Location of public highway

The scheme drawings for the proposed development show retaining walls that should be sufficient to maintain the stability of the adjacent road and associated infrastructure. There is nothing unusual or exceptional in the proposed development or the findings of the investigation that give rise to any concerns with regard to stability over and above any development of this nature.

Founding depths relative to neighbours

The basement has been designed to ensure that the deepest section is most remote from neighbours. The outer areas of the basement are proposed to extend to a depth of 2.5 m and the excavations can be readily managed using standard engineering solutions to ensure that the stability of the adjacent foundations is maintained. These solutions include preventing excavation within a zone that would lead to instability, and constructing retaining walls in limited panel widths to ensure that no more general stability problems arise. The investigation has not highlighted any issues that give rise to concerns regarding the effectiveness of these normal engineering solutions at this particular site.

7.0 CONCLUSIONS

A Land Stability Assessment, also referred to as a Slope Stability Assessment, has been carried out following the information and guidance published by the London Borough of Camden. Information from a Site Investigation has been used to assess potential impacts identified by the screening process.

It is concluded that the proposed development is unlikely to result in any specific land or slope stability issues.

5.0 Surface Flow and Flood Impact Assessment

16 DALEHAM GARDENS
NW3 5DA

SURFACE WATER AND FLOODING ASSESSMENT

ELLIOTT WOOD PARTNERSHIP

FINAL

ISSUE DATE: SEPTEMBER 2011

PROJECT NUMBER: 11067

WATER | ENVIRONMENT

Water Environment Limited
Highland House
165 The Broadway
Wimbledon
SW19 1NE

Tel: 020 8544 8067
Fax: 020 8544 8068

www.WaterEnvironment.co.uk

revision	date	prepared by:	checked by:	approved by:	Notes
FINAL	1st September 2011	Guy Laister MSc Eng BSc Eng	Tony Clothier PhD, BSc Eng, (Civil) CEng, CEnv, MCIWEM	Tony Clothier PhD, BSc Eng, (Civil) CEng, CEnv, MCIWEM	FOR PLANNING

1 INTRODUCTION

General Information

1.1 The site is located in Belsize Park, London Borough of Camden and is currently occupied by a single, detached dwelling. The site is less than 1ha, and is characterised by the dwelling and a mixture of hard paved and permeable garden areas.

1.2 The site is shown in Flood Zone 1 of the latest Environment Agency Flood Zone maps, and by definition the risk of flooding from fluvial and tidal sources is less than 0.1% in any year. The site is less than 1ha, and therefore a full flood risk assessment is not required by Planning Policy Statement 25[1].

1.3 The London Borough of Camden policy dictates that surface water and flood risk is considered in this case primarily due to basement construction. This Surface Water and Flooding impact assessment has been produced to assess the risks of flooding from other potential sources such as overland flow, groundwater, artificial water bodies and underground sewers. The impact of the proposed development on surface water infrastructure is considered, to form part of the Basement Impact Assessment.

Planning Policy

1.4 As part of the Local Development Framework (LDF), Camden adopted the Core Strategy and Development Policies in November 2010. Policy CS13 relates to flood risk and states:

"Water and surface water flooding "

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

- *protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;*
- *making sure development incorporates efficient water and foul water infrastructure;*
- *requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross (see Map 1).'*

1.5 The Development Policies also include a policy specific to basements as follows:

DP27 – Basements and lightwell

"...The Council will only permit basement and other underground development that does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability...."

[1] Planning Policy Statement 25, March 2010

1.6 The London Borough of Camden has strict policies with regards to basement development within the Borough, therefore they have provided guidelines for 'New basement developments and extensions to existing basement accommodation[2]'. Formal planning guidance has also been released[3] setting out specific criteria for assessing the impact of basement construction. As part of the Basement Impact Assessment (BIA), it is necessary to consider 'Surface flow and flooding'. A screening flowchart addresses individual sources of potential flooding, and where a risk of flooding is present, a scoping and impact assessment need to be undertaken as appropriate. This report covers this component of the BIA.

