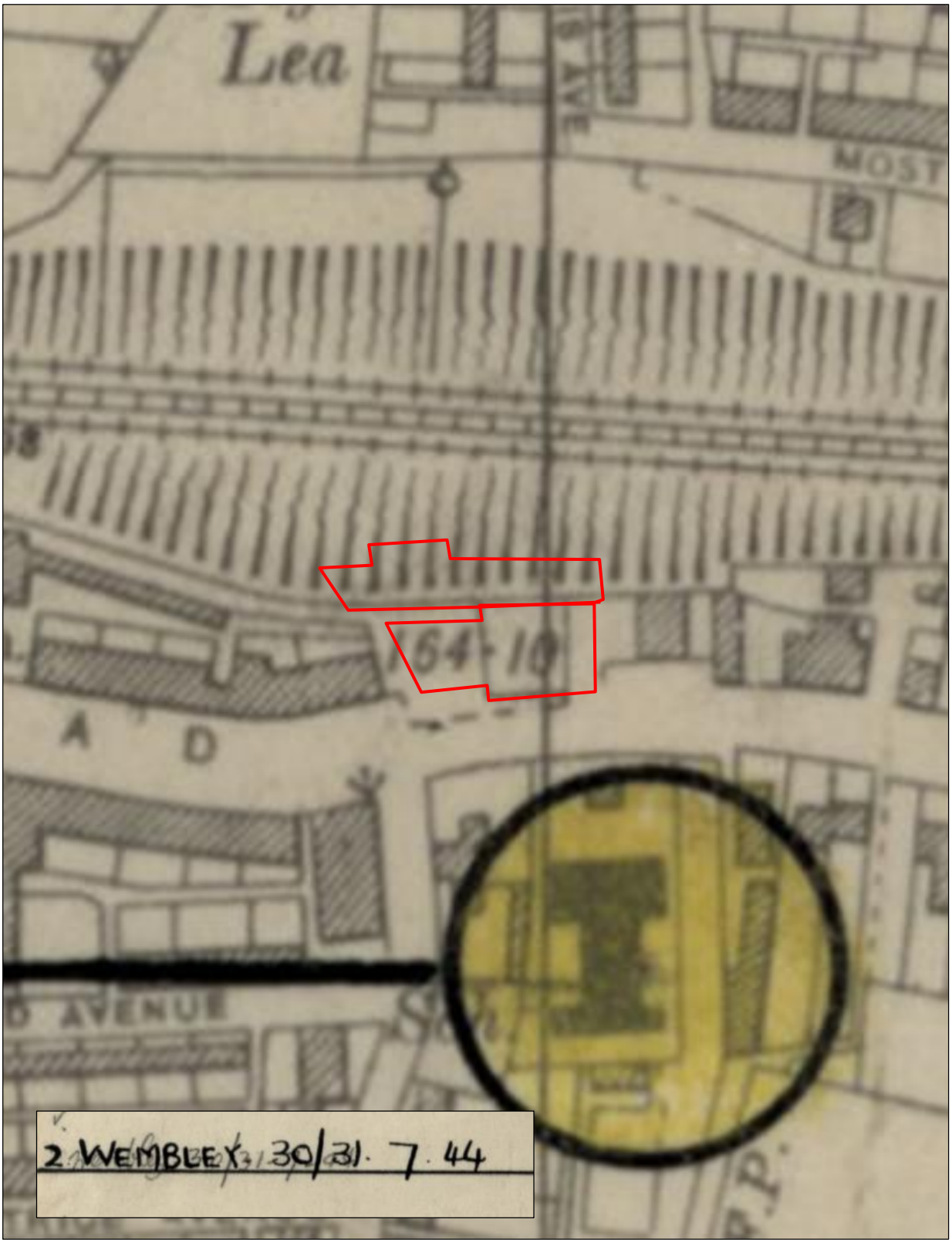
Source: The National Archives, Kew

Approximate site boundary

N

London V-1 Flying Bomb Map

Annex: K



V-1 flying bomb

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Approximate site boundary

Project: **390-406 High Road, Wembley HA9 6AL**

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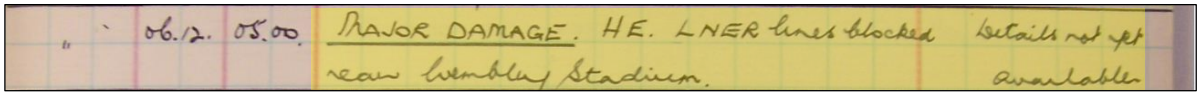
Ref: **DA14925-00**

