CampbellReith
consulting engineers

20 – 21 King's Mews
London, WC1N 2JB

Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12336-54
Revision: F1

June 2016

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Contents

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 20 – 21 King's Mews, WC1N 2JB (Camden Planning reference 2016/1093/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 authors of the JMS report all have MICE or MIStructE qualifications. The reviewers of the Hydrogeology report are Chartered Geologists (C.Geol.).

1.5. The site comprises a two storey existing garage structure which is proposed to be partially demolished with a new 3 storey building over a basement constructed to provide flats.

1.6. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

1.7. An exploratory hole has now been undertaken to determine the sequence and depth of strata, however, groundwater monitoring to establish the groundwater level was not undertaken.

1.8. The proposed underpinning depth is within the Made Ground and it is requested that this is reconsidered as there are concerns about the stability of the neighbouring properties.

1.9. There are a number of outstanding issues and it is recommended that these can be provided within a Basement Construction Plan which should include:

- Confirmation of the presence/absence of a basement beneath No 22 King's Mews
- Results of investigations to determine the nature and depth of the foundations to No 22 King's Mews
- Groundwater level determined from monitoring and control measures for groundwater ingress during underpinning
- Reconsideration of the proposed underpinning depth
- Further information to demonstrate the stability of the neighbouring properties will be maintained following the removal of the vertical loads from the party walls

- Full condition survey which includes all the party walls following possession of site
- Proposals on how further damage to the party walls already indicated to be in poor condition is to be limited
- Detailed monitoring scheme with trigger levels to be agreed as part of the Party Wall award.

1.10. An outline works duration has been provided in the Construction Management Plan (CMP) and it is accepted that a more detailed programme may be provided by the Contractor. Details of the CMP may be agreed with the Council.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 21 April 2016 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 20 – 21 King's Mews, WC1N 2JB (Camden Planning reference 2016/1093/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 *"Demolish two storey building and erection of 2 x 3 bedroom, four storey dwellings including a new basement floor."*

2.6. The Audit Instruction also confirmed 20 -21 King's Mews is a neighbour to a listed building (55 Grays Inn Road).

2.7. CampbellReith accessed LBC's Planning Portal on 27 April 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment (BIA): JMS Consulting Engineers, dated April 2016
- BIA (Groundwater): ESI Limited, dated April 2016
- Building Condition Survey and Structural Inspection Report: TCL Chartered Surveyors, undated
- Design and Access statement: Marek Wojciechowski Architects Ltd, dated February 2016
- Construction Management Plan, undated
- Planning Application Drawings consisting of

  Location Plan

  Demolition Drawings

  Proposed Elevations

  Proposed Sections

- 1 No. Planning Comment and Response

2.8. Following the initial audit, supplementary information has been provided between 9 and 16 June 2016 by email and the documents provided, some of which are included in Appendix 3, are as follows:

- JMS drawings showing details of investigated neighbouring properties, underpinning sequence, pile layout and underpinning detail sections
- JMS letter response to initial audit queries, dated 9 June 2016
- JMS letter response to further queries, dated 16 June 2016
- JMS proposed monitoring regime, dated June 2016
- JMS Structural Inspection report, dated 8 February 2016
- Exploratory hole record

2.9. CampbellReith accessed LBC's Planning Portal on 20 June 2016 and gained access to 1 No. consultation response.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	Qualifications of all individuals involved in the BIA meet requirements of CPG4 (see Audit paragraph 4.1).
Is data required by Cl.233 of the GSD presented?	Yes	JMS BIA and supplementary information
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	Supplementary information from JMS
Are suitable plan/maps included?	Yes	Architects Drawings and Arup GSD extracts within JMS BIA.
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?	No	An incorrect response was given to Q5 and the response to Q13 contradicted the JMS BIA Section 9.1. The presence of basements beneath the neighbouring properties has now been clarified (see Audit paragraphs 4.5, 4.8 and 4.9)
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	ESI Groundwater report.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	No	Environment Agency (EA) website and Camden SFRA maps not referenced, although, it does not appear that the site is in a risk area for flooding.
Is a conceptual model presented?	Yes	Model was based on nearby sites and it was noted this could vary greatly on site. A site specific investigation has now been undertaken.

Item	Yes/No/NA	Comment
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	No	Provided but considered incorrect and Q12 from the screening not carried forward despite a 'Yes' response. These issues have now been addressed in the supplementary documents (see Audit paragraphs 4.8 and 4.9).
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	ESI report Section 3.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No issues identified from screening.
Is factual ground investigation data provided?	No	Site specific investigation was not undertaken. Limited investigation now undertaken with exploratory hole records provided.
Is monitoring data presented?	No	Site specific investigation now undertaken but monitoring not included (see Audit paragraph 4.11)
Is the ground investigation informed by a desk study?	N/A	Desk study information within Design and Access statement and BIA but ground investigation was not undertaken.
Has a site walkover been undertaken?	Yes	Undertaken as part of the '*environmental desk based assessment*' for archaeology purposes.
Is the presence/absence of adjacent or nearby basements confirmed?	No	Incomplete. Contradictory statements with respect to the presence of adjoining basements given in the response to Q13 of the Land Stability screening and the JMS BIA Section 9.1. Clarification included in the supplementary documents but considered incomplete (see Audit paragraphs 4.8 and 4.9).
Is a geotechnical interpretation presented?	No	Some advice on foundations was given in Section 8.4 of the JMS BIA, however this was not based on a site specific ground investigation.

Item	Yes/No/NA	Comment
Does the geotechnical interpretation include information on retaining wall design?	Yes	Included in BIA but considered incomplete as stiffness parameters were not given. Stiffness values now given in supplementary information (see Audit paragraph 4.14).
Are reports on other investigations required by screening and scoping presented?	No	A ground investigation was recommended in the Hydrogeology report but this was not undertaken. Limited investigation now undertaken with exploratory hole records provided.
Are the baseline conditions described, based on the GSD?	Yes	Sequence and depth of strata was previously not established, no description of party wall foundations and contradictory statements with respect to the presence of neighbouring basements. Information now provided.
Do the base line conditions consider adjacent or nearby basements?	Yes	Considered but contradictory statements were given in different reports. Clarification now provided (see Audit paragraphs 4.8 and 4.9).
Is an Impact Assessment provided?	No	Neither the ESI nor JMS reports include an impact assessment of all the issues identified. Issues now addressed in supplementary documents.
Are estimates of ground movement and structural impact presented?	Yes	However there are concerns about proposed construction method (see Audit paragraphs 4.18 and 4.19)
Is the Impact Assessment appropriate to the matters identified by screening and scoping?	N/A	Impact assessment not provided.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	Cannot be confirmed. Although supplementary information has been provided, there are still concerns about the proposed construction method.
Has the need for monitoring during construction been considered?	Yes	Considered but no outline proposals were presented. These have now been provided with the supplementary information.

