Basement Impact Assessment

Former Stag Brewery, Mortlake

April 2023

Waterman Infrastructure & Environment Limited

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Client Name:	Reselton Properties Limited
Document Reference:	WIE18671-100.R.24.2.2.BIA
Project Number:	WIE18671

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001: 2018)

Issue	Date	Prepared by	Checked by	Approved by
First	March 2023	Jon Coates Senior Consultant	Freddie Alcock Technical Director	Andrew Harrison Director
Second	April 2023	Jon Coates Senior Consultant	Freddie Alcock Technical Director	Andrew Harrison Director

Comments

Second Issue. Updated following comments for Gerald Eve

Disclaimer

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Site Details

Site Details	Applicant Information
Site Name	The Former Stag Brewery Mortlake
Planning Application reference	22/0900/OUT / 22/0902/FUL
Address and postcode	The Former Stag Brewery, Lower Richmond Road, Mortlake, London SW14 7ET
Brief description of works	Redevelopment of the former Stag Brewery for residential-led mixed use
Geology type	Made Ground, over Kempton Park Gravel Member over London Clay Formation
Presence of Aquifer	Alluvium and Kempton Park Gravel Member Secondary A Aquifer
Total site area	9.25 ha
Is the site currently known to be at risk of flooding from any sources	The Site is indicated to be within an area at between 50% and 75% risk of groundwater flooding

Chartered Professional Verification

Professional Details	Application Information
Name	Andrew Harrison
Profession / area of expertise	Structural Engineer
Chartered institution and membership level	Institution of Structural Engineers - Member
Brief description of assessment involved	Review and signoff of Basement Impact Assessment prepared in general accordance with LBRuT's Good Practice Guide on Basement Developments (2015).
Brief summary of assessment results	The various environmental studies undertaken indicate the development's substructure will not lead to significant impacts or an increase in flood risk to the Site or surrounding area. Appropriate mitigation measures will be incorporated to manage surface water run-off from the development, prevent water ingress into the new basements, and protect off-site assets. Detailed ground investigation will be undertaken post determination. Information gained from detailed ground investigation will be used to inform ground movement analysis to assess the performance of the proposed raft, piles and pile/raft interface. The detailed ground investigation will be a combined geotechnical and environmental investigation.
Signature	

1. Introduction

1.1 Objectives

Waterman Infrastructure & Environment Limited ("Waterman") was instructed by Reselton Properties Limited to prepare a Basement Impact Assessment to support two linked planning applications, Application A (22/0900/OUT) and Application B (22/0902/FUL) for the proposed redevelopment of the former Stag Brewery in Mortlake within the London Borough of Richmond upon Thames (LBRuT) (hereafter referred to as "the Site").

This report should be read in conjunction with the following reports:

- Basement Screening Assessment, WIE18671-100-BSA-16.1.4-RJM, August 2022, prepared by Waterman Infrastructure & Environment Ltd;
- Drainage Strategy, WIE18671-104-R-11-7-2-DS, April 2023, prepared by Waterman Infrastructure & Environment Ltd;
- Arboricultural Impact Assessment, WIE18671-102-R-6-4-2-AIA, March 2023, prepared by Waterman Infrastructure & Environment Ltd;
- Structural Impact Assessment, STR13514-SIA-DH, March 2022, prepared by Waterman Structures Ltd;
- Environmental Statement, WIE18671-100-ES-3.1.1, March 2022, Waterman Infrastructure & Environment Ltd;
- Preliminary Risk Assessment, WIE18761-106-R-8.2.1-RJM, February 2022, prepared by Waterman;
- Built Heritage Assessment, WIE18671-100-R-9-2-2, February 2022, prepared by Waterman;
- Flood Risk Assessment, FRA - 512_Stag_Brewery_FRA_v5d_220303, February 2022, prepared by Hydro-Logic Services;
- Ground Investigation Report, WIE10667-101-R-4.2.1-RJM, February 2018, prepared by Waterman;
- Report on Preliminary Ground Investigation, 10022/OT/JRCB, November 2016, prepared by Soil Consultants; and
- Phase 2 Environmental Site Assessment Report, 47075502, September 2015, prepared by AECOM.

1.2 Proposed Development

Planning permission for the development is sought in two parts (see Figure 1); detailed planning permission for the eastern half of the Site and outline planning permission for the western half of the Site for a residential-led mixed-use development (Application A) alongside a detailed school application within the western part of the Site (Application B).

These applications seek planning permission for the following:

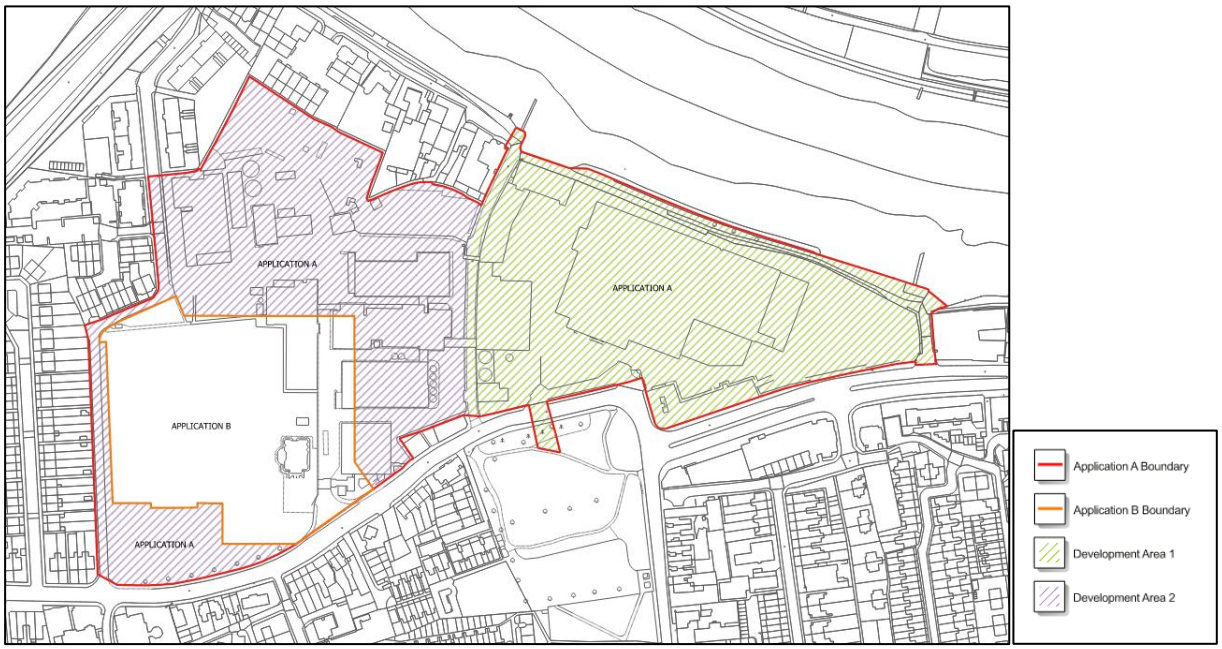
- **Application A (22/0900/OUT):** a hybrid planning application for the demolition of the majority of buildings (except for the Maltings, the façade of the Former Bottling building and the façade of the Former Hotel) and structures within the Site and the redevelopment of the majority of the former Stag Brewery. To the east of Ship Lane, planning permission is sought in detail for the construction of 549 residential units (as amended), flexible use floorspace, office, cinema, hotel / pub with rooms, and community use, flood defence works, towpath works, landscaping, amenity space, play space, public

open space, car and cycle parking, installation of plant and energy equipment, new accesses, internal routes, and various associated works (Development Area 1). To the west of Ship Lane, planning permission is sought in outline (with all matters reserved) for up to 522 residential units (as amended), and various associated works (Development Area 2).

- **Application B (22/0902/FUL):** a detailed planning application for the construction of a six-form entry secondary school with associated sports pitch and play space, floodlighting, landscaping, car and cycle parking, new access routes and associated works to the west of Ship Lane in the area of the Site that is not covered by Application A.

The two Planning Applications are separate but will be linked through a S106 Agreement.

Figure 1: Planning Application Boundaries - Applications A and B



1.3 Regulatory Context

Planning applications which feature basements require the submission of supporting information regarding the potential impact the proposed development will have. The Applicant needs to show the development will not adversely impact the site itself, neighbouring properties, and the wider natural environment, including impacts to groundwater and water transferred via throughflow[1].

LBRuT's Basement Assessment User Guide (2021) requires preparation of a Basement Screening Assessment if the proposed development site falls within an area with >=25% susceptibility to groundwater flooding and/or is in one of the four throughflow catchment areas, as shown on LBRuT's Strategic Flood Risk Assessment (SFRA) map.

