A2 Site Investigation

15 Fitzroy Road

Basement Impact Assessment

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Project Name	15 Fitzroy Road
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Client	Kate & Mark Waites
Document Name	Basement Impact Assessment

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1. Non-Technical Summary

1.1.1. The site location is 15 Fitzroy Road, London, NW1 8TU.

1.1.2. The current development / property comprises a four-storey masonry residential property, inclusive of a lower ground level over the full footprint of the building, with a private garden. The current property shares Party Walls with 13 Fitzroy Road and 17 Fitzroy Road.

1.1.3. The proposed development works comprise deepening the lower ground floor by 700mm, demolition and reconstruction of the existing two-storey outrigger extension, and removal of selected internal walls at lower ground level.

1.1.4. The excavation will be retained by mass concrete underpins, cast in sequence in bays.

1.1.5. It is understood that the bulk excavation works and the construction of permanent works elements will take place following the installation of all retention systems, i.e. utilising a *bottom-up* methodology.

1.1.6. Temporary propping / shoring measures will be installed at lower ground level, prior to proceeding with bulk excavation works. The props will increase the stiffness of the retention systems during construction and reduce the risk of adversely affecting neighbouring structures and/or third-party assets, due to excessive ground movement.

1.1.7. The following assessments are presented in the current document:

- Screening.
- Scoping.
- Additional evidence/assessments (as required), including:
  - Architectural and structural drawings.
  - Ground movement assessment.
- Basement impact assessment.

1.1.8. The ground conditions beneath the site comprise (based on a review of BGS data and site-specific ground investigations):

- Made Ground: to a depth of approximately 1m below lower ground level.
- London Clay Formation: The London Clay Formation is expected to be at least 45m thick. The thickness of this stratum is not considered to be of engineering significance to the proposed scheme and has not been proven by site-specific ground investigation works.

1.1.9. The hydrogeological conditions at the site, relevant to the proposed development, are predicted to comprise:

- Finite bodies of local perched groundwater within the Made Ground present above the London Clay.
- It is expected that the pore water pressure distribution within the London Clay Formation will be approximately hydrostatic from the surface of the formation.

1.1.10. The BIA has assessed land stability, and the impacts of the proposed development on neighbouring structures will be limited to Category 1 – Very Slight, in accordance with the Burland Scale.

1.1.11. The BIA has not identified any hydrological impacts, as the site is not underlain by an aquifer. Although the excavation will extend below the water table, it will be within the London Clay Formation, which is classed as an unproductive stratum.

2. Introduction

2.1. Overview

2.1.1. A2 Site Investigation Limited (A2SI) were engaged by BC Structural Design Ltd (BC Structural) on behalf of Kate Waites to prepare a basement impact assessment (BIA) for the proposed lower ground floor extension and outrigger construction works at the 15 Fitzroy Road site, located in London.

2.1.2. The purpose of this assessment is to consider the potential effects of the proposed works at 15 Fitzroy Road, London, NW1 8TU, on the local hydrology, geology and hydrogeology, and the potential impacts to neighbours and the wider environment.

2.1.3. The location of the proposed development is shown in Figure 2.1

Figure 2.1 15 Fitzroy Road site location.

2.1.4. The development site is located within the jurisdiction of the London Borough of Camden.

2.1.5. The BIA has followed the approach developed by the London Borough of Camden, which is considered to represent current industry best practice.

2.1.6. The BIA comprises the following elements:

- Screening.
- Scoping.
- Additional evidence / assessments (as required), including:
  - Architectural and structural drawings.
  - Ground movement assessment (GMA).
- Basement impact assessment.

2.2. Credentials

2.2.1. The BIA has been reviewed by Alex Nikolic. Alex is a Chartered Member of the Institution of Civil Engineers (MICE) with more than 20 years of industry experience in geotechnical design and construction of ground engineering works. Alex has attained post-graduate qualifications, including a Master of Science in Soil Mechanics (MSc DIC) from the Imperial College London and a Master of Studies (MSt Cantab) in Sustainable Development from the University of Cambridge. Alex was formerly the Director of Ground Engineering at Buru Happold Ltd.