Item	Yes/No/NA	Comment
Have the residual (after mitigation) impacts been clearly identified?	No	None identified but the proposed construction method may lead to residual impacts on the neighbouring properties.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	There are still concerns about the proposed construction method (see Audit paragraphs 4.13 and 4.19).
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	JMS BIA.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	See Audit paragraphs 4.13 and 4.19.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	Maximum Slight (Category 1) damage predicted but there are concerns about the proposed construction method and the Structural Inspection report states eastern party wall not in sound condition (see Audit paragraph 4.13 and 4.19)
Are non-technical summaries provided?	No	Not provided.

4.0 DISCUSSION

4.1. The main Basement Impact Assessment (BIA) has been carried out by JMS Consulting with the Hydrogeology assessment undertaken by ESI Ltd. The qualifications of the individuals concerned are in accordance with the requirements of CPG4.

4.2. The proposal is for the partial demolition of two storey existing garage structure and the construction of a new 3 storey building over a basement to provide 6 flats.

4.3. It was stated in Section 8.2 of the BIA states that '*investigations at the site have been limited due to ongoing use of the footprint of the building*'. The investigation did not appear to have identified a competent bearing strata nor the depth to the groundwater. An intrusive investigation was recommended in the Hydrogeology report.

4.4. The response to Question 5 of the Land Stability screening was incorrect as it stated the London Clay is the shallowest stratum, however, it was stated on Section 3.1 that Superficial Deposits are present overlying the Gravels. This is further indicated by the exploratory hole records provided.

4.5. The response to Question 9 of the Land Stability screening stated that '*the proposed basement does not abut cellars'*, however, Section 9.1 notes that Nos 3 & 5 Northington Street and 18 to 19 King's Mews, the neighbouring properties to the north, both have '*dry*' basements. Clarification was requested.

4.6. A 'Yes' response is given to Question 12 of the Land Stability screening which relates to whether or not the site is within 5m of a highway, however, this was not carried forward to scoping.

4.7. Limited ground investigation in the form of foundation inspection pits was been carried out. The location plan indicated four trial pits (TH1 to TH4), however, only logs for TH2, undertaken against No 3 Northington Street, and TH4, undertaken against No 22 King's Mews, were provided. There was no discussion on what the pits revealed, however, the logs provided indicated TH2 recorded Made Ground to 3m bgl over soft clay to 3.70m bgl over sand and gravel. It appears the base of the foundation was not proven as it is noted on the log at 3.70m bgl that this is the '*suspected bottom of the foundation*'. TH4 was undertaken to 3.20m bgl where an obstruction was encountered and the pit revealed Made Ground to the base.

4.8. A drawing showing the foundation inspection pit sketches together with a letter giving details of the neighbouring property foundations has now been provided and these are included in Appendix 3. Trial pit 1 was undertaken against No 19 King's Mews, one of the neighbouring properties to the north. The JMS letter response states this property is structurally independent

from No 20 – 21 and comprises a basement indicated to be c.500mm deeper than the proposed basement. The trial pit revealed concrete foundations on fill at a depth of c.2.40m bgl. No 3 Northington Street, also located to the north is indicated to be structurally independent and comprises a '*dry*' basement at a similar depth to the proposed. Trial pit 2 was undertaken against No 3 Northington Street which revealed a footing at c.2m on fill. This is considered to be associated with an '*old/redundant*' basement party wall and it is stated that the current basement is set behind this wall. The trial pit did not reveal the basement foundations and it is stated the presence of a basement was '*verbally confirmed*'.

4.9. No 55 – 55 Gray's Inn Road, located to the east is indicated to comprise a 2.20m deep basement which was also '*verbally confirmed*'. Trial pit 3 revealed the party wall foundations at a depth of c.2.40m bgl founded on fill. The property to the south, No 22 King's Mews, shares a party wall with No 20 – 21, however, it is stated investigations on the foundations have not yet been undertaken due to access restrictions. The presence or absence of a basement is not confirmed. These should be investigated once the site is vacant and the information should be provided as part of a Basement Construction Plan (BCP).

4.10. The sequence of strata presented in the BIA was established from nearby British Geological Survey (BGS) boreholes and in the main BIA it was stated that the Made Ground extends to 3 to 4m depth over Lynch Hill Gravel to approximately 6m bgl over the London Clay. The borehole logs referenced and included as an appendix to the Hydrogeology report indicated Made Ground to up to 5.10m bgl over soft to firm clay to 6.65m bgl in one of the boreholes. Clarification was requested. A borehole has now been undertaken towards the centre of the site and the exploratory hole record indicates Made Ground to 3.60m bgl underlain by granular Superficial Deposits to 5.70m bgl over Clay.

4.11. It was stated in the Land Stability scoping that the nearby boreholes suggest that the water table is lower than the basement and its associated works. This has not been established as a site specific ground investigation with a programme of groundwater monitoring has not been undertaken. The Hydrogeology scoping states that one of the nearby boreholes referenced recorded groundwater at 3.30m bgl which is within the basement depth of 3.50m bgl and further states the presence of groundwater at the site is probable pending confirmation from a site investigation. The JMS letter response, dated 9 June 2016, states that '*it has not been possible to determine site water levels although no water was encountered during the excavation of the trial holes and records suggest the water levels are likely to be below formation level. Nevertheless, the design and construction methods have presumed that water levels will rise two-thirds up the height of the basement*'. It should be noted that not encountering groundwater in the exploratory holes does not indicate its absence or that it is likely to be deep. The groundwater level is unlikely to have reached equilibrium conditions during excavation and drilling hence its absence. A suitable programme of groundwater

monitoring is to be undertaken once the site is vacant. The established groundwater level should be provided as part of a BCP.

4.12. It is proposed to underpin the party walls, however, the proposal was not sufficiently detailed in the text. It was stated in Section 9.1 that the '*rear*' and '*right hand side'* elevations will be underpinned to basement depth to allow construction of the basement wall. The basement depth was not given in the main BIA although one of the drawings appeared to indicated 2.50m depth which contradicted the 3.50m depth given in the Hydrogeology report. Given the ground conditions indicated by the nearby boreholes, this was likely to be in the Made Ground or soft clays which are not competent strata. The initial audit stated that in light of the possible depth to a suitable bearing stratum and the groundwater table, the construction methodology may need to be reconsidered. It was also requested that the party walls are referred to in relation to the building numbers of the neighbouring properties rather than '*rear*' or '*right hand side'* as this is subjective. It was also noted that No 55 Gray's Inn Road, one of the neighbouring properties, is listed.

