

#### STRUCTURAL BASEMENT IMPACT ASSESSMENT (INCORPORATING FLOOD RISK ASSESSMENT)

FOR

#### **PROPOSED NEW HOUSE**

AT

#### 17 TEMPLEWOOD AVENUE LONDON NW3 7UY

#### FOR

**MR T HENRY** 

Project No. P2000

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ISSUED FOR PLANNING



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#### **EXECUTIVE SUMMARY**

This executive summary is an overview of the key findings of the report, but the full body of the report should also be consulted for further detail and to give appropriate context.

#### Brief

This report was commissioned by Mr T Henry and is intended to accompany the planning application. It was prepared by Michael Alexander Consulting Engineers and compiled by a chartered structural engineer. It follows the approach laid out in CPG4 (April 2011) in assessment of the impact of the basement development. It is to be read in conjunction with De Metz Forbes Knight's architectural drawings, the 'Desk Study and Site Investigation report' prepared by GEA, and the SUDS report by Three Counties Flood Risk Assessment.

#### **Project Description**

At 17 Templewood Avenue there is currently a detached property with a partial basement. The works comprise the demolition of the existing house and construction of a new house with a larger and deeper basement.

#### Screening results

A screening exercise was carried out in accordance with the recommendations of CPG4 in respect of groundwater flow; land stability and surface flow/flooding. Due reference was made to the Camden Geological, Hydrogeological and Hydrological Study and other data sources. In respect of groundwater flow, further consideration was required due to the construction of the basement being below the ground water level. With regards to ground stability the issues of dewatering during construction and the differential foundation level compared to adjoining properties was carried forward to the scoping stage. In respect of surface flow/flooding the increase in impermeable area was considered to require more detailed review. Templewood Avenue was affected by the 2002 floods so a flood risk assessment was required.

#### Scoping

The results of screening exercise were use to define the scope of further studies and investigations/ This included a site soil investigation and a 'ground movement and building damage assessment'

#### Basement impact assessment

The basement impact assessment was prepared, focussing on those issues raised during screening.

A hydrogeological assessment concluded that there would be no significant impact in ground water levels or flows due to the development.

Ground movements were assessed using both computer analyses and hand methods, using conservative assumptions as to the level of adjoining foundations. The results of these analyses were used to predict possible damage in accordance with the method outlined by Burland. The worst case predicted damage was category 2 (Slight) for the front walls to the adjoining garages and to the gable wall to no. 19 Templewood Avenue, which is within normally acceptable levels. All other walls were classified as likely to experience 'Very Slight' or 'Negligible' Damage.

The impact assessment and outline construction method statement highlighted measures that will be taken to reduce water ingress into the basement during excavation and to minimise any ground movements.

With regards surface flow and flooding, it was considered that the decrease in permeable area would not significantly impact groundwater received by the aquifer. Attenuation measures will be implemented to meet the requirements for Code for Sustainable Homes and these will reduce peak flows discharged into the local combined sewer to below existing levels.

The flood risk assessment demonstrated that the flood risk for the site was low and hence compatible with the construction of habitable basement accommodation.

#### 1.0 INTRODUCTION

- 1.01 Michael Alexander Consulting Engineers has been appointed to prepare a Structural Basement Impact Assessment to support the Planning Application for the new house to be constructed at 17 Templewood Avenue, London NW3 7UY.
- 1.02 The proposed Works involve the demolition of the existing house and construction of a new house including a basement.
- 1.03 The existing property is a detached house, built in 1997. It comprises garages and a swimming pool at ground floor level, which is set partly into the slope of the ground. There are reception rooms at first floor level and bedrooms at second floor level.
- 1.04 The site is in the Redington Frognal conservation area.
- 1.05 The existing property is not Listed.
- 1.06 The adjoining properties are large detached houses and are assumed to be of a more mature age and construction. It is not thought that 19 Templewood Avenue has a basement. 15 Templewood Avenue has a basement under part of the house, which was extended in 2003 however the buildings immediately adjacent to the boundary do not appear to have a basement.
- 1.07 Drawings have been prepared by De Metz Forbes Knight Architects to show the existing and proposed layouts and elevations.
- 1.08 This document provides a summary of the proposed basement structure and includes an Outline Method Statement for the construction of the Works, which will be developed in detail by the appointed Contractor. The Report also addresses the specific key issues in DP27 as described in Camden Planning Guidance CPG4 (April 2011).