1.7 In conjunction with ARUP, the London Borough of Camden produced a 'geological, hydrogeological and hydrological study for guidance on subterranean development[4]'.

Location

1.8 The site is situated on Daleham Gardens in Belsize Park, North London – see Figure 1.

Existing Development

1.9 The total impermeable area on site is 233m² (0.0233ha) which constitutes approximately 50% of the site. The existing dwelling has a lower ground floor level.

1.10 A topographic survey of the site has been undertaken, and included as Drawing 1. The survey shows Daleham Gardens falling in a southerly direction from a level of 50m (arbitrary datum) to 48.5m along the length of the site. Ground levels are between 49m and 50m, and between 47.5m – 48m, at the front and rear of the dwelling respectively. The finished floor level is at 50m. The finished floor level of the house is therefore set above surrounding ground levels.

Proposed Development

1.11 Proposals include side and rear extensions, excavation and extension of the lower ground floor, a new basement with associated light wells and landscaping. The extent of the lower ground floor, and basement is outside the building footprint of the existing dwelling and therefore the total plan area to be formally drained will increase.

1.12 External areas will be landscaped to suit.

[2] London Borough of Camden, Shaping Camden – Guidelines – New Basement Development and Extensions to Existing Basement Accommodation, February 2009

[3] London Borough of Camden – Camden Planning Guidance (CPG4) Basements and lightwells.

[4] ARUP Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development, November 2010

2 POTENTIAL FLOODING ON SITE

Historic Information

2.1 No records have been found of the site flooding in the past from any of the sources identified in PPS25.

2.2 It is noted in the North London SFRA[5] that a large area in the north of Camden was affected by surface water flooding in August 2002, which was the result of heavy rainfall inundating the public sewer system. A similar region of Camden was affected by surface water/sewer flooding in 1975. In both instances the flooding that occurred is understood to have been the result of high intensity rainfall inundating the main sewer and causing manholes and gulleys to surcharge.

2.3 However, even during these high intensity events that have, on 2 occasions, affected large parts of Camden, there is no record of the site or Daleham Gardens being affected by surface water flooding.

2.4 Map 22 of the SFRA[5], and Figure 15 of the ARUP study[4] show the roads which were recorded as flooded in 1975 and 2002. Daleham Gardens is not highlighted on these maps.

Tidal and Fluvial Flooding

2.5 In October 2004, the Environment Agency released updated floodplain maps for the UK based on the 'JFLOW' project, a two-dimensional hydraulic modelling project. Figure 1 shows the latest 'Flood Zone Map' for the River Thames in central London.

2.6 The floodplain indicated in dark blue is the area that may be affected by the 1 in 200 event, neglecting the influence of any flood defences in the area. This is categorised by the Environment Agency as Flood Zone 3. The light blue colour shows the additional extent of an extreme flood (greater than 0.1% probability in any year), and is categorised as Flood Zone 2. Areas benefiting from flood defences are shown as hatched.

2.7 The site is located in Flood Zone 1, approximately 5km north of the Thames at its nearest location. By the definition of Flood Zone 1, the risk of the site being affected by fluvial or tidal flooding is therefore less than 0.1% in any given year.

2.8 Although no area of London Borough of Camden is in Flood Zone 2 or Flood Zone 3, there are several watercourses in the borough, the majority of which have been culverted and are often referred to as 'Lost Rivers'.

2.9 Figure 11 of the ARUP study[4] shows the watercourses in Camden, including culverted sections. Tributaries of the Tyburn are shown to the west and east of Daleham Gardens. It is understood that these watercourses are culverted in the proximity of the site and therefore form part of the wider sewer system.

[5] North London Strategic Flood Risk Assessment, (August 2008)

Flooding from Sewers

2.10 Surface water flooding is typically the result of high intensity rainfall that is unable to infiltrate into the ground or enter the drainage system, ultimately following overland flow paths. In an urban environment such as Camden, surface water runoff is disposed of almost entirely via formal drainage systems, and consequently sewer flooding and surface water flooding (overland flow) need to be considered in tandem in this instance.

