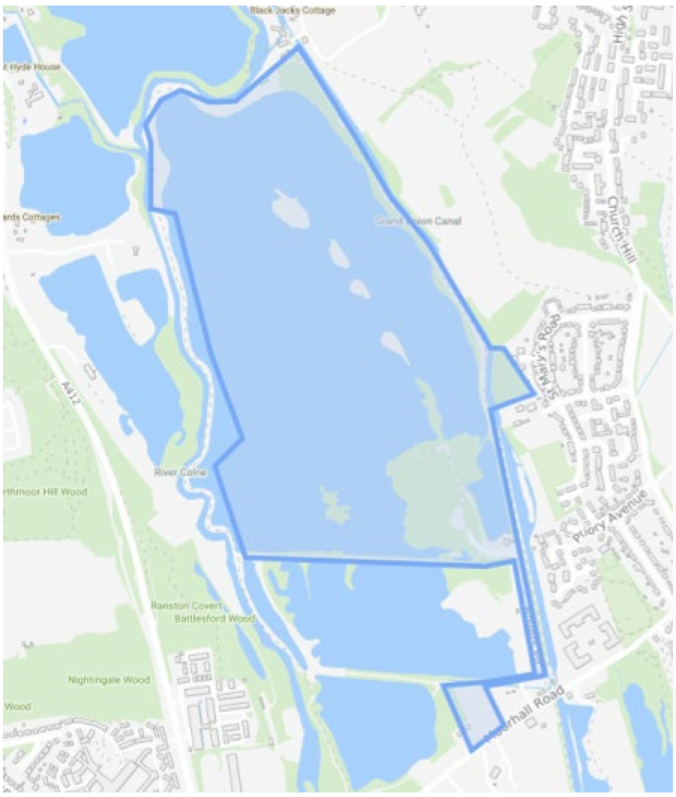
Stage 1 Preliminary Explosive Ordnance Risk Assessment

Project:	Broadwater Lake, Harefield	**Client:**	Geo-Integrity
Doc Ref:	PRA.10144.23	**Issue Date:**	11th September 2023

Conclusion(s)		
SI works	There is a **potentially elevated** likelihood of EO (explosive ordnance) encounter during the anticipated SI works.	
Development works	There is a **potentially elevated** likelihood of EO encounter during the proposed development works.	
Recommendation(s)		
SI works	**Stage 2 Detailed Risk Assessment** to elucidate the potential risk. Alternative option: EOD Engineer onsite supervision of intrusive works.	To receive a Stage 2 DRA quotation: info@impartialassessments.com +44 (0) 207 126 8164
Development works	**Stage 2 Detailed Risk Assessment** to elucidate the potential risk.	

The Site



British National Grid Ref:
TQ 04493 89407

Site Address:
Broadwater Lake
Harefield
London Borough of Hillingdon
UB9 5LY

Note, the Broadwater Lake, Harefield site will subsequently be referred to as the 'Site'.

Introduction

Introduction	A preliminary risk assessment (PRA) is the first stage of the UXO (unexploded ordnance) / EO (explosive ordnance) risk management process. It is a qualitative screening exercise to assess the likelihood of encountering EO during ground works at a given site. The assessment considers the basic factors that affect the likelihood of buried EO being present at a given site today and the likelihood it will be encountered during the proposed works.
Assessment methodology	This desktop risk assessment has been researched and written by a dedicated EO risk analyst and is produced in accordance with CIRIA C681 (2009) and C785 (2019) guidelines on UXO risk assessment. As such, the assessment considers the following five factors: ▶ Site location and Site history / occupancy ▶ Wartime UXO: German bombing, German shelling, and British and Allied anti-aircraft weaponry fire ▶ Domestic military activity: British and Allied armed forces activity during wartime and peacetime ▶ Mitigating Factors ▶ Extent of the proposed ground works Note, the likelihood of EO initiation / detonation and consequence(s) of EO initiation / detonation are assessed at Stage 2, not Stage 1. The numerical preliminary risk rating calculation included within this PRA is a unique Impartial Assessments Ltd (IAL) methodology that makes for a transparent and accountable risk assessment process.
Information sources	This assessment draws on preliminary research utilising information sources immediately available to IAL at the time of writing. The availability of historical information will differ depending on the Site's location. As an absolute minimum, all IAL Stage 1 PRAs involve analysis of recent aerial photography, historic OS mapping, original WW2 bombing density records and our PIEO (potential indicators of explosive ordnance) GIS map. The PIEO map plots our vast database of locations and incidents of interest.
Stage 1 objective	The main objective of a Stage 1 PRA is to confirm whether or not further research is required to verify the EO risk. If a low risk cannot be confirmed at Stage 1, a Stage 2 Detailed Risk Assessment (DRA) will be recommended.

