Flood Risk Assessment

J1219 1 Radlett House

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Revision: X2

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GENERAL NOTES

Only construction status documentation is to be constructed from. If you do not have a construction issue document and you are about to build something, please contact Webb Yates Engineers. Ensure that you have the latest revision prior to construction.

REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Date	Author	Reviewer	Description
X1	10/10/12	AL	AY	First Issue – For Comment
X2	19/10/12	AL	AY	First Issue – For Comment

1 INTRODUCTION

Webb Yates Engineers have been appointed to redesign the structural scheme for a large private house in Primrose Hill, London. The development includes a 2-story basement and 2-story superstructure with a loft space. Contiguous piled walls will be used to retain the concrete basement box and brown or green roofing used wherever possible.

The site is surrounded on 3 sides by other large residential sites and by Primrose Hill to the North East and the existing building is a large 2-story structure with extensive impermeable areas including a tennis court tarmac area.

There are no nearby rivers and the site is far from the sea so the flood risk is likely to be low, however, it is important to examine the most likely causes of flooding and help to alleviate them wherever possible. In order to do this, the basement structure will be designed so that it makes the minimum impact, with respect to ground water, as possible.

This report provides a Flood Risk Assessment to support the planning application and Code for Sustainable Homes assessment.

2 GENERAL DESCRIPTION OF SITE

The site is located to the south west of Primrose Hill in Camden, located off Ave Road. The site OS coordinates are approximately TQ272837. The site address is 1 Radlett Place, Primrose Hill, Camden, NW8 6BT. A location plan is provided in Figure 1 below with the site highlighted.

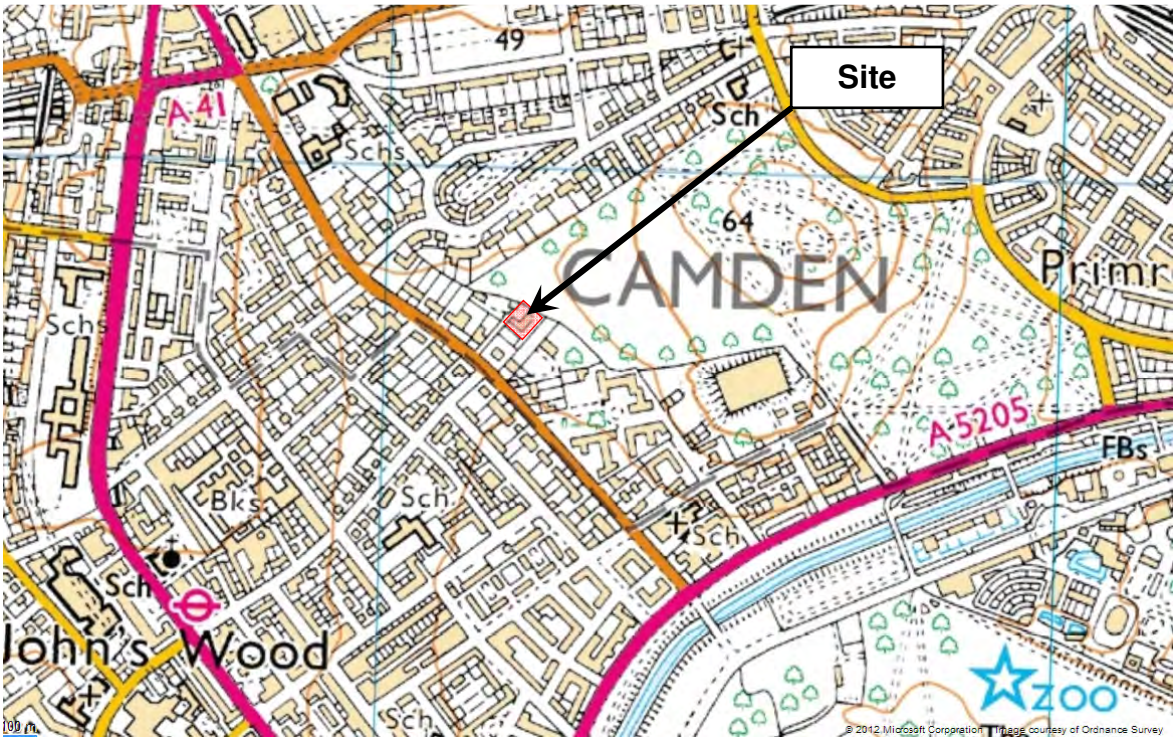


Figure 1: Site Location Plan

In accordance with Camden Council's Local Development Framework, Core Strategy and Development Policies, the site is located within a Conservation Area (Figure 2)

