CampbellReith
consulting engineers

Panther House
38 Mount Pleasant, The Brain Yard
156-164 Gray's Inn Road, WC1X

Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12336-03
Revision: F1

March 2016

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Project Number	12336-03
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Planning Reference	2015/6955/P

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 Panther House, 38 Mount Pleasant, London WC1X (planning reference 2015/6955/P). The basement is considered to fall within Category C as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access the latest revision of submitted documentation and reviewed it against an agreed audit check list.

1.4. The BIA has been carried out by a well known firm of consultants who possess relevant qualification and experience.

1.5. The redevelopment consists of three separate buildings, one of which will be refurbished and has an existing basement. The other two buildings will be demolished behind a retained façade and a new basement will be constructed to match the existing. The new basement will be formed by a combination of underpinning and an interlocking secant bored pile retaining wall.

1.6. A ground investigation has been undertaken which identified that the new basement will be formed within the River Terrace Gravel, below which London Clay is to depth. Two readings from two standpipes has shown that the basement is close to the measured water table.

1.7. The site is located within a Critical Drainage Area and a Flood Risk Assessment and Surface Water Drainage Statement has been carried out which identifies an acceptable low risk to flooding.

1.8. The provision of green roofs and below ground attenuation has identified a reduction in surface water run off rates and discharge volumes resulting in a reduction to the risk of downstream flooding.

1.9. It is accepted that there are no slope stability concerns, no hydrogeological concerns and no hydrological concerns with respect to the development proposals.

1.10. The BIA could be improved by the inclusion of map extracts from CPG4 source documents, showing the site location, to support statements made in the screening process.

1.11. The GMA has been revised following the initial audit which raised a number of queries. It is accepted that although a maximum Category 2 damage is predicted to the neighbouring

properties, given the depth of the basement, this is likely to be an overestimate and damage should be within Category 1 with good control of workmanship.

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

- Further investigation of groundwater equilibrium conditions and seasonal variations, as well as groundwater flow
- details of adjacent boundary foundations these should be incorporated into the final design of the retaining walls
- the presence of any basements in adjacent properties
- an indicative temporary works scheme
- confirmation of any construction phasing
- confirmation that the ground movement and building damage assessment conclusions remain valid following confirmation of any construction phasing
- a specific ground movement monitoring proposal.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 11 January 2016 to carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for Panther House, 38 Mount Pleasant, WC1X Camden Reference 2015/6955/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 *"Redevelopment of existing buildings to provide part 4 storey and part 7 storey building following partial demolition of existing Panther House and Brain Yard buildings for a mix of Class B1a (office), A1(retail) and A3(restaurant/café) uses, provision of a new 7 storey building at 156-164 Gray's Inn Road behind retained façade from existing building at 160-164 Gray's Inn Road to provide flexible*

Class A1/A3 (retail/restaurant) use at ground and basement levels and 13 self-contained residential units (C3) (4 x 1-bed, 7 x 2-bed and 2 x 3-bed) at upper floor levels". The Audit Instruction also confirmed the property did not involve a listed building nor was a neighbour to a listed building.

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

- Structural Report and Basement Impact Assessment dated December 2015 Eckersley O'Callaghan and Appendices:

- Appendix A – Outline Specification
- Appendix B – Design Parameters
- Appendix C – Proposed Structural Drawings
- Appendix D – Geotechnical Report (BIA) by GEA Ltd
- Appendix E – Ground Movement Assessment by GEA Ltd
- Appendix F – Construction Management Plan by Wates
- Appendix G – Flood Risk Assessment and Surface Water Drainage Statement by Robert West.

2.7. Campbell Reith received revised information from Eckersley O'Callaghan on 02 March 2016 in response to the D1 revision of this report as follows:

- Basement Impact Assessment (BIA) by GEA Ltd.
- Ground Movement Assessment by GEA Ltd.

