Chelmer
Consultancy Services
'Groundbreaking Services'

Up-dated Independent Assessment of Revised Basement Excavation Justification for Planning Application

Site	140-146 Camden Street London NW1 9PF
Client	London Borough of Camden
Date	April 2015
Our Ref	BIAREV/5130B

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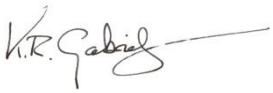
Lead author:	Keith Gabriel MSc DIC CGeol FGS UK Registered Ground Engineering Adviser	
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Foreword

This report has been prepared in accordance with the scope and terms agreed with the Client, and the resources available, using all reasonable professional skill and care. The report is for the exclusive use of the Client and **London Borough of Camden** and shall not be relied upon by any third party without explicit written agreement from Chelmer Site Investigations Laboratories' Ltd.

This report is specific to the proposed site use or development, as appropriate, and as described in the report; Chelmer Site Investigations Laboratories' Ltd accept no liability for any use of the report or its contents for any purpose other than the development or proposed site use described herein.

This assessment has involved consideration, using normal professional skill and care, of the findings of ground investigation data obtained from the Client and other sources. Ground investigations involve sampling a very small proportion of the ground of interest as a result of which it is inevitable that variations in ground conditions, including groundwater, will remain unrecorded around and between the exploratory hole locations; groundwater levels/pressures will also vary seasonally and with other man-induced influences; no liability can be accepted for any adverse consequences of such variations.

This report must be read in its entirety in order to obtain a full understanding of our recommendations and conclusions.

CONTENTS

1.0 INTRODUCTION

1.1 This up-dated independent assessment was commissioned by the London Borough of Camden (LBC) and concerns the revised documents submitted with planning application 2014/7908/P for the demolition of the existing buildings at 140-146 Camden Street, London, NW1 9PF, and the erection of a 3-8 storey building with a single storey basement.

1.2 The application describes the proposed works as the: "*Demolition of existing buildings and erection of a part 3, 4, 5 & 8 storey building plus single storey basement level comprising 2000sqm of commercial floorspace and 51 residential units (20 x 1-bed, 20 x 2-bed and 11 x 3-bed) with associated landscaping.*".

1.3 The scope for this assessment, as set out in LBC's letter of enquiry dated 10th February 2015, is to provide:

1) "an audit of the submission documents for compliance with the Revised Basement Impact Assessment";
2) "a view on the technical sufficiency of the work carried out";
3) "assessment of the completeness of the submission";

all in relation primarily to compliance with Camden's LDF Development Policy DP27, and the Basement Impact Assessment requirements as set out in LBC's guidance document CPG4 'Basements and Lightwells' (2013) and the associated 'Camden, geological, hydrogeological and hydrological study – Guidance for subterranean development'' (Camden GHHS, Arup, November 2010).

1.4 Six specific requests were included within the scope; these are addressed in the Conclusions to this report. The final two (Nos 5 and 6) also included additions to the three aspects of the scope listed above; they were:

5. comment on whether the critiques submitted by the neighbours "raise any reasonable concerns about the technical content or considerations of the submission which should be addressed by the applicant by way of further submission, *prior* to planning permission being granted".
6. "Raise any relevant and reasonable considerations in respect of the structural integrity or condition of the road and the neighbouring properties which may be unknown or unaccounted for by the submission **or** which would benefit from particular construction measures or methodologies in respect of the development *following* a grant of permission for the development."

1.5 The over-riding aim of Camden's LDF Development Policy DP27 'Basements and Lightwells', as stated in its first paragraph, is: "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 instability". Detailed requirements are then presented for what developers must demonstrate and matters that the council will consider when assessing applications.

1.6 The professional organisations involved with the proposed basement are:

- Chassay + Last Architects
- Price & Myers Structural Engineers
- GEA Site investigation contractors

1.7 This assessment has been prepared by Keith Gabriel, a Chartered Geologist with a MSc degree in Engineering Geology and Mike Summersgill, a Chartered Civil Engineer and Chartered Water and Environmental Manager with a MSc degree in Soil Mechanics. Both authors have over 30 years experience in ground engineering and have previously undertaken assessments of basements in several London Boroughs.

1.8 Comments on the technical aspects of each of the main submission documents are presented in Section 2, together with technical issues raised by the consultees, followed in Section 3 by a comparison against LBC's specific requirements as identified in the scope for this assessment. No comment is expressed here on the Design & Access Statement, because a critique of the architectural aspects of the scheme is beyond the scope of this assessment. Similarly, this assessment does not provide a full technical review or check of the submitted documents.