4.13. Further details on the proposed underpinning have now been provided in the JMS letter responses included in Appendix 3. It is proposed to underpin the boundary walls adjacent to No 19 King's Mews and No 3 Northington Street and the party walls to No 53 – 55 Gray's Inn Road and No 22 King's Mews to basement depth to allow for the excavation of the basement. It is stated that the new structure will be independently supported on piled foundations with all the vertical loads from the existing building removed from the party walls. Underpinning the existing foundations onto the Made Ground which has poor load bearing capacity is considered unacceptable especially with respect to the party walls with No 53 – 55 Gray's Inn Road, which is listed, and No 22 King's Mews. The proposed depth of the underpinning should be reconsidered to bear on the competent stratum beneath instead. There are also concerns about the removal of the vertical loads from the party walls although it is stated in the JMS letter response, dated 16 June 2016, that the level of the existing ground floor slab is being maintained ensuring that any current propping action remains and no surcharge is applied to the party walls from either side. Further information to demonstrate this should be provided as part of the BCP.

4.14. Retaining wall parameters were included in Section 8.4 of the BIA, however, stiffness parameters were not included and this was requested. This has now been provided, however, the value for the Made Ground is considered too high.

4.15. Heave movements due to excavation were indicated to be approximately 12mm at the centre and reducing to 5mm at the edges. It was not stated how these were derived. Mitigation measures in the form of heave forces being transmitted to the walls, on to tension piles within the basement or a void layer or layer of compressible material beneath the slab were proposed.

Further clarification was requested. It is stated in the JMS letter response that the heave movements were derived using '*empirical methods of observation and experience'*. A void is to be provided between the top of the formation and underside of the foundations.

4.16. It was stated in Section 9.2 that movements in the range of 2 to 5mm are anticipated provided the works are carried out by a reputable contractor. It was not stated if these are horizontal or vertical movements. It was further stated that the '*estimated movements are considered to represent a worst case scenario particularly as movements resulting from a basement excavation will be minimised due to the control of propping in the temporary works and a regime of monitoring*'. Category 0 (Negligible) damage was predicted for the nearby and adjoining structures with limited areas of Category 1 (Very Slight) damage to the '*front right hand corner of the building/party wall'.* It was unclear which party wall this referred to. It was stated in the conclusion in Section 11 that '*we can therefore conclude that the construction of the proposed development generally, and the subterranean basement in particular, will not affect the integrity of the surrounding building stock or overload the near surface geology*'.

4.17. Movement resulting from underpinning is almost entirely due to workmanship and it may be possible to limit damage to Category 1 provided the works are properly controlled and the affected structures are in sound condition. However, in this case given that the sequence and depth of strata and the groundwater level has not been established, the initial audit stated the ground movement assessment may require reconsideration due to the depth of underpinning which may be required as a result of the soils encountered. The impact to the roadway and any utilities running beneath was also not considered.

4.18. The JMS letter response now gives a predicted damage category for the neighbouring buildings. Category 0 (Negligible) damage is predicted for No 19 King's Mews and 3 Northington Street with Category 1 (Very Slight) damage indicated for No 53- 55 Gray's Inn Road and No 22 King's Mews. Negligible impact is indicated for the roadway. Predicted horizontal and vertical movements for No 19 and 22 are not given in the more recent letter response, however, it is stated that '*resistance to horizontal movement will be via a new concrete wall set in front of the existing wall. There is no additional vertical loading to be imparted to the e*xisting *walls and as such no vertical movement is expected'.* It is further stated that '*some disturbance may arise due to the underpinning process but this will be mitigated by adopting best practice, a competent contractor and a monitoring system*'.

4.19. It should be noted that vertical and horizontal movements would arise as a result of the underpinning and excavation although as stated above movements from underpinning is almost entirely due to workmanship. Damage to neighbouring properties may be limited to Category 1 provided the works are properly controlled and the buildings are in sound condition. The Structural Inspection Report, dated 8 February 2016, notes cracking to the '*left and right party*

walls' (assumed to be No 19 and No 22 King's Mews) which are indicated to have been previously repaired but since re-opened indicating ongoing movement. It is stated that access was not possible '*to the sides or rear of the building and as such the external condition of these elevations could not be commented upon* '. It is further stated that '*from an internal inspection, the walls appeared to be structurally stable although will rely on the mezzanine floor structure for future stability and as stated above this floor is in an inadequate condition'*. It is difficult to predict anticipated damage or determine the reliability of a damage assessment for a property in poor condition. It is recommended that a full condition survey be undertaken and details on how further damage to the party walls already in poor condition are to be limited should be provided as part of a BCP and agreed as part of the Party Wall awards.

4.20. The need for monitoring had been considered, however, no details were provided. Outline proposals were requested following the initial audit with details and trigger levels to be agreed as part of the Party Wall awards. A proposed monitoring regime with trigger levels has now been provided and is included in Appendix 3. The trigger levels may need revising following reconsideration of the proposed underpinning depth, however, these may be agreed as part of the Party Wall awards.

4.21. An outline works duration is provided in the Construction Management Plan (CMP) and it is accepted that a more detailed programme may be submitted at a later date.

4.22. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

5.0 CONCLUSIONS

5.1. The authors of the JMS report all have MICE or MIStructE qualifications. The reviewers of the Hydrogeology report are Chartered Geologists (C.Geol.).

5.2. The site comprises a two storey existing garage structure which is proposed to be partially demolished with a new building to provide 6 flats over 3 floors plus a basement constructed.

5.3. An exploratory hole has now been undertaken to determine the sequence and depth of strata, however, the groundwater monitoring to establish the groundwater level was not undertaken.

5.4. The proposed underpinning depth is within the Made Ground and it is requested that this is reconsidered.

5.5. There are a number of outstanding issues and it is recommended that these can be provided within a Basement Construction Plan which should include:

- Confirmation of the presence/absence of a basement beneath No 22 King's Mews
- Results of investigations to determine the nature and depth of the foundations to No 22 King's Mews
- Groundwater level determined from monitoring and control measures for groundwater ingress during underpinning
- Reconsideration of the proposed underpinning depth
- Further information to demonstrate the stability of the neighbouring properties will be maintained following the removal of the vertical loads from the party walls
- Full condition survey which includes all the party walls following full access to the site
- Proposals on how further damage to the party walls already indicated to be in poor condition is to be limited
- Detailed monitoring scheme with trigger levels to be agreed as part of the Party Wall award.

