MAX FORDHAM

Highgate Cemetery - Landscape

Flood Risk Assessment

P02

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ISSUE HISTORY

Issue	Date	Description
P01	9/8/24	Planning Submission
P02	22/10/24	Planning Submission

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APPENDICES

1.0 INTRODUCTION

1.1 Overview

The subject development is situated within Highgate Cemetery, at Swain's Lane, London, N6 6PJ, and shall henceforth be referred to as the Application Site.

The primary objective of this flood risk assessment is to demonstrate the development proposal's compatibility with the local environment, ensuring it does not exacerbate existing flood risks nor compromise the development itself. This assessment adheres to the guidelines outlined in the National Planning Policy Framework (NPPF), the Planning Guidance on Flood Risk and Coastal Change, DEFRA's National Standards for Sustainable Drainage, and relevant Local Guidance and Policy Documents.

Given the dynamic nature of these regulatory frameworks, this assessment is based on the most current guidance available as of December 2023.

1.2 Site Location and Description

The Application Site is located at Ordnance Survey grid reference 528491mE, 187152mN, and the redline boundary includes an area of 14.95ha, as indicated on Figure 1.

Figure 1 Site Location Plan

1.3 Current Site Usage

The Application Site is currently a Cemetery (Sui Generis), as shown in Figure 2.

Figure 2 Aerial Photograph

1.4 Development Proposals

The development proposal includes restoration, demolition and replacement of buildings in East Side and West Side of Highgate Cemetery, including Cemetery wide landscaping, drainage, public realm and access works and repair of tombs and monuments to support the function of a working cemetery and community uses.

East Side includes the demolition and replacement of gardener's compound with a community education building, removal of ticket booth and replacement with sentry at Swain's Lane and erection of additional sentry at Chester Road, and the erection of a two-storey gardener's building, for office, workshop, staff welfare and storage use, plus alterations to the boundary wall.

West Side includes erection of a two-storey visitor and operations building, demolition and replacement of visitor toilets building with a utility store, restoration of Dissenters' Chapel and Anglican Chapel for community and funeral uses, and restoration of South Lodge for visitor toilets and North Lodge for staff welfare.

1.5 Development Size Classification

In accordance Flood Risk and Coastal Change Planning Policy Guidance, the Development Proposals would be classified as a Major Development.

The Planning Policy Guidance for Flood Risk and Coastal Change states a Major Development is classified as:

- in respect of residential development, the provision of 10 or more dwellings, or a site of 0.5 hectares or more if the number of dwellings is unknown;
- in respect of non-residential development, new floorspace of 1,000 square metres or more, or *a site of 1 hectare or more.*

Based on the Environment Agency and DEFRA definitions, the Development Proposals considered to be a Major Development, on account of the site area larger than 1 hectare.

2.0 SCOPE OF ASSESSMENT

Under Section 14 of the NPPF, a Flood Risk Assessment (FRA) is required for Development Proposals which meet any of the following conditions:

1. Development in Flood Zones 2 and 3.
2. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more;
3. Land which has been identified by the Environment Agency as having critical drainage problems;
4. Land identified in a strategic flood risk assessment as being at increased flood risk in future; or,
5. Land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

The NPPF states that a FRA needs to consider the risk of flooding to a property or site and demonstrate that the site will be safe over its lifetime (including identification of appropriate mitigation measures). The FRA also needs to demonstrate that the proposals will not increase flood risk to others. The sources of flooding that need to be assessed are from the following sources:

1. Fluvial (River) flooding. When flows within watercourses exceed the capacity of the watercourse, causing out of bank flows and resulting in flooding of adjacent areas.
2. Groundwater flooding. Usually, the result of prolonged wet weather, causing groundwater levels to rise sufficiently to either emerge at surface or to cause flooding of below ground infrastructure, such as basements.
3. Pluvial (Surface Water) flooding. When rainfall causes overland flow rates and volumes which exceed the capacity of the drainage network, causing flooding to land that is normally dry.
4. Tidal flooding. When high tide events overtop the shoreline to cause flooding to land behind. This is usually the result of a combination of high tide events and storm surges.

As well as considering the risk of flooding from these primary sources, a FRA needs to consider the potential impact of a failure of flood defence or reservoir infrastructure; however, as the likelihood of these types of flooding are much lower, they are known as “residual risks”. The residual flood risks to be considered are:

1. Reservoir failure. Although the likelihood of reservoir failure resulting in widespread flooding is extremely low, the consequences of such an event need to be considered to inform appropriate emergency planning.
2. Flood defence failure. The consequence of a failure of part of a flood defence could result in the rapid release of water in an area that would otherwise not be at risk of flooding. If such an event were to occur, there could be very little warning time and therefore it is unlikely that prior evacuation from an area at risk could be achieved.

3.0 REVELANT POLICY AND GUIDANCE

This Flood Risk Assessment has been developed in accordance with the guidance and legislation set out in the below documents:

3.1 National Policy

- Water Industry Act (1999)
- EU Water Framework Directive (2000)
- EU Floods Directive (2007)
- The Flood Risk Regulations (2009)
- Flood and Water Management Act (2010)
- The Building Regulations, Part H (2015)
- Town and Country Planning, Development Management Procedure, (England) Order (2015)
- British Standards, Drain and sewer systems outside buildings (BS EN 752:2017)
- National Planning Policy Framework (NPPF, 2023)

3.2 National Guidance

- Non-statutory Sustainable Drainage Technical Standards (2015)
- Flood Risk and Coastal Change Planning Practice Guidance (PPG, 2014)
- CiRIA SuDS Manual (C753, 2015)
- Sector Guidance in relation to the adoption of sewerage assets by sewerage companies in England (October 2019)
- Preparing a Flood Risk Assessment: Standing Advice, Environment Agency, and DEFRA (2022)
- Flood Risk Assessments: Climate Change Allowances, Environment Agency (2020)

3.3 Local Policy

- Managing flood risk in Camden Camden's Flood Risk Management Strategy – published 2022 and available at: https://democracy.camden.gov.uk/documents/s108746/13a%20Appendix%201%20-%20Camden%20Flood%20Risk%20Management%20Strategy.pdf
- The London Plan – published 2021 and available at: https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf
- Preliminary flood risk assessment: London Borough of Camden (2017) – published 2017 and available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698621/PFRA_London_Borough_of_Camden_2017.pdf
- London Borough of Camden Strategic Flood Risk Assessment(SFRA) – published 2024 and available at: https://www.camden.gov.uk/documents/20142/4820180/Camden+Strategic+Flood+Risk+Assessment+1.pdf/b1d197e1-c2d8-2cba-c089-973effef5748?t=1705503973648
- Camden Local Plan – published 2017 and available at: https://www.camden.gov.uk/documents/20142/4820180/Local+Plan.pdf/ce6e992a-91f9-3a60-720c-70290fab78a6

4.0 EXISTING SITE

4.1 Site Topography

A topographic survey was prepared by Atlantic Geomatics (dated November 2020) determined ground levels within the application site. The west side ranges from 122.58 mAOD at its highest point to 88.78 mAOD at its lowest. The east side varies between 86.45 mAOD and 60.35 mAOD. While the site is generally upslope, the predominantly permeable landscape of the cemetery is not anticipated to significantly increase surface water runoff. Topographic survey drawings can be found in Appendix A: Site Topology Survey.

