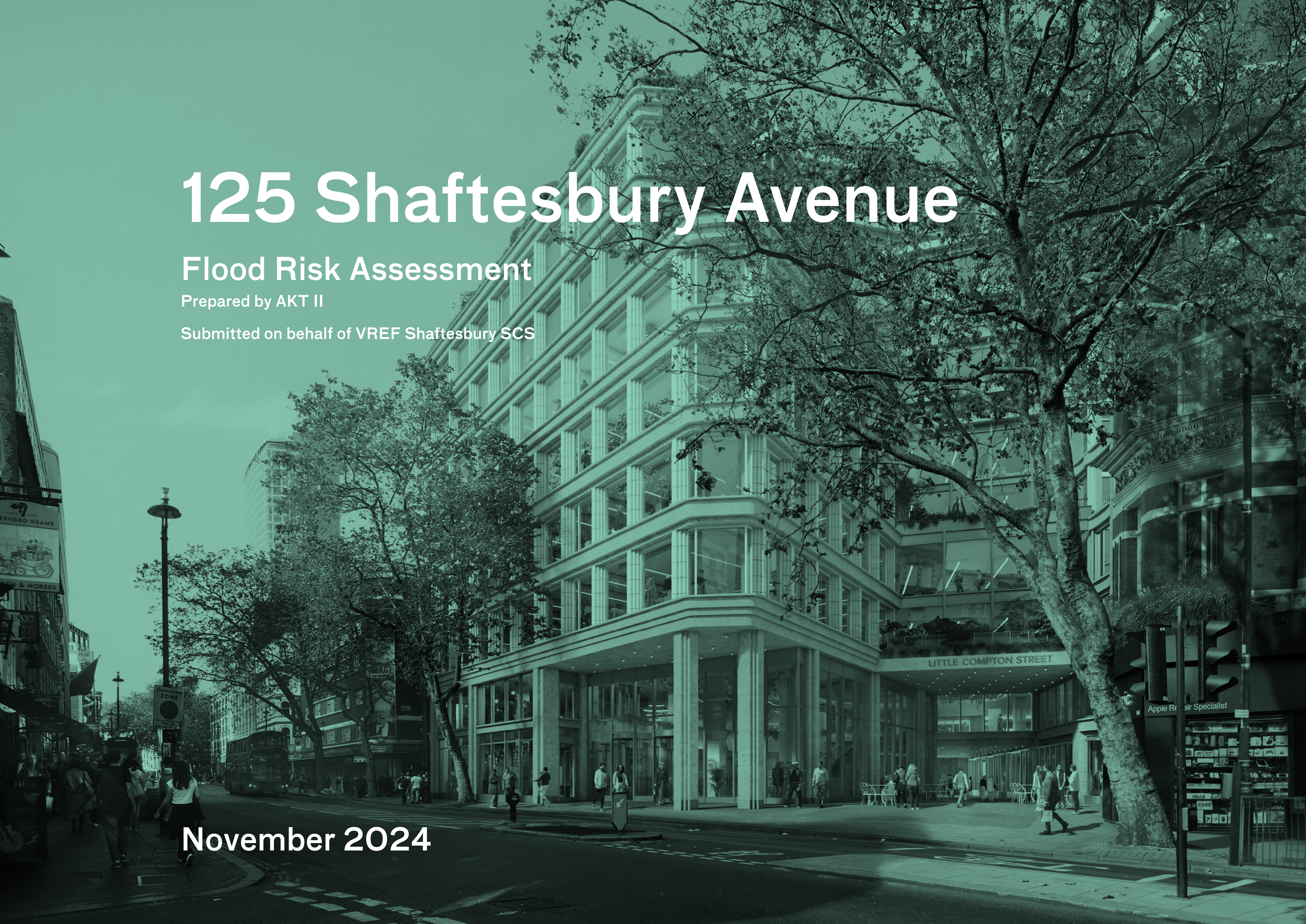
125 Shaftesbury Avenue

Flood Risk Assessment

Prepared by AKT II

Submitted on behalf of VREF Shaftesbury SCS

November 2024



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1 Introduction

This Flood Risk Assessment report has been prepared by AKT II in support of the proposed redevelopment of 125 Shaftesbury Avenue, WC2H 8AD, London. The proposal involves remodelling, refurbishment and extension of the existing building to provide Use Class E commercial and retail space, amenity terraces, a new public route, relocated entrances, cycle parking, servicing and rooftop plant along with associated highway, landscaping and public realm improvements and other associated works.

This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance and it is intended to cover flood risk and to provide guidelines and parameters for the detailed drainage design.

2 Existing Site

The proposed site is located at 125 Shaftesbury Avenue, London, WC2H with an approximate grid reference E529955 N181103. It lies approximately 100m south of St Giles in-the-fields Church, 250m south of Centre Point / Tottenham Court Road Station (Central and Northern lines and Crossrail) and 250m north of Leicester Square Station (Northern and Piccadilly lines).

The site covers an area of approximately 61m by 52m and is bounded by:

- Charing Cross Road to the south west;
- Shaftesbury Avenue to the south east;
- Stacey Street to the north east; and
- Phoenix Street to the north west.

The 0.359ha site lies within the London Borough of Camden and sits between the distinct character areas of Soho, Covent Garden, Seven Dials and Bloomsbury. It is not located within a Conservation Area, but is part of a small urban pocket surrounded by the Soho, Denmark Street and Seven Dials Conservation Areas.

The site is currently occupied by a basement, ground plus 10-storey building designed by Ian Fraser, John Roberts and Partners and completed in 1982. When the building was first completed, a retail arcade occupied much of the ground floor, providing a pedestrian route through the building. This was later closed after it failed economically and replaced by a single large retail unit.

The site adjoins Trentishoe Mansions on Caxton Walk/Charing Cross Road and 119 Shaftesbury Avenue. The site also shares a light well with 24 Cambridge Circus and 84-86 Charing Cross Road (currently occupied by McDonalds). Tenants of these adjoining buildings currently enjoy rights of escape through the basement of 125 Shaftesbury Avenue.

For further information with regards to the site history, its geotechnical and geo-environmental information, as well as the site constraints please refer to the Desk Study developed by AKT II.

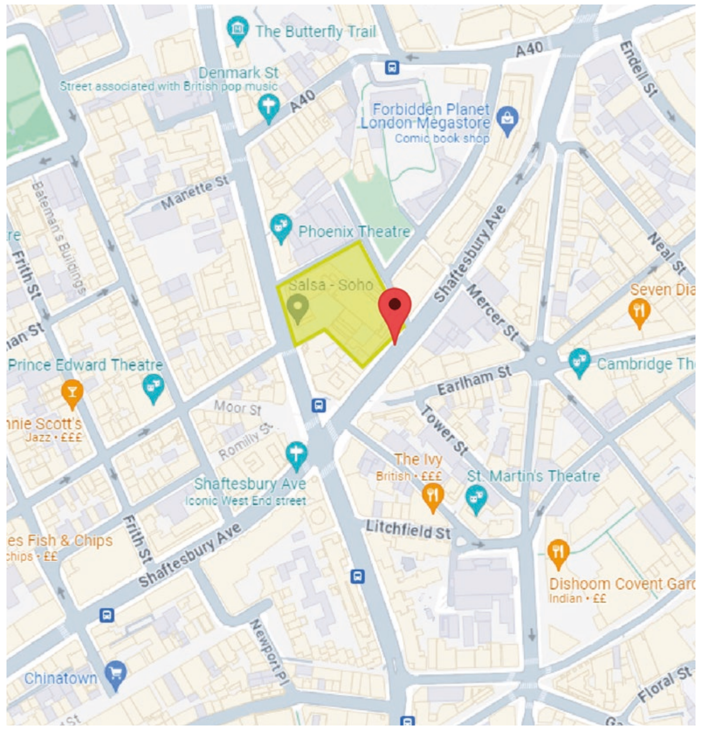


Figure 2.1 Site Location Map

Figure 2.2 Existing aerial view of the site (Google Earth)

3 Proposed Site

The 125 Shaftesbury Avenue project involves remodelling, refurbishment and extension of the existing building to provide Use Class E commercial and retail space, amenity terraces, a new public route, relocated entrances, cycle parking, servicing and rooftop plant along with associated highway, landscaping and public realm improvements and other associated works.

The development will be car-free and no car parking is proposed on site.

The proposed development will contribute to the ongoing improvement and reinvention of this central London location.

Figure 3.1 Proposed Development

4 Planning Policies & requirements of National Planning Policy Framework (NPPF)

4.1 Camden Local Plan 2017

The Local Plan was adopted by Council on 3 July 2017. It sets out the Council's policies and plays an essential role in the delivery of the Camden Plan. The following policies have been referred to in preparation of this FRA:

- Policy CC2 Adapting to climate change - this policy requires new developments to be resilient to climate change;
- Policy CC3 Water and flooding - The Council will seek to ensure that developments do not increase flood risk and reduce the risk of flooding where possible.

4.2 Camden Planning Guidance - Water and flooding

The Council has prepared Camden Planning Guidance (CPG) on Water and flooding to support the policies in the Camden Local Plan 2017. This guidance provides information on the water environment in Camden, water efficiency and flooding, supporting Local Plan Policy CC3 Water and flooding. Key considerations of this guidance are:

- All development must not increase the risk of flooding;
- Development are required to utilise Sustainable Drainage Systems (using the drainage hierarchy) to achieve greenfield run off rates, where feasible.

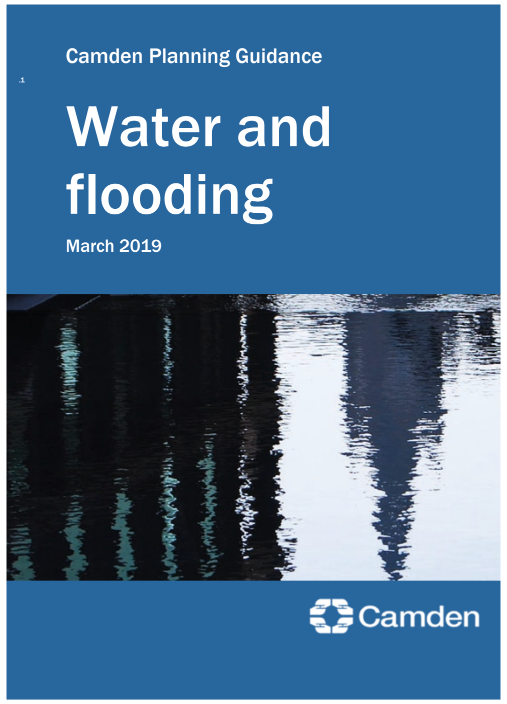


Figure 4.1 Camden Planning Guidance - Water and flooding cover page

4.3 NPPF

The National Planning Policy Framework (NPPF) sets out government;s planning policies for England and how these are expected to be applied. Key requirements and goals in termos of flood risk are as follows:

- The susceptibility of land to flooding is a material planning consideration;
- The Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;
- Planning decisions should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid inappropriate development on undeveloped and undefended flood plains etc;
- Developers should fund flood defences and warning measures required because of the development;
- Planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not only be restricted to flood plains.