Figure 2: Site Location Plan showing conservation area (brown) and nearby open green area (Primrose Hill)

The current site area is approximately 0.24 ha (2,380 m^2) of which approximately 350 m^2 is covered with buildings and 880 m^2 with other hard surfacing. The proposed construction will comprise 820 m^2 of buildings and 880 m^2 of other impermeable areas and of this; 545m^2 will be green roof of substrate depth at lease 150mm.

The site is approximately level with ground levels ranging from approximately 21.2m AOD to 22.30m AOD with the higher areas only occurring in the eastern tip of the site. There is a slight fall across the site from the east (high) to west (low). The existing site survey and site plan are provided in Appendix A.

The surroundings are predominantly private residential buildings on one side and Primrose Hill, a large open area on the other. Figure 3 below shows the surrounding area.

Figure 3: Site Aerial Photograph, note; image taken from the West.

3 SITE CONTEXT

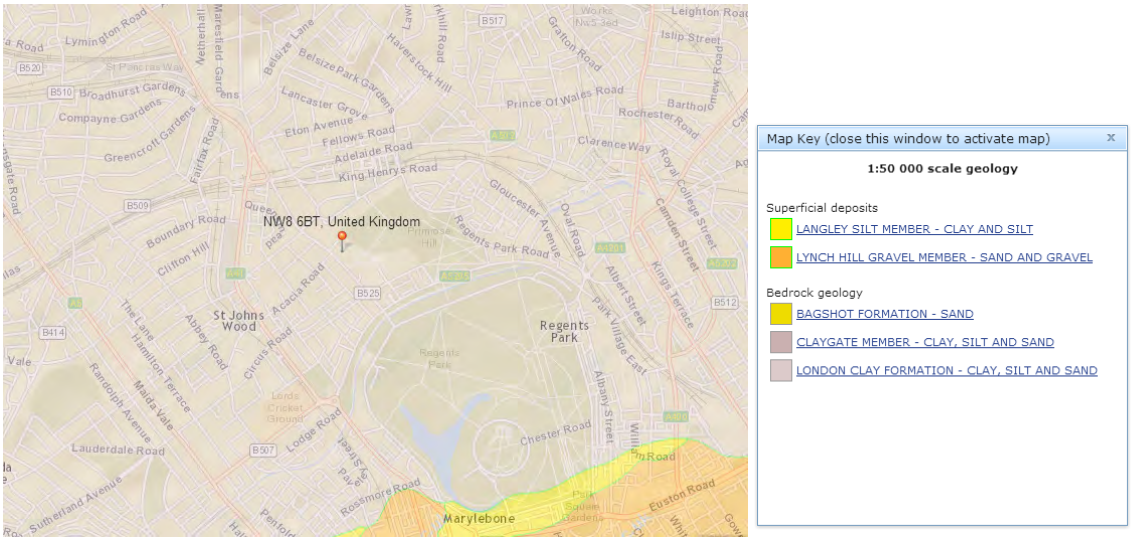
3.1 TOPOGRAPHY

The site is approximately level at around 21.50m AOD. The surrounding area is also relatively level with the exception of a few low hills to the East (Primrose Hill) and South East (Regents Park). The wider area gently slopes down to the South, towards the River Thames.

3.2 GEOLOGY

The British Geological Society (BGS) 1:10,000 Superficial Geology map for the site indicates that the site is underlain by a bedrock formation of London Clay.

Previous boreholes on site uncovered stiff to very stiff grey-brown silty Clay under varying depths of made ground. This very stiff clay extends up to around 14m below ground level.



3.3 GROUNDWATER

Boreholes encountered groundwater around 1.3 – 6.5m below ground level but these are likely to be unreliable due to the low permeability of the soil. In order to get a more accurate reading, 3 standpipes were used and sampled at 3 different times. The standing water level from these tests put the level between 3.4m and 3.7m below ground level.

3.4 HYDROLOGY

The main watercourse in the area is a canal to the South East between Primrose Hill and Regents Park. There is also an artificial 'Boating Lake' within Regents Park. The River Thames is approximately 5km to the South East but will have little effect on the site.

