

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at YLCAN – Crouch End.

Recommended Risk Mitigation Measures	
Activity	Recommended Risk 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.
Open Excavations (trial pits, service pits, bulk excavations, strip foundations etc.)	Unexploded Ordnance (UXO) Specialist Presence on Site to support open excavations When on site the role of the UXO Specialist would include: - Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. - Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. - To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Boreholes and Piled Foundations	Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth: 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

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

13th August 2025

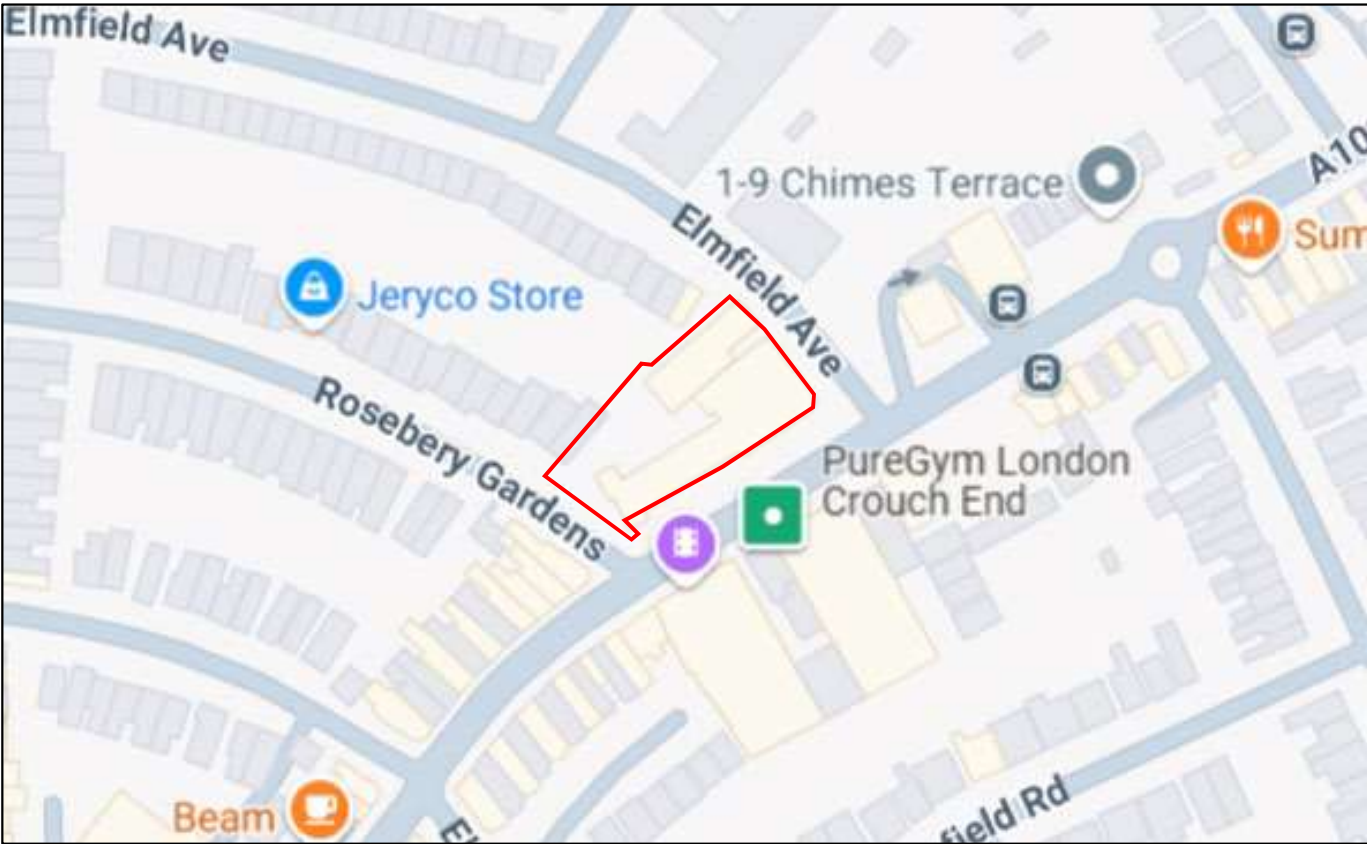
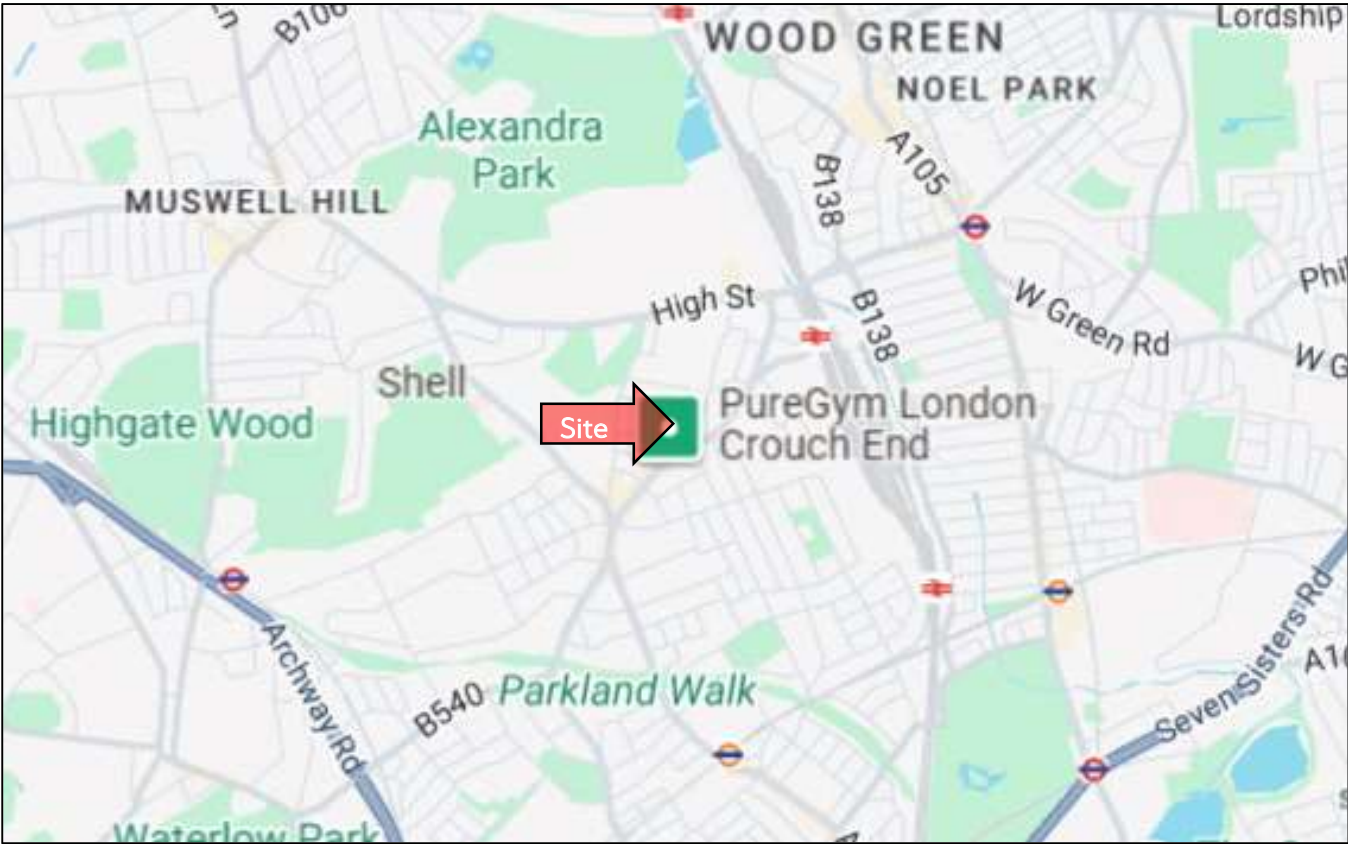
This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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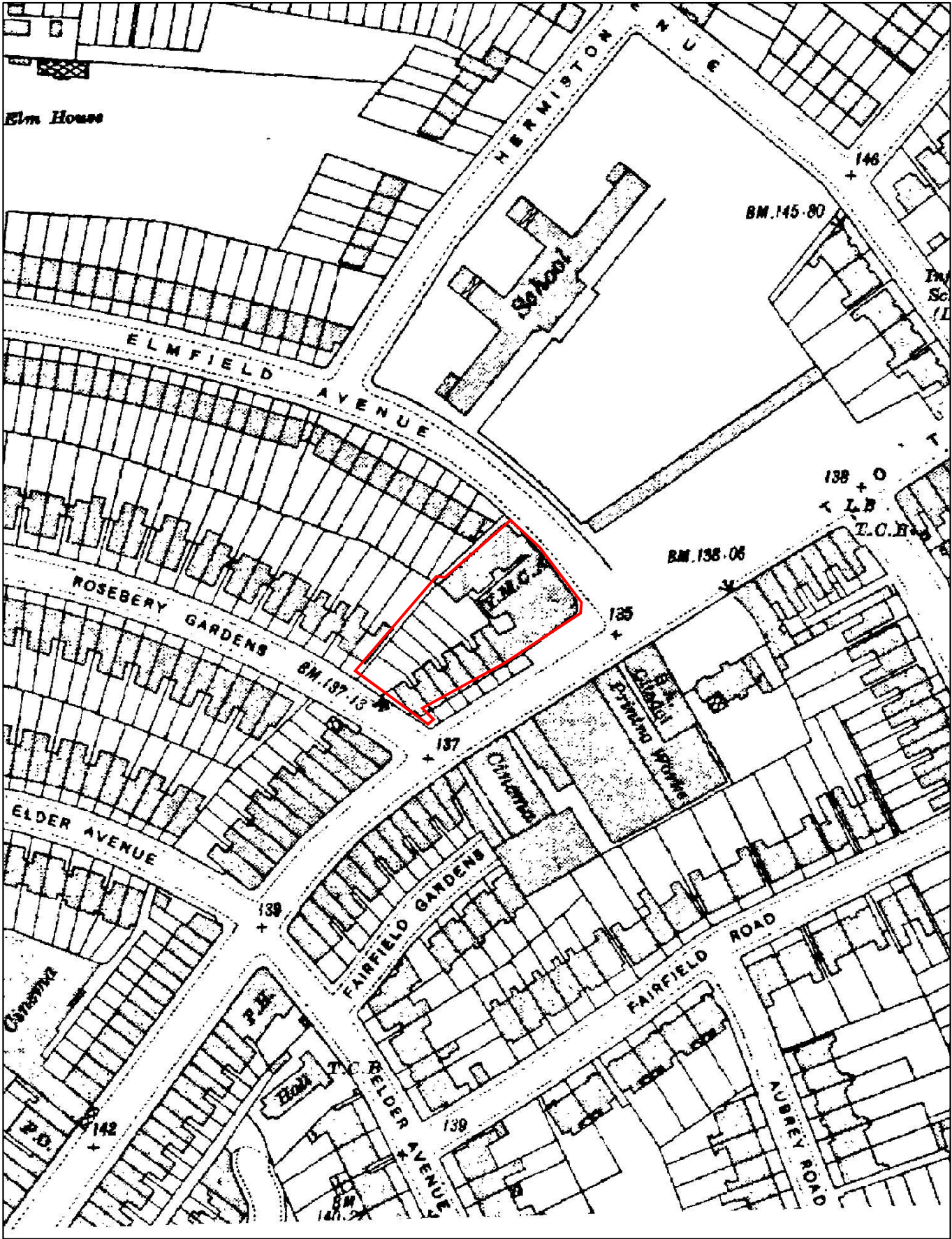
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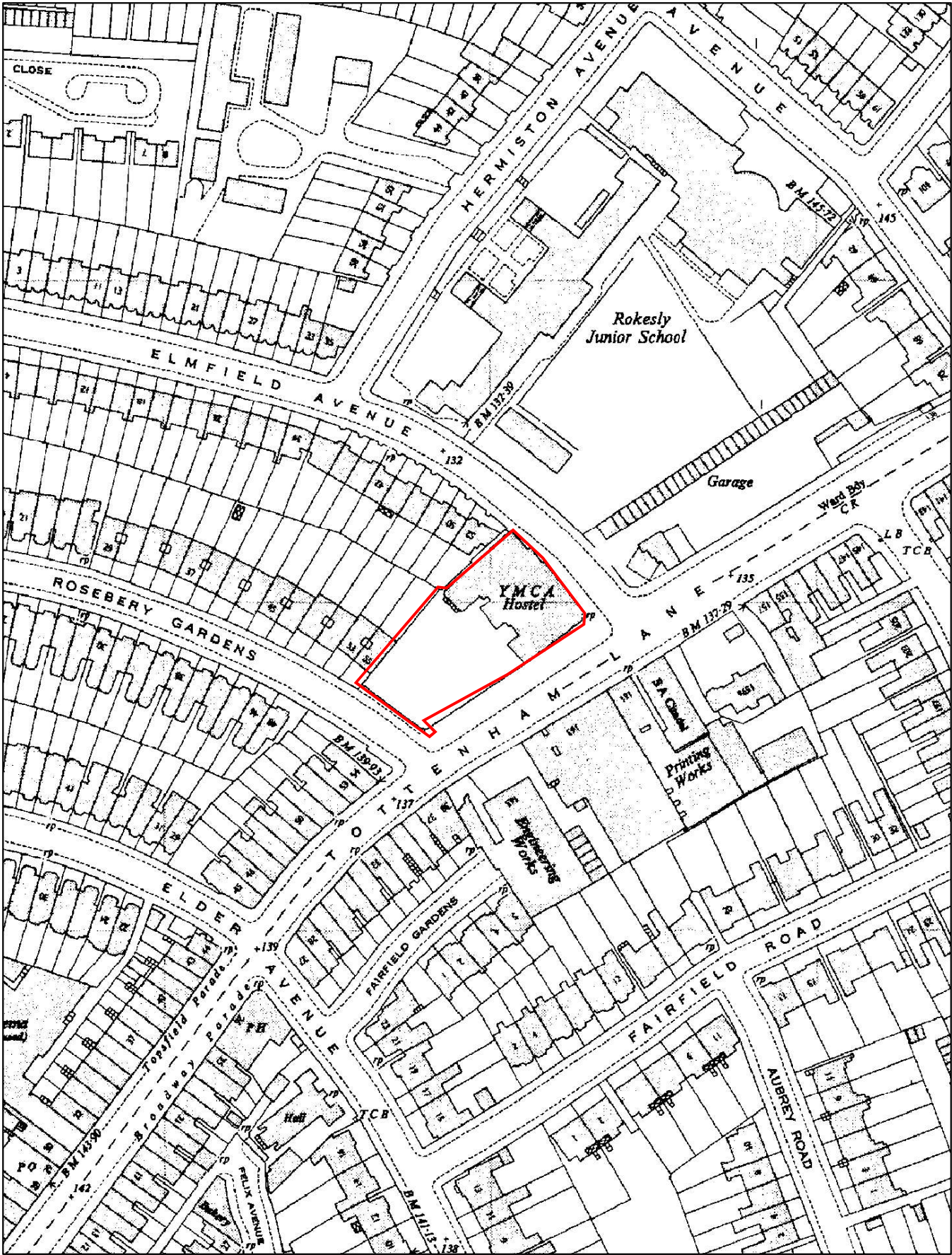
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Client: YMCA London City and North