The Site and Proposed Works

Current Site occupancy		A large gravel pit lake with some small, vegetated islands, and vegetated banks. At the southeast edge of the lake, there is a large wooded area (sand / gravel). A sailing club (comprising buildings, boat storage area, and jetties) occupies the lake's northern bank, and the southern Site extent comprises an access track leading to a field (unmaintained grassland).
WW1-era / WW2-era Site occupancy (OS maps review)		Pre-WW1: Agricultural land intersected by drainage ditches, the Grand Union Canal, and a towing path. Gardens and open ground associated with Broadwater Farm, occupy the Site's eastern extent. During WW1: Unchanged. Pre-WW2: Unchanged. Post WW2: Unchanged by the 1950s. A sand / gravel extraction pit between the 1960s and the 1980s.
Risk mitigating factors	Shallow ground disturbance?	Years of post-war agricultural ploughing may have affected the farmland on Site, partly mitigating the shallow buried EO risk. Large-scale sand / gravel extraction will almost certainly have fully mitigated the risk within the affected area (the existing lake).
	Deep ground disturbance?	The post-war sand / gravel extraction probably disturbed deep levels (>2.0m bgl).

	Military EO clearance activity	Highly unlikely to have occurred on Site historically.
Proposed works		Development works comprise the demolition of existing buildings, prior to the creation of the new Hillingdon Watersports Facility and Activity Centre, which will see the construction of several buildings, pontoons, slipways, a boat shed, equipment storage, car parking, access, floating islands, fixed islands, soft and hard landscaping. Ground works involve localised dredging, land reclamation, and a mix of traditional concrete foundations and piling. At the time of writing, SI works had already been completed, however further SI may be required.

Enemy Action during WW1		
UXO source	Relevance	Details
German aerial bombing	Irrelevant	Note, Middlesex was not bombed during WW1.
German naval shelling	Irrelevant	n/a

Enemy Action during WW2	
German aerial bombing	
Indicator	Assessment
Bombing density	**Wider Area:** The Urban District of Uxbridge sustained 20.7No. ‘iron’ bombs / 1,000 acres, a low-to-moderate bombing density. Note, this is the official government bomb census figure. ‘Iron’ bomb refers to large (>40kg) thick-steel-cased bombs (most of which were high explosive filled). The bomb census did not report the numbers of small (1kg / 2kg) incendiary bombs (IBs), millions of which were dropped on the UK.
	Locally: The Site was situated in close proximity to a confirmed Luftwaffe target, and several potential targets, which could conceivably have caused an elevation in the localised bombing density.
Confirmed Luftwaffe bombing targets	Original Luftwaffe target records identify Denham Airfield (740m west of the Site) as the closest bombing target.
Potential secondary / opportunistic targets	The Grand Union Canal located within the Site boundary, alongside Denham Film Studios 460m west, a large industrial works 770m north, and a railway line 920m south of the Site.
British bombing decoys sites	None installed locally. The closest decoy was approximately 10.7km south southwest of the Site.
Evidence of bomb damage	No substantial buildings to which damage could be sustained (and recorded) occupied the Site. No such evidence identified in the vicinity.
Evidence of bombing incidents	Some original bombing incident records were unavailable within the time frame of this report and analysis of all original bombing incident records is beyond the scope of this report. Original bomb census mapping plots an ‘iron’ bomb strike on Site and a further nine strikes within ~200m. Note, detailed research could conceivably identify additional local incidents.

German land-based (French coast) artillery shelling	
Is the Site located within an area subjected to shelling?	No.

Domestic Military Activity		
Source of EO	Relevance	Details
WW1 anti-aircraft (AA) artillery fire	Unlikely	Two heavy anti-aircraft (HAA) gun batteries were active within firing range of the Site. Note, many WW1 AA guns did not occupy fixed batteries. They were instead mounted on vehicles and therefore mobile. The number of active guns within range could therefore have been higher. However, these AA guns would have expended a very small quantity of ammunition.
WW2 anti-aircraft artillery fire	Potentially	► 13No. HAA gun batteries were positioned within firing range of the Site. ► One permanent light AA gun battery was active within autocannon firing range of the Site. However, two RAF airfields within autocannon firing range of the Site probably saw a mix of temporary and permanent light AA gun deployments. ► No U.P. rocket projector (ZAA) batteries were active within firing range of the Site. Luftwaffe and V1 Bomb activity in the region was frequent. These batteries would have expended ammunition over the wider area on multiple occasions, however most engagements will have been short.
Military bases / installations	Irrelevant	n/a
Military training areas / weapons ranges	Irrelevant	n/a
Munitions or explosives factories	Irrelevant	n/a
Munitions storage depots	Irrelevant	n/a
Defence fortifications / other measures	Potentially	From 1940, London and by extension Harefield, were fortified in anticipation of a German invasion and land attack. The outer London anti-tank stop-line (Line ‘A’) was marked by the Grand Union Canal (utilising it as an anti-tank obstacle) and therefore defence activities affected the east Site boundary. Initial research has identified one pillbox fortification ~25m east of the Site boundary and the possibility that additional defensive measures were established within the Site boundary cannot be ruled out at this preliminary stage.
WW2 minefields	Unlikely	No evidence found at this preliminary stage.
Wartime requisition	Potentially	No evidence found at this preliminary stage. However, the presence of a stop-line raises the possibility that parts of the Site were temporarily used by the British Army.