Given the relevant policies in the NPPF, those proposing particular developments should:

- Provide an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and the measures proposed to deal with these effects and risks and;
- Satisfy the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect thus ensuring the safe development and secure future occupancy of the site.

After this has been addressed, it is then the local planning authority's responsibility (advised as necessary by the Environment Agency on fluvial and tidal flood risk, and the LLFA on surface water flood risk) to determine an application for planning permission after taking into account all material considerations, including the issue of flood risk and how it might be managed or mitigated. Local planning authorities are required to adopt a risk-based approach to proposals for development in flood risk areas. The assessment of risk should take into account:

- The area liable to flooding;
- The probability of flooding occurring, both now and over time;
- The extent and standard of existing flood defences and their effectiveness over time;
- The likely depth of flooding;
- The rates of flood flow likely to be involved; and
- The nature of the development proposed and the extent to which it is designed to deal with flood risk.

Local planning authorities in conjunction with the Environment Agency are responsible for determining that the threat of flooding should be managed. This is to ensure that the development is and remains safe throughout its lifetime (i.e. it has an appropriate degree of protection) and does not increase flood risk elsewhere.

Following flooding in December 2000 the Environment Agency (EA) provided indicative flood plain maps to all authorities and published them on the EA website. In addition to these indicative maps (following a national programme adopted by the Agency in 1996), detailed data and maps for priority areas at risk are available, to provide precise information for building developments.

Under the NPPF (paragraph 167), local development plans should apply a sequential, risk based approach to the location of development (taking into account all sources of flooding and climate change) so as to avoid flood risk to people and property. Under a sequential test, sites are to be categorised under the following zones.

1 Areas with little or no potential risk of flooding (annual probability less than 0.1% for rivers, tidal & coastal). These areas would have no constraints on development other than the need to ensure that the development does not increase run-off from the site to greater than that from the site in its undeveloped or presently developed state. For development proposals on sites located within Flood Zone 1 comprising one hectare or above the vulnerability to flooding from other sources as well as from river and the sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA.

2 Areas with low potential risk of flooding (annual probability between 1.0% - 0.1% for rivers and between 0.5% - 0.1% for tidal & coastal). These areas would be suitable for most developments.

3a Areas with high potential risk of flooding (annual probability greater than 1.0% for rivers and greater than 0.5% for tidal & coastal). These areas will generally be suitable for "Less Vulnerable" uses such as commercial, retail and industrial uses, provided there are adequate flood defences in place, that ensure buildings are designed to resist flooding, there are suitable warning and evacuation procedures in place and the new development does not add to flood risk downstream.

3b Areas at highest risk from flooding (including those areas behind defences that offer a standard of defence less than 1% for rivers and less than 0.5% for tidal & coastal or where there is a significant risk that failure could lead to rapid inundation by fast flowing water). These areas may be suitable for recreation, sport and conservation use.

5 Strategic Flood Risk Assessments

Strategic Flood Risk Assessments (SFRA) are produced by Local Authorities in order to form the basis for preparing appropriate policies for flood risk management. The Environment Agency advise that Developers "should consult the Strategic Flood Risk Assessment prepared by the local planning authority" when preparing the design.

The site has been the subject of a Preliminary Flood Risk Assessment (PFRA) in March 2011, a Surface Water Management Plan (SWMP) in July 2011 and Strategic Flood Risk Assessment (SFRA) - the North London Level 1 SFRA dated August 2008, which has been superseded by London Borough of Camden (LBC) SFRA dated July 2014. This document has been superseded by Level 1 Strategic Flood Risk Assessment by London Borough of Camden in January 2024.

The key findings and recommendations from the latest SFRA relating to the development site are summarised in the following section and have been used to inform the preparation of this site-specific flood risk assessment. For reference, a set of maps produced for the SFRA are contained within Appendix 2.

5.1 Level 1 Strategic Flood Risk Assessment London Borough of Camden

The London Borough of Camden (LBC) commissioned Aecom to prepare a SFRA for the entire borough. The report was issued in January 2024. The report provides a series of guidelines to be followed by sites across the Borough and the main points impacting this development site as are follows:

- The entire borough is located within Flood Zone 1. The sequential test is still required to consider flood risk from other sources.
- The SFRA identifies a number of Critical Drainage Areas (CDAs). The proposed development is not located in local flood risk zone, however, it is located within a local critical area.
- Developers should seek to minimize the surface water run-off rates post-development to 50% of the existing. This is in order to reduce surface water runoff and also reduce the strain on the combined sewer network.
- Any proposed development should consider the implementation of SuDS even if it is not at direct risk of flooding.
- Camden has a potential risk of flooding from surface water during an extreme rainfall event. Severe surface water flooding incidents were experienced in Camden in 1975, 2002 and 2021. However, all those flooding events were remote from the site (see Figure 4 'Flooded Streets 1975, 2002 & 2021') in Appendix 2 of this report.
- The majority of the area in Camden have a relatively low risk of flooding from groundwater.
- Where basement dwellings are constructed, access must be situated 300mm above the design flood level, and waterproof construction techniques should be employed to avoid seepage during flood events.

Extracts from the report and the relevant figures are enclosed in Appendix 2.

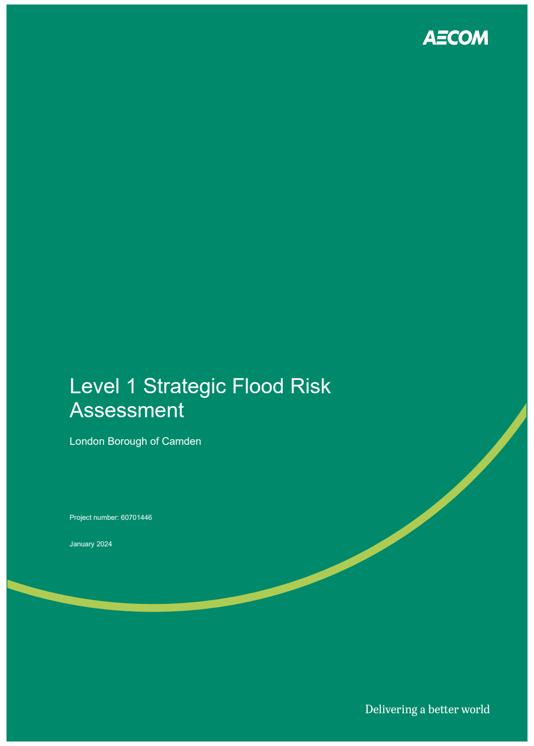


Figure 5.1 Level 1 Strategic Flood Risk Assessment London Borough of Camden

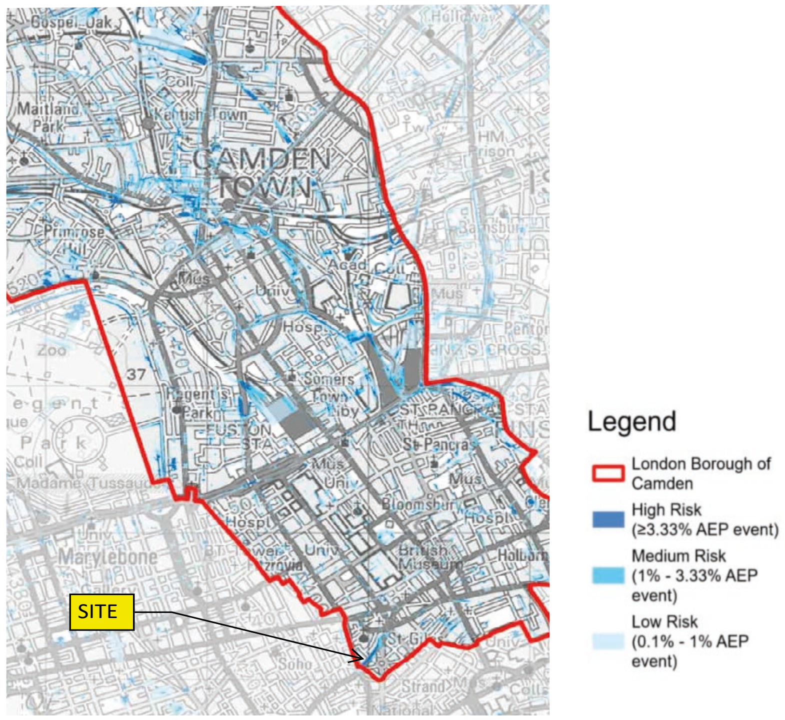


Figure 5.2 Updated flood maps for surface water flooding (from Level 1 SFRA London Borough of Camden 2024).

6 Sources of Flooding

The requirement for a flood risk assessment comes from the Local Plan, Policy CC3, where the circumstances in which a FRA is required are at paragraph 8.63 - of relevance to this site, it is a basement development with some flood risk. For the purpose of this report, flood risk to the development has been broken down into five potential sources:

- Flooding from rivers and sea
- Flooding from sewers
- Flooding from groundwater
- Flooding from artificial sources (e.g. reservoirs and canals)
- Flooding from surface water

These sources are discussed and assessed in more detail in Sections 6.2 to 6.6 below.