2.11 It is reasonable to assume that adopted sewers have been designed to the 1 in 30 year return period (in accordance with Sewers for Adoption 6th Edition[6]), which is considerably lower than the 100 year standard considered for fluvial flooding. As such, sewer flooding is often more frequent but less severe than fluvial flooding.

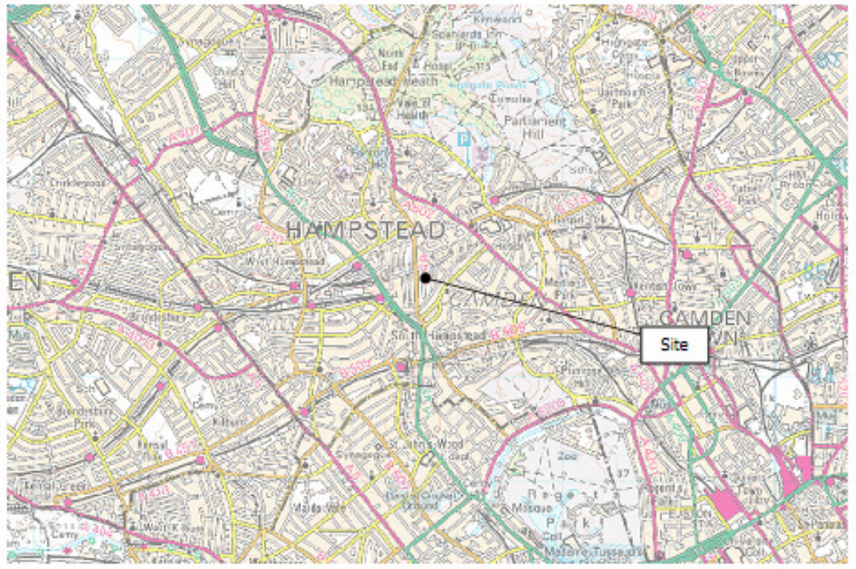


Figure 1 – Environment Agency floodplain map

2.12 Data collected from the 1975 and 2002 events were used to map areas of the borough that are more susceptible to surface water flooding. This information was subsequently used to inform Camden's supplementary guidance document on basement developments[2]. In this document, roads that were affected by either flood are known as "secondary areas", and roads affected by both floods are known as "primary areas". Any proposals for a basement development located in a primary or secondary area must include a flood risk assessment.

[6] WRc7 plc (March 2006) Sewers for Adoption – A Design and Construction Guide for Developers. 6th Edition.

2.13 The site is not located in either a primary or a secondary area. The risk of sewer and surface water flooding is therefore considered to be low in this region of London Borough of Camden.

Flooding from Artificial and Lake Water Bodies

2.14 The Regent's Canal and Regent's Park Lake are the nearest artificial water bodies to the site (reference Figure 12 of the ARUP Study)[4]. However at both locations water is not retained above natural ground level and flooding as a result of infrastructure failure is therefore not possible.

2.15 Figure 14 shows the Hampstead Heath Surface Water Catchments and Drainage, including the pond chains, in greater detail. The site is not located within the catchment of the pond chains on Hampstead Heath.

2.16 The risk of flooding from artificial water bodies is therefore considered extremely unlikely.

Flooding from Groundwater

2.17 The underlying geology of Camden and the majority of North London consists of London Clay, which typically has a very low infiltration rate. The North London SFRA[5] notes that this clay is over 100m deep in high lying parts of Camden. Consideration of the Environment Agency's groundwater maps confirms that the bedrock geology is not an aquifer.

2.18 The SFRA also noted that there have been very few recorded incidents of groundwater flooding in North London, none of which were located in Camden.