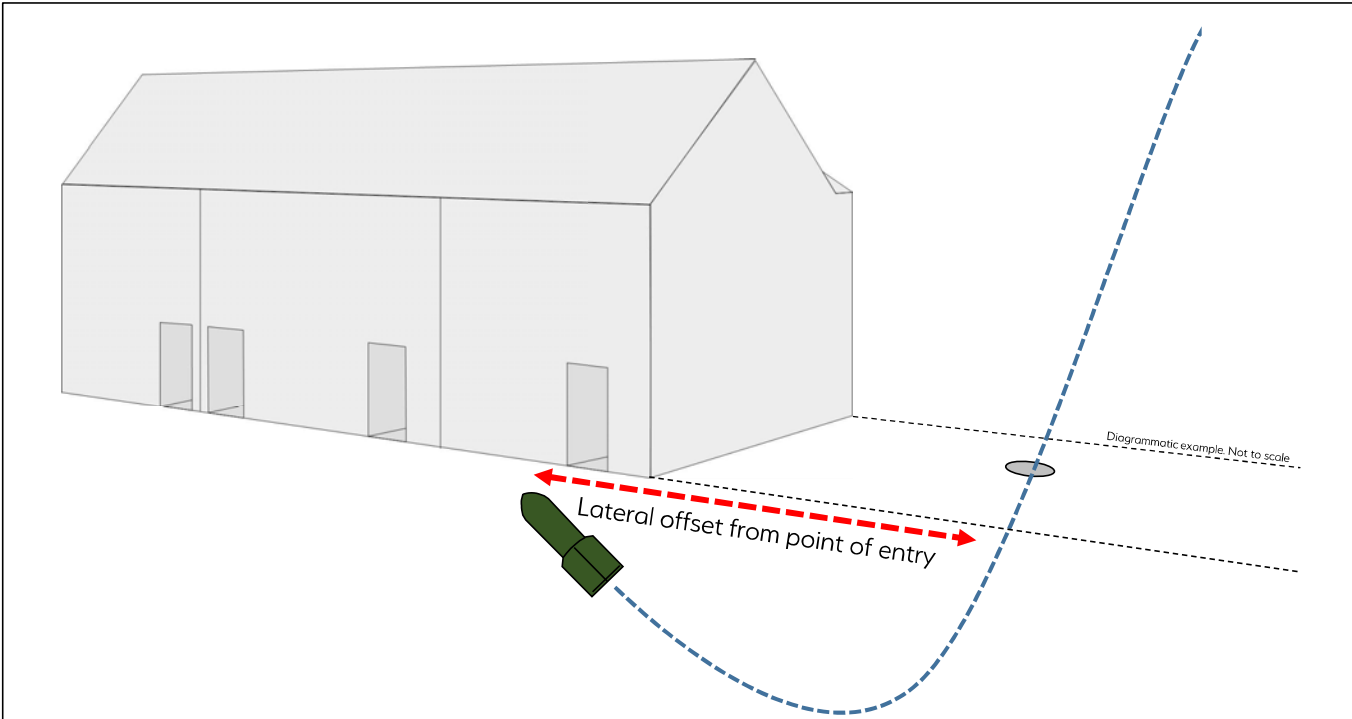
Project: YLCAN – Crouch End

Ref: DA22141-00

Source: Landmark Maps

— Approximate site boundary





Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

The photograph **above** shows a 250kg unexploded bomb found in Bermondsey in 2015, 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**).

BBC

NEWS

WW2 bomb found near London City Airport blown up



An unexploded World War Two bomb found near London City Airport has been detonated.

The 500kg device was discovered at the King George V Dock on Sunday during planned work at the airport.

It was closed and all flights were cancelled on Monday after an exclusion zone was put in place.

The detonation, which took place off Shoeburyness, Essex, was postponed on Tuesday because of high winds and dangerous conditions for divers.

The 1.5m-long German bomb - which was found in a bed of silt, 15m underwater - was carefully removed from the Thames and placed in a secure location a mile away from the coast of Essex.

500kg German HE Bomb, February 2018

BBC

NEWS

Exeter WW2 bomb is detonated after homes evacuated



Exeter WW2 bomb is detonated after homes evacuated

More than 2,600 households and 12 university halls of residence were cleared before the 2,200lb (1,000kg) device **was destroyed** on Saturday.

Police said the blast left a crater about the size of a double-decker bus.

Police have reported large pieces of metal debris hitting buildings and said some properties in the 100m (330ft) exclusion zone had sustained "structural damage".



1000kg German HE bomb, February 2021

BBC

NEWS

Great Yarmouth: Huge blast after unplanned WW2 bomb detonation



Great Yarmouth: Huge blast after unplanned WW2 bomb detonation

A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.

Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT.

People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away.

There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said.

Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe.

250kg German HE Bomb, February 2023

BBC

NEWS

Plymouth unexploded WW2 bomb: Thousands of people displaced



Plymouth unexploded WW2 bomb: Thousands of people displaced

A 500kg (1,102lb) German World War Two bomb that forced the evacuation of thousands of people in Plymouth has been detonated at sea.

The unexploded device was **found in a garden** on St Michael Avenue on Tuesday, sparking four days of disruption.

On Friday police closed roads and rail and bus services were stopped as the bomb was transported 1.4 miles (2.3km) through the city's streets.

The device was taken by boat beyond the breakwater and detonated at 21:51 GMT.



500kg German HE Bomb, February 2024

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

Unexploded hand grenade found in Hampstead Heath pond

Detonation creates 'phantom fire' puff of smoke on banks of Heath pond

Saturday, 12th December 2020 — By [Harry Taylor](#)



A cordon was put up by police while the bomb was detonated on Saturday lunchtime

PART of Hampstead Heath was sealed off by police on Saturday lunchtime after anglers hooked an unexploded Second World War hand grenade from a Heath pond.

Detectives and officers from the Metropolitan Police’s bomb disposal squad were called to the Heath’s number 2 pond just before 11:30am, after a fisherman using a magnet accidentally picked up the grenade. It is believed to be a type-36 “Mills Bomb” explosive from the Second World War.

Michele Martin was out shopping for a Christmas tree with her 19-year-old son near Hampstead Heath overground station, when she saw five police cars and two vans race up South Hill Park.

