CampbellReith consulting engineers

4 The Hexagon, Fitzroy Park London, N6 6HR

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12066-85

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August 2016

Campbell Reith Hill LLP Friars Bridge Court 41-45 Blackfriars Road London SE1 8NZ

T:+44 (0)20 7340 1700 F:+44 (0)20 7340 1777 E:london@campbellreith.com W:www.campbellreith.com



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Author	J Jensen, BEng (Civil), MIEAust
Project Partner	E M Brown, BSc MSc CGeol FGS
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1.0 NON-TECHNICAL SUMMARY

- 1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 4 The Hexagon, Fitzroy Park, London N6 6HR (planning reference 2016/3252/P). The basement is considered to fall within Category B as defined by the Terms of Reference.
- 1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.
- 1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.
- 1.4. The BIA was undertaken by LBH Wembley Geotechnical & Environmental. The reviewer's qualifications are in accordance with CPG4 requirements.
- 1.5. The proposal includes increasing the depth of the existing lower ground floor and the Elliot Wood Structural and Civil Engineering Planning report states that a contiguous piles wall will be formed along the north-east of the proposed building. In addition reinforced concrete underpins will be constructed at the boundaries to the south-east and the south-west of the site and be constructed in a hit and miss sequence. Sketches to illustrate the construction sequence with any temporary propping indicated and an underpinning bay sequence are not provided and this is requested. The information provided should also include structural details of the proposed basement.
- 1.6. Details of the proposed bypass drainage system should be provided along with a permeability investigation to justify its suitability.
- 1.7. The omitted hydrogeology screening question should be addressed as discussed in Section 4
- 1.8. The screening exercise did not identify that the site is in an area at risk from surface water flooding. The BIA should be updated to consider this potential impact.
- 1.9. The issue of additional hard surface areas should be assessed as discussed in Section 4.
- 1.10. Young's Modulus values are not included in the retaining wall parameters and these are requested.
- 1.11. The ground movement assessment predicts Category 0 (Negligible) damage for No 5 The Hexagon and Category 1 (Very Slight) for No 3 The Hexagon. It is correctly identified that CPG4 requires mitigation measures for Category 1 or higher predicted damage and this is provided.



- 1.12. The full tabular input and output from the SAPPER programme is not included and this is requested for completeness.
- 1.13. Work durations have been indicated in the CMP, however a detailed programme should be submitted at a later date. Details of the CMP are to be agreed with the Council.
- 1.14. An outline monitoring proposal is included. Details and trigger levels are to be agreed as part of the Party Wall award.
- 1.15. Queries and requests for further information are discussed in Section 4 and summarised in Appendix 2.



2.0 INTRODUCTION

- 2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 18th July 2016 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 4 The Hexagon, Fitzroy Park, London N6 6HR, Camden Reference 2016/3252/P.
- 2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.
- 2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within
 - Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
 - Camden Planning Guidance (CPG) 4: Basements and Lightwells.
 - Camden Development Policy (DP) 27: Basements and Lightwells.
 - Camden Development Policy (DP) 23: Water.
- 2.4. The BIA should demonstrate 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;
 - avoid cumulative impacts upon structural stability or the water environment in the local area, and;

evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as "*Erection of a 3 storey 3-bed dwelling following demolition of existing 3 storey dwelling, and associated works."*

The Audit Instruction also confirmed 4 The Hexagon was a neighbour to a Grade II listed building at 10 Fitzroy Park.