2.19 According to the Ground Investigation[7], groundwater was not encountered in any of the exploratory boreholes during boring and excavation. London Clay Formation was encountered below a thin layer of made ground and Superficial Head Deposits (maximum depth of 0.9m) to a depth of 20m below ground level (bgl).

2.20 Groundwater was subsequently recorded at approximately 5m bgl in three of the four monitoring standpipes after approximately 3 weeks. The fourth borehole remained dry. Discussions with the site investigation company suggest that the groundwater encountered is not believed to be indicative of the geologically significant local water bearing strata.

2.21 The risk of the site being affected by groundwater flooding is therefore considered to be very low.

[7] Site Analytical Services Ltd (August 2011) 16 Daleham Gardens - Report on a Ground Investigation

3 SURFACE FLOOD AND FLOODING IMPACT ASSESSMENT

STAGE 1: SCREENING

3.1 CPG4 includes a Surface flow and flooding screening flowchart for assessing the impact of potential sources of flooding, as well as the impact of the development on flood risk elsewhere.

3.2 The flow chart is set out with six questions, which are addressed with reference to the site and proposed development at 16 Daleham Gardens as follows:

- **Question 1**: Is the site within the catchment of the pond chains on Hampstead Heath?

  Reference: Figure 14 of the ARUP Study

  Answer: No

- **Question 2**: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak runoff) be materially changed from the existing route?

  Reference: Surface water runoff mechanisms and connection type and location with receiving watercourse

  Answer: **No** – surface and foul water from the dwelling will continue to drain to the combined sewer in Daleham Gardens using the existing connection.

- **Question 3**: Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?

  Reference: Total area of roof and external paved area following development compared with the existing site.

  Answer: Yes

- **Question 4**: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourse.

  Reference: Proposed landscaping and drainage system to be implemented as part of the development compared with the existing site. SUDS are required to mitigate any increase in peak flow.

  Answer: Yes

- **Question 5**: Will the proposed basement result in changes to the quality or surface water being received by adjacent properties or downstream watercourses:

Reference: Proposed landscaping and drainage system to be implemented as part of the development compared with the existing site. SUDS are required to mitigate any increase in peak flow.

Answer: No

3.3 According to CPG4, it is necessary to carry forward to the scoping stage of the Basement Impact Assessment those matters of concern where the response is 'yes'. Therefore, it is necessary to consider Question 3 and 4 in more detail.

3.4 In addition:

- **Question 6**: Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?
- Reference: Consider the risk of flooding from surface water and artificial water bodies
- **Answer: No** – see chapter 2 for details. **A Flood Risk Assessment is therefore not required.**

STAGE 2: SCOPING

3.5 Increasing the area of hard standing on site as result of development will increase the volume and peak flow rate of surface water generated. In order to ensure that development does not increase flood risk elsewhere, mitigation needs to be provided in the form of storage onsite to attenuate the peak rate of surface water runoff. Where possible it is also beneficial to prevent the additional volume of surface water discharging from the site, although this is not always feasible.

3.6 A new drainage system is proposed for the development, which will capture runoff from the entire house, not only the new extensions. The development will increase the total hard standing area to be formally drained by 54m^2. The development will therefore increase surface water runoff rates, and storage is required to attenuate flows. Peak runoff rates from the existing site, and from the site following development need to be calculated. A drainage strategy needs to be developed, taking into consideration the existing and proposed layouts, and storage needs to be provided in the system to ensure that the peak rate of runoff does not increase following development. SUDS should be prioritised.

STAGE 3: SITE INVESTIGATION AND STUDY

3.7 Chapter 2 of this report contains information on the background of the project, the various organisations and studies which have been consulted for data, as well as the site investigations which have been undertaken. Surface water runoff is the only issue which requires further consideration past the screening stage. The scoping stage of the assessment identified the need for mitigation to minimise the impact of the development on surface water flows.

3.8 Thames Water asset plan show a 965mm x 610mm combined public sewer in Daleham Gardens. Combined sewer systems are common in this part of London.