#### 2.0 PROPOSED CONSTRUCTION

- 2.01 The details of the existing building and proposals for the basement and upper floors are shown on De Metz Forbes Knight drawings.
- 2.02 Outline proposals for the basement are shown on De Metz Forbes Knight drawings, as follows:
  - A100 Rev.C Proposed GA Plans, basement level
  - A101 Rev.E Proposed GA Plans, ground floor
  - A102 Rev D Proposed GA Plans, first floor
  - A103 Rev D Proposed GA Plans, second floor

- A104 Rev.D Proposed Roof Plan
- A150 Rev.F Proposed Elevation A-A
- A151 Rev.F Proposed Section B-B, section through driveway
- A152 Rev.F Proposed Elevation C-C, section through entrance lobby
- A153 Proposed Section D-D
- A154 Proposed Section E-E, section through rear lightwell
- A155 Rev.F Proposed Section F-F, section through garden
- A156 Rev.F Proposed Section G-G, section through 15 Templewood
- A158 Rev.F Proposed Section I-I, section through living room
- A159 Rev.A Proposed Section J-J, section through lobby
- A160 Rev.B Proposed Section L-L, section through 19a Templewood
- 2.03 The superstructure of the building will be subject to detailed design, but is likely to be a concrete framed structure with reinforced concrete flat slab floors. It may be that lightweight timber and steel construction will be adopted for the top floor.
- 2.04 The new basement will be constructed using secant piled wall around the perimeter. The retaining construction will be lined with a reinforced concrete (RC) wall and new RC raft slab and ground floor slabs will be constructed to create a reinforced concrete "basement box".
- 2.05 The design and construction of the building structure shall be in accordance with current Building Regulations, British Standards, Codes of Practice, Health and Safety requirements and good building practice.
- 2.06 The basement will be Grade 3 to BS8102 and the waterproofing to achieve this will be specified by the Architect. It is likely that an admixture will be used in the concrete, to improve the water resistance of the reinforced concrete basement box, with an internal drained cavity system for the floors and walls.

### 3.0 GROUNDWATER

#### 3.01 STAGE 1 (SCREENING)

- 3.01.1 The impact of the proposed development on ground water flows is considered here as outlined in Camden Planning Guidance CPG 4 (April 2011). The references are to the screening chart figure 1 in CPG4.
- 3.01.2 (Q1a) With reference to the Camden Geological, Hydrogeological and Hydrological Study (figure a) in Appendix A) the site is above a secondary aquifer.
- 3.01.3 (Q1b) The local groundwater level was found from the site soil investigation to at a level of approximately 107-107.5mOD, which is approximately 3m below the level of the existing drive, and around 6.5m below the rear garden level. Based on an

allowance of 1 metre to allow for a future rise in ground water level due to climate change, a water table level of 108.5mOD will be assumed in the design. The proposed basement therefore extends below the water table surface.

3.01.4 (Q2) With reference to the Camden Geological, Hydrogeological and Hydrological Study, (refer Figures b) and c) in Appendix A), the closest subsurface water courses run along the approximate line of Reddington Gardens towards Hampstead Heath to the south and east and along Redington Road to the west of the site. The proposed basement is however not within 100m of these subsurface watercourses.

The nearest surface water is that which forms part of the Golders Hill Chain Catchment toward the north of the site, which is located more than 100m away. The local geology suggests that the site is located adjacent to a spring line. From the British Geological Society 'Geoindex' the nearest water well is adjacent to Hampstead High Street approximately 1000m from the site.

- 3.01.5 (Q3) With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
- 3.01.6 (Q4) The surface permeability of the site will be affected by the proposals. There is an increase (approximately 17%) in the footprint of the building. There is also an increase of 5% in hardstanding areas throughout the site.
- 3.01.7 (Q5) It is not considered appropriate to discharge surface water into the sub-soil, so collected surface water will be discharged to the combined sewer in Templewood Avenue. Therefore no surface water will be discharged to ground as part of the site drainage.
- 3.01.8 (Q6) There are no local ponds or other surface water features in close vicinity to the site.
- 3.01.9 On the basis of items 3.01.2 to 3.01.8 above and in reference to Figure 1 of CPG4, the aspects carried forward to the scoping stage in respect of ground water are:
  - The site being above a secondary aquifer (Q1a)
  - The basement extending below the water table (Q1b)
  - The site being adjacent to a spring line (Q2)
  - The decrease in surface permeability (Q4)

It is not considered necessary to consider further the other issues raised in the screening stage where a negative response was given.

#### 3.02 STAGE 2 (SCOPING)

- 3.02.1 With reference to the Camden Geological, Hydrogeological and Hydrological study Appendix F2, the potential impacts which will need to be considered will include:-
  - Whether the basement works will impact on the groundwater level locally and whether this will impact neighbouring properties.
  - Whether the basement works will impact on the aquifer and affect the groundwater flow regime.
  - Whether the basement will affect the flow from any springs on the spring line
  - Whether the increase in hard standing will change the ground water levels
- 3.02.2 In response to these issues raised in the scoping stage, a conceptual ground model was developed by GEA and is included in their report 'J11244 Desk Study and Ground Investigation Report' dated January 2012.
- 3.02.3 The desk study and conceptual ground model was used to inform both the scope of the site soil investigation and the scope of interpretive report.