2.2.2. The BIA has been approved by Tony Suckling. Tony is a Chartered Fellow of the Institution of Civil Engineers (FICE) and a Fellow of the Geological Society (FGS). Tony has a Master of Science (MSc) in Geotechnical Engineering from City University. Tony is a Registered Ground Engineering Professional (Rogi) with more than 30 years of industry experience in geotechnical design and construction of ground engineering works. Tony has previously held the position of Technical Director for Balfour Beatty Ground Engineering Ltd. Tony has been a past Chairman of the Federation of Piling Specialists Technical Committee and a Board Member of the Deep Foundation Institute Europe. Tony was part of the steering group for CIRIA C760 Guidance on Embedded Retaining Wall Design.

2.3. Sources of Information

2.3.1. The following baseline data has been referenced to complete the BIA in relation to the proposed development:

- *Phase I Desk Study* prepared by A2 Site Investigation Limited, dated September 2022.
- *Factual Report* prepared by A2 Site Investigation Limited, dated September 2022.
- Architectural drawings produced by Box 9 Design Ltd, dated May 2022.
- *Structural Engineers Report* and structural drawings prepared by BC Structural Design Ltd, dated August 2022.
- Public domain geological mapping from British Geological Society Geology of Britain Viewer and Borehole Viewer.
- Flood map for planning – Environment Agency.
- Hydrogeological data obtained by Envirocheck.
- LB Camden, Strategic Flood Risk Assessment (produced by URS, 2014).
- LB Camden, Floods in Camden, Report of the Floods Scrutiny Panel (2013).
- LB Camden, Planning Guidance (CPG4) – Basements (March 2018).
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development (produced by Arup, 2010) (GHHS).
- LB Camden, Local Plan Policy A5 Basements (2017).
- LB Camden's Audit Process Terms of Reference.

2.4. Existing Development

2.4.1. The development site is located at 15 Fitzroy Road, London, NW1 8TU. The site has approximate dimensions of 30m-long by 5m-wide, covering an area of approximately 0.02ha.

2.4.2. The existing ground level at the site is approximately 33.0mOD.

2.4.3. The site is within a wider hillside setting and is founded on a gentle slope, with increasing ground level towards Primrose Hill to the west. The gradient of the slope is less than 7° in close proximity to the site.

2.4.4. The site is currently occupied by a four-storey masonry residential property, which is assumed to be occupied at this time. A lower ground floor is present, with a lightwell present at the front of the building.

2.4.5. Below-ground vaults are present beneath the pavement and street in front of the building. Access to the vaults is provided from the lower ground floor.

2.4.6. The development building is supported by shallow strip foundations bearing on the underlying soils beneath all structural walls.

2.5. Neighbouring Properties and Infrastructure

2.5.1. The existing structure shares Party Walls with 13 Fitzroy Road to the northeast and 17 Fitzroy Road to the southwest. The two adjacent structures both comprise the same construction as 15 Fitzroy Road and are both four-storey terraced residential properties with lower ground storeys and back gardens.

2.5.2. There are no listed buildings within the zone of influence of the proposed development.

2.5.3. The northwest boundary of the site comprises Fitzroy Road. The southeast boundary of the site comprises 6A Egbert Street, a terraced residential dwelling.

2.5.4. Asset owners with existing underground services that may be impacted by the proposed development include the following:

- London Borough of Camden and the Greater London Authority.
- Thames Water Ltd – Clean water and wastewater
- BT (BT Group Plc) and Virgin Media Ltd – Telecoms.
- UK Power Networks Ltd – Electricity distribution.
- Cadent Gas Ltd and Southern Gas Networks Plc – Gas.

2.5.5. Asset protection teams for the assets listed in 2.5.4 may require engagement as the design of the proposed development continues. Where necessary, separate GMAs may be required to meet design assurance requirements.

2.6. Proposed Development

2.6.1. The proposed development *Structural Engineers Report* and drawings are included in Appendix B.

2.6.2. The development is planned to be for private residential use.

2.6.3. The development does not include increasing the number of storeys of the existing structure.

2.6.4. A lower ground floor extension is planned beneath the footprint of the existing building. The average excavation depth to formation level is 0.7m from existing lower ground floor finished floor level (FFL).

2.6.5. The existing two-storey outrigger will be demolished in its entirety and reconstructed. The new outrigger will be two-storeys and will comprise steel frame and timber joist construction.

2.6.6. The proposed excavation perimeter will be retained by mass concrete underpins. The underpins will support the front wall and Party Wall loading.

