Flood Risk Assessment

Prepared by Arup

Submitted on behalf of Lab Selkirk House Ltd

Selkirk House, 166 High Holborn and 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR

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Rev 01

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1 Introduction

This Flood Risk Statement (FRS) has been prepared by Ove Arup & Partners Ltd. ('Arup') in support of the detailed planning application being submitted by Lab Selkirk House Ltd. ('the Applicant') to the London Borough of Camden ('the Council') for the redevelopment of the land at Selkirk House, 166 High Holborn and 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR ('the site').

This FRS is intended to summarise flood risks and considerations for the site using readily available sources of information.

The proposed development will include offices, residential units, and retail outlets within the site. The current site will be reconfigured, and buildings reconstructed to create a new high quality public realm and development.

The currently site comprises a mix of a Travelodge hotel (now closed), multi storey car park (no longer operational), retail and residential units. There are also disused or under used properties on the site.

This report has been prepared solely for the benefit of the client in connection with this development. The report does not address any other potential impacts that may result from the development.

This FRS is based upon readily available information. Detailed hydrological or hydraulic calculations have not been carried out.

Arup does not accept any liability for the degree of accuracy or correctness of any information derived from secondary sources. However, endeavours have been made to verify the suitability and appropriateness of information where possible.

1.1 Key sources of information

The key documents and sources of information that have been used in the production of the FRS include:

- Borough of Camden Strategic Flood Risk Assessment (SFRA)[1]
- Environment Agency (EA) flood map for planning[2];
- Environment Agency (EA) long term flood mapping[3];

[1] Borough of Camden SFRA. Available from: https://www.camden.gov.uk/flooding#wxbh [Accessed: 13/11/2019]

[2] EA flood mapping for planning. Available from: https://flood-map-for-planning.service.gov.uk/confirmlocation?easting=432513&northing=565101&placeOrPostcode=jarrow [Accessed: 15/11/2019]

[3] EA long term flood risk information. Available from: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map [Accessed: 15/11/2019]

- British Geological Survey[4];
- Defra Data Services Platform[5]
- Defra Magic[6]

2 Planning Context

There are three planning documents that should be considered when assessing flood risk on the site. These are:

- The National Planning Policy Framework (NPPF) (2019)[7];
- Planning Practice Guidance (PPG) (2014)[8]; and
- Borough of Camden Local Plan 2017[9].

3 Proposed works description and location

The site for the proposed development is located within the London Borough of Camden (LBC), and is a short distance from Oxford Street, Soho, and Covent Garden.

The site is approximately 0.53 ha with current building uses conforming to the following categories: retail, office accommodation, hotel accommodation, residential units, and carparking facilities.

Development proposals include the demolition of the Selkirk House building and the reconfiguration of the site. A new building will come forward on Museum Street/High Holborn. Surrounding buildings on West Central Street will be renovated and extended, with the site encouraging an active frontage and a newly created route through the site. A focus on high quality public realm will be included with hard and soft landscaping being introduced to increase environmental qualities.

Figure 1 shows the proposed application boundary. The site is bounded to the north by New Oxford Street, the east by Museum Street, and the South by High Holborn. To the east, Grape Street creates the immediate boundary with Shaftesbury Theatre and Shaftesbury Avenue in proximity. The site is well served

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[4] British Geological Survey, Geology of Britain viewer. Available from: http://mapapps.bgs.ac.uk/geologyofbritain/home.html [Accessed: 15/11/2019]

[5] Defra data services platform. Available from: https://environment.data.gov.uk/ [Accessed: 12/11/2019]

[6] DEFRA Magic Mapping. Available from: https://magic.defra.gov.uk/MagicMap.aspx [Accessed: 13/11/2019]

[7] National Planning Policy Framework. Available from: https://www.gov.uk/guidance/national-planning-policy-framework [Accessed: 15/11/2019]

[8] Flood risk and coastal change guidance. Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-change [Accessed: 15/11/2019]

[9] Camden Local Plan. Available from: https://www.camden.gov.uk/documents/20142/3912524/Local+Plan+Low+Res.pdf/54bd0f8c-c737-b10d-b140-756e8beeae95 [Accessed: 15/11/2019]

with public transport routes and vehicular routes, as well as maintaining the potential to link into surrounding green and active travel corridors.