5.6. An outline works duration has been provided in the Construction Management Plan (CMP) and it is accepted that a more detailed programme may be provided by the Contractor. Details of the CMP may be agreed with the Council.

5.7. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Pollard (Owner of 5 Northington Street/18-19 Kings Mews)	55 Colebrook Row London N1 8AF	April 2016	Incorrect statement on the absence of a basement beneath the neighbouring properties	Now addressed with the exception of No 22 King's Mews
Balchin (on behalf of the) owner of No 3 Northington Street	Not provided	June 2016	Adverse impact on the listed buildings in the conservation area Ongoing damp/water issues associated with '*rising water table*'	See Audit paragraph 5.5

Appendix 2: Audit Query Tracker

Audit Query Tracker

Query No	Subject	Query	Status	Date closed out
1	BIA format/ Stability	No site specific ground investigation to confirm sequence and depth of strata	Closed – exploratory hole undertaken to determine sequence and depth of strata.	22/06/16
2	Hydrogeology	Groundwater level not established	Open – groundwater to be monitored with results provided and water level provided as part of Basement Construction Plan	N/A
3	Stability	Retaining wall parameters incomplete as stiffness parameters not given	Closed – provided with supplementary documents although value for the Fill is considered too high	22/06/16
4	Stability	Contradictory statements on the presence of basements in the neighbouring properties and neighbouring property foundations not determined	Open – Clarification provided with regards to the presence of basements beneath three of the properties together with foundation sketches from investigations. Presence or absence of a basement and results of investigations on foundations to No 22 to be provided as part of BCP.	N/A
5	Stability	Proposed construction method not sufficiently detailed in the text and may need reconsideration. Depth of the basement is to be confirmed.	Open – Concerns about underpinning onto the existing Fill and stability of neighbouring properties to be addressed in BCP as summarised in Section 5.	N/A
6	Stability	Ground movement assessment to be revised following ground investigation and reconsideration of construction methodology. No consideration of impact on roadway and any possible utilities	Open – Predicted damage to neighbouring properties and roadway provided. This assumes properties are in sound condition, however, cracking noted on one party wall with the other not investigated. Details on how further damage to buildings is limited to be provided in BCP and agreed as part	N/A

			of Party Wall awards.	
7	Stability	Movement monitoring proposal not provided	Open - Outline proposal provided. Details and trigger levels which may need revising to be provided with BCP and agreed as part of Party Wall awards.	N/A

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Appendix 3: Supplementary Supporting Documents

JMS letter responses dated 7th and 16th June
Borehole log
Monitoring proposal

Our Ref: L15/284/12

9th June 2016

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

For the attention of Fatima Drammeh

Dear Sirs

Re: 20-21 King's Mews WC1N 2JB – Your Ref 12336-54-240516

Further to our telephone conversation of 7th June 2016 regarding the above project I have set out below, together with relevant attachments, the information as discussed in answer to your Audit Query Tracker.

Query 1 - BIA - Format Stability

Access to the site has been significantly limited due to the continued use of the building. From trial holes that have been managed to be excavated around the internal perimeter of the site and a borehole located internally, it has been established that poor ground conditions exist to approximate proposed formation level (see drawing L15/284/12-507P2). The deepest excavation that was possible encountered natural dense sands and gravels at approximately 3.7m which equates to findings in borehole records undertaken on adjacent sites and as enclosed in the Hydrogeology report. Within these aforementioned boreholes, Clay sub-strata has been identified at approximately 6-7m below ground level. Due to the limited and unconfirmed information relating to the ground conditions, 'worst case' scenarios have been considered for the design and construction of the basement.

Query 2 – Hydrogeology

It has not been possible to determine site water levels although no water was encountered during excavation of the trial holes and records suggest that water levels are likely to be below formation level. Nevertheless, the designs and construction methods have presumed that water levels will rise 2/3rds up the height of the basement.

Query 3 – Stability

Due to the limited soils information available the following parameters are to assumed within the designs:

> Using ko, the earth pressures are considered 'at rest'. Active pressure (ka) will be mobilised if the wall moves 0.25-1% of the wall height, while passive pressures (kp) will require movements of 2-4% in dense sand or 10-15% in loose sand/fill.
>
> ko values adpoted:
>
> - 0.50-0.60 for normally consolidated clay,
> - 0.35 for dense sand,
> - 0.6 for loose sand/fill
> - 1.0-2.8 for overconsolidated clays such as London clay.
>
> *(source: Structural Engineer's Pocket Book, Eurocodes by Fiona Cobb, page 336)*

Query 4 – Stability

Site and record investigations have identified basements extending to a similar depth of the proposed development to 19 King's Mews and 53-55 Greys Inn Road (see Drg L15/284/12-507P2). We have been unable to determine the depth of the existing foundations and/or the presence of a basement to 3 Northington St or 22 King's Mews although have been verbally informed that a basement exists to 3 Northington St. Subsequently, it is proposed to allow, where necessary, for the extension of the foundations to properties utilising mass concrete underpinning stools as indicated on drawing L15/284/12-506P4 attached.

As outlined in Section 9.1 of the BIA:

- *The buildings adjacent to the left hand side of the site, (Nos. 3 & 5 Northington Street / 18-19 King's Mews) are structurally independent from No 20-21 and both have existing 'dry' basements as confirmed by the owner of No. 5 Northington St and the trial pits (see Appendix A). As the proposed works to No. 20/21 is independently supported and not extending to any significant depth below that of No 3 & 5 Northington St., these buildings will not be effected by the proposed basement works. The left hand flank wall of No 20 is not a party wall although is to be underpinned to allow construction of the new basement structure.*
- *The front elevation is currently largely open construction and is to be supported at first floor level in the proposed scheme and is not effected by the proposed works*
- *The rear elevation is a party wall and is to remain largely unchanged. Resistance to horizontal movement following the formation of the basement is to be via a new concrete wall set in front of the existing wall. It is proposed that the wall will be underpinned to basement depth to allow construction of the basement wall.*
- *The right hand side elevation is a party wall and is to remain largely unchanged. Resistance to horizontal movement following the formation of the basement is to be via a new concrete wall set in front of the existing wall. It is proposed that the wall will be underpinned to basement depth to allow construction of the basement wall.*
- *Propping will be provided during the construction of the basement and in the permanent condition*

