3. Basement Impact Assessment Issues

3.1 Scoping of Basement Impact Assessment (BIA)

BIA is expected to include the assessment of all potential impacts arising from a proposed basement development. These are generally separated into three broad areas of consideration as follows:

- groundwater flow (hydrogeology)
- surface water flow and flooding
- ground stability

In the case of the proposed development at this site a screening assessment of the desk study information results in the following potential issues to be assessed further.

3.1.1 Potential Groundwater Issues (Hydrogeology)

a. The site is located directly above an aquifer and it is clear that the proposed basement will extend into the aquifer and will affect the groundwater flow regime. Changes in the flow regime could potentially cause the groundwater level within the zone encompassed by the new flow route to increase or decrease locally.
b. De-watering techniques, if adopted, can cause ground settlement. The zone affected by this settlement could extend beyond a site boundary and affect neighbouring structures. Conversely, an increase in water levels can have a detrimental effect on stability.
c. Flow from nearby springs or watercourse may increase or decrease as a result of changes to the groundwater flow regime. If the flow is diverted, it may result in the groundwater flow finding another location to issue from with new springs forming or old springs being reactivated. A secondary potential impact is on the quality of the water issuing from the spring or being water abstracted from any local well.
d. If an increased amount of surface water is discharged to the ground (e.g. via soakaways and/or SUDS) this may also impact upon the groundwater flow or levels.

3.1.2 Potential Surface Water Issues (Flooding)

e. Guidance advises that the sealing off of the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground and that in areas underlain by an aquifer; this may impact upon the groundwater flow or levels. A change in the in proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.
f. As part of the site drainage, surface water flows (e.g. rainfall and run-off) may be materially changed from the existing route. The basement development may increase the load on the sewer and drainage systems if it leads to increased occupancy of dwellings. In turn this may increase the risk of flooding should the sewer and drainage systems become overwhelmed.
g. Constructing a basement will typically remove the permeable shallow ground that previously occupied the site footprint. This reduces the capacity of the ground to allow rainfall to be stored in the ground (which in essence acts as a natural SUDS, or sustainable urban drainage system).

This runoff must then be managed by other means (e.g. through construction of SUDS), to ensure that it doesn't impact on adjoining properties or downstream watercourses.

3.1.3 Potential Ground Stability Issues

h. Guidance advises that if the site is within 5m of a highway or pedestrian right of way, excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

i. If the proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties, the proposed excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

4. Basement Impact Assessment

The May 2016 Chelmer report is entitled Basement Impact Assessment and will be referred to here as such but appears (section 1.1) to refer only to a hydrogeological assessment and does not address an assessment of stability or surface water impacts. The brief is described as simply to prepare a revised hydrogeological statement (section 1.5).

The BIA does not refer to the current London Borough of Barnet requirements in relation to basement construction, which are contained in the 2013 Supplementary Planning Documents (SPD) for Sustainable Design and Construction and Residential Design Guidance and refers only (section 1.1) to the earlier London Borough of Barnet in Design Guidance No.5 "Extensions to houses" (Revised March 2010), which arguably does not apply to the situation under assessment.

The BIA notes that structural engineers have been appointed but does not include consideration of any structural engineering drawings (section 1.4).

The BIA notes (section 3.1 and 3.2) that while the footprint of the proposed basements is "broadly similar" to the original proposal, the proposed building ground floor has been lowered by 0.4m from +98.65m OD to +98.25m OD and the basement floor level has been lowered by 0.86m from +95.23m OD to +94.37m OD.

According to the revised BIA an additional level of basement has been added in order to accommodate swimming pools and plant with a floor level at suggested floor level at +92.37m OD, and the BIA acknowledged that this will likely involve excavation to approximately +91.90m OD.

It should be noted that the drawings have been independently scaled by others who have suggested a sub-basement floor level at +91.87m OD, and likely excavation to approximately +91.27m OD.

The BIA notes the site to lies within the hydrological catchment area of the Golders Hill Park chain of ponds (section 5.1).

Three boreholes were constructed at the site in 2012 using a continuous flight auger. Two boreholes were drilled to a depth of 8m below existing ground level, with the third being advanced to a depth of 15m.

The BIA describes the expected geological setting of the site as being Bagshot Formation overlying the Claygate Member (section 4.1). However, the geology reported by the 2012 ground investigation does not conform to the indications of the British Geological Survey maps of the area. The map evidence suggests the following approximate sequence of strata.