3.9 A CCTV drainage survey of the existing below ground drainage network revealed that the existing private system is also combined and discharges into the combined public sewer. It is proposed to reuse the existing connection to the public sewer and therefore the mechanism of drainage surface water from the site will remain unchanged following development.

3.10 The Ground Investigation found a thin layer of made ground and superficial deposits over London Clay proved to a depth of 20m. Infiltration techniques such as soakaways are therefore not feasible on this site.

STAGE 4: IMPACT ASSESSMENT

3.11 The site is underlain by London Clay and surface water runoff rates from permeable areas are expected to be relative high for comparative Greenfield rates. The existing site has an impermeable area of 233m^2. The development will increase the hard standing (including roof area) by 54m^2 to 287m^2.

3.12 Micro Drainage has been used to determine the peak surface water flow rate as 8l/s, as well as to model the proposed drainage system.

3.13 The existing 150mm diameter combined drain connecting to the public sewer in Daleham Gardens will be retained. A demarcation chamber will be installed to allow for inspection of the public owned drain. New, separate, private surface and foul water sewer systems will be constructed for the development, draining to the existing combined sewer connection.

3.14 Surface water runoff will be captured from external hard standing areas by trapped gulleys and channel drains, and from the roof by rainwater pipes. Surface water collecting at basement level will be pumped from a cavity drain using a rising main into a manhole upstream of the demarcation chamber. This manhole will also contain the flow control to limit discharge to a peak rate of 8l/s.

3.15 The system has been modelled for a 1 in 100 year + 30% rainfall event, which shows that 0.726m^3 of storage is required in addition to the storage contained inherently within the system (i.e. in the pipes and manholes). A trench drain will be installed along the edge of the rear terrace. The trench will be 450mm wide, 600mm deep and filled with 30% void granular fill. A 100mm perforated pipe will be installed at the base of the trench as a carrier pipe. The trench will capture runoff from the terrace and the rear of the building.

3.16 Storage will be provided as part of the surface water drainage system to attenuate the peak rate of runoff for a 1 in 100 year + 30% event to 8l/s without causing flooding on the surface. The proposed development will therefore not increase surface water runoff rates from the site. In practice the new surface water drainage system will reduce flood risk elsewhere as it has been designed to the 1 in 100 year + 30% standard, which is in excess of standards required by Building Regulations and Sewers for Adoption.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 The site is located on Daleham Gardens in the London Borough of Camden. At present the site is occupied by a detached residential dwelling. Proposals include side and rear extensions, excavation and extension of the lower ground floor, a new basement with associated light wells and landscaping.

4.2 The latest online Environment Agency flood zone maps indicate that the site is located in Flood Zone 1 (low risk), and the site is less than 1 hectare in area. In accordance with PPS25, a flood risk assessment is not required for the site. Local policy guidance on basement developments specifies that all new basement developments located in borough-defined areas at risk of surface water flooding need to be accompanied by a flood risk assessment. The site is not located in an area defined as being at risk of surface water flooding.

4.3 All sources of flooding have been assessed and are considered to pose a negligible risk to the site. While large areas in the north of the borough were affected by surface water and sewer flooding in 1975 and 2002, the site itself was unaffected in either event. The risk of surface water and sewer flooding are therefore considered to be low in this region of Camden.

