CampbellReith
consulting engineers

# 66 Fitzjohn's Avenue, London, NW1 0AA

## Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12066-98
Revision: D1

February 2016

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## Document History and Status

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## Document Details

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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 66 Fitzjohn's Avenue, London NW3 5LT (planning reference 2015/5847/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 and Hydrology BIA were completed by competent consultants suitably qualified in accordance with CPG4.

1.5. The proposed works consist of the demolition of the existing above ground two storey building and the construction of a three storey building above ground with basement below.

1.6. The BIA has confirmed that the ground conditions comprise Made Ground over the Claygate Member and then London Clay. Monitoring of a single borehole has shown a groundwater level approximately 0.50m above the proposed top of floor slab level and additional groundwater monitoring is recommended.

1.7. No geotechnical laboratory tests, interpretation or proposed geotechnical parameters for design were provided in the BIA. These should be provided.

1.8. Nearby foundations have been assumed to be shallow strips and the presence or otherwise of basements to any of the adjoining properties should be confirmed. This should be confirmed in order to verify the potential impact on groundwater flows.

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

1.10. The proposed construction method for the basement is to be a propped bored pile, secant retaining wall. Indicative calculations for the retaining walls and floor slab are required, together with an indicative construction sequence demonstrating the principles of design.

1.11. It should be ensured that the boundary wall alongside No 64 Fitzjohn's Avenue can support the proposed loadings and vibration associated with construction and whether that area is underlain by a tunnel.

1.12. The predicted ground movements make no allowance for heave due to the overall basement excavation and assume the piles are completely embedded in stiff clay. Confirmation for the validity of these assumptions and the resultant building damage assessment should be provided.

1.13. It should be confirmed whether the removal of the Silver Birch tree could affect any existing shallow foundations.

1.14. The need for monitoring and condition surveys should be further reviewed, although the final scheme may be agreed with the party wall surveyor.

1.15. The flood risk assessment shows the only significant flood risk as blockage of private drainage connections.

1.16. The Historic Shepherds Hill conduit (water course) used to run within 20-40m to the west of the site. Based on this and the groundwater level identified in the borehole, mitigation measures are proposed. The BIA has stated that the development will not impact on the wider hydrogeology of the area, any other watercourses, springs or the Hampstead Heath Pond chain catchment area.

1.17. The proposed development increases the impermeable surface area. Analyses and design are required to understand the need for mitigation.

1.18. Queries and requests for clarification are discussed in Section 4 and summarised in Appendix 2.

## 2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 5th January 2016 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 66 Fitzjohn's Avenue, London NW3 5LT, Planning Reference 2015/5847/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 "*Demolition of existing two houses and the erection of two new single family dwellings*."

2.6. CampbellReith accessed LBC's Planning Portal on 9th February 2016 and gained access to the following relevant documents for audit purposes:

General Information

- arboricultural report.pdf

- BIA Audit Form.pdf
- BIA.pdf
- Construction Management Plan.pdf
- Design Access statement.pdf
- Hydrological BIA Report.pdf
- Location Plan.pdf
- Planning Application Form.pdf
- PLANNING CMP.pdf
- Planning Policy Statement.pdf

Drawings

- 1169.01.02-Exstng SP(2).pdf
- 1169.01.04-Exstng GF(2).pdf
- 1169.01.05-Exstng RP(2).pdf
- 1169.03.01-Exstng FE(2).pdf
- 1169.03.02-Exstng RE(2).pdf
- 1169.03.03-Exstng SE(2).pdf
- 1169.03.04-Exstng SE(2).pdf

- 1169.01.10(B)-Prpsd SP(2).pdf
- 1169.01.11(C)-Prpsd SP(2).pdf
- 1169.01.12(A)-Prpsd LGF(2).pdf
- 1169.01.13(B)-Prpsd GF(2).pdf
- 1169.01.14-Prpsd FF(2).pdf
- 1169.01.15-Prpsd SF(2).pdf
- 1169.01.16-Prpsd RP(2).pdf
- 1169.01.17-Prpsd CDM(2).pdf
- 1169.02.11-Prpsd AA(2).pdf
- 1169.03.11-Prpsd FE(2).pdf
- 1169.03.12-Prpsd RE(2).pdf