The Site falls in an area with >=25% susceptibility to groundwater flooding. Therefore, a Basement Screening Assessment was prepared by Waterman in August 2022 (Report ref. WIE18671-100-BSA-16.1.4-RJM presented as Appendix B) to identify any potential matters that may have an adverse impact and determine if a BIA is required.

As part of the Basement Screening Assessment , if the answer to any of the screening questions presented in LBRuT's Basement Assessment User Guide is "yes", or is currently unknown, matters relating to that question will need to be addressed as part of a Basement Impact Assessment.

[1] Basement assessment user guide (richmond.gov.uk) . Accessed 10 March 2023

The answer to several screening questions in the submitted Basement Screening Assessment was “yes”.

The relevant screening questions carried over from the Basement Screening Assessment are as follows:

Subterranean Characteristics

> *“Does the recorded water table extend above the base of the proposed subsurface structure?”*
>
> *“Is the proposed subsurface development structure within 100m of a watercourse or spring line?”*
>
> *“Does the proposed excavation during the construction phase extend below the local water table level or spring line (if applicable)?”*
>
> *“Is the site underlain by an aquifer and/or permeable geology?”*

Land Stability

> *“Will the implementation of the proposed subsurface structure require any trees to be felled or uprooted?”*

Flood Risk and Drainage

> *“Will the proposed subsurface development result in a change in impermeable area coverage on the site?”*
>
> *“Will the proposed subsurface development impact the flow profile of throughflow, surface water or groundwater to downstream areas?”*

The potential impact of the above development characteristics will be assessed as part of this Basement Impact Assessment, and as advised in LBRuT’s Basement Assessment User Guide (2021), the contents presented herein are in accordance with guidance provided under “Structural Impact Assessments” as part of LBRuT’s Good Practice Guide on Basement Developments (2015)[2].

[2] https://www.richmond.gov.uk/media/7616/good_practice_guide_basement_developments_may_2015.pdf . Accessed 10 March 2023

2. Basement Impact Assessment

2.1 Section A - Desk Study Records

Site Description

Stag Brewery is at National Grid Reference 520360, 175990, in Mortlake, south-west London. The brewery comprises two adjacent land plots bisected by Ship Lane. The eastern half of the Site is entirely occupied by brewery buildings, with the western half occupied by further brewery buildings in the north and east, and a playing field (Watney's Sports Ground) in the south-west. Thames Water sewers pass beneath the Site; however, these have been decommissioned by backfilling at the Site boundary. The existing site level is approximately 5 to 6m OD with the highest level to the west falling to the east.

Brewing activities ceased in the Site in 2015. Subsequent works have been undertaken to strip out brewery infrastructure from the buildings and external areas such as tanks and electrical cabinets. Partial demolition of the external walls of some structures in the west of the Site has been completed to facilitate removal of larger tanks and other equipment.

There are three buildings on Site with historical interest and have been proposed for retention/refurbishment. The eight/nine storey masonry-framed building (The Maltings Building) north of the site, located at the corner where Thames Bank joins Ship Lane. The three-storey masonry-framed building (former Hotel Building) located at the junction of Mortlake High Street, Lower Richmond Road and Sheen Lane. The two-storey masonry-framed building (former Bottling Building) adjoining the former Hotel Building along the Mortlake High Street.

There are a number of trees around the Site, most of which are located adjacent to Watney's Sports Ground and along the river edge (outside the Site boundary). The tallest is approximately 22m high located north of the Site. Reference should be made to the Arboricultural Survey Report and Impact Assessment document (Ref: WIE18671-102-R-6-4-2-AIA).

The northern Site boundary is retained by an existing riverside wall. It is likely that the riverside wall has ties and anchor blocks. For information on boundary walls refer to Built Heritage Assessment report produced (Ref: WIE18671-100-R-9-3-2-BH).

Site History

Details of the Site's history are presented in the Built Heritage Assessment and the Preliminary Risk Assessment (Ref. WIE18761-106-R-8.2.1-RJM). In summary, the Site was used as a brewery since the 15th Century, which expanded to occupy the majority of the eastern half of the Site by 1896 and the whole Site except for Watney's Sports Ground by 1974. Brewery activities ceased on the Site in December 2015. Roadways within the wider project boundary were all developed by 1933.

Geology

The Site's geology, as established from previous ground investigations by Dames and Moore (1995), CRA (2003), Aecom (2015) and Soil Consultants (2016), alongside British Geological Survey 1:50,000 map sheet 270 (South London, Solid and Drift Edition) and BGS borehole records TQ27/NW-596 and TQ27/NW-597 (accessed online December 2021), is summarised in Table 1.

Table 1: Site Geology

Stratum	Area Covered	Estimated Thickness	Typical Description
Hardstanding.	Entire Site excluding the playing fields.	0.25 - 0.8	Tarmac or reinforced concrete floor slab at surface level. Encountered as two or three separate layers up to 0.5 m thick, each separated by up to 0.5 m Made Ground in eastern area.
Made Ground	Entire Site	0.4 – 4.6m, typically 1.0 – 3.0m across the main Site area	Predominantly coarse sand and gravel, including pieces of brick and minor amounts of black clinker.
Alluvium	Sporadic across entire Site area	0.35 – 1.5	Soft brown grey slightly gravelly clay with occasional roots
Kempton Park Gravel Member	Entire Site	1.2 – 5.9m, generally thicker towards the east	Clayey, silty sand with varying gravel content with areas of soft, brown, sandy clay.
London Clay Formation	Entire Site	73	Stiff grey to brown clay, with occasional pockets of silt and sand.

Hydrogeology

The Environment Agency classifies the geological deposits underlying the Site as follows:

Table 2: Site Hydrogeology

Stratum	EA Classification
Made Ground	Not classified
Superficial Deposits (Alluvium and Kempton Park Gravel Member)	Secondary A Aquifer
London Clay Formation	Unproductive Stratum

The Site is not in a groundwater Source Protection Zone. Based on available information, shallow groundwater in the Alluvium and Kempton Park Gravel Member is in hydraulic continuity with the tidal River Thames directly adjacent to the Site. However, monitoring of tidal influence on groundwater levels by AECOM in 2015 indicated negligible fluctuations (0.04 – 0.06m) in groundwater levels in a monitoring well 20m from the River Thames. No measurable effect on groundwater elevation was recorded in the two wells located 65m and 200m from the River Thames. Groundwater flow direction in the Superficial Deposits was inferred as west.

Hydrology

The nearest surface water to the Site is the River Thames, adjacent to the north. As detailed in the Flood Risk Assessment (Ref. FRA - 512_Stag_Brewery_FRA_v5d_220303, presented as Appendix C of this report), the Site is protected by formal Thames Tidal Flood defences, including the Thames Barrier. The boundary wall on the Site of the Stag Brewery also forms part of the flood defence at this location.

Cumulative Schemes

As concluded in the March 2022 Environmental Statement (Ref. WIE18671-100-ES-3.1.1), there are no

other schemes within 1 km of the Site that would materially affect the significance of environmental effects owing to their small scale and location within established residential areas.

2.2 Section B - Existing Structures

The Structural Impact Assessment (Ref. STR13514-SIA-DH), presented as Appendix D, includes detail of the structures and services to be retained as part of the Development, potential for effects from the proposed basements on these structures, and includes additional details submitted for the retained structures.

The Maltings Building, and the façades of the Former Hotel Building, and Former Bottling Building will be retained. A summary of the report's findings is presented below.

The SIA concludes that structurally both temporary works and permanent designs will not affect the locally listed buildings and the Thames Water assets.

The Maltings Building (Block 04)

The building will be retained and temporary works will be installed to maintain the integrity of the existing walls.

An assessment of the external walls of the Maltings building against the actions applied by the River Thames water levels rising to the flood defence level currently predicted to occur in 2100 has been carried out by WIE.

The new basement is over 10m from the footprint of the building and will not affect the foundations.

The internal alterations will respect the load paths and load intensities of the original building and the building stability will be maintained during construction and in the final condition.

Former Hotel Building (Block 05 West)

The façade of this building will be retained on the boundary perimeter and temporary works will be installed to maintain the structural integrity of the existing walls.

The new basement is over 13m from the footprint of the building and will not affect the foundations.

A new lower ground is proposed and to maintain the foundations against the site boundary a 400mm thick retaining wall is proposed. Temporary works will be proposed to retain both the roadway and the footings to the existing wall.

The internal alterations will respect the load paths and load intensities of the original building and the building stability will be maintained during construction and in the final condition.

Former Bottling Building (Block 05 East)

The façade of this building will be retained on the boundary perimeter and temporary works will be installed to maintain the structural integrity of the existing walls.

The new basement is over 15m from the footprint of the building and will not affect the foundations.

