Independent Review
of
Basement Impact Assessment for planning application 2015/0127/P (UPDATE)
at

11 Cannon Lane
London
NW3 1EL

for
London Borough of Camden

LBH 4328

June 2015

LBH WEMBLEY

Geotechnical & Environmental

Project No: LBH 4328

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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 demolish the existing building at this property and replace it with a new house on a slightly reduced footprint with a lower ground floor that cuts back into the hillside and has a basement extending some 4.5m below the ground front garden and a swimming pool set 1.5m below this. Because of the rising ground, this basement and swimming pool will extend to almost 10.5m and 12m below the existing rear garden level.

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 Consultancy Services, dated December 2014, Ref: BIA/4938
2. Planning, Heritage Design and Access Statement by Planning Sense, dated December 2014, unreferenced
3. Construction and Traffic Management Plan by Knowles, dated 17th December 2014, unreferenced
4. Arboricultural Report by Anthony George & Associates Ltd, dated 29th August 2014, Ref: EP – 102
5. Drawings of Existing by greenway architects, dated 1st December 2014 and 12th March 2015, Refs: ES-101, EP-101, EP-102, EP-110A, EE-102, EE-103, AS-001 and AD-203,

6. Drawings of Proposed by greenway architects, dated 1st December 2014 and 12th March 2015, 30th April 2015 and 1st May 2015 Refs: AS-101-A, AS-102-A, AS-103, AS-104, AP-100-B, AP-101, AP-102-A, AP-103-B, AP-104-A, AP-105-A, AP-110-B, AE-101, AE-102, AE-103-B and AD-201, AD-202 and AD-204
7. Ground Movement Assessment by Chelmer Consultancy Services, dated June 2015, Ref: GMA/4938
8. Temporary Works to Protect Upslope Boundaries and Allow Reduction in Site Levels by Vincent & Rymill, dated May 2015, unreferenced

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 proposed development will result in a change in the area of hard-surfaced/paved areas.**
- **More surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS).**

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 site is within 100m of a watercourse of a potential spring line.**
- **The site is within an aquifer.**
- **The proposed basement will extend beneath the water table such that dewatering may be required during construction.**
- **The site is within 5m of a highway or pedestrian right of way.**
- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
- **The site is over (or within the exclusion zone of) tunnels, e.g. railway lines.**

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:

- **As part of the site drainage, surface water flows (e.g. rainfall and run-off) will be materially changed from the existing route.**
- **The proposed basement development will result in a change in the proportion of hard-surfaced/paved areas.**

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).

Checklists have been provided in the BIA and there is scoping stage described in the BIA.

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 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 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 site is within 100m of a watercourse, well (used/disused) or potential spring line.**
  The guidance advises that flow from a spring, well or watercourse may increase or decrease if the groundwater flow regime which supports that water feature is affected by a proposed basement.
  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 impact is on the quality of the water issuing or abstracted from the spring or water well respectively.

- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**
  The 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. 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 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.

- **More surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS).**

  The guidance advises that in areas underlain by an aquifer, this may impact upon the groundwater flow or levels – this would then have similar impacts to those listed in 1b) and 2). 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 site is within 5m of a highway or pedestrian right of way.**
  The guidance advises that excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
  The guidance advises that excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

- **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.

- **As part of the site drainage, surface water flows (e.g. rainfall and run-off) will be materially changed from the existing route.**
  The guidance advises that 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. Constructing a basement, either beneath or adjacent to an existing building 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 (eg through construction of SUDS), to ensure that it doesn't impact on adjoining properties or downstream watercourses..

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).

The site investigation submitted comprised three continuous flight auger boreholes to depths of 8 to 15m, three hand dug trial pits to expose existing foundations and two groundwater monitoring visits.

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 submission includes an Impact Assessment stage and the following statements are provided:

- **The site is located directly above an aquifer.**
- **The proposed basement will extend beneath the water table surface.**
  "The seepage into borehole BH2 at 3.6m showed that there is some groundwater in the sands above the clays, as would be expected."

  "*The highest groundwater level readings from the standpipes during the limited monitoring period were 6.3m to 6.8m bgl. The water levels were still rising so these were probably still in the process of reaching equilibrium with water pressures in the surrounding ground. The groundwater monitoring must therefore be continued through the current winter and during the detailed design stage, in order to gain a greater understanding of the current range of fluctuations in the water table.*"

  "Provided that the secant bored pile walls proposed above are adequately sealed into both the clay recorded at the base of BH3 and the clays at basement level in BH2, then groundwater control should be limited to pumping to remove the 'trapped' groundwater within the bored pile wall 'box'"

  "*The basement structure must be designed to resist the buoyant uplift pressures which could be generated by groundwater at design level eventually selected.*"

- **The site is within 100m of a watercourse, well (used/disused) or potential spring line.**
  "the basement and pool are expected to be founded in the Claygate Member clays over the southern part of the new building's footprint, and in the sands as recorded in BH3 over the northern part of the footprint. If the deeper sands in BH3 are laterally extensive, then any natural flow of groundwater in these sands would be able to continue to flow around the new basement. This behaviour is acknowledged in the Camden GHHS which noted that even extensive excavations for basements in the City of London have not caused any serious problems in 'damming' groundwater flow, with groundwater simply finding an alternative route (Arup, 2010, paragraph 205)."