4.2 Site Hydrology

Ordinary watercourses
According to the Camden Local Plan, the River Fleet, an Ordinary Watercourse, is located approximately 100m south of the site (see Figure 3). A spring potentially feeding the River Fleet has been observed at the southwest corner of the west side of the site.

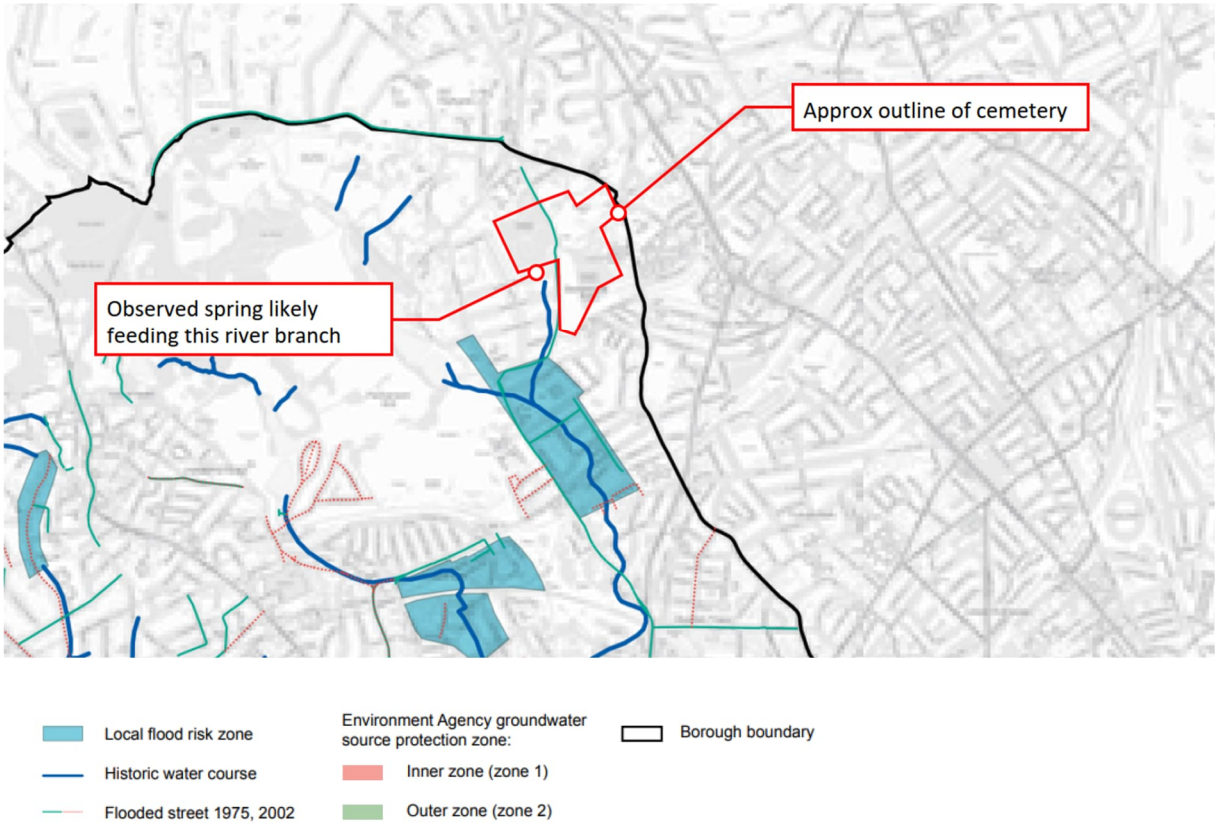

Figure 3 Ordinary Watercourse (Source: Camden Local Plan)

4.3 Ground Conditions

4.3.1 BGS Hydrogeological Setting

According to the BGS Hydrogeological Setting data, the application site is classified as:

Aquifers in which flow is virtually all through fractures and other discontinuities: Rocks with essentially no groundwater

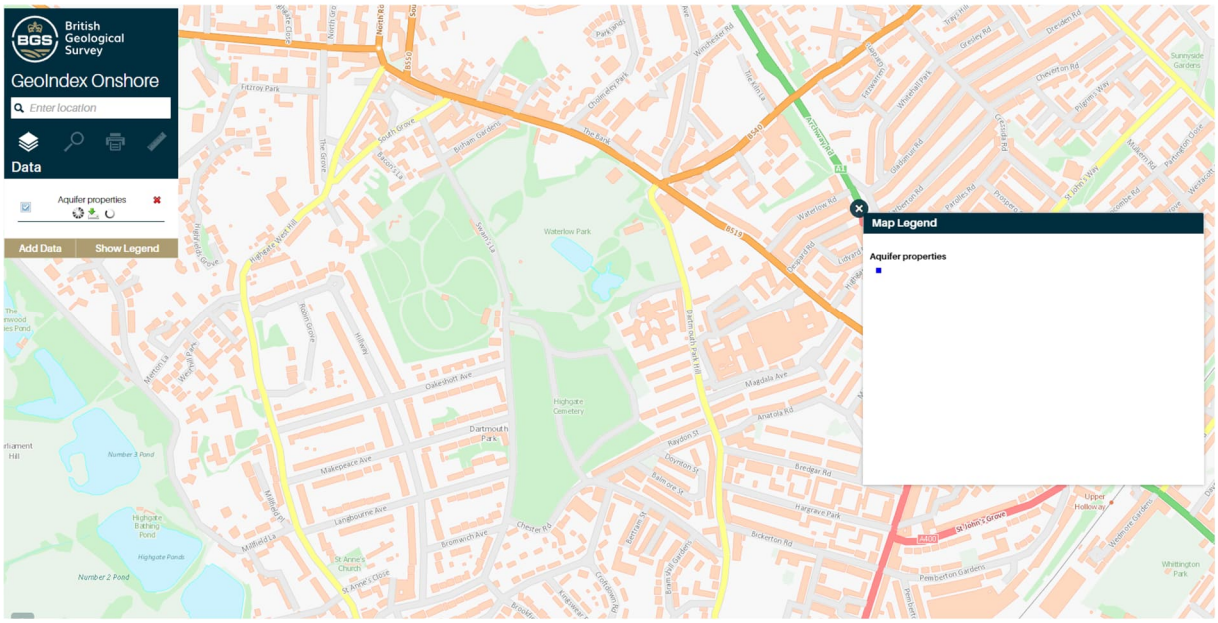

Figure 4 BGS Hydrogeological Setting (Source: BGS)

4.3.2 BGS Lithology

According to the BGS Lithology, the ground beneath the Application Site has the following attributes (see Figure 5):

Superficial Geology: None

Bedrock Geology: Mix of Bagshot formation, London Clay and Claygate member.