A new lower ground is proposed and to maintain the foundations against the site boundary a 400mm thick retaining wall is proposed. Temporary works will be proposed to retain both the roadway and the footings to the existing wall.

The internal alterations will respect the load paths and load intensities of the original building and the building stability will be maintained during construction and in the final condition.

Thames Water Assets

An assessment of potential effects on Thames Water assets is presented in the Drainage Strategy report (Ref. WIE18671-104-R-11-7-1-DS) in Appendix E which states easements to existing drainage infrastructure crossing the Site need to be allowed for to ensure it is not impacted upon. The Development complies with all necessary easements, and where these are not possible, appropriate diversions are proposed.

Furthermore, the 225mm diameter Thames Water foul sewer crossing the Site is proposed to be diverted as shown on the drainage plan in Appendix E of the Drainage Strategy report. The two rising mains only service the existing uses within the Site (now redundant and dis-used) and are proposed to be abandoned as part of the Development. An easement of 4.0m is allowed for to the combined sewer along the north-eastern boundary of the Site to ensure it is not impacted upon as it conveys off-Site flows.

Two 36-inch water mains pipes run close to the site along Mortlake High Street and must be protected against damage from the works associated with the development. Consideration to mitigating the effect of ground movement/vibration associated with plant movement and the construction of the new basement will require further assessment, monitoring, and agreement with Thames Water. Unrestricted access must be maintained at all times for Thames Water maintenance and repair of the asset during the works.

To mitigate this risk: an accurate survey will be carried out to ascertain the exact location of the water mains relative to the buildings/foundations; protection will be installed against plant movements and specific non-impact construction methods have been selected.

Along Block 10; Silent Sheet piles will be used which are non-impact hydraulically pushed sheet piling method that will minimise disturbance of the soil.

Along Block 09: Continuous Flight Auger (CFA) piles will be used which are non-impact auger screw piling method.

Both these methods are also low-noise construction techniques. These methods; Silent Sheet piles and CFA piles are shown in the figures on the following pages.

The planning condition wording as agreed with Thames Water for a previous scheme at the site in 2020 (and anticipated to be similar for this development) is as follows[3]:

"*No construction related activities shall take place within 5m of the trunk water main unless otherwise agreed with the local planning authority in consultation with Thames Water. Information detailing how the development will be carried out so as to prevent the potential for damage to subsurface potable water infrastructure, must be submitted to and approved in writing by the local planning authority in consultation with Thames Water. Any construction must be undertaken in accordance with the terms of the approved information. Unrestricted access must be available at all times for the maintenance and repair of the asset during and after the construction works.*"

[3] LBRuT (2020); Planning Committee Report, Wednesday 29 January 2020.

Figure 2: Proximity of Block 10 Silent Sheet Piles to 36-inch Water Mains

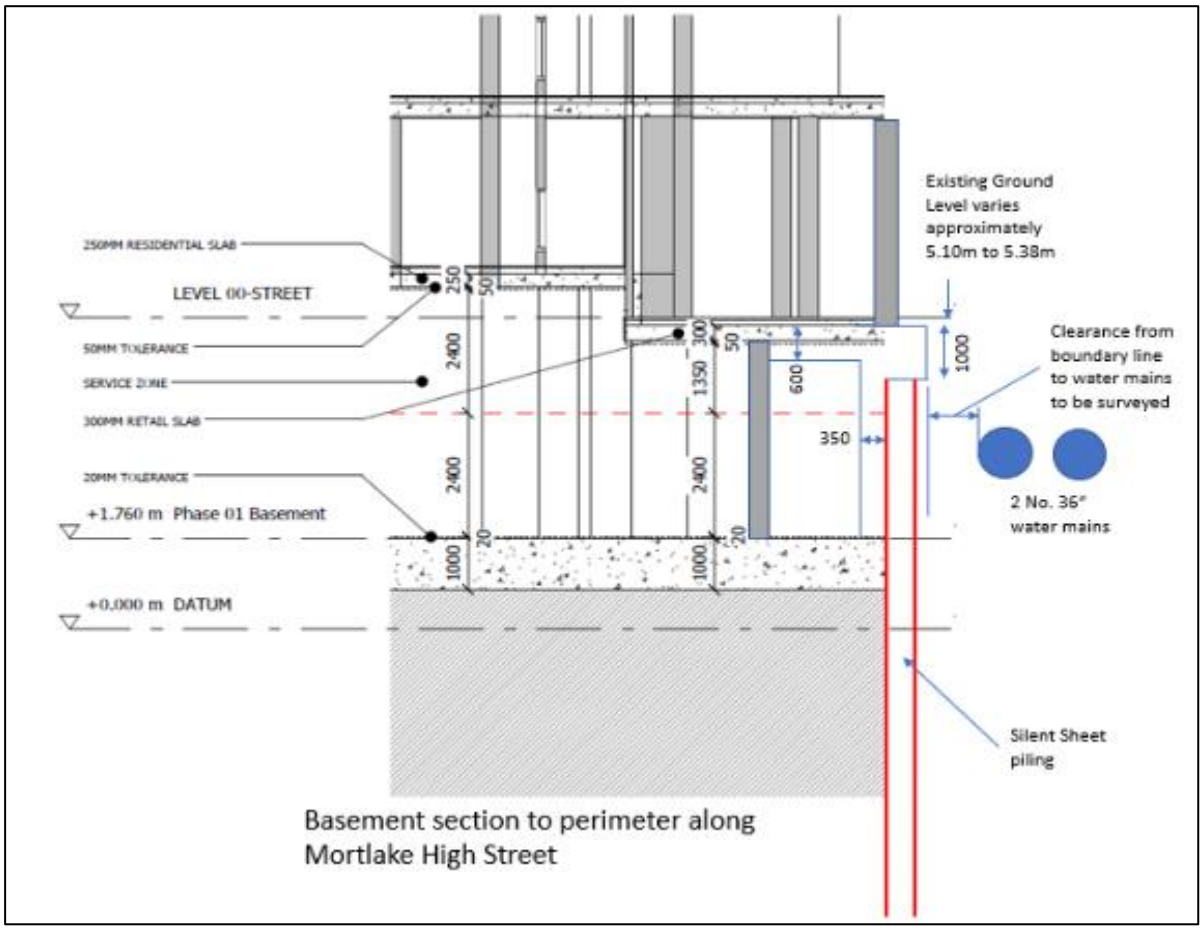
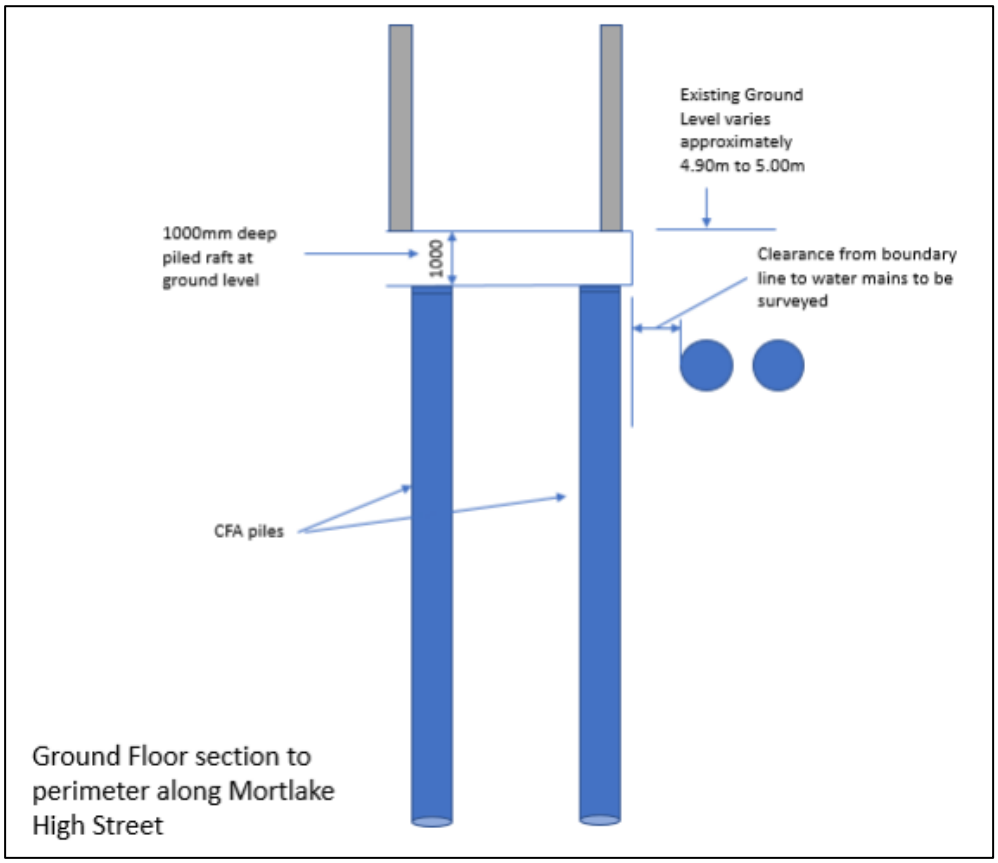


Figure 3: Proximity of Block 09 CFA piles to 36-inch mains



Neighbouring Properties

As detailed in the Basement Screening Assessment, the Site is bounded by residences to the west, and the proposed western Site basement will not be excavated proximal to these dwellings. At the eastern Site, nearby buildings to the south and east are separated from the proposed excavation area by roadways which will provide a buffer between the new basement and these structures. The locations of basement footprints in relation to the Site boundary and neighbouring properties are presented in Figure 3 in Appendix A.