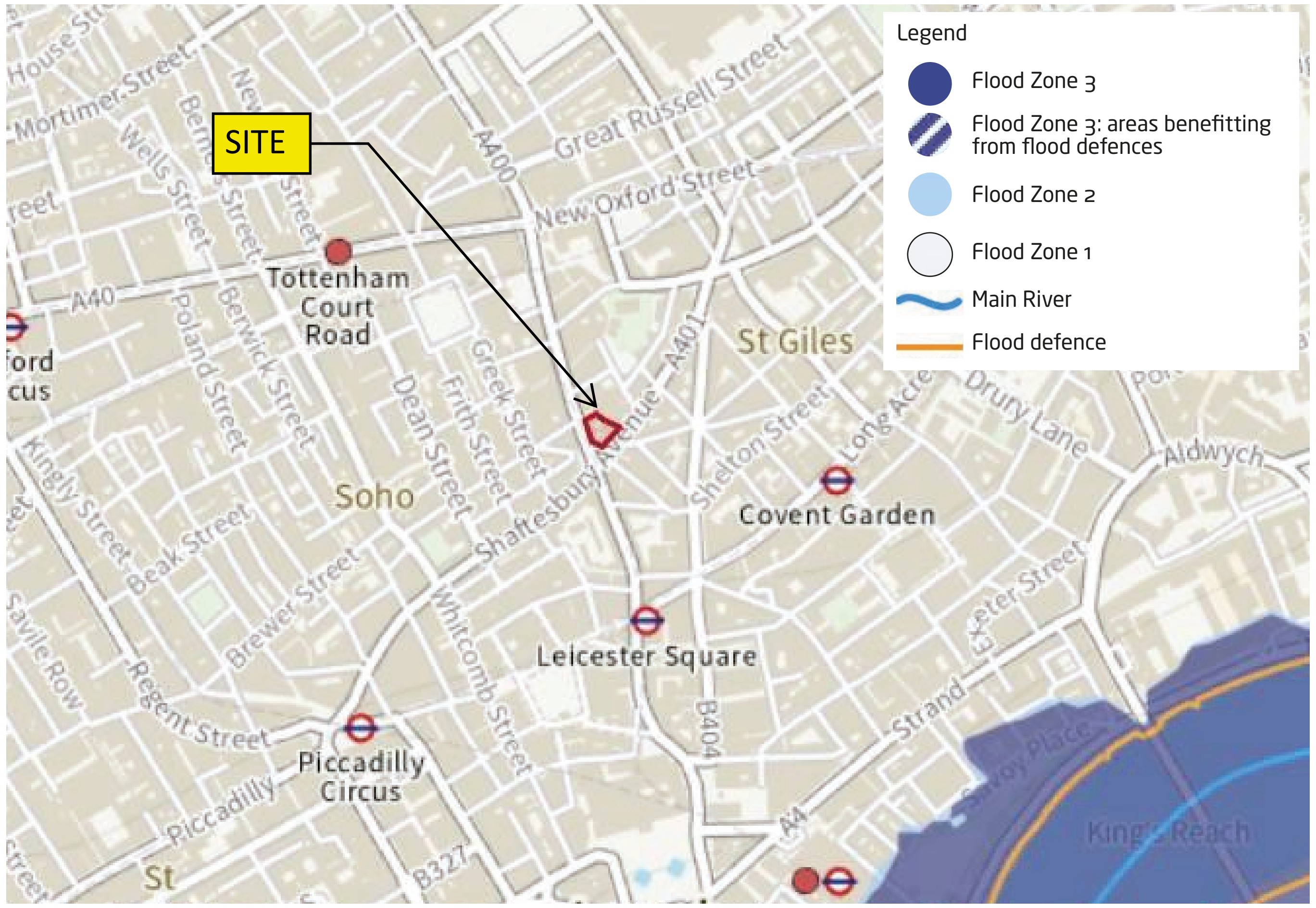


Figure 6.1 Environment Agency indicative flood map

6.1 Sequential Test

A risk-based Sequential test should be applied at all stages of the planning process. The aim is to steer developments to areas at the lowest probability of flooding (i.e. Flood Zone 1).

Based on the Environment Agency's "Flood Map for Planning (Rivers and Sea)" (refer to Figure 6.1), the site is located within Flood Zone 1 - an area assessed as having a low probability of flooding (less than 1 in 1,000 annual) from rivers and sea.

The proposed development will comprise of retail uses at ground floor with office accommodation above.

In accordance with NPPF Table 2 (reproduced below in Table 6.1), buildings used for office and retail space are classified as "less vulnerable".

Referring to NPPF Table 3 (reproduced below in Table 6.2) "less vulnerable" land uses are suitable in Flood Zone 1 and there is no requirement for the Exception Test to be applied. Therefore, the proposed land uses are appropriate for the site and the sequential test is passed.

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*
Less vulnerable • Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible development • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to a specific warning and evacuation plan.*

Table 6.1 National Planning Policy Framework: Flood Risk Vulnerability Classification

Flood Risk vulnerability classification (see Table 2)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	✗	✗	✗

Table 6.2 National Planning Policy Framework: Flood Risk Vulnerability and Flood Zone 'Compatibly'

6.2 Rivers and Sea

Fluvial flooding is caused by rivers, watercourses or ditches overflowing. Tidal flooding is caused by elevated sea levels or overtopping by wave action.

Based on the Environment Agency's "Flood Map for Planning (River and Sea)" (refer to Figure 6.2), the development is located entirely within Flood Zone 1 - an area assessed as having a 1 in 1000 or less annual probability of river or sea flooding (<0.1%). Figure 14 'Flood Map for Planning' from Level 1 SFRA London Borough of Camden (Appendix 2 of this report) confirms that the development lies outside the flooding zone even in the breach scenario.

The closest watercourse to the site is the River Thames which is located approximately 1100 m south of the site. The River Thames is protected from overflowing its banks by a raised embankment and flood walls constructed to a 100-year standard of protection.

The SFRA and Environment Agency records do not indicate any historical fluvial and tidal flooding around the site.

Using all the available evidence it is therefore considered that the site has a **very low probability** of flooding from fluvial and tidal sources.

Legend - Flood Risk

High | Low

Medium | Very Low

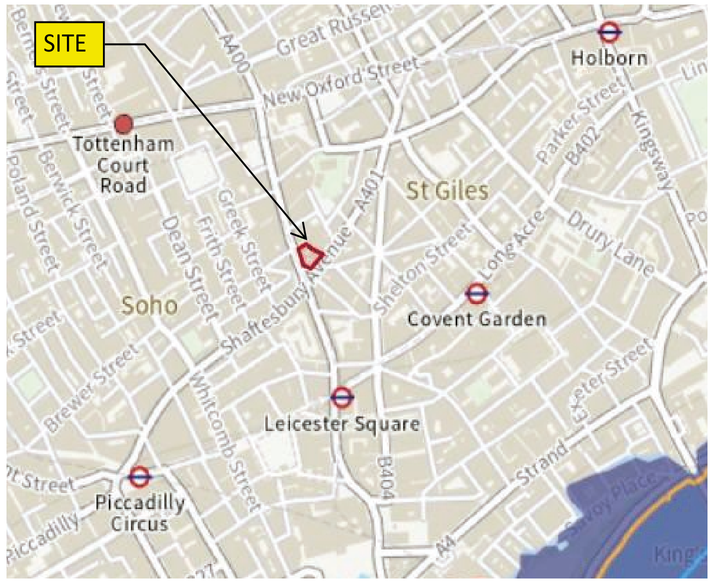


Figure 6.2 Environment Agency Flood Risk Map (Rivers and Sea)

6.3 Sewers and Local Drainage

Sewer and highway drainage flooding occurs when the capacity of systems are exceeded, or the function of the system is impeded (e.g. tide locking), which results in surcharging of the system and water being forced to the surface via gullies, manholes, foul water appliances such as toilets or other dedicated overflows.

The existing Thames Water Asset map contained in Appendix 6 of this report (Figure 6.3) indicates that there are combined sewers in close proximity of the site:

- A 1219 x 813 mm combined water sewer under Shaftesbury Avenue to the south of the site.
- A 1143 x 762 mm combined water sewer in Stacey Street to the north of the site.
- A 1143 x 762 mm combined water sewer in Phoenix Street to the north.
- A 1219 x 813 mm combined water sewer in Charing Cross Road to the west.
- A 1321 x 787 mm dia. combined sewer running under the site. The sewer was removed when this development was built in 1980s. AKT II are liaising with Thames Water to get this asset removed from their records.

According to flooding history records obtained from Thames Water and Figure 23 'Reported Incidents of Sewer Flooding' of the Level 1 SFRA contained in Appendix 2, the site is not in an area at risk of sewer flooding hotspots.

Using all the available evidence, it is therefore considered that the site has a **very low probability** of flooding from sewers and the local drainage network.

Manhole
Combined sewer

Figure 6.3 Thames Water Asset Map - Sewers

6.4 Flooding from Groundwater

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata and is often highly localised in low lying areas which are underlain by permeable aquifers. After a prolonged period of rainfall, a considerable rise in the water table can result in inundation for extended periods.

The Envirocheck geology map indicates that there are superficial deposits in the area where the site is located. The named formations are Lynch Hill Gravel Formation (Sand and Gravel), Hackney Gravel Formation (Sand and Gravel) and Langley Silt (Silt). The bedrock geology in the borough is underlain by Bagshot Formation (Sand), Claygate Member (Sand, Silt and Clay) and London Clay Formation (Silt and Clay).

The areas underlain by bedrock within the borough are expected to have depths to the water table of either >5 m throughout the year or <3 m for part of the year. Susceptibility to Groundwater Flooding map of the Level 1 SFRA in Appendix 2 shows those areas within the Borough where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2 m of the ground surface.

An extract of this map is shown in Figure 6.5 and it indicates that the site is within an area with potential for groundwater flooding of property situated below ground level.

Due to the depth to groundwater in the shallow aquifer and the presence of predominantly impermeable surfaces at and surrounding the site, the likelihood of groundwater emergence at the surface is considered to be low. Therefore the part of the site located at and above ground level are considered to be at low risk of groundwater flooding.

During the excavation works associated with the installation of new foundations and drainage runs in the existing basement there is the possibility of ground water inflow from the adjacent soils. A suitable method of minimising water entry to the excavation, and retaining the surrounding soils, will be required.

Using all the available evidence it is therefore considered that with a suitable waterproofing strategy implemented as part of the proposed development, and with the provision of appropriate protection measures during construction, there is a **low probability** of flooding from groundwater.