1.9 Drawings of the existing property and the proposed scheme were prepared by Chassay + Last, Architects. The following drawings were obtained from the LBC Planning website (drawings for floors above 1st floor level have been ignored):

Existing Drawings

- Drg No D-CSC3-A100 Location Plan
- Drg No D-CSC3-A101 Site Plan
- Drg No D-CSC3-A102 Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A103 Ground Floor Plan (Street level)
- Drg No D-CSC3-A104 First Floor Plan
- Drg No D-CSC3-A201 South & West Context Elevation
- Drg No D-CSC3-A202 North & East Context Elevation
- Drg No D-CSC3-A203 West Elevation
- Drg No D-CSC3-A204 South Elevation
- Drg No D-CSC3-A205 East Elevation
- Drg No D-CSC3-A206 North Elevation
- Drg No D-CSC3-A207 Section AA
- Drg No D-CSC3-A208 Section BB
- Drg No D-CSC3-A209 Section CC

Demolition Drawings

- Drg No D-CSC3-A.200 Site Plan
- Drg No D-CSC3-A.201 Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A.202 Ground Floor Plan (Street level)
- Drg No D-CSC3-A.203 First Floor Plan
- Drg No D-CSC3-A.204 Section AA
- Drg No D-CSC3-A.205 Section BB
- Drg No D-CSC3-A.206 Section CC

Proposed Drawings

- Drg No D-CSC3-A110-Rev.A Location Plan
- Drg No D-CSC3-A111-Rev.A Site Plan
- Drg No D-CSC3-A112-Rev.A Lower Ground Floor Plan (Canal level)
- Drg No D-CSC3-A113-Rev.A Ground Floor Plan (Street level)
- Drg No D-CSC3-A114-Rev.A First Floor Plan
- Drg No D-CSC3-A211-Rev.A South & West Context Elevation
- Drg No D-CSC3-A212-Rev.A North & East Context Elevation
- Drg No D-CSC3-A213-Rev.A West Elevation
- Drg No D-CSC3-A214-Rev.A South Elevation
- Drg No D-CSC3-A215-Rev.A East Elevation
- Drg No D-CSC3-A216-Rev.A North Elevation
- Drg No D-CSC3-A311-Rev.A Section AA
- Drg No D-CSC3-A312-Rev.A Section BB
- Drg No D-CSC3-A313-Rev.A Section CC
- Drg No D-CSC3-A314-Rev.A Section CC

These drawings have been referred to primarily for factual information purposes.

1.10 Structural Drawings of the proposed scheme were prepared by Price & Myers. The following structural drawings were included in the revised Basement Impact Assessment report (Supporting Document 5):

- Drg No. SK10-Rev.C Lower Ground Floor & Foundations
- Drg No. SK11-Rev.B Ground Floor
- Drg No. SK12-Rev.B First Floor
- Drg No. Sk22-Rev.B Section A & Section B
- Drg No. SK25 Section D
- Drg No. SK26 Section C

And in Supporting Document 6 'Proposed Temporary Works':

- Drg No. SK23-Rev.B Temporary Works: Lower Ground Floor & Foundations
- Drg No. SK24-Rev.A Temporary Works (Sections)

1.11 The revised Basement Impact Assessment (revised BIA) prepared by Price & Myers (report Ref: 20216, version 5, March 2015) includes 13 'Supporting Documents'. Some of these Supporting Documents are revised or reconfigured versions of the previous Appendices. There are also five completely new documents (or sets of drawings):

- Flood Risk Assessment (Document 4)
- Proposed Drainage Strategy (Document 7)
- Ground Movement Analysis (Document 8)
- Client Commissioned Geotechnical Report from 2007 (Document 11)
- Archive Drawings for the design of the existing building, prepared in the 1950's by various consultant/contactors (Document 13).

In addition, P&M have provided a covering letter, dated 25th March 2015, with a useful summary of their responses to the key concerns raised in our original review.

1.12 Instructions to prepare this up-dated Independent Assessment were received by email on 10th April 2015 (covered by purchase order No. PO 10397353).

2.0 CONSIDERATION OF DOCUMENTS SUBMITTED

2.1 Basement Design & Construction Method Statement

2.1.1 From our review of the documents it is understood that construction of the proposed basement will require excavation of the entire footprint of the existing building, ground floor (northern part), lower ground floor (southern part) and removal of all the existing pile caps. The drawings in Supporting Document 5 of 'Revised Basement Impact Assessment' report by Price & Myers (P&M) indicate that the perimeter walls of the basement will require a combination of:

- Mass concrete underpinning and a reinforced concrete (RC) liner wall to the party wall with Pulse House (northern part of the east boundary).
- Construction of a new reinforced concrete (RC) retaining wall alongside the new Regent Canalside building (southern part of the east boundary).
- Construction of a new RC retaining wall along the canal frontage (new proposal in revised BIA).
- Retention of the existing (RC) retaining wall along the southern part of the (west-facing) frontage onto Camden Street, with RC underpinning in order to incorporate this wall into the new basement structure (new detail provided in revised BIA).
- A new contiguous bored pile wall along the north, Bonny Street frontage and the northern part of the frontage onto Camden Street.
- Mass concrete underpinning to the RC wall at the north end of the existing ramp structure (new proposal in revised BIA, in lieu of the easternmost part of the bored pile wall, in order to reduce the potential impact on the north wall of Pulse House).

2.1.2 The layout of the bearing piles shown on P&M's Drg No.20216/SK10 rev.C has been revised following our previous concerns (the locations of some piles were not buildable). The revised layout has addressed that issue.