- 1169.03.13-Prpsd SE(2).pdf
- 1169.03.14-Prpsd SE(2).pdf

## 3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

| Item | Yes/No/NA | Comment |
|---|---|---|
| Are BIA Author(s) credentials satisfactory? | Yes | BIA was by a Chartered Engineer (CEng) who is a Member of the Institution of Structural Engineers.<br>Hydrology BIA by a Chartered Geologist (CGeol). Other (unnamed) contributors have suitable qualifications. |
| Is data required by Cl.233 of the GSD presented? | No | Boundary is not clearly defined.<br>Development occupies almost the whole site apart from an access strip & no temporary land appears to be available for construction.<br>Extent of impacted area not clearly defined. |
| 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 and Construction Management Plan (CMP) |
| Are suitable plan/maps included? | Yes | See BIA, HBIA & Drawings |
| Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail? | Yes | See BIA, HBIA & Drawings |
| Land Stability Screening:<br>Have appropriate data sources been consulted?<br>Is justification provided for 'No' answers? | Yes | See BIA – further assessment needed. |
| Hydrogeology Screening:<br>Have appropriate data sources been consulted?<br>Is justification provided for 'No' answers? | Yes | See HBIA – further assessment needed. |
| Hydrology Screening:<br>Have appropriate data sources been consulted?<br>Is justification provided for 'No' answers? | Yes | Appropriate data sources have been consulted but further assessment required. |
| Is a conceptual model presented? | Yes | Description is given in HBIA |

| Item | Yes/No/NA | Comment |
|---|---|---|
| | | |
| Land Stability Scoping Provided?<br>Is scoping consistent with screening outcome? | No | Potential impact of heave from 4m deep excavation has not been assessed.<br>Potential impact from proposed removal of a Silver Birch in high plasticity clay soils warrants further consideration.<br>Condition surveys and monitoring of all adjacent properties is required. |
| Hydrogeology Scoping Provided?<br>Is scoping consistent with screening outcome? | No | See HBIA. Some increase in ground water level may occur - a French drain & sump are proposed for mitigation.<br>Proposed impermeable "roof" over the basement could result in a local increase in infiltration with potential risk of water emerging into the sunken Patio to No 62 – roof should be laid to fall towards the French drain and sump. |
| Hydrology Scoping Provided?<br>Is scoping consistent with screening outcome? | Yes | Hydrology scoping is provided and is consistent. |
| Is factual ground investigation data provided? | No | See HBIA & BIA – laboratory data, ground descriptions not included. |
| Is monitoring data presented? | Yes | Standpipes - only one result provided. The BIA indicates that monitoring is to be ongoing and we would concur. |
| Is the ground investigation informed by a desk study? | Yes | See HBIA |
| Has a site walkover been undertaken? | Yes | See HBIA & BIA |
| Is the presence/absence of adjacent or nearby basements confirmed? | No | The BIA assumes there are no basements but as no contact has been made with the neighbours, this has not been confirmed. |
| Is a geotechnical interpretation presented? | No | Only part of the ground investigation is provided. No laboratory results, descriptions, proposed geotechnical parameters or interpretation are included. |
| Does the geotechnical interpretation include information on retaining | No | |

| Item | Yes/No/NA | Comment |
|---|---|---|
| wall design? | | |
| Are reports on other investigations required by screening and scoping presented? | Yes | Additional groundwater monitoring required and provision of further factual and interpretive geotechnical information. |
| Are the baseline conditions described, based on the GSD? | Yes | See BIA & HBIA. |
| Do the base line conditions consider adjacent or nearby basements? | No | The BIA assumes there are no basements but as no contact has been made with the neighbours this has not been confirmed. |
| Is an Impact Assessment provided? | Yes | But some issues need to be further reviewed. |
| Are estimates of ground movement and structural impact presented? | No | Only empirical values for vertical and horizontal movements are provided that don't allow for potential heave from 4m deep excavation. The estimate assumes that piles are embedded in stiff clay but the ground investigation shows this to be unlikely (firm clay). |
| Is the Impact Assessment appropriate to the matters identified by screen and scoping? | No | Assumes effect on adjacent buildings will be negligible but has not presented analyses to confirm this. Has not determined whether adjacent basements exist. No geotechnical parameters or interpretations provided. |
| Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme? | No | Although mitigation has been suggested, the BIA does not consider all of the contributory factors. |
| Has the need for monitoring during construction been considered? | No | Although considered it is concluded in the BIA that monitoring of adjacent structures is not required. CampbellReith does not agree. |
| Have the residual (after mitigation) impacts been clearly identified? | No | No details have been given as to the possible effect of long term heave on the adjacent properties. |
| Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained? | No | See comments regarding possible heave. |

| Item | Yes/No/NA | Comment |
|---|---|---|
| Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment? | Yes | See HBIA – however, further assessment of the need for a basal drainage layer to the basement and for attenuation of surface water infiltration are needed. |
| Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area? | Yes | See HBIA but see comments above. |
| Does report state that damage to surrounding buildings will be no worse than Burland Category 2? | Yes | Report says it will be no worse than Category 1. However, the prediction does not consider all possible contributory factors. Further assessment required. |
| Are non-technical summaries provided? | No | However, the BIA has generally been written in a way that is easy to understand without the use of excessive technical terms. |

## 4.0 DISCUSSION

4.1. The BIA was carried out by a local Consulting Engineering Practice, Michael Chester & Partners, and was authored by a Chartered Engineer (CEng) who is a Member of the Institution of Structural Engineers.