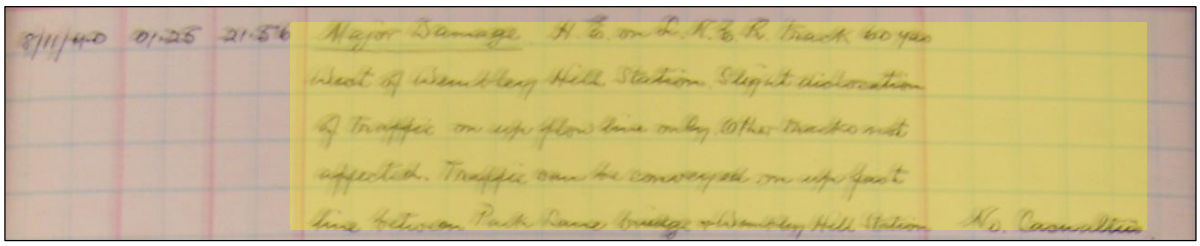
Source: The National Archives, Kew

3rd October 1940



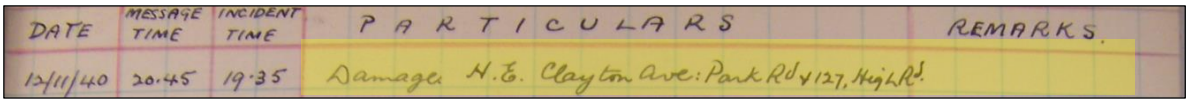
"	06.12.	05.00.	MAJOR DAMAGE. HE. LNER lines blocked near Wembley Stadium.	Details not yet available

8th November 1940



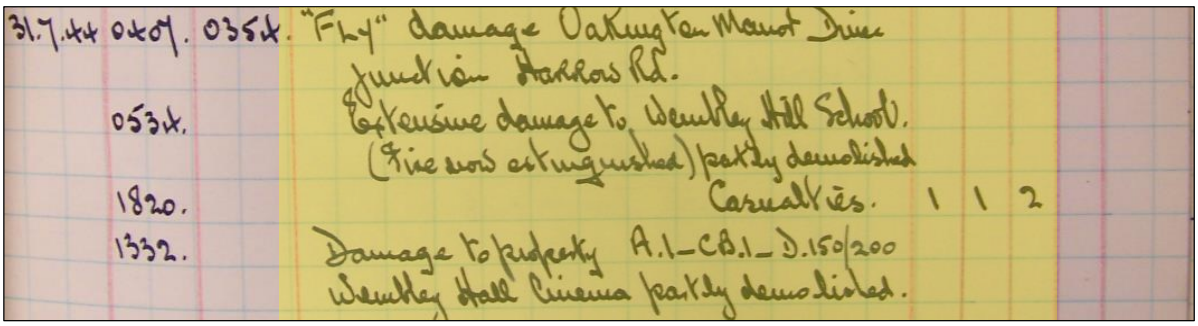
8/11/40	01.25	21.56	Major Damage H.E. on L.N.E.R. track 60 yds West of Wembley Hill Station. Slight dislocation of traffic on up slow line only. Other tracks not affected. Traffic can be conveyed on up fast line between Park Lane Bridge & Wembley Hill Station. No. Casualties.	

12th November 1940



DATE	MESSAGE TIME	INCIDENT TIME	PARTICULARS	REMARKS.
12/11/40	20.45	19.35	Damage H.E. Clayton Ave: Park Rd & 127, High Rd.	

31st July 1944



31.7.44	0404.	0354.	"Fly" damage Oakington Manor Drive junction Harrow Rd. Extensive damage to Wembley Hill School. (Fire was extinguished) partly demolished	
		0534.		
		1820.	Casualties. 1 1 2	
		1332.	Damage to property A.1-C.B.1-D.150/200 Wembley Hall Cinema partly demolished.	

Middlesex County Council Bomb Damage Map

Annex: **M**

Category 1 - "Total damage, building to be demolished."
Category 2 - "Some repairs possible, but could become Cat 1."
Category 3 - "Border line areas, uncertain whether repairs possible, might have to be demolished."