2.2 Construction Method Statement

2.2.1 A Construction Management Plan (sub-titled Method Statement for Planning Stage) was prepared by Chassay + Last, Architects (C+L). This document provides a very brief summary of the proposed basement works, titled 'Excavation and Basement Construction' (Section 3 in 'OUTLINE SPECIFICATION OF STRUCTURE & ENVELOPE'). It has not been up-dated to suit the revised BIAs.

2.2.2 Construction methods have been considered in the following documents:

1. The revised BIA report by Price & Myers now includes a 'Construction Method Statement' (Supporting Document 1, which contains much of the previous Appendix A).
2. 'Temporary Works' (Document 6, unchanged from the previous Appendix E).
3. 'Construction Management Plan' (Document 9). This comprises annotated diagrams with a tabulated 19-stage 'Outline Sequence of Works' summary for the basement construction phase, which was further revised on 30th April 2015. This is more detailed than the original version, though we note that it still omits both the RC liner wall (see label on P&M's Drg No.20216/SK10rev.C), which will be essential to maintain the stability of the mass concrete underpins along the boundary with Pulse House, and the new RC wall alongside the Regent Canalside development.
4. In various sections of the covering letter from P&M dated 25th March 2015.

2.2.3 The covering letter from P&M dated 25th March 2015 clarifies that construction of the retaining wall, which will span over the Fleet Sewer at the north-west corner of the site, "will be constructed in sections" and will be agreed with Thames Water.

2.2.4 As most of the consideration of construction methods has been presented in the supporting documents to the revised BIAs, the matters arising in relation to construction methods are presented in the following review of the BIAs.

2.3 Revised Basement Impact Assessment Reports

2.3.1 The revised Basement Impact Assessment (BIA) prepared by Price & Myers (report Ref: 20216, version 5, March 2015) now comprises three paragraphs of text, the three Screening tables which form Stage 1 of the process required by CPG4, and 13 'Supporting Documents'. Supporting Document 3 is a 'Site investigation and Basement Impact Assessment Report' by Geotechnical & Environmental Associates (GEA, report Ref: J13304, 'Revised Final' status dated 27 March 2015), which covers ground stability and groundwater matters but not surface water/flooding.

2.3.2 These BIAs have been assessed against the revised (September 2013) version of CPG4.

2.3.3 The authors of Price & Myers' revised BIA, are now listed as Phil Hudson CEng MIStructE MICE, supported for specific 'Supporting Documents' (No's 3, 4, 7 & 8) by Dimitris Linardatos CEng MICE (hydrologist – see P&M covering letter dated 25th March) and Steve Branch CGeol of GEA (engineering geologist and geotechnical engineer). The remaining Supporting Documents appear to have been authored by Phil Hudson alone, so are not strictly compliant with CPG4's requirements.

2.3.4 While most aspects of CPG4's requirements in relation to ground stability and groundwater matters are covered adequately in GEA's BIA, some aspects are still covered only in the Price & Myers (P&M) document, such as justifications for some of the 'No' responses to the screening questions.

2.3.5 The authors of GEA's BIA and site investigation report were Steve Branch (see above), Martin Cooper CEng MICE and John Evans CGeol (Hydrogeologist). Their qualifications cover all the professional qualifications required by CPG4 with the exception of hydrological expertise, which was excluded from their report.

2.3.6 GEA's BIA report covers the four Stages required by CPG4. Relevant desk study information about the site's history, geology, hydrology and hydrogeology is collated in Section 2, which is a sensible approach. The contamination risk assessment has not been reviewed as that falls outside the scope of CPG4. This report was originally prepared in November 2013; while some aspects have been up-dated, it is not fully aligned with the current scheme. For instance, the report does not allow for the proposed deepening of the existing basement beneath the southern part of the site.

2.3.7 P&M's revised BIA emphasises several times the benefit of having archive drawings of the existing buildings. While certainly useful, it must be remembered that these do not appear to be as-built drawings, and it is not uncommon for the sub-structures actually built to differ from the design drawings.

Screening:

2.3.8 The Stage 1 Screening requires responses to the questions identified in CPG4 and the Camden GHHS (Arup 2010); these responses are presented in Section 3.0 of GEA's BIA report and Tables 1-3 of P&M's version. As mentioned above (2.3.4) several questions were answered 'No' by GEA without giving any justification, albeit these 'No' answers all appeared to be appropriate, whereas P&M did provide justifications.

2.3.9 Questions for which we previously considered either the response or the justification by P&M to be inappropriate have all now been answered appropriately, however, some of the justifications given by P&M are not appropriate. The same issues arise in other documents so, rather than considering separately each of the screening questions of concern and each of the supporting documents, paragraphs 2.3.19 to 2.3.31 below consider each of the issues of possible concern.

Scoping:

2.3.10 Section 4 of GEA's BIA report presents the Scoping which forms Stage 2 of the BIA process. This considered all the Screening issues which had been identified with the exception of Groundwater Screening Q6 (excavation may extend below mean water level in canal). This omission appeared to have arisen because GEA's revised report did not allow for the proposed deepening of the southern part of the basement.