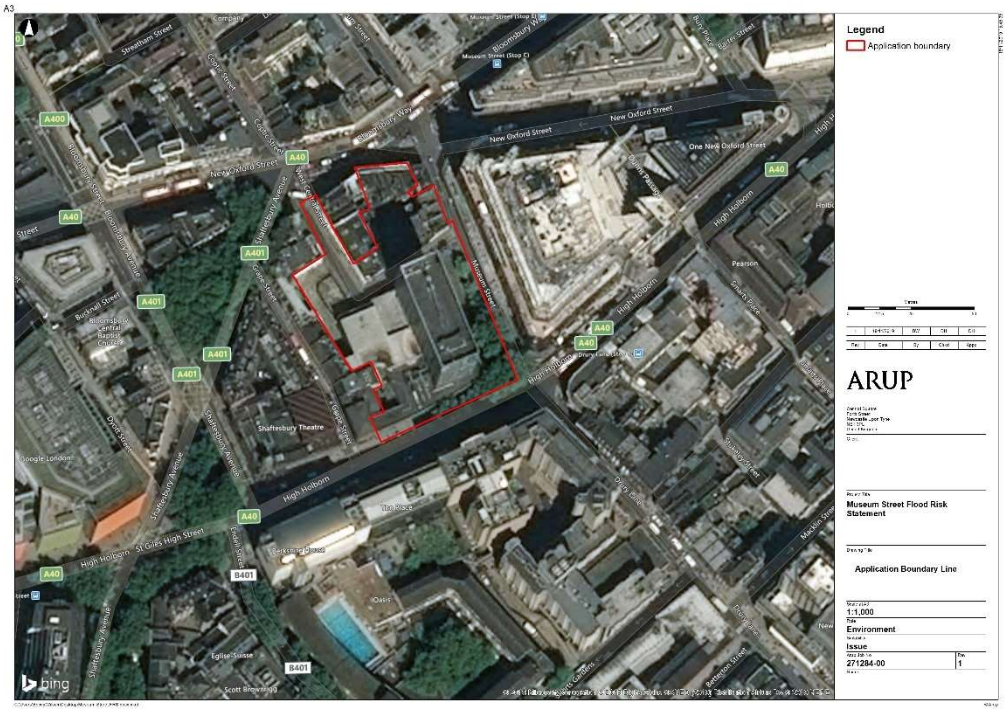

Figure 1: Application site boundary (as denoted by the red line polygon).

3.1 Existing topography and landscape

The current site consists mainly of commercial facilities and areas of hardstanding, with West Central Street dividing the site into two sections. There is minimal environmental provision on the site currently, with some planted trees to the south east, on the Museum Street/High Holborn corner of the site. All four sides of the site are accessible by major roads.

The general topography of the site is flat and at a consistent elevation. The LiDAR (Light Detection and Ranging) data, presented in **Figure 2**, indicate that the site is elevated to 22m-24m Above Ordnance Datum (AOD).

The site sits on bedrock formed from the London Clay Formation, this bedrock layer consists of clay, silt, and sand. Superficial deposits across the site are categorised as Lynch Hill Gravel Member: sand and gravel. London Clay is impermeable, and due to this it is of little significance as an aquifer[10]. Therefore, it is designated as an Unproductive aquifer. Lynch Hill Gravel is classed as a 'Secondary A' aquifer. A 'Secondary A' aquifer is classified as a bedrock that has permeable layers that are capable of supporting water supplies at a local level and may form important base flow source to local rivers[10]. The volume of superficial

[10] British Geological Survey: The physical properties of minor aquifers in England and Wales. Available from: http://nora.nerc.ac.uk/id/eprint/12663/1/WD00004.pdf [Accessed: 18/11/2019]

deposits across the LBC is low and often does not interact with the hydrology of sites according to the LBC SFRA[1].