4.2. The accompanying Hydrology BIA Report (HBIA) by SLR Consulting, was authored by a Chartered Geologist (CGeol). It is stated that other (unnamed) staff involved in the preparation included two hydrogeologists with Chartered Geologist qualifications and one hydrologist who is a Chartered Civil Engineer and holds a Masters Degree in Hydrology. For completeness, these staff should be named together with their relevant qualifications.

4.3. The proposed works consist of the demolition of the existing above ground two storey building and the construction of a three storey building above ground with basement below.

4.4. The proposed above ground building measures approximately 7m x 16m on plan which is a generally similar size to the existing building. The below ground works for the basement, however, measure approximately 12.5 x 16.3m on plan which is almost double the plan area of the existing building. The excavation depth for the basement to the underside of basement slab is approximately 4.5m below the existing ground level. The new basement extends under almost the whole of the existing plot right up to the boundaries with the adjacent properties.

4.5. There is only a narrow access strip alongside No 64 Fitzjohn's Avenue and it has been reported by one of the local residents that there may be some form of tunnel under this strip. Further investigation into the potential for a tunnel should be undertaken. The boundary wall supports the intended access route for construction traffic. It should be ensured that it is adequate to accommodate the construction traffic loadings.

4.6. The BIA has confirmed that general ground conditions at the site are a variable thickness of Made Ground (gravelly clay, sand and clayey gravel) of up to 3.8m, over the Claygate Member (soft becoming firm sandy clay) to 4.5m to 5.0m and then firm becoming stiff London Clay to the base of the borehole at 15m bgl. The BIA & HBIA have identified that in the middle of the proposed basement there is approximately 1m of Made Ground overlaying approximately 3.5m of fine, sandy clay, thus the basement will be founded in or just above the London Clay. The retaining walls will support a combination of Made Ground and materials from the Claygate Formation.

4.7. No geotechnical laboratory tests, interpretations or proposed geotechnical parameters fro design were provided in the BIA. It should be confirmed that they were undertaken and they should be included with the borehole logs etc as they will inform the parameters used in detailed design.

4.8. Monitoring of a single borehole has shown a groundwater level approximately 0.5m above the proposed top of floor slab level. However, this was in the summer and the hydrogeology BIA states that water levels could rise considerably in the winter months. Additional groundwater monitoring is recommended.

4.9. There are a number of existing trees adjacent to the boundary of, or on the site of, the proposed basement works. There is a Western Red Cedar immediately adjacent to the southern boundary and a large London Plane Tree, with its trunk just outside the boundary of the property. An aboricultural report concluded that damage would not be caused to the tree. In the BIA it is proposed that an existing Silver Birch on the site is to be felled.

4.10. The underlying clay formation is known to be of high plasticity so the removal of the Silver Birch could also result in some heave. The potential impact of ground movements for shrinking and/or swelling of clays, especially in the context of tree removal is required for any shallow foundation.

4.11. Additional groundwater monitoring is recommended. This will further clarify any need for design against flotation. It is noted that proposed measures were described to deal with such a scenario i.e. basal drainage layer. The basement is to be tanked and a drained cavity system will be provided.

4.12. The proposed construction method for the basement is to:

- construct a bored pile, secant type, wall around the edge of the new basement;
- cast a concrete capping beam onto the piles;
- partially excavate within the piled perimeter to 1.0m;
- install temporary props;
- excavate to full depth;
- cast basement slab;
- remove lower props
- cast walls;
- cast ground floor slab; and
- remove upper props.

4.13. No indicative calculations or temporary works details have been provided. In light of concerns raised, this should include a consideration of the need for and impact of dewatering.

4.14. The piles appear to be positioned directly under the existing boundary fences which will need to be removed to enable construction to proceed. The piling rig may also clash with the canopy of the London Plane Tree and Western Red Cedar and some lower branches may need to be removed.

4.15. Some account has been taken of likely ground movements based on CIRIA 580 assuming high support stiffness and piles embedded in stiff clay. These predict maximum horizontal movements of around 5.7mm and vertical 3.7mm behind the wall. On this basis, damage to adjacent structures is predicted to be Category 0 to Category 1.