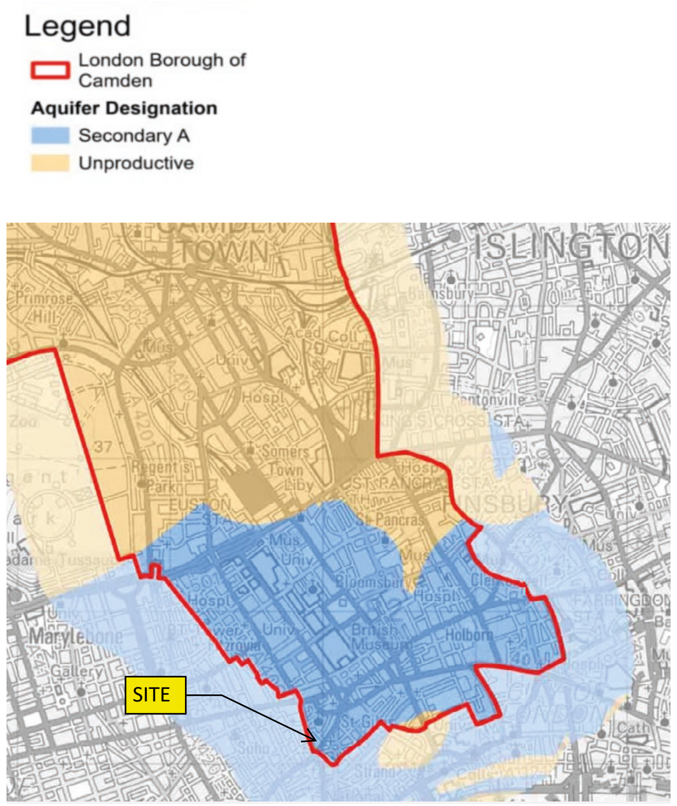


Figure 6.4 Envirocheck Superficial Aquifer Map

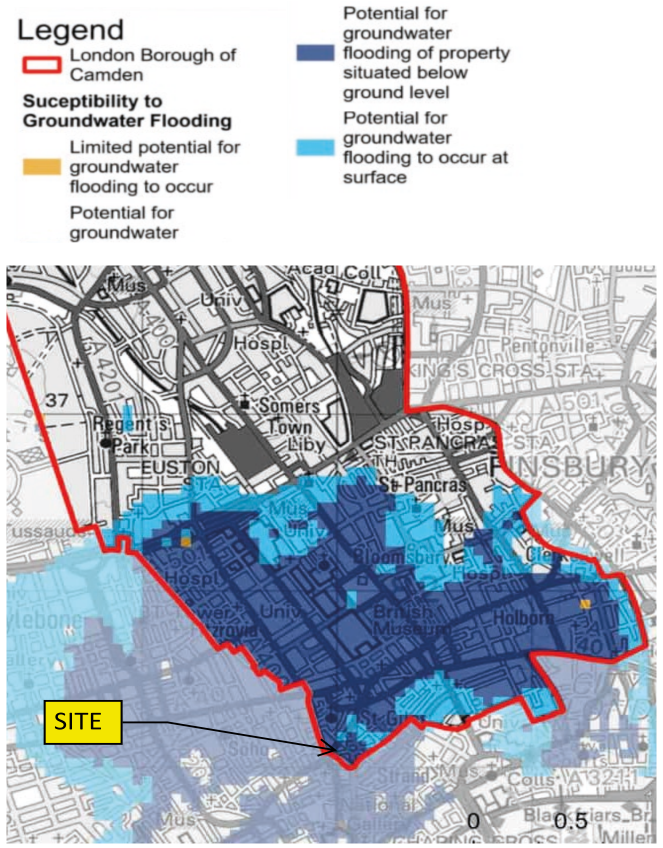


Figure 6.5 Increased Potential for Elevated Groundwater

6.5 Flooding from Artificial Sources

Where infrastructure retains, transmits or controls the flow of water, flooding may result if there is a structural, hydraulic, geotechnical or mechanical failure of the infrastructure.

The Environment Agency Map in Figure 6.9 which shows the extent of flooding from reservoirs does not show any flooding in the vicinity of the site.

The Thames Water Asses map indicates the following water mains:

- A 300mm trunk water main and 2 nos. 125mm HPPE distribution water mains in Shaftesbury Avenue to the south;
- A 300mm trunk water main and 2 nos. 125mm HPPE distribution water mains in Charing Cross Road to the west;
- A 125mm HPPE distribution main in Phoenix Street to the north; and
- A 180mm water main in Stacey Street to the east.

Although unlikely, a water main can burst at anytime which can result in the flooding of nearby properties. The SFRA holds no record of burst mains around the site. It is considered that the risk of the building flooding from an external burst water main should be low if the local drainage system is adequately maintained, as it should be adequately protected by the relative levels of the surrounding infrastructure as outlined in the surface water assessment in Section 7. Any initial sign of a burst water main should be reported to Thames Water as soon as possible.

To further reduce flood risk from water mains, any initial sign of a burst main should be reported as soon as possible and the local highway drainage system should be adequately maintained to ensure water is conveyed away from the burst main.

The Environment Agency's Flood Risk from Reservoirs Map, shown in Figure 6.9, confirms that the site is not located in areas of potential risk of flooding associated with reservoirs.

Based on all the information available it is therefore considered that the site is at a **very low probability** of flooding from artificial sources.

Bedrock and Faults Map Legend

London Clay Formation

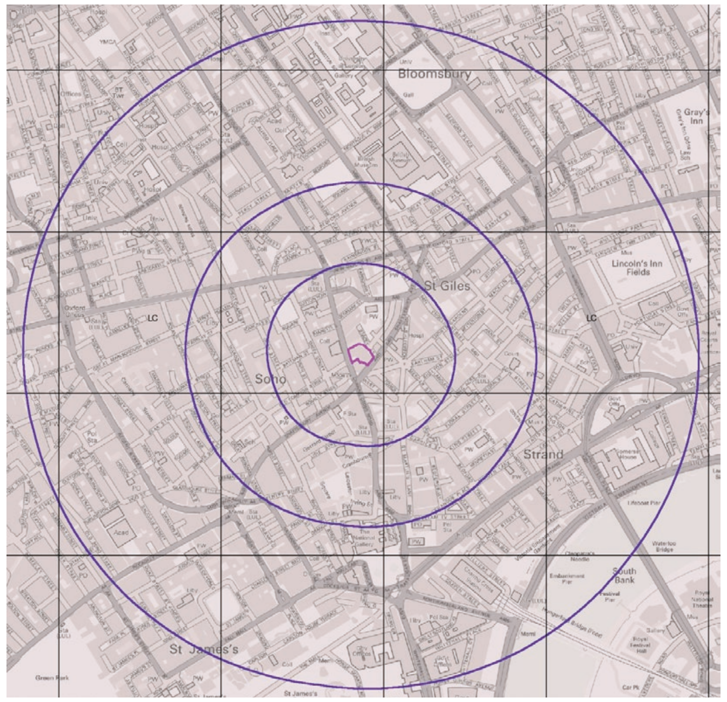


Figure 6.6 Envirocheck Bedrock and Faults Map.

Superficial Geology Map Legend

Alluvium
Langley Silt Member
Kempton Park Gravel Formation
Hackney Gravel Member
Taplow Gravel Formation

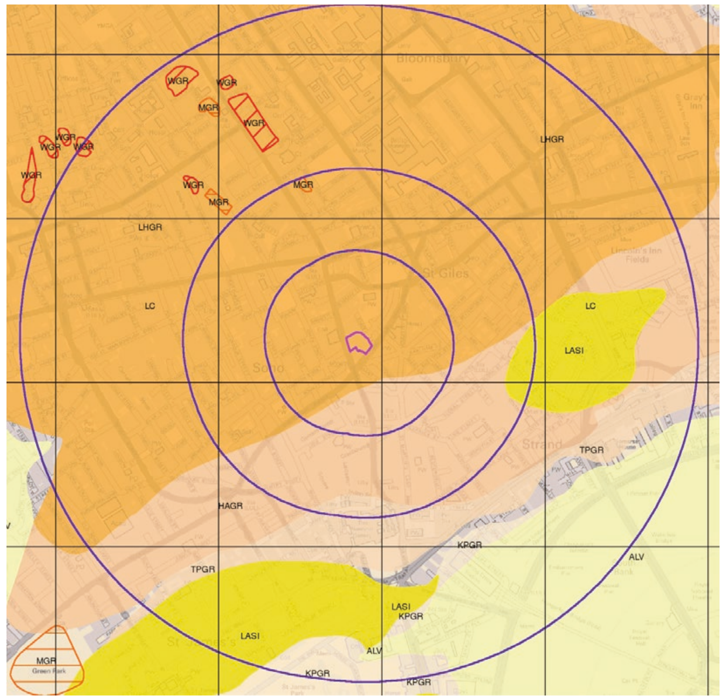


Figure 6.7 Envirocheck Superficial Geology Map.

Legend - Flood risk

Distribution Main
Trunk Main

Figure 6.8 Thames Water Asset Map - Water Mains

Legend - Flood risk

When river levels are normal
When there is also flooding from river

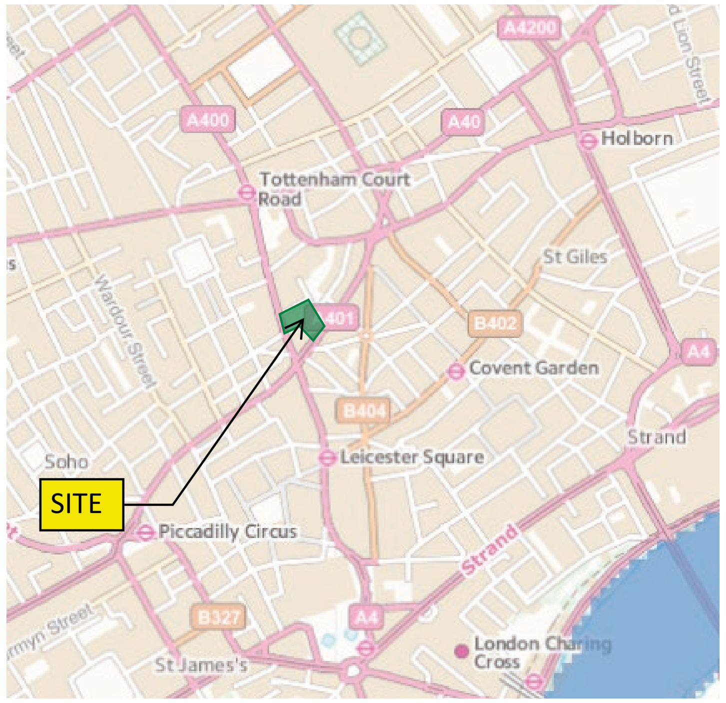


Figure 6.9 Environment Agency Flood Map - Reservoirs

6.6 Flooding from Surface Water

Surface water flooding can occur as a result of either overland flow or ponding. Overland flow occurs following heavy or prolonged rainfall, or snow melt, where intense rainfall is unable to soak into the ground or enter drainage systems due to blockages or capacity issues. Unless it is channelled elsewhere, the run-off travels overland, following the gradient of the land. Ponding occurs as the overland flow reaches low lying areas in the local topography. These flood events tend to have a short duration and depend on a number of factors such as geology, topography, rainfall, saturation, extent of urbanisation and vegetation.