- Top of west side: Bagshot Formation, formed of sand.
- Mid of west side: Claygate Member, formed of clay, silt and sand.
- Remaining site: London Clay, formed of clay, silt and sand.

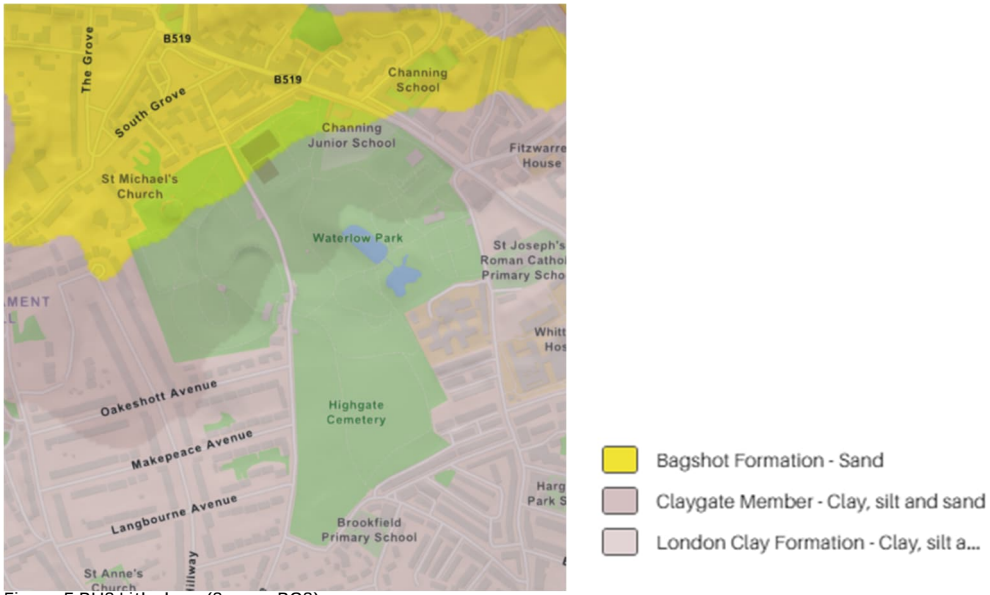

Figure 5 BHS Lithology (Source BGS)

4.3.3 BGS Borehole

According to the BGS historic borehole records data, the nearest recorded borehole to the Application Site is; TQ28NE150 50m to the east of the site (see Figure 6). No groundwater was indicated down to 14.94m below the ground level (see Appendix B: BGS Borehole Record).

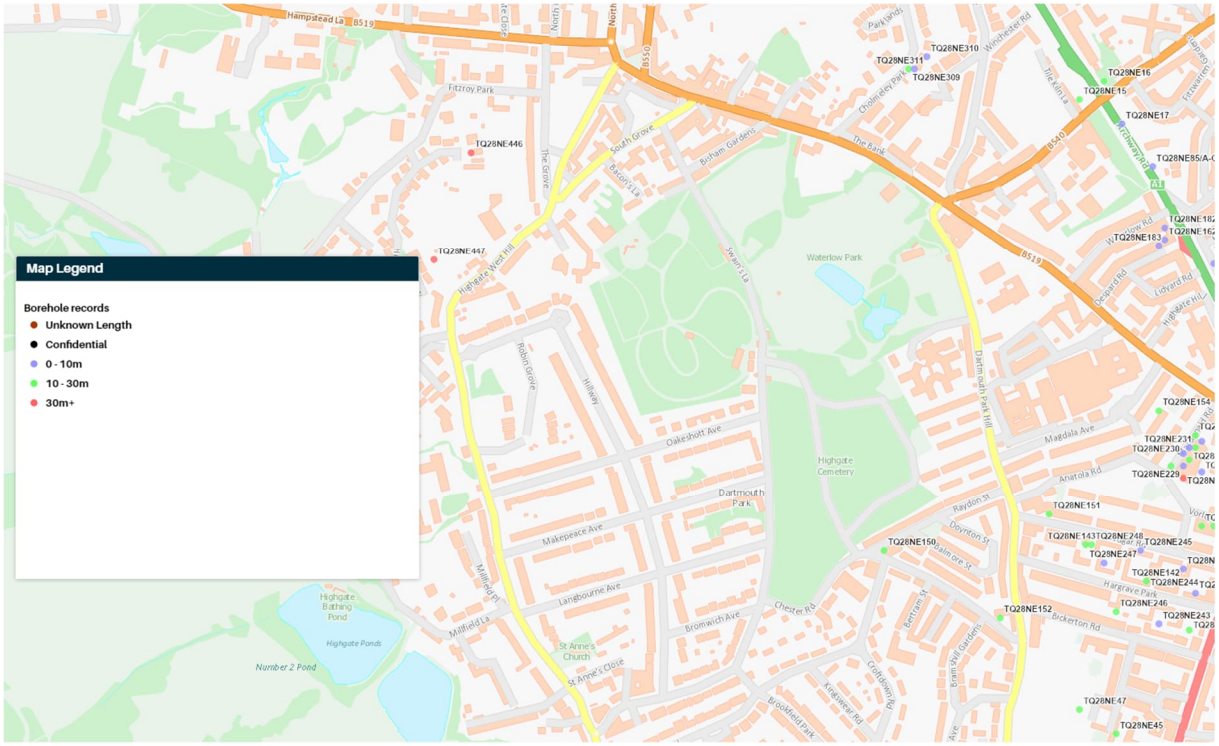

Figure 6 BGS Borehole Records (Source: BGS)

