

60-70 Shorts Gardens & 14-16
Betterton Street
WC2H

Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12466-86
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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 60-70 Shorts Gardens & 14-16 Betterton Street WC2H (planning reference 2017/2204/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 Basement Impact Assessment (BIA), desktop study, ground movement, and screening reports have been carried out by established engineering and geotechnical consultants. Ground conditions have also been described by a chartered geotechnical consultant. Qualifications of the authors have been demonstrated to be in accordance with LBC guidance.
- 1.5. The proposal consists of deepening an existing partial single storey basement to double height, in order to match the depth of an existing double height basement to the property.
- 1.6. A desktop study has been undertaken. However, a site specific site investigation has not been carried out due to current access restrictions. A conceptual site model should be presented following the site investigations.
- 1.7. The ground conditions are anticipated as being Made Ground, overlying River Terrace Gravel and London Clay. It has been identified that the excavation is likely to encounter ground water. Until a site investigation is undertaken, the exact ground and groundwater conditions remain unknown.
- 1.8. The basement structure is proposed to be constructed utilising underpinning, completed with reinforced concrete liner walls.
- 1.9. In order to allow excavation below groundwater level, injection of the surrounding soil with grout is proposed. This is a specialist construction technique that must be carried out carefully by an experienced contractor in order to avoid causing movement of the surrounding ground.
- 1.10. It is noted that, whilst temporary works have been proposed, until site specific ground and groundwater conditions are fully understood the appropriateness of proposed temporary works cannot be fully assessed, including consideration of suitable excavation and construction techniques through saturated granular soils.

- 1.11. An outline structural design has been produced for the basement walls and for the basements resistance to floatation from ground water in order to demonstrate the structural feasibility of the proposal.
- 1.12. A ground movement assessment has been carried out based on assumptions of the ground conditions, which predicts damage to neighbouring buildings of either Category 1 or 2 depending on assumptions taken. This is to be revisited following the site investigations. It should be noted that Category 1 damage is the maximum permissible.
- 1.13. An adequately detailed construction programme has been provided.
- 1.14. A Crossrail tunnel has been identified beneath the site, with dialogue open with Crossrail regarding obtaining approval for the proposal from their safeguarding team.
- 1.15. Provisional assessment has indicated that the impact on groundwater flows will be minimal. This is to be reviewed following further site investigations and presented in a Basement Construction Plan (BCP).
- 1.16. The BIA states that the existing basement has historically flooded with some research presented into the cause of this. Further consideration of flood risk to the proposed development should be given, including mitigation measures to be incorporated, following the site investigation.
- 1.17. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.
- 1.18. It is recommended that a Basement Construction Plan (BCP) is secured by a condition of planning, due to the complexity of the proposed construction and the current lack of site investigation information.
- 1.19. Closed queries and matters to be presented in a BCP are summarised in Appendix 2.
- 1.20. Subject to the completion and approval of the basement construction plan it is accepted that the requirements of CPG4 have been met.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 26 June 2017 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 60-70 Shorts Gardens & 14-16 Betterton Street WC2H, planning reference 2017/2204/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.
- Local Plan Policy A5 Basements.

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;
- 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 *"The refurbishment, extension and alteration of 60-70 Short Gardens and 14-16 Betterton Street to provide a two storey roof extension to both properties and a mix of B1/A1/A3/D1/D2/C3 uses. The development proposes the refurbishment of the basement and the installation of mezzanine floors associated to the basement and ground floor units of Shorts Garden. These floors will provide a mix of A3/D1/D2*

uses and B1/D1/D2 respectively, with all upper floors on Shorts Gardens for B1 use. A change of use to Betterton Street to provide a mix of C3 to upper floors and A1/D1/D2 uses on ground floor with the introduction of a mezzanine to this unit. Dedicated cycle storage for residential and office uses will be located on ground floor and basement of Betterton Street and provision of refuse and recycling storage areas are located on ground floors of both buildings. Ancillary and plant spaces are allocated within basement areas of Shorts Gardens and Betterton Street, with a UKPN substation on the ground floor and a discrete plant enclosure on the roof of Shorts Gardens.”

The Audit Instruction also confirmed 60-70 Short Gardens and 14-16 Betterton Street neither involved, or was a neighbour to, listed buildings.

2.6. CampbellReith accessed LBC’s Planning Portal on 10/07/17 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment Report (BIA), Fluid Structures, Ref:24509/May ‘17
- Preliminary Investigations Report, Soiltechnics, Rev:0 January 2015
- Construction Management Plan, Draft 02, 06/04/2017
- Planning Drawings, Stanton Williams, Project 498, Rev 00
 - Existing plans, elevations, and sections
 - Proposed plans, elevations, and sections
 - Demolition plans, elevations, and sections
 - Site location plan

2.7. The following documents were received via email during W/C 17/07/17 and where still relevant, have been included in Appendix 3 of this audit report.

- Structural Statement, Fluid Structures, 21/07/2017
- Historic borehole scans and borehole logs, Soiltechnics
- Ground movement Analysis, ground model, and geological statement, Soiltechnics, 14/07/2017
- Screening report, Soiltechnics, Rev:0, July 2017

2.8. The following documents were received from the applicant following the issue of the D1 revision of this audit report and are presented in Appendix 3;

- BIA Audit (Appendix 2) Response, Fluid Structures, 07/09/17
- Structural Feasibility Report P2, Fluid Structures, 22/03/17
- Appendix B: Structural Calculations, Fluid Structures
- Preliminary Basement Impact Assessment P2, Fluid Structures, 07/09/17

- Screening report, Soiltechnics, Rev02
- 2.9. The following documents were received from the applicant following the issue of the D2 revision of this audit report and are presented in Appendix 3;
- Geological and Hydrogeological statement, Chord Environmental Ltd, 15/11/17
 - Screening report, Soiltechnics, Rev03

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	Credentials provided for the author(s) of the BIA and Chord letter report are in accordance with the requirements of CPG4.
Is data required by Cl.233 of the GSD presented?	Yes	Appropriate plans and maps, along with a construction programme are provided.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	No	General details of the temporary and permanent works have been provided. However, ground and groundwater conditions not confirmed. Construction methods are not yet confirmed, nor their potential impacts i.e. permeation grouting and stability of water bearing granular soils.
Are suitable plan/maps included?	Yes	Architects drawings, desktop study report.
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	BIA screening report. A statement of justification has been provided for each no answer.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA screening report. A statement of justification has been provided for each no answer.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA screening report. A statement of justification has been provided for each no answer.

Item	Yes/No/NA	Comment
Is a conceptual model presented?	Yes	A partial conceptual model has been produced, however this is incomplete due to the lack of SI and knowledge of neighbouring basements and should be updated following the SI.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	Scoping is generally discussed as part of screening, or within conclusions, for all yes answers.
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	No	Scoping is generally discussed as part of screening, or within conclusions, for yes answers. However the cumulative impact on ground water flows has not been discussed.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No hydrology items were identified by the screening stage.
Is factual ground investigation data provided?	No	No site specific ground investigation has been carried out.
Is monitoring data presented?	No	
Is the ground investigation informed by a desk study?	No	However, preliminary assessment by Soiltechnics based on historic, surrounding borehole data is presented.
Has a site walkover been undertaken?	Yes	Photographs and the description of the site indicate that a walkover has been carried out.
Is the presence/absence of adjacent or nearby basements confirmed?	No	Some nearby structures are identified as having basements, whilst others are stated to "require investigation".
Is a geotechnical interpretation presented?	No	
Does the geotechnical interpretation include information on retaining wall design?	No	

Item	Yes/No/NA	Comment
Are reports on other investigations required by screening and scoping presented?	Yes	A preliminary ground movement assessment is presented. However, this is based on a number of assumptions and should be revised based on site specific information.
Are the baseline conditions described, based on the GSD?	No	Baseline conditions based on the desktop study were determined. However, these should be confirmed through site investigation.
Do the base line conditions consider adjacent or nearby basements?	No	
Is an Impact Assessment provided?	Yes	The impacts of items carried forward from screening and scoping are discussed. However, not all potential impacts considered.
Are estimates of ground movement and structural impact presented?	Yes	Movement analysis, ground model and geological statement by Soiltechnics. This is a preliminary assessment based on assumptions and requires confirmation. Noted that Category 2 damage to adjacent structures is predicted.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	No	Not all potential impacts considered e.g. cumulative hydrogeological impacts.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	The BIA discusses the use of mitigation measures to control ground water and to assist excavation. These should be confirmed based on site investigation information. Damage impacts to be mitigated to within CPG4 requirements.
Has the need for monitoring during construction been considered?	Yes	Section 10 of the BIA.
Have the residual (after mitigation) impacts been clearly identified?	No	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	GMA and method statement presented, based on assumptions. However further details of the construction method will need to be provided as part of a Basement Construction Plan.

Item	Yes/No/NA	Comment
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	No	The cumulative impact on the water environment has not been discussed.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	The cumulative impact on the water environment has not been discussed.
Does report state that damage to surrounding buildings will be no worse than Burland Category 1?	No	The current worst case damage category calculation is 2. This is to be revisited following the SI.
Are non-technical summaries provided?	No	

4.0 DISCUSSION

- 4.1. The Basement Impact Assessment (BIA) has been carried out by an established firm of engineering consultants, Fluid Structures, whose qualifications are in accordance with CPG4 for the slope stability and hydrological aspects of the assessment.
- 4.2. Desktop study and screening reports have been produced by Soiltechnics Ltd, an established firm of environmental and geotechnical consultants, along with a geological and hydrogeological statement by Chord Environmental Ltd. The qualifications of the authors are in accordance with CPG4 for the hydrogeological aspect of the assessment.
- 4.3. The LBC Instruction to proceed with the audit identified that the basement proposal neither involved a listed building nor was adjacent to listed buildings.
- 4.4. The existing building comprises three storeys of super structure and a double height 7.5-8m deep basement level, is of late Victorian construction, and a combination of load bearing masonry and steel framing. To the east and west of the double height basement, separate single storey basement areas of approximately 4m in height are present.
- 4.5. The proposal consists of deepening the single storey height basement to the west to match the level of the main double storey basement level in order to provide a stair access to the main basement level. It is also proposed to provide a partial mezzanine level to the existing basement.
- 4.6. A desktop study has been undertaken to determine the likely ground conditions of the site, which primarily is based on information from 6 publically available boreholes located between 70m and 660m from the proposed development site, along with geological maps. No site specific borehole or trial pits have been undertaken.
- 4.7. It is stated that a full site investigation will take place once access is possible to the site in order to verify the construction proposals and impact assessment that have been based on the desktop study. While it is usually expected that site specific investigations are carried out prior to planning permission being granted, it is accepted that in some instances (due to current access constraints) site investigations have to follow on from this, with the proposed construction process informed by a detailed desktop study at the planning stage.
- 4.8. The ground conditions are anticipated in the BIA as being 3-4m of Made Ground overlying, 2-3.5m of Lynch Hill Gravel, overlying 20m of London Clay. Likewise ground water levels are predicted as being between 17.4m and 19.4m AOD (between 5.6mbgl and 3.6mbgl) within the Lynch Hill Gravel.

- 4.9. The construction method is proposed as reinforced concrete underpinning to the existing perimeter walls to the level of the double height basement foundation, with a basement slab and reinforced concrete liner walls within the underpinning to permanently resist lateral forces from the basement walls. A mezzanine level and ground level slab will be cast in conjunction with the liner walls to form two levels of permanent props to the liner walls. The basement slab is to be cast over a void former in order to negate the effects of heave forces on the underside of the basement.
- 4.10. A calculation has been produced to check the proposed basement for buoyancy and has determined that the existing building will be sufficiently heavy to counteract uplift with its self-weight. This is generally accepted however this should be considered in more detail during the detailed design to ensure that a sufficient factor of safety is achieved when considering the building's self-weight alone using accurate dead loads. The basement slab design should also be considered during detailed design and how this interacts with the existing structure to mobilise the building's self-weight against uplift.
- 4.11. The structural solution is accepted as an appropriate and commonly adopted form of basement construction, with outline calculations produced to indicate the feasibility of the proposal and to provide approximate structural member sizes.
- 4.12. Outline temporary works drawings are provided that indicate the stages of construction, with the initial underpinning carried out in hit and miss bays that are to be propped at the head, with additional props installed as the ground level is reduced. Raking props are to be installed to the basement wall internal to the existing basement, in order to transfer lateral loads from the west basement excavation face into the existing basement slab. Liner walls are indicated as being installed in half storey lifts, with lateral propping maintained throughout and to the face of the liner walls as they are installed. Mezzanine and ground floor slabs are indicated as being installed bottom up along with the liner walls, with temporary propping sequentially removed as the permanent slab props are constructed.
- 4.13. While the base of the Lynch Hill Gravel member is not known precisely it has been estimated to lay at approximately 16.7m AOD, which would be located close to the proposed basement slab level of approximately 16.0m AOD, indicating that the majority of the excavation depth may be through Made Ground and Lynch Hill Gravel.
- 4.14. The Lynch Hill Gravel has been identified as being a Secondary A aquifer that is of moderate permeability and likely to contain groundwater. Permeation grouting is proposed in order to reduce the potential for groundwater flows through the gravel prior to excavation. Whilst this is recognised as an effective method in reducing groundwater flows during excavation, it is likely that a complete barrier to water will not be formed and that some water inflows will still occur. No additional dewatering strategy has been proposed, which should be given consideration.

- 4.15. It is also noted that permeation grouting is a specialist activity that can result in ground and structural movements if not appropriately designed, installed and controlled. As such, a site specific assessment and methodology would need to be considered following a site investigation to ensure suitability, including an assessment of potential impacts to neighbouring structures.
- 4.16. Details of neighbouring basements have been presented, with the buildings immediately to the west containing either a single storey basement or no basement. The larger TV studio further to the west contains a deep basement of approximately 6.5m depth. To the east, the neighbouring building contains a double storey basement. While it is indicated that the proposed basement extension will likely disrupt the ground water flows, ground water will be diverted to the west and will pass beneath the single storey basements of the neighbouring properties, and the impact on ground water flows overall will be negligible. It is accepted that a pathway will remain to the west of the proposed basement extension, although this pathway will become more restricted, it will still be approximately 20m. It is recommended that the conclusions of the impact on groundwater flow be reviewed following the site specific SI.
- 4.17. The BIA states that the existing basement has historically flooded. Some discussion is presented in previous investigations into the cause of this, which were inconclusive in determining whether the flooding was attributable to ground water entering the basement or a manmade source such as a nearby leaking water main. Further assessment of the risk of ground water flooding will be required of the proposed basement, which is to be submitted as part of the BCP following the SI.
- 4.18. A ground movement assessment (GMA) has been produced based on three, separate assumed ground models: Lynch Hill Gravel overlying London clay; Lynch Hill Gravel only; and, London Clay only. The walls have been considered as embedded retaining walls with ground movements calculated in accordance with CIRIA 760. Impacts of up to damage Category 2 (Slight) have been calculated. Once ground conditions have been confirmed by site investigation the GMA should be updated to indicate a final damage category prediction presented as part of a BCP, with it noted that Category 1 being the maximum that LBC can accept. It should be noted that CIRIA C760 is intended for use with embedded retaining walls as opposed to underpinning, however it is considered to provide an conservative approximation for ground movements caused by underpinning in certain situations.
- 4.19. An adequately detailed programme has been provided that details a construction phase from March 2018 until March 2019.
- 4.20. It has been identified that a Crossrail tunnel is located beneath the site, with evidence of correspondence with the Crossrail safeguarding team provided. Approval will be required to be obtained from Crossrail prior to commencement of the works.

- 4.21. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding from surface water or rivers and seas.
- 4.22. Given the complexities of the proposal it is recommended that a more detailed proposal is prepared by the applicant and included in a Basement Construction Plan (BCP) in accordance with CPG4. This should provide:
- Data from a site specific investigation, to confirm the ground and groundwater conditions;
 - Existing foundation / basement details to adjacent and neighbouring structures;
 - Detailed method statements relating to the design, application and control of permeation grouting, the likely effectiveness of this grouting and whether additional dewatering measures are required;
 - Any other specific temporary works measures required;
 - An updated GMA;
 - Impacts to neighbouring structures and mitigation measures to be adopted;
 - A detailed structural movement monitoring proposal to effectively control the works and maintain damage within Category 1;
 - An assessment of the risk of ground water flooding to the proposed basement based on data obtained from the SI.
 - A complete Conceptual Site Model that collates the existing and proposed structural details in the context of the ground model, identifying the potential risks and impacts. e.g. to neighbouring structures, underground assets, the hydrogeological environment etc.
 - Confirmation that the assessments presented within the BIA are correct, updating these assessments as required.
- 4.23. Provided an adequate BCP containing the items listed above, it is accepted that information has been provided to satisfy the other queries identified within this audit as listed in Appendix 2.

5.0 CONCLUSIONS

- 5.1. Qualifications of the BIA authors are in accordance with CPG4.
- 5.2. A desktop study has been undertaken. A complete conceptual site model is to be presented in the BCP once the SI has been carried out.
- 5.3. It is accepted that there are no impacts relating to slope stability.
- 5.4. Whilst flood risk from surface water and rivers and seas is accepted to be very low, the BIA reports flooding of the existing basement. Some assessment has been made of the cause of flooding which should be reviewed following the SI.
- 5.5. A cumulative groundwater assessment has been carried out based on the anticipated geology and hydrogeology, which indicates the impact on ground water flows is likely to be low. This assessment is agreed with in principle, however it should be reviewed following the site specific SI and presented in the BCP.
- 5.6. A Crossrail tunnel has been identified beneath the site, approval from Crossrail's safeguarding team therefore being required.
- 5.7. An outline construction programme has been provided.
- 5.8. Assessments are based on assumed ground and groundwater conditions. Until a site investigation is undertaken, the exact ground and groundwater conditions remain unknown, and an updated assessment should be submitted as part of the BCP.
- 5.9. Whilst temporary and permanent works have been proposed, until site specific ground and groundwater conditions are fully understood the appropriateness of proposals cannot be fully assessed. Further details of which should be submitted following the SI as part of the BCP, particularly relating the proposed to permeation grouting.
- 5.10. An outline structural design has been produced for the basement walls and for the basements resistance to floatation in order to demonstrate the structural feasibility of the proposal.
- 5.11. A ground movement assessment has been carried out that predicts damage to neighbouring buildings of Category 2 (Slight). LBC guidance requires that where Category 1 (very Slight) or greater is predicted, mitigation measures must be proposed. It should be noted that Category 1 damage is the maximum permissible and should be reviewed following the SI and submitted as part of the BCP.

- 5.12. It is recommended that a Basement Construction Plan (BCP) is secured by a condition of planning, due to the complexity of the proposed construction and the current lack of site investigation information.
- 5.13. Closed queries and matters to be presented in a BCP are summarised in Appendix 2.
- 5.14. Subject to the completion and approval of the basement construction plan it is accepted that the requirements of CPG4 have been met.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
TFL Planning	Windsor House, SW1H 0TL	19.5.17	The proposed development is directly over a Crossrail Tunnel. Crossrail Safeguarding Team to be Consulted.	See section 4.

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Stability	Clarification is required regarding the presence of nearby tunnels, with the screening stating that there are none within 50m of the site, yet the BIA identifying that a Crossrail tunnel is located beneath the site. Consultation with TFL should be presented regarding any restrictions imposed on the development.	Crossrail safeguarding to be secured via planning condition	N/A
2	Stability	To be provided: Site specific ground investigation, depth of neighbouring foundations and basements, appropriate temporary and permanent works to be confirmed, GMA and damage impact assessment, structural monitoring strategy	It is recommended a BCP is secured by a condition of planning to address these issues.	N/A
3	Stability	Outline structural calculations to indicate feasibility of the basement retaining walls is required. Outline structural calculations or scheme to deal with buoyancy is required.	Closed – The applicant has provided satisfactory outline structural calculations	25/09/17
4	Hydrogeology	The potential cumulative impact on ground water flows should be discussed.	Appended documents to BIA indicate pathway for water between proposed basement and neighbouring basements, which is to be reviewed in the BCP	N/A
5	BIA Format	Author qualifications – should be demonstrated as per CPG4 requirements	Closed – Letter report provided by Chord Environmental Ltd	29/11/17
6	BIA Format	A Conceptual Site Model should be presented that collates the existing and proposed structural details in the context of the ground model, identifying the potential risks and impacts. e.g. to neighbouring structures, underground assets, the hydrogeological environment etc.	It is recommended a BCP is secured by a condition of planning to address these issues.	N/A
7	Hydrogeology	The BIA notes that the current basement has historically flooded. Further assessment as to the causes of flooding should be presented, including mitigation measures to be adopted in the proposed	It is recommended a BCP is secured by a condition of planning to address these	N/A

		development.	issues.	
8	Stability	GMA to be revisited following the site investigations in order to confirm that damage category does not exceed 1.	It is recommended a BCP is secured by a condition of planning to address these issues.	N/A

Appendix 3: Supplementary Supporting Documents

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