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23 Ravenshaw Street
London, NW6 1NP

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12466-56

Revision: F1

August 2017

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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 23 Ravenshaw Street, London NW6 1NP (planning reference 2017/0911/P). The basement is considered to fall within Category C 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 proposed development involves the demolition of the existing building at 23 Ravenshaw Street followed by the construction of 8 flats over three storeys plus a basement level across the entire site to a depth of 3.5m below ground level.

1.5. The BIA has been prepared by Maund Geo-Consulting with supporting documents prepared by Croft Structural Engineers. In the revised submissions, the authors' qualifications are presented and are in accordance with LBC guidance.

1.6. A desk study has been presented, broadly in accordance with aspects recommended by LBC guidance. In the revised submissions, utility companies have been approached with regards to underground infrastructure and Network Rail has been consulted regarding the adjacent railway cutting to the southwest of the site. Network Rail state that they will secure asset protection measures via a Condition of Planning.

1.7. The site investigation identifies the London Clay as the bearing formation for the proposed foundations, underlying Made Ground. The site investigation indicates that groundwater is likely to be encountered within the basement excavation. Further investigation should be undertaken in advance of the excavation to confirm the likely groundwater conditions.

1.8. In the revised submissions, the structural scheme and temporary works proposals appear adequate. The retaining walls will be formed by underpinning, where excavations are required below Party Walls, and reinforced concrete walls will be formed in short sections in an 'underpinning' sequence to the front and rear of the site. The retaining walls will be propped in the temporary and permanent cases.

1.9. In the revised submissions, the ground movement assessment has been updated and a damage assessment has been undertaken for the neighbouring properties. The predicted movements

are within the range expected considering the depth of the proposed basement. Damage impacts to neighbours are predicted to be within Category 1 (Very Slight), which is accepted.

1.10. The BIA presents an outline structural monitoring methodology which is considered appropriate.

1.11. Ravenshaw Street is within the designated 'Sumatra Road' Local Flood Risk Zone and within a Critical Drainage Area, although this was not identified within the original BIA screening or scoping process. In the revised submissions, further assessment is presented and it is accepted that the proposed development is as very low risk of flooding from all sources.

1.12. An attenuation drainage scheme is proposed that will reduce the surface water run off rate by up to 70% of the existing condition. This should provide an improvement to the current site conditions and betterment to the wider hydrological environment.

1.13. The proposed development will not impact the wider hydrogeological environment.

1.14. Non-technical summaries have been provided within the revised BIA submissions.

1.15. Queries and matters requiring further information or clarification are discussed in Section 4 and summarised in Appendix 2. Considering the revised submissions, the BIA meets the requirements of CPG4.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 7 March 2017 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 23 Ravenshaw Street, London NW6 1NP, Camden Reference 2017/0911/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; and,

c) 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 three storey plus basement building comprising 8x flats (4 x 3-bed units and 4 x 2-bed units) following the demolition of the existing house".

2.6. CampbellReith accessed LBC's Planning Portal on 21 April 2017 and gained access to the following relevant documents for audit purposes:

· Basement Impact Assessment dated 7 July 2016 by Maund Geo-consulting.

- Basement Method Statement dated 12 March 2015 (ref 150122) by Croft Structural Engineers.
- Scheme Structural Calculations for Planning dated 6 July 2016 (ref 150122) by Croft Structural Engineers.
- Structural Monitoring Statement dated 10 March 2015 (ref 150122) by Croft Structural Engineers.
- Draft Construction Management Plan dated February 2017 by G2 Planning Solutions.
- Design and Access statement by Chris Taylor (the applicant).
- Planning Statement dated 7 February 2017 by Chris Taylor (the applicant).
- Existing plans and elevations, proposed elevations, proposed CGI views, proposed sections dated 11 February 2017 by Chris Taylor (the applicant).
- Proposed floor plans dated 15 February 2017 by Chris Taylor (the applicant).
- Tree Survey Report dated 4 February 2014 by Tree Reports Ltd.
- Comments and objections to the proposed development from local residents.

2.7. Additional supplementary documents were provided for review in June and July 2017:

- Consultation with Network Rail and Thames Water Responses.
- Basement Method Statement dated 25 May 2017 Rev 3 (ref 150122) by Croft Structural Engineers.
- Revised Basement Impact Assessment (dated 7 July 201) by Maund Geo-consulting, revisions undated.
- Structural Calculations, Drawings and Sections by Croft Structural Engineers.
- Utilities Drawings.
- Flood Risk Reports (Groundsure, Homecheck).

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	The input of CEng MICE author / reviewer is confirmed.
Is data required by Cl.233 of the GSD presented?	Yes	Updated in revised submissions.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	Updated in revised submissions.
Are suitable plans/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Updated in revised submissions.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA, Section 6.1. The potential for perched water to be present above the London Clay formation level has been identified.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	Updated in revised submissions.
Is a conceptual model presented?	Yes	BIA, Figure 7.1 However, it does not identify potential impacts e.g. to adjacent railway cutting etc.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Updated in revised submissions.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	Updated in revised submissions.
Is factual ground investigation data provided?	Yes	BIA report Section 3 and Appendix C.
Is monitoring data presented?	Yes	BIA report Section 4 and Appendix D.
Is the ground investigation informed by a desk study?	Yes	BIA report and Design and Access Statement.
Has a site walkover been undertaken?	Yes	
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	Shallow foundations assumed for GMA
Is a geotechnical interpretation presented?	Yes	BIA report Section 5.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Geotechnical design parameters presented. Retaining wall design outlined in Scheme Structural Calculations Report. However, rear basement wall construction methodology unclear.
Are reports on other investigations required by screening and scoping presented?	Yes	Ground movement assessment provided in Scheme Structural Calculations Report. However, should be updated to include effects of heave, identify a zone of influence and assess structures within the zone.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	No	However, stability assessments generally conservative. Hydrogeological impacts not applicable.

Item	Yes/No/NA	Comment
Is an Impact Assessment provided?	Yes	BIA report – Section 8
Are estimates of ground movement and structural impact presented?	Yes	Updated in revised submissions.
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	Updated in revised submissions.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Network Rail will require mitigation measures secured by a condition of planning.
Has the need for monitoring during construction been considered?	Yes	Basement Monitoring Statement report outlines the monitoring works to be undertaken at the site.
Have the residual (after mitigation) impacts been clearly identified?	Yes	Updated in revised submissions.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	Updated in revised submissions. NR to be consulted regarding cutting.
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	Updated in revised submissions. NR to be consulted regarding cutting.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Updated in revised submissions.
Are non-technical summaries provided?	Yes	Summary to BIA considered understandable although not wholly non-technical.

4.0 DISCUSSION

4.1. The BIA has been prepared by Maund Geo-Consulting with supporting documents prepared by Croft Structural Engineers. In the revised submissions, the authors' qualifications have been demonstrated to be in accordance with the requirements of CPG4.

4.2. The BIA indicates that the proposed work involves the demolition of the existing building at 23 Ravenshaw Street followed by the construction of a development of 8 flats over three storeys plus a basement level across the entire site at a depth of 3.5m below ground level. Neither the site nor the surrounding structures are designated as listed buildings and the site does not lie within a conservation area. The rear site boundary is along the top of a Network Rail cutting.

4.3. The construction methodology indicates underpinning the neighbouring party walls to form the new basement level, and casting new retaining liner walls internally to the underpins. Sequencing and propping information is provided within the Basement Method Statement. Basement walls to the front of the property adjacent to the highway will be formed in a similar 'underpinning' sequence. Retaining wall design is provided in the Scheme Structural Calculations report. The construction methodology for the basement walls at the rear of the development have been provided in the revised submissions.

4.4. The site investigation undertaken identifies the London Clay as the bearing formation for the proposed foundations, underlying Made Ground. Interpretative geotechnical information in accordance with the GSD Appendix G3 is presented. The site investigation and BIA have been informed by a desk study broadly in accordance with the GSD Appendix G1. In the revised submissions utility companies have been approached with regards to underground infrastructure and records are presented.

4.5. The BIA presents discussion on the slope of the rail cutting and the stability of the London Clay. However, it does not consider the potential impact of the proposed development to the rail cutting and assets. Network Rail has now been consulted and their requirements should be adopted, secured by a condition of planning.

4.6. Groundwater was encountered as seepages within the London Clay during the site investigation. Monitoring was undertaken indicating water above basement formation level. A leaking water main (reported as being subsequently repaired) has been identified as the cause of high water levels, within the Made Ground, during one period of monitoring. The basement has been designed adopting an assumed worse case water level of 0.5m below ground level (bgl). This is generally accepted as a reasonably conservative approach. It is recommended that further groundwater monitoring is undertaken in advance of excavation to further inform temporary works contingency planning and control of construction.

4.7. Dewatering is likely to be required and this is briefly discussed in the BIA. Given the choice of underpinning as the construction methodology, and the granular nature of the Made Ground, this will need to be carefully considered and detailed by the contractor.

4.8. The structural scheme and temporary works proposals appear adequate, and the revised submissions provide further information on propping and sequencing, including construction of the rear walls. Based on the information provided and discussion with the Engineer, this audit considers that the retaining walls will be propped at all times, in both the temporary and permanent cases.

4.9. A heave assessment is presented for the whole site, and a separate Ground Movement Assessment (GMA) is presented that considers the movements related to excavation and construction of the basement retaining walls. The movements indicated in both the heave assessment and GMA are in line with expectations for a basement development of this depth formed by underpinning.

4.10. The original BIA indicated Category 1 damage (Very Slight) in regards to 21 Ravenshaw Street. However, this assessment was not considered comprehensive and additional assessment was requested, to consider the specific construction methodologies to be adopted and other properties in the zone of influence of the development. In the revised submissions, damage Category 1 (Very Slight) is predicted for 21 and 25 Ravenshaw Street. Considering the proposed temporary works sequencing and propping arrangements, including the requirement for retaining walls to be stiffly propped both in the temporary and permanent case, the movements and damage category predicted are in line with expectations, assuming good workmanship by an experienced contractor.

4.11. The BIA presents an outline structural monitoring methodology, including visual condition surveys, measured survey using total station and crack monitoring, if applicable. Frequency of survey, trigger levels and contingency actions are considered appropriate to maintain damage impacts to neighbours within Category 1.

4.12. Ravenshaw Street is within the designated 'Sumatra Road' Local Flood Risk Zone and within Critical Drainage Area (Group 3-010), although this was not identified within the original BIA screening or scoping process. Developments within Local Flood Risk zones require a flood risk assessment. The BIA identified that the site is at very low risk of surface water flooding, from referenced Environment Agency data. The adjacent highway is identified as low to medium risk. The risk from sewer surcharging was not originally assessed.

4.13. In the revised submissions flood risk assessments from two sources are presented confirming a very low risk of flooding. Additionally correspondence with Thames Water is presented confirming that a relief sewer in the area is now operational, easing the demand on local

drainage and likelihood of surface water flooding. It is accepted that the proposed development is at very low risk. Standard mitigation measures such as elevated thresholds to entrances and lightwells, the use of non-return valves and appropriate drainage should be adopted in the final construction.

4.14. The proposed scheme will slightly increase the proportion of permeable area. An attenuation scheme is proposed, with a rainwater collection tank that will reduce the surface water run off rate by up to 70% of the existing condition. This should provide an improvement on the current site conditions and betterment to the wider hydrological environment.

4.15. The proposed development will not impact the wider hydrogeological environment.

4.16. Queries and matters requiring further information or clarification are summarised in Appendix 2.

5.0 CONCLUSIONS

5.1. In the revised submissions, the authors' qualifications have been demonstrated to be in accordance with the requirements of CPG4.

5.2. Network Rail has been consulted regarding the adjacent railway cutting to the southwest of the site. Network Rail state that they will secure asset protection measures via a Condition of Planning.

5.3. The London Clay will be the bearing formation for the proposed foundations, underlying Made Ground. Groundwater is likely to be encountered within the basement excavation. The contractor should confirm groundwater conditions in advance of the construction works.

5.4. In the revised submissions, the structural scheme and temporary works proposals appear adequate. The retaining walls will be propped in the temporary and permanent cases.

5.5. In the revised submissions, the ground movement assessment has been updated and a damage impacts to neighbours are predicted to be within Category 1 (Very Slight), which is accepted.

5.6. The BIA presents an outline structural monitoring methodology which is considered appropriate.

5.7. In the revised submissions, further assessment is presented and it is accepted that the proposed development is as very low risk of flooding from all sources.

5.8. An attenuation SUDS scheme is proposed that should provide an improvement on the current site conditions and betterment to the wider hydrological environment.

5.9. The proposed development will not impact the wider hydrogeological environment.

5.10. Queries and matters that required further information or clarification are summarised in Appendix 2. Considering the revised submissions, the BIA meets the criteria of CPG4.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Eastwood	95 Ravenshaw Street	25th February 2017	Concerns about excavation of basement causing subsidence issues for surrounding houses and disturbance of underground streams.	5.5, 5.9
Sluys	33a Mill Lane NW6 1NZ	13th March 2017	Concerns about creating basements in a flood area. Both Mill Lane and Ravenshaw Street become 'veritable torrents of water in heavy rainfall'.	5.7
Earl	Fortune Green and West Hampstead Neighbourhood Development Forum	17th March 2017	Concerns about basement in a flood area and structural problems for neighbouring properties.	5.5, 5.7
Caines	29 Ravenshaw Street	17th March 2017	Concerns about structural integrity and impact on neighbouring houses.	5.5
McGill	47 Ravenshaw Street	Not provided	Basement excavation does not address the proximity of the high speed railway line.	5.2
Alfano	40 Ravenshaw Street	Not provided	Concerns about subsidence issues.	5.5
Bermudez	15 Dornfell Street	Not provided	Concerns about subsidence and structural impact issues relating to basement excavation in close proximity of the high speed railway line.	5.2, 5.5
Not provided	Not provided	Not provided	Houses on Ravenshaw Street have historically suffered from subsidence and ground movement. Excavation will cause movement.	5.5

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status/Response	Date closed out
1	BIA Format	BIA authors' qualifications	Closed	July 2017
2	Desk Study	Identify underground infrastructure within proposed development's zone of influence	Closed	July 2017
3	Desk Study	Proximity of railway cutting requires consultation with Network Rail.	Noted that NR Asset Protection Team have detailed likely requirements that should be secured by a Condition of Planning	N/A
4	Groundwater	Further groundwater monitoring should be undertaken.	Contractor to confirm groundwater levels in advance of construction as 4.6, 4.7	N/A
5	Surface Water Flow	Proposed development is located within a Local Flood Risk Zone – additional assessment / mitigation.	Closed	July 2017
6	Stability	Construction methodology for rear basement walls and propping of lightwells	Closed	July 2017
7	Stability	Ground Movement Assessment and Damage Assessment for all structures within the zone of influence. Monitoring proposals to be updated (if required).	Closed	July / August 2017
8	BIA Format	Non-technical summaries	Closed	July 2017

Appendix 3: Supplementary Supporting Documents

None

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