2.8. An email response from GEA on 23 March 2016 is included in Appendix 3 following a request for clarification on the conclusions of the revised Ground Movement Assessment.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See Section 1.5.
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	See BIA Section 2.
Are suitable plan/maps included?	No	Location map only.
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	No	Extracts from Camden GHHS, EA and Strategic Flood Risk Assessment identifying site location could be provided.
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4.1.2.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4.1.1.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	See BIA Section 4.1.3.
Is a conceptual model presented?	Yes	See BIA Section 7.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes Yes	See BIA Section 5.1.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes Yes	See BIA Section 5.1.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	
Is factual ground investigation data provided?	Yes	See BIA Section 3 and Appendix D.
Is monitoring data presented?	Yes	See BIA Section 3.2 but only one monitoring visit.
Is the ground investigation informed by a desk study?	Yes	See BIA Appendix Section 2.1. and 2.2.
Has a site walkover been undertaken?	Yes	See BIA Section 2.1.
Is the presence/absence of adjacent or nearby basements confirmed?	No	
Is a geotechnical interpretation presented?	Yes	See BIA Section 3.1.
Does the geotechnical interpretation include information on retaining wall design?	Yes	See BIA Section 8.1.2.
Are reports on other investigations required by screening and scoping presented?	Yes	Ground Movement Assessment Report. Flood Risk Assessment and Surface Water Drainage Statement.
Are baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	No	
Is an Impact Assessment provided?	Yes	See BIA Section 9.
Are estimates of ground movement and structural impact presented?	Yes	See BIA Appendix E.

Item	Yes/No/NA	Comment
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	See BIA Section 9.
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	See BIA Section 10.
Has the need for monitoring during construction been considered?	Yes	See BIA Appendix E Section 6.2.
Have the residual (after mitigation) impacts been clearly identified?	Yes	See BIA Section 10.
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	Yes	
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	See Flood Risk Assessment and Surface Water Drainage Statement.
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	Category 0 (Negligible) to 2 (Slight) predicted
Are non-technical summaries provided?	No	

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) has been produced by a well known firm of consultants, Geotechnical and Environmental Associates (GEA) and has been produced by individuals who possess relevant qualifications and experience.

4.2. The BIA is contained within a Structural Report and Basement Impact Assessment (SR) by Eckersley O'Callaghan as its Appendix D.

4.3. The redevelopment site consists of three separate buildings, Panther House, Brain Yard and 156-164 Gray's Inn Road. Panther House comprises three blocks which are to be refurbished and vertically extended around a central courtyard, which is to be infilled following the demolition of an existing basement area and insertion of new piled foundations to support a new circulation core and toilet block. Following the demolition of the existing buildings on Brain Yard and Gray's Inn Road, a new basement is to be constructed between the retained Gray's Inn Road frontage and Panther House requiring the existing Brain Yard basement to be lowered. The new basement will be formed by a contiguous bored pile retaining wall inserted adjacent to the existing foundations of Dulverton Mansions to the north, 150 Gray's Inn Road to the south and the retained façade of 156-164 Gray's Inn Road. Gable walls on the north and south boundaries will be underpinned down to the level of the proposed basement immediately adjacent to the extent of the bored piled retaining wall. Foundations below the internal columns of the new buildings will consist of bored piled and pile caps.

4.4. A soils investigation has been undertaken by Site Analytical Services in August 2015 comprising two boreholes and eight trial pits. This determined that below a variable thickness of Made Ground, River Terrace Deposits (sandy gravel) is underlain by London Clay and the Lambeth Group. The proposed basement will be constructed to a similar level as the existing basement below Panther House (approx. 15.54m OD) and the River Terrace Gravel extends to between 13.69m OD and 13.80m OD in the boreholes, i.e. towards the limit of the gravel. Groundwater has been measured within the standpipes installed in the boreholes at depths of between 13.72m OD and 15.30m OD. The BIA concludes that "*on this basis, the basement level is close to the measured water table. Further monitoring is required to confirm the groundwater level and it would be prudent to carry out trial excavations to the full depth of the proposed basement to assess the stability of the soils and level of water table. The investigation was undertaken in August and the ground investigation would establish seasonally low groundwater levels, such that the basement may extend below the water table. In any case, inflows could conceivably occur from perched water tables, particularly in the vicinity of existing foundations. These inflows should be adequately dealt with through sump pumping. However, it would be prudent for the contractor to have a contingency plan in place to deal with more significant or prolonged inflows as a precautionary measure".* This is accepted and recommended that the

additional investigation takes place prior to site commencement. The investigation should involve additional monitoring standpipes to determine groundwater flow, equilibrium conditions and the extent of any seasonal fluctuations. It should also confirm that the proposed excavations, and in particular the underpinning bays, remain above the water table. It is noted that although eight trial pits were excavated, identified at the rear of the appendix to the BIA and summarised in the BIA section 3.4, none investigated the form and depth of existing foundations to the site boundary walls. It is recommended that these are included in any additional investigation.