2.3.11 For each of the identified potential impacts, a brief note was provided on the possible consequences. These are generally appropriate.

2.3.12 P&M's BIA had no Scoping, so none has been provided for the Surface Flow and Flooding Screening (which has been removed from GEA's revised BIA). However, a Flood Risk Assessment (Document 4) and a Drainage Strategy (Document 7) have been provided in order to address surface water issues.

Ground Investigation (Stage 3):

2.3.13 Sections 5 and 6 of GEA's BIA report present the scope and findings from the site-specific ground investigation which forms Stage 3 of the BIA process. This site investigation was limited (by the client) to two boreholes drilled with window sampling equipment to depths of 5.50-6.00m below ground level. As the site is underlain by London Clay (with only a limited thickness of Made Ground where the existing basement is present) it is unlikely that a consistent groundwater flow direction could be determined, so two boreholes could be considered reasonable for planning purposes, although the greater uncertainty regarding ground and groundwater conditions would need to be allowed for in interpreting the findings.

2.3.14 Despite the availability of some historic engineering drawings of the existing buildings, hand dug trial pits should have been excavated alongside the boundary walls to be underpinned (including Pulse House) in order to confirm the depths and nature of the existing foundations, and to enable further assessment of the ground and groundwater conditions. Such pits would have allowed a greater awareness of the relative levels and enabled more specific conclusions to be reached in the BIA.

2.3.15 Fine rootlets were noted in BH1 in the uppermost 1.4m of the London Clay, which, at 4.10-5.50m below ground level (bgl), is unusually deep. BH1 was close to the largest of the three trees on the Bonny Street footway which is the only feasible source for these roots (assuming that they were live). This suggests that standard NHBC guidance on extent of influence of roots from this tree will not apply here.

Impact Assessment (Stage 4):

2.3.16 GEA's 'Design Basis Report' (Section 9) is effectively part of the impact assessment. Their advice and recommendations are broadly sound, though rather general, and all subject to the recommended further ground investigations, which is appropriate.

2.3.17 The depth of excavation for the new, northern section of basement is repeatedly given as 3.80m, whereas the basement's finished floor level will be 3.0-4.1m below the adjacent roads (as given on Chassay + Last's drawings) and when the thickness of the basement slab, insulation and floor finishes is taken into account the depths of excavation are likely to be in the order of 3.5-4.5m.

2.3.18 Section 10.0 of GEA's BIA report is identified as the impact assessment (as previously). Their new, separate report on Ground Movement Analyses (Document 8) considers the potential impact of the proposed basement on the adjoining and adjacent structures. However, no consideration would appear to have been given in either document to the potential future impact of nearby trees on the ground below the foundations to Pulse House, once its west flank wall has been underpinned, despite potential impacts on neighbouring properties being a particular concern of DP27.

Groundwater:

2.3.19 Our concern regarding groundwater centres on the generally dismissive nature of the approach taken by the applicants to groundwater and the presence of the canal; relevant points are:

1. We agree that the groundwater encountered at 0.42m in BH2 (immediately beneath the concrete floor slab) was probably perched groundwater above the London Clay. It is also noted that GEA considered that groundwater is "*the main issue that requires careful consideration at this site*…" (Section 11.0).
2. Given the scale of the development, a very minimal ground investigation (two 5.5-6.0m deep boreholes) has been undertaken so it is not reasonable to claim that this groundwater is an "*isolated pocket*"; that may be correct but it certainly has not been proved, and additional boreholes will be required (which we propose should be subject of a condition on any planning consent granted – see paragraph 3.3.2). Similarly it is not reasonable to state that because the canal is man-made that the water within it is fully contained (Table 1, Q6). Canals often do leak slowly, as acknowledged by GEA, and the Made Ground beneath the building has been shown to be permeable sands.
3. The Regent's Canal was identified by GEA as a potential source of water, if it is leaking, and the Made Ground is known to be permeable sands with included building debris (BH2), with groundwater at only 0.42m below the existing floor slab. Scaling of P&M's new section across the canal tow path shows that the proposed basement FFL will be approximately 0.15m below the mean water level in the canal (which may, in itself, not be the highest canal water level). The excavations for removal of the existing pile caps and construction of new pile caps (and the basement slab) will require excavation to 1.35m below the existing slab, approximately 0.9m below the groundwater in BH2 and 1.2m below the mean water level in the canal. Use of trench sheeting is currently proposed by P&M for temporary support along the tow path, whereas fully interlocked ('clutched') sheet piles would be expected to be more effective in minimising water entries into the excavations from the area beneath the tow path. The presence of claystone, as recorded in BH2 at 1.60m and 5.50m, would need to be allowed for when selecting the sheet piles.