2.3 Section C – Site Investigation Records

The Site has been the subject of several desk-based and intrusive investigations to characterise its ground conditions. The results of these investigations are summarised in the Preliminary Risk Assessment (Ref. WIE18761-106-R-8.2.1-RJM). Reports including factual records from the most recent intrusive investigations at the Site by AECOM (Ref. 47075502; September 2015) and Soil Consultants (Ref. 10022/OT/JRCB, November 2016) are appended to the Basement Screening Assessment in in Appendix B. A summary of the Site's geology as established from the investigations is presented in Table 1 in Section A.

Geological cross sections are presented in Appendix A and show the strata encountered and associated elevations. In general, the Site comprised Made Ground (typically 1.0 – 3.0m thick), overlying locally present Alluvium (up to 1.5m thick), then the Kempton Park Gravel Member (1.2 – 5.9m thick). The Kempton Park Gravel Member is underlain by the London Clay Formation which is about 73m thick.

Groundwater level monitoring undertaken as part of the AECOM and Soil Consultants investigations is summarised in Table 3 and 4. AECOM recorded groundwater elevations between 1.315m OD and 4.025m OD. The reading of 4.025m OD was from perched water. Tidal influence on groundwater levels in three monitoring wells was recorded over 2.5 days. Daily fluctuations of 0.04 - 0.06m were recorded in a monitoring well 20m from the River Thames. However, no measurable effect on groundwater elevation was recorded on the two wells located 65m and 200m from the River Thames. Groundwater flow direction in the Superficial Deposits was inferred as west.

AECOM also undertook a review of groundwater elevations from five groundwater monitoring rounds completed between 2003 and 2015 (see Figure 4). The review indicated relatively consistent groundwater levels over the five monitoring rounds.

The Soil Consultants investigation included installation of groundwater monitoring wells across the east of the Site (Development Area 1), targeting the shallow aquifer in the Kempton Park Gravel Member. Recorded groundwater elevations ranged from 2.67m OD to 0.81m OD.

Table 3: Groundwater levels, AECOM 2015

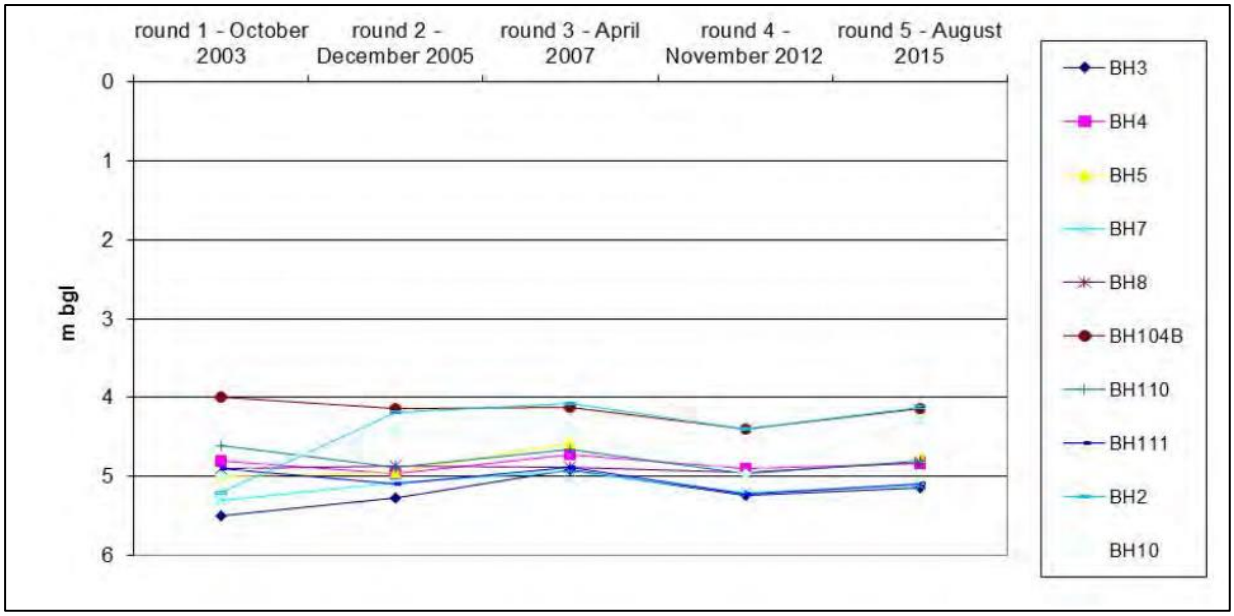
	Groundwater Levels Recorded				
Location	**m bgl**	**m AOD**	**Location**	**m bgl**	**m AOD**
BH2 (East)	4.121	1.569	BH9 (West)	1.75	4.025*
BH3 (West)	5.14	1.35	BH10 (West)	4.277	1.558
BH4 (West)	4.83	1.35	BH104B (East)	4.141	1.574
BH5 (West)	4.755	1.33	BH109 (West)	4507	1.633
BH7 (West)	5.11	1.315	BH110 (West)	4.805	1.435
BH8 (West)	4.8.15	1.34	BH111 (West)	5.097	1.313
BH112 (West)	Dry	Dry	BH201A (East)	3.59	1.90

*Likely anomaly and not representative of groundwater levels.

Table 4: Groundwater levels in the east of the Site, Soil Consultants 2016

Location	Groundwater Levels Recorded	
	m bgl	m AOD
BH1	3.82	1.33
BH2b	3.51	1.45
WS1	4.48	1.64
WS4	4.10	1.75
WS5	3.09	2.67
WS7A (inside building)	4.42	0.81
WS10A	2.30	2.62

Figure 4: AECOM Summary of Monitored Groundwater Levels Between 2003 and 2015



Source: AECOM, Phase 2 Environmental Site Assessment Report, 47075502, September 2015.

2.4 Section D – Details of Engineering Design

The Site has been subject to environmental, geotechnical, and structural assessments to inform design. Summaries of the pertinent findings are presented below.

Ground Conditions and Groundwater

Preliminary geotechnical assessment detailed in the Soil Consultants report (Ref. 10022/OT/JRCB) considered that, due to relatively high groundwater, an embedded water-tight retaining wall construction will be required to permit basement excavation and stop any water ingress. A sheet pile or secant bored pile wall was considered to be the optimum type. A copy of the Soil Consultants report is appended to the Basement Screening Assessment presented in Appendix B.

In the permanent case the lateral earth pressures will be supported directly by the piled retaining wall or by a reinforced concrete lining wall cast within the piles. In either case horizontal support to the wall will be provided by the new ground and basement floor slabs.

The report considered use of a reinforced concrete basement raft would provide an eminently suitable foundation solution and that ground movement analysis is undertaken in due course to provide the design/performance information based on the findings of the ground investigations.

A design water level of about 2m bgl was considered suitable for preliminary basement raft design along with a theoretical hydrostatic uplift pressure of 50kN/m^2 (for a 7m deep excavation). This preliminary value can be regarded as the minimum design uplift pressure for the basement raft.

For the ground conditions encountered, with groundwater being present within the superficial soils, CFA piles are considered likely to present the optimum type for load-bearing. The final pile design would be confirmed following consultation with a specialist piling contactor.

Soil and groundwater soluble sulphate analysis suggested the London Clay is probably pyritic at the Site, with many of the oxidisable sulphide levels significantly exceeding 0.3%. The preliminary recommendation is that that buried concrete which is in contact with soils that have been disturbed/potentially oxidised is designed in accordance with ACEC Site Class AC-4.

The Soil Consultants report recommended further comprehensive ground investigations and monitoring of water levels will be required prior to final scheme design.

Removal of Trees

As detailed in the Arboricultural Impact Assessment (Ref. WIE18671-102-R-6-4-2-AIA) submitted in March 2023, a total of 37No. trees require removal for Application A, and 13No. for Application B. The design team actively sought to restrict tree removals to lower quality trees wherever possible and protect the vast majority of high quality value ‘A’ grade trees.