Query 5 – Stability

The proposed method of construction has been outlined in Section 8.3 of the BIA but has been expanded below in more detail:

The general philosophy is to construct the proposed development in a way to be independent of the existing structures, walls and foundations of adjacent buildings by creating a reinforced concrete 'box' within the footprint of the building and supported on a piled. The existing party walls/neighbouring foundations will retain their existing foundation arrangement with no

additional vertical or horizontal load being transferred. There may be a need to carry out local underpinning to existing foundations in order to prevent disturbance of founding soils whilst the new basement is being constructed and, to address the worst case scenario, the following strategy is to be implemented:

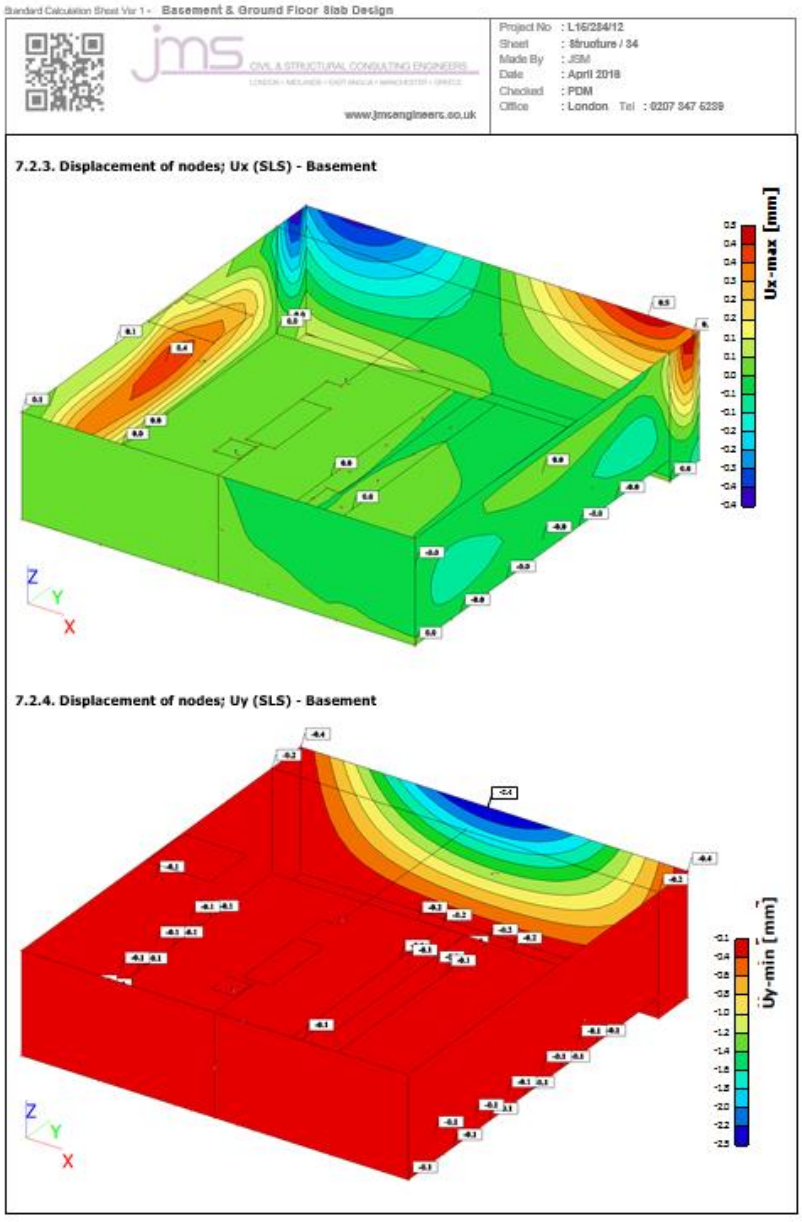
- Excavation for underpins, where required, to occur in the sequence specified on JMS drawing L15/284/12 – 501A, at half the final basement level (approximately 1.90m deep). Underpinned bays to be packed and backfilled once the underpin has been completed sufficiently to support the wall above.
- Once all bays have been completed at Stage 1, excavation to final basement level to occur in the sequence specified on drawing JMS L15/284/12 – 501A. Underpinning Bays to occur in a staggered position compared to Stage 1 Underpinning Bays. Underpinned bays to be packed and backfilled once the leg of underpinning has been completed sufficiently to support the underpin above.
- Should ground water be encountered, permeation grouting is to be utilised
- Excavation to final formation level installing suitable propping as drawing JMS L15/284/12-506P9
- Use of Kitten Pile Rig (or similar) and commencement of piling from basement formation level as shown on JMS drawing L15/284/12 – 501A.
- Construction of new Basement slab and Retaining Walls and ground floor structure
- The final sequence of working in detail will be agreed with the successful main contractor and any variations reported accordingly. The foregoing is an indication of the likely process for the substructure works, subject to completion of all intrusive surveys, all agreements being in place and selection of the agreed final construction process subject to those intrusive site findings.

Query 6 – Stability

The proposed development has been designed and detailed in a way to be independent of the existing structures, walls and foundations by creating a reinforced concrete ‘box’ within the footprint of the building and supported on a piled structure.

- The side walls, in the permanent state, are propped at basement and ground floor level reducing lateral movement to virtually zero.
- The rear wall abuts an existing basement with subsequent retention of approximately 1.8m. Lateral movement is predicted to less than 2mm
- The front wall, in the permanent state, is also propped at basement and ground floor level reducing lateral movement to virtually zero.
- Subsequently, the impact on the highway and any services is zero

The estimated movements (see below) are considered to represent a worst case scenario, particularly as the movements resulting from basement excavation will be minimised due to control of the propping in the temporary works and a regime of monitoring



Query 7 – Stability

Outline of movement monitoring has been included with section 10.2 but we confirm that the predictions of ground movement will be checked by monitoring of adjacent properties and structures. Condition surveys of the above existing structures will be carried out before and after the proposed works. The precise monitoring strategy will be developed at a later stage and it will be subject to discussions and agreements with the owners of the adjacent properties and structures. Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works.

We trust that the above and enclosed satisfactorily answer your queries but should you require additional clarification and/or information then please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of JMS Engineers Ltd

D Staines BEng(Hons) CEng MIStructE

Enc

Our Ref: L15/284/12

16th June 2016

Campbell Reith
Friars Bridge Court
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London
SE1 8NZ

For the attention of Fatima Drammeh

Dear Sirs

Re: 20-21 King's Mews WC1N 2JB – Your Ref 12336-54-240516

Following our telephone conversation of today I can confirm the following:

1. I attach revised drawing 507P3 which clarifies the results and positions of the original trial pits together with identifying the position of the more recent Borehole carried out by Merewood of which I sent the log on the 13th June 2016.