As the surrounding area is highly developed it entirely comprises of impermeable hardstanding area which, during high intensity storms, will generate large surface water runoff flows. The LBC Surface Water Management Plan (SWMP) identified a number of Critical Drainage Areas (CDAs) within LBC, which are defined in the SWMP as: "*a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and / or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.*"

Therefore a specific area within a CDA is not necessarily at higher risk from surface water than an area outside of a CDA. However the location of an area within a CDA indicates that it is within a catchment area which contributes to a flooding hotspot. Within CDAs, surface water management should be a particular focus of new developments.

The SWMP also identifies a number of Local Flood Risk Zones (LFRZ) and are defined in the SWMP as: "*discrete areas of flooding that do not exceed the national criteria for a 'Flood Risk Area' but still affect houses, businesses or infrastructure. A LFRZ is defined as the actual spatial extent of predicted flooding in a single location.*"

The 'Critical Drainage Areas and Local Flood Risk Zones' map in Appendix 2 show that the site is located within CDA "Group3_005" but is not located in a local flood risk zone.

The Environment Agency maps also indicate that the risk due to surface water at the site is low as shown in Figure 6.10. The map also shows that there is a potential risk of surface water run off to pond at the junction between Shaftesbury Avenue and Stacey Street directly outside the building but no water entering the buildings along that stretch. This is consistent with the fact that the existing finished floor level is approximately 170 mm above the road channel level and the road levels falling to the south.

Although the site is not at risk, these adjacent areas of flooding have been reviewed in more detail as a precaution (see Sketch in Appendix 7) The Environment Agency provide further maps which break down this flooding into probabilities ranging from "High" to "Very Low" risk of occurring where "High" is a greater than 1 in 30 (3.3 %) chance of occurring, "Medium" is a between 1 in 30 (3.3 %) and 1 in 100 (1 %) chance of occurring, "Low" is a between 1 in 100 (1 %) and 1 in 1000 (0.1 %) chance of occurring and "Very Low" is a less than 1 in 1000 (0.1 %) chance of occurring.

- The "High" probability map shown in Figure 6.11 indicates that the area at the junction between Shaftesbury Avenue and Stacey Street experience flooding less than 300 mm in depth and with a velocity of less than 0.25 m / s (Figure 6.12).
- The "Medium" probability map shows a slightly larger extent of flooding in the areas above which is around 300 mm in depth in any of them and with a velocity of less than 0.25 m / s (Figure 6.14) in all of them.
- The "Low" probability map in Figure 6.15 shows the flooding on Charing Cross Road and Stacey Street stretching beyond the junction with Shaftesbury Avenue with the depth still remaining less than 300 mm immediately in front of the site but increasing to 300 to 900 mm to the south-easy corner of the site on Shaftesbury Avenue and with a velocity of greater than 0.25 m / s (Figure 6.16).

However, it has been demonstrated by a review of the existing levels around the site, that the surface water won't enter the proposed development (see sketch contained in Appendix 7 of this report).

Using the above information, the site is a very low risk of surface water flooding under a storm event with a 1 in 1000 (0.1 %) probability of occurring. A safe access assessment is discussed in Section 6.6.1 below which further confirms that there is a low risk to the proposed development.

Based on the above information the development is considered to be at **low risk** of flooding from surface water.

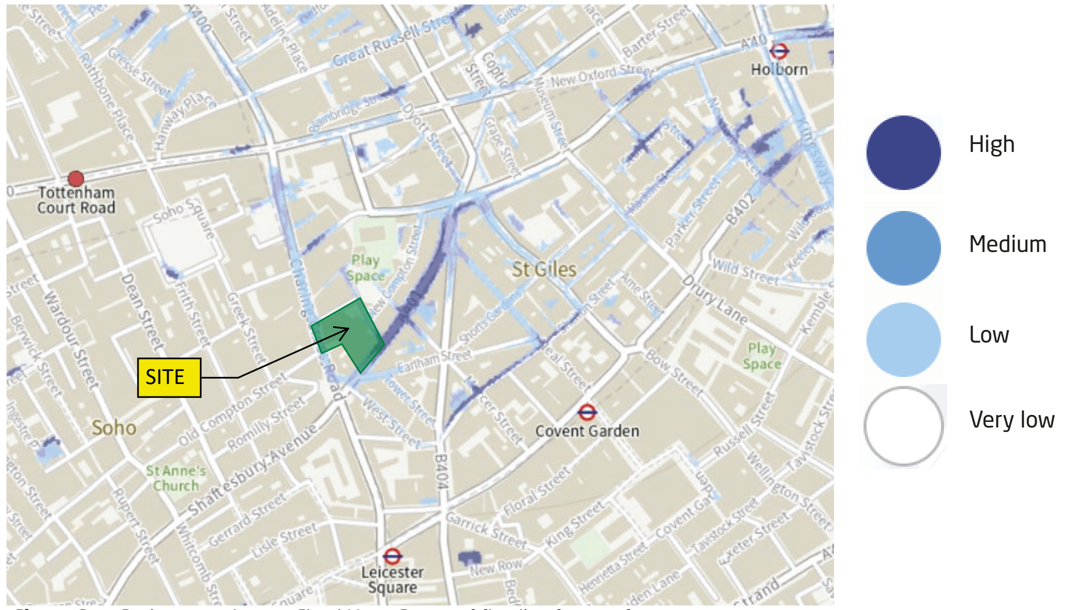
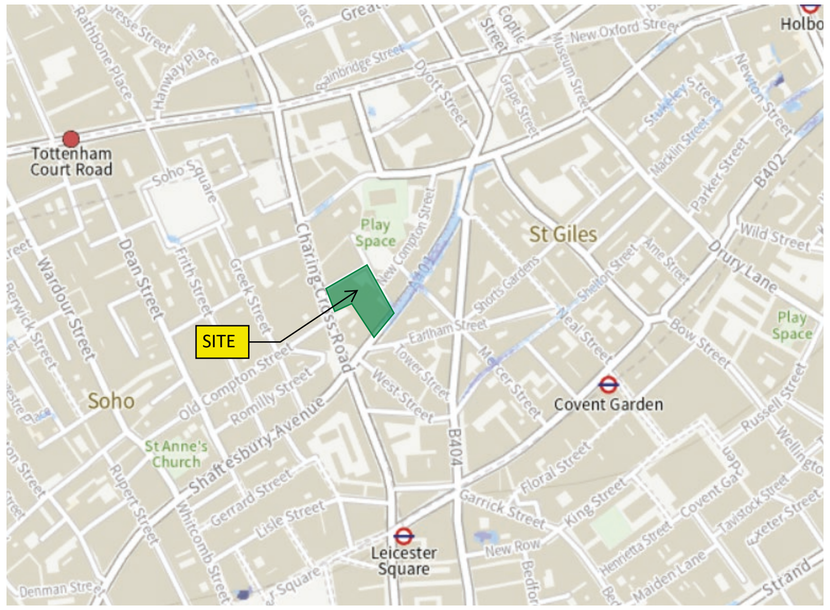


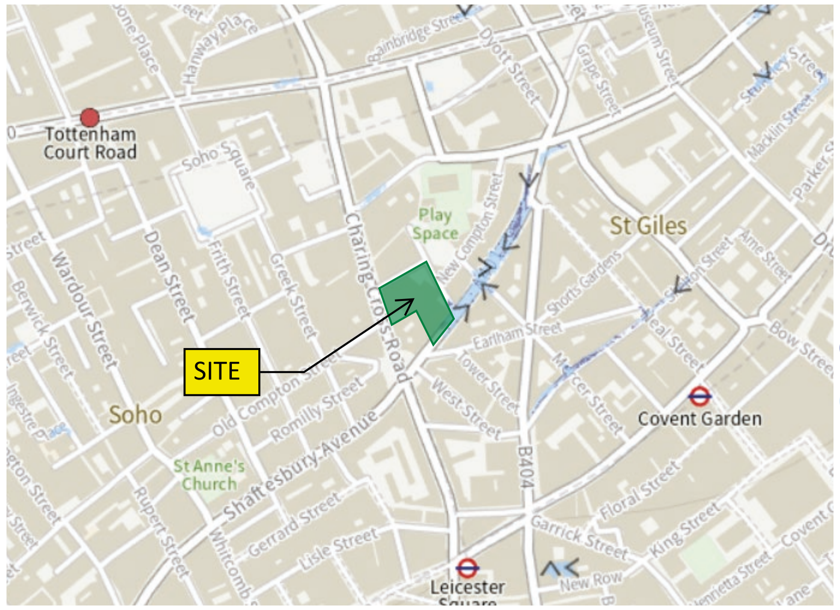
Figure 6.10 Environment Agency Flood Map - Extent of flooding from surface water



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

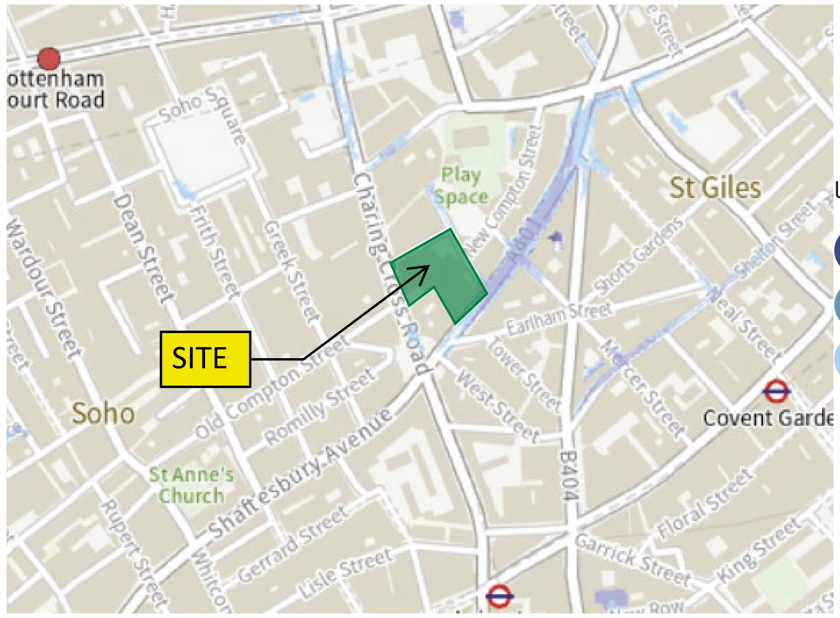
Figure 6.11 Environment Agency's Flooding from Surface Water Map (High Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