3.5 HYDROGEOLOGY

The Environment Agency Aquifer Designations Map for the area indicates that site is not located above any aquifers at any level (See Appendix B). However, there is a groundwater Source Protection Zone about 250m away and the site is in Source Protection Zone 2 (Outer Zone).

3.6 EXISTING SURFACE WATER DRAINAGE

The existing hard surfaces to the site (building roof areas and hard landscaping) are currently provided with a below ground drainage system. This collects the storm water flows and discharges them to a public sewer.

The existing hard surfaced areas of the site are approximately 320m^2 to buildings and 880m^2 of other hard landscaping. Based on the existing surface water system collecting the flows from these areas only, the existing peak run-off rates for various storm durations have been calculated in accordance with the Modified Rational Method and are presented below in Table 1.

	1 year	**5 years**	**20 years**	**100 years**
15 mins	10.5	17.5	24.2	33.1
30 mins	7.2	11.8	16.5	22.9
60 mins	4.6	7.5	10.5	14.7
120 mins	2.6	4.1	5.8	8.1

Table 1: Existing Site Peak Run-off Rates

4 PROPOSED DEVELOPMENT

4.1 BUILDINGS

All building on the site are to be demolished and an new basement approximately 8m deep is to be excavated and retained with concrete contiguous piled walls. Following this, the new building is constructed including a 2-story basement and 3-story superstructure.

The building and other impermeable areas has a footprint of around 1230m^2 and the proposed development a footprint of around 1700m^2. There is therefore an increase in the impermeable area of buildings on the site; however, the proposal for the new building also has areas of 'green roof' totalling 545 m^2.

4.2 EXTERNAL LANDSCAPING

A key aspect of the landscaping proposals are the improvements in site drainage through SUDS measures including green and brown roofs and retention tanks. As well as providing an enhanced user experience at the site, they are intended to provide an improved response to the flood risk of the site and the wider area.

Much of the paving and hard landscaping of the site will be permeable so that water can drain freely into the soil below.

4.3 PROPOSED RUN-OFF RATES

Although the exact extent of new hard landscaping has not yet been fully quantified, it is understood that the proposed hard surfaced areas of the site will be approximately 820m^2 to buildings and 880m^2 of other hard landscaping. There is also 545m^2 of green and brown roof area which can be assumed to only contribute half its area to the run-off volume. Based on the surface water system collecting the flows from these areas only (totalling 1430m^2), the proposed peak run-off rates for various storm durations have been calculated in accordance with the Modified Rational Method including a +20% allowance for climate change and are presented below in Table 2.

Note that these rates do not currently account for any attenuation or retention due to tanks etc. Within the final design of the surface water system, the use of SUDS will be accommodated to ensure that the new stormwater flows off site (including +20% for climate change) do not exceed the current peak outflow rates.

	1 year	5 years	20 years	100 years
15 mins	15.6	25.9	36.1	49.8
30 mins	10.8	17.5	24.6	34.3
60 mins	7.0	11.0	15.4	21.6
120 mins	4.0	6.1	8.5	11.9

Table 2: Preliminary Proposed Site Peak Run-off Rates (including 20% for climate change effects)

5 POTENTIAL SOURCES OF FLOODING

Following the guidance provided in the National Planning Policy Framework and accompanying technical guidance (NPPF) and the site context discussed in the previous section, the following potential sources of flooding may affect development on the site:

5.1 FLOODING FROM RIVERS AND THE SEA

There are no nearby rivers that pose a threat to the site via flooding and the site is located far away from the sea or any body of water prone to tidal variation.

5.2 FLOODING FROM LAND

Primrose Hill to the North East is a large area of open land that slopes gently down towards the site and surrounding area. It is separated from the site by a high wall and an area of trees.

The North London SFRA (Mouchel, August 2008) classifies Camden's risk by scale of consequence from overland flow/combined sewers to be "medium", indicating up to 500 buildings affected. The SFRA also provides information regarding areas susceptible to surface water flooding but the site is not located in a highlighted vulnerable area (See Appendix C).