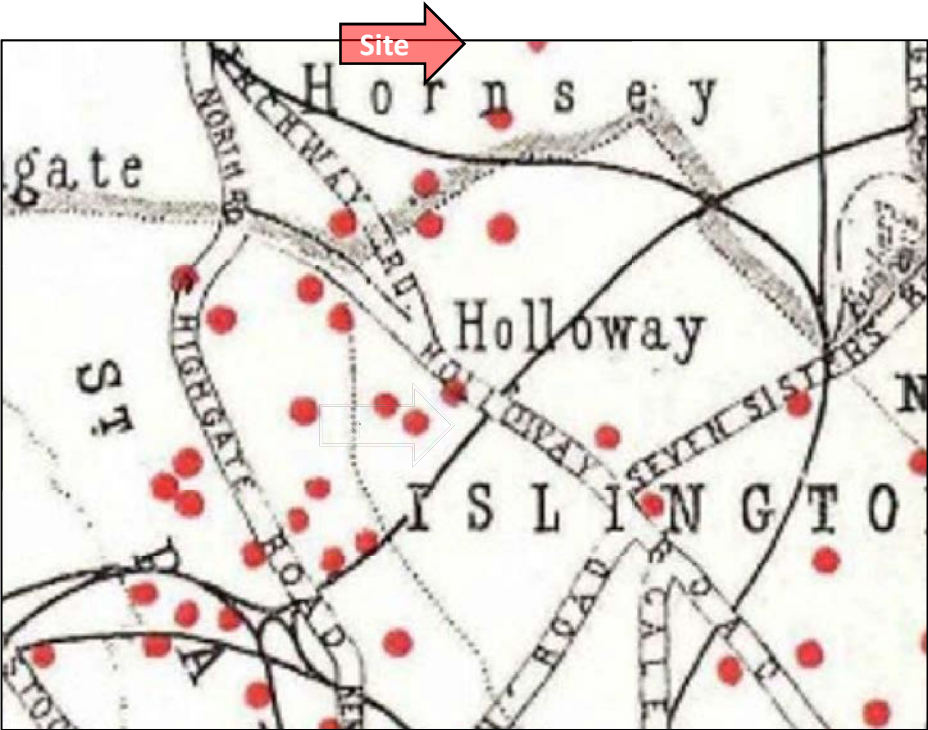
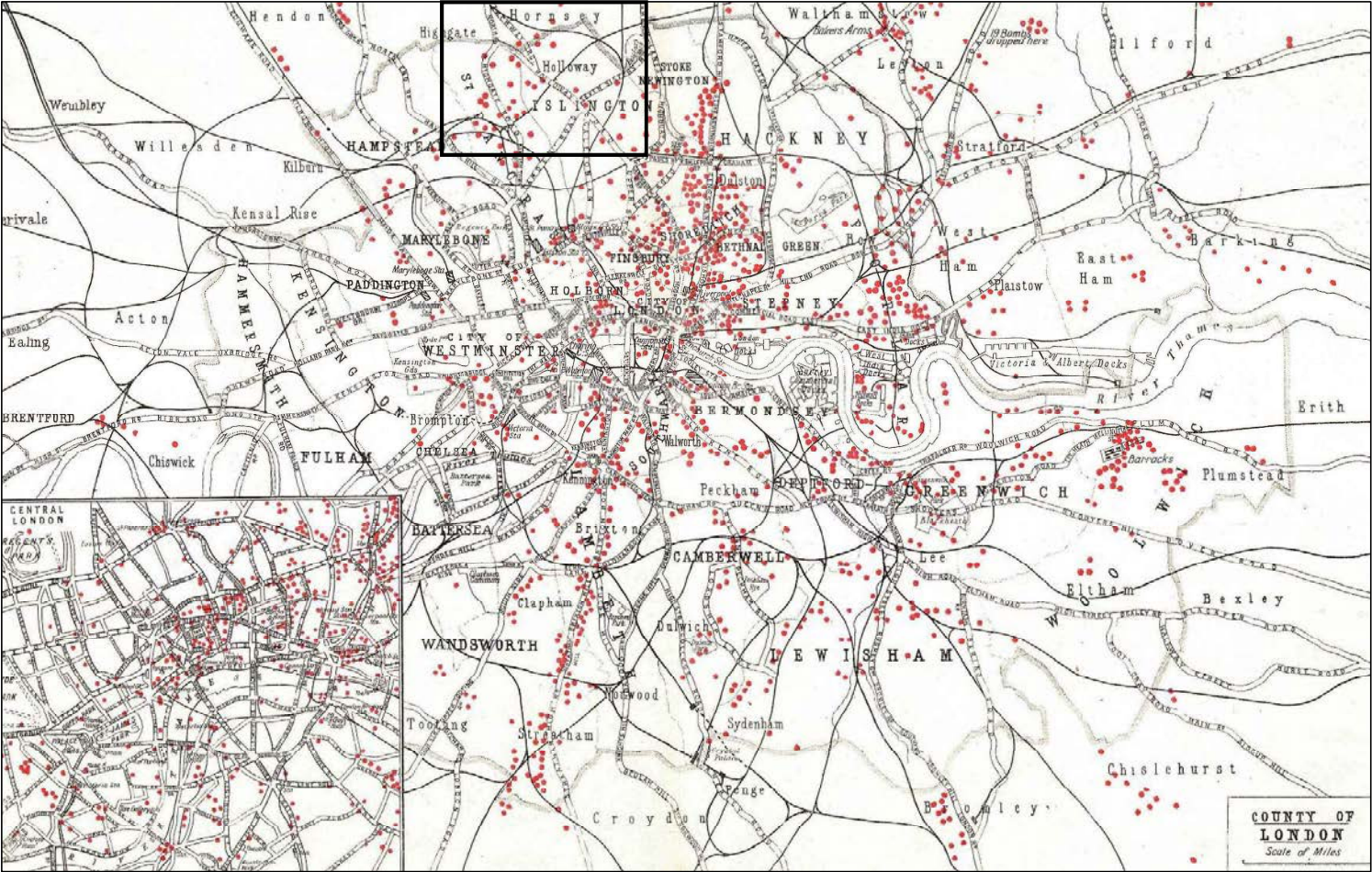
The 54-year-old said: “It was obviously something. Then we were walking back to the car park and noticed that they had started to cordon off the area with police tape all around the pond.

Robert Barta, who was fishing with friends near the path between Hampstead 1 and 2 ponds, said: “Police started to come down [From South Hill Park Gardens], and asked us if we had given them the call. We said no, and they went over to the two guys. I asked them what had happened, and they said they had pulled out a hand grenade.”

As detectives sealed off the area while they dealt with the recently retrieved explosive, dozens of onlookers broke from their Christmas shopping and Saturday morning walks to see what was going on.

“There were two guys, both of them were in camouflage flack looking like fishermen,” said Ms Martin. “They were two brothers from Watford who had come down for the day. The one had found two pennies and had pulled out this pineapple-shaped thing. He was a bit scared and they called the police and they came really quickly.

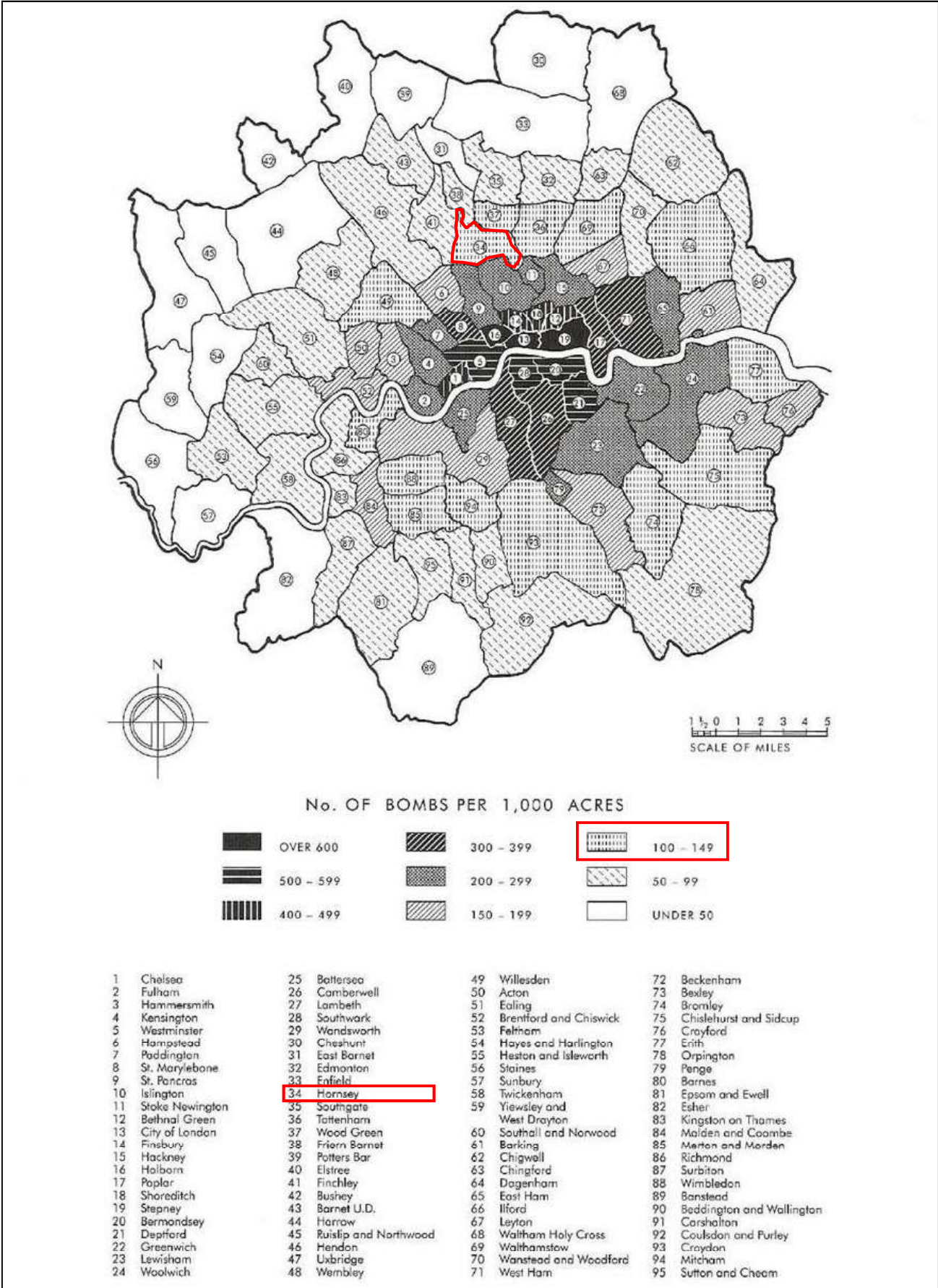
“There were a lot of people, a lot of families out for Christmas with babies, buying trees and stuff. Some people were stopping and saying: ‘Oh we’d better get away if it’s an unexploded bomb’, and moving off quite quickly, some watching, some people saying to the fishermen: ‘Thank you so much, that’s such a dangerous thing to have around here, you’re a hero’.”