2.6.7. Temporary props / shoring will be installed at lower ground level, prior to proceeding with bulk excavation works. Such measures will increase the system stiffness of the retaining walls and reduce the risk of adversely affecting neighbouring structures and third-party assets, due to excessive ground movement.

2.6.8. The lower ground floor will be reduced to the formation level using standard means and methods of excavation.

3. Desk Study

3.1.1. A *Phase I Desk Study* report has been undertaken by A2 Site Investigation Limited for the project. The Desk Study report has been used to inform this BIA.

3.1.2. The Desk Study informs further actions in relation to ground contamination risks. It is provided in Appendix A.

4. Screening

4.1. Subterranean (Groundwater) Flow, Screening Flowchart

Question		Response	Details
1a.	Is the site located directly above an aquifer?	No	The site is underlain by London Clay Formation with no superficial deposits. The London Clay Formation is an unproductive stratum, as noted in the desk study in Appendix A.
1b.	Will the proposed basement extend beneath the water table surface?	N/A	
2.	Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	No	The site is not within 100m of a watercourse, well or potential spring line. The nearest surface water feature is 220m to the southeast.
3.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not located within the catchment of the pond chains on Hampstead Heath.
4.	Will the proposed basement development result in a change in the proportion of the hard surfaced / paved areas?	No	The proposed lower ground extension and outrigger construction will not extend beyond the footprint of the existing hardstanding/building.
5.	As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and / or SUDS)?	No	The proposed development will maintain the existing surface water discharge conditions.
6.	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?	No	The lowest level of the below ground space is not lower than the mean water level in any local pond.

4.2. Stability Screening Flow Chart

Question		Response	Details
1.	Does the existing site include slopes, natural or man-made, greater than 7 degrees (approximately 1 in 8)?	No	The site is founded on a slope with a gradient less than 7 degrees.
2.	Will the proposed re-profiling or landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No	There are no re-profiling / landscaping works proposed that will increase the slopes existing on site to gradients greater than 7 degrees.
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8)?	No	The areas surrounding the site is founded on a slope with a gradient less than 7 degrees.
4.	Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8)?	No	The site is founded on a wider hillside setting, with a slope with a gradient less than 7 degrees.
5.	Is the London Clay the shallowest strata at the site?	Yes	BGS information and site-specific ground investigation proved London Clay to be the shallowest strata at the site.

Question		Response	Details
6.	Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained?	No	No trees will be felled during the development works. The works will not take place in any tree protection zones.
7.	Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	Yes	The London Clay strata is usually classified as having a high-volume change potential and hence can lead to seasonal shrink-swell subsidence where buildings are founded in desiccated soils. However, there is no specific evidence of subsidence having been experienced on site or in the immediate surrounding area.
8.	Is the site within 100m of a watercourse or a potential spring line?	No	The site is not within 100m of a watercourse, well or potential spring line. The nearest surface water feature is 220m to the southeast.
9.	Is the site within an area of previously worked ground?	No	The site is not in an area of previously reworked ground.
10.	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The site is underlain by the London Clay Formation which is an unproductive stratum. Dewatering will likely not be required during construction, to be confirmed by additional site-specific ground investigation.
11.	Is the site within 50m of the Hampstead Heath Ponds?	No	The site is not within 50m of the Hampstead Heath Ponds.
12.	Is the site within 5m of a highway or pedestrian right of way?	No	The site is not located within 5m of a highway or pedestrian right of way.
13.	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	The differential depth of the foundations of the existing development relative to neighbouring properties will not be significantly increased. The maximum increase in foundation depth is 0.7m, and the Party Walls with neighbouring properties will be underpinned.
14.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	There are no tunnels in close proximity to the site.

4.3. Surface Water and Flooding Screening Flowchart

Question		Response	Details
1.	Is the site within the catchment of the ponds chains on Hampstead Heath?	No	The site is not located within the catchment of the pond chains on Hampstead Heath.
2.	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The existing route is expected to be incorporated into the scheme.
3.	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The proposed lower ground extension and outrigger construction will not extend beyond the footprint of the existing hardstanding/building.
4.	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by	No	The proposed lower ground extension and outrigger construction will not extend beyond the footprint of the existing hardstanding/building.

Question		Response	Details
	adjacent properties or downstream watercourses?		
5.	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	The proposed lower ground extension and outrigger construction will not extend beyond the footprint of the existing hardstanding/building.
6.	Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature?	No	The site is in an area with a very low risk of flooding due to surface water.