4.3.4 Intrusive Onsite Ground Investigations

A soil infiltration test was conducted at twelve trial pits distributed across the east and west sides of the Application Site (see Appendix C: Soil Infiltration Test Result). The results indicate successful infiltration on the west side but a failure on the east side. Infiltration rate of test pits are summarised in Table 1. A summary of the test pits records are shown below;

- Test Pit TP1 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP2 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP3 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP4: identifies 0.4m MADE GROUND on top of 0.6m CLAY. No Groundwater was encountered.
- Test Pit TP5: identifies 0.2m MADE GROUND on top of 0.8m CLAY. No Groundwater was encountered.
- Test Pit TP6: identifies 0.4m MADE GROUND on top of 0.6m CLAY. No Groundwater was encountered.
- Test Pit TP7 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP8 identifies 0.95m MADE GROUND. Groundwater was encountered at 0.8m.
- Test Pit TP9 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP10 identifies 1.0m MADE GROUND. No Groundwater was encountered.
- Test Pit TP11: identifies 0.4m MADE GROUND on top of 0.6m CLAY. No Groundwater was encountered.
- Test Pit TP12: identifies 0.65m MADE GROUND on top of 0.35m CLAY. No Groundwater was encountered.

Table 1 Soil Infiltration Test Result

Test Pit Reference	Soil Infiltration Rate (m/sec)
TP1	4.89E-06
TP2	4.48E-05
TP3	Failed
TP4	1.26E-05
TP5	7.01E-07
TP6	Failed
TP7	Failed
TP8	Failed
TP9	2.40E-06
TP10	1.13E-06
TP11	1.13E-06
TP12	1.13E-06

4.3.5 Existing Surface Water Drainage

A detailed drainage survey was carried out in March 2024 to find out details of existing drainage system in the Application Site (see Appendix D: Drainage Survey Report and Appendix E: Drainage Survey Site Plans). Detailed information on the existing surface water drainage can also be found in Appendix F: Thames Water Asset Map and Appendix G: Site Utilities and Drainage Survey.

The site's surface water drainage is managed through an underground piped system that collects runoff from the main paths, buildings, and surrounding landscape. This water is typically conveyed to the Thames Water sewage network or an unidentified underground stream.

Landscape Drainage

- Surface water from the landscape where graves are located infiltrates directly into the ground.
- The main paths on both the east and west sides are equipped with gullies and drainage channels to collect surface water and direct it into the underground system.
- However, not all paths have adequate outlets, increasing the risk of surface water runoff.

Underground Drainage System

- The system is a combined network of underground pipes carrying both sewage and surface water.
- Pipes are primarily made of aged materials such as clay, brick, or concrete, and are located beneath the paths with accessible manholes.
- A CCTV inspection has identified defects in certain sections of the system.

Sewer Connection

- On the west side, surface water is collected in Thames Water manhole 5901 and discharged into the combined sewer in Swain's Lane. Additionally, some water appears to enter an unidentified underground stream via another manhole.
- On the east side, surface water flows into the Thames Water combined sewer in Chester Road, though the exact connection point is unknown due to limited data.

5.0 DEVELOPMENT COMPATIBILITY WITH FLOOD ZONE

5.1 Development Vulnerability Classification

The vulnerability classifications are summarised in and identifies that the Development Proposals are Water compatible Development, as highlighted below.

Table 2 Annex 3 of the NPPF, Flood risk vulnerability classification

Classification	Description
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 and ambulance stations; fire stations and command centres; 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, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; 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.

5.2 Flood Zone Classification

The flood map for planning (see Figure 7) demonstrates that the Development Proposals are located within an area defined as Flood Zone 1.

Figure 7 Flood Map for Planning (Source: Gov.UK)

Table 2 of the Flood Risk and Costal Change Guidance (see Table 3), presents the flood zone definitions.

Table 3 Flood Risk and Coastal Change, Table 1

Classification	Description
1	*Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).*
2	Medium Probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% to 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% to 0.1%) in any year.
3a	High Probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
3b	The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. SFRA's should identify this Flood Zone (land which would flood with an annual probability of 1 in 30 (3.3%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).

5.3 Flood Zone & Vulnerability Compatibility

The NPPF Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table 3 is summarised below as Table 4.

Table 4 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	*Appropriate*
Flood Zone 2	Appropriate	Exception Test Required	Appropriate	Appropriate	Appropriate
Flood Zone 3	Exception Test Required	Not Appropriate	Exception Test Required	Appropriate	Appropriate
Flood Zone 3b (Functional Floodplain)	Exception Test Required	Not Appropriate	Not Appropriate	Not Appropriate	Appropriate

Given the Application Site is located within Flood Zone 1 and the Development Proposals are for a Less Vulnerable development, under the NPPF, the Development Proposals are considered appropriate.

6.0 CLIMATE CHANGE ALLOWNACE

The Environment Agency published guidance on climate change allowances for Flood Risk Assessments in February 2016, with the latest update in October 2021. The current Environment Agency climate change allowances are classified on how likely that scenario is predicted to occur, based on percentile of the scenario.

An allowance based on the 70th percentile is exceeded by 30% of the projections in the range. At the 95th percentile it is exceeded by 5% of the projections in the range. For these allowances it is important you do not use a single percentile out of context. For example, while the 70th percentile is the higher central estimate, it does not represent the full range of likely futures. Using this percentile on its own may cause you to under-adapt to climate change.

6.1 Fluvial Climate Change Allowances

Fluvial Climate Change Allowances are determined by the predicted increase in peak river flows. These are determined by regional variations, which are based on the management catchments. Management catchments are sub-catchments of river basin districts.

As Camden SFRA suggested "No main rivers are located within the London Borough of Camden, meaning there is no flood risk from fluvial", which means climate change would have no impact on flood risk of Application Site.

6.2 Pluvial Climate Change Allowances

Surface water Climate Change Allowances are determined by the predicted increase in peak rainfall intensity. These are determined by regional variations, which are based on the management catchments. Management catchments are sub-catchments of river basin districts.

The Application Site is located in the London management catchment, climate change allowances are based on a 1981 to 2000 baseline. The 2070, 30 Year Central Climate Change allowance for peak rainfall intensity is 20%. The 2070, 100 Year Central Climate Change allowance for peak rainfall intensity is 40%.

7.0 FLOOD RISK OVERVIEW

7.1 Introduction

The Environment Agency's National Assessment of Flood Risk (NAFR) outlines the most common flood types in England. To comply with the National Planning Policy Framework (NPPF), these flood types must be assessed within a Flood Risk Assessment (FRA). The following sections will address each flood type in detail.