Examples of 50 and 100kg German WWI bombs



A zeppelin is recorded to have passed approximately 100m west of the site, though no bomb strikes are indicated nearby.



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Ref: DA22141-00

Source: The London Archives

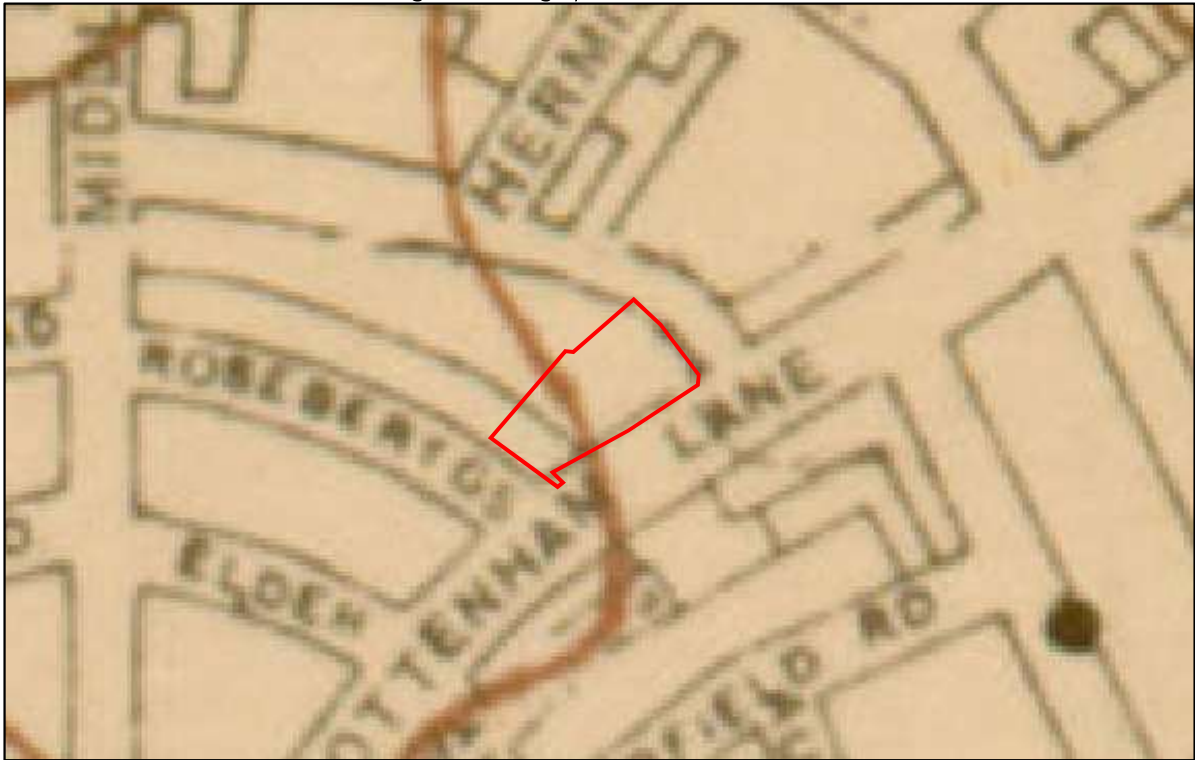




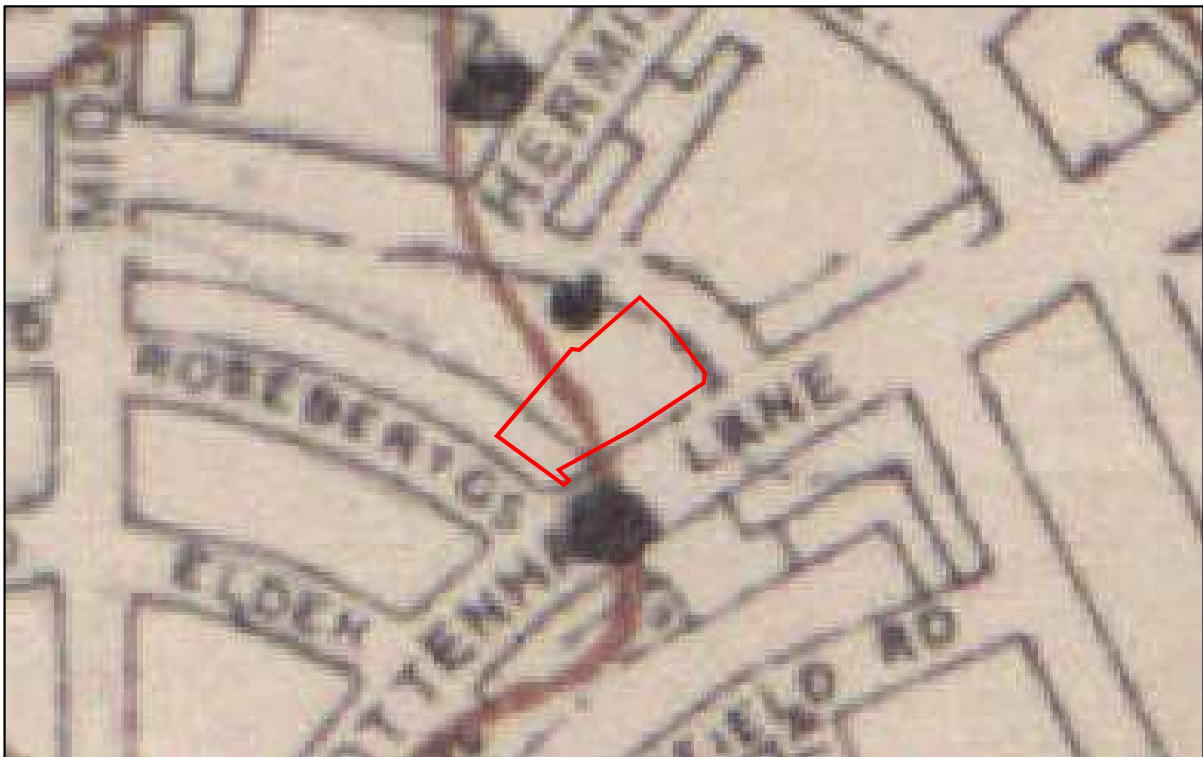
London – Tottenham
A. Water Treatment Works and Reservoir

The site, outside of the scope of this photograph, is located approximately 4.4km west of the Tottenham water treatment works and reservoir.