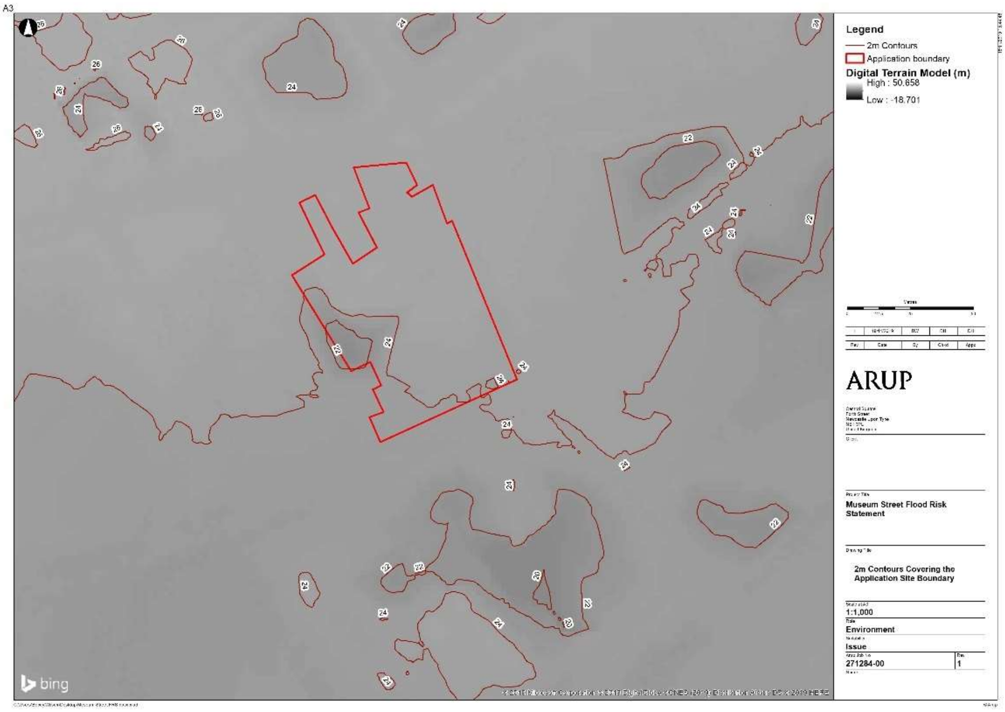

Figure 2: 2m contour lines across the application site and surrounding area (as denoted by the red line polygon).

3.2 Development vulnerability

The vulnerability of the proposed development's classification varies depending on the final use of the buildings. Units intended for drinking establishments and residential dwellings are classed as More Vulnerable and the rest of the units that may be used for shops, offices, and cafes are classed as Less Vulnerable according to the Planning Practice Guidance on Flood Risk[11]. The site is assigned according to the highest rating and so it categorised as More Vulnerable.

[11] Flood Vulnerability classifications (Table 2, Paragraph: 066 Reference ID: 7-066-20140306 of Planning Practice Guidance on Flood Risk). Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-changeThe #Site-Specific-Flood-Risk-Assessment-checklist-section[Accessed: 12/11/2019]

4 Definition of Flood Hazard

4.1 Flood sources/mechanisms

4.1.1 Fluvial

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Fluvial flood risk can be classified in terms of probability. The below references to degrees of river and sea flood risk are expressed in terms of Annual Event Recurrence (AER) probability. This reflects the likelihood of an event occurring in any single year, with less frequent and more extreme events having a lower AER probability (and vice versa). This is an alternative means to 'Return Periods' to express flood risk. For comparative purposes, degrees of flood risk can be summarised as:

- (Low Risk): Flood Zone 1 - An AER of 0.1% (equivalent to a 1 in 1000 year return period) or lower chance of occurrence each year from river or sea flooding sources;
- (Medium Risk): Flood Zone 2 - An AER of between 1% and 0.1% (equivalent to between a 1 in 100 and 1 in 1000 year return period) chance of happening each year for river flooding sources. An AER of between 0.5% and 0.1% (equivalent to between a 1 in 200 and 1 in 1000 year return period) chance of occurrence each year for sea flooding sources; and
- (High Risk): Flood Zone 3 - An AER of 1% (equivalent to a 1 in 100 year return period) or greater chance of occurrence each year for river flooding sources. An AER of 0.5% (equivalent to a 1 in 200 year return period) or greater chance of happening each year for sea flooding sources.

4.1.2 Coastal or near coastal flood risk

Coastal and near coastal flooding is caused by extreme sea levels, which can occur due to three main mechanisms and, most commonly, as a combination of two or more of:

1. High astronomical tide level; cyclical variation in tide levels due to the gravitational effects of (mainly) the sun and moon. These effects lead to the twice daily variations between high and low tide, and to the spring-

neap tide cycle, which occurs approximately monthly, largely controlled by the phases of the moon;

2. Surge; an increase in water level above the astronomical tide level caused by low barometric pressure exacerbated by the wind acting on the surface of the sea (also known as “set-up”);
3. Wave action; dependent on wind speed, wind direction, fetch length, local topography and exposure. Waves can be in the form of sea-scale swell waves, or more local sea surface waves.

4.1.3 Surface water flooding

Overland flow is a description for water flowing over the ground surface, which has yet to enter a natural drainage channel, an artificial drainage system or the natural substrate. It is often a result of very intense and short rainfall events but can also be produced during mild rainfall events when drainage systems are at capacity or blocked, or when the ground is already saturated. Surface water flooding (sometimes referred to as flash flooding) occurs when the rainfall rate is greater than the infiltration rate, causing surface water to be stored above ground. This can result in the inundation of low-lying areas and can also be related to sewer flooding, excessive groundwater and infrastructure failure.

Surface water flood risk can also be classified in terms of probability. For comparative purposes, the following degrees of flooding risk have been classified for surface water:

- Very Low Risk: Each year, this area of land has a less than 1 in 1,000 (0.1%) chance of flooding;
- Low Risk: Each year, this area of land has between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance of flooding;
- Medium Risk: Each year, this area has between a 1 in 100 (1%) and 1 in 30 (3.3%) chance of flooding; and
- High Risk: Each year, this area has greater than 1 in 30 (3.3%) chance of flooding.

4.1.4 Groundwater Flooding

Flooding can occur in locations where groundwater naturally occurs at shallow depths under the ground level. Prolonged periods of rainfall can result in increased groundwater levels that can lead to the groundwater level reaching the surface. This can pose a flood risk to developments, particularly basements and cellars, but also the emergence of groundwater will prevent infiltration occurring and so will promote the occurrence of overland flow. In addition, groundwater may leak into existing surface water drainage systems of poor integrity, reducing their ability to accommodate surface water runoff.

4.1.5 Reservoirs, canals, and other artificial sources

Artificial flooding can occur due to infrastructure failure or human intervention. Sources include reservoirs, canals, retention ponds, docks, and other artificial structures. The probability of a structural breach is low; however, the potential extent of damage can be significant.

4.2 Likelihood of flooding

4.2.1 Historical flooding

Environment Agency historic flood maps indicate that no flooding has been recorded on the application site (**Figure 3**). LBC SFRA maps display that the application site is out with Local Flood Risk Zones[12] and is not listed in the areas affected by major historical local floods.

4.2.2 Fluvial and tidal flooding

The entire LBC borough is located within Flood Zone 1 (1 in 1000 year chance of flooding or lower (0.1%)). The application site is 750m from Flood Zone 2 or Zone 3, both of which are associated with the Thames (**Figure 3**). The River Thames has flood defences along its banks, although the site is not influenced by these defences.