7.2 River flooding (fluvial)

Occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment.

Given that the site is situated within Flood Zone 1, the risk of flooding from fluvial sources is as such considered as being *Very Low* throughout the lifetime of the development proposals. No specific mitigation measures are considered necessary, and the residual flood risk is *Very Low*.

7.3 Coastal flooding (tidal)

Results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen, which can cause serious flooding.

The development proposals are situated in Flood Zone 1 and are at a minimum topographic level of 60.35mAOD, according to topology survey (see Appendix A: Site Topology Survey). As the Application Site is not identified as being at risk of tidal flooding, no specific mitigation measures are considered necessary. The residual flood risk is *Very Low*.

7.4 Surface water (pluvial)

Occurs when heavy rainfall overwhelms the drainage capacity of the local area. It is difficult to predict and pinpoint, much more so than river or coastal flooding.

The site is situated within a Critical Drainage Area (CDA), Group3_001 (see Figure 8). However, the site is not located within local flood risk zone.

The majority of the site is considered *Very Low* risk of flooding from surface water (<1 in 1000 year RP) (see Figure 8).

A minority part of the site is shown to have *Low* risk (1 in 1000 year RP) from surface water flood event (see Figure 8).

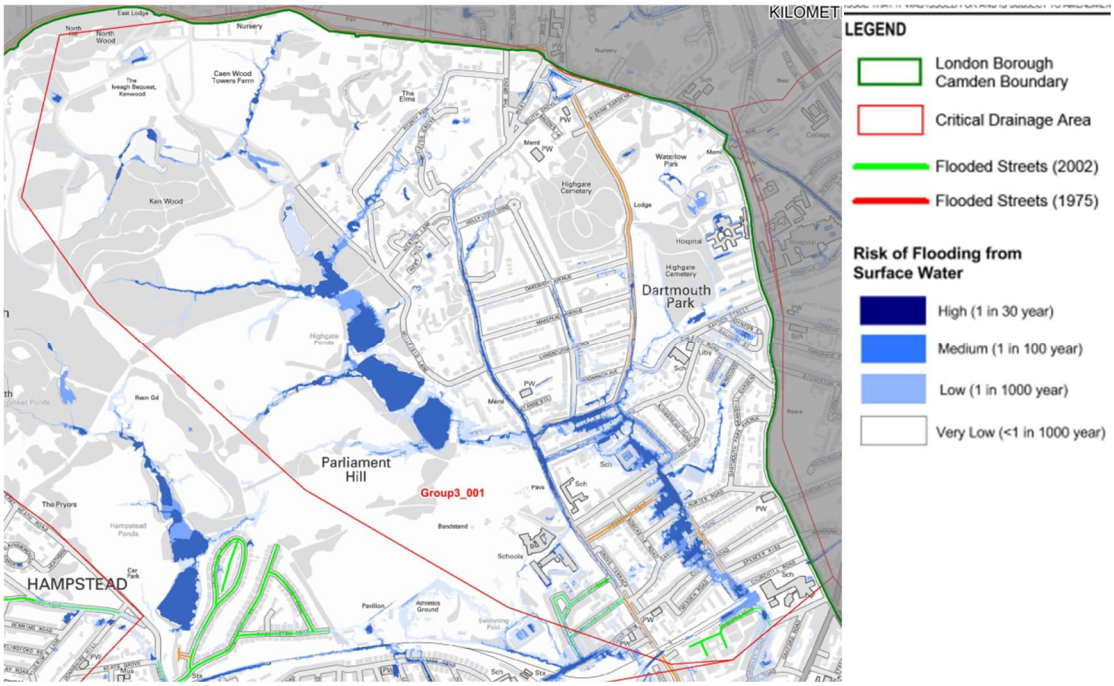

Figure 8 Flood Maps for Surface Water Flooding (uFMfSW) (Source: SFRA)

7.5 Sewer flooding

Occurs when sewers are overwhelmed by heavy rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewerage system. Land and property can be flooded with water contaminated with raw sewage as a result. Rivers can also become polluted by sewer overflows.

Sewer asset records and the Strategic Flood Risk Assessment (SFRA) have been reviewed to determine the Application Site's proximity to public sewers and any history of nearby sewer flooding. The site's area is shown by the SFA internal and external sewer flooding map to have recorded no cases of sewer flooding recorded (see Figure 9 & Figure 10). Hence the risk of sewer flooding is considered *Very Low*.

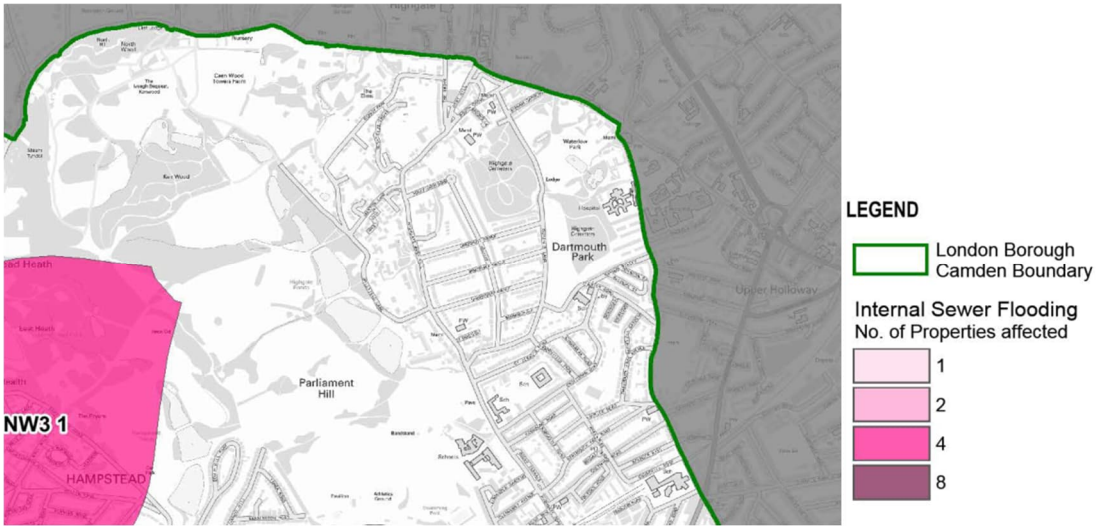

Figure 9 DG5 Internal Sewer Flooding Map (Source: SFRA)

Figure 10 DG5 External Sewer Flooding (Source: SFRA)

7.6 Groundwater flooding

Occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, regional aquifers, such as chalk or sandstone, or may be more local, sand or river gravels in valley bottoms underlain by less permeable rocks.

