Independent Review
of
Basement Impact Assessment for planning application 2014/5771/P
at

5 Highfields Grove
Highgate
London
N6 6HN

for
London Borough of Camden

LBH 4298

January 2015

LBH WEMBLEY

Geotechnical & Environmental

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Foreword-Guidance Notes

GENERAL

This report has been prepared for a specific client and to meet a specific brief. The preparation of this report may have been affected by limitations of scope, resources or time scale required by the client. Should any part of this report be relied on by a third party, that party does so wholly at its own risk and LBH WEMBLEY Geotechnical & Environmental disclaims any liability to such parties.

The observations and conclusions described in this report are based solely upon the agreed scope of work. LBH WEMBLEY Geotechnical & Environmental has not performed any observations, investigations, studies or testing not specifically set out in the agreed scope of work and cannot accept any liability for the existence of any condition, the discovery of which would require performance of services beyond the agreed scope of work.

VALIDITY

Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances shall be at the client's sole and own risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should therefore not be relied upon in the future and any such reliance on the report in the future shall again be at the client's own and sole risk.

THIRD PARTY INFORMATION

The report may present an opinion on the disposition, configuration and composition of soils, strata and any contamination within or near the site based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

1. Introduction

It is proposed to construct two single storey basements beneath the existing property at 5 Highfields Grove.

Basement 1 is to be to the west and outside the footprint of the existing building, Basement 2 is to be to the south side of the existing building, extending outwards from the south wall of the house.

1.1 Brief

LBH WEMBLEY Geotechnical & Environmental have been commissioned to provide an Independent assessment of information submitted against the requirements of LDF policy DP27 (but also including CS5, CS14, CS15, CS17, CS18, DP23, DP24, DP25 and DP26 – as stated at paragraphs 1.5 and 1.6 of CPG4) and with reference to the procedures, processes and recommendations of the Arup Report and CPG4 2013.

1.2 Report Structure

This report commences with a description of the LDF policy requirements, and then considers and comments on the submission made and details any concerns in regards to:

1. The level of information provided (including the completeness of the submission and the technical sufficiency of the work carried out)
2. The proposed methodologies in the context of the site and the development proposals
3. The soundness of the evidence presented and the reasonableness of the assessments made.
4. The robustness of the conclusions drawn and the mitigation measures proposed in regard to:
    a. maintaining the structural stability of the building and any neighbouring properties
    b. avoiding adversely affecting drainage and run-off or causing other damage to the water environment and
    c. avoiding cumulative impacts on structural stability or the water environment in the local area

1.3 Information Provided

The information studied comprises the following:

1. Basement Impact Assessment, by Chelmer, Ref: BIA/4957, dated January 2015
2. Engineer's Construction Method Statement, by Elite Designers, dated 3rd October 2014, Rev: 00
3. Proposed basement drawings by Elite Designers, included as Appendix A of Document 2, refs: 2014-207-01 (Revision 0), 2014-207-02 (Revision 0), 2014-207-03 (Revision 0 - dated 7th October 2014) & 2014-207-04 (Revision 0), dated 6th October 2014.
4. Addendum Ground Movement Assessment Report by Chelmer (noted as Appendix D of Document 1 but not included within Document 1), Ref: GMA/4957 dated January 2015.
5. Existing and Proposed Site Plan Drawings, by Yeates Design, refs: 548/P/002, 548/P/003, 548/P/007, and 548/P/009 (Revision A), 548/P/010, 548/P/011, 548/P/012, 548/P/013, 548/P/015, 548/P/016, 548/P/020 dated July 2014.
6. Topographic Survey by Glanville, Ref: GS8131057/01, dated November 2013.

7. Arboricultural Implications Report, by Simon Jones Associates, Ref: SJA air 14188-01, dated September 2014.
8. Proposed basement drawings by Elite Designers, refs: 2014-207-00 (Revision 0) dated 6th October 2014, 2014-207-B1 (Revision 0) dated 20th January 2015.
9. Structural Calculations by Elite Designers, Ref: 2014-207,dated 22nd January 2015

2. Policy DP27 – Basements and Lightwells

The CPG4 Planning Guidance on Basements and Lightwells refers primarily to Planning Policy DP27 on Basements and Lightwells.