[12] Appendix B Figure 6 in LBC SFRA. Available from: https://www.camden.gov.uk/documents/20142/0/download+%2815%29.pdf/37025249-3da8-4fe1-3075-aa025d3b66de [Accessed: 19/11/2019]

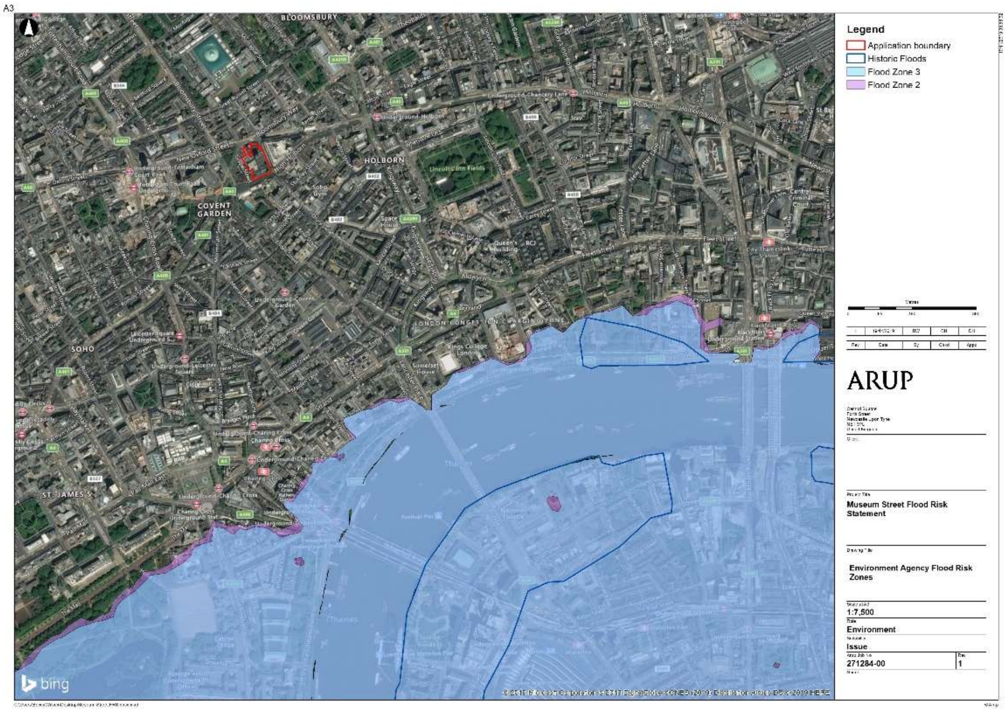

Figure 3: EA Flood Zones and Historic Flooding (as denoted by the red line polygon).

4.2.3 Surface water flooding

EA flood map for surface water flooding risk[13] (**Figure 4**) suggest that there is limited surface water flood risk at the application site. A few small areas of low risk (0.01 annual chance of flooding from surface waters) are outside of the area of the building components of the proposed new development and are on the edges of the application site boundary.

It should be noted that there is always a risk of surface water flooding, which should be managed by appropriate landscaping and surface drainage design.

[13] EA long term flood risk information. Available from: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map [Accessed: 20/11/2019]