The British Geological Survey's (BGS) Areas Susceptible to Groundwater Flooding (AStGW) dataset has been used to determine the groundwater flood risk to the Development Proposals. This mapping has four categories:

- Unaffected (Very Low Risk);
- Limited potential for groundwater flooding to occur (Low Risk);
- Potential for groundwater flooding of property situated below ground level (Medium Risk);
- Potential for groundwater flooding to occur at surface (High Risk).

By reviewing the SFRA from Camden Council, the groundwater flood risk to the Development Proposals is classified as *unaffected (Very Low Risk)* (see Figure 11). Therefore, the risk of groundwater flooding is considered to be *Very Low*.

Figure 11 Susceptibility to Groundwater Flooding map

As the Application Site is not identified as being at risk of groundwater flooding, and no floors beneath the ground level are planned as part of development proposals, no specific mitigation measures are considered necessary. The residual groundwater flood risk is *Very Low*.

7.7 Residual Flood Risk

Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- the failure of flood management infrastructure, such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area or failure of a pumped drainage system;
- failure of a reservoir, or;
- a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.

7.7.1 Flood Defence Breach

The consequence of a failure of part of a flood defence could result in the rapid release of water in an area that would otherwise not be at risk of flooding. If such an event were to occur, there could be very little warning time. Therefore, it is unlikely that prior evacuation from an area at risk could be achieved.

The Application Site is in Flood Zone 1 and is not in an area that benefits from flood defences according to the EA Flood Map; therefore, the Application Site is not at residual risk of a flood defence breach and no specific mitigation measures are required.

7.7.2 Reservoir Failure

In the unlikely event that a reservoir dam was to fail, a large volume of water would escape at once, with little or no warning. According to the EA, there has been no loss of life in the UK from reservoir flooding since 1925.

All large reservoirs must be inspected and supervised by reservoir panel engineers, as detailed by the enforcement authority for the Reservoirs Act 1975 in England. The EA are responsible to ensure that reservoirs are inspected regularly and to ensure that essential safety work is carried out.

As reservoir flooding is unlikely and the modelled flood depths are based on the worst-case scenario, flooding from this source may be considered as a relatively low risk. Through the management of the risks via the reservoir act and the work of the Environment Agency, the risk of reservoir flooding can be considered to have been reduced to as low a level as practical.

The Environment Agency risk of reservoir flooding indicates that no risk is associated with the Application Site (see Figure 12).

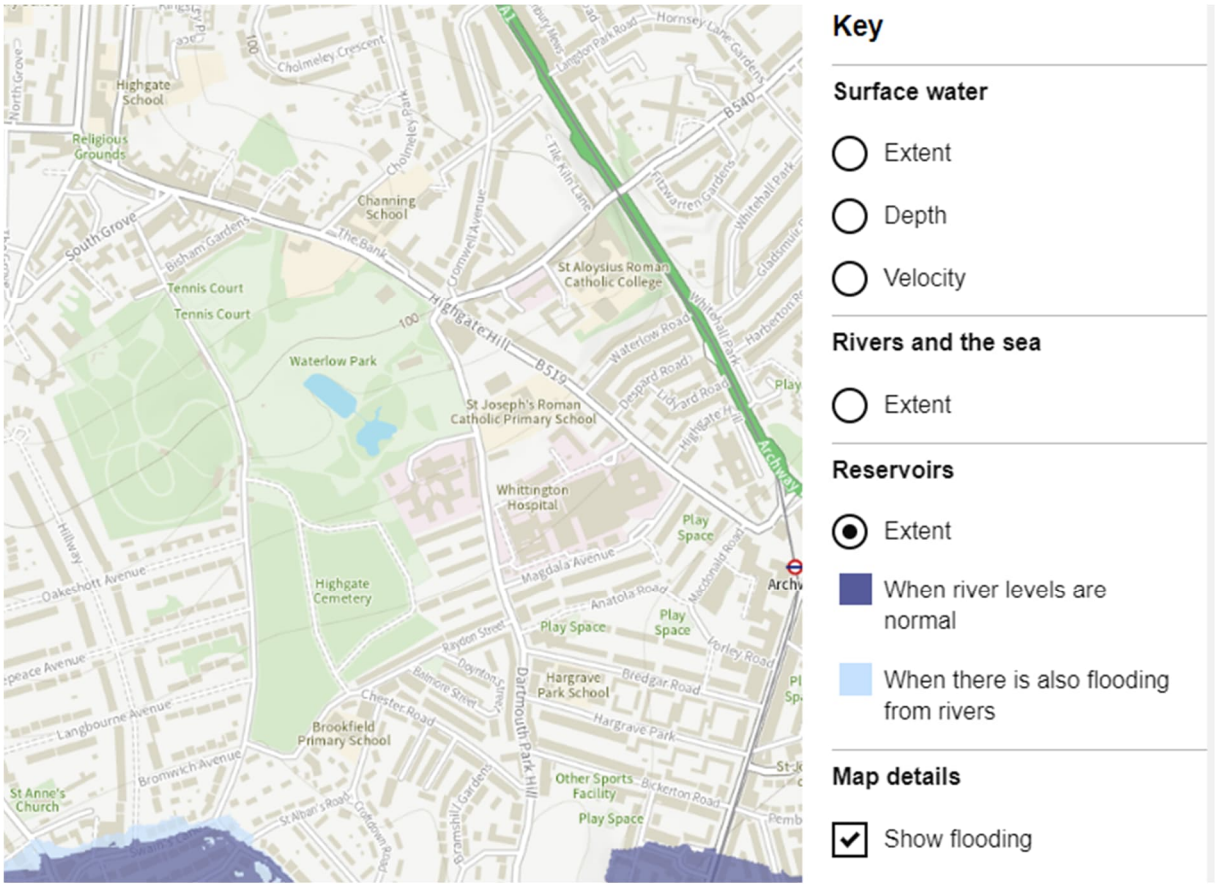

Figure 12 Environment Agency, Risk of Reservoir Flooding

8.0 FLOOD RISK: HISTORIC RECORDS

8.1 Assessment Methodology

In order to assess if the Application Site has previously been affected by flooding, the following data sources have been inspected.

- Environment Agency Historic Flood Maps
- Environment Agency Recorded Flood Outlines
- Strategic Flood Risk Assessment (SFRA)
- Camden Local Plan

8.2 Recorded Flooding

The Camden Local Plan includes records of historic flooding, which have been reviewed. A notable flooding event occurred in 1975, affecting Swain's Lane within the cemetery, between the east and west sides of the site (see Figure 13).