#### 3.03 STAGE 3 (SITE INVESTIGATION AND STUDY)

- 3.03.1 During the ground investigation, the level of water strikes were recorded as they were encountered in the boreholes. Standpipes were then installed in four of the boreholes and a return monitoring visit was made to check stabilised levels.
- 3.03.2 The following was considered in evaluating the potential impact of the basement on groundwater level and flows:
  - The levels recorded in these standpipes
  - The thickness of the Bagshot Beds and Claygate Member aquifer strata
  - The size, location and depth of the existing basement relative to the water table surface and to the adjoining buildings
  - The size, location and depth of the proposed basement relative to the water table surface and to the adjoining buildings

#### 3.04 STAGE 4 (IMPACT ASSESSMENT)

- 3.04.1 The water levels recorded in the standpipes suggest that the proposed basement will extend below the water table surface.
- 3.04.2 The hydrogeological impact was assessed by GEA by a chartered geologist and their conclusions are included in section 7.6 of their report.

3.04.3 In summary, the report notes that the new basement is larger on footprint than the existing and extends into the less permeable Claygate member strata. However the report concludes that there is ample space for groundwater to pass around the proposed basement and hence that there will not be any significant detrimental effect on groundwater flows or level.

### 4.0 GROUND STABILITY

#### 4.01 STAGE 1 (SCREENING)

- 4.01.1 The impact of the proposed development on land stability is considered here as outlined in Camden Planning Guidance CPG 4 (April 2011). The references are to the screening chart figure 2 in CPG4.
- 4.01.2 (Q1) With reference to survey drawings, the existing site rises adjacent to road at the rate of around 4.2° across the width of the property. There is a very gentle slope of around 1.3° across the width of the property at the rear. The site also slopes around 5.4° front to back. All slopes are therefore less than 7 degrees.
- 4.01.3 (Q2) The land will generally remain terraced at close to existing slopes in the permanent condition.
- 4.01.4 (Q3) The neighbouring properties also have slopes generally less than 7 degrees
- 4.01.5 (Q4) Templewood Avenue falls around 9m over approximately 150m as it passes the site, suggesting an overall slope of around 3.5 degrees. Running east-west cutting across the property, there is a lesser slope of approximately 2.5 degrees. The site falls 4m from the rear boundary to Templewood Avenue, over a distance of 55m representing a slope of around 4 degrees. The wider hillside setting is therefore less steep than 7 degrees in each direction.
- 4.01.6 (Q5) The underlying soil strata is Bagshot Formation, with reference to Camden Geological, Hydrogeological and Hydrological Study (refer figure (e) in Appendix A),.
- 4.01.7 (Q6) Three small trees will be removed as a result of the proposals. The design reflects the need to avoid excavation with the root protection zones wherever possible. Refer pre-development arboricultural report by The Tree Bureau.
- 4.01.8 (Q7) The Bagshot Formation strata at the site has been classified as having lowmedium volume change potential. Whilst in theory seasonal shrink-swell subsidence could occur, and will affect the depth required of any shallow foundations, it is much less shrinkable than the Clays encountered elsewhere in the locality. There is no evidence of subsidence having previously affected 17 Templewood Avenue

- 4.01.9 (Q8), (Q11) With reference to the Camden Geological, Hydrogeological and Hydrological Study, (refer Figures b) and c) in Appendix A), the closest subsurface water courses run along the approximate line of Reddington Road to the west and Reddington Gardens to the South, both of which are greater than 100mfrom the proposed basement. The nearest surface water is the Golders Hill pond chain to the north, which again is greater than 100m from the site. The local geology suggest that spring lines could be present as the site runs close to the interface between the Bagshot Formation and the Claygate Member.
- 4.01.10 (Q9) The site is not in the vicinity of any recorded areas of worked ground, the nearest recorded on the geological map is south of West Heath Road and East of Branch Hill, approximately 400m away from the site. This is consistent with the findings of the trial pits and borehole.
- 4.01.11 (Q10) With reference to the Camden Geological, Hydrogeological and Hydrological Study (figure a) in Appendix A) the site is above a secondary aquifer. The basement will extend beneath the water table level, so limiting water ingress during construction will need to be considered.
- 4.01.12 (Q12) The closest excavation from the site to the pedestrian pathway is approximately 4m and the highway a further 3m.
- 4.01.13 (Q13) The works will make the foundations to 17 Templewood Avenue deeper than those of the neighbouring properties, particularly those buildings or parts of buildings which are not assumed to have existing basements.
- 4.01.14 (Q14) The site is not in the vicinity of any near surface tunnels owned by LUL, TFL or National Rail (refer figure (d) in Appendix A).
- 4.01.15 On the basis of items 4.01.2 to 4.01.14 above and in reference to Figure 2 of CPG4, the aspects carried forward to the scoping stage in respect of land stability are: -
  - The removal of existing trees within the site extents (Q6)
  - The impact of the proposed works close to a spring Line (Q.8)
  - The impact of the works extending beneath the water table (Q10)
  - The proximity of the proposed basement to the public footway (Q12)
  - The increase in differential depth of foundation relative to neighbouring properties (Q13)

It is not considered necessary to consider further the other issues raised in the screening stage.