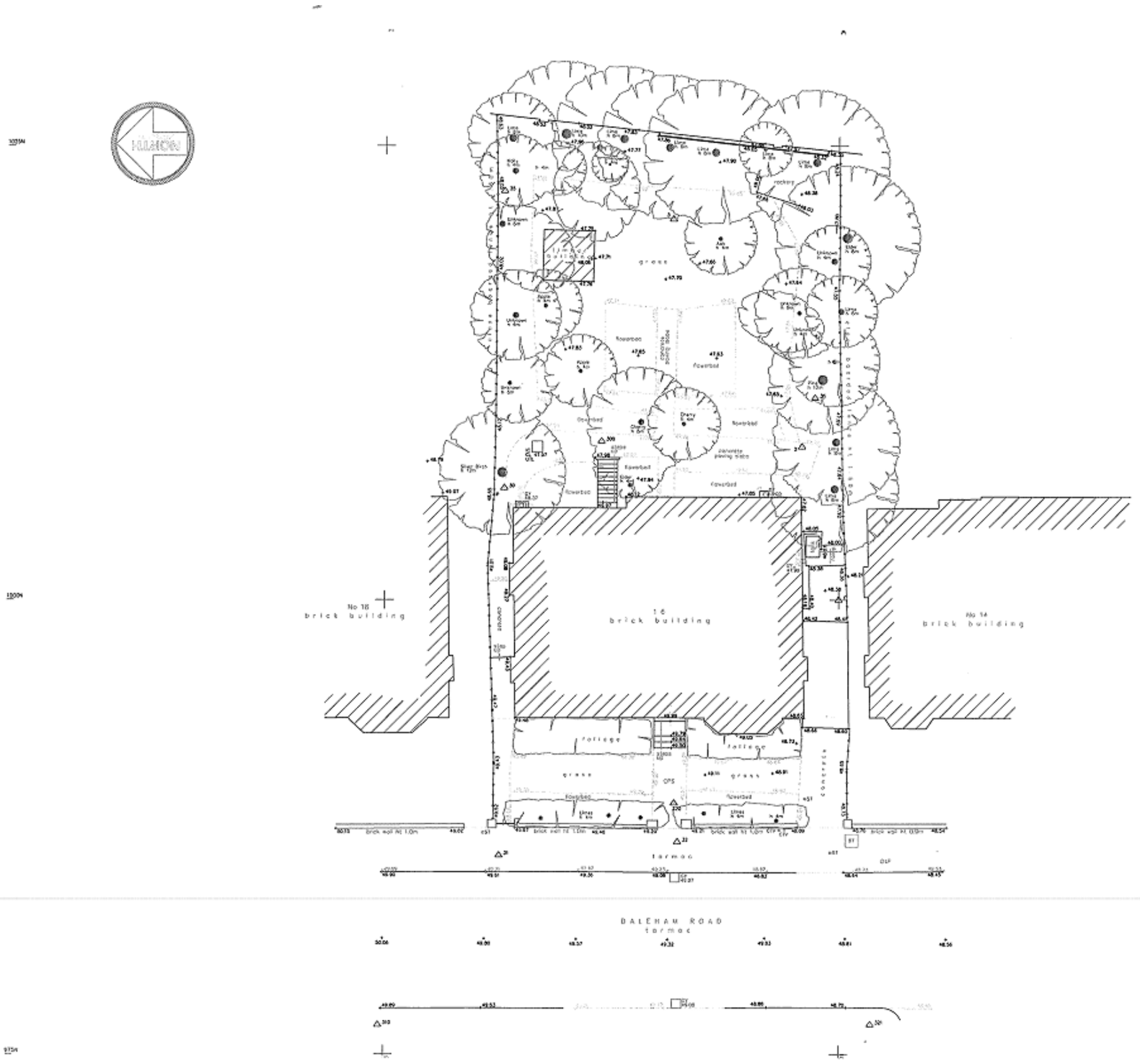
4.4 An assessment of Surface Flow and Flooding has been carried out consistent with the requirements of the Camden Planning Guidance 4. The screening assessment identified a potential impact of development on surface water runoff rates and therefore an impact assessment was completed. A new surface water drainage system will be constructed as part of the development to capture runoff from the site. Ground conditions prohibit soakaways, and the site will continue to drain to the existing 150mm diameter combined sewer in Daleham Gardens. Storage will be provided to attenuate the peak rate of runoff from the site to 8l/s for the 1 in 100 year + 30% event without flooding the surface. The development will decrease the risk of flooding from the site due to the improved standard of design.