The DP27 Policy reads as follows:

In determining proposals for basement and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability, where appropriate. 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. We will require developers to demonstrate by methodologies appropriate to the site that schemes:

a) maintain the structural stability of the building and neighbouring properties;
b) avoid adversely affecting drainage and run-off or causing other damage to the water environment;
c) avoid cumulative impacts upon structural stability or the water environment in the local area;

and we will consider whether schemes:

d) harm the amenity of neighbours;
e) lead to the loss of open space or trees of townscape or amenity value;
f) provide satisfactory landscaping, including adequate soil depth;
g) harm the appearance or setting of the property or the established character of the surrounding area; and
h) protect important archaeological remains.

The Council will not permit basement schemes which include habitable rooms and other sensitive uses in areas prone to flooding. In determining applications for lightwells, the Council will consider whether:

i) the architectural character of the building is protected;
j) the character and appearance of the surrounding area is harmed; and
k) the development results in the loss of more than 50% of the front garden or amenity area.

In addition to DP27, the CPG4 Guidance on Basements and Lightwells also supports the following Local Development Framework policies:

Core Strategies:

- CS5 Managing the impact of growth and development
- CS14 Promoting high quality places and conserving our heritage
- CS15 Protecting and improving our parks and open spaces & encouraging biodiversity
- CS17 Making Camden a safer place
- CS18 Dealing with our waste and encouraging recycling

Development Policies:

- DP23 Water
- DP24 Securing high quality design
- DP25 Conserving Camden's heritage
- DP26 Managing the impact of development on occupiers and neighbours

This report makes some specific further reference to these policies but relies essentially upon the technical guidance provided by the Council in November 2010 to assist developers to ensure that they are meeting the requirements of DP27, which is known as the Camden Geological, Hydrogeological and Hydrological Study, Guidance for Subterranean Development (CGHHS), and was prepared by Arup.

3. Assessment of Adequacy of Information Provided

3.1 Basement Impact Assessment Stages

The methodology described for assessing the impact of a proposed basement with regard to the matters described in DP27 takes the form of a staged approach.

3.1.1 Stage 1: Screening

Screening uses checklists to identify whether there are matters of concern (with regard to hydrogeology, hydrology or ground stability) which should be investigated using a BIA (Section 6.2 and Appendix E of the CGHSS) and is the process for determining whether or not a BIA is required. There are three checklists as follows:

- subterranean (groundwater) flow
- slope stability
- surface flow and flooding

3.1.1.1 Subterranean (Groundwater) Flow

A screening checklist for the impact of the proposed basement on groundwater is included in the BIA (Document 1).

This identifies the following potential issues of concern:

- **The site is located directly above an aquifer.**
- **The proposed basement will extend beneath the water table surface.**
- **The site is within the catchment of the pond chains on Hampstead Heath.**
- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**

3.1.1.2 Stability

A screening checklist for the impact of the proposed basement on land stability is included in the BIA (Document 1).

This identifies the following potential issues of concern:

- **The existing site includes slopes, natural or manmade, greater than 7 degrees.**
- **The development neighbours land, including railway cuttings and the like, with a slope greater than 7 degrees.**
- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees.**
- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained.**
- **The site is located within an aquifer.**
- **The proposed basement will extend beneath the water table such that dewatering may be required during construction.**
- **The site may be over, or within the exclusion zone of tunnels.**

3.1.1.3 Surface Flow and Flooding

A screening checklist for the impact of the proposed basement on surface water flow and flooding is included in the BIA (Document 1).

This identifies the following potential issues of concern:

- **The site is within the catchment area of the pond chains on Hampstead Heath.**
- **The proposed basement development will result in a change in the proportion of hard-surfaced/paved areas.**
- **The proposed basement will result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses.**

3.1.2 Stage 2: Scoping

Where the checklist is answered with a "yes" or "unknown" to any of the questions posed in the flowcharts, these matters are carried forward to the scoping stage of the BIA process.