The standpipes were monitored again in February 2016 and the results included in the revised BIA. This showed that the groundwater level has risen by 0.57 metres, i.e even closer to the proposed basement level. It is recommended that further monitoring of groundwater levels is carried out.

4.5. The BIA and SR have both identified that there is no increase in impermeable area across the ground surface above the basement and it is accepted that the surface water flow regime will be unchanged.

4.6. The site is located within a Critical Drainage Area Group 3-003 as defined by LBC's Surface Water Management Plan and a Flood Risk Assessment and Surface Water Drainage Statement has been carried out by Robert West and is included in the BIA as Appendix G. This has identified that the site has a low risk to flooding from surface water, sewers, reservoirs (and their artificial sources), groundwater and fluvial/tidal watercourses and it is accepted that no mitigation measures are required to reduce the risk further. A drain cavity pump station and anti-flood valve will be incorporated into the basement to prevent storm water surcharge.

4.7. The surface water strategy for the development incorporates the addition of green roofs onto the new roof space and the provision of below ground attenuation had identified potential reductions in peak run off rates and discharge volumes resulting in a reduction to the risk of downstream flooding.

4.8. It is accepted that there are no slope stability concerns regarding the basement development.

4.9. It is accepted that no known ponds, springlines or wells are in close vicinity to the site and that the site is outside the Hampstead pond chain catchment area.

4.10. Although it is evident that GEA provided a thorough screening process within the BIA, it would be beneficial if the requirements of CPG4 were followed accurately by the inclusion of map extracts from the LBC GSD, Environment Agency and the LBC Flood Risk Management Strategy identifying the site location on each map. These extracts would help to support statements made in the BIA screening process.

4.11. It is noted that the revised BIA identifies the use of a contiguous bored pile retaining wall but the solution contained within the SR refers to a secant wall only which inherently provides more protection against groundwater inflows during construction. It is accepted that this cut-off construction is unlikely to have a significant effect as groundwater will be able to continue to flow around the proposed substructure.

4.12. The BIA recognises that the excavation of the 4m deep basement will induce heave and potential groundwater uplift forces on the basement floor slab and these precautions have been followed through into the SR.

4.13. The SR contains a comprehensive construction sequence with diagrams of each stage and discusses, in general terms, the form of temporary works necessary to maintain the stability of surrounding buildings during construction. However, an indicative temporary works scheme should be provided which is likely to necessitate confirmation of the phasing of the construction works between Panther House and the remaining new build development. This, together with the additional investigation works discussed previously in item 4.4, should be provided as part of a Basement Construction Plan prior to construction commencement.

4.14. The SR includes a Ground Movement Assessment (GMA) by GEA as its Appendix E which uses the geotechnical modelling software XDisp to predict vertical and horizontal movements to adjacent buildings and the highway caused by piling, underpinning and excavation. The GMA models installation effects as a contiguous piled wall, which is in conflict with the SR report, which indicates a secant piled wall. The GMA should therefore be updated for a secant piled wall, which is more conservative. In addition, the anticipated pile length should be used when determining installation effects, and not the basement depth.

4.15. There is conflict between the GMA text and the XDisp input when predicting ground movements due to underpinning. The text indicates the underpinning will be modelled as 'installation of a planar diaphragm wall' whereas 'excavation in front of a wall in sand' has been used in XDisp. This should be addressed.

4.16. Ground movements due to the excavation itself have also been modelled as 'excavation in front of a wall in sand'. This is not considered appropriate as this is for walls embedded wholly in sands. This part of the GMA should also be updated.

4.17. Finally, the site is within 5m of a public highway and as such the GMA should be updated to include predicted movements along the roadway.