4.16. In the BIA no account is taken of the potential effect of heave on adjacent foundations even though over 800 cubic metres of soil is to be removed. Additionally, the borehole suggests that the clay is firm to around 7-8m depth. Confirmation that the ground movement and building damage assessments are valid is required.

4.17. No proposals for inspection or monitoring of adjacent buildings are included in the BIA. This should be further reviewed and outline proposals for an inspection and movement monitoring strategy during excavation and construction specified. This should include proposed trigger and action levels, although the final monitoring strategy may be agreed with the party wall surveyor.

4.18. The local topography is <7 degrees and slope stability is suggested not to be an issue.

4.19. Hydrogeology & Hydrology screening, scoping and mitigation measures have been included in the HBIA. The historic Shepherds Hill conduit (water course) used to run within 20-40m to the west of the site. It is acknowledged within the HBIA that the basement construction may increase below ground water levels and in view of this and the historic conduit, it proposes a drainage corridor, French drain and sump as mitigation measures.

4.20. A flood risk assessment was completed. The only significant flood risk identified was from blockage of private drainage connections.

4.21. Development increases the impermeable surface area. An assessment was undertaken in accordance with CIRIA Suds Manual C697 and concluded that there is no material impact from the increased surface area. However, it did state that attenuation could be provided if needed to ensure the existing condition is maintained and detailed drainage design could also include grassed filter strips. Further analyses and design are required to further develop this.

4.22. The BIA has stated that the development will not impact on the wider hydrogeology of the area, any other watercourses, springs or the Hampstead Heath Pond chain catchment area.

## 5.0 CONCLUSIONS

5.1. The BIA and Hydrology BIA were completed by competent consultants suitably qualified in accordance with CPG4.

5.2. The proposed works consist of the demolition of the existing above ground two storey building and the construction of a three storey building above ground with basement below.

5.3. The BIA has confirmed that general ground conditions at the site comprise Made Ground to up to 3.8m, over the Claygate Member and then London Clay to the base of the borehole at 15m bgl. Monitoring of a single borehole has shown a groundwater level approximately 0.5m above the proposed top of floor slab level. Additional groundwater monitoring is recommended.

5.4. No geotechnical laboratory tests, interpretation or proposed geotechnical parameters for design were provided in the BIA. It should be confirmed that they were undertaken and they should be included with the borehole logs etc as they will inform the parameters used in detailed design.

5.5. Nearby foundations have been assumed to be shallow strips and the presence or otherwise of basements to any of the adjoining properties should be confirmed. This is accepted as being conservative with respect to potential building damage but should be confirmed in order to verify the potential impact on groundwater flows, and any impact from tree removal.

5.6. The site and surrounding area are essentially flat (slope angles <7°). The proposed development will not alter this scenario. It is accepted that the surrounding slopes to the development site are stable.

5.7. The proposed construction method for the basement is to be a propped bored pile, secant retaining wall. Props will be removed after construction of the basement level and first floor level slabs. Indicative calculations for the retaining walls and floor slab are required, together with an indicative construction sequence demonstrating the principles of design. The need for dewatering should be considered.

5.8. It is noted that, depending on ongoing groundwater monitoring, allowance has been made for anti-flotation mitigation comprising a basal drainage layer.

5.9. The Historic Shepherds Hill conduit (water course) used to run within 20-40m to the west of the site. Based on this, the groundwater level identified in the borehole and the increased impermeable area, mitigation measures are proposed in the BIA and HBIA. These include provision of a drainage corridor, French drain, sump and pump.

5.10. There may be some form of tunnel beneath the narrow access strip to 64 Fitzjohn's Avenue (reported by a local resident). Further investigation into the potential for a tunnel and whether it could be damaged by the works should be undertaken.

5.11. The boundary wall to No. 64 Fitzjohn's Avenue supports the proposed access road (for construction traffic). It should be ensured that the wall can support the proposed loadings and vibration.

5.12. Some account has been taken of likely ground movements based on the empirical method in CIRIA 580 assuming a piled retaining wall embedded in stiff clays and high support stiffness and damage to neighbouring structures in predicted to be no worse than Burland Category 1. The predicted ground movements make no allowance for heave due to the overall basement excavation and assume the piles are completely embedded in stiff clay. Confirmation for the validity of these assumptions and the resultant building damage assessment should be provided.

5.13. No proposals for inspection or monitoring of adjacent buildings are included in the BIA. This should be further reviewed and proposals for an inspection and movement monitoring strategy during excavation and construction specified, although the final scheme may be agreed with the party wall surveyor.