5.3 FLOODING FROM GROUNDWATER

Historic borehole information from the site indicates that groundwater is approximately 3.2 – 3.7m below ground level. Data from BGS indicates that the site is in an area classified with Low Susceptibility to Groundwater Flooding. In addition the SFRA classifies the consequences from groundwater flooding to be "very small", indicating up to 40 buildings. The SFRA also contains a groundwater contour map shown in Appendix B, which indicates that the underlying groundwater level is about 85m below ground.

There is also a historical river path through the site, which means there may be groundwater flow even if there is no assumed aquifer in the area.

5.4 FLOODING FROM SEWERS

The existing surface water sewer network collects the storm water flows from the hard surfaced areas of the site and discharges them to a public sewer. Whilst it is not currently known the capacity of the existing public sewer network it can be anticipated that a typical design return period of 1 in 30 year has been applied. There is a therefore a risk of flooding to the site occurring should a rainfall event greater than the 1 in 30 year event be experienced.

The Level 1 SFRA also highlights local roads that have experienced flooding in the past with data from a flood in 1975 and 2002 (See Figure 3 below and Appendix C for full map). This map shows that the local main road (Avenue Road) flooded in 2002. The 2002 floods were due to large quantities of rain being unable to drain into the storm sewers quick enough, causing road sewers to overflow.

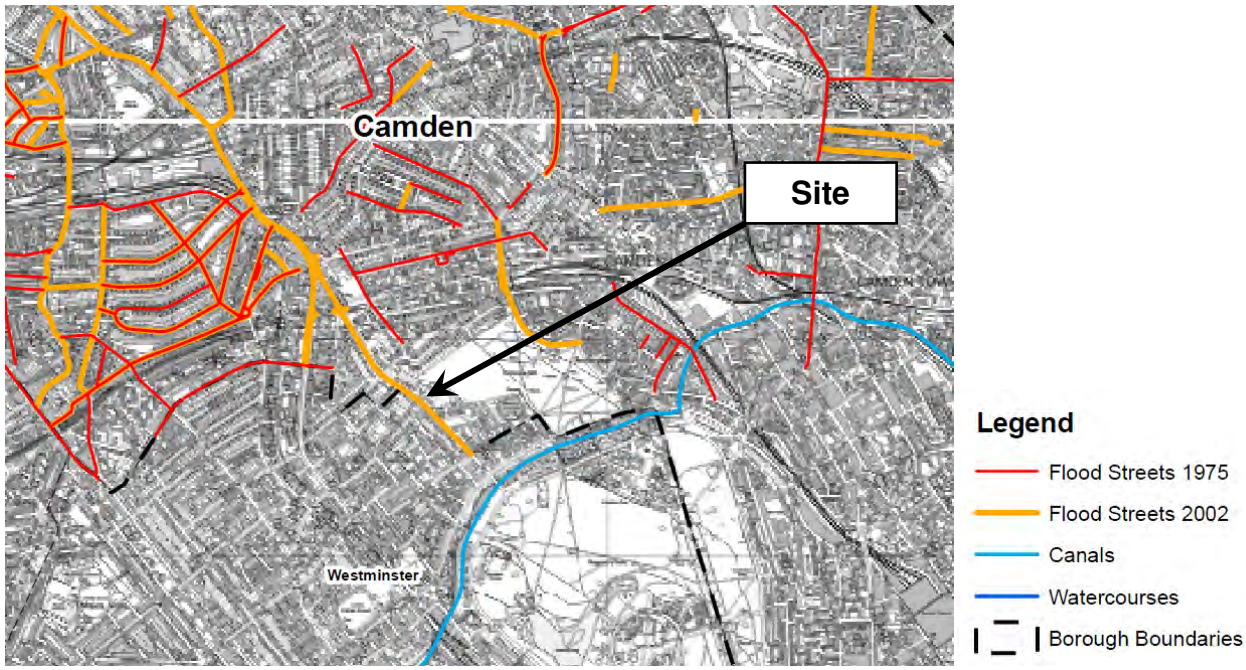


Figure 3: North London SFRA map of historic flood locations.

5.5 FLOODING FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

There is a large canal to the South East of the site between Regents Park and Primrose Hill but it is closely controlled and assumed to not pose any risk to the site. The Environment Agency Flooding from Reservoirs Map (see Figure 4 below) shows the site to be far from any zone at risk from flooding due to the failure of a reservoir or canal.