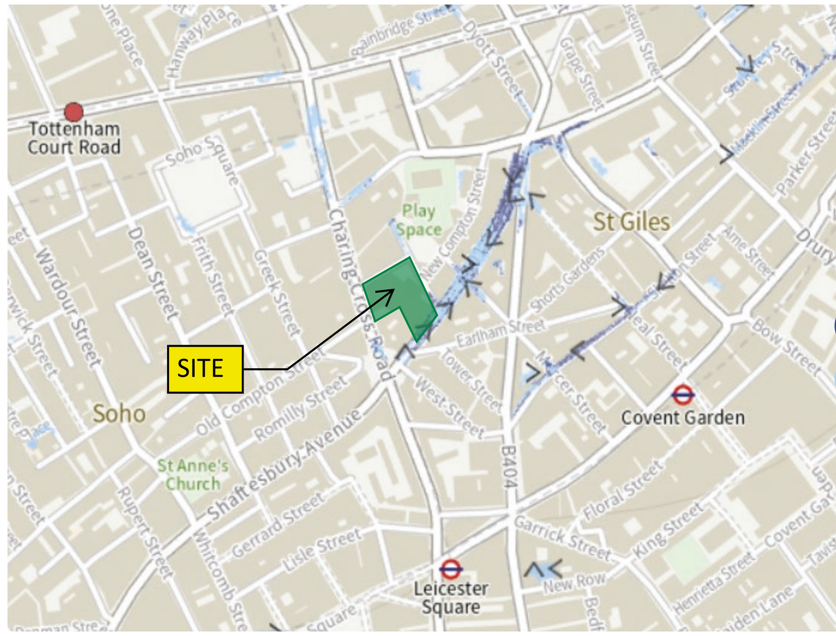
Figure 6.12 Environment Agency's Flooding from Surface Water Map (High Probability - Velocity)



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

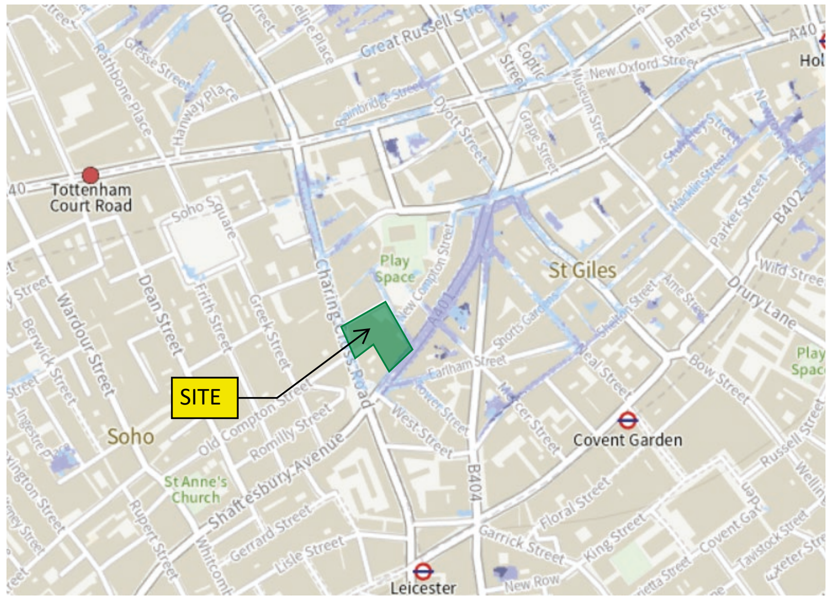
Figure 6.13 Environment Agency's Flooding from Surface Water Map (Medium Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

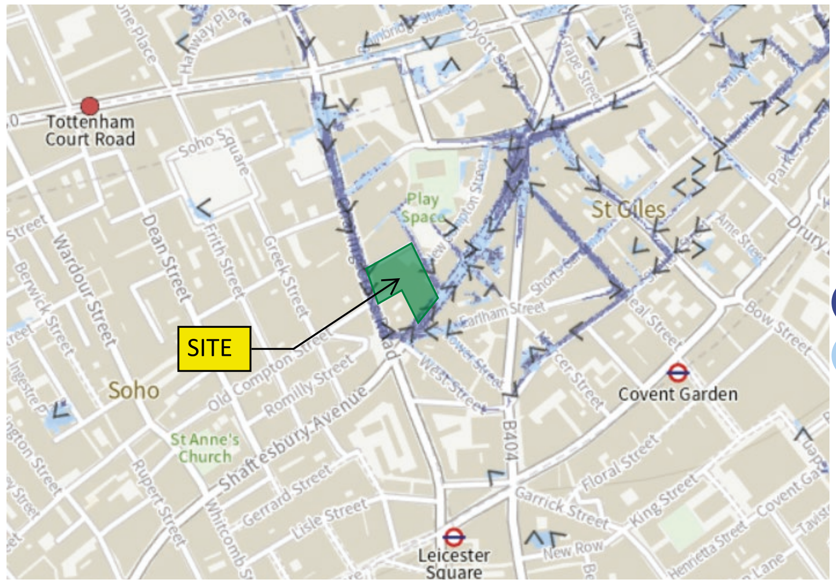
Figure 6.14 Environment Agency's Flooding from Surface Water Map (Medium Probability - Velocity)



Legend - Flood Depth

- Over 900mm
- 300 to 900mm
- Below 300mm

Figure 6.15 Environment Agency's Flooding from Surface Water Map (Low Probability - Depth)



Legend - Flood Velocity

- Over 0.25m/s
- Less than 0.25m/s

Figure 6.16 Environment Agency's Flooding from Surface Water Map (Low Probability - Velocity)

6.6.1 Safe Access

The EA and Defra published FD2321/TR2 "Flood Risks to People" in March 2006. Guidance Note 2, Figure 6.17 provides details on combinations of flood depth and velocities that cause danger to people. This table shows that people can become endangered in shallow but fast moving water through to still but deep water.

From the Environment Agency Surface Water Flooding Maps discussed above, the maximum depth of flooding during an event of low chance of occurring on the roads adjacent the site can reach 300 mm to 900 mm with a velocity greaten than 0.25 m/s.

Therefore, for leaving the site, pedestrians should use the exit on Stacey Street and walk northwards on New Compton Street without endangering themselves. Figure 6.18 below shows an approximate dry escape route from the site.

	Depth (m)									
Velocity (m/s)	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**	**2.25**	**2.50**
0.00	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.50	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.00	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.50	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.00	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.50	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.00	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.00	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.50	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.00	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Flood Hazard Rating (HR)	**Colour Code**	**Hazard to People Classification**
< 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.00		Danger for most – includes the general public
> 2.00		Danger for all – includes the emergency services

Figure 6.17 FD2321/TR2 "Flood Risk to People" Extract

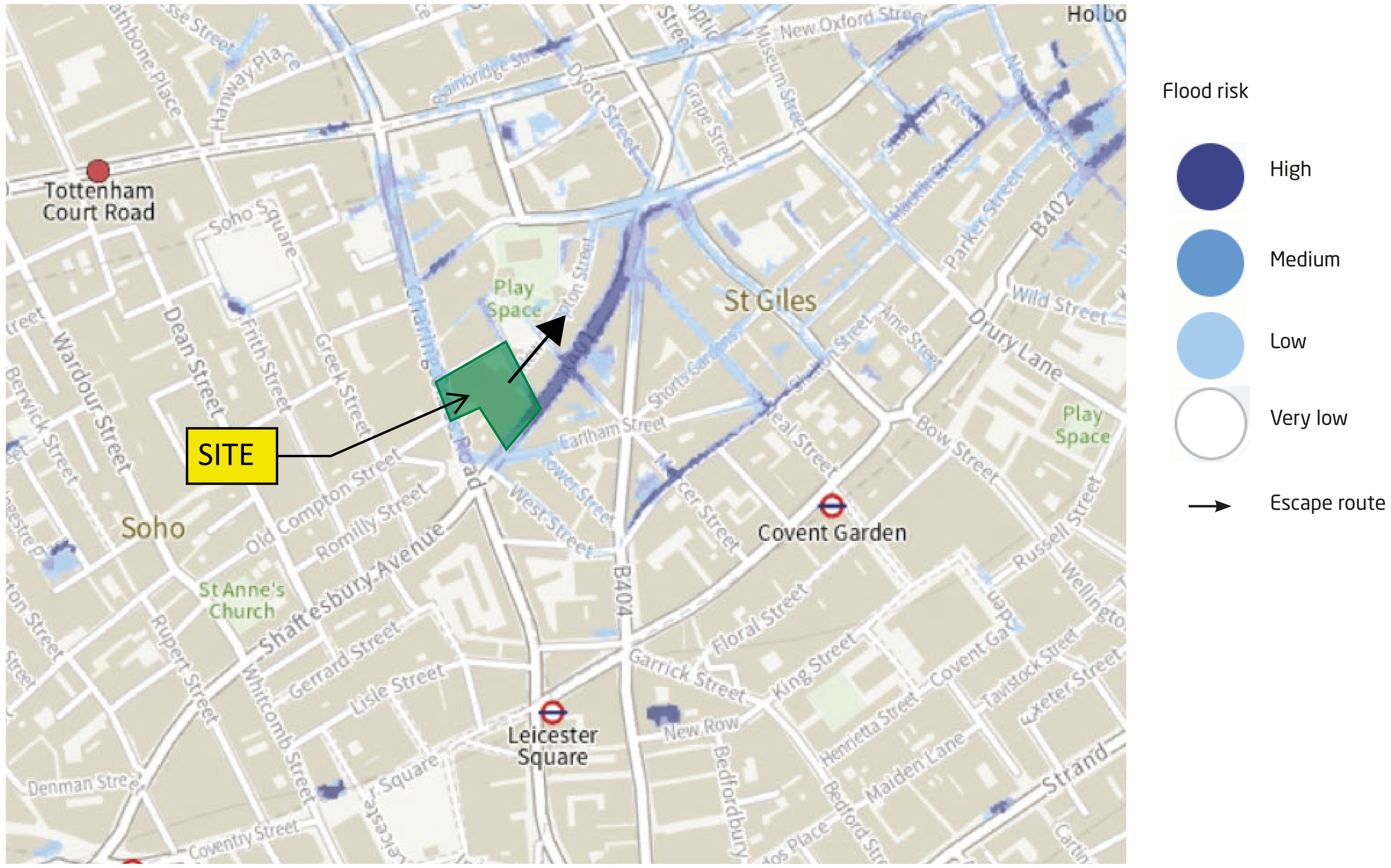


Figure 6.18 Environment Agency's Extent of Surface Water Flooding map

7 Run-off Assessment

7.1 Existing Site Run-off

The available Thames Water record plans indicate that the site is bounded by the following network:

- AA1219 x 813 mm combined water sewer under Shaftesbury Avenue to the south of the site.
- A 1143 x 762 mm combined water sewer in Stacey Street to the north of the site.
- A 1143 x 762 mm combined water sewer in Phoenix Street to the north.
- A 1219 x 813 mm combined water sewer in Charing Cross Road to the west.
- A 1321 x 787 mm dia. combined sewer running under the site. The sewer was removed when this development was built in 1980s. AKT II are liaising with Thames Water to get this asset removed from their records.