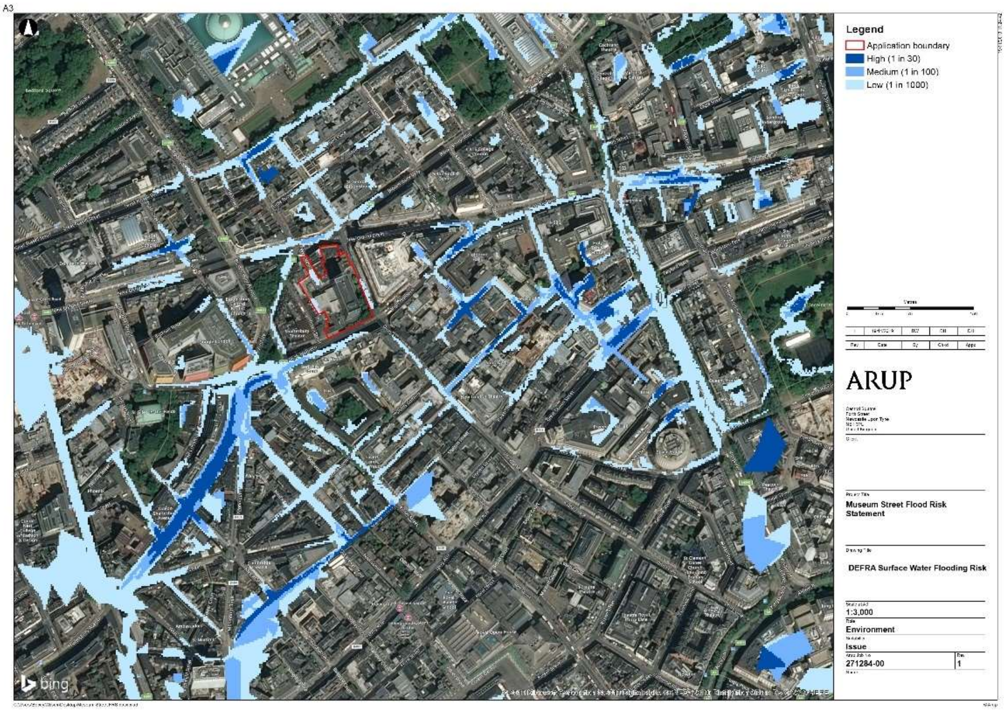

Figure 4: Risk of flooding from surface waters (as denoted by the red line polygon).

4.2.4 Groundwater flooding

The SFRA[1] does not list the application site as being in an area for increased susceptibility to elevated groundwater, nor has it experienced a groundwater incident recorded by the EA[14]. However, the site is located in a Critical Drainage Area (CDA) and within an area with potential for groundwater flooding of property situated below ground level[15]. This will need to be appropriately addressed in the design and associated relevant assessments (e.g., basement impact assessment; drainage strategy). Several areas, greater than 75m from the site, are listed as having the potential for groundwater flooding at the surface[15].

The site is anticipated to be underlain by Made Ground overlying Sand and Gravels of the Lynch Hill Gravel Member which in turn sit on the London Clay. The Lynch Hill Gravel Member is a Secondary A Aquifer; a permeable layer capable of supporting water supplies at a local level. The underlying geology of the site is considered to permit moderate infiltration although permeability is spatially variable.

Historic groundwater monitoring in the area indicates a groundwater level in the Sands and Gravels in the order of 20.5mOD (circa 3.5m bgl), although variability

[14] Appendix B Figure 4e in the SFRA. Available from: https://www.camden.gov.uk/documents/20142/0/download+%2815%29.pdf/37025249-3da8-4fe1-3075-aa025d3b66de [Accessed: 19/11/2019]

[15] 1 Museum Street and West Central Street - Geotechnical and Geo-environmental Desk Study Report (doc ref: 1084-A2S-XX-XX-RP-Y-0001-00), A-squared Studio Engineers Ltd (2019)

and seasonal changes are anticipated. For the preliminary design, a long-term design level of 23.0mOD (1.0m bgl) has been selected[15].

Based on the available data, the risk of groundwater flooding at the surface is considered low.

Groundwater monitoring will be required during the GI to confirm the hydrogeology of the site.

Figure 5 shows indicative groundwater levels as recorded from British Geological Survey (BGS) historic borehole records in this location.