The GMA has been revised following the initial audit with the queries above addressed. It is stated that part of the basement will be formed by a contiguous or a secant wall although a secant wall analysis has been undertaken. An anticipated damage ranging from Category 0

(Negligible) to Category 2 (Slight) is predicted for the immediate neighbouring properties. One of these properties (No 166) is indicated to comprise a lower ground floor and an assumed foundation level was used in the Xdisp model. A damage Category 0 (Negligible) is predicted for Gray's Inn Road. Short term heave movements due to excavation have been estimated using the Oasys software Pdisp and approximately 12.5mm movement is indicated in the centre of the excavation reducing to less than 5mm at the edges. Clarification was requested on the statement within the conclusions in Section 7 regarding the estimated damage and the sensitivity of the neighbouring structures. An email from GEA on 23 March 2016 indicates the predicted damage is likely to be an overestimate and maximum damage should be within Category 1 with good control of workmanship and this is accepted. It is further, stated, however that monitoring and mitigation measures should be implemented to ensure the movements do not exceed these limits.

4.18. It is noted that Section 5.11 of the GMA states that a vertical line load of up to 300kN/m is required to be supported by the retaining walls and an embedment depth of 6m has been assumed at this initial stage. It is acknowledged that the designs are yet to be finalised, however, it should be noted the piles may need to extend to greater depths to provide adequate resistance.

4.19. Further details are requested regarding the presence of any basements in the adjacent properties and these should be included in the Basement Construction Plan.

4.20. Although the BIA discusses which adjacent properties should be monitored for ground movements, no specific details are proposed and these should be incorporated into a Basement Construction Plan.

5.0 CONCLUSIONS

5.1. The BIA has been carried out by a well known firm of consultants who possess relevant qualification and experience.

5.2. The redevelopment consists of three separate buildings, one of which will be refurbished and has an existing basement. The other two buildings will be demolished behind a retained façade and a new basement will be constructed to match the existing. The new basement will be formed by a combination of underpinning and an interlocking secant bored pile retaining wall.

5.3. A soils investigation has been undertaken which identified that the new basement will be formed within the River Terrace Gravel, below which is London Clay to depth. Two readings from two standpipes has shown that the basement is close to the measured water table.

5.4. The site is located within a Critical Drainage Area and a Flood Risk Assessment and Surface Water Drainage Statement has been carried out which identifies an acceptable low risk to flooding.

5.5. The provision of green roofs and below ground attenuation has identified a reduction in surface water run off rates and discharge volumes resulting in a reduction to the risk of downstream flooding.

5.6. It is accepted that there are no slope stability concerns, no hydrogeological concerns and no hydrological concerns with respect to the development proposals.

5.7. The BIA could be improved by the inclusion of map extracts from CPG4 source documents, showing the site location, to support statements made in the screening process.

5.8. The GMA has been revised following the initial audit which raised a number of queries. It is accepted that although a maximum Category 2 damage is predicted to the neighbouring properties, given the depth of the basement, this is likely to be an overestimate and damage should be within Category 1 with good control of workmanship.

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

- Further investigation of groundwater equilibrium conditions and seasonal variations, as well as groundwater flow
- Details of adjacent boundary foundations and these should be incorporated into the final design of the retaining walls
- The presence of any basements in adjacent properties

- An indicative temporary works scheme
- Confirmation of any construction phasing
- confirmation that the ground movement and building damage assessment conclusions remain valid following confirmation of any construction phasing
- A specific ground movement monitoring proposal

Appendix 1: Residents' Consultation Comments

None

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status/Response	Date closed out
1	Stability	Ground Movement Assessment to be revised.	Closed – GMA revised with initial queries addressed	23/03/16
2	BIA-Screening	Map extracts from CPG4 source documents showing site location	Open - to be included in Basement Construction Plan (BCP)	N/A
3	Hydrogeology	Further investigation of groundwater level and flow	Open - to be included in BCP	N/A
4	Stability	Details of adjacent boundary foundations	Open - to be included in BCP	N/A
5	Stability	Presence of any basements in adjacent properties	Open - to be included in BCP	N/A
6	Stability	Indicative temporary works scheme	Open - to be included in BCP	N/A
7	Stability	Confirmation of any construction phasing	Open - to be included in BCP	N/A
8	Stability	Confirmation that the ground movement and building damage assessment conclusions remain valid following confirmation of any construction phasing	Open - to be included in BCP	N/A
9	Stability	Specific ground movement monitoring proposal	Open - to be included in BCP with details and trigger levels to be agreed as part of Party Wall awards.	N/A