#### 4.02 STAGE 2 (SCOPING)

- 4.02.1 With reference to the Camden Geological, Hydrogeological and Hydrological study Appendix F3, the potential impacts which will need to be considered will include:-
  - The impact on the soil moisture levels and soil stability due to the removal of trees
  - Whether any changes to the groundwater flow regime will impact on soil stability
  - Whether any de-watering required to construct the basement will impact on soil stability
  - The potential for structural damage to neighbouring properties during excavation of the basement
  - The potential for damage to the public footway or the services contained therein.
- 4.02.2 In response to these issues raised in the scoping stage, a conceptual ground model was developed by GEA and is included in their report 'J11244 Desk Study and Ground Investigation Report' dated 23 December 2011.
- 4.02.3 The desk study and conceptual ground model was used to inform both the scope of the site soil investigation and the scope of interpretive report.

#### 4.03 STAGE 3 (SITE INVESTIGATION AND STUDY)

- 4.03.1 A site investigation has been carried out by Geotechnical and Environmental Associates Limited (GEA), which comprised boreholes and trial pits and included monitoring of ground water levels.
- 4.03.2 The ground in the vicinity of the site comprises a thin layer of made ground over fine silty sand classified as being the Bagshot Beds, over the silty Clay of the Claygate member.
- 4.03.3 Groundwater was encountered at around 3m below the lowest existing ground level at the site.
- 4.03.4 Existing foundations of the adjoining buildings and boundary walls were found to be relatively shallow. The garage building to no. 15 was found to have foundations 300mm below drive level, and the garage building to no. 19 to have foundations 850mm below existing ground level.
- 4.03.5 An elevated level of lead was identified followed laboratory tests on a single sample taken from within the made ground.
- 4.03.6 GEA have prepared an interpretative report following the results of the site investigation, drawing on their understanding of the proposals and the issues raised in the screening stage.

The report makes recommendations regarding basement excavation and foundation design and includes a site specific risk assessment in respect of soil contamination.

- 4.03.7 Following the receipt of the geotechnical information a specialist 'Ground Movement and Building Damage Assessment' was commissioned to advise on the likely ground movements and any impact on the adjoining properties. The report was prepared by Byland Engineering and its findings are summarised in section 4.04 below.
- 4.03.8 In accordance with the requirements of CPG4, if the building damage category predicted by the analysis is 'moderate' or greater then mitigation measures will be required to the design.

#### 4.04 STAGE 4 (IMPACT ASSESSMENT)

- 4.04.1 The GEA report 'J11244 Desk Study and Ground Investigation Report' dated June 2011 and the interpretative report contained therein comprises the first part of this impact assessment
- 4.04.2 Elements of the basement design were considered in more detail following the findings of this report. The basement will be founded within the Claygate Member subsoils and there is a potential for uplift forces acting on the basement, due to heave recovery of the soil; there is also the possibility of hydrostatic pressures due to the level of the water table. The uplift forces will be resisted by a combination of the self weight of the structure and a grid of tension piles under the raft slab
- 4.04.3 The approach for maintaining ground stability during the works is demonstrated by the outline method statement given in Section 6.0.
- 4.04.4 The design of the new structure and, in particular the substructure, will take into account the close proximity of adjoining buildings. Those parts of the adjoining properties which are particularly close to the proposed basement construction will be continually monitored during the substructure works. The monitoring will be carried out using high accuracy measuring devices.

The potential for ground movements have been looked at in detail by the carrying out of a Ground Movement and Building Damage Assessment. The assessment draws on the approach laid out in CIRIA Report C580 and uses a combination of hand calculation and computer analysis.

The tensile strains output from analysis for both pile installation and excavation operations are then combined to assess the potential impact. The assessment identifies likely damage to adjoining buildings, using the method developed by Burland which classifies the extent of cracking likely to be encountered by means of 'damage categories'.