4.5 It can be concluded that the proposed basement is at a low risk of flooding from all sources, and that the proposed basement is considered acceptable in the context of flood risk. Furthermore, surface water runoff from the site will not increase following development, and there will be no increase in flood risk elsewhere in the borough as a result of the development.

APPENDIX A – DRAWINGS

Drawing 1 – Topographic survey

The drawing shows levels on the site, including carriageway level in Daleham Gardens, ground levels to the front, side and rear of the building, and finished floor levels of the exiting dwelling.



Do Not Scale From Paper Copies

Co-ordinate table

Station	Easting	Northing	Level
1	1000.000	1000.000	48.363
2	997.878	1000.415	47.736
3	990.872	1000.842	47.687
30	987.260	1006.145	48.426
31	981.398	999.936	48.701
32	991.147	996.684	48.230
35	984.928	1002.502	48.036
36	990.893	1011.084	47.739
300	986.925	1008.745	47.970
310	974.703	978.933	50.035
320	990.859	988.037	49.583
321	1001.741	978.549	48.785
323	990.858	997.282	50.159

Every effort has been made to confirm tree species on site, yet it is advised to confirm these details with an arborist before proceeding with any design.

Every effort has been made to confirm drainage run, type and size on site, yet it is advised to check these details against statutory authority records before proceeding with any design.

Revision	Description	Date

LEGEND

Survey control station △5
Building
Banking
Gate (single)
Fence
Gate (double)
Contour 22.50
Wall
Tree Spread and Girth shown to scale
Ordnance Survey Value 15.37m

Abbreviations

Bollard	BD	Post	P
Borehole	BH	Pipe	PE
British Telecom Box	BTB	Road Sign	RS
BT Inspection Cover	BT	Rodding Eye	RE
Concrete Paving Slabs	CPS	Service Marker	MK
Cable Television Cover	CTV	Sign Post	SP
Electricity Cable Pit	EC	Sluice Valve	SV
Electricity Pole	EP	Stop Tap	ST
Earth Rod	ER	Stop Cock	SC
Fire Hydrant	FH	Telegraph Pole	TP
Flag Staff	FS	Telephone Call Box	TCB
Gas Valve	GV	Traffic Light	TL
Gate Post	GP	Unsurfaced	U/S
Gully	GY	Vent Pipe	VP
Inspection Cover	IC	Water Meter	WM
Kerb Outlet	KO	Eaves Level	EL
Lamp Post	LP	Ridge Level	RL
Manhole	MH	Roof Level	RTL
Marker Post	MK	Soffit Level	SFL
Parking Meter	PM	Threshold Level	THL
Retaining Wall	RTW	Cover Level	CL
Barbed Wire Fence	BWF	Invert Level	IL
Close Boarded Fence	CBF	No Visible Connection	NVC
Chainlink Fence	CLF	Unable to Lift	U/L
Chestnut Paling Fence	CPF		
Post and Chain Fence	PCF		
Post and Rail Fence	PRF		
Post and Wire Fence	PWF		

terrain
Land and Architectural Surveyors

Client
MATTHEW BELLAMY

Project
16 DALEHAM GARDENS
LONDON
NW3 5DA

Title
TOPOGRAPHICAL SURVEY

Drawn by	Checked by
NM	JL
Scale 1:100	Date OCT 2010
Drawing Number TS10-198T\1	Revision 0
Sheet 1 of 1	

All levels related to FFL at entrance to no 16 Daleham Gardens. (arbitrary value)

Wimbledon
241 The Broadway
London
SW19 1SD

tel. (020) 8544 0033
fax. (020) 8544 0066

Central London
4 John Prince's Street
London
W1G 0JL

tel. (020) 7499 5888
fax. (020) 7499 5444

Nottingham
Halifax House
Halifax Place
Nottingham
NG1 1QN

tel. 0870 460 0061
fax. 0870 460 0062

email: info@elliottwood.co.uk
www.elliottwood.co.uk

elliott wood partnership llp
structural and civil engineers