A further three trees will be removed as a result of the potential S278 works. T107 (category A) will be removed as it is within the footprint of the realignment works at Chalkers Corner, and T152 and T333 (both category C) will be removed as they would impact the proposed zebra crossing on Mortlake High Street.

A tree protection plan will be implemented for trees to be retained as part of the development. As shown in the Tree Protection Plan drawing (drawing ref. WIE-ZZ-XX-7703-P02) presented in Appendix A of the

Arboricultural Impact Assessment, 5No. trees (tree refs. T31 – T35) are to be removed to facilitate construction of the basement in development Area 2 within Application A. Tree refs. T32 and T35 are categorised as Grade 'U', T33 is categorised as Grade 'C' and T31 and T34 are categorised as Grade 'B'. Therefore, no trees of high quality and value will be removed to facilitate basement construction. Furthermore, these trees are at least 15m from the nearest Site boundary to the north.

Details on the requirements of the Tree protection plan details are presented in the Arboricultural Impact Assessment.

Drainage Strategy

The drainage strategy for the development has evolved following assessment and as comments from statutory consultees have necessitated some minor scheme changes. Full details of the assessment and the proposed drainage strategy are presented in the Drainage Strategy report in Appendix E. A summary of the Drainage Strategy is presented below.

Surface water runoff from the northeast of the Site would discharge by gravity to the River Thames (adjacent to the northern boundary of the Site) via three outfalls. As the River Thames is tidal in this location, direct discharge to the river would be unrestricted.

The area to discharge into the River Thames has been maximised using shallow geo-cellular conveyance channels, in order to relieve the Thames Water network of flows. Surface water runoff from the remainder of the Site would discharge via gravity to the Thames Water sewer network in the surrounding highways, maximising the attenuation volume within each drainage catchment to restrict surface water flows as much as possible.

Based on an area of 5.69ha currently draining into the Thames Water network, the existing discharge rate was calculated to be 812.3 l/s. The incorporation of permeable paving, rain gardens, and underground attenuation tanks achieves a reduction of surface water flows to the greenfield runoff rate of 37.4l/s, equal to a 95% reduction compared to the existing rate.

Appropriate treatment would be incorporated into the drainage system to ensure that the quality of water discharged is acceptable. This would be achieved through the incorporation of green roofs, permeable paving aggregate sub-base, rain gardens, and rainwater harvesting. A biomat filtration system within the attenuation tanks and downstream defenders or similar hard engineered solution would also be incorporated if deemed necessary at detailed design to ensure discharge is appropriately treated.

Foul flows from the Site would discharge by gravity to the Thames Water sewer network. The existing and proposed foul discharge rates have been calculated using the water consumption method at 14.4l/s and 24.1 l/s respectively.

The on-site drainage networks and Sustainable Drainage Systems would be privately managed and maintained for the lifetime of the Development, ensuring they remain fit for purpose and function appropriately. The management company / operator would be appointed post-planning. The school drainage system (Application B) would be delivered and maintained separately from the Application A site.

Flood Risk

The potential risk of flooding resulting from construction of the development is assessed in the Flood Risk Assessment (Ref. FRA - 512_Stag_Brewery_FRA_v5d_220303), with the Flood Risk Assessment

Addendum being prepared to provide clarification as to how components of the Exception Test as presented in the FRA meet paragraph 164 of the National Planning Policy Framework. The report includes an assessment of the potential for groundwater flooding as resulting from construction of the developments basements and potential for the development's basements to flood.

Section 4.3.5 of the Flood Risk Assessment considers the potential for groundwater flooding impacting off-site receptors and notes that where the proposed basement projects into the saturated area under the Site to the east of Ship Lane, this would not lead to any increase in groundwater levels off-site. A small reduction on the southern side of the development is the most likely response and this would not require any mitigation.

It was observed that the groundwater flow paths were to the west and south-west and away from the River Thames. It was inferred that the levels in the River Thames, averaged over a tidal cycle of around 2m OD, were providing the "source" for the associated hydraulic gradient.

With respect to potential groundwater flooding of the proposed basements, the Flood Risk Assessment notes that for the Site east of Ship Lane, the underside of the basement car park slab is 0.76m OD (the slab thickness is 1.0m), which is 1.25m below the typical groundwater level of 2m OD. However, the Flood Risk Assessment advises this encroachment does not pose any groundwater flood risk, either on-site or off-site, but will need to be taken account of in design and construction of the basement and preliminary estimates of groundwater flows associated with high transmissivity gravels (MacDonald et al., 1999) and the naturally occurring groundwaters of the underlying minor aquifer range from 0.1 to 0.5 m3/s under wet weather conditions. Basement finished floor levels under Block 01 (cinema) are locally lower at -1.635m OD. This is to accommodate Plant Rooms and a Tank Room in Basement Level 2 with cinemas in Basement Level 1.

Temporary control of groundwater seepage during excavations (foundation dewatering) were recommended design mitigation measures for the proposed basement car park and Cinema.

For the basement west of Ship Lane, the underside of the slab varies from around 1.45 m OD to 3.1m OD under buildings. Finished floor levels in the Site west of Ship Lane will be above the observed groundwater levels and no mitigation will be required.

Given the presence of high transmissivity gravels across the Site, groundwater would be expected to flow around the basement founded in the upper horizons of the London Clay Formation. Where the basement is founded in the Kempton Park Gravel member, to the west of Ship Lane, groundwater will flow around and/or below the basement (depending on the groundwater elevation at that time).

Design of the Proposed Substructure

There will be a single storey basement structure under the majority of the Site and buildings in the east side of Application A. The exception is Block 01/Cinema which has a two level basement to accommodate the Auditoria and plant. The west side of Application Area A has a reduced area of basement under the buildings. The primary purpose of the basements is to provide car parking and plant space.

The retaining walls are to be formed utilising steel sheet piles and a reinforced concrete wall where vertical loads are to be resisted above ground floor level. The latter will require a piled raft along its edge to mitigate differential settlement. No surcharge, from any of the proposed buildings, are to be exerted on the proposed basement walls. If applicable, adjacent new buildings will be supported off new piled foundations, to mitigate surcharge. If steel sheet piles are to be used, the clutches/joints are to be welded

to form a water-tight seal and painted from the inside to resist corrosion. The steel sheet piling wall is to be constructed as a permanent wall.

The basement will be designed to achieve a minimum of Grade 1 environment using the grade classification in Table 2 in BS 8102:2009, Clause 6.2.3, except that no water penetration will be permitted.

Currently, the Environment Agency requires any new structure to be 4m clear from the flood defence wall for maintenance purposes and all new proposed construction complies with this requirement. The construction sequencing, which should be formed as part of the appointed Contractor's method statement, will require consideration in the detailed design of the sub and superstructure.

A ground bearing raft is the likely foundation option under the basement structures, where this can be formed at/below the Kempton Park Gravel Member. This stratum starts at approximately 2.8m OD. The exception again is Block 01/Cinema which will be a piled foundation due to the larger grid formed by the Auditoria.

Where the substructure cannot be founded on suitable bearing stratum, or will exert a surcharge load onto the basement wall, a piled foundation shall be adopted.

It is possible for the low-rise terrace houses located north west of Application Area A and not over the basement to supported off trench footings which will need be confirmed at detailed design. The initial recommended bearing capacity for the river terrace gravel is 175kPa with a spring stiffness of 5-6MN/m^2/m. Further details are presented in the Soil Consultants report.

Further analysis at the detailed design stage can refine the capacity through soil structure interaction and floatation calculations.

2.5 Section E – Upper Aquifer Details

Recorded groundwater levels are summarised in Section C above.

The underside of the slab of the deepest basement (in Block 01/Cinema) will extend to -2.635m OD. The underside of slab for the single level basement to the east of Ship Lane will be 0.76m OD and the underside of the slab for the single level basement to the west of Ship Lane will be 1.45m OD.

Recorded groundwater levels in Superficial Deposits from the 2015 and 2016 ground investigations ranged from 2.67m OD to 0.81m OD (excluding the perched water reading of 4.025m OD). The top of London Clay Formation is generally present at between 1.2m and -1.7m OD.

The geological cross section presented in Appendix A indicate formation levels of basement level slabs and show the single and two level basements to the east of Ship Lane will be founded in the upper horizons of the London Clay Formation and, therefore, will be founded below groundwater in Superficial Deposits.