4.04.5 The predicted category of damage is generally Category 0 'Negligible', as defined by Burland, with the exception of the following walls: -

Property	Wall	Damage Category
15 Templewood Avenue	Garage Boundary Wall	Cat 1 'Very Slight'
	Garage Front Wall	Cat 2 'Slight'
19 Templewood Avenue	Garage Front Wall	Cat 2 'Slight'
	Main House Rear Elevation	Cat 1 'Very Slight'
	Main House Gable Elevation	Cat 2 'Slight'

- 4.04.6 The predicted strains induced in the walls range from the negligible to the slight category and well below the moderate category at which mitigation measures must be considered as outline in CPG4
- 4.04.7 The report highlights the necessarily conservative assumptions taken in the analysis, which mean that the analysis results are likely to be an upper bound on the movements and hence damage that will be experienced. Specifically: -

- The assessment is likely to be conservative as it considers the ground surface movements at a level of 113mOD. In practise the level of the foundations of the neighbouring properties will be somewhat deeper than 113mOD and as such the foundations themselves may experience less deflection than quoted in the analysis

- In accordance with CIRIA Guide C580 the gable wall to no. 19 has been modelled as 10m high while the actual wall height may be of the order of 6m and the roof supported by it rising a further 4m. Hence, the damage category for the wall has probably been slightly overpredicted.

- 4.04.8 A key consideration in limiting total movements will be the early installation of an effective prop to the structure close to ground level ('high level' as described in CIRIA C580). This will generally be achieved by the use of steel props spanning across the excavation or across its corners. Capping beams will be installed to the top of the piled retaining walls and the top sections of the underpinning will be similarly reinforced to span laterally between prop locations and the lines of return piles. The props and capping beam will be installed prior to significant excavations being undertaken. A limit of excavation prior to propping of 1 metre depth is usually found to limit pre-propping deflections to acceptable levels whilst permitting practical working room to construct the capping beams.
- 4.04.9 Overburden loads applied at ground level adjacent to excavations can increase pile deflections. The construction method will be interrogated to ensure this is avoided within the site boundaries. Beyond the boundaries the areas adjacent to the basement are paths or soft landscaping so there are unlikely to be significant 'live' overburdens occurring during the excavation works.

- 4.04.10 The following further issues were highlighted by the scoping stage and are discussed here:
  - The removal of trees could increase soil moisture levels and hence lead to swelling of cohesive subsoils. The trees outlined to be removed are small in height and their removal will not significantly change the overall vegetation coverage. Furthermore for the majority of site the made ground is underlain by the Bagshot Beds, which are of low-medium volume change potential hence the potential for ground swelling is small.
  - The scoping stage raised the concern that any changes to the groundwater flow regime could impact on soil stability. As outlined in section 3.04 there are not expected to be any significant changes to the groundwater flow regime as any ground water flows should readily pass around the proposed basement.
  - Excessive water ingress into the basement excavation could cause general de-watering of the surrounding sub-soils which could lead to foundation movements for the adjoining buildings. For this reason a secant piled retaining wall has been proposed for perimeter of the basement excavation.

The toes of the secant piles will be into the less permeable Claygate member and hence water ingress from the surrounding soils into the basement excavation will be limited.

• The methods proposed should reduce the risk of any damage to the public footway or the services contained therein. The footway will be scanned for services prior to works commencing so that the depth and location of services can be reflected in the Contractor's detailed method statements.

### 5.0 SURFACE FLOW AND FLOODING

#### 5.01 STAGE 1 ASSESSMENT (SCREENING)

- 5.01.1 The impact of the proposed development on the surface water environment and whether a flood risk assessment is required is considered here as outlined in Camden Planning Guidance CPG4 (April 2011). The references are to the screening chart figure 3 in CPG4.
- 5.01.2 (Q1) With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains in Hampstead, nor the Golder's Hill Chain.
- 5.01.3 (Q2) On completion of the development the surface water flows will be routed similarly to the existing condition, with rainwater run-off collected in a surface water drainage system and discharged to the combined sewer. The surface water run off will be limited to pre-development levels to comply with the requirements of the Code for Sustainable Homes.

- 5.01.4 (Q3) The surface permeability of the site will be affected by the proposals. There is an increase (approximately 17%) in the footprint of the building. There is also the increase of 5% in other hardstanding areas, and this will have to be carried into the scoping stage.
- 5.01.5 (Q4) All surface water for the site will be contained within the site boundaries and collected as described in 5.01.3 above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites.
- 5.01.6 (Q5) The surface water quality will not be affected by the development, as in the permanent condition surface water will be collected and discharged to the public sewer.
- 5.01.7 On the basis of 5.01.2 to 5.01.6 above, with reference to figure 3 in CPG4, it is considered appropriate to carry forward the potential impact of the increase in impermeable area to the scoping stage. It is not considered necessary to consider further the other impacts of the works in respect of surface flow and flooding, due to the negative responses above.
- 5.01.8 (Q6) Templewood Avenue is noted as one of the streets within the Camden Planning Guidance CPG 4 (April 2011) as a street "at risk of surface water flooding" (refer figure (f) in Appendix A) due to a flood in 2002.
- 5.01.9 On the basis of 5.01.8 above and in accordance with the figure 3 in Camden Planning Guidance CPG 4 (April 2011), a flood risk assessment is required and is included in section 7.0