- Bagshot Beds
  Interface at +95 to100m OD
- Claygate Beds
  Interface at +80m to +85m OD
- London Clay

The BIA refers to "the Hampstead Heath borehole" and deduces an alternative approximate strata sequence from that borehole to be approximately as follows:

- Bagshot Beds
  Interface at +110m OD
- Claygate Beds

Interface at +94m OD
- London Clay

The 2012 site investigation appears to have confirmed the site to lie within the Claygate, with the London Clay interface at around +94.5m OD. The investigation at this site thus appears to demonstrate the presence of about 4m of alternating beds of Claygate clays, silts and fine sand overlying the London Clay.

While the Claygate beds may be considered to be in part permeable and are regarded as a Secondary A Aquifer (Section 5.2) by the Environment Agency, the London Clay is usually virtually impermeable and is classed as unproductive strata by the EA.

Groundwater was encountered within the Claygate Beds by the 2012 investigation the records of these seepages along with subsequent water monitoring (in 2012) (section 6.5) suggest a water table (or piezometric surface) falling from a maximum of around +97m OD across the site with an hydraulic gradient of around 1 in 17.

The BIA concludes (inter alia) that

- the use of either a contiguous or a secant bored pile wall will be required for the proposed basements because of their close proximity to root protection areas. (section 8.7)
- the completed basement will obstruct groundwater flows
- the proposed basements may cause a slight local rise in groundwater levels next to their southern sides (section 8.8)
- it is unlikely that there would be any significant adverse impact on groundwater flows
- installation of land drainage on the southern sides of the basements is recommended in order to prevent groundwater rising to ground level (provided that an acceptable discharge location is available)
- well-pointing or other groundwater control methods may be required and that these may influence groundwater pressures beyond the site boundary with No.1 Elm Walk (although it is anticipated that there will be little or no pressure reduction beneath the foundations to No.1 Elm Walk).

5. Adequacy of information

5.1 Description of Works

The information that has been provided does not include any definitive description of the temporary and permanent works that are actually going to be undertaken. The BIA assessment provided thus amounts at best to an assessment of potential impacts associated with potential construction methodologies and provides a series of recommendations for design.

Until a structural engineer and an appointed contractor have committed to a particular scheme of temporary and permanent works there cannot be a categorical assessment made stating that the prospective development will not have any adverse impact affecting the local geology, hydrogeology or hydrology.

It is understood that although implementation of the consented scheme has in fact commenced and that there is a contractor on site, no structural engineering input or contractor input has been presented in the BIA document.

5.2 Investigation of Issues

It is considered that each of the nine potential issues (a to i) that have been identified in section 3.1 above would merit additional study, investigation or monitoring in order to enable the BIA to reasonably conclude the assessment of each with regards to land stability, hydrology or hydrogeology. Some of these potential impacts have not been addressed at all.

At the heart of the present uncertainty lies the presented geological model, which, on the basis of three boreholes constructed using continuous flight auger drilling techniques, effectively asserts that the British Geological Survey Mapping Information is wrong by some 10m to 15m. While it is accepted that a small error in the mapping of several metres would not be unusual, this is a very significant amount of discrepancy and does not tally. One possible deduction from the investigation findings is that there may be some local faulting within the strata. Because such a feature, if present, could potentially cause havoc with the assumptions of ground permeability and hydrogeology that have been made, the apparent anomalous ground conditions certainly merit further investigation. It has been noted that the investigation undertaken to date has used techniques that are not considered to be wholly reliable for accurate logging purposes.

It is noted that a ground stability report (Document 7) was prepared for the original scheme, but that the report did not consider the significantly deeper basement excavation that is now under consideration. It is noted that the report did conclude that a rigorous heave analysis using finite element methods should be undertaken during detailed design once the construction methods and sequence have been finalised.

The London Borough of Barnet have specifically raised issues relating to possible groundwater coffering effects from basements installed in this area, where the natural groundwater flow regime is interrupted. By diverting underground streams off their natural course, this can cause reduced flow in these surface water courses, and/or increased groundwater levels in other surrounding areas, depending on how the basement structures interrupt the natural flow regime. This may also lead to a consequent loss in water volumes to some of these ponds. In view of the above concerns, and the sensitivity of the study site location, it is considered that further, more detailed consideration of the hydrogeological issues needs be carried out.

A suggested list of the components to be expected in a good BIA is set out in the following table.