4. P&M's letter of 25th March 2015 notes that "*in the absence of better information, the normal convention is to design with groundwater 1m below ground surface*", with design levels expected to vary around the building. While we agree that the design levels must vary, the current geotechnical design codes (Eurocode EC7 and the superseded BS) require the use of worst credible groundwater levels. Given the water level in the canal and the high risk of flooding over the towpath (see below) a design level at 1m below ground surface is not considered appropriate.
5. The Flood Risk Assessment states that "*As the site is not located within any aquifer catchment areas the proposed basement will not have an impact on any below ground flow paths and therefore will not increase the risk of flooding to the surrounding areas*" (Document 4, end of Section 4.2). This claim is not correct; groundwater flow can occur through granular Made Ground above the London Clay (where not prevented by obstructions), especially in areas of sloping ground, and where such flow does occur, creation of a major obstruction such as a large basement may have an impact. That impact would usually be limited to a small rise in groundwater levels on the upslope side of the basement which, in most cases, would not cause any problems though, where existing old cellars/basements without waterproofing are present just above groundwater level, then flooding may occur. Fine sand horizons do also occur within the London Clay and, where those are sufficiently interconnected, flow can occur through them. While it is understood that there is no cellar under Pulse House, the ground floor does step down progressively southwards. Thus, while it is considered unlikely that the proposed basement will have an adverse impact on groundwater flow and levels around the basement, further ground investigation and groundwater monitoring will be required to confirm that.

Adequacy of temporary support to Canal Tow Path:

2.3.20 P&M propose to excavate for the new retaining wall alongside the tow path by hand, with trench sheeting used to support the towpath. A new section across this wall, towpath and canal has been provided (SK25 in Document 5). SK25 indicates that the basement slab excavations will reach 0.7m below the existing floor slab, and the underside of the pile caps will require a further 0.65m depth of excavation to 1.55m below the tow path level. The pile caps are shown on the 'Lower Ground Floor and Foundations' plan to extend along almost the whole length (89%) of this retaining wall, so the total volume of excavation will be significant. Most contractors would choose to use a mini-digger for that excavation. For planning purposes, the issue is whether adequate provision has been included to ensure that the stability of the tow path and canal bank will be maintained; SK25 shows a single horizontal, high level prop with nothing in the vicinity for it to prop against, whereas the revised Document 9 identifies the need for raking props. No requirement has been included for the trench sheets to provide continuous, full-face support to the canal bank, nor for the trench sheets to be 'clutched' (ie: interlinked) in order to minimise groundwater entries. Thus, we remain concerned that the stability of the tow path and canal bank has not been given adequate consideration.

Surface Water flooding over the Canal Tow Path:

2.3.21 The Flood Risk Assessment claims that flood water is "*not expected to spill from the canal on to the tow path…*" because it is a managed waterway, and "*This is confirmed by the EA's map*". A larger extract from the EA's map (EA website, 2014) is presented in Figure 1 which shows that a 'High' risk of surface water flooding from the adjacent canal is predicted, including the towpath alongside the site of current interest. Appropriate flood resistance measures will therefore be required. Once again, provision of relevant details could be conditioned.

2.3.22 It is understood that the published Environment Agency map of surface water flood risk is less detailed than the full model, so the EA could be consulted for further details of the maximum predicted flood level of water from the canal.

Temporary Support:

2.3.23 The statement in Section 7.2 of Supporting Document 1 that "*existing retaining structures … will be examined and suitable temporary works devised if necessary*" gives no confidence that the essential temporary support will be installed. As the whole of the basement slab will be broken out and removed, and the existing walls to be retained will be underpinned, we cannot envisage a situation where temporary support would not be required.

Ground Movement and Damage Category Assessment:

2.3.24 The ground movement analyses in GEA's Supporting Document 8 provide detailed modelling of predicted ground movements around the excavations, and the accompanying diagrams indicate that the increase in depth of the existing basement has been allowed for (unlike GEA's BIA).