#### 5.02 STAGE 2 (SCOPING)

- 5.02.1 With reference to the Camden Geological, Hydrogeological and Hydrological study Appendix F1, the potential impacts which will need to be considered will include:-
  - Whether the increase in hard landscaping will significantly affect the groundwater received by underlying secondary aquifer and hence impact on local groundwater levels
  - Whether the increase in impermeable area will impact on the rate of surface water received by the public combined sewer
- 5.02.2 The above impacts will be evaluated by considering whether the surface permeability of the site will be significantly affected by the works, and what measures will be used to mitigate the impact of this.

#### 5.03 STAGE 3 (SITE INVESTIGATION AND STUDY)

- 5.03.1 The site is approximately 0.1 hectares in size and is generally laid to lawns. The area of roofs to the existing house is approximately 292m<sup>2</sup> (0.029 Ha.). Hard landscaping surrounding the building accounts for approximately 204m<sup>2</sup> (0.020 Ha.), giving a total of 496m<sup>2</sup> (0.049 Ha.) non permeable area. This represents approximately 50% of the total site area.
- 5.03.2 The area of roofs to the proposed house will be approximately 343m<sup>2</sup> (0.034 Ha.). Hard landscaping surrounding the building will account for approximately 214m<sup>2</sup> (0.021 Ha.). The total impermeable area of 557m<sup>2</sup> will represent approximately 56% of the total site area.
- 5.03.3 The surface water run off will be reduced to pre-development levels to comply with the requirements of the Code for Sustainable Homes.

SUDS measures that will be considered to achieve this are as follows:

- the use of a lined permeable paving system to external hard landscaped areas to attenuate surface water run off
- the use of green roofs to reduce the rate of run off
- collection of rainwater and reuse for irrigation
- other methods of attenuation

For further details refer the SUDS report by Three Counties Flood Risk Assessment

#### 5.04 STAGE 4 (IMPACT ASSESSMENT)

- 5.04.1 As demonstrated by the calculations in 5.03, there is a increase in the impermeable area for the site. However taken as a whole for the site, or the wider locality, this increase is small as a proportion of the total permeable area. It is therefore considered unlikely to have any significant impact on groundwater levels within the sub-soils.
- 5.04.2 In terms of discharge to the public sewer, the measures required to meet the requirements for Code for Sustainable Homes will limit both peak rates of runoff and volume of runoff to pre-development 'Greenfield' levels by use of SUDS measures. The flow rates and volumes have been calculated and summarised in the SUDS report by Three Counties Flood Risk Assessment.

This will reduce the discharge into the public combined sewer under storm conditions to lower levels than those under the currently developed site.

### 6.0 CONSTRUCTION METHOD STATEMENT - SUBSTRUCTURE

- 6.01 The following provides an outline Method Statement for the construction of the basement. This will be developed and finalised by the appointed Contractor, once the detailed design is complete.
- 6.02 The works will commence with demolition of the existing house down to first floor level. Prior to any excavation or works to the substructure, monitoring measurements will be taken to act as a base level.
- 6.03 The perimeter and internal piling works will then proceed. The piling platform level will vary across the site, with some piles installed from close to existing ground level and some installed off the first floor slab with back propping installed as required. There are several viable methods of temporary support to the surrounding ground, during the excavation of the basement. The proposals are that secant piled walls will be used around the perimeter of the proposed basement. This method of construction is non-percussive and will minimise the disruption to the surrounding ground, minimise water ingress, and ensure that there is no impact on the adjoining structures. The piles shall be designed as propped cantilevers with temporary supports inside the area of excavation, which shall be installed close to the proposed ground floor level.
- 6.04 When the piling works are complete, reinforced concrete capping beams will be installed around the perimeter of the proposed basement. Temporary props will then be installed between the capping beams.
- 6.05 The existing basement structures will then be demolished and bulk excavation will proceed. The ground water encountered within the basement perimeter will be collected in temporary sumps and pumped. During excavation monitoring readings will be regularly taken. If any unexpected movements are recorded either in the piles or the adjoining buildings then the excavation will be stopped and pre-agreed contingency measures implemented to prevent further movements.
- 6.06 When bulk excavation is complete to basement level, the bottom surface of the excavation will be immediately blinded. The internal piles will then be exposed and cut down to the level of the basement.
- 6.07 The basement raft will then be constructed, followed by the RC walls and columns to ground floor level.
- 6.08 The construction of the substructure works will then proceed by construction of the ground floor slab. When this slab has been constructed and the concrete has reached target strength, then the lateral propping will be removed.