Night Bombing up to 7th October 1940

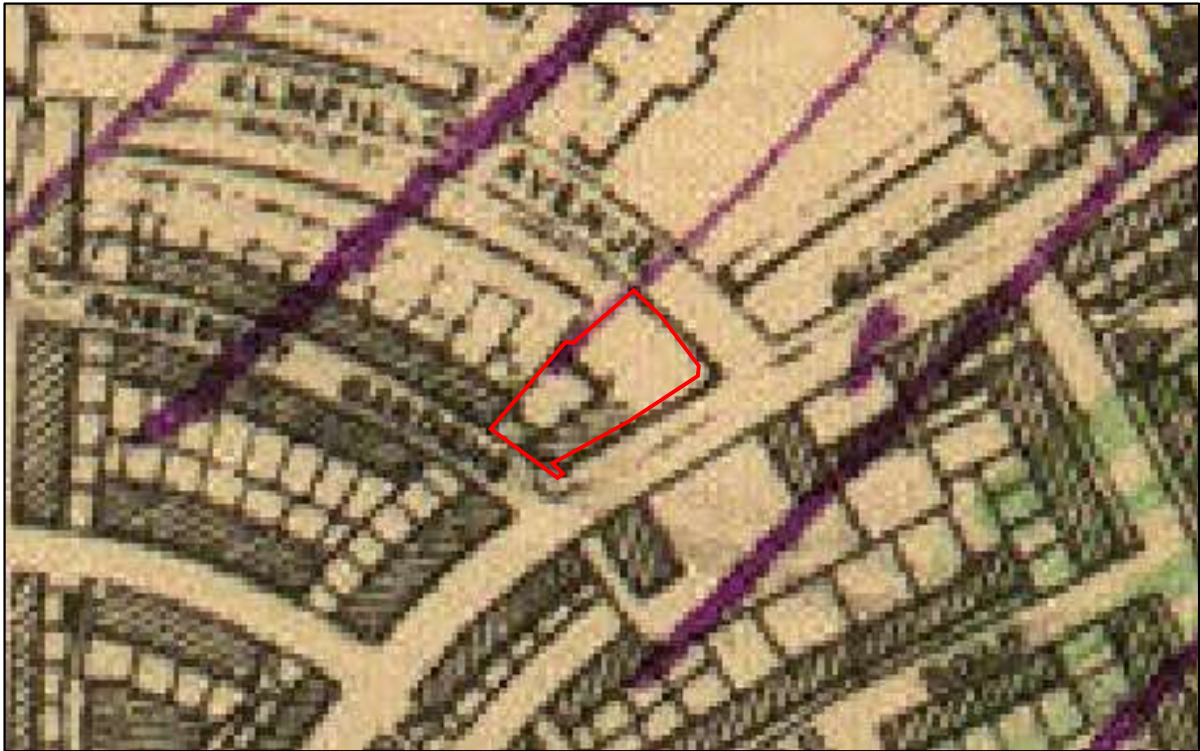


Night Bombing - 7th October 1940 to 6th June 1941

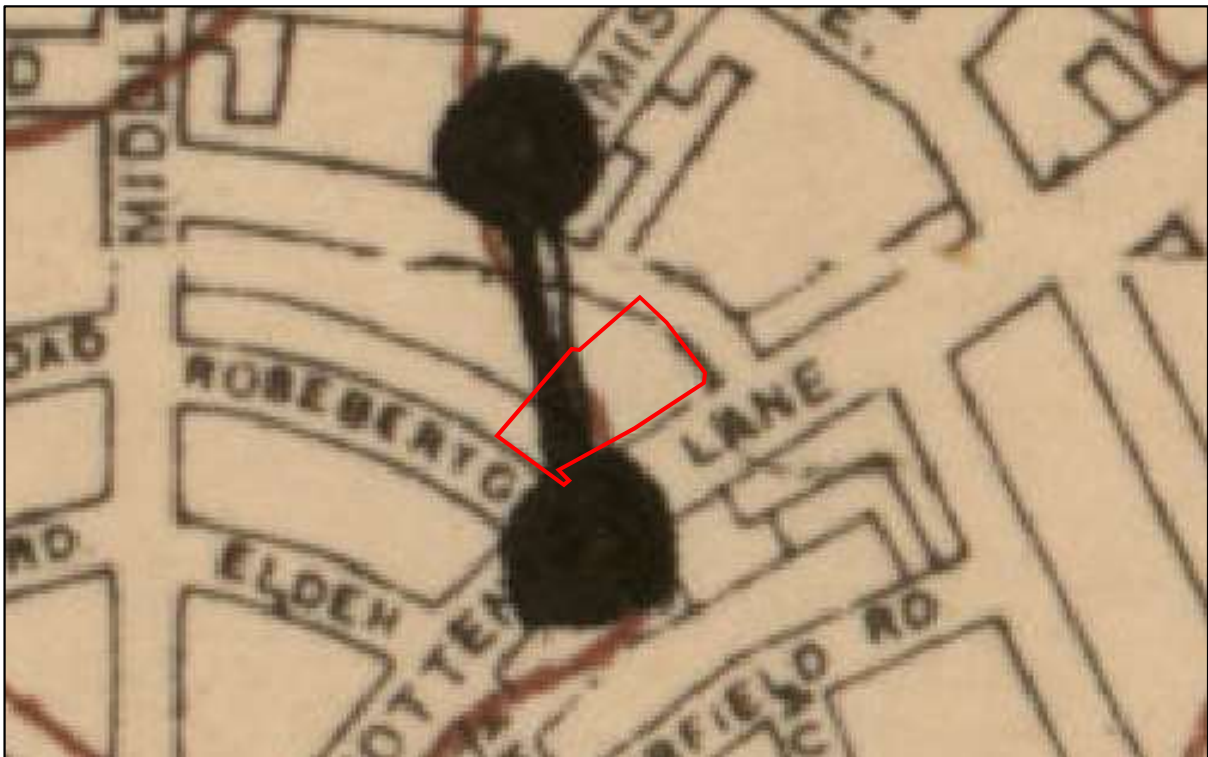


●● Recorded bomb strike

7th -14th October 1940



28th October – 4th November 1940



- 

Recorded HE bomb strike
- 

Recorded incendiary bomb shower
- 

Recorded UXB strike
- 

Recorded oil bomb strike

Key to weekly map symbol colours
Monday - Brown Friday - Green
Tuesday - Vermilion Saturday - Violet
Wednesday - Blue Sunday - Yellow
Thursday - Black