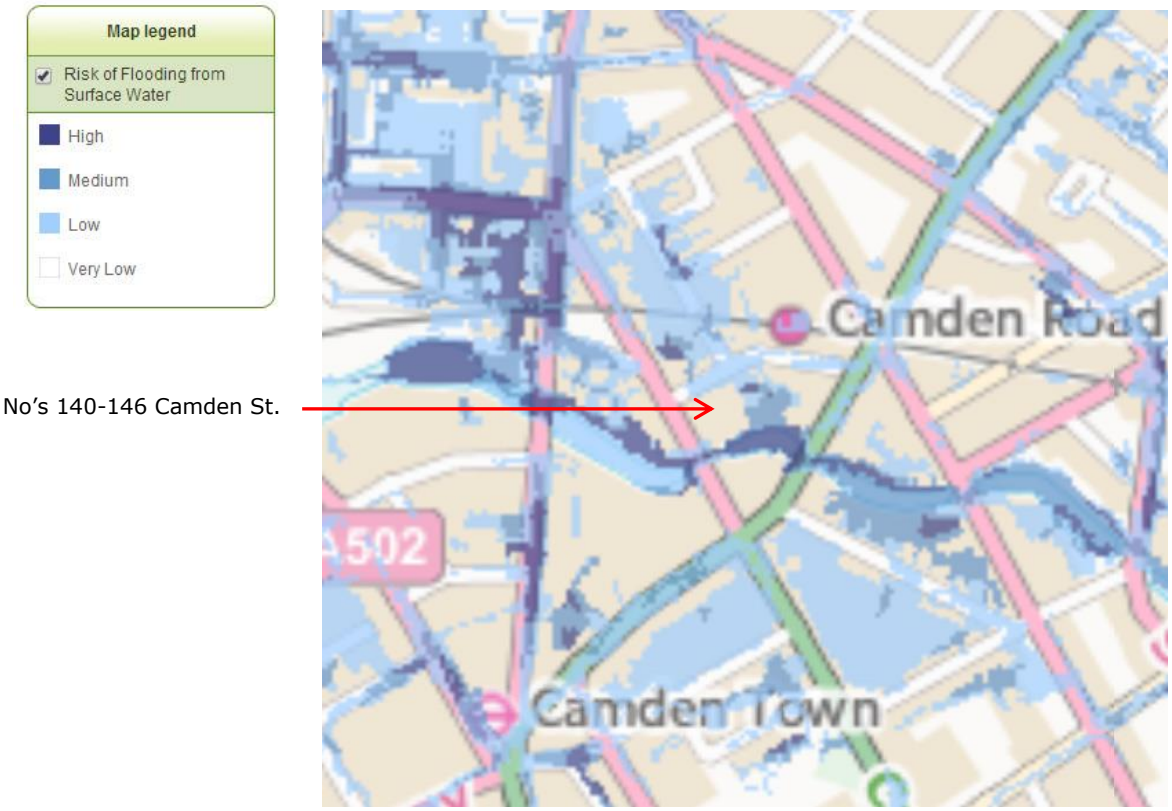

Figure 1: Extract from the Environment Agency's map of 'Risk of Flooding from Surface Water'.

2.3.25 The acceptability of the predicted displacements on the Fleet river/sewer tunnel must be assessed by Thames Water.

2.3.26 No consideration appears to have been given to the potential for differential movement between the underpinned party wall with Pulse House, and the remainder of Pulse House. The potential influence of the nearby Maple tree (T3) on the front wall of Pulse House will also need to be considered, whether it is retained and continues growing, or is removed as suggested by P&M. The abnormal root growth from this tree as apparently recorded in GEA's BH1 must also be considered.

Mitigation:

2.3.27 While some mitigation measures are recommended (eg: underpinning the party wall with Pulse House and the surface water bypass) no summary of the proposed mitigation measures has been provided in the BIA reports, as expected by most Camden planning officers in accordance with Cls 2.31 of CPG4.

Monitoring:

2.3.28 P&M's Discussion of the Basement Works (Document 1, Section 7) does note that monitoring will be undertaken, but only for Pulse House, whereas GEA recommended that the adjacent part of the Regent Canalside development should also be monitored. The columns supporting the access deck to the Police Station and the Camden Street bridge abutment (and Regent Canalside) should also be monitored unless their owners are satisfied that their foundations are sufficiently deep/robust to be unaffected by the proposed works. Specific details of the monitoring are expected for compliance with Cls. 2.50 of CPG4, together with trigger levels and an action plan identifying steps to be taken when recorded movements approach or exceed the given triggers values.

Drainage:

2.3.29 Suitable calculations in relation to foul and surface water drainage (and the changes caused by this redevelopment) have been included in Document 7 (Drainage Strategy); these calculations incorporate current design standards and an allowance for climate change. A control mechanism to limit surface water outflows to sewer, including an on-site SuDS (storage tank), has been incorporated – the proposal appears to be sensible, although installation details are sketchy. The additional outflow of foul drainage (peaking at 11 lit/sec with all domestic outlets in operation) from the new housing is compared to the reduction in peak stormwater flows for the current development (down from 20 lit/sec in a 30-year rainfall event to a controlled 5 lit/sec); this will be a matter for Thames Water to find acceptable for adoption.

2.3.30 A Flood Risk Assessment (FRA) has been included as Document 4 (Figure 2 therein has some transposition errors on the copy viewed, but this is still comprehensible); comments on potential flood risk from the Canal and across the towpath have been made previously in 2.3.21 & Figure 1 above, and this aspect is dismissed in the FRA; canals are frequently conduits for licensed/unlicensed surface water outfalls (and will have concomitant overflow weirs leading to watercourses/sewers), and hence normal water levels may rise in storm conditions. Confirmation needs to be obtained from Canal & River Trust on this aspect (and/or the EA & Thames Water).

2.3.31 The FRA also acknowledges the risk from surface water ponding on Bonny Street, and proposes a bypass solution incorporating a siphoned pipe and outfall (to the Canal towpath). The details of this 'relief pipe' are preliminary, and will need further design evaluation and licensing of outfall, but the concept is not uncommon albeit the functionality of such submerged pipework requires regular maintenance.

2.4 Technical evidence from Consultees

2.4.1 Thames Water's consultation response states that the existing wastewater infrastructure cannot accommodate the needs of the proposed development. Their preferred solution is for all surface water to be disposed of on-site using SuDS. The new Drainage Strategy document recommends temporary interception storage in order to manage the rate of overall discharge(s) to the public sewers, which is considered a rational approach for a site which has no open land presently upon which permeable in-ground solutions could be proposed (the site also being underlain at depth by impermeable strata). As mentioned in 2.3.29 - 2.3.31 above, it would necessary to submit detail of the foul and surface water drainage proposals to the consultees for further comment and evaluation/approval of outfall(s).

