

**3 Greenaway Gardens
London NW3 7DJ**

**Basement Impact Assessment
Audit**

For
London Borough of Camden

Project Number: 12066-53
Rev: F1

February 2016

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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 (BIA) submitted as part of the Planning Submission documentation for 3 Greenaway Gardens (planning reference 2015/3373/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 basements 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 review it against an agreed audit check list. Additional information has been provided in response to Campbell Reith's initial audit report, revision D1.
- 1.4. The BIA and Ground Investigation Report (GIR) have been prepared by personnel who have suitable qualifications.
- 1.5. The proposed development comprises alteration works to the superstructure of the existing detached building and the introduction of a basement, up to 7.6 metres deep below existing ground floor level, founded in the Claygate Member.
- 1.6. The revised BIA has confirmed that the basement will be constructed by a combination of conventional underpinning below the perimeter wall adjacent to No.2 and a secant piled retaining wall elsewhere on the basement boundary.
- 1.7. Additional documentation has provided satisfactory information concerning construction methodology to stabilise the retained façade and provide temporary works to enable demolition of parts of the original building, install underpinning and piled retaining walls and excavate the basement.
- 1.8. The Revised GMA for 2 and 4 Greenaway Gardens is considered acceptable, with up to damage Category 2 (Slight) being predicted. Mitigation is therefore required.
- 1.9. Additional documentation has provided an acceptable ground movement monitoring proposal once anticipated movements can be agreed.
- 1.10. It is accepted that there will be no significant alteration to existing surface water drainage flows and the hydrology of the general area will be unaffected.
- 1.11. Additional information has allowed confirmation that the hydrogeology of the general area will be unaffected.
- 1.12. It is accepted that land stability issues will not impact on the general area.

- 1.13. Queries and requests for further information are summarised in Appendix 2.
- 1.14. The revised BIA information supplied subsequently adequately identifies the impacts to and from the basement proposals and outlines suitable construction techniques for this stage of the project.

2.0 INTRODUCTION

- 2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 04 September 2015 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 3 Greenaway Gardens, Camden Reference 2015/3373/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 the *"Excavation of basement with associated front and rear rooflights, replacement of existing side garage, erection of 3-storey rear extension at ground, first and second floor (roof) level, formation of terrace at rear first floor level, erection of rear dormer window and alterations to windows and doors on side elevation and change of use of property from 2 x self-contained flats to single-family*

dwellinghouse (Class C3) (as approved under planning permission 2011/3798/P on 23/09/2011) and also an increase in height and depth of approved rear extension, and enlargement of approved basement to the front side and rear including underground parking and a car lift and repositioning the two existing dormers and roof lights on the side (south elevation)”

and confirmed that the basement proposals neither involved nor were a neighbour to listed buildings.

2.6. CampbellReith accessed LBC's Planning Portal on 21 September and 05 October and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA)
- Desk Study and Ground Investigation Report (GIR)
- Architect's Drawings
 - Proposed
 - Existing

2.7. Following the issue of CampbellReith's Audit Report Version D1, the following additional information was made available for further auditing purposes:

- Revised Basement Impact Assessment (RBIA) dated December 2015 by Michael Alexander
- Ground Movement Assessment (GMA) dated August 2015 by GEA
- Movement & Vibration Monitoring during Piling & Excavations dated October 2015 by design STUDIO².
- Preliminary Construction Method Statement dated November 2015 by design STUDIO².

2.8. Following the issue of CampbellReith's Audit Report Version D2, a revised Ground Movement Assessment (RGMA) dated January 2016 was provided by GEA.

2.9. This audit report has been generally updated to reflect the additional information provided other than Section 4, where the original comments have been kept and further commentary added where appropriate.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	BIA Document Control.
Is data required by Cl.233 of the GSD presented?	Yes	BIA.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	BIA Sections 3.0 to 5.0.
Are suitable plan/maps included?	Yes	BIA Section 3.0 to 5.0.
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 Section 4.01.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 3.01.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 5.01.
Is a conceptual model presented?	Yes	GIR Section 6.0.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.02.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 3.02.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 5.02.
Is factual ground investigation data provided?	Yes	GIR Section 4.0.
Is monitoring data presented?	Yes	Standpipes monitored once, see GIR Section 4.4.
Is the ground investigation informed by a desk study?	Yes	GIR Section 2.0
Has a site walkover been undertaken?	Yes	GIR Section 1.3.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	BIA Section 2.0.
Is a geotechnical interpretation presented?	Yes	GIR Section 7.0 although this was for a prior application.
Does the geotechnical interpretation include information on retaining wall design?	Yes	GIR Section 7.0 although this was for a prior application.
Are reports on other investigations required by screening and scoping presented?	Yes	GIR.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	Yes	
Is an Impact Assessment provided?	Yes	BIA Sections 3.04, 4.04 and 5.04.
Are estimates of ground movement and structural impact presented?	Yes	GMA provided in RBIA

Item	Yes/No/NA	Comment
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	Identified and incorporated into RBIA.
Has the need for monitoring during construction been considered?	Yes	Monitoring proposal included in RBIA.
Have the residual (after mitigation) impacts been clearly identified?	Yes	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties will be maintained?	Yes	
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Details provided in RBIA.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	
Are non-technical summaries provided?	Yes	Included in RBIA Introduction.

4.0 DISCUSSION

- 4.1. The BIA has been carried out by an established firm of consulting engineers, Michael Alexander (MA), and the lead author has suitable qualifications.
- 4.2. The Ground Investigation Report (GIR) for the site has been carried out by a well known firm of consultants, Geotechnical and Environmental Associates (GEA), and the author and reviewer have suitable qualifications.
- 4.3. The proposed development comprises the refurbishment and extension of the existing detached building above ground level together with the introduction of a substantial basement under the entire footprint of the house and extending into the rear and front gardens. The basement incorporates a swimming pool which has a maximum depth of construction of approximately 7.6m below existing ground slab level. Elsewhere, the depth of basement construction is approximately 5m.
- 4.4. The GI for the site (reported upon in the above GIR) comprised the sinking of a single cable percussion borehole to 25m below ground level (bgl) together with the sinking of 4 window sampler holes to depths of 6m bgl. The investigation showed the site to be underlain by up to 0.9m of Made Ground, below which lies the Claygate Member to a depth of 8.1m bgl, below which the London Clay was encountered. Water strikes were recorded at 5.66m bgl and 7.55m bgl in the Claygate Member and at 9.4m bgl in the London Clay. Monitoring of the standpipes indicated groundwater to be present at depths of between 2.61m bgl and 2.98m bgl i.e. within the basement depth. Although groundwater flow is unlikely to be severe, no indication is provided in the BIA as to how groundwater seepages into open excavations will be controlled. Particular care will need to be taken to ensure that fine material is not washed out of the sandy lenses within the Claygate Member as this could lead to ground settlement.
- 4.5. The method statement within the BIA indicates that the flank wall adjacent to N^o. 2 Greenaway Gardens will be underpinned as will all other external walls to remain and internal load bearing walls. Elsewhere, where the basement extends beyond the line of the existing building, either contiguous or secant bored pile walls will be utilised. The external walls will be lined with reinforced concrete to form a watertight construction. The basement is to be provided with tension piles to resist upward heave forces.
- 4.6. The revised Basement Impact Assessment (RBIA) has indicated that secant, rather than contiguous, bored piling will be utilised to form the perimeter retaining wall. These piles will be terminated in the London Clay and, hence, will ensure that groundwater seepages into open excavations will be controlled. This is an acceptable revision to the previously ambiguous situation.

- 4.7. Temporary works to stabilise the external walls during underpinning, piling and excavation and support the existing and new superstructure loads are discussed in general, but no specific proposals are provided. Careful consideration will have to be given to likely load paths and the correct transfer of above ground loads to the new foundations. Sequencing of the works above and below ground should be identified together with an indicative structural solution.
- 4.8. The RBIA refers to an additional document submitted by Design STUDIO² "Preliminary Construction Method Statement" dated November 2015. This provides an acceptable indicative temporary works solution to stabilise the external retained façade prior to demolition works, piling, underpinning and excavation for the proposed basement. Procedures for propping, underpinning, piling and placing of concrete permanent works are provided. It is noted that this document contains an erroneous reference to contiguous piled retaining wall (Stage 5 Piling Operations) which should be corrected in due course.
- 4.9. A RGMA has been made available in the additional information recently provided. There is some conflict with regards to basement depth and underpinning between the GMA and RBIA with Michael Alexander's drawings which requires clarification. The RBIA indicates the basement is to be up to 7.60m deep in the swimming pool area and that the basement excavation level is 83.50m AOD. The GMA is in general agreement with this, giving a basement level of 86.20m AOD, locally reducing to 84m AOD in the region of the basement. The GMA indicates the underpins are to bear at 85m AOD but states they will only be 4m in height. To bear at this depth they will be in the region of 5m deep. This is in conflict with the Michael Alexander drawings which indicate underpinning between 1.5 and 3m. Further clarification is required, however, it is accepted that the RGMA is conservative.
- 4.10. The RGMA describes that part of the existing structure will be underpinned and the remainder of the permanent excavation will be supported by a secant piled wall. It is noted that localised grouting or other waterproofing treatment may be required. The localised deepening for the swimming pool which lies within the perimeter basement wall is proposed to be formed using a contiguous piled wall.
- 4.11. The methodology for controlling groundwater seepage into excavations will be through the use of secant piles around the perimeter. The RGMA states that trial excavations will be carried out to assess the level of water ingress through exposed faces and to ensure that underpinning will be carried out in dry conditions. The Preliminary Construction Method Statement states that during underpinning the rear of the excavation will not be left unsupported for more than 24 hours and must be propped when the site is unattended.
- 4.12. Should significant groundwater ingress be encountered, consideration should be given to using temporary sheeting during underpinning and whether a contiguous pile wall around the swimming pool will be adequate given that the water will not be completely sealed out along the side of the underpinning.

- 4.13. The predicted building damage to numbers 2 and 4 Greenaway Gardens, adjacent to the proposed basement, is up to Category 2 (slight). Whilst the basement wall has been modelled as a contiguous piled wall rather than a secant piled wall, due to C580 being considered an overestimate, the damage assessment is considered acceptable with respect to 2 Greenaway Gardens, particularly as underpinning is largely proposed in this area.
- 4.14. The RGMA for 4 Greenaway Gardens is considered acceptable. Predicted ground movements along Greenaway Gardens have also been presented, which are considered reasonable.
- 4.15. The RBIA refers to an additional document submitted by design STUDIO² "Movement & Vibrations Monitoring During Piling & Excavations" dated October 2015. This provides an acceptable ground movement monitoring proposal allowing actual movements during construction to be compared to predicted values ensuring that any propping arrangements can be adjusted as necessary to minimise potential damage.
- 4.16. The BIA indicates that there will be an increase in the area of hard landscaping but it is accepted that the proposed use of harvesting and attenuation methodologies such as permeable paving will result in no net increase in surface water discharge.
- 4.17. The BIA should be updated to include any residual, after mitigation, impacts together with non-technical summaries as required by CPG4 once the identified additional information has been provided.
- 4.18. The RBIA contains a non-technical summary prior to the document's introduction and the additional documentation submitted provides acceptable statements regarding residual impacts.
- 4.19. Whilst it is accepted that the proposal is unlikely to have an effect on the hydrology of the general area, until an assessment of groundwater flow and a ground movements analysis have been carried out, it is not possible to confirm that hydrogeology and land stability effects are acceptable.
- 4.20. It is accepted that the RBIA has allowed confirmation to be made that hydrogeological and land stability impacts have been successfully mitigated.

5.0 CONCLUSIONS

- 5.1. The BIA and GIR have been prepared by personnel who have suitable qualifications.
- 5.2. The proposed development comprises alteration works to the superstructure of the existing detached building and the introduction of a basement, up to 7.6 metres deep below existing ground floor level, founded in the Claygate Member.
- 5.3. The revised BIA has confirmed that the basement will be constructed by a combination of conventional underpinning below the perimeter wall adjacent to No.2 and a secant piled retaining wall elsewhere on the basement boundary.
- 5.4. Additional documentation has provided satisfactory information concerning construction methodology to stabilise the retained façade and provide temporary works to enable demolition of parts of the original building, install underpinning and piled retaining walls and excavate the basement.
- 5.5. The RGMA for 2 and 4 Greenaway Gardens is considered acceptable, with up to damage Category 2 (Slight) being predicted. Mitigation measures are therefore required.
- 5.6. Additional documentation has provided an acceptable ground movement monitoring proposal once anticipated movements can be agreed.
- 5.7. It is accepted that there will be no significant alteration to existing surface water drainage flows and the hydrology of the general area will be unaffected.
- 5.8. It is accepted that additional information has allowed confirmation that the hydrogeology of the general area will be unaffected.
- 5.9. It is accepted that land stability issues will not impact on the general area and adjacent buildings.
- 5.10. The revised BIA information supplied subsequently adequately identifies the impacts to and from the basement proposals and outlines suitable construction techniques for this stage of the project.

Appendix 1: Residents' Consultation Comments

None

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Groundwater	Methodology to control seepages in excavations	Item closed.	January 2016
2	Stability	Specific proposal to include superstructure load transfer	Item Closed.	January 2016
3	Stability	Ground Movement Assessment to be revised for impact on adjacent properties and highway	Item Closed.	February 2016
4	Stability	Movement monitoring strategy and trigger levels required	Item Closed.	January 2016
5	Residual Impacts	General update of BIA to include residual impacts and non-technical summaries	Item Closed.	January 2016

Appendix 3: Supplementary Supporting Documents

None

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