Suggested BIA components

1	Description of proposed development.
2	Plan showing boundary of development including any land required temporarily during construction.
3	Plans, maps and or photographs to show location of basement relative to surrounding structures.
4	Plans, maps and or photographs to show topography of surrounding area with any nearby watercourses/waterbodies including consideration of the relevant maps in the Strategic FRA by URS (2014)
5	Plans and sections to show foundation details of adjacent structures.
6	Plans and sections to show layout and dimensions of proposed basement.
7	Programme for enabling works, construction and restoration.
8	Identification of potential risks to land stability (including surrounding structures and infrastructure), and surface and groundwater flooding.
9	Assessment of impact of potential risks on neighbouring properties and surface and groundwater.
10	Identification of significant adverse impacts.
11	Evidence of consultation with neighbours.
12	Ground Investigation Report and Conceptual Site Model including - Desktop study - exploratory hole records - results from monitoring the local groundwater regime - confirmation of baseline conditions - factual site investigation report
13	Ground Movement Assessment (GMA).
14	Plans, drawings, reports to show extent of affected area.
15	Specific mitigation measures to reduce, avoid or offset significant adverse impacts.
16	Construction Sequence Methodology (CSM) referring to site investigation and containing basement, floor and roof plans, sections (all views), sequence of construction and temporary works.
17	Proposals for monitoring during construction.
18	Confirmatory and reasoned statement identifying likely damage to nearby properties according to Burland Scale
19	Confirmatory and reasoned statement with supporting evidence that the structural stability of the building and neighbouring properties will be maintained (by reference to BIA, Ground Movement Assessment and Construction Sequence Methodology), including consideration of cumulative effects.
20	Confirmatory and reasoned statement with supporting evidence that there will be no

	adverse effects on drainage or run-off and no damage to the water environment (by reference to ground investigation, BIA and CSM), including consideration of cumulative effects.
21	Identification of areas that require further investigation.
22	Non-technical summary for each stage of BIA.

5.3 Mapping Detail

It is considered that an illustrative long section should be established showing the assumed topographical geological and hydrogeological detail. This section should stretch from the catchment watershed on West Heath Road to the Leg of Mutton Pond.

5.4 Assessment Methodology

It is considered that

- a rigourous analysis of ground movements is required by the previous ground stability report and, arguably, by Condition 21 of the original consent
- groundwater flow modelling is required to be undertaken in order to explore the potential effects of the proposed basement and to substantiate the hydrogeological assessment.

5.5 Mitigation

Despite the submission of a Construction Method Statement it is not at all clear what actual mitigation is actually planned. No engineering design appears to have yet been progressed.

5.6 Monitoring

The need for on-going groundwater monitoring has been identified but it is noted that no groundwater monitoring appears to have been undertaken since 2012, despite Condition 19 of the original consent.

6. Conclusions

The residual impacts of the proposed development cannot be identified until a specific scheme of construction methodology has been selected and assessed. Although it is understood that implementation of the consented scheme has in fact commenced and that there is a contractor on site, no structural engineering input or contractor input has been presented in the BIA document and hence the BIA cannot be concluded.

It would appear that applicant's specialist consultant has not been properly briefed to address the London Borough of Barnet's present requirements as reported on 10th May 2016 and has as a result delivered what must be considered an unacceptable response.

The amended Basement Impact Assessment does not demonstrate that the proposed development will

1. maintain the stability of the neighbouring properties
2. avoid adversely affecting drainage and run-off or causing other damage to the water environment and
3. avoiding cumulative impacts on the water environment

It is considered that the following further information is required to be obtained through additional study, investigation or monitoring:

- A detailed assessment of the configuration of the geological strata beneath the site using best practice investigation techniques. Reason: to confirm the geology.
- The presentation of an illustrative long section hydrogeological model stretching from the catchment watershed on West Heath Road to the leg of Mutton Pond. Reason: to clarify the groundwater situation
- An updated assessment of groundwater impact, based upon additional groundwater monitoring and local modelling of the proposed basement. Reason: to demonstrate acceptability of the impacts.
- A specific construction sequence and methodology indicating in detail how neighbouring properties and highways are to be protected. Reason: to demonstrate robustness of the intended mitigation.
- A detailed assessment of the extent of the possible ground movements to be expected during and after the works. Reason: to demonstrate acceptability of the residual impacts.

In the present absence of sufficient information to demonstrate compliance with Barnet Planning Policy the application must be considered inadequate and refused.

References

2010 March	London Borough of Barnet	Design Guidance No. 5 *"Extensions to houses"*
2013 April	London Borough of Barnet	Report of Cabinet meeting 18th April
2013 April	London Borough of Barnet	Adopted Local Plan - Supplementary Planning Document: *"Residential Design Guidance"*
2013 November	London Borough of Barnet	Report of Council meeting 5th November
2014 January	London Borough of Barnet	Report of Council meeting 21st January