- **The proposed development will result in a change in the area of hard-surfaced/paved areas.**
  "*The smaller footprint of the proposed new house and the larger garden area gives the potential to increase beneficial infiltration and recharge direct to the aquifer.*"

- **More surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS).**
- **As part of the site drainage, surface water flows (e.g. rainfall and run-off) will be materially changed from the existing route.**

  "*…it is not known whether any of the existing surface water is discharged to soakaways. A quantitative analysis will be required, based on a survey of the drainage system including the roof water downpipes if records are not available, in order to establish the net changes to surface water run-off that will be generated by the proposed redevelopment scheme*."

  "*Discharge to deep bored soakaways could be an option, subject to appropriate testing and Environment Agency approval. The testing should be undertaken once the existing house has been demolished and access is available for a larger drill rig.*"

  "*If use of soakaways is not feasible then, in order to minimise surface water run-off from the site, if, then appropriate Sustainable Drainage System (SuDS) could be included in the scheme, such as:*
  - *Installing a green (sedum) roof, although these offer no additional storage once they become fully saturated in a storm situation ;*
  - *Intervention storage;*
  - *Rainwater harvesting;*
  - *Directing some roof water to rain gardens;*
  - *Use of permeable paving. "*

- **The site is within 5m of a highway or pedestrian right of way.**
  " *Ensure adequate temporary and permanent support by use of best practice working methods"*

- **The proposed basement will significantly increase the differential depth of foundations relative to the neighbouring properties.**
  "Analyses of the proposed embedded retaining walls have been undertaken using FREW, a dedicated retaining wall analysis program (by Oasys) in order to assess the likely horizontal ground movements which will occur in response to construction of the proposed retaining walls."

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Table 2: Summary of wall geometries and predicted displacements

Location	*24/11 Party Secant Pile Retaining Wall (BH2 Geology)*	*24/11 Party Secant Pile Retaining Wall (BH3 Geology)*	*North Contiguous Pile Retaining Wall (+ berm)*	*East Secant Pile Retaining Wall*
Retained height (m)	*8.78*	*8.78*	*9.08*	*8.05*
Embedded length (m)	*8.59*	*6.97*	*3.62*	*3.21*
Displacement at top of wall (mm)	*12.3*	*1.2*	*2.3*	*6.7*
Maximum displacement within retained height (mm)	*19.5*	*26.5*	*28*	*23*

"*In order to relate the predicted ground movements to possible damage which an adjacent property might suffer, it is necessary to consider the strains and the angular distortion (as a deflection ratio) which they might generate*."

"*No.24 Well Road*:"

".. these deformations represent a damage category of 'very slight' (Burland Category 1, εlim =0.05-0.075%), close to the boundary with Burland Category 2, as given in CIRIA SP200"

"*Parish Lock-up*:"

"…these deformations once again represent a damage category of 'very slight' (Burland Category 1, εlim =0.05-0.075%) as given in CIRIA SP200"

- **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 search should be undertaken. If any such infrastructure is identified, then its potential influence on the proposed basement must be assessed. These searches will not identify any private services.*"

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).

Yes.

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?

Previously no specific construction method and sequence had been presented. Document 8 to 10 now state secant and contiguous piles will be used as well as a temporary works design.

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.

A ground movement and damage category assessment has now been provided (Document 7).

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).

A ground movement and damage category assessment has been provided and concludes that the proposed works will result in a Burland Category 1, very slight.

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?

A ground movement and damage category assessment has been provided.

4. Assessment of Acceptability of Residual Impacts

4.1 Proposed Construction Methodology

A specific construction method is now provided.

4.2 Soundness of Evidence Presented

The evidence provided appears sound.

4.3 Reasonableness of Assessments

A ground movement and damage category assessment has been provided.

4.4 Robustness of Conclusions and Proposed Mitigation Measures

The robustness of the proposed mitigation appears reasonable.

5. Conclusions

The original BIA submission did not wholly reflect the processes and procedures set out in DP27 and CPG4.

It was considered that in order to meet the requirements of DP27 further information should be submitted as follows:

- A ground movement and damage category assessment.
- A specific construction methodology and sequence including details of all temporary works propping to secure the stability of neighbouring properties at all times and
- Details of measures to be adopted to stabilise the existing retaining walls on the upslope boundary.

A ground movement and damage category assessment has now been submitted that predicts “very slight” damage to adjacent properties.

A statement regarding the temporary works design and sequence has now been submitted (see 3.2.3 above).

It is considered that the submission now accords sufficiently with DP27, in respect of

a. Maintaining the structural stability of the building and any neighbouring properties
b. Avoiding adverse impact on drainage and run-off or causing other damage to the water environment and
c. Avoiding cumulative impacts on structural stability or the water environment