### 7.0 FLOOD RISK ASSESSMENT TO PPS 25

- 7.01 **Information Sources** The following additional sources of information have been reviewed in preparing this section of the report:-
  - 7.01.1 The Environment Agency (EA) flood maps
  - 7.01.2 Thames Water Drainage Records
  - 7.01.3 Thames Water records on sewer flooding
  - 7.01.4 'Floods in Camden Reports of the Flood Scrutiny Panel', LB of Camden, June 2003
  - 7.01.5 The North London Strategic Flood Risk Assessment, August 2008
  - 7.01.6 Planning Policy Statement (PPS) 25
  - 7.01.7 PPS25 Guidance

#### 7.02 **Development Description and Location**

- 7.02.1 The proposals are for the demolition of the existing 3 storey house (including a part basement), and the construction of a new 4 storey with a full basement. Refer architect's details and the other sections in this report for further details. For the property location refer figure (m) in Appendix A
- 7.02.2 The property is classified as 'Highly Vulnerable' in accordance with Table D2 of PPS25 due to its use as a basement dwelling
- 7.02.3 The proposed development is generally consistent with the Local Development Documents, such as CPG4 and DP27. CPG4 does not recommend habitable basement spaces where there is a risk of sewer flooding. However as described in 7.03.1 below, whilst there has been previous sewer flooding to Templewood Avenue this is unlikely to have affected no. 17 Templewood Avenue nor to affect it in the future.
- 7.02.4 The Sequential Test suggests that the site is suitable for construction of basement dwellings, since the site is within Flood Zone 1

#### 7.03 **Definition of the Flood Hazard**

7.03.1 Sewer flooding is considered worthy of further consideration due to the 2002 flood event which flooded a number of streets in the LB of Camden. Templewood Avenue and the adjoining Templewood Gardens were on the list of affecting streets. In this flood event the surface water/combined sewers became overloaded and so further rainfall flowed at street level and ponded at the lower lying areas of the road.

The extent of inundation of Templewood Avenue in the 2002 floods is not clearly mapped. However no. 17 Templewood Avenue is unlikely to have been affected for the following reasons:

- Thames Water records do not show any history of flooding from the local sewers at this address (Refer correspondence in Appendix C).
- Templewood Avenue rises from its junction with West Heath Road (111.8mOD) to around 116mOD before falling steadily past the site (road level 109.5mOD) to a low point of 99.7mOD at its junction with Templewood Gardens. It would seem more likely that any sewer flooding would occur at the lower end of the road.
- The site is adjacent to and higher than the adjacent streets Birchwood Drive and Grange Gardens, which are not on the list of streets affected by the 2002 flood.
- The combined sewer is at a fair depth of 4-5m below street level as it passes the property.

It therefore seems unlikely that sewer flooding will have previously impacted or would in future impact this property.

7.03.2 The existing surface water collects in a manhole within the drive, which in turn connects to the combined sewer within Templewood Avenue – refer figure n) in Appendix A. The combined sewer is at a depth of approximately 4-5m below street level as it passes 17 Templewood Avenue.

#### 7.04 **Probability**

- 7.04.1 The site is within Flood Zone 1, indicating that the annual probability of flooding is 1 in 1000 years or less from river/sea sources – refer figure (g) in Appendix A. The site is also low risk in respect of flooding from reservoirs – refer figure (h) in Appendix A
- 7.04.2 The relevant Strategic Flood Risk Assessment is the North London SFRA dated August 2008. It concluded that within the LB of Camden the 'fluvial flood risk remains low due to the lack of watercourses'. However it noted that LB of Camden has a 'particularly high risk of flooding from sewer and surface water flooding' but that 'the consequences are unlikely to restrict development providing that mitigation for surface water flooding is applied using the precautionary approach'. The Hampstead Pond Chains were considered to 'present a low risk to Camden'
- 7.04.3 Given the conclusions in clause 7.03.1 that Sewer flooding is unlikely, the flood probability remains low. For sites within Flood Zone 1 an annual probability of 1 in 1000 is usually taken.
- 7.04.4 The plot size is approximately 1000m<sup>2</sup> (0.1 Ha) and the area of roofs to the existing house is approximately 292m<sup>2</sup>. Hard landscaping around the property is about a further 204m<sup>2</sup>.
- 7.04.5 Following the works the roof area will be increased by approximately 17% to 343m<sup>2</sup>. The area of hard landscaping is increased by around 5% to 214m<sup>2</sup>. Refer figures k) and l) in Appendix A

- 7.04.6 To meet the requirements of the Code For Sustainable Homes, the peak rate of runoff will be limited to 'Greenfield' levels. The volume of discharge for a 6 hour storm event will similarly be limited.
- 7.04.7 A number of SUDS measures will be implemented to achieve the restricted discharge rates. These are likely to include: -
  - Measures to reduce the rate at which water is collected in the below ground drainage system; for example the use of green roofs to reduce the rate of runoff, and potentially lined permeable paving under hardstanding areas.
  - Attenuation of the flow within the below ground drainage, likely to be by means of cellular storage

The proposed approach is summarised in the SUDS report by Three Counties Flood Risk Assessment

7.04.8 The peak rates of run off and volume of discharge for a storm event will therefore be less than for the current condition.