4.4. Non-Technical Summary of Screening Process

4.4.1. The screening process identifies the following issues to be carried forward to scoping for further assessment:

- London Clay is the shallowest strata on site and there may be a risk of seasonal shrink-swell subsidence.

4.4.2. The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

5. Scoping

5.1. Stability: Seasonal shrink-swell of the London Clay Formation

Hazards

5.1.1. Seasonal shrinking and swelling (subsiding and heaving) of the London Clay Formation underneath the site.

Potential Impacts

5.1.2. Damage to the proposed new foundation / retention systems and neighbouring properties.

Assessments and Further Actions

5.1.3. A site-specific ground investigation has been undertaken to provide more information about the shrink-swell properties of the near-surface London Clay Formation and groundwater levels.

5.1.4. The findings of the investigation indicate that the London Clay Formation below the site is not desiccated.

5.1.5. Seasonal shrink-swell of the London Clay Formation will be considered as part of the design of foundations.

6. Site Investigation

6.1.1. A site-specific ground investigation was carried out in August 2022 by A2SI to support the design of the proposed lower ground extension and outrigger construction.

6.1.2. The *Factual Report* prepared by A2SI summarising the works undertaken is included as Appendix C.

6.1.3. The investigative works included the following:

- 1no. window sample borehole to a maximum depth of 6m below lower ground level.
- 4no. structural trial pits exposing existing foundations.
- Geotechnical in-situ and laboratory testing.
- Geo-environmental laboratory testing.
- Groundwater and gas monitoring.

6.1.4. The locations of the ground investigation positions are shown in Figure 6.1.

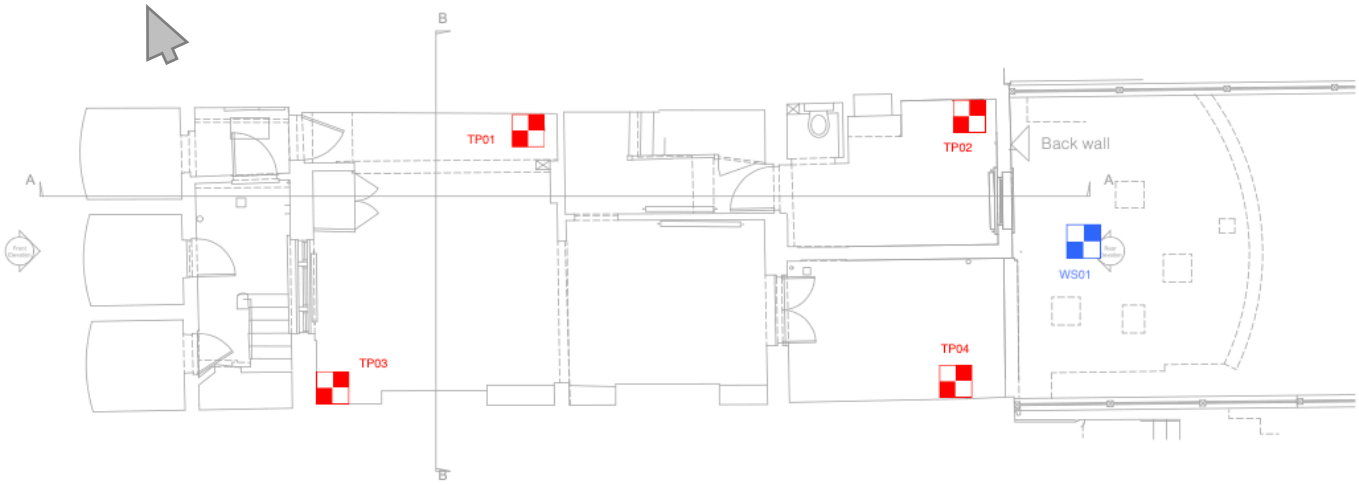

Figure 6.1 Exploratory hole locations

6.1.5. The encountered ground conditions at the site are summarised in Table 1.

6.1.6. Groundwater monitoring in WS01 did not encounter groundwater in the Made Ground.

Table 1 Encountered stratrigraphic profile

Stratum	Depth Encountered (m)[1]	Thickness (m)	Description
Made Ground	0.0	1.0	• Soft to firm light brown slightly gravelly silty CLAY. Gravel is angular to subangular fine to coarse brick, concrete and flint. • Very soft black sandy gravelly CLAY with rare roots and rootlets. Sand is fine to coarse. Gravel is angular to subangular fine to coarse brick and flint.
London Clay	1.0	Proven to 5.0	• Soft to firm very closely fissured light brown mottled light grey silty CLAY. Rare shell fragments, mica crystals and claystone fragments. Occasional pockets of yellow fine to coarse SAND.