2. The Computer analysis carried out by the Scia program predicting movements of the basement walls has adopted the following values of Young's Modulus:
    - Sand/Gravel silty (including the fill) = 15 Mpa
    - Stiff Clay (High Plasticity) = 18 Mpa

3. The maintaining of stability of the adjacent buildings has been taken into consideration in both the superstructure and substructure design. The level of the existing ground floor slab is being maintained ensuring that any current propping action remains and that no surcharge is being applied to the party walls from either side.

4. A structural inspection report of the existing building has been undertaken (see attached report dated 8th February 2016 ref DJS/L15/284/12). This report has confirmed that the party walls *''to be structurally stable (pg. 5)*" although require lateral restraint which has been addressed by the temporary works shown on drg 508 and the structural framing in the permanent works as shown on the drawings.

5. The pile layout indicated on drawing 501 identifies the support proposal for the new building and is entirely located beneath the footprint of this site i.e. does not form part of underpinning of party walls or contiguous piled walling. The philosophy behind the design is that the new structure is entirely supported off an independent piled foundation solution with all vertical loads from the existing building removed from the party walls. Lateral stability of the party walls is via tying to the new building with vertical sliding anchors allowing vertical differential movement to be maintained.

6. The following is a summary of the predicted Damage:

    a. 19 Kings Mews This building is structurally independent from No 20-21 and has a basement of a greater depth (approx. 500mm) than the proposed. This building will not be affected by the proposal and damage is classed as **Category 0 (negligible)**

    b. 3 Northington St This building is structurally independent from No 20-21 and, we understand, has a dry basement of a similar depth to that of the proposed. Trial pit 2 identified a footing to the depth of 2m below GL but it is viewed that this the footing of the 'old/redundant' basement party wall with the new basement of No 3. set behind this. Nominal underpinning of this non-loadbearing wall will be undertaken but the building will not be affected by the proposal and damage is classed as **Category 0 (negligible)**

    c. **Kings Mews (Front Elevation/Road)** The front elevation is currently largely open construction and is to be supported at first floor level in the proposed scheme. No underpinning works are required and the construction of the retaining wall is to be undertaken utilising trench boxes maintaining full earth

support at all times. Lateral movement has been calculated as less than 1mm and damage is classed as **Category 0 (negligible)**

d. 53/55 Gray's Inn Road An existing basement exists to these properties to a depth of approximately 2.2m below existing ground level. Resistance to horizontal movement following the formation of the basement is to be via a new concrete wall set in front of the existing wall and it is proposed that the existing wall will be underpinned to basement depth to allow construction of the basement wall. There is no additional vertical loading to be imparted to the existing wall and as such no vertical movement is expected. Some disturbance may arise due to the underpinning process but this will be mitigated by adopting best practice, a competent contractor and a monitoring system and damage is classed as **Category 1 (very slight)**

e. 22 Kings Mew's The foundations to this party wall have yet to be identified due to site restrictions but is presumed the worst case of relatively shallow foundations. (Confirmation of actual depths of the foundations will be identified on possession of the site and before any construction works are undertaken.) Subsequently, at present it is proposed to underpin this wall adopting the techniques indicated on the drawings prior to constructing the new, independently supported basement structure. Resistance to horizontal movement following the formation of the basement is to be via a new concrete wall set in front of the existing wall. There is no additional vertical loading to be imparted to the existing wall and as such no vertical movement is expected. Some disturbance may arise due to the underpinning process but this will be mitigated by adopting best practice, a competent contractor and a monitoring system and damage is classed as **Category 1 (very slight)**

7. With regard to proposed monitoring of works/movement during the construction process we have attached monitoring regime (L15_284_12 Monitoring Spec) which is to be agreed with the relevant Party Wall Surveyors.

8. I have replicated in Appendix A the predicted lateral movements of the retaining walls which I believe were not clear on the previous submission. As you will see, due to the presence of the existing neighbouring basements, the stiffness of the proposed walls and propping action of the ground floor slab, the predicted movements are generally less than 1mm. Please note, the 2.4mm deflection to the wall abutting 53/55 Grays Inn is at the top. The Grays Inn Road properties, as confirmed above, have basements to a depth of approximately 2.2m below Ground level where the deflection is less than 1mm.

9. As discussed in our earlier telephone conversation, unlike the horizontal movements, the vertical movement of the soils due to the removal of the overburden have not been computer modelled and the predictions outlined in section 9.2 & 9.3 of the BIA are based upon empirical methods of observation and experience. The relatively small footprint of the basement, the presence of a 2m (approx.) sand/gravel layer under the formation layer before encountering the clay and the variable depth of the surrounding buildings all combine to prevent an accurate ground model to be produced. Subsequently, a worst case scenario has been allowed for by providing a foundation solution independent of the existing party walls/adjacent buildings and providing a (150mm) void between the top of formation and underside of the foundations. Computer models are unable to take account of the mitigating effect of existing structures, the stiffness of the proposed floor slab, proposed underpins and the piles, which in reality will combine to restrict these movements within the basement excavation. The movements predicted at or just beyond the site boundaries are unlikely to be fully realised and should not therefore have a detrimental impact upon any nearby structures.

We trust that the above and enclosed satisfactorily answer your queries but should you require additional clarification and/or information then please do not hesitate to contact the undersigned.