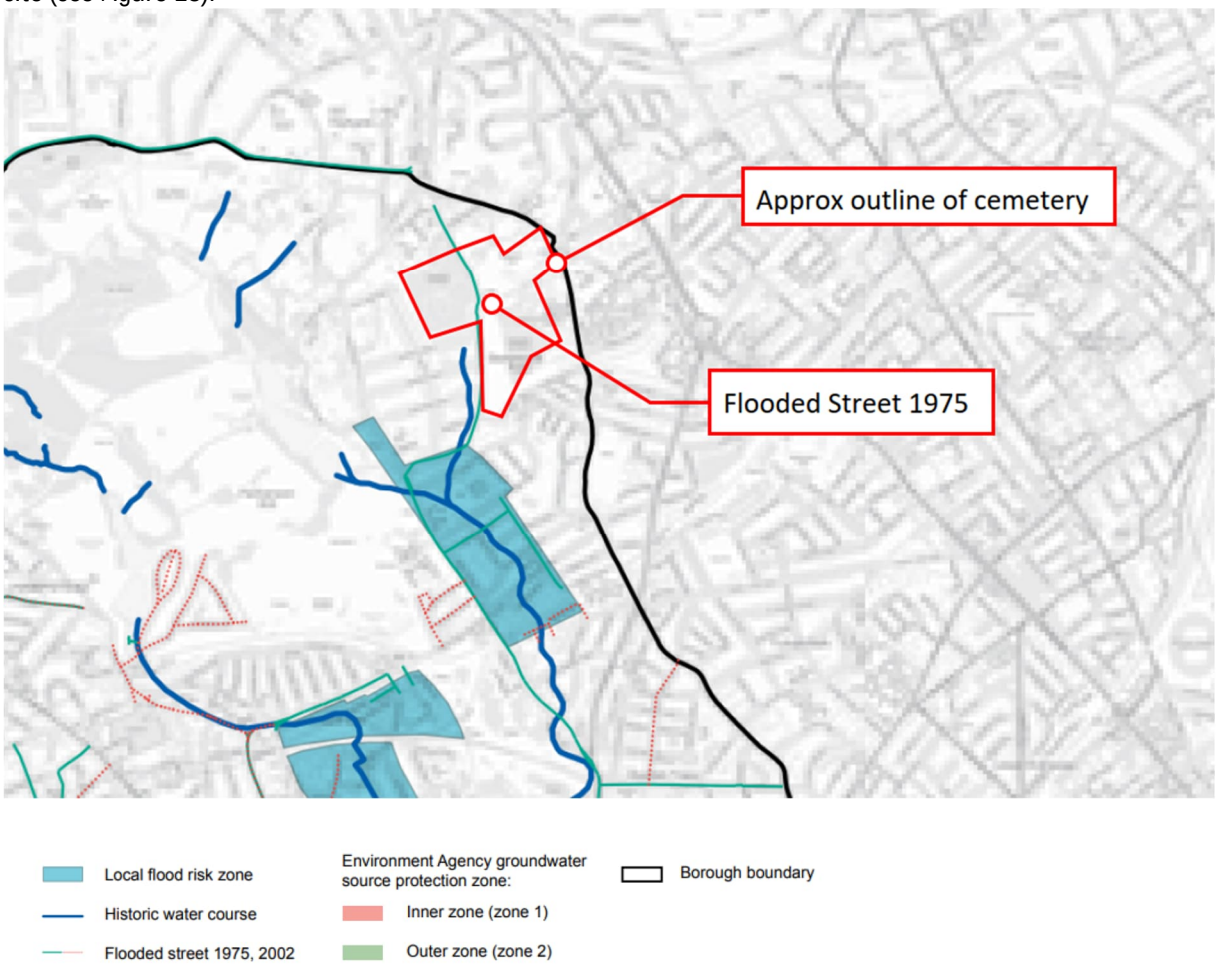

Figure 13 Historic and Recorded Flood Event

According to SFRA from Camden, the flooding is believed caused by a large storm event occurred in north London on 14th August 1975, and has been identified as the most extreme rainfall event ever recorded in London.

9.0 OFF SITE IMPACTS

9.1 Impact to Flood Risk Elsewhere

The Development Proposals are located within Flood Zone 1. As such, they will not displace fluvial flood waters and will not increase flood risk to others.

Given Swain's Lane's history of flooding, measures have been implemented to prevent the application site from exacerbating the issue. Positive drainage systems have been installed on both the east and west sides facing Swain's Lane, with drainage channels capturing surface water at both entrances to prevent runoff into the lane. Details can be referred to Appendix H: .

Furthermore, SuDS techniques are proposed on the east and west side of Application Site to manage reduce the pressure on sewage network by implementing soakaway systems and long term storage. Refer to section 10.1.3 and Appendix H: for details.

9.2 Floodplain Compensation

The Development Proposals are located within Flood Zone 1. As such, they will not displace flood waters and will not increase flood risk to others.

10.0 FLOOD MITIGATION

10.1 Recommendation

Based on the findings of this assessment, more specifically in relation to the surface water flood depths the site is shown to experience in the design *Very Low* risk (1 in 1000 year RP) Surface Water Event, it is recommended that the client should incorporate the following mitigation measures:

10.1.1 Landscape electrical connection

- All electrical elements, including incomer, meters and switchboard should be installed at least 900mm above external ground level.
- All external electrical components should be IP66 rated or enclosed in a IP66 rated enclosure.
- Bringing down electrical services from ceilings on the ground floor (where possible).

10.1.2 Water supply

- All plumbing insulation to be of closed-cell design.

10.1.3 Landscape Drainage

- To manage surface water sustainably, we propose permeable paving and a soakaway system to capture and infiltrate rainwater, reducing the load on the sewage system. A long-term storage facility on the east side will further mitigate peak flows. Detailed plans are outlined in the Sustainable Drainage Strategy Report.
- To mitigate sewer flooding risk, foul and surface water systems should remain separate where possible. Non-return valves or similar measures should prevent sewer backflow into property drains.
- Manhole / Inspection chamber covers to be secured.
- Non-return valves on sewers to be installed separately on the foul and surface water systems, to prevent back-flow and “self-flooding”.
- Climate change is altering rainfall patterns and increasing water availability, placing greater strain on the public sewer network. Development proposals incorporate rainwater reuse scheme to new buildings.

10.1.4 Flood Warning & Emergency Plan

No Flood Warning & Emergency Plan is required as part of this assessment, since the application site is situated within Flood Zone 1.