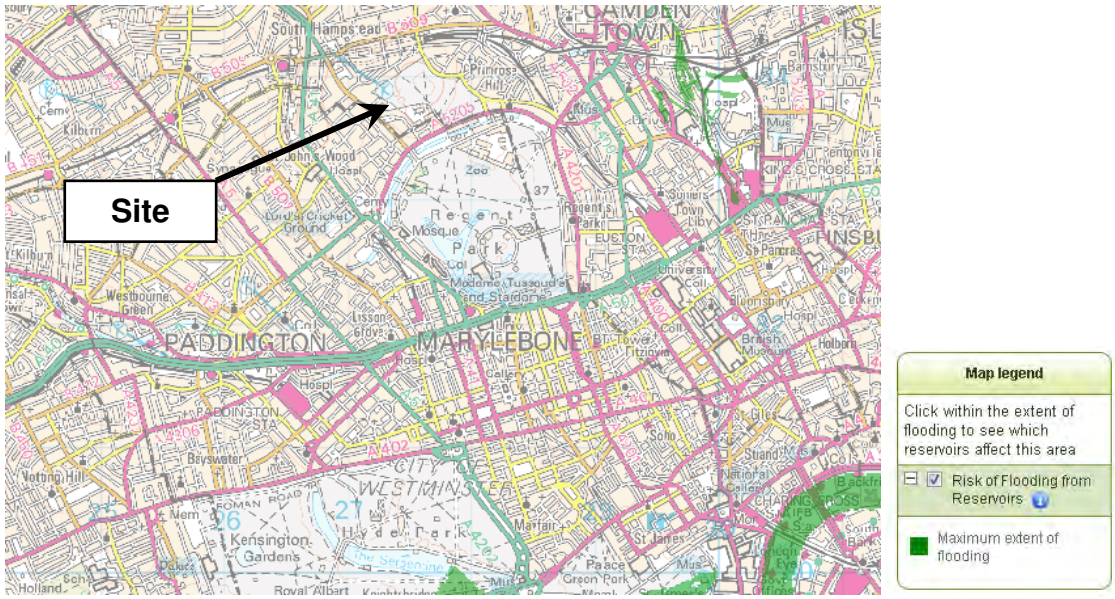


Figure 4: EA Online Flooding from Reservoirs Map (Source: http://www.environment-agency.gov.uk/homeandleisure/floods/31650.aspx. © Environment Agency Copyright and Database Rights 2012)

6 FLOOD RISK

6.1 ENVIRONMENT AGENCY FLOOD ZONE

The National Planning Policy Framework (NPPF) guidance defines Flood Zones based on the probability of river and sea flooding, ignoring the presence of defences. These Flood Zones are defined as:

- **Zone 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%).
- **Zone 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% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- **Zone 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.
- **Zone 3b: The Functional Floodplain.** This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) 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 Environment Agency, including water conveyance routes).

The Environment Agency Flood Map (see Figure 2 below) shows the site to be in Flood Zone 1 as it is not within an area susceptible to flooding (note that the EA mapping does not differentiate between Zones 3a and 3b).