Whilst the finished floor level (2.45m OD) of the single level basement to the west of Ship Lane will be above recorded groundwater levels in this part of the Site, the underside of the 1.0m thick slab extends up to 1.45m OD. Groundwater levels recorded to the west of Ship Lane ranged from 1.63m OD to 1.31m OD. Therefore, groundwater levels may straddle between the underside and slightly above slab formation level. Notwithstanding, as detailed in the Flood Risk Assessment, basement development would not lead to any increase in groundwater levels off-site and a small reduction in groundwater levels to the southern side of the development are likely.

Where there is potential for groundwater ingress into basement structures, such as to the east of Ship Lane, basements will be designed prevent water penetration.

Excavations below groundwater level will be required to facilitate basement construction east of Ship Lane. Therefore, the use of sumps and pumps will likely be required to dewater excavations. Dewatering of excavations will be done so in accordance with an Environmental Permit (if required) and disposal of groundwater undertaken in accordance with a Thames Water discharge consent.

2.6 Section F – Ground Movements Assessment

The Structural Impact Assessment concluded the new basement will not affect the foundations of structures to be retained on-site. The nearest retained on-site structure is over 10m from the new basement. As detailed in Section B, appropriate measures will be implemented to prevent development works from damaging Thames Water assets.

Detailed ground movement analysis will be required to assess the performance of the proposed raft, piles and pile/raft interface. Further detailed ground investigation will be carried out to inform the ground movement analysis.

2.7 Section G – Construction Sequence

Details of the construction sequence is presented in *Chapter 6 - Development Programme, Demolition, Alteration, Refurbishment and Construction* of the Environmental Statement (Ref. WIE18671-100-ES-3.1.1).

The works are anticipated to be undertaken in the following way:

- Site enabling and demolition works will be undertaken Site wide in one phase;
- archaeological trenches will be dug in line with basement excavations;
- basement excavation will take place concurrent with the phasing of the building construction above using sheet piling to form basement boxes with temporary wall/bund construction. This will allow each basement area designated to the plot above to be developed independently;
- construction of the School will be concurrent with the construction works of Phase 1, and will be completed and operational before commencement of construction works on Phases 2 to 4;
- Chalkers Corner highways works would be undertaken prior to the completion of the school;
- an entire Phase would be completed before any buildings within the Phase are occupied.

Substructure works will comprise the following activities:

- sheet piling to form a retaining wall and groundwater stop to the basement structure;
- deep excavations;
- dewatering and disposal, using standard techniques such as sumps and pumps;
- ground remediation and preparation of excavated surface;
- construction of basement structure including foundations, columns and reinforced concrete slabs;
- waterproofing of substructure system; and
- backfilling as necessary.

3. Basement Screening Assessment Clarifications

In August 2022 Waterman Infrastructure & Environment (Waterman) prepared a Basement Screening Assessment (Appendix B of this BIA report, Document Ref. WIE18671-100-BSA-16.1.4-RJM). The Basement Screening Assessment was submitted as part of the planning Applications A (22/0900/OUT) and Application B (22/0902/FUL). In April 2023, a Basement Impact Assessment (WIE18671-100.R.24.2.2.BIA – this report) has also been prepared and submitted in respect of the above planning applications.

In their review of the Basement Screening Assessment, LBRuT requested several clarifications be made. These clarifications are addressed within this Basement Impact Assessment, however for ease of reference, responses to LBRuT's clarification requests are set out below.

LBRuT Request for Clarification: *"….the screening assessment also states the playing fields are largely retained, and the basement will not alter the impermeable area coverage across the site. Which is not correct."*

Response: The statement in the Basement Screening Assessment (WIE18671-100-BSA-16.1.4-RJM) is incorrect. The planning application seeks redevelopment of the existing playing field which will include for a new six form entry secondary school with associated play facilities which include roof play facilities, an indoor sports hall, an external Multi Use Games Area (MUGA) and a full sized sports pitch (3G sports pitch) and associated spectator spaces.

To the south of the proposed school building and sports pitch, north of Lower Richmond Road (Development Area 2 of Application A), it is proposed to provide a new public community park.

Despite this incorrect statement, Waterman IE can confirm that the original conclusion that the proposed basement will not alter the impermeable area coverage across the site remains accurate. Currently the area of the site where the proposed basements are located is occupied by the current site buildings or hardstanding, therefore the construction of the basement and the building above will not alter the impermeable coverage on the site.

LBRuT Request for Clarification: *"The incorrect site layout plans are shown in the appendix's – has this been realised. With the correct layout plans, does it alter the conclusions of the screening assessment?"*

Response: Waterman IE agree the incorrect layout drawings were shown and the drawings have since been updated with changes including the revised basement access ramp. The latest site layout plans are appended to Appendix A of the BIA (WIE18671-100.R.24.2.2.BIA). The basement footprints and formation levels remain the same and, therefore, the conclusions of the screening assessment do not alter.

The final basement drawings submitted for approval, which have been considered and assessed in the BIA, are:

- 18125_C645_B01_E_S_001_G – Building 01 – Proposed South Elevation (dated 21/07/22);
- 18125-C645_Z1_P_B1_001-G-Proposed Development Area 01 Basement Plan (dated 09/03/23);
- 18125-C645_Z1_S_B1_001-D-Proposed Development Area 01 Basement Section AA (dated 09/03/23);
- 18125-C645_Z1_S_B1_002-D-Proposed Development Area 01 Basement Section BB (dated 09/03/23);

- 18125-C645_Z2_P_B1_001-G-Proposed Development Area 02 Basement Plan (dated 09/03/23); and
- 18125-C645_Z2_S_B1_001-D-Proposed Development Area 02 Basement Section CC (dated 09/03/23).

LBRuT Request for Clarification: *"The FRA states Development Area 2 basement will be 2.45m AOD above the observed groundwater levels of September 2015, however, the screening states it may be below the ground water levels – which is it?"*

Response: 2.45m AOD is the finished floor level of the basement internally, and therefore considered in the FRA. However, the basement slab is 1.0m thick and its underside is 1.45m AOD. Therefore, whilst the basement is mostly located above local groundwater levels, the underside of the basement slab has the potential to encroach slightly below groundwater level (which fluctuates depending on changes in precipitation between seasons and years as well as minor changes due to the tidal River Thames at this location). This clarification does not affect the conclusions of the Basement Screening Assessment (Appendix B of this BIA report, document ref: WIE18671-100-BSA-16.1.4-RJM).

4. Conclusions and Recommendations

In accordance with LBRuT's Basement Assessment User Guide (2021), a Basement Screening Assessment (ref. WIE18671-100-BSA-16.1.4-RJM) was prepared to identify pertinent topics through consideration of screening questions associated for the development. The pertinent topics have been assessed as part of this Basement Impact Assessment and development proposal details and several assessments have been presented under each of the sections stipulated in LBRuT's Good Practice Guide on Basement Developments (2015) as summarised below.

The various environmental studies indicate the development's substructure will not lead to significant impacts or an increase in flood risk to the Site or surrounding area. Appropriate mitigation measures will be incorporated to manage surface water run-off from the development, prevent water ingress into the new basements, and protect off-site assets.

Groundwater encountered during basement excavations will be appropriately managed. Dewatering of excavations will be done so in accordance with an Environmental Permit (if required) and disposal of groundwater undertaken in accordance with a Thames Water discharge consent.

It is recognised that gaps in ground conditions information exist and these will be addressed by detailed ground investigation. Information gained from detailed ground investigation will be used to inform ground movement analysis to assess the performance of the proposed raft, piles and pile/raft interface. Further ground investigation will be carried out post determination and will be a combined geotechnical and environmental investigation.

Section A - Desk Study Records

Details of existing and historical Site uses, geology encountered by ground investigations on-site, recorded hydrogeological conditions, hydrology, and nearby cumulative schemes.

Section B - Existing Structures

Potential impacts from basement construction to site structures to be retained, Thames Water Assets, and neighbouring properties have been considered. Appropriate mitigation measures have been identified.

Section C – Site Investigation Records

Ground investigation records for the Site have been presented. The Site's geology and hydrogeology has been summarised and geological cross sections presented in Appendix A.

Section D – Details of Engineering Design

A summary of design considerations is presented and includes details from geotechnical assessment, Arboricultural Impact Assessment, the Drainage Strategy, Flood Risk Assessment, and design detail of the proposed substructure.

Section E – Upper Aquifer Details

Groundwater levels in Superficial Deposits have been summarised along with elevations of basement formation levels, and mitigation required to manage groundwater ingress into excavations and prevent water penetration into the new basements.

Section F – Ground Movements Assessment

Potential effects to retained Site structures and Thames Water assets are summarised.

It is recognised that detailed ground movement analysis will be required to assess the performance of the proposed raft, piles and pile/raft interface. Further detailed ground investigation will be carried out to inform the ground movement analysis.

Section G – Construction Sequence

A summary of the construction sequence has been presented.