The scoping produces a statement which defines further the matters of concern identified in the screening stage. This defining should be in terms of ground processes, in order that a site specific BIA can be designed and executed (Section 6.3 of the CGHSS).

There is a detailed scoping stage described in the BIA (Document 1), containing three sections, scoping the identified issues within the same three subsets used in the screening checklists.

The issues identified from the checklists as being of concern have been assigned bold text in the previous sections and are as follows:

- **The site is located directly above an aquifer.**
  The guidance advises that the basement may extend into the underlying aquifer and thus affect the groundwater flow regime.

- **The proposed basement will extend beneath the water table surface.**
  The guidance advises that dewatering can cause ground settlement. The zone of settlement will extend for the dewatering zone, and thus could extend beyond a site boundary and affect neighbouring structures. Conversely, an increase in water levels can have a detrimental effect on stability. The groundwater flow regime may be altered by the proposed basement. Changes in flow regime could potentially cause the groundwater level within the zone encompassed by the new flow route to increase or decrease locally. For existing nearby structures then the degree of dampness or seepage may potentially increase as a result of changes in groundwater level.

- **The site is within the catchment area of the pond chains on Hampstead Heath.**
  The guidance advises that with regard to the pond chains on Hampstead Heath, in particular the bathing ponds, changes in quality would be of concern; in particular the risk of contamination. This may potentially lead to the bathing ponds not attaining the required Bathing Water Directive water quality standards. Any reduction in the surface water inflow to the ponds would reduce the overall flow through the ponds, which in turn could allow an increased build-up of contaminants. Any increase in surface water inflow to the ponds could result in an increase in contaminants (e.g. animal faeces and organic matter) being washed into the ponds. Any increase in surface water

inflow to the ponds could also result in an increase in the "normal" volume of water in the ponds. With more water in the ponds on a day-today basis, the available spare capacity in the ponds for receiving storm rainfall would be reduced, thus increasing the risk of the ponds over-topping when, in the event of a storm, that spare capacity is needed. If overtopping were to occur, this could cause inundation of land and properties downstream.

- **The existing site includes slopes, natural or manmade, greater than 7 degrees.**
  The guidance advises that there may be local slope instability within the site.

- **The development neighbours land, including railway cuttings and the like, with a slope greater than 7 degrees.**
  The guidance advises that there may be instability within the neighbouring site(s).

- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees.**
  The guidance advises that there may be potential for a larger slope failure system including re-activation of a pre-existing slide.

- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained**
  The guidance advises that the soil moisture deficit associated with felled tree will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect the slope stability. Additionally the binding effect of tree roots can have a beneficial effect on stability and the loss of a tree may cause loss of stability.

- **The proposed basement will extend beneath the water table such that dewatering may be required during construction.**
  The guidance advises that dewatering can cause ground settlement. The zone of settlement will extend for the dewatering zone. And thus could extend beyond a site boundary and affect neighbouring structures. Conversely and increase in water levels can have a detrimental impact on stability.

- **The site is over (or within the exclusion zone of) tunnels, e.g. railway lines.**
  The guidance advises that excavation for a basement may result in damage to the tunnel.

- **The proposed basement development will result in a change in the proportion of hard-surfaced/paved areas.**
  The guidance advises that 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. The sealing off of the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas underlain by an aquifer, this may impact upon the groundwater flow or levels. In areas of non-aquifer (i.e. on the London Clay), this may mean changes in the degree of wetness which in turn may affect stability

- **The proposed basement will result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses.**
  The guidance advises that changes could result in decreased volume, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

3.1.3 Stage 3: Site Investigation and Study

Site investigation and study is undertaken to establish the baseline conditions. This can be done by utilising existing information and/or by collecting new information (Section 6.4 of the CGHSS).