3.0 COMPARISON AGAINST LONDON BOROUGH OF CAMDEN'S REQUIREMENTS

3.1 Compliance with requirements for Basement Impact Assessment

3.1.1 GEA's Basement Impact Assessment (BIA) report is structured appropriately so that it covers Stages 1 to 4 of the requirements in LBC's CPG4 'Basements and Lightwells' and the associated Camden GHHS (Arup 2010). However, the revised GEA version does not cover surface water and flooding, which is dealt with by Price & Myers in their BIA, that section being authored by a P&M chartered civil engineer.

3.1.2 The ground investigation scope comprised two boreholes and laboratory testing. Groundwater monitoring was only possible in one of these boreholes because the Made Ground in BH1 collapsed, preventing installation of a standpipe, though the monitoring of BH2 was minimal with a only a single reading. Current standards require use of 'worst credible' groundwater levels in geotechnical design, so either further monitoring (in BH2 and additional boreholes) will be required or the retaining wall designs should allow for groundwater at surface.

3.1.3 Further boreholes and monitoring will be required in order to obtain an adequate understanding of groundwater distribution around the site, and the degree of fluctuation of the water levels, in order to permit a proper evaluation of the impact of the basement on the groundwater.

3.1.4 A detailed commentary on matters arising from the BIA report is presented in Section 2.3. The main non-compliances in relation to procedural aspects of CPG4 include:

i. While many of our previous concerns have been addressed, the structure of the documents, with two partial BIAs and several supporting documents, has not aided clarity and probably contributed to the issues identified below.
ii. The Supporting Documents, other than those written by or with the support of named individuals, were authored only by Phil Hudson of P&M, so still do not comply with the qualification requirements in CPG4.
iii. The revised documents have no Scoping for surface water and flooding matters.
iv. There were no non-technical summaries, as required by clause 2.10 of CPG4.
v. While some recommendations for mitigation measures have been provided (though not identified as such), there is no summary of the mitigation recommendations as normally expected in compliance with paragraph 2.31 of CPG4.

3.1.5 Most of the technical matters can be dealt with by placing conditions on any planning consent (see Sections 3.2 and 3.3). The decision as to whether further revisions to the BIA reports are required in order to achieve procedural compliance with CPG4 (and DP27) may be taken by the Planning Authority's case officer.

3.2 Technical sufficiency of the work carried out

3.2.1 While many of our previous concerns about the Basement Impact Assessments have been resolved, concerns remain about some important issues, as raised in Section 2.3 above. These are summarised in brief below.

3.2.2 The ground investigation should have included trial pits alongside the perimeter walls which will be incorporated into the proposed building, in order to clarify the extent of underpinning required.

3.2.3 The groundwater regime has not been adequately investigated and there appears to be a dismissive approach to its significance, despite groundwater being found immediately under the floor slab of the existing basement and the need to excavate at least 1.2m below the water level in the adjacent canal. Further monitoring and impact assessment will be required during the full design investigation.

3.2.4 The proposals for temporary support of the excavations alongside the canal remain minimal and potentially unsuitable.

3.2.5 The risk of flooding over the canal towpath has not been accepted, so no flood resistance measures have been proposed. Further information needs to be sought.

3.2.6 No consideration has been given to the potential for future differential movement between the basement and parts of the adjoining Pulse House, which will remain supported on shallow footings. Further mitigation will need to be considered.

3.2.5 The monitoring proposed in principle by P&M is less extensive than recommended by GEA and omits other structures close to the basement. No details, no trigger levels and no action plan have been provided.

3.3 Completeness of the Submission

3.3.1 The submitted BIA report falls short of the matters required by CPG4, DP27 and the Camden GHHS in various respects, as has already been identified. Recommendations for further submissions which should be obtained and reviewed prior to planning permission being granted are given in Section 3.4 below, so those aspects are not considered further in this section.

3.3.2 The following matters could sensibly be made the subject of planning conditions to be imposed on any consent granted:

i. Undertaking further groundwater monitoring and submission of a further assessment of the potential impact of this basement on the groundwater regime.
ii. Submission of flood resistance proposals for the canal frontage. Consultees Thames Water and the Canal & River Trust may also wish to add further conditions in relation to the revised proposals.
iii. Submission of full proposals for monitoring adjoining and adjacent structures, with trigger levels and an action plan.
iv. Submission of mitigation measures to protect Pulse House from differential movement.
v. Submission of the appointed contractor's method statements which must have been approved by the appointed structural engineer and, if separate, the temporary works engineer. These method statements should include full details of all temporary work to support the excavations, the existing structures to be retained and the new retaining walls prior to completion of the permanent works in order to minimise movements in the adjacent ground. Particular attention will be required to:
    a. prevention of damage to the Fleet sewer;
    b. support for the canal bank and the exclusion of groundwater;
    c. minimising noise and vibration during the works. Use of non-percussive techniques could be made mandatory for all demolition and breaking-out, although use of hammer drills will be unavoidable.
vi. A requirement for an appropriately competent ground engineer, who complies with the relevant professional qualification requirements within CPG4 and/or is a member of the UK Register of Ground

Engineering Professionals at Adviser grade, to be retained by the applicant for the duration of the groundworks. The ground engineer's brief should be to review all scheme drawings, specifications, method statements and other relevant documents and to inspect the works and the ground exposed at appropriate stages, so that he/she is able to advise the applicant and his appointed structural engineer regarding the adequacy of all ground engineering aspects of the permanent and temporary works.

3.3.3 The planning conditions proposed above should require the applicant to submit the document(s) concerned to the Planning Authority for their review and approval in writing, prior to the start of basement construction works on site.

3.4 Requirement for further Submissions

3.4.1 Whether further revisions of the BIAs are required in order to meet the remaining (and new) procedural deficiencies is a decision which may be taken by the Planning Authority's case officer. The technical issues identified in Sections 2.3 & 3.2 above could all be dealt with by use of conditions on any planning consent granted, though it would have been preferable for items ii, iii and iv in paragraph 3.3.2 above to have been included within the BIAs.

4.0 CONCLUSIONS

4.1 These conclusions consider only the six specific requests in the enquiry letter from London Borough of Camden (dated 30th January 2015). Each is considered in turn below. The whole report should be read to obtain a full understanding of the matters considered.

1. *The submission contains a Basement Impact Assessment, which has been prepared in accordance with the processes and procedures set out in CPG4.*
   The BIAs remain deficient in a limited number of respects, though these deficiencies could be resolved by placing carefully worded conditions on any planning consent granted.

2. *The methodologies have been appropriate to the scale of the proposals and the nature of the site.*
   The methodologies have broadly met the requirements in CPG4, though the unusual and fragmented structure of the documents submitted has resulted in some matters not being addressed adequately.

3. *The conclusions have been arrived at based on all necessary and reasonable evidence and considerations, in a reliable, transparent manner, by suitably qualified professionals, with sufficient attention paid to risk assessment and use of conservative engineering values/estimates.*
   As discussed above, the borehole component of the ground investigation was acceptable for planning purposes whereas the lack of trial pits has resulted in apparent uncertainties regarding the extent of underpinning required.
   The qualifications of the lead/sole author of several Supporting Documents in P&M's BIA do not meet the requirements of CPG4.
   The ground stability risks associated with differential movement between Pulse House and the proposed development, taking into account the influence of tree T3, have not been addressed adequately.

4. *The conclusions are sufficiently robust and accurate and are accompanied by sufficiently detailed amelioration/mitigation measures to ensure that the grant of planning permission would accord 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*

   The evidence and conclusions are currently not sufficiently robust, as described under items 1-3 above, to ensure accordance with DP27 in respect of (a) and (b) above. Further mitigation measures are required, as identified.

5. *Raise any reasonable concerns about the technical content or considerations of the submission which should be addressed by the applicant by way of further submission, prior to planning permission being granted. In this case it would need to be apparent that the submission is so deficient in some respect that the three conclusions (points 4a-c above) cannot be guaranteed without the provision of further*

information at this stage. Please clearly denote the precise information (if any) that would be required to satisfy 4a-c
See Sections 3.2 & 3.4 above.

6. *Raise any relevant and reasonable considerations in respect of the structural integrity or condition of the road and the neighbouring properties which may be unknown or unaccounted for by the submission, or which would benefit from particular construction measures or methodologies in respect of the development following a grant of permission for the development. Please clearly denote what such conditions should entail.*
The structural condition of the Fleet Sewer, which passes diagonally beneath this site, is not known and will need to be protected to the satisfaction of Thames Water.
We are not aware of any abnormal conditions affecting the road, though no site inspection was included in this review.
If planning consent is granted, the detailed condition of the adjoining properties should be established by condition surveys under the Party Wall Act processes.
Use of best practice methods of underpinning and temporary support will be essential to control adequately the ground movements and hence minimise structural damage in Pulse House and its neighbouring properties, although control of temporary works through the planning system is known to be difficult.
Items which could be made the subject of planning conditions, rather than being required prior to planning, are listed in paragraph 3.3.2.

References

Arup (November 2010) Camden geological, hydrogeological and hydrological study – Guidance for subterranean development. Issue 01. London.

BS EN 1997-1 (2004) Eurocode 7: Geotechnical Design – Part 1: General rules. British Standards Institution.

London Borough of Camden (2013) Camden Planning Guidance CPG4– Basements and lightwells.

NHBC (2013) NHBC Standards, Chapter 4.2, Building Near Trees.

a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of Chelmer Site Investigation Laboratories Limited (CSI) to act as a consultant.
b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, CSI has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
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CSI does not provide specialist legal advice and the advice of lawyers may be required.
g) In the Summary and Recommendations sections of this report, CSI has set out our key findings and provided a summary and overview of our advice, opinions and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by CSI and therefore any advice, opinions or recommendations set out in the Executive Summary, Summary and Recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data, which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
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