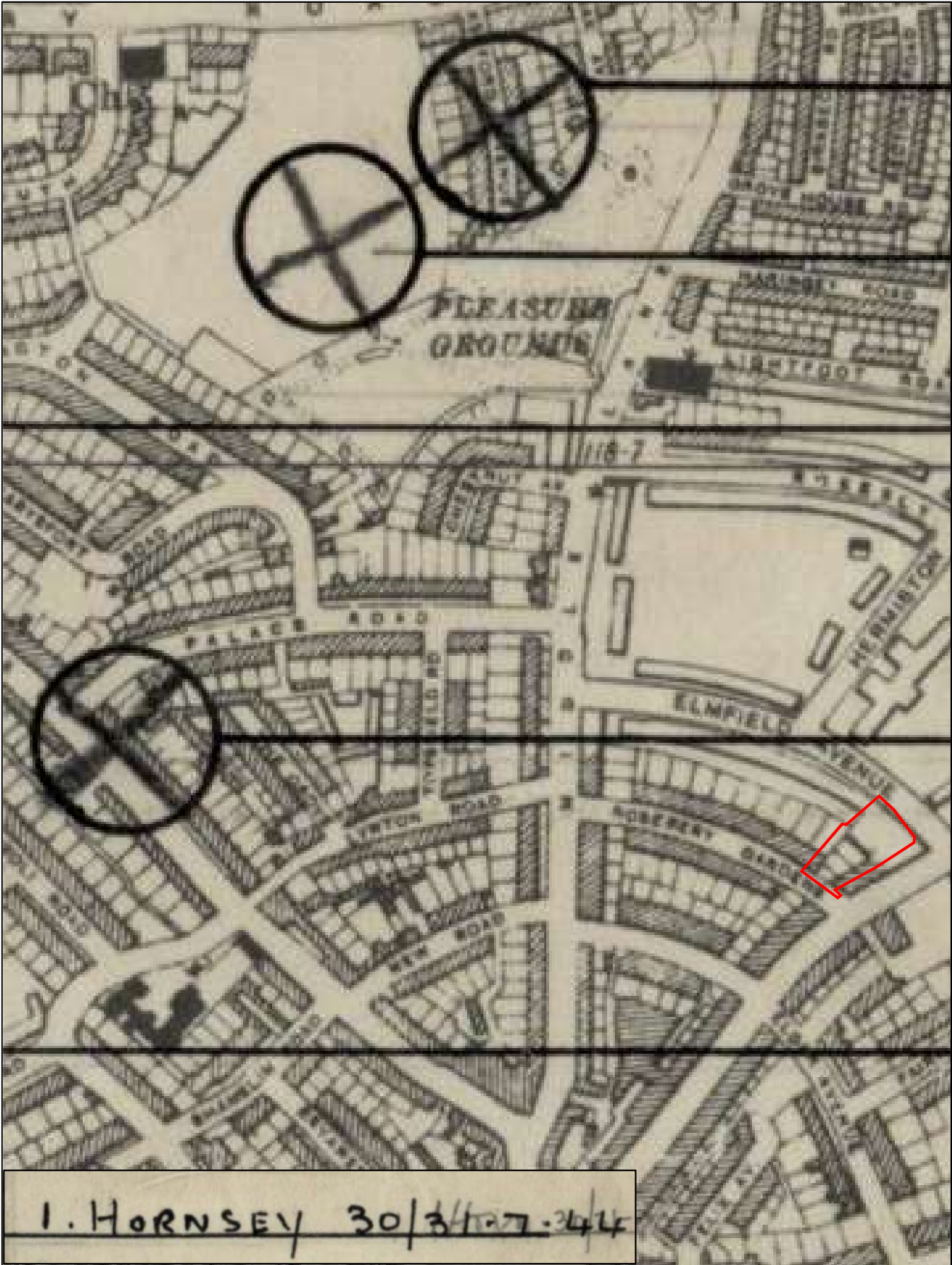
4th – 11th November 1940



- Recorded HE bomb strike
- Recorded UXB strike
- Recorded incendiary bomb shower
- Recorded oil bomb strike

Key to weekly map symbol colours
Monday - Brown Friday - Green
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Wednesday - Blue Sunday - Yellow
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V-1 Flying Bomb



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Source: The National Archives, Kew

Approximate site boundary





DATE	MESSAGE TIME	INCIDENT TIME	PARTICULARS	REMARKS
13/9/40	01.32		Major Damage 00.39 Ux B L.N.E.R. sidings Western Bank North end Hornsey. Minor bombing N.E. & I.B. Roseberry Gardens Crouch End. Fire.	No Casualties 04.36 nose of AA shell found in crater so presume caused fire

DATE	MESSAGE TIME	INCIDENT TIME	PARTICULARS	REMARKS
1/11/40	20.25	19.30	M.B. H.E. Centre of Trinity Park.	No. dam. or Cas.
	22.02.		M.B. H.E. Tottenham Lane. Eastfield Rd. and Hamstead Avenue. (Tottenham Lane for Main of this blocked.	Damage to main
	22.47.			
	22.05.	21.50.	M.B. Oil Bomb. Mount Pleasant Villas Ly. Mountview Road.	No fire. or Cas. Light Damage.
2/11/40.	01.18	22.02.	Major Damage. Flooding Tottenham Lane Damage to Main. Tottenham Lane and Middle Lane blocked.	Cas. 6. Killed 10 Slightly Wounded 6 Slightly Wounded 112 persons evacuated
	01.23.	"	M.B. Fairfield Rd. damage by bomb. Jan incident Elmfield Av. gas. & water main damaged. Cas unknown.	9 people evacuated.
	21.25.	21.04.	Damage A.E. Hamstead Lane near Hamstead Road. Hamstead Lane flooded.	

8.11.40	19.58, 20.51 21.13	19.13	Minor B. H.E. Elmfield Ave & Roseberry Gardens. Casualties: 6 (2 Serious).	Damage to Coal Gas Services.
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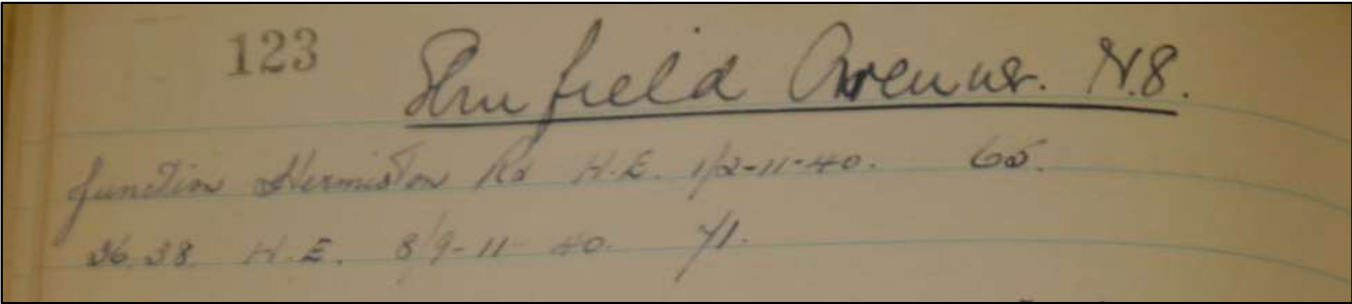
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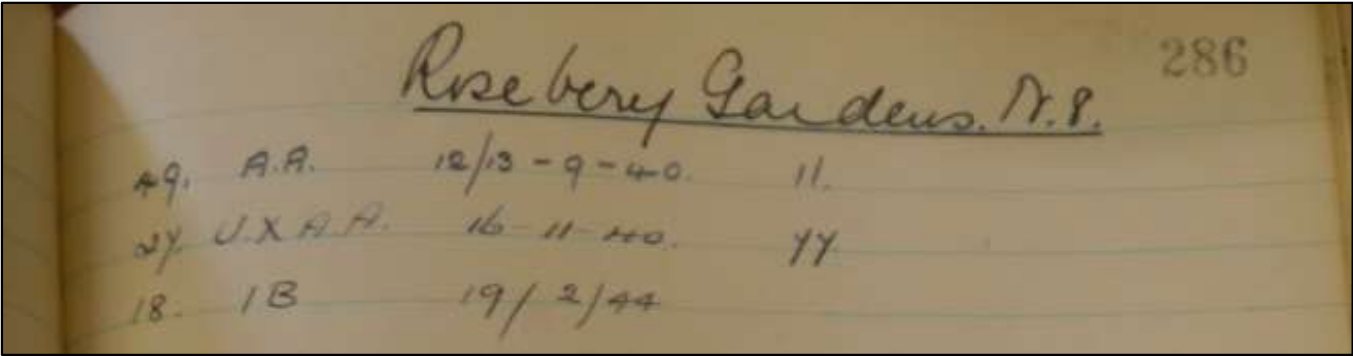
Source: London Metropolitan Archives

— Approximate site boundary

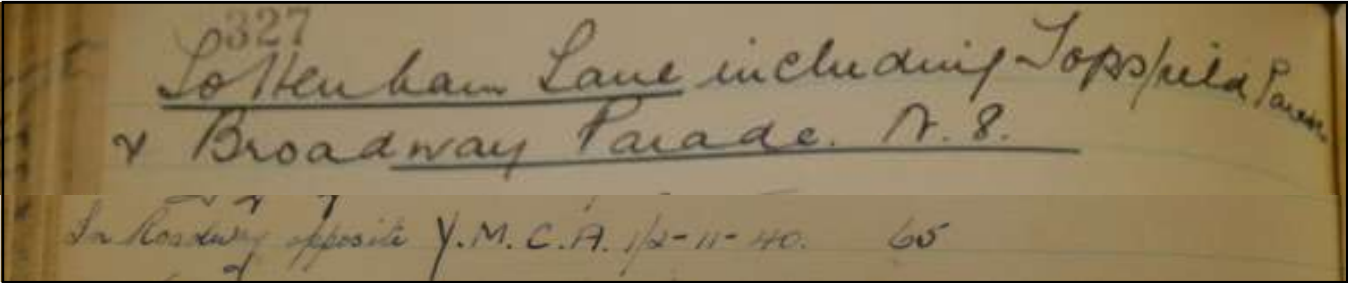




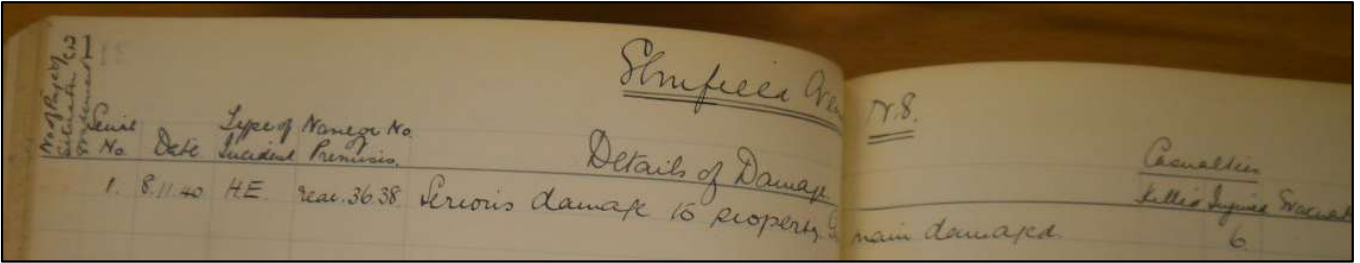
Above: Elmfield Avenue junction Hermiston Road. HE. 1st / 2nd November 1940.
Approximately 60m north-west of the site.
36, 38 Elmfield Avenue. HE. 8th / 9th November 1940. *Approximately 45m north-west of the site.*