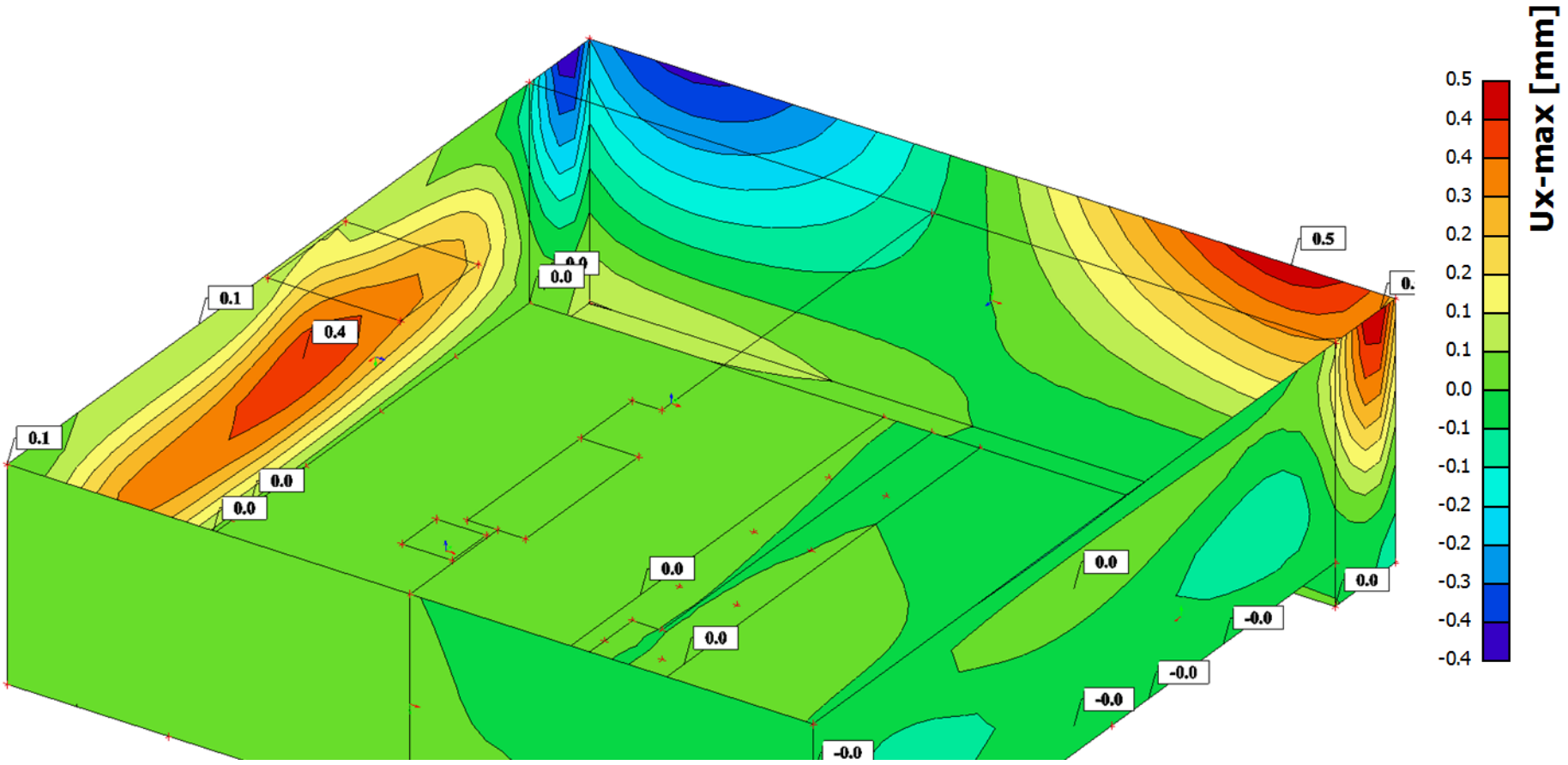
Yours faithfully
For and on behalf of JMS Engineers Ltd

D Staines BEng(Hons) CEng MIStructE

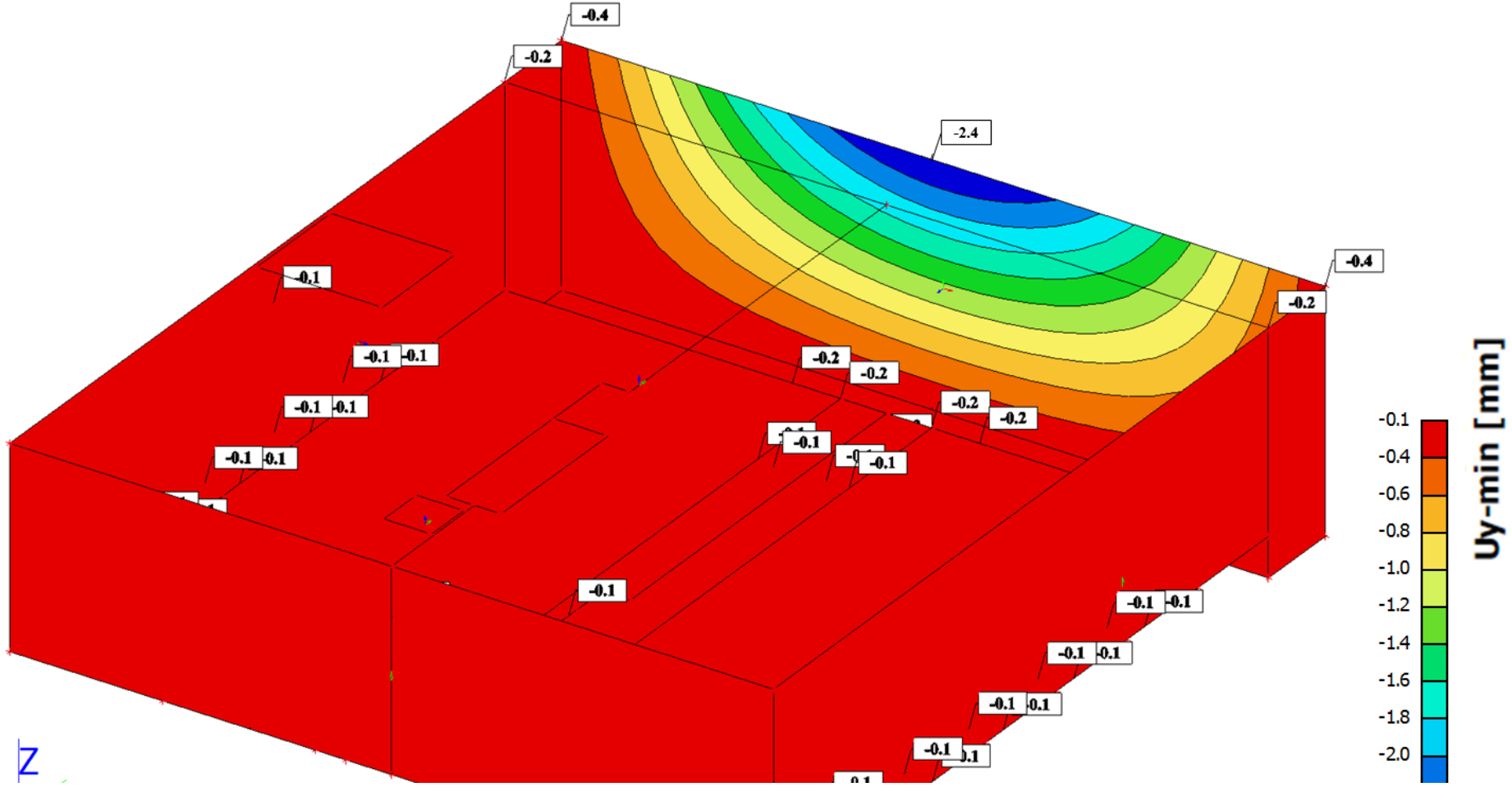
Enc

Appendix A

7.2.3. Displacement of nodes; Ux (SLS) - Basement



7.2.4. Displacement of nodes; Uy (SLS) - Basement



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Borehole Log

Borehole No. **MBH1**

Sheet 1 of 2

Project Name:	Kings Mews, London	Project No. 20081	Co-ords:
Location:	London		Level:
Equipment:	Cut down Shell and Auger Rig		Dates: 10/06/2016