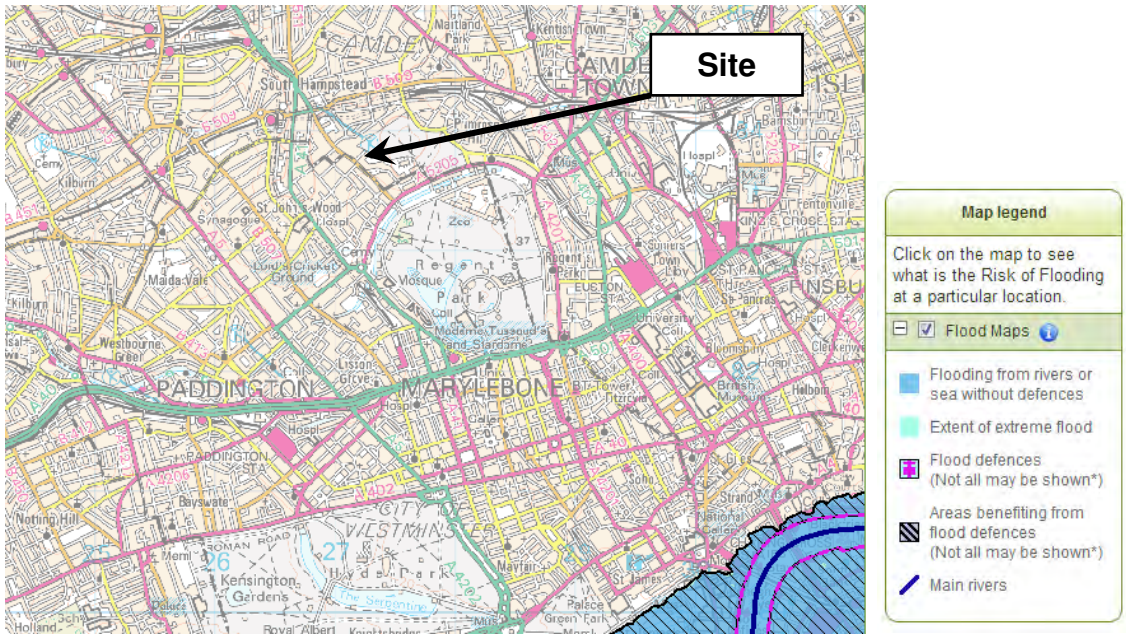


Figure 2: EA Online Flood Map (Source: http://www.environment-agency.gov.uk/homeandleisure/floods/31650.aspx © Environment Agency Copyright and Database Rights 2012).

6.2 STRATEGIC FLOOD RISK ASSESSMENT (SFRA)

The Flood Zone Map presented (see Appendix D) in the North London Strategic Flood Risk Assessment (Mouchel, August 2008) shows the site to be in Flood Zone 1, i.e. 1:1000 or less annual probability of flooding from rivers.

No Level 2 or 3 SFRA has been undertaken for Camden as the entire borough is within Flood Zone 1 and there are no major rivers or reservoirs passing through it.

6.3 CLIMATE CHANGE EFFECTS

In accordance with the NPPF guidance, the effects of climate change should be included within the assessment of future flood risk. Following the recommended contingency allowances presented in NPPS, the following allowances should be made for the proposed development:

- **Peak Rainfall Intensity**: +20% for 2065.

The new surface water drainage systems for the site will include SUDS and will be designed to accommodate increases in peak rainfall intensity as given in NPPF and CIRIA Report C697: The SUDS Manual.

6.4 VULNERABILITY

PPS 25 classifies various land uses according to their vulnerability to flooding. The vulnerability classes can then be used in the Sequential Test to assess which types of development are appropriate in each Flood Zone. Vulnerability type is assessed by classifying developments into five categories:

- Essential Infrastructure
- Highly Vulnerable
- More Vulnerable
- Less Vulnerable
- Water-compatible Development

The proposed development is a private residential house with a basement and is therefore classified as 'Highly Vulnerable' in accordance with Table 2: Flood Risk Vulnerability Classification, Technical Guidance to the NPPF.

Combining this classification with the site location in Flood Zone 1, Table .3 from the NPPF Guidance (reproduced as Table 3 below) shows that for the site development is appropriate.

Flood Risk Vulnerability classification		Essential Infrastructure	Water-compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	**Zone 1**	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✖	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	✖	✖	✖

Key

✓ Development is appropriate

✖ Development should not be permitted

Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' (Table 3 from the NPPF guidance)

7 CONCLUSIONS

The entire site area is within "Flood Zone 1" so has less than 1:1000 year risk from flooding. The usage of the whole site is for a private dwelling with a basement and hence is classified as "Highly Vulnerable". As such, there are no options to place the new development in lower risk or lower hazard zones.

The site area is approximately 2400m^2 of which covered with approximately 320 m^2 of the existing buildings. The new development takes up a total area of 1700m^2, almost entirely filling the site where there are not tree root protection zones. As such there is no availability to move the new building elsewhere on the site.

As the structure takes up such a large proportion of the site area, it is important to ensure flow can pass through the site underground and flows are not adversely affected by the new development. Contiguous piled walls are used to retain the basement structure so that where they extend deeper than the lowest basement point, there is space between them for water to flow. In the topsoil layer, water is also allowed to drain across the site through the green roof area at ground level. The development also includes an open patio area below ground level. In order to prevent flows through the topsoil around it into this area, upstands that extend above the final ground level are to be used.

The proposed site is classified as "Development is Appropriate" and the development poses no intrinsic additional flood risk to the surrounding area.