#### 7.05 Climate Change

Since the site is at low risk of fluvial flooding, the increase in peak river flows given in Table B2 of PPS25 will not increase the flood risk for the site. The increase in peak rainfall intensities will increase the risk elsewhere in the borough of sewer flooding, but as outlined in 7.03.1 it is not considered a significant risk for this part of Templewood Avenue.

The effect of Climate Change will be included in the calculations to determine the intensity of storm events in accordance with PPS25.

#### 7.06 **Detailed Development Proposals**

The detailed development proposals are given on the architect's drawings. The structural approach is outlined in the Michael Alexander sketches included in Appendix B

#### 7.07 Flood risk management procedures

Since there is a low risk of flooding specific measures to protect from flooding are not considered necessary. However as good practice all connections into the existing sewer will be fitted with non-return valves.

#### 7.08 **Off site impacts**

7.08.1 Due to the measures taken to restrict surface water flows to below existing rates, the proposed development will not increase flood risk elsewhere

- 7.08.2 Rainfall onto the site will either be:
  - Collected and reused for irrigation
  - Collected and discharged into the public sewer as before (rainfall falling on roofs or into the lightwell)
  - Fall on soft landscaped areas and be absorbed into the soils

Hence run-off from the development will not cause any impact to the adjoining properties.

#### 7.09 Residual Risks

The residual risks are summarised below

Risk	Likelihood	Severity	Managed by
Future adjoining development causes run-off into our site	L	М	LB of Camden to manage development by the planning process and implementation of CPG 4
Sewer blockage due to poor maintenance (rather than extreme storm event) causes backing up of sewers	L	М	Thames Water have statutory obligation to maintain sewers

## **APPENDIX A**

### FIGURES



**Figure (a)** Acquifer Designation Map (Extract from Fig 8 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (b)** Watercourses (Extract from Fig 11 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (c)** Surface Water Features (Extract from Fig 12 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (d)** Map of underground infrastructure (Extract from Fig 18 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (e)** Geological Map (Extract from Fig 4 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (f)** Flood Map (Extract from Fig 15 of Camden Geological, Hydrogeological and Hydrological Study)



Map of X: 525,991.96; Y: 186,011.21 at scale 1:20,000



Figure (h) Areas at Risk of Flooding from Reservoirs (Extract from Environment Agency flood map)



**Figure (i)** Slope Angle Map (Extract from Fig 16 of Camden Geological, Hydrogeological and Hydrological Study)



**Figure (j)** Surface Water Features (Extract from Fig 14 of Camden Geological, Hydrogeological and Hydrological Study)







## **APPENDIX B**

## **OUTLINE STRUCTURAL DRAWINGS**



-8





## APPENDIX C

## THAMES WATER RECORDS



8201	111.46	107.18			
-	-	-			
8301	115.6	113.56			
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.					

#### Figure C1 - Extract from Thames Water Asset Search showing a combined sewer

# Sewer Flooding History Enquiry



Search address supplied: 17, Templewood Avenue, London NW3 7UY

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

- (i) any negligent or incorrect entry in the records searched;
- (ii) any negligent or incorrect interpretation of the records searched;
- (iii) and any negligent or incorrect recording of that interpretation in the search report
- (iv) compensation payments

#### Thames Water Utilities Ltd

Property Searches PO Box 3189 Slough SL1 4VWV

DX 151280 Slough 13

T 0118 925 1504 F 0118 923 6655/57 E searches@thameswater.co.uk www.thameswaterpropertysearches.co.uk

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P2000 Structural Basement Impact Assessment\_Issue 3

## Sewer Flooding History Enquiry



History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

Although Thames Water does not have records of public sewer flooding within the vicinity, please be aware that property owners are not legally obliged to report this flooding to Thames Water. In addition flooding from private sewers, watercourses and highways drains are not the responsibility of Thames Water, and such incidents may not be noted in our records. We therefore strongly advise you to contact the current owners and occupiers of the premises and inquire about sewer flooding.

For your guidance:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0845 9200 800 or website www.thameswater.co.uk

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Thames Water Utilities Ltd

Property Searches PO Box 3189 Slough SL1 4VWV

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## APPENDIX D

## PHOTOGRAPHS