Hole Type: CP
Scale: 1:50
Logged By: STM

Well	Wtr Strk	Sample and In Situ Testing: Depth (m)	Type	Results	Coring: FI	TCR	SCR	RQD	Depth (m)	Level (m)	Legend	Stratum Description
									0.20			MADE GROUND: Concrete.
									0.50			MADE GROUND: Crushed brick and concrete.
		0.50	D,J									MADE GROUND: Soft to firm dark brown very gravelly medium sandy clay. Gravel is fine to coarse angular brick and concrete.
		1.50	D									
		1.50	SPT(S)	N=5 (1,1/1,1,1,2)								
		2.50	D									
		2.50	D,J									
									2.90			MADE GROUND: Dense to very dense brown very clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to rounded flint, quartz and brick.
		3.50	D,J									
		3.50	SPT(C)	N=50 (2,9/9,18,18,5)					3.60			Dense to very dense orange very gravelly medium SAND. Gravel is fine to coarse sub-angular flint and quartz.
		3.60	D									
		3.60	D,J									
		4.00	B						4.00			Very dense orange brown medium sandy GRAVEL. Gravel is fine to coarse sub-angular flint and quartz.
		4.50	B						4.30			Medium dense orange gravelly medium SAND. Becoming very gravelly with depth. Gravel is fine to coarse sub-angular flint and quartz.
		4.50	SPT(C)	N=20 (4,4/3,4,6,7)								
									5.30			Medium dense orange brown medium sandy GRAVEL. Gravel is fine to coarse sub-angular flint and quartz.
		5.50	SPT(C)	N=13 (2,2/2,3,3,5)					5.70			Stiff orange brown slightly gravelly CLAY. Gravel is fine to coarse sub-angular flint and quartz.
		6.00	D						6.00			Stiff becoming very stiff with depth dark grey CLAY with occasional shell fragments.
		6.50	SPT(C)	N=15 (2,2/2,3,5,5)								
		7.50	D									
		8.00 - 8.50	U	Ublow=75								
		8.50	D									
		9.50	D									
		9.50	SPT(S)	N=20 (2,4/4,5,5,6)								
												Continued on Next Sheet

D = small disturbed sample (tub)
J = organic sample (amber glass jar)
V = volatile sample (amber glass vial)
B = bulk bag sample
SPT(C) = Standard Penetration Test (Cone)
SPT(S) = Standard Penetration Test (Split Spoon)

HSV = hand shear vane (kPa)
PP = pocket penetrometer (kg.cm2)
PID = photoionisation detector (ppm)
FI = fracture index
TCR = total core recovery
SCR = solid core recovery
RQD = rock quality designation

Remarks

Groundwater levels not logged due to addition of water during drilling.

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Borehole Log

Borehole No.
MBH1
Sheet 2 of 2

Project Name:	Kings Mews, London	Project No. 20081	Co-ords:
Location:	London		Level:
Equipment:	Cut down Shell and Auger Rig		Dates: 10/06/2016

Hole Type: CP
Scale: 1:50
Logged By: STM

Well	Wtr Strk	Sample and In Situ Testing			Coring				Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results	FI	TCR	SCR	RQD				
		11.00 - 11.50	U	Ublow=90								
		12.50 12.50	D SPT(S)	N=26 (2,4/6,5,7,8)								
		14.00 - 14.50	U	Ublow=90								
		15.00 15.00	D SPT(S)	N=25 (4,6/5,6,7,7)					15.00			End of Borehole at 15.00m

11 12 13 14 15 16 17 18 19 20

D = small disturbed sample (tub)
J = organic sample (amber glass jar)
V = volatile sample (amber glass vial)
B = bulk bag sample
SPT(C) = Standard Penetration Test (Cone)
SPT(S) = Standard Penetration Test (Split Spoon)

HSV = hand shear vane (kPa)
PP = pocket penetrometer (kg.cm2)
PID = photoionisation detector (ppm)
FI = fracture index
TCR = total core recovery
SCR = solid core recovery
RQD = rock quality designation

Remarks
Groundwater levels not logged due to addition of water during drilling.

Our Ref: L15/284/12

June 2016

Re: Proposed Monitoring Regime – 20-21 King's Mews WC1N 2JB

In order to monitor potential effects of the proposed construction works at the above site it is intended to undertake a monitoring regime so as to identify movement of existing structures adjacent to the site and take action accordingly. All works are to undertaken by a Chartered Building Surveyor or appropriate Company and is instigated as follows:

1. Surveyor to visit the site to inspect the site structures and those adjacent to it. A number of monitoring points to be installed as as agreed by relevant parties. These monitoring points are set in order to measure both vertical and horizontal movement to 1mm accuracy.

2. An initial set of readings to be taken prior to commencement of construction. Timing of subsequent visits will be subject to the main contractor's program of works on site but a bi-weekly basis is expected whilst below ground construction takes place. It is anticipated that the monitoring regime will last for the duration of the basement structural works.

3. Reports showing numbered positions of the monitoring targets together with a spreadsheet showing any discrepancies between the previous visit and the original visit is to be issued to all relevant parties within 24hrs of site visit.

4. Trigger limits are to be set as:

    - **0-2mm** (Green) – No Action
    - **2-4mm** (Amber) - Structural Engineer should be notified and the contractor to proceed with caution.
    - **4mm+** (Red) - Structural Engineer should be notified and works halted on site until otherwise agreed with the Engineer.

An example of monitoring points that may be used:

75 x 75mm Prisim

The prisim is the most accurate and is bolted to the building surface using a 8mm x 80mm expanding bolt. Once removed they leave a drilled hole in the wall

8 x 80mm Fixing Bolt

25 x 25mm Target

These targets stick to the surface, they are slightly less accurate and have a potential to come away from the surface due to weather conditions and only to be used where prisim targets are inappropriate

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