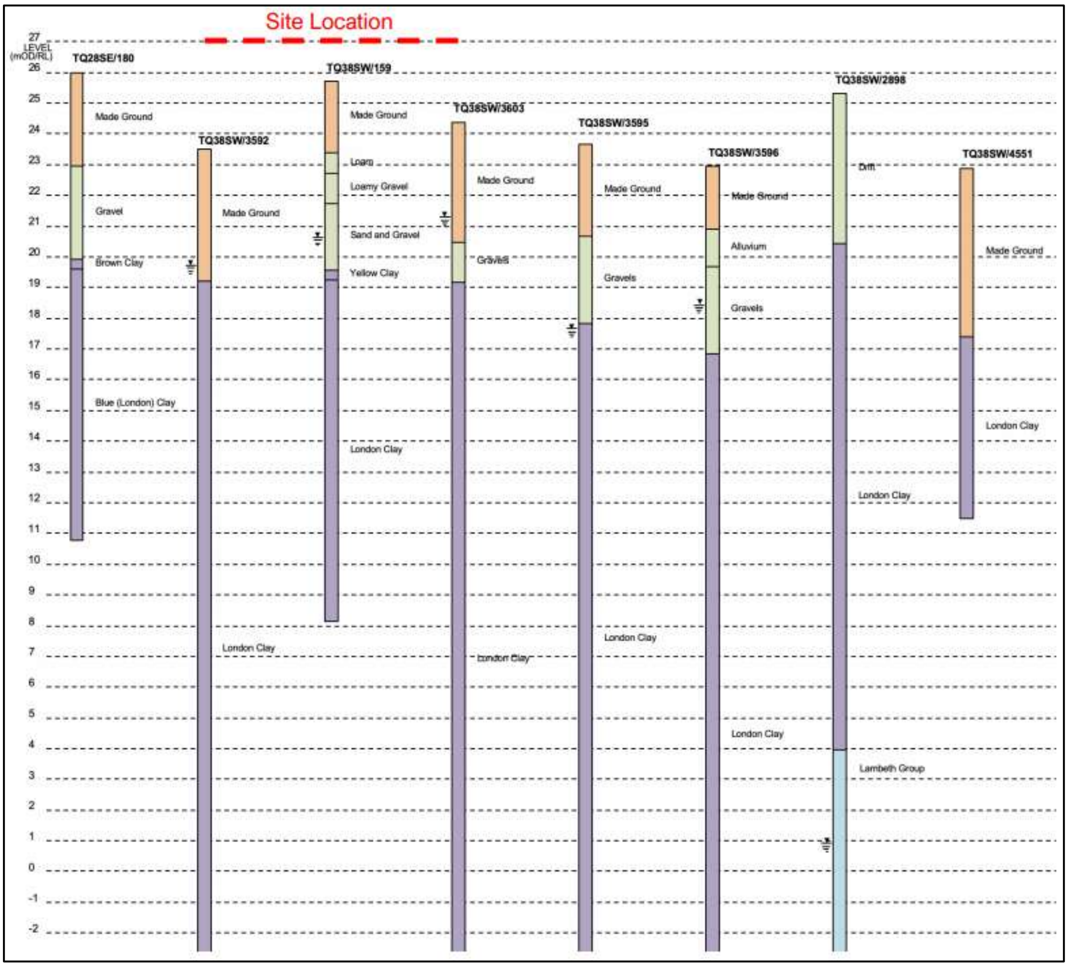

Figure 5: BGS historical borehole data (indicative cross-section, west-east)

4.2.5 Drainage, SuDS and off-site flood risk

The site is developed in a dense urban area with the majority of the application site being hardstanding. The proposed development would not increase the areas of impermeable land from the current situation by a significant degree as similar footprints to the existing buildings will be followed. There is potential to use SuDS within the site drainage plan, also the conceptual site plans include green roofs and soft landscaping within that will increase environmental amenity and attenuate surface runoff through the site.

Subject to final site levels, SuDS-type surface drainage features should be considered in preference to a traditional piped drainage system where the proposed topography and ground conditions allow.

4.2.6 Flooding from reservoirs, canals, and other artificial sources

The Environment Agency reservoirs flooding extent map[16] shows modelled maximum extent of flooding from reservoirs in both 'wet-day' (when there is also flooding from rivers) and 'dry-day' (when river levels are normal) scenarios. In either scenario, the map indicates that the application site is not at risk of flooding from reservoirs. The nearest at risk area is situated on the northern boundary of the Thames River, approximately 750m south-east of the application site.