5.14. The flood risk assessment shows the only significant flood risk as blockage of private drainage connections.

5.15. Development increases the impermeable surface area. It stated that attenuation could be provided if needed to ensure the existing condition is maintained and detailed drainage design could also include grassed filter strips. Analyses and design are required to understand/develop these further.

5.16. The BIA has stated that the development will not impact on the wider hydrogeology of the area, any other watercourses, springs or the Hampstead Heath Pond chain catchment area.

# Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

| Surname | Address | Date | Issue raised | Response |
|---|---|---|---|---|
| McGregor | Flat A, 64 Fitzjohns Avenue | 26/01/2016 | Existing tunnel beneath main access road in the property is unsuitable for lorries and large vehicles. Tunnel also bears onto the walls of No. 64 Fitzjohns Avenue. | Item 4 - Audit Query Tracker |
| | | | The site access road is supported by the wall of No. 64 Fitzjohns Avenue. Vibrations caused by lorries will be considerable. | Item 5 - Audit Query Tracker |
| | | | Effects of short term de-watering during basement construction could be detrimental to stability of adjacent properties. | Item 9 - Audit Query Tracker |
| | | | Basement is below groundwater level which will be shallower in the winter than recorded in investigation undertaken. Diversion of groundwater will impact surrounding buildings. | Item 2 – Audit Query Tracker. Water diversion also addressed in current Hydrogeology BIA. |
| | | | Proposed basement is too close to suspected water courses. | Addressed in current HBIA |
| | | | Potential rise in groundwater level is unacceptable due to groundwater already being shallow. | Item 2 – Audit Query Tracker. Water diversion also addressed in current Hydrogeology BIA. |
| | | | Potential effects due to tree removal and installation of a contiguous piled wall. | Items 6 and 7 – Audit Query Tracker |
| Oldroyd | Flat D, 64 Fitzjohns Avenue | 26/01/2016 | Slope stability and subterranean (groundwater) are development constraints. | Items 2, 3, 6, 7 & 10 – Audit Query Tracker |

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|---|---|---|---|---|
| | | | Prediction of ground movements due to the works are difficult to predict accurately. This creates unknown future risks. | Item 6 – Audit Query Tracker |
| | | | Property likely to be on a 'raft' of clays that are that are subject to changes in groundwater level and best left undisturbed. | Items 1, 2 & 6 – Audit Query Tracker |
| Oldroyd | Flat D, 64 Fitzjohns Avenue | 02/02/2016 | Objective is to keep damage to neighbouring properties within Burland category 2. However, Category 2 still requires repair works and therefore cost and inconvenience to neighbours. | Item 6 – Audit Query Tracker |
| | | | Risk of surface flow flooding after heavy rain. | Refer to paragraph 4.21 |
| | | | Basement requires excavation close to neighbouring foundations. This triggers Party Wall Act of 1996 and a notice needs to be served to neighbours. | Agreed |

# Appendix 2: Audit Query Tracker

Audit Query Tracker

| Query No | Subject | Query | Status | Date closed out |
|---|---|---|---|---|
| 1 | Hydrogeology/Stability | All geotechnical data i.e laboratory testing, interpretations, derived geotechnical parameters for design etc. to be provided.<br><br>Further ground monitoring to be carried out. | Open. | |
| 2 | Hydrogeology/Hydrology | Further assessment of:<br>• Attenuation requirements for water infiltration to ground to ensure current regime is maintained.<br>• Need for basal drainage layer to basement. | Open. | |
| 3 | Stability | Are there any basements in adjacent properties and/or what are foundation types, depths etc? | Open. | |
| 4 | Stability | Is there a tunnel beneath the access strip adjacent to No.64 Fitzjohn's Avenue and will it be affected by the works or trafficking? | Open. | |
| 5 | Stability | Is site access road supported by the wall of No.64 Fitzjohn's Avenue? Is it structurally able to support proposed construction traffic loads? | Open. | |
| 6 | Land Stability | Further review of potential ground movement/building damage assessment needed, in particular heave due to the 4.5m excavation and installation of piles in form clay. | Open. | |

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|---|---|---|---|---|
| 7 | Land Stability | Confirmation of impact of removal of Silver Birch tree required. | Open. | |
| 8 | Stability | A monitoring regime for adjacent buildings/infrastructure is required, including development of trigger and action levels. | Open. | |
| 9 | Stability | Indicative structural calculations and construction sequence required showing principles of design and propping, and consideration of dewatering. | Open. | |

# Appendix 3: Supplementary Supporting Documents

None

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