WW2 Home Guard (HG) activity	Potentially	Soldiers of 14th Middlesex (Uxbridge) HG battalion would have been responsible for the defence of the wider study area. Given the presence of the stop-line, Site access by armed HG troops cannot be ruled out at this preliminary stage. Note, experience suggests that during WW2, bodies of water (e.g. canals) were often used as a hassle-free means of unwanted ammunition disposal - an unauthorised activity.

Key Findings

German UXO:	Is the study area known to have experienced or probably did experience an elevated WW1 and / or WW2 bombing density?	**Yes**
	Did the Luftwaffe earmark any targets within 3km of the Site for attack?	**Yes**
	Would the study area have been vulnerable to small-scale random / indiscriminate bombing? i.e. due to proximity of heavily bombed urban area or an individual / isolated primary target.	**Yes**
	Evidence of an officially abandoned unexploded bomb (UXB) in the vicinity?	**No**
	Has preliminary research identified evidence of bombing within 500m of the Site, direct evidence (recorded bomb strike) or indirect evidence (structural damage or bomb crater)?	**Yes**
	Did (or could) the Site boundary have encompassed risk elevating ground cover during WW1 and / or WW2?	**Yes**
	Could part(s) of the Site have been neglected / inaccessible during WW1 and / or WW2?	**Yes**
	Additional observations / considerations.	None.

British / Allied EO:	Was AA weapon ammunition expenditure significantly elevated within firing range of the Site during WW1 and / or WW2?	**Yes**
	Could an unexploded AA projectile strike have gone undetected / unreported on Site, due to risk elevating wartime occupancy / ground conditions?	**Yes**
	Has evidence of wartime or peacetime military activity affecting the Site been identified?	**Yes**
	Does the Site's location / position / occupancy raise the possibility of temporary wartime military activity affecting the Site? e.g. invasion defences activity or military requisition.	**Yes**
	Could HG soldiers have accessed / utilised the Site during WW2?	**Yes**
	Additional observations / considerations.	None.

Likelihood of EO remaining and EO encounter:	Does undisturbed WW2-era soil (that could be EO contaminated) remain at shallow depths (<1.5m bgl) on Site today?	**Possibly**
	Does undisturbed WW2-era geology (that could be German UXB contaminated) remain at deeper depths (>2.0m bgl) on Site today?	**Yes**

Will the proposed ground works intrude the zone of potential EO contamination?		**Yes**
Are 'blind' intrusions (piling works and / or boreholes) planned?		**Yes**
Additional observations / considerations.	As the locations of the proposed development were not known at the time of writing, analysis regarding the likelihood of EO encounter are limited. As the depths / extent of post-WW2 sand / gravel extraction was not known at the time of writing, analysis regarding the degree of EO risk mitigation are limited.	

Preliminary (Indicative) Risk Calculation

The preliminary risk rating calculation involves three elements:

- The likelihood of EO contamination (Site location and history)
- The likelihood of EO remaining on Site today (the extent of any risk mitigating factors)
- The likelihood of EO encounter during the proposed works (the degree and type of proposed soil disturbance)

Each factor is numerically rated (**1 to 5**). For 'likelihood of EO contamination' and 'likelihood of EO encounter', **one** is the lowest likelihood. For 'likelihood of EO remaining', **five** is the lowest degree of risk mitigative activities.

When added together, a final score of **eight or more** triggers the recommendation of a Stage 2 DRA.

Proposed Works	Contamination	Risk Mitigation	Proposed Soil Disturbance	Risk Rating Calculation	
	1 = lowest | 5 = highest	1 = highest | 5 = lowest	1 = lowest | 5 = highest		
SI works	3	3	2	3+3+2=	**8**
Development Works	3	3	3	3+3+3=	**9**

Further research is required to locate all local bomb strikes, assess the orientation of local bomb sticks (aircraft bombloads) in relation to the Site, to elucidate the historic Site occupancy / ground conditions, to elucidate the local WW2 army / HG activity, and to elucidate the extent of post-WW2 sand / gravel extraction activities.

A Stage 2 Detailed EO Risk Assessment is recommended prior to further SI and development works commencing.

IAL has exercised all reasonable care, skill and due diligence in preparing this risk assessment. However, a low-risk conclusion at Stage 1 does not mean 'no risk'. For example, it is impossible to identify locations where members of the public have previously buried unwanted (often inherited) EO on private land (such as residential back gardens). Such EO contamination is not uncommon.

IAL cannot be held responsible for any inaccuracies or omissions within any records / information relied upon to conduct this risk assessment.

IAL is not liable for any relevant records / information that has become available subsequent to this risk assessment's issue date.

IAL cannot accept liability for subsequent changes to Site conditions that could affect the risk level.

At the time of writing, the relevant UK construction industry guidelines on explosive ordnance risk assessment (CIRIA) were adhered to. Subsequent revisions to these guidelines or new guidelines / legislation may render part(s) of this report obsolete. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.

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