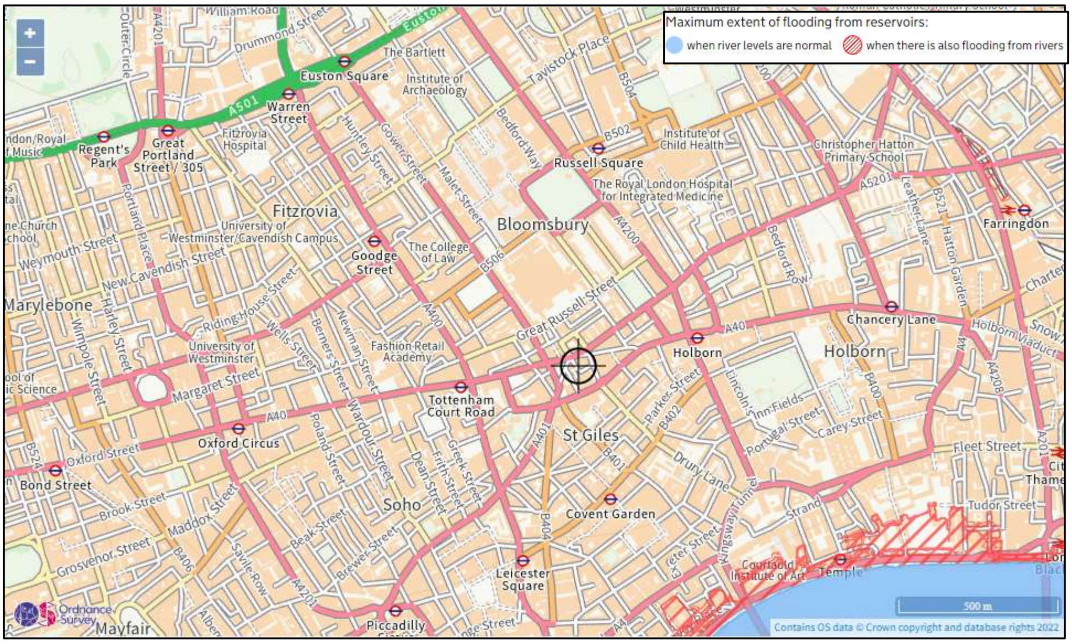

Figure 6: EA extent of flooding from reservoirs map

[16] EA Extent of flooding from reservoirs map. Available from: https://check-long-term-flood-risk.service.gov.uk/managing-flood-risk [Accessed: 06/07/2022]

5 Conclusion

According to EA flood mapping, the application site is contained within a low-risk area for flooding occurring from rivers and/or seas. Additionally, the site contains small areas of ground that are classified as low risk for surface water flooding, the rest of the site is associated with negligible risk.

The available information suggests that groundwater flooding is not considered to be an issue for this site due to the underlying geology being clay and an unproductive aquifer[17]. Furthermore, the application site is not located in a critical drainage zone. There are no historical records of flooding within EA records or the SFRA document. However, it is acknowledged that this does not necessarily mean that the site has not flooded in the past.

The redevelopment of the existing site will not increase the area of impermeable hardstanding as the site is already fully developed. The site design has scope to include SuDS and to use green infrastructure such as green roofs to increase biodiversity and manage surface water on site in a more sustainable manner.

The information presented in this document for the application site indicates low flood risk conditions from all sources. The footprint of the proposed development will be less than the 1-hectare, meaning that a Flood Risk Assessment will not be needed for this development according to NPPC guidance[18].

Consequently, a full Flood Risk Assessment may not be necessary and has the potential to be scoped out of the planning application for the proposed development. However, an FRA may still be requested by the Local Authority of Environment agency officers based on local drivers and conditions.

[17] Section 2.10 in LBC SFRA. Available from: https://www.camden.gov.uk/flooding#wxbh [Accessed: 20/11/2019]
[18] EA guidance. Available from: https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications [Accessed: 20/11/2019]