An intrusive ground investigation was carried out at the site between 24th November and 9th December 2014 which comprised one cable percussion borehole to a depth of 20m, two continuous flight auger boreholes to depths of 20m and five hand-dug trial pits to investigate the nature of existing foundations.

Groundwater monitoring standpipes were installed in the boreholes and were monitored on two further occasions.

3.1.4 Stage 4: Impact Assessment

Impact assessment is undertaken to determine the impact of the proposed basement on the baseline conditions, taking into account any mitigation measures proposed (Section 6.5 of the CGHSS).

The submitted BIA (Document 1) does include an Impact Assessment stage and the submitted documents include the following comments in relation to the identified potential issues of concern:

- **The site is located directly above an aquifer.**
- **The proposed basement will extend beneath the water table such that dewatering may be required during construction.**

"Groundwater control will be required during excavation and construction of these basements. Minor water entries should be manageable by sump pumping but the possibility remains that use of closely spaced well points will be required in order to maintain the stability of these excavations. An appropriate discharge location must be identified for the water removed from the excavations".

"A careful watch should be maintained to check that fine soils are not removed with the groundwater; if any such erosion/removal of fines is noticed, then pumping should cease and the advice of a suitably experienced and competent ground engineer should be sought".

"Where the formation level onto which the underpins and the basement slabs will bear consists of clays, they must be protected from water, because they would soften rapidly if water gets onto these surfaces. Thus, the formation should be blinded with concrete immediately following excavation and inspection".

- **The site is within the catchment area of the pond chains on Hampstead Heath.**

"These basements will be located within the catchment of the Highgate Ponds, but will be over 500m from the nearest pond (No.6) and at a much higher level, so will have no discernible impact on the flow of groundwater reaching the ponds".

- **The existing site includes slopes, natural or manmade, greater than 7 degrees.**
- **The development neighbours land, including railway cuttings and the like, with a slope greater than 7 degrees.**
- **The site is within a wider hillside setting in which the general slope is greater than 7 degrees.**

"With an overall slope angle of approximately 9° and steeper slopes bordering this property in the areas where both basements will be built, appropriate precautions will be required. The basements themselves will be supported on pile foundations, so the unloading from the excavations will be beneficial to the stability of the slopes below the basements on the southern and south-western sides of the site".

"The proposed South Elevation drawing provided by Yeates Design (Drg No.548/P/019) shows a new retaining wall to be constructed in order to allow the removal of the toe of this slope and creation of a level area (marked 'Decking' on the plan) above this basement".

"Full slope stability analyses will be essential as part of the design analyses for the [new retaining] *wall, in order to confirm the overall stability of the slope and the retaining wall at the crest of the slope (as required by both BS8002:1994 'Code of Practice for Earth Retaining Structures' and Eurocode EC7)"*.

"As the retaining wall which forms the east boundary of the site is already leaning downslope, the stability of this wall must be assessed, and remedial works implemented if necessary, before the proposed new retaining wall is constructed".

"Precautions will be required to maintain the stability of the slopes; including not stockpiling materials within 5mof the crest of any slope".

- **Trees will be felled as part of the proposed development and/or works are proposed within tree protection zones where trees are to be retained**

An arboricultural report has been submitted (Document 6) that sets out *"general and specific provisions to be taken during construction of the proposed development, to ensure that no unacceptable damage is Caused"*

- **The site is over (or within the exclusion zone of) tunnels, e.g. railway lines.**

"*No railway tunnels are known to pass below or close to the site. Other infrastructure (including tunnels), for sewers, cables or communications might be present within the zone of influence of the proposed basement, so an appropriate services/utilities search should be undertaken, although the likelihood of major infrastructure being present within the depth of current interest is considered to be low given that these houses are on piled foundations."*

- **The proposed basement development will result in a change in the proportion of hard-surfaced/paved areas.**
- **The proposed basement will result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses.**

"in order to maintain approximately the current balance between infiltration and discharge to the mains sewer system it will be necessary to implement a combination of at least two types of SuDS systems, comprising:

- *switching some of the hard surfacing to permeable paving in order to maintain a similar level of infiltration, possibly supplemented by directing some roof water to rain gardens;*
- *provision of temporary intervention storage, which could include rainwater harvesting, in order to ensure no increase in discharge rate to the mains sewers when the ground is saturated or frozen".*

3.2 The Audit Process

The audit process is based on reviewing the BIA against the criteria set out in Section 6 of the CGHSS and requires consideration of specific issues:

3.2.1 Qualifications / Credentials of authors

Check qualifications / credentials of author(s):

Qualifications required for assessments

Surface flow and flooding	A Hydrologist or a Civil Engineer specialising in flood risk management and surface water drainage, with either: • The "CEng" (Chartered Engineer) qualification from the Engineering Council; or a Member of the Institution of Civil Engineers ("MICE"); or • The "C.WEM" (Chartered Water and Environmental Manager) qualification from the Chartered Institution of Water and Environmental Management.
Subterranean (groundwater) flow	A Hydrogeologist with the "CGeol" (Chartered Geologist) qualification from the Geological Society of London.
Land stability	A Civil Engineer with the "CEng" (Chartered Engineer) qualification from the Engineering Council and specialising in ground engineering; or A Member of the Institution of Civil Engineers ("MICE") and a Geotechnical Specialist as defined by the Site Investigation Steering Group. With demonstrable evidence that the assessments have been made by them in conjunction with an Engineering Geologist with the "CGeol" (Chartered Geologist) qualification from the Geological Society of London.

Surface flow and flooding: The report meets the requirements.

Subterranean (groundwater) flow: The report meets the requirements

Land stability: The report meets the requirements

3.2.2 BIA Scope

Check BIA scope against flowcharts (Section 6.2.2 of the CGHSS).

The BIA scope is considered appropriate.

3.2.3 Description of Works

Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?

Yes.

3.2.4 Investigation of Issues

Have the appropriate issues been investigated? This includes assessment of impacts with respect to DP27 including land stability, hydrology, hydrogeology.

Yes.

3.2.5 Mapping Detail

Is the scale of any included maps appropriate? That is, does the map show the whole of the relevant area of study and does it show sufficient detail?

Yes.

3.2.6 Assessment Methodology

Have the issues been investigated using appropriate assessment methodology? (Section 7.2 of the CGHSS).

Yes.

3.2.7 Mitigation

Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme? (Section 5 of the CGHSS)

Yes.

3.2.8 Monitoring

Has the need for monitoring been addressed and is the proposed monitoring sufficient and adequate? (Section 7.2.3 of the CGHSS)

Yes.

3.2.9 Residual Impacts after Mitigation

Have the residual (after mitigation) impacts been clearly identified?

Yes, no residual impacts are predicted.

4. Assessment of Acceptability of Residual Impacts

4.1 Proposed Construction Methodology

The proposed construction methodology appears sound.

4.2 Soundness of Evidence Presented

The evidence provided appears sound.

4.3 Reasonableness of Assessments

The assessments appear reasonable.

4.4 Robustness of Conclusions and Proposed Mitigation Measures

The conclusions and proposed mitigation measures appear to be robust.

5. Conclusions

The submitted BIA (Document 1) reflects the processes and procedures set out in DP27 and CPG4. However, the Engineer's Construction Method Statement (Document 2) appears to have been based upon an unacceptable earlier BIA and must be altered to reflect the requirements of Document 1.

It is considered that the present submission does not demonstrate sufficient detail and certainty to ensure accordance with DP27, in respect of:

a. maintaining the structural stability of the building and any neighbouring properties
b. avoiding adversely affecting drainage and run-off or causing other damage to the water environment and
c. avoiding cumulative impacts on structural stability or the water environment in the local area

5.1 Further Information Required

It is considered that in order to meet the requirements of DP27 further information is required as follows:

- An updated detailed construction sequence and methodology that reflects the BIA findings, particularly in regards to slope stability and retaining wall assessments, temporary works design, excavation face support, propping, water ingress and monitoring.