10.1.5 Safe Access and Egress

The EA Flood Hazard Ratings (guidance set out in FD2120/TR2 and FD2321/TR1) as well as the HR Wallingford and Environment Agency (May 2008) 'supplementary note on flood hazard ratings and thresholds for development planning and control purpose' outline the requirements for safe access and egress.

The EA Flood Hazard Rating is categorised as follows:

- Very low hazard: use caution
- Danger for some: includes children, the elderly and the infirm
- Danger for most: includes the general public
- Danger for all: includes emergency services

Further detail regarding these classifications can be found in section 0 of this report.

Accordingly, when assessing safe access and egress routes from the Application Site, it is necessary to review the EA Flood Hazard Ratings along the proposed route. Appropriate access and egress have been considered as part of the Flood Warning & Emergency Plan.

Safe access and egress to the proposed building is possible during the Very Low Risk (1 in 1000 year RP) surface water runoff event, with flood hazard levels below 0.75 around the site (see Figure 14). Flood Hazard Levels of <0.75 are classified as being "Safe for All" by the EA.

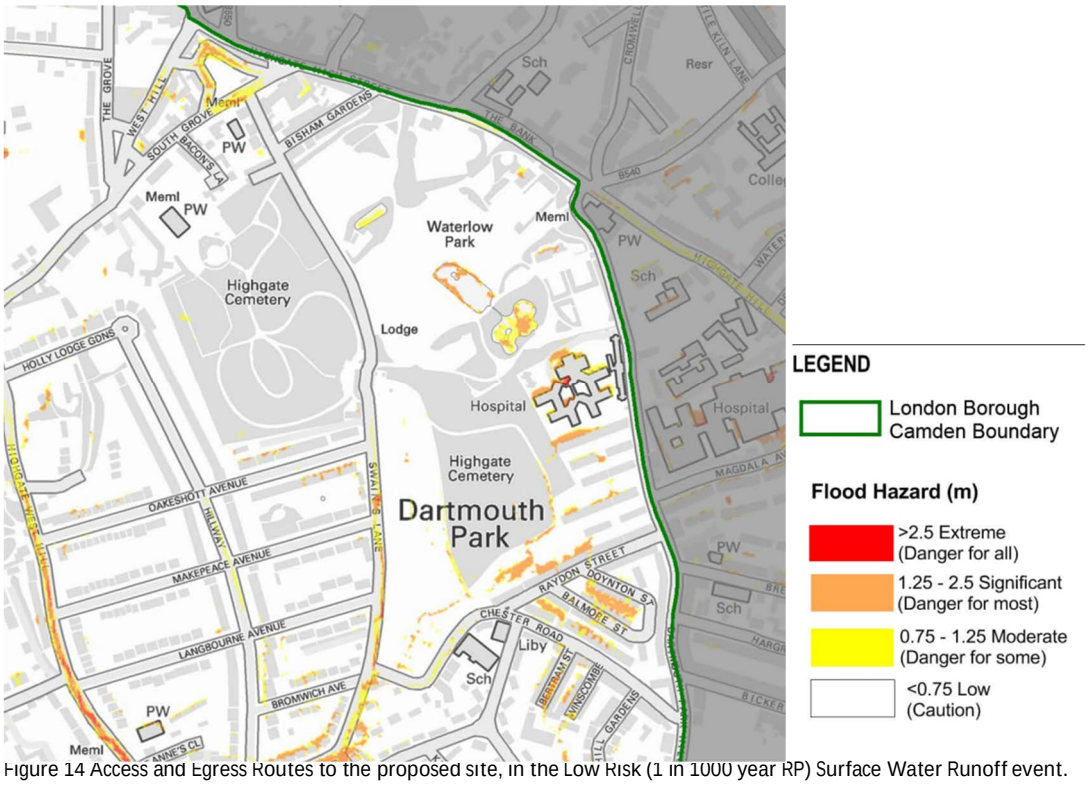

Figure 14 Access and Egress Routes to the proposed site, in the Low Risk (1 in 1000 year RP) Surface Water Runoff event.

11.0 FLOOD WARNING & EMERGECY PLAN

Given the site's location in Flood Zone 1 and the relatively low risk of flooding from surface water sources, combined with mitigation measures and safe access and egress during a Medium Risk (1 in 100 year RP) Surface Water flood event, a full FWEP is not required for the development proposals.

However, parts of the site and surrounding areas are at risk of surface water flooding during a Medium Risk (1 in 100-year RP) Surface Water flood event. Therefore, it is recommended that site managers and users sign up for Met Office Weather Warnings.

The Met Office provides weather warnings up to 5 days in advance through the National Severe Weather Warning Service. During periods of bad weather, site users should monitor local weather reports and sign up for Met Office UK weather warnings. These warnings can be accessed via an Apple/Android app, Twitter, or directly via email. Further information is available at https://www.metoffice.gov.uk/.

12.0 CONCLUSIONS

The development proposal includes restoration, demolition and replacement of buildings in East Side and West Side of Highgate Cemetery, including Cemetery wide landscaping, drainage, public realm and access works and repair of tombs and monuments to support the function of a working cemetery and community uses.

According to Annex 3 of the NPPF, the Development Proposal's Vulnerability Classification is "Water-compatible Development", which consists of the following use in this instance:

> *"Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms"*

The key findings of the Flood Risk Assessment are as follows:

- The site is situated within Flood Zone 1, and is as such considered as being at *Very Low* risk of flooding from tidal and fluvial sources.
- The site is situated within a local Critical Drainage Area (CDA) as denoted by the Camden SFRA (2024).
- A small area of the site is shown to experience Low Risk (0.1%-1% AEP event) surface water flood event.
- A range of flood mitigation measures to combat the effects of surface water flooding have been recommended as part of this report, and can be found in Section 10.0. With flood mitigation measures recommended, the risk of flooding from surface water sources is considered as relatively very low.
- The risk of flooding from groundwater and sewer sources is considered as very low.
- Safe access and egress is possible during the Low Risk (1 in 1000 year RP) Surface water Flood Event, with hazard levels of <0.75 on access routes and in areas surrounding the proposed development. Flood Hazard Levels of <0.75 are classified as being "Safe for All" by the EA.

The Flood Risk Assessment has been undertaken in accordance with the requirements of the NPPF and it can be demonstrated that the Development Proposals are compatible with the predicted flood risk profile, including climate change allowance over the development lifetime.

It should be noted that the Development Proposals are not predicted to increase the risk of flooding to others over the development lifetime. Consequently, it is concluded that, with regards to the Flood Risk requirements of the NPPF, the Development Proposals are acceptable.