1. Depth below lower ground floor finished floor level.

7. Construction Methodology / Engineer Statements

7.1. Outline Temporary and Permanent Works Proposals

7.1.1. The outline basement construction proposal is to construct the basement using a *bottom-up* methodology.

7.1.2. Standard means and methods of excavation are expected to be suitable to excavate the basement, based upon the ground conditions proven by means of ground investigation works.

7.1.3. The lower ground floor extension excavation will be restrained by mass concrete underpins.

7.1.4. Design of the retaining walls and temporary propping shall be carried out in accordance with the relevant Eurocodes/British Standards, non-conflicting codes of practice, and associated design best practice.

7.1.5. It is anticipated that any ground water inflow during excavation arising from finite bodies of perched ground water can be suitably managed/mitigated with localised pumping where required.

7.2. Ground Movement and Damage Impact Assessment

7.2.1. A GMA has been carried out in accordance with CIRIA C760 and takes into account the construction methodology and site-specific ground and groundwater conditions. The GMA is included as Appendix D.

7.2.2. All structures / properties within the zone of influence of the proposed development have been assessed.

7.2.3. The following assumptions have been made within the GMA:

- New underpins are assumed to be founded in the London Clay Formation.
- The buildings included in the GMA are assumed to be founded on ground surface.
- The walls of the above-mentioned buildings are assumed to behave as equivalent beams.

7.2.4. The ground movements resulting from the works comprise deformations arising from the following mechanisms:

- Installation of the underpins.
- Bulk excavation works.
- Heave and settlements due to the unloading / load redistribution of London Clay Formation.

7.2.5. The following structures were assessed, having been identified as falling within the zone of influence of the proposed development:

- 13 Fitzroy Road
- 17 Fitzroy Road

7.2.6. The evaluated potential damage/impact is contained within Category 1 – Very Slight, in accordance with the Burland Scale.

7.2.7. The expected ground movements resulting from the proposed works are proposed to be limited by means of temporary propping, which is planned to be installed before the excavation phase.

7.2.8. The following mitigation measures are proposed to reduce ground movements and damage:

- Design of the temporary propping measures shall be carried out in accordance with the relevant Eurocodes, non-conflicting codes of practice, and associated design best practice.
- Underpinning works to be performed by an experienced ground engineering contractor.
- Frequent monitoring of neighbouring properties to be carried out during excavation, to validate ground movement predictions against reality.
- Development of a monitoring-trigger-action plan that identifies trigger levels, responsible personnel and actions to be followed in the event of a trigger level exceedance.
- Incorporating stiff, high level props into the temporary works design of the excavation, so as to provide a high stiffness wall. Design details regarding minimum wall flexural stiffness, prop stiffness and arrangement, shall be defined as part of detailed design development.
- Designated areas for stacking and storing materials behind the underpins should be identified. These should be located away from sensitive structures. The design of the underpins should incorporate an appropriate surcharge load to the rear of the wall, to capture effects of stacking and storing materials, vehicle traffic, etc.
- The GMA did not consider the impact of the proposed development on existing buried utilities (e.g. Thames Water sewer assets). It is expected that these assets will be assessed (if applicable to the proposed works) following engagement of the asset owner and direction from the asset protection team, with regards to establishing limiting performance criteria.

7.3. Control of Construction Works

7.3.1. Following the selection of a Principal Contractor, a Construction Method Statement should be developed, which will cover the items outlined in this section in detail.

7.3.2. Work method statements developed for main stages of the construction works, outlining the means and methods of safely carrying out the works.

7.3.3. Details of temporary propping and temporary works, required to ensure structural stability is maintained throughout demolition and excavation operations.

7.3.4. Construction traffic management plans.

7.3.5. Detailed development of structural and environmental monitoring strategy, developed to control construction works and maintain movements/damage impacts within the predicted limits and monitor environmental impacts, including:

- A structural monitoring layout plan of instrumentation/survey points/critical sections.
- Programme/frequency of monitoring.
- Trigger values derived for each of the structures within the zone of influence of the proposