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51 Calthorpe Street, London, WC1X 0HH

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12066-39

Revision: F1

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Appendix

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 51 Calthorpe Street, London, WC1X 0HH (planning reference 2015/3049/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 has been prepared by individuals who possess suitable qualifications.

1.5. A ground investigation has been carried out and examines the various strata below ground level, which were found to be of a large depth of Made Ground, overlaying sloping beds of sands, gravels, and clays, and London clay at varying depths. The geology is anticipated to have been caused by a historic river once within the vicinity of the site.

1.6. Due to the depth of Made Ground below the site, piled foundations have been proposed which walls also form the walls of the basement structure. The piled wall is to be constructed in a way that is effective at limiting ground movements assuming it is carried out with good workmanship.

1.7. Ground water was encountered at approximately 5.6m and is likely to require sump pumping during excavation.

1.8. A Royal Mail tunnel is located beneath the road at the front of the site with the site located within the safe guarding zone. While it is thought that the risk of damage to this is low, given good workmanship, permission is required from The Royal Mail Group prior to commencement of the works.

1.9. A suitable outline construction method has been proposed which should, carried out correctly, be effective at limiting surrounding ground movements.

1.10. The property is neighboured by a hotel that contains a basement on one side, and a row of listed terrace properties on the other.

1.11. A ground movement assessment has been carried out for the neighbouring listed terrace of properties which has calculated a very slight damage potential. While some reservations

remaining regarding the way that the ground movement assessment has been carried out it is accepted that the damage potential is likely to be very slight.

1.12. The basement has been designed to allow for heave of the underlying clay caused by the excavation.

1.13. The BIA concludes that groundwater flow is unlikely to be significantly affected due to the low flow rates and the absence of neighbouring basements to a similar depth. This conclusion is accepted.

1.14. Proposals are provided for a movement monitoring strategy during excavation and construction. These are included in the BIA Supplementary Statement.

1.15. It is proposed to include an attenuation tank to limit outflows to the public sewer, given the distance from the highway and the proposed construction method this is thought to pose a low risk of damage to the highway given good workmanship.

1.16. It is accepted that the area of surface run off will be slightly reduced due to additional soft landscaping being provided in the permanent scheme.

1.17. It is accepted that the surrounding slopes to the development site are stable.

1.18. It is accepted that the development is not in an area subject to flooding.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 6th August 2015 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 51 Calthorpe Street, London WC1X 0HH, Reference 2015/3049/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 erection of an additional storey on top of the existing building, the insertion of a mezzanine storey and the excavation of a sub-basement and lowering of the garden level, in connection with the change of use of the building from offices to residential, to provide a total of 17 new units."*

The Audit Instruction also confirmed that the building, or a neighbouring building to the site, is listed.

2.6. CampbellReith accessed LBC's Planning Portal on 21st August 2015 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (Volume 1) – (BIA)
- Basement Impact Assessment (Volume 2) – (BIA)
- Basement Impact Assessment (Volume 3) – (BIA)
- Existing Drawings
    - EXISTING - Sections-Layout
    - Existing Basement Plan
    - Existing First Floor Plan
    - Existing Ground Floor Plan(2)
    - Existing Roof Plan
- Proposed Drawings
    - 939.110 - Ground Floor-A2(2)
    - 939.111 - First Floor-A3(4)
    - 939.112 - Second Floor-Second Floor(3)
    - 939.311- Proposed Elevation Pakenham Street(2)
    - BB West elevational Section(2)
    - Basement-A3(2)
    - ELEVATION EE
    - Elevations AA 1
    - Elevations AA
    - Lower Ground Floor-A3(2)

- Proposed Rear Elevation(2)
- Proposed Calthorpe Street Elevation(2)
- Rear elevation(2)
- Third Floor-A3(5)

- Resident's Consultation Comments
- Design & Access Statement

Note: Basement Impact Assessment (Volume 4) was not available during first document retrieval. This document was provided by email on 24th August 2015.

Note: The BIA Supplementary Statement and the Resident's comments were received 16th September 2015.

2.7. An updated BIA marked as rev A, including appended further site investigations, along with updated plans were received from the applicant following the D1 issue of this report.

2.8. An updated BIA marked as rev B was received from the applicant following the D2 issue of this report.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	
Are suitable plan/maps included?	Yes	Throughout BIA. Also see Appendix J (Volume 4 of 4).
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	See BIA Volume 4 of 4.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4 and Table 4.3.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4 and Table 4.1.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4 and Table 4.2.
Is a conceptual model presented?	Yes	See BIA Section 7.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	See BIA Table 5.1.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	See BIA Table 5.1.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	See BIA Table 5.1.
Is factual ground investigation data provided?	Yes	See BIA Section 5.0 and Appendix I.
Is monitoring data presented?	Yes	See BIA Table 6.2 (Section 5).
Is the ground investigation informed by a desk study?	Yes	Stated in BIA Section 5.2. Historic maps not provided.
Has a site walkover been undertaken?	Yes	Stated in BIA Section 3.16.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	The neighbouring Premier Inn contains a basement.
Is a geotechnical interpretation presented?	Yes	See BIA Sections 5.25 to 5.27.
Does the geotechnical interpretation include information on retaining wall design?	Yes	Engineering design parameters are provided in the second phase ground investigations report.
Are reports on other investigations required by screening and scoping presented?	Yes	See BIA Section 7.4 to 7.7 and 7.18.
Are baseline conditions described, based on the GSD?	Yes	See BIA Section 4.2.
Do the base line conditions consider adjacent or nearby basements?	Yes	Details of the neighbouring basement have been presented and this has been considered in the baseline conditions.
Is an Impact Assessment provided?	Yes	See Section 6.0 and Table 6.1 (Section 6)

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	Yes	A ground movement assessment has been produced for the neighbouring Victorian terrace
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	See BIA Table 6.1 (Section 6).
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	See BIA Table 6.1 (Section 6).
Has the need for monitoring during construction been considered?	Yes	See BIA Table 6.1 (Section 6).
Have the residual (after mitigation) impacts been clearly identified?	Yes	See BIA Table 6.1 (Section 6).
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	Ground movement assessment
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Attenuation tank to be provided to limit discharge rates to the public sewer. Also area of soft landscaping to be increased.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	Yes	The neighbouring basement has been considered with regards to cumulative impact
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Burland category 1 damage has been calculated
Are non-technical summaries provided?	Yes	

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) has been carried out by engineering consultants, Create Consulting Engineers, and the individuals concerned in its production have suitable qualifications.

4.2. The LBC Instruction to proceed with the audit identified that the basement proposal either involved a listed building or was adjacent to listed buildings but gave no details. The Design & Access Statement identified that a group of three storey grade II listed Georgian houses are situated to the west of the site. The site also sits within the Bloomsbury Conservation area.

4.3. The proposed basement consists of a single storey construction formed under the existing footprint of the Lower Ground Floor. It is also proposed to extend the lower ground floor out towards the public highway at the front of the site.

4.4. Three boreholes undertaken as part of the Ground Investigation have identified that the existing reinforced concrete ground slab is underlain by a varying thickness of Made Ground of up to 8.00 metres, below which lies sloping beds of sands, gravels, and soft clay, ultimately underlain by London clay at depths that vary between 7mbgl and 22mbgl. It has been concluded that the varying depth of the London Clay and the sloping beds of superficial deposits overlaying this are a fluvial scour feature caused by a nearby historic river.

4.5. Architectural and structural plans have been produced, providing a co-ordinated scheme. Structural drawings indicate an outline of the structural works proposed, indicating external basement walls formed of secant piled walls, cantilever transfer slabs supporting existing foundations and forming the lower ground level, and a suspended basement level slab incorporating heave protection measures.

4.6. Trial pits and site investigations have been carried out in order to determine the foundations to the neighbouring buildings. To the east a Holiday Inn which has been identified as containing an existing basement level from gaining access into the basement and a void space that is located between the two existing sub structures. To the west a row of grade II listed terrace properties adjoin 51 Calthorpe Street, that although adjoining have been visually identified as having separate flank walls and therefore foundations. An internal trial pit to the flank wall of 51 Calthorpe Street has been carried out, with reasonable assumptions made as to the foundations of the neighbouring building which are not possible to investigate directly.

4.7. A piling plan has been obtained for the Holiday Inn to the east which indicated non-contiguous piled foundations, with piling not having been utilised to form the basement walls.

4.8. A construction method has been provided that indicates top down construction is to be utilised. The lower ground floor slab/transfer structure is to be constructed first, to support the existing foundations to the building and to provide a stiff prop to the head of the piled retaining walls, prior to the ground level being reduced below the building. This is an effective method of reducing piled wall deflections during the construction phase, as a permanent stiff prop is in place at the head of the wall at all stages of the work which remains in place during the permanent case.

4.9. A ground movement assessment has been carried out for 49 Calthorpe Street which has concluded that ground movements fall within Burland Category 1 (very slight). A number of errors remain in the ground movement assessment, with the distance to negligible movement having been taken as a multiple of the excavation depth rather than a multiple of the pile depth when considering movement due to pile installation. The deflection ratio has also not been correctly calculated, which can have a significant impact on the damage category that is calculated despite having low horizontal strains, and rather has been produced as a separate calculation not relating to the horizontal deflections as described in CIRIA580. However by inspection it can be seen that the vertical deflections are low in relation to the building, and in this case the deflection ratio would unlikely impact on the damage category. It is therefore accepted that the damage category of 1 'very slight' is a reasonable conclusion.

4.10. A ground movement assessment has not been carried out for the neighbouring Holiday Inn, or the highway at the front of the property. However given the presence of a neighbouring basement to a comparable depth, the main basement excavation being set back several meters from the highway, along with the top down construction method proposed it is agreed that the conclusion that the risk of damage to these structures being low is reasonable.

4.11. Proposals are provided for a movement monitoring strategy during excavation and construction, this should be reviewed following the revised ground movement assessment to ensure predicted movements and trigger levels collaborate. It is also suggested that visual condition surveys be carried out to neighbouring properties.

4.12. A Royal Mail tunnel is located to the front of the property running beneath Calthorpe Street. The tunnel is identified as being 16m below ground level, given that a bored piled solution is proposed should the piles be constructed to an equal or deeper depth than the tunnel much of the potential impact may be mitigated. Approval will be required from Royal Mail Group due to the proposal being within their safe guarding zone, with a more detailed pile design and construction method likely required to satisfy this.

4.13. The site is located at approximately 20.0m AOD and the land surrounding the site is generally flat (gradients less than 7^{o}).

4.14. The site is not located within a groundwater Source Protection Zone (SPZ), however it does sit within a secondary 'A' Aquifer.

4.15. The site is located in Flood Risk Zone 1 but it is accepted that the site is not at potential risk from surface water flooding and did not flood during the floods in 1975 and 2002.

4.16. Ground water monitoring has been carried out with a stabilised level of 10.85m AOD determined. It has been concluded that groundwater flows across the site are low due to the static groundwater level recorded, and the site is considered an appropriate 'window' size to consider a similar conclusion for the wider area.

4.17. Given the low ground water flows, the absence of secant piled foundations to the neighbouring basement, and a gap between the proposed basement and the site boundary on all sides, it has been concluded that any damming potential is low, and that ground water will flow around the proposed basement. While groundwater flow calculations would have been preferred to support this conclusion, it is accepted that the risk of a significant damming effect occurring is low.

4.18. Waterproofing of the basement is proposed to be provided by adding additives to the concrete and also limiting crack widths through detailing of reinforcement. Although this does provide two defences against water ingress, given the fact that the water table may rise above the level of the basement, it would be prudent to allow a means of drainage should water penetrate the basement floors and walls. Further provision should be considered.

4.19. An attenuation tank is proposed to reduce peak run off to the public sewer. This is to be located under the lower ground floor slab, the position of which is indicated on the structural section and the drainage mark up plans. The walls to form the enclosure of the tank are indicated as being the basement secant piled wall on one face, and traditional RC walls shored and propped during in construction for the other faces. The tank is set back from the highway by several metres, therefore the formation of this local excavation, assuming good workmanship, should have minimal risk of causing damage to the highway.

5.0 CONCLUSIONS

5.1. The Basement Impact Assessment (BIA) has been carried out by engineering consultants, Create Consulting Engineers, and the individuals concerned in its production have suitable qualifications.

5.2. It is likely that the groundwater table will be encountered during basement foundation excavation for which pumping may be required.

5.3. The construction is propped as a piled perimeter wall, constructed using top down construction that is recognised as best practice for minimising ground movements.

5.4. The permanent structural solution proposed involves forming the basement wall with bored secant piled walls formed partly inside of the existing building footprint, with a cantilever transfer slab supporting the existing foundations.

5.5. Appropriate site investigations have been carried out to determine the geology and the existing foundations. It has been concluded that the impact on ground water flows will be low as ground water flow around the basement, as flow rates are low and there are no neighbouring basements to the same level.

5.6. The site appears to be underlain by a scour feature that has large depths of variable superficial deposits overlying the London Clay at the site.

5.7. A ground movement assessment has been completed for the neighbouring listed properties with a conclusion that the damage category is 1 (very slight). While some reservations about how the ground movement assessment has been calculated it is accepted that the damage category is likely to be no worse than 1.

5.8. A Royal Mail tunnel is located to the front of the property running beneath Calthorpe Street. Approval will be required from Royal Mail group due to the proposal being within their safe guarding zone.

5.9. Proposals are provided for a movement monitoring strategy during excavation and construction.

5.10. It is accepted that the surrounding slopes to the development site are stable.

5.11. It is accepted that the site is not in an area subject to flooding.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Mahoupe	49 Calthorpe Street	Unknown	1) The proposed basement excavation- a basement under the existing basement will endanger the listed building adjoining 51 and the whole listed terrace. 2) The 'made ground'. The engineers who dug a hole this year at 51 were called AF Howland. They dug down 15 metres and still found no clay. They ground was all soft and moving. You could see the gravel and wet mud. Other engineers reports have mentioned the 'made ground' and the 'mound of shale'. 3) Basement Impact Assessments: I quote from the draft local plan: Basement Impact Assessments must contain a non-technical summary of the evidence that applicants have gathered against each stage of the assessment. This should be presented in a format which can be fully understood by those with no specialist technical knowledge in these matters. 4) River Fleet: In the B I A vol 1 there is a table on page 12 and page 14. It is claimed that the site is NOT within 100 metres of a watercourse. It mentions the Fleet as being 'culverted'. Now the engineers reports of 1985, where measurements were made from 51 down to 45, showed the ground getting wetter and wetter towards 45. These engineers (sent by Camden), said that there was slippage towards the wet ground in the garden of 45, and they recommended underpinning the whole terrace, which was not done. If you cross the road and look at the terrace, you can see this tendency. 45 lists down to the West and 49 list down to the East. 5) 1990's: It was in the 1990's, when the Holiday Inn was built that no 51 slipped to the East and all its window arches broke. My house no 49 slipped at that time also; and its top wall (adjoining 51) became	1) A ground movement assessment has calculated that damage to the neighbouring terrace falls within acceptable limits. 2) Appropriate piled foundations have been specified for the ground conditions identified. 3) A non-technical summary has now been provided. 7) The proposal is to use a Secant piled wall inside the boundary of 51 (adjacent to the boundary of 49). This proposal would avoid the need to underpin the party wall.

			bowed. The crookedness is visible. 6) More about the Basement Impact Assessment 7) Vol 1 page 23 of the new BIA shows an Assessment of Impacts Table. Boxes 3,7,13 all show that movement could affect the neighbouring building. Further danger to curtilage structures. My old Victorian brick underground vault is under my garden, and it is joined to the garden wall of 49/51. Any digging down will certainly have a deleterious effect. All or nothing. The only way to stabilise 51, 49, 47, and 45 would be to underpin all four buildings together. I own 49, Camden Council owns 47, and Camden is the freeholder of 45. Jonathan Avis (Leaseholder of lower flat at 45) might well agree to co-operate with underpinning the whole row, if that is necessary.	
Unknown	Wren Street	Unknown	1) The excavation of a very deep extra basement and the insertion of concrete risks undermining the water-table and seriously affecting the adjacent three period listed terrace houses. Their foundations could be dislodged and undermined. Number 51 is itself listed and any planning application ought to be approved by English Heritage as well as Camden Council.	1) It has been demonstrated that the proposed foundations and method of construction are suitable for the proposal and do not pose a significant risk to the neighbouring properties.
Unknown	50 Tavistock Place	Unknown	1) As a local resident and supporter of Bloomsbury's architectural heritage, I am concerned that the proposed plans will have a detrimental effect on the adjacent row of private houses. These properties are unique and I already suffer some underpinning weakness which no doubt would be aggravated by the deep excavation in the basement of the proposed development.	1) It has been demonstrated that the proposed foundations and method of construction are suitable for the proposal and do not pose a significant risk to the neighbouring properties.
Mahoupe	49 Calthorpe Street	Unknown	An incomplete extract from a website has been presented which provides information as to the original position of the River Fleet prior to its culverting. It is assumed that the concern comes from the original River Fleet passing through, or alongside the site of 51 Calthorpe Street and the adequacy of the proposals with this in mind.	The site investigations have identified the scour feature created by the historic River Fleet. The foundation and basement design proposed adequately take into account the geological conditions. However an outstanding query regarding groundwater flows is outstanding in the query tracker.

Note: Where similar comments have been received only the first instance has been listed.

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	Hydrogeology	Confirm direction of groundwater flow and how the basement will effect this considering that the neighbouring property also has a deep basement.	Closed	26/08/16
2	Hydrogeology and stability	Further ground investigation required to confirm possible influence of scour feature or former River Fleet.	Closed	29/06/16
3	Stability	Confirm order of strata below ground level. As table 3.3 or as sections 5.20 to 5.22.	Closed	29/06/16
4	Stability	Confirm structure/type of basement walls.	Closed	29/06/16
5	Stability	Confirm neighbouring foundation depths/type.	Closed	29/06/16
6	Stability	Confirm temporary works for installation of attenuation tank.	Closed	29/06/16
7	Stability	Carry out assessment of movement analysis for various sections through the basement walls. Confirm anticipated movement in relation to the Burland Category Scale.	Closed	26/08/16
8	Stability	Confirm design parameters for the foundations and retaining wall design.	Closed	29/06/16
9	Stability	Confirm proximity of any tunnels beneath the site or within the tunnel exclusion zones	Closed	29/06/16
10	All	Non Technical summaries need to be added for each section.	Closed	29/06/16
11	Stability	Approval is required from The Royal Mail Group for construction within the safe guarding area prior to the works commencing.	N/A	-

Appendix 3: Supplementary Supporting Documents

None

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