An extract from the record plans is shown in Figure 7.1 for reference.

It is believed that all surface water from the site currently discharges directly to one or more of these public sewers without any form of attenuation. However, it is not clear which one and it is therefore recommended that a CCTV survey of the existing site drainage network is undertaken to confirm the location, size and condition of all existing connections from the site and also to inform whether or not existing connections can be reused in the new scheme.

The total site area used for the calculations is 3,590 m² and is all hardstanding. An existing split level basement covers the majority of site area. In accordance with the Modified Rational Method, the peak existing run-off from the site is calculated from the formula:

$$Q = 3.61 \times C_v \times A \times i$$

where C_v is the volumetric runoff coefficient, A is the catchment area in hectares and i is the peak rainfall intensity in mm/hr.

For the peak 1 in 1 year return period storm event this gives an existing discharge rate from the site of:

$\mathbf{Q_1}$ = 3.61 × 0.75 × 0.359 × 38.9 = **37.8 litres/sec**

and for the peak 1 in 100 year return period storm event this gives an exisitng discharge rate from the site of:

$\mathbf{Q_{100}}$ = 3.61 × 0.75 × 0.359 × 106.5 = **103.5 litres/sec**

Manhole reference	Manhole cover level	Manhole invert level
8105	n/a	n/a
9001	n/a	n/a
9009	23.22 m	18.1 m
9010	23.09 m	18.14 m
9012	22.85 m	18.2 m
9102	23.34 m	18.98 m

Figure 7.3 Thames Water Manhole Details

7.2 Proposed Scheme

- Proposed impermeable area = 3,590 m²
- Percentage Impermeable (PIMP) = 100 %
- Climate change allowance = 40% ("Upper Limit" of the DEFRA guidance (refer to Figure 7.2 below)
- Standard Annual Average Rainfall (SAAR) = 600 mm
- Hydrological Growth Curve Region = 6/7 (South East England)

The Infodrainage results demonstrate that all water is contained within the proposed drainage system (attenuation tank) for every event up to and including the 1 in 100 year plus 40% climate change allowance event (Figure 7.2).

Detailed calculations for the proposed run off rates and discharge volumes are contained in the Drainage Strategy Report for reference and are summarised below.

Return Period	Existing Peak run off rate[1] (litres/sec)	Proposed scheme unattenuated peak run off rate (litres/sec)	Greenfield run off rate (litres/sec)	Proposed Design Peak run off rate (litres/sec)	Existing Discharge Volume (m³)	Proposed Discharge Volume (m³)
1 in 1 year	37.82	37.82	1.12	1.30	66	66
1 in 30 years	79.55	79.55	3.16	1.30	137	137
1 in 100 years	103.51	104.51	4.20	1.30	178	178
1 in 100 years (+40%)	144.91	144.91	n/a	1.30	250	250

[1] The existing run off rates were determined by the Wallingford Rational Method with a rainstorm of 30 minutes duration and an assumed runoff of 100% for impermeable areas and 0% for permeable areas

[2] Calculated based on EA "Rainfall runoff management for developments"

[4] Based on BS 8582 Section 9.8

The provision of green roofs will help to intercept some of the small rainfall events.

Figure 7.1 Thames Water Sewer Record

The proposed uses of the site will ensure that water leaving the site by the piped system to the sewers will be of good quality.

The proposed drainage strategy will provide a 95% reduction in the peak flow rate and volume of surface water leaving the site and will therefore, reduce the potential risk to the site itself and also the surrounding area from overland flow or sewer flooding.

In the unlikely event that the capacity of the surface water system is exceeded, water will leave the site via an overflow connection from the attenuation tank and into the Thames Water sewer network.

No exceedance flows will enter the site from external sources. The primary exceedance route for flows generated outside the site is surface water run-off which will be contained within existing kerblines and directed towards a low point to the south east as demonstrated in section 6.6 of this report.

In addition, the proposed drainage strategy results in the potential for an exceedance event and the exceedance volumes generated by the site being greatly reduced.

Range	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2059	Total potential change anticipated for 2060-2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Figure 7.2 Peak rainfall intensity allowance

7.3 Disposal Methods

SuDS management train

A useful concept used in the development of sustainable drainage systems is the SuDS management train (sometimes referred to as the treatment train). Just as in a natural catchment, drainage techniques can be used in series to change flow and quality characteristics of the run-off in stages. There are a variety of measures that can be implemented to achieve these goals:

Site management / Prevention

Site management procedures are used to limit or prevent run-off and pollution and include:

- Minimising the hardened areas within the site
- Frequent maintenance of impermeable surfaces
- Minimising the use of de-icing products

Source control

Source control techniques will be used where possible as they control run-off at source in smaller catchments. They can also provide effective pollution control and treatment, thereby improving the quality of the effluent discharged to the receiving waters.

Site control

Where source control techniques do not provide adequate protection to the receiving watercourses in terms of flood protection and pollution control, site control may be required.

Regional control

Where large areas of public space are available regional control can be incorporated to provide additional 'communal' storage and treatment to run-off from a number of sites. However, in this case, all storage and treatment will be implemented on site.

Drainage Hierarchy

Based on the above and in line with the London Plan (2021) Policy SI 13 on Sustainable drainage, the following drainage hierarchy will therefore need to be considered when preparing the surface water disposal strategy:

1. Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. Rainwater infiltration to ground at or close to source
3. Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. Rainwater discharge direct to a watercourse (unless not appropriate)
5. Controlled rainwater discharge to a surface water sewer or drain
6. Controlled rainwater discharge to a combined sewer

The London Plan 2021 also states that "rainwater should be managed as close to the top of hierarchy as possible" and that "there should be a preference for green over grey features, and drainage by gravity over pumped system".

Assessment of SuDS Techniques

Rainwater harvesting

This involves the capture of rainwater into a tank for re-use (usually non-potable) such as irrigation, toilet flushing or vehicle cleaning. Systems are now available which combine rainwater harvesting with tanked attenuation. This means that water is stored during dry periods for re-use but released ahead of predicted storms in order to ensure that the full attenuation capacity remains available when it is needed.

A harvesting system is proposed at this development. Details of the harvesting system will be developed by MEP Consultant.

Green / brown / blue roofs

These are used on flat or shallow pitched roofs to provide a durable roof covering which also provides thermal insulation, amenity space, biodiversity habitat as well as attenuation of rainwater. Depending on the design, these roofs can attenuate differing volumes of rainwater. The term 'blue roof' is reserved for those roofs designed to maximise water retention. This is a relatively recent area of increased focus and can involve effectively an attenuation tank at roof level which reduces (or avoids) the need for pumping of basement tanks.

This technique would provide attenuation and water treatment during smaller storm events although during large storm events the impact will be negligible and would have minimal effect on the attenuation tank.

Green roofs are proposed at this development.

Raingardens

Raingardens are planted areas (usually close to buildings but not immediately adjacent) that allow the diversion of a portion of rainwater from either downpipes or the surrounding paved surfaces. These techniques can be incorporated into the landscaping plans for a site and are most effective where the landscaping regime is designed with the aim of capturing as much rainfall as possible. They can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. There are also a number of vertical raingardens attached to building walls with rainwater downpipes diverted through a stacked series of planters.

As the existing structure takes up the entire site area it is not possible to incorporate raingardens into the scheme.

Bio-retention

This refers to a chain of landscaped features, potentially including reed beds, filter drains, etc. designed to hold and treat surface water. They are often used where there is a high risk of low-level pollution, for example from road run-off. However, it does require areas of open space. The design of a bio-retention system can vary widely depending on site conditions and available space. At a small scale this could include flow through planters or tree pits.

As the existing structure takes up the entire site area it is not possible to incorporate bio-retention systems into the scheme.

Permeable surfacing

Permeable hard surfaces which work in much the same way as traditional impermeable surfaces apart from the ability to allow rainwater to pass through. Permeable blocks are traditionally used but there are now a range of permeable asphalt and resin bound gravel pavings being used increasingly commonly. Permeable surfaces can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. They are suitable in even the most densely built-up development. However, they're not well suited to roads carrying heavy or fast motor traffic.

As the existing structure takes up the entire site area it is not possible to incorporate permeable surfacing into the scheme.

Swales

These are dry ditches used as landscape features to allow the storage, carriage and infiltration of rainwater and are often used as linear features alongside roads, footpaths or rail lines. They can also be integrated into the design of many open spaces.

As the existing structure takes up the entire site area it is not possible to incorporate swales into the scheme.

Detention basin / ponds

Landscape features designed to store and in some cases infiltrate rainwater. Detentions basins are usually dry, whereas a pond should retain water. These features need areas of open space but can often be combined with other sustainable drainage techniques.

As the site is heavily developed with limited external areas there is insufficient space to provide a basin or pond.

Discharge to tidal river / dock / canals

Discharging clean rainwater directly to tidal rivers, canals or docks isn't normally a sustainable drainage technique. Other more productive techniques should be used first. However, it is generally more sustainable than discharging to the combined or surface drainage systems. Residual surface water can be discharged to tidal / large waterbodies, in some cases with no limitation on volumes. Some storage may be required to allow for outfalls becoming tide locked. Care is needed to prevent scour in the receiving waterbody and potentially to prevent pollution. Consent from the Environment Agency, the asset owner and where applicable the Canal and River Trust is required.

There are no immediately adjacent rivers or ponds and so discharge to a watercourse will not be a viable disposal method.

Storage tanks / geocellular storage

Storage tanks are single GRP units usually located (but not necessarily) below ground level which attenuate rainwater for later slow release back into the drainage system but do not provide the wider benefits of green infrastructure sustainable drainage. They can also have the disadvantage that pumping may be required to empty the tank into the drainage system – especially if the tank is located at or below basement level. Where tanks are designed for large storm events, care is needed to ensure that they still perform a useful sustainable drainage function for low order storms.