APPENDICES

A. Site Plans

Project Details	WIE18671-100: Stag Brewery, Mortlake
Figure Title	Figure 1: Site Location Plan
Figure Ref	WIE18671-100_GR_BIA_1A
Date	March 2023
File Location	\\s-lncs\wiel\projects\wie18671\100\graphics\bia\issued figures

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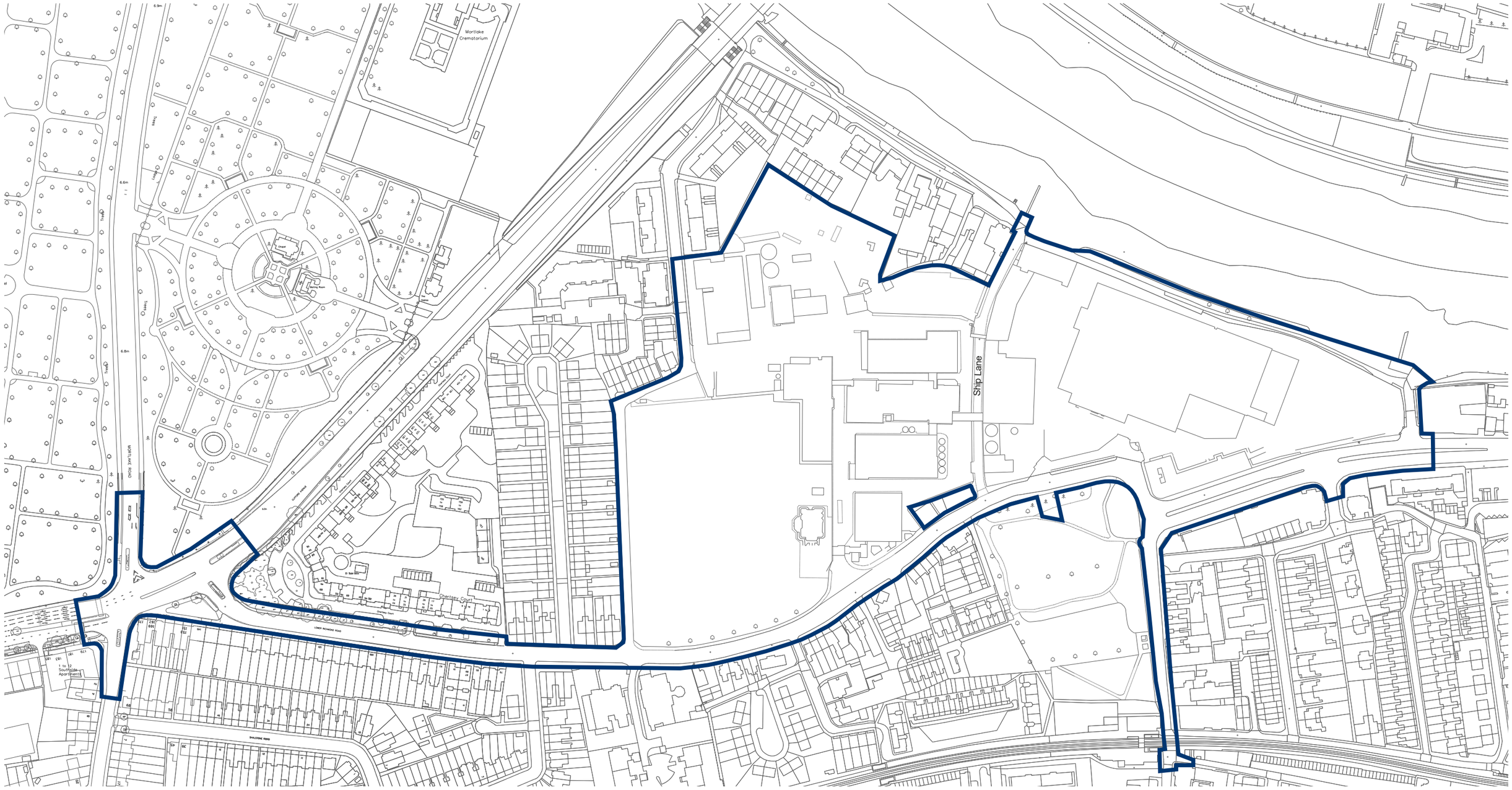

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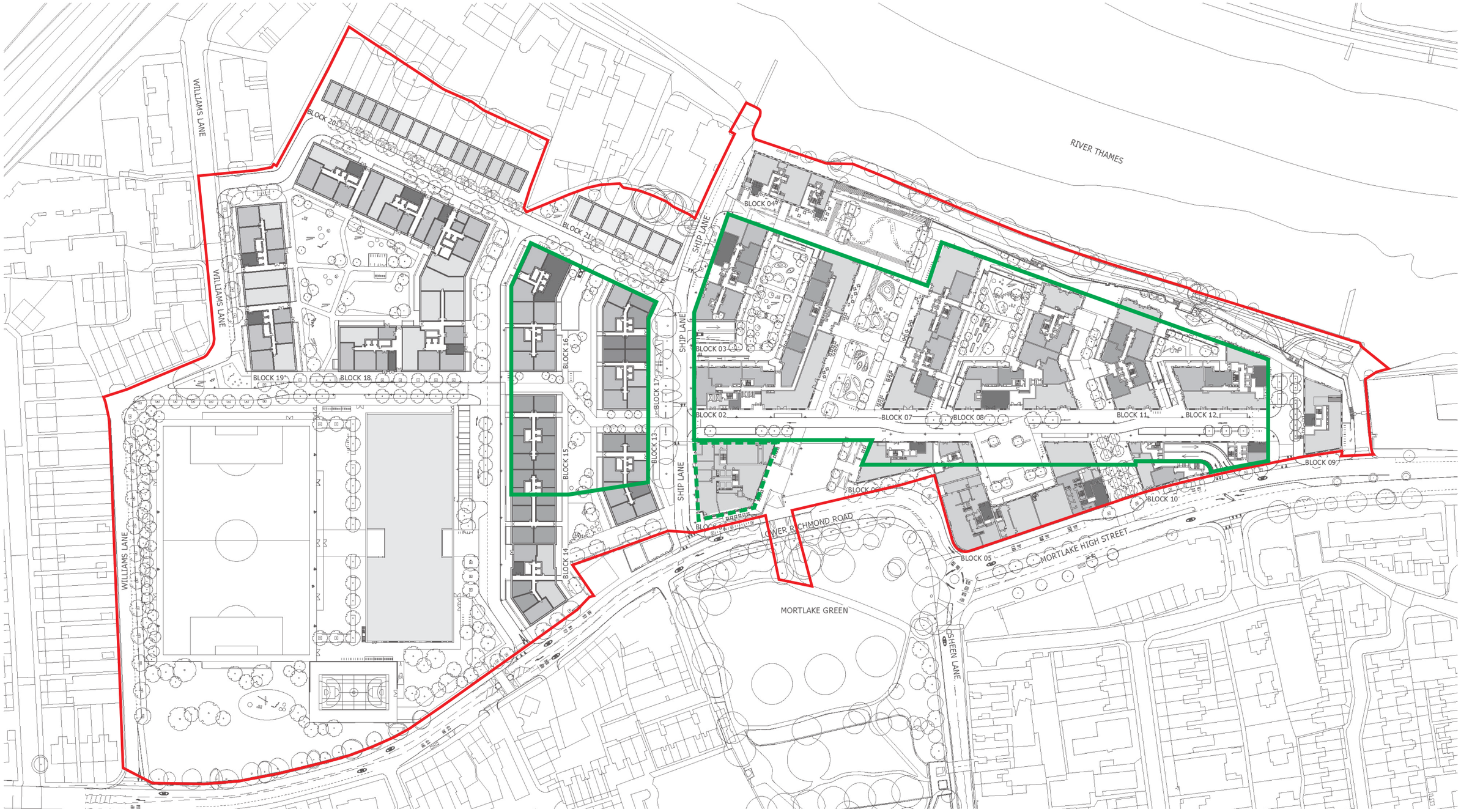
Project Boundary

Project Details	WIE18671-100: Stag Brewery, Mortlake
Figure Title	Figure 2: Project Boundary
Figure Ref	WIE18671-100_GR_BIA_2A
Date	March 2023
File Location	\\s-lncs\wiel\projects\wie18671\100\graphics\bia\issued figures