Above: A.A. 49 Roseberry Gardens. 12th / 13th September 1940. *Approximately 20m west of the site.*
U.X.A.A. 27 Roseberry Gardens. 16th November 1940. *Approximately 90m west of the site.*
IB. 18 Roseberry Gardens. 19th February 1944. *Approximately 115m west of the site.*

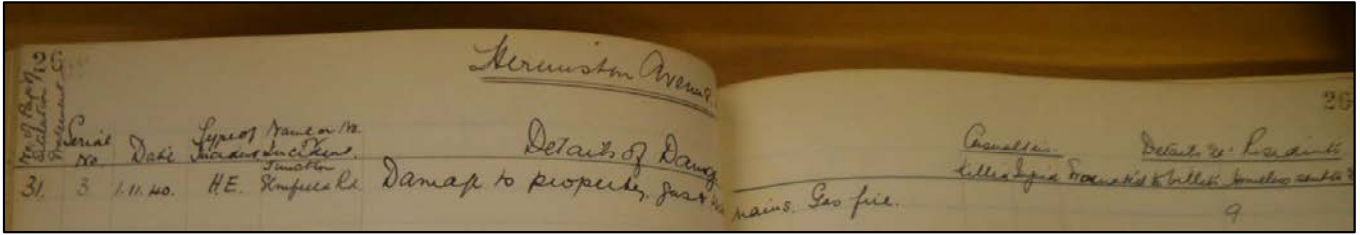


Above: In roadway opposite Y.M.C.A. 1st / 2nd November 1940.
This incident occurred directly east of the site.

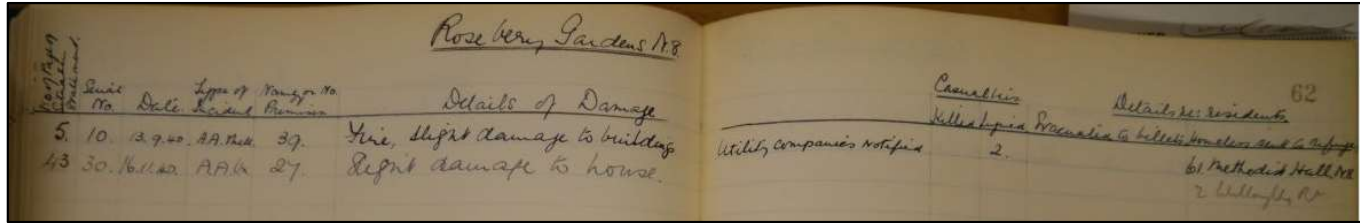


Above: HE at rear of 36 / 38 Elmfield Avenue. Serious damage to property. Main damaged. The date of this incident was 8th November 1940.

This incident occurred approximately 40m west of the site.

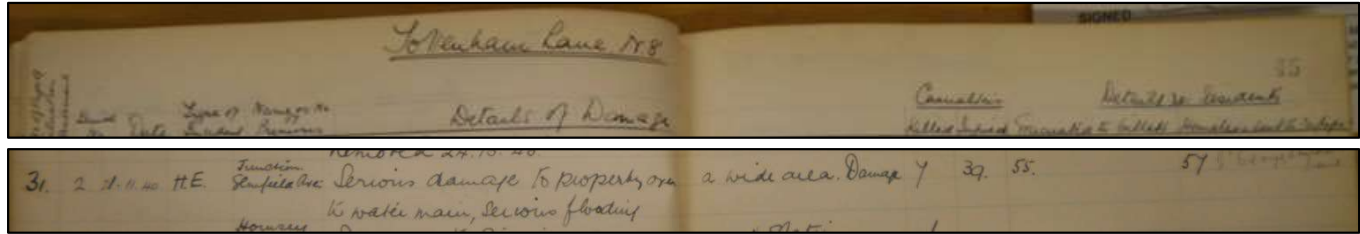


Above: Hermiston Avenue junction Elmfield Road. HE. 1st November 1940.
This incident occurred approximately 60m north-west of the site.



Above: AA Shell. 39 Rosebery Gardens. Fire, slight damage to building. The date of this incident was 13th September 1940.
This incident occurred approximately 50m west of the site.

AA U.X. 27 Rosebery Gardens Slight damage to house. The date of this incident was 16th November 1940.
This incident occurred approximately 90m west of the site.



Above: HE at junction Elmfield Avenue / Tottenham Lane. Serious damage to property on a wide area. Damage to water main, serious flooding. The date of this incident was 21st November 1940.
This incident occurred directly north-east of the site.



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Source: Haringey Archives

— Approximate site boundary



1 Serial No.	2 LOCALITY OF RAID	3 TIME		4 TYPE OF BOMB			5 DAMAGE	6 CASUALTIES		7 STEPS TAKEN TO DEAL WITH DAMAGE	8 CONDITIONS AS TO WIND, MOON, ETC.
		A Initiated	B Report Received	A HE	B HE	C Fusion Gas		Killed	Injured		
1039	ROSEBERY GARDENS	00.33	0034	AA SHELL			TO FRONT OF HOUSE			FA REP. ISF UTILITY GAS NOTIFIED.	

Above: AA Shell on 39 Rosebery Gardens. Damage to front of house. The date of this incident was 11th / 12th September 1940. *This incident occurred approximately 50m west of the site.*

11/11/40	Y.M.C.A. TOTTENHAM LANE	11.11	11.11	HE			WATER MAIN DAMAGE. FIRE.			WATER MAINS STOPPED. FIRE EXTINGUISHED BY TOTTENHAM FIRE BRIGADE.	
11/11/40	HERMISTON AND ELDFIELD AVENUE JUNCTION	11.11	11.11	HE			WATER AND COAL GAS MAINS. FIRE.			WATER MAINS STOPPED. FIRE EXTINGUISHED BY TOTTENHAM FIRE BRIGADE.	

Above: HE on YMCA Tottenham Lane in roadway. Water main damage. Fire. The date of this incident was 1st / 2nd November 1940. *This incident occurred directly east of the site.*

HE. Hermiston and Elmfield Avenue Junction. Water and coal gas. Mains. Fire. The date of this incident was 1st / 2nd November 1940. *This incident occurred approximately 60m north-west of the site.*

8/9/11/40	36 / 38 ELDFIELD AVENUE - REAR	8.11	8.11	HE			COAL GAS. SERIOUS TO PROPERTY.			COAL GAS STOPPED. PROPERTY DAMAGED.	
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Above: HE at 36 / 38 Elmfield Avenue – rear. Damage: Coal gas. Serious to property. The date of this incident was 8th / 9th November 1940. *This incident occurred approximately 40m west of the site.*

16/11/40	27 ROSEBERY GARDENS	00.00	11.23	UX AA SHELL			ROOF - CEILING				
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Above: UX AA Shell. 27 Rosebery Gardens. Damage to roof and ceiling. The date of this incident was 16th November 1940.

This incident occurred approximately 90m west of the site.

19/2/44	18 ROSEBERY GARDENS			ROCKET SHELL			SMALL FIRE				
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Above: Rocket Shell. 18 Rosebery Gardens. Small fire. The date of this incident was 19th February 1944.

This incident occurred approximately 115m west of the site.





- 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."





 Clearance
 Damage