It is has been concluded that this is the most feasible disposal option for the site and the table below presents the approximate tank volumes required for a range of discharge rates under the 1-in-100-year (plus 40% climate change) storm event:

Discharge condition	Discharge rate	Storage volume required
Mitigate climate change only (Absolute minimum)	102,3 litres/sec	50 m³
50% reduction on existing	51.15 litres/sec	90 m³
Pre-development 1-year peak flow rate	37.37 litres/sec	110 m³
Greenfield (Environment Agency's preferred rate)	**1.30 litres/sec**	**300 m³**

Based upon the London Plan requirements, it is proposed to provide a storage volume of 300 m³ (Greenfield rate) in order to achieve a maximum permissble discharge rate from the development of 1.30 litres/sec.

It it proposed to provide storage volume in a free-standing attenuation tank which will be located above the existing outfall level in order to achieve a gravity discharge via existing building outfall. Locating the tank below this level would result in a pumped surface water system which is both unsustainable and uneconomic.

Oversized piping

Using larger than necessary pipework creates more room to store rainwater. Potentially more sustainable than storage tanks/geocellular storage if the pipes drain by gravity and do not require pumping. However, lacks the wider benefits of the green infrastructure-based techniques.

Due to the restricted nature of the site the pipework would become impractically large to provide the volume of storage required to achieve the required run-off rate.

Design for exceedance

This involves designing areas within a site such that they will flood and hold water during rare storm events (typically a frequency of once in ten years or longer).

As the attenuation storage to be provided has been sized to accommodate the 1-in-100-year plus climate change event there is no need to design for exceedance.

Summary of the Proposed SuDS Strategy

It is proposed to provide green roofs at various levels which will enhance biodiversity of the development and positively contribute to a intercepting storage.

The proposed attenuation volume will be provided in a free-standing tank which will be located at basement above the existing building outfall in order to achieve a gravity discharge into the existing public sewer. The overall attenuation volume will 300 m³ based upon a maximum permissible discharge rate of 1.30 litres/sec (Q_{BAR}) for all storm events up to and including the 1-in-100-year + 40% scenario.

The Proposed Development includes both rainwater and greywater harvesting systems to reduce reliance on main water supply.

The existing combined water outfall will be re-used in the final scheme. This is subject to verification by undertaking a condition CCTV survey. A cost allowance should be made for replacing the existing outfall via heading.

Element	Management stage	Water quantity	Water quality	Amenity & biodiversity	SuDS options
Rainwater harvesting	Prevention	✓	✗	✗	✓
Green/brown / blue roof	Source control	✓	✓	✓	✓
Raingardens	Source control	✓	✓	✓	✗
Bio-retention	Source control	✓	✓	✓	✗
Permeable surfacing	Source control	✓	✓	✗	✗
Swales	Source control	✓	✓	✓	✗
Detention basin / ponds	Source control	✓	✓	✓	✗
Discharge to tidal river / dock / canals	Site control	✓	✗	✗	✗
Storage tanks / Geocellular storage	Site control	✓	✗	✗	✓
Oversized piping	Site control	✓	✗	✗	✗
Design for exceedance	Site control	✓	✗	✗	✗

Figure 7.4 Summary of potential SuDS devices

8 Conclusion

- The Environment Agency Flood Map indicates that the site is located within Flood Zone 1, an area of land assessed as having less than 0.1 % (1 in 1000) annual probability of flooding from fluvial or tidal sources. Using all the available evidence, it is considered that the site has a **very low** probability of flooding from fluvial or tidal sources.
- Using all the available evidence, it is considered that the site has a **low** probability of flooding from groundwater.
- Using all the available evidence, it is considered that the site has a **very low** probability of flooding from sewers and other drainage networks as long as they are adequately maintained as required.
- Using all the available evidence, it is therefore considered that the site has a **low** probability of flooding from surface water and overland flow.
- Using all the available evidence, it is considered that the site has a **very low** probability of flooding from artificial sources.
- This report has therefore demonstrated that the site has a **very low** probability of flooding from all sources.

9 References

Site Specific Document

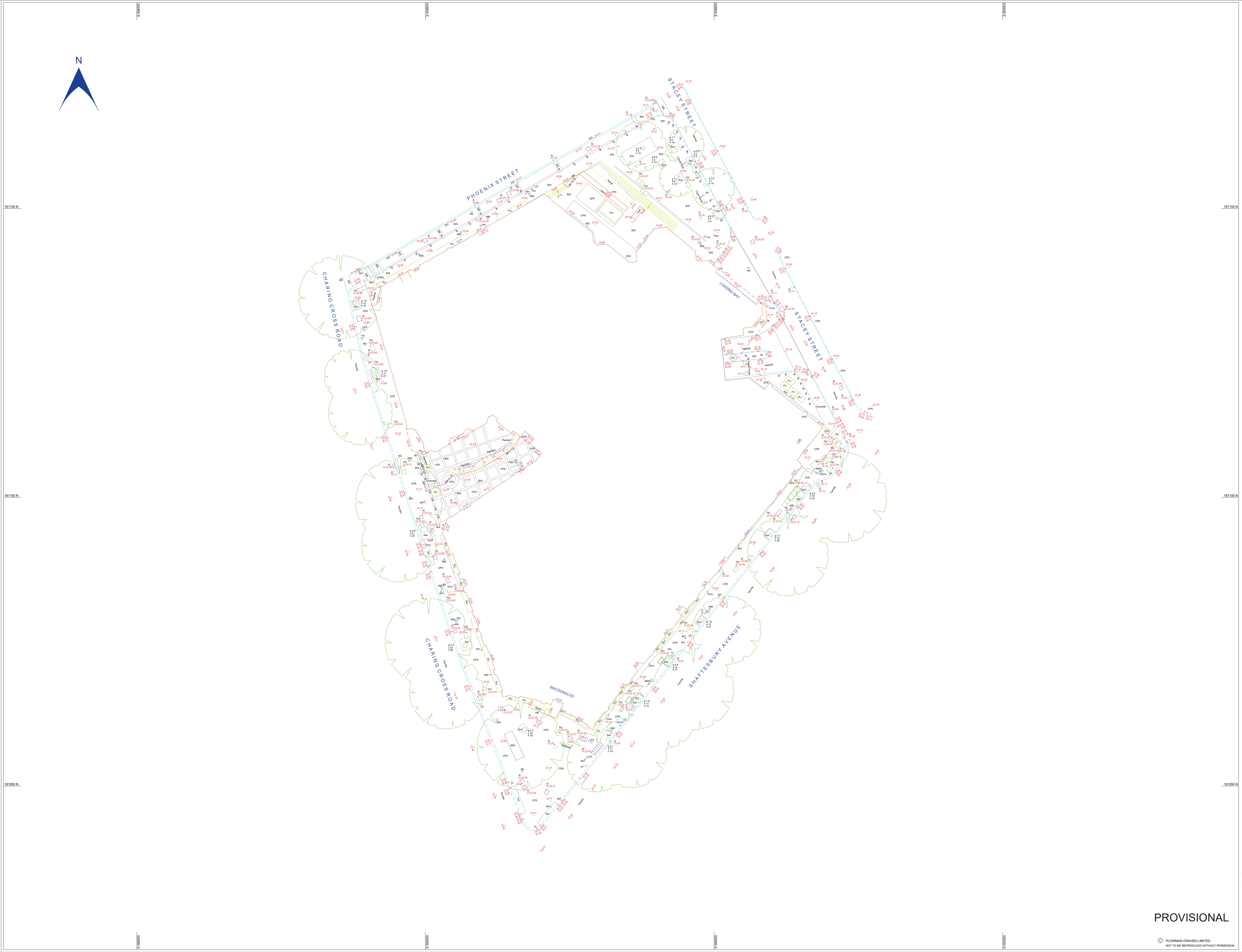
- Thames Water Asset Map, February 2024
- The Shaftesbury Avenue Envirocheck Report, March 2024

Technical Guidance and Planning Policy Documents

- Camden Local Plan 2017, Policy CC2 & CC3.
- Camden Planning Guidance - Water and flooding, March 2019.
- Department for Communities and Local Government, National Planning Policy Framework, March 2012.
- Department for Communities and Local Government, Technical Guidance to the National Planning Policy Framework, March 2012.
- London Borough of Camden, Level 1 Strategic Flood Risk Assessment, January 2024
- London Borough of Camden, Surface Water Management Plan, June 2013
- BS 8533:2011, Assessing and managing flood risk in development : Code of Practice, October 2011.
- CIRIA Report C624, Development and flood risk: guidance for the construction industry, 2004.

Appendix 1

Existing Site Topographical Survey



STANDARD ABBREVIATIONS

OTHER ABBREVIATIONS

LEGEND

22.70	Ceiling level
F22.70	False ceiling level
(solid arrow)	Stair/step arrows point up
(open arrow)	Sloping ceiling arrows point up
(line arrow)	Roof arrows point down
(line)	Assumed detail

The identification of service covers has been made by a surface inspection only - critical identifications should be verified by the lifting of covers or a full utilities survey

Due to the inherent instability of paper materials, drawings plotted on paper may be stretched and distorted - dimensions scaled from paper plots should therefore be treated with caution

This drawing has been produced for the purpose of the original commissioning agent. Plowman Craven Limited will accept no responsibility for details that are subsequently found to be the consequence of undisclosed facts or that were obscured from view at the time of survey or that have been altered since the survey.

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SHEET LAYOUT

TO-XX-DR-Y-00001

STATUS CODE & REVISIONS

Stat	Rev	Details	Checked 1st	Checked 2nd	Date
S3	P01	First Issue - QA approval required	PCL	XXX	08/04/24

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table

All levels are in metres and are above Ordnance Survey Newlyn Datum derived by multiple network RTK GPS observations

The survey grid shown on this drawing is positioned on Ordnance Survey (OS) National Grid, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

All quoted dimensions are in metres

Drawing units are millimetres

CLIENT
Blackburn & Co. Ltd
No. 1 Clink Street
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SE1 9DG

PROJECT TITLE
125 Shaftesbury Avenue
London WC2H 8HR

2D Topographic Survey

PRESENTATION SCALE 1:200 @ A0

DATE OF ORIGINAL SURVEY March 2024

PC PROJECT No.32153-003

STATUS & REVISION S3 P01

DRAWING No.
32153-003-PCL-TO-XX-DR-Y-00001

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