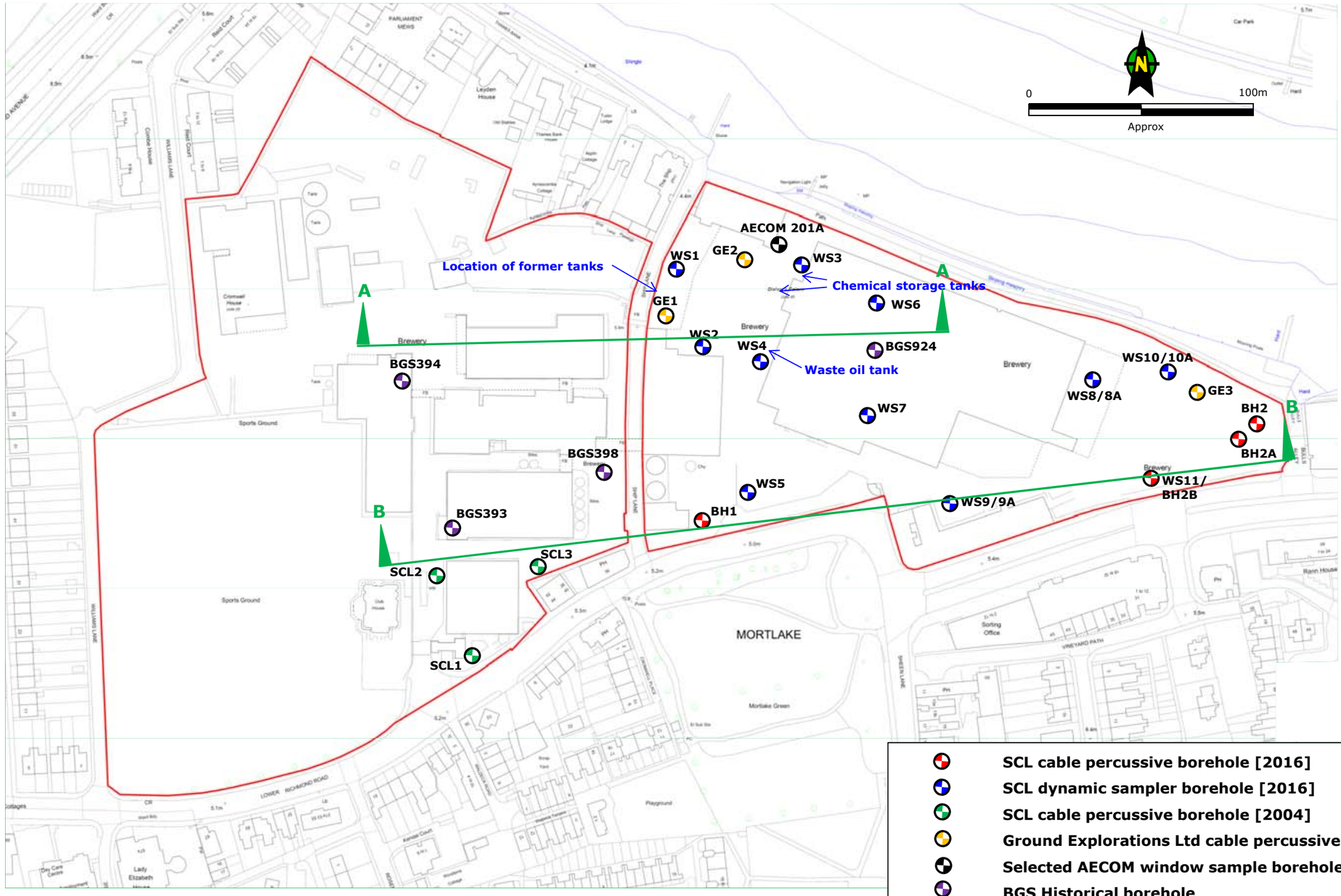
N

Site Boundary

Single storey basement

Two storey basement

Project Details	WIE18671-100: Stag Brewery, Mortlake
Figure Title	Figure 3: Proposed Basement Footprint Locations
Figure Ref	WIE18671-100_GR_BIA_3A
Date	March 2023
File Location	\\s-lncs\wiel\projects\wie18671\100\graphics\bia\issued figures

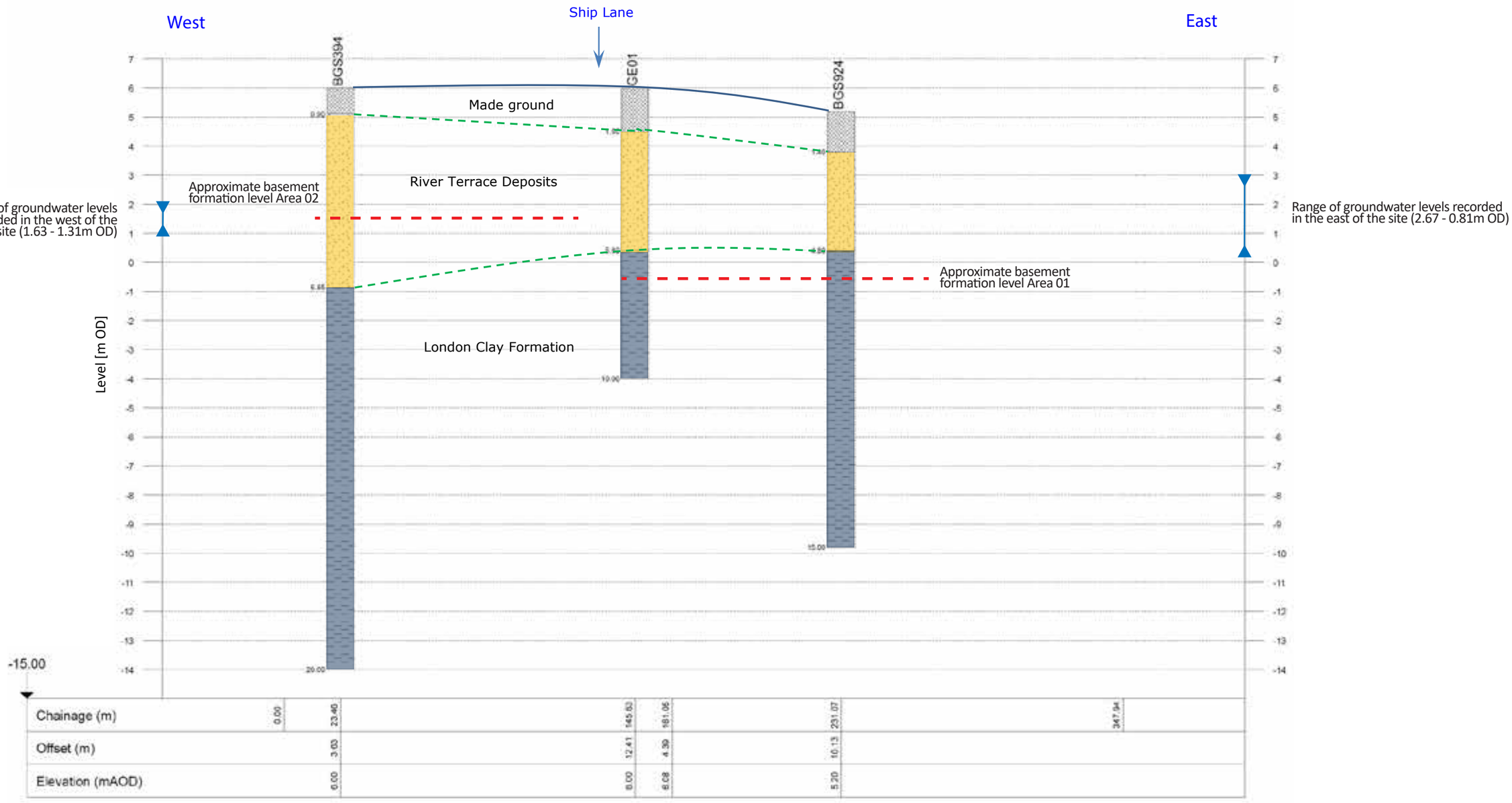


	SCL cable percussive borehole [2016]
	SCL dynamic sampler borehole [2016]
	SCL cable percussive borehole [2004]
	Ground Explorations Ltd cable percussive borehole [1980]
	Selected AECOM window sample borehole [2015]
	BGS Historical borehole

Project Details	WIE18671-100: Stag Brewery, Mortlake
Figure Title	Figure 4: Section Location Plan
Figure Ref	WIE18671-100_GR_BIA_4A
Date	March 2023
File Location	\\s-lncs\wiel\projects\wie18671\100\graphics\bia\issued figures

Source: Soil Consultants

SECTION A-A



Source: Adapted from Soil Consultants Plan 10022/0T (Section B-B)

Project Details	WIE18671-100: Stag Brewery, Mortlake
Figure Title	Figure 5: Geology Cross Sections and Proposed Basement Formation Levels
Figure Ref	WIE18671-100_GR_BIA_5A
Date	March 2023
File Location	\\s-lncs\wiel\projects\wie18671\100\graphics\bia\issued figures