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Approximate site boundary

Project: **390-406 High Road, Wembley HA9 6AL**

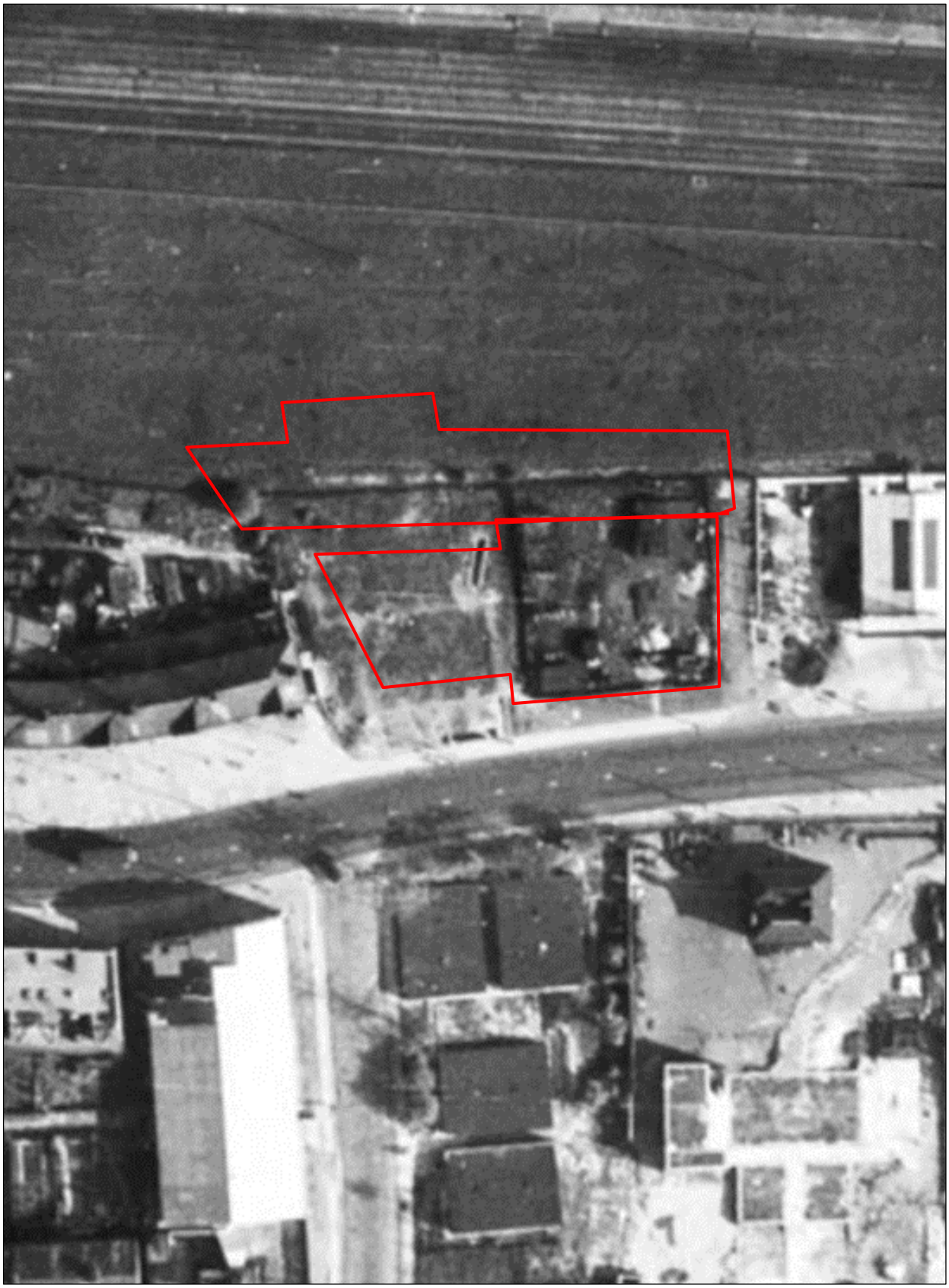
N

Ref: **DA14925-00**

Source: London Metropolitan Archives

RAF Aerial Photography – 20th April 1946

Annex: **N**



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Source: National Monuments Record Office (Historic England)

Approximate site boundary

N