Appendix 3: Supplementary Supporting Documents

Email from GEA dated 23 March 2016

RE: Panther House GEA ref:J15249A
Matthew Penfold
to:
fatima.drammeh@campbellreith.com, FatimaDrammeh@campbellreith.com
23/03/2016 16:57
Cc:
Martin Cooper, Steve Branch
Hide Details
From: Matthew Penfold <Matthew@gea-ltd.co.uk>
To: "fatima.drammeh@campbellreith.com" <fatima.drammeh@campbellreith.com>, "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com>
Cc: Martin Cooper <Martin@gea-ltd.co.uk>, Steve Branch <Steve@gea-ltd.co.uk>
History: This message has been replied to.

Fatima,

Thank you for your email.

Yes, in answer to your query, we do consider that the predicted damage categories are likely to represent an overestimate and have made comments to this effect within the report, in particular in the following paragraph of the conclusions, where we state that the predicted movements are unlikely to be fully realised, although monitoring and mitigation measures should still be implemented to ensure this.

Further to your comments below we have revised our concluding statement, which we include below for you to review - at this stage, we assume that this should be sufficient and that you do not require the report to be updated and re-issued?

'The analysis has concluded that the predicted damage to the neighbouring properties would generally be Negligible to Very Slight, with some limited sections of Category 2 (slight) damage on the front and rear / side elevations of the adjoining properties. It is, however, important to bear in mind that the results provide a conservative estimate of the behaviour of each of the sensitive structures and that in reality the predicted movements are unlikely to be fully realised. It is therefore considered that the predicted damage categories represent an overestimate and that the maximum damage potential is unlikely to exceed Category 1 (Very Slight).

At this site, it is therefore considered that the damage that will inevitably occur as a result of such an excavation will fall within the acceptable limits, although monitoring and mitigation measures should still be implemented to ensure that no excessive movements occur that would lead to damage in excess of these limits.'

Regards,

Matt

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-----Original Message-----
From: FatimaDrammeh@campbellreith.com [mailto:FatimaDrammeh@campbellreith.com]
Sent: 21 March 2016 17:22
To: Martin Cooper <Martin@gea-ltd.co.uk>
Cc: Matthew Penfold <Matthew@gea-ltd.co.uk>; camdenaudit@campbellreith.com
Subject: RE: Panther House GEA ref:J15249A

Hi Martin,
He did ring me back in the morning. The queries we have are following that conversation and are as follows:

A maximum Category 2 (slight) is predicted. We cannot accept the argument in Section 7 of the GMA about the neighbouring properties not being residential therefore damage worse than than Category 1 is acceptable.
We do acknowledge that in reality with good control of workmanship movements should be controlled within acceptable limits
Rather than describe the assessment as conservative, do you think the predicted damage is an overestimate? If this argument can be made then we can hold off issuing our report.

Thank you.

Kind regards
Fatima Drammeh
Geotechnical Engineer

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From: Martin Cooper <Martin@gea-ltd.co.uk>
To: "FatimaDrammeh@campbellreith.com" <FatimaDrammeh@campbellreith.com>
Cc: Matthew Penfold <Matthew@gea-ltd.co.uk>
Date: 21/03/2016 17:07
Subject: RE: Panther House GEA ref:J15249A

Hi Fatima

I had passed on your earlier message for Matt to give you a ring however he must have been tied up this afternoon. If it helps would you like to e-mail us with the query? I am in head office and will be seeing Matt in the morning so if we can't get a response to you this afternoon then we can sort it first thing tomorrow morning.

Thanks and regards

Martin

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-----Original Message-----
From: FatimaDrammeh@campbellreith.com [
mailto:FatimaDrammeh@campbellreith.com]
Sent: 21 March 2016 16:52
To: Matthew Penfold
Cc: Martin Cooper
Subject: Panther House GEA ref:J15249A

Hi Matthew,
I rang earlier however you were unavailable. We were hoping to issue our audit report today however, there is one aspect of the GMA we'd like to discuss and close out before issuing our report. Can you please give me a ring on 02073401700 so I can run through our queries with you.

Thank you.

Kind regards
Fatima Drammeh
Geotechnical Engineer

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