- 2.6. CampbellReith accessed LBC's Planning Portal on 8th August 2016 and gained access to the following relevant documents for audit purposes:
 - Basement Impact Assessment Report (BIA) 9th June 2016 by LBH Wembley Geotechnical & Environmental
 - Structural & Civil Engineering Planning Report Construction Method Statement June 2016 by Elliot Wood Partnership LLP
 - Geotechnical, Hydrogeological and Ground Movement Assessment 9th June 2016 by LBH Wembley Geotechnical & Environmental
 - Planning Application Drawings consisting of Location Plan – July 2015 by Soup Architects

Existing Plans – July 2015 by Soup Architects

Demolition Plans – May 2016 by Soup Architects

Proposed Plans – May 2016 by Soup Architects

- Planning & Heritage Statement June 2016 by Soup Architects
- Structural Drawings April & June 2016 by Elliot Wood Partnership LLP
- Drainage Drawings 10th June 2016 by Elliot Wood Partnership LLP
- Arboriculture Report & Impact Assessment 8th June 2016 by Crown Consultants
- Construction Management Plan 26th May 2016 by Motion
- Planning Comments and Response



3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Audit Paragraph 4.1.
Is data required by Cl.233 of the GSD presented?	No	Proposal not sufficiently detailed (see Audit paragraph 4.6 to 4.8).
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	No	Proposal not sufficiently detailed (see Audit paragraph 4.6 and 4.7).
Are suitable plan/maps included?	No	Arup GSD, EA and Camden SFRA map extracts with site location indicated not provided (see Audit paragraph 4.9).
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	No	As above.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Relevant map extracts not provided with site location indicated (see Audit paragraph 4.9).
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Relevant map extracts not provided with site location indicated. Question 3 not answered (see Audit paragraph 4.8 and 4.9).
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Relevant map extracts not provided with site location indicated. Response to Question 3 and 6 incorrect (see Audit paragraph 4.9 to 4.11).
Is a conceptual model presented?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 4.3 to 4.6.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	No	Provided but not in accordance with Arup GSD. Question 10 has not been considered in terms of stability in the scoping.
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	No	Provided but not in accordance with Arup GSD.



Item	Yes/No/NA	Comment
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	No	Provided but not in accordance with Arup GSD. Question 3 and 6 should have been carried forward from the screening.
Is factual ground investigation data provided?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report (Borehole Logs, Dynamic Probe Results and Geotechnical Test Results).
Is monitoring data presented?	Yes	Not immediately obvious from the report however the borehole logs contained within the LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report indicate monitoring has occurred.
Is the ground investigation informed by a desk study?	Yes	See Audit paragraph 4.12.
Has a site walkover been undertaken?	No	Not explicitly stated however it is noted a visual inspection was undertaken as part of the structural inspection of the property.
Is the presence/absence of adjacent or nearby basements confirmed?	No	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 7.1 describes the neighbouring houses but does not confirm the presence or absence of basements to these dwellings (see Audit paragraph 4.15).
Is a geotechnical interpretation presented?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 6.0.
Does the geotechnical interpretation include information on retaining wall design?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 6.5, however the stiffness values 'E' are not provided.
Are reports on other investigations required by screening and scoping presented?	Yes	Arboriculture report has been provided (see Audit paragraph 4.16)
Are the baseline conditions described, based on the GSD?	No	Neighbouring properties has not been fully described. Specifically the presence or absence of basements.



Item	Yes/No/NA	Comment
Do the base line conditions consider adjacent or nearby basements?	No	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 7.1 describes the neighbouring houses but does not confirm the presence or absence of basements to these dwellings (see Audit Paragraph 4.15).
Is an Impact Assessment provided?	Yes	BIA Section 7.0
Are estimates of ground movement and structural impact presented?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 7.0.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	No	See Audit paragraphs 4.7, 4.10, 4.11 and 4.17 also the stability has not been considered due to the presence of the aquifer.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	Not considered and not possible to determine if further mitigation is needed as the impact assessment has not been fully undertaken.
Has the need for monitoring during construction been considered?	Yes	BIA Section 7.8 and LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 9.2.
Have the residual (after mitigation) impacts been clearly identified?	N/A	None identified
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 7.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	No	See Audit Paragraph 4.17
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	See above. As surface water runoff has been considered cumulative impacts cannot have. See Audit Paragraph 4.17.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	BIA Section 7.4 and LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 8.1 & 8.2 predicts Category 0 (Negligible) damage for No 5 and Category 1 (Very Slight) damage for No 3 (See Audit Paragraph 4.20).
Are non-technical summaries provided?	No	No Non-Technical Summaries have been provided in accordance with Section 3.5 of the CPG4 report.

4.0 DISCUSSION

- 4.1. The Basement Impact Assessment (BIA) has been carried out by LBH Wembley Geotechnical & Environmental and the reviewers has MSc, CEng, MICE, CGeol, FGS, MIEnvSc and FRGS qualifications, which are in accordance with the requirements of CPG 4.
- 4.2. A Structural and Civil Engineering Planning Report has been carried out by Elliot Wood Partnership LLP but no proof of expertise has been provided.
- 4.3. The LBC Instruction to proceed with the audit identified that the basement proposal was adjacent to a listed building at 10 Fitzroy Park to the west it is however considered to be outside the zone of influence of the proposals. The Planning and Heritage Statement prepared by SOUP Architects identifies that 4 The Hexagon is located in the Highgate Conservation Area.
- 4.4. The existing site comprises a three storey detached house that is stepped into the hillside, with a lower ground floor located at the rear of the site. The existing lower ground opens into a rear garden to the south and the west of the dwelling. A 3m drop in level is indicated from the street level to the rear garden.
- 4.5. The proposed development will comprise a three storey dwelling that will replace the existing house on roughly the same footprint. This proposed new lower ground floor will be located approximately 0.5m below the existing lower ground level. This will be 2.50m below the existing car parking area on the north of the development.
- 4.6. The proposal includes increasing the depth of the existing lower ground floor and the Elliot Wood Structural and Civil Engineering Planning report states that a contiguous piles wall will be formed along the north-east of the proposed building. In addition reinforced concrete underpins will be constructed at the boundaries to the south-east and the south-west of the site and be constructed in a hit and miss sequence. It is also mentioned that temporary propping will be required. Structural details of the proposed basement are not provided. Although a construction sequence is provided in the text, sketches to illustrate this are not provided. An underpinning bay sequence is also not provided.
- 4.7. The bypass drainage proposal does not provide any indication of the permeability of the proposed soakaway. No details of the system are provided.
- 4.8. Question 3 of the hydrogeology screening has not been answered.
- 4.9. For the remaining questions, the relevant map extracts from the Arup GSD, Camden SFRA and the Environment Agency (EA) identifying the site location on each map are not referenced or not included. It would be beneficial if these extracts are included as they help to support statements made in the BIA screening process.



- 4.10. A 'No' response is given to Question 4 of the Hydrology screening which relates to whether there will be change in the profile of the inflows of surface water flows received by the neighbouring properties. As the impermeable area of the property has been indicated as increasing the response to this question should have been 'Yes' with the issue appropriately addressed in the scoping.
- 4.11. A 'No' response was given to Question 6 of the Hydrology screening which relates to whether or not the site is in an area at risk from flooding. Figure 3iii of the Camden SFRA indicates the site is in area at risk from surface water flooding.
- 4.12. Whilst the desk study information required by the Arup GSD has been presented it is in a fragmented format and it is not clear it has been considered in the assessment. A sufficient desk study consolidating all the available historic, geological, hydrology and hydrogeological information in a single document will facilitate the impact assessment.
- 4.13. The ground investigation revealed Made Ground to approximately 1.00m bgl below which lies Claygate Member to a depth of 7m BGL, below which lies the London Clay Formation. It is also noted that the upper 2 to 3m of the Claygate Member is subject to downwash. The LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report confirmed the basement is to be founded within the Claygate Member and although groundwater was monitored at shallow depth, the water table is considered to be perched water within the permeable sections of the Made Ground. A bypass drainage system is proposed around the new structure installed at the early stages of construction to protect the basement excavation.
- 4.14. Three trial pits were undertaken to investigate the existing building foundations. The trial pits indicate that the existing foundations appear to be concrete strip footings bearing on weathered soft to firm clay of the Claygate Member at depths of between 0.60m and 0.70m below the existing lower ground level.
- 4.15. The BIA does not confirm if there are any adjacent basements to the site and the neighbouring foundations are likely to be similar to the foundations to 6 The Hexagon. Unless further information is forthcoming or an investigation undertaken to determine these, the maximum differential depth should be assumed.
- 4.16. Arboriculture report has been provided however it is clear that this has been completed after the BIA. There is a contradiction between the BIA and Arboriculture Report and Architectural drawings. The BIA states a 10m fir tree is to be removed however the tree report states that a 4m Black Mulberry and 4m Cherry Laurel tree are to be removed.
- 4.17. LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report Section 5.3.3 indicates there will be an increase in hard surfaced area that will be drained via SuDs



however the BIA does not address this and propose how a SuDs system would be implemented to address the screening/scoping items relating to the increase in impermeable area of the development and the discharge of surface water and bypass drainage to the groundwater.

- 4.18. The retaining wall parameters provided in Section 6.5 of the LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report is considered incomplete as it does not include Young's Modulus, E, values.
- 4.19. A ground movement analysis has been undertaken based on maximum excavation depth of 2.50m and a contiguous piled wall along the northeast boundary with an embedment depth of 1.50 x the excavation depth. The calculations are based on CIRIA C580 with high support stiffness assumed. Heave movements due to demolition and excavation and settlement due to the new building loads have been calculated using the SAPPER programme. Although contour plots of the heave and settlement are included, the full tabular input and output from the programme is not provided.
- 4.20. Damage assessments have been undertaken for No 3 and No 5 The Hexagon based on the movements discussed above. Category 0 (Negligible) damage for No 5 with Category 1 (Very Slight) damage for No 3. Although a damage assessment for No 6 due to the excavation and proposed underpinning and along the southeast has not been undertaken, it is acknowledged the depth of excavation is reduced in this area and the property is at a sufficient distance away.
- 4.21. It is stated in Section 9 of the and LBH Wembley Hydrogeological, Geotechnical & Ground Movement Assessment Report that mitigation measures are required for predicted damage of Category 1 or higher. The measures proposed include designing the piled wall as rigidly as possible, use of additional propping and a suggestion to use large diameter piles with increased reinforcement for additional rigidity.
- 4.22. A works duration is indicated in the Construction Management Plan (CMP), however a detailed programme should be submitted by the appointed contractor at a later date. Details of the CMP should be agreed with the Council.
- 4.23. An outline monitoring proposal is included in the Structural and Civil Engineering Planning Report with trigger levels included. Details and trigger levels should be agreed as part of the Party Wall award.



5.0 CONCLUSIONS

- 5.1. The BIA was undertaken by LBH Wembley Geotechnical & Environmental. The reviewer's qualifications are in accordance with CPG4 requirements.
- 5.2. The proposal includes increasing the depth of the existing lower ground floor and the Elliot Wood Structural and Civil Engineering Planning report states that a contiguous piles wall will be formed along the north-east of the proposed building. In addition reinforced concrete underpins will be constructed at the boundaries to the south-east and the south-west of the site and be constructed in a hit and miss sequence. Sketches to illustrate the construction sequence with any temporary propping indicated and an underpinning bay sequence are not provided and this is requested. The information provided should also include structural details of the proposed basement.
- 5.3. Details of the proposed bypass drainage system should be provided along with a permeability investigation to justify its suitability.
- 5.4. The omitted hydrogeology screening question should be addressed as discussed in Section 4
- 5.5. The screening exercise did not identify that the site is in an area at risk from surface water flooding. The BIA should be updated to consider this potential impact.
- 5.6. The issue of additional hard surface areas should be assessed as discussed in Section 4.
- 5.7. Young's Modulus values are not included in the retaining wall parameters and these are requested.
- 5.8. The ground movement assessment predicts Category 0 (Negligible) damage for No 5 The Hexagon and Category 1 (Very Slight) for No 3 The Hexagon. It is correctly identified that CPG4 requires mitigation measures for Category 1 or higher predicted damage and this is provided.
- 5.9. The full tabular input and output from the SAPPER programme is not included and this is requested for completeness.
- 5.10. Work durations have been indicated in the CMP, however a detailed programme should be submitted at a later date. Details of the CMP are to be agreed with the Council.
- 5.11. An outline monitoring proposal is included. Details and trigger levels are to be agreed as part of the Party Wall award.



Appendix 1: Residents' Consultation Comments



Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Man & Edwards	3 The Hexagon Fitzroy Park London N6 6HR	26/07/16	Ground water Stability/Damage to neighbouring building	See Audit Paragraph 4.7, 4.10 & 4.17 See Audit Paragraph 4.19, 4.20, 4.21 & 4.23
Apcar (on behalf or residents 10 Fitzroy Park)	Kinetic House Theobald St Borehamwood Hertfordshire WD6 4PJ	26/7/16	Stability of Grade II building Groundwater	See Audit Paragraph 4.3, 4.19, 4.20, 4.21 & 4.23 See Audit Paragraph 4.7, 4.10 & 4.17
Carnell	1 The Hexagon Fitzroy Park London N6 6HR	28/7/16	Stability of neighbouring buildings Groundwater flow	See Audit Paragraph 4.19, 4.20, 4.21 & 4.23 See Audit Paragraph 4.7, 4.10 & 4.17
Clements (on behalf of Highgate Society)	10A South Grove Highgate London N6 6BS	29/7/16	Increased Runoff (SuDS)	See Audit Paragraph 4.10 & 4.17



Appendix 2: Audit Query Tracker



Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format	BIA not undertaken in accordance with ARUP GSD and CPG4 requirements	Open – Omitted screening question to be assessed as outlined in Audit paragraph 5.4.	
2	BIA format	Works programme and CMP	Works duration provided in outline CMP. Detailed programme to be provided by appointed Contractor at a later date. Details of CMP to be agreed with Council.	N/A
3	BIA format/stability	Stiffness parameters not given for retaining wall design	Open – To be provided	
4	Hydrogeology	Impact of increased hard standing area and discharge to groundwater	Open – Risk to be assessed and appropriately addressed.	
5	Hydrogeology	Bypass Drainage System	Open – Details of proposed system and permeability testing results to be provided.	
6	Hydrology	Impact of increase hard standing area and discharge to groundwater	Open – Risk to be assessed and appropriately addressed.	
7	Hydrology	Screening did not identify that the site is located in an area at risk from surface water flooding.	Open – To be considered and addressed as necessary.	
8	Stability	Presence or absence of basement beneath neighbouring properties not discussed in BIA and foundations depths not determined.	Open – Presence or absence of basements to be beneath adjacent properties to be confirmed. Foundation depths investigated or maximum differential depth assumed.	
9	Stability	No construction sequence sketches and no temporary works proposal.	Open – Construction sequence sketches with temporary works indicated if required to be provided.	



10	Stability	Full input and output from the SAPPER programme not included	Open – to be provided for completeness	
11	Stability	Monitoring proposals	Outline proposal provided. Details and trigger levels to be agreed as part of Party Wall award.	N/A



Appendix 3: Supplementary Supporting Documents

None

London

Friars Bridge Court 41- 45 Blackfriars Road London, SE1 8NZ

T: +44 (0)20 7340 1700 E: london@campbellreith.com

Surrey

Raven House 29 Linkfield Lane, Redhill Surrey RH1 1SS

T: +44 (0)1737 784 500 E: surrey@campbellreith.com

Bristol

Wessex House Pixash Lane, Keynsham Bristol BS31 1TP

T: +44 (0)117 916 1066 E: bristol@campbellreith.com

Birmingham

Chantry House High Street, Coleshill Birmingham B46 3BP

T: +44 (0)1675 467 484 E: birmingham@campbellreith.com

Manchester

No. 1 Marsden Street Manchester M2 1HW

T: +44 (0)161 819 3060 E: manchester@campbellreith.com

UAE

Office 705, Warsan Building Hessa Street (East) PO Box 28064, Dubai, UAE

T: +971 4 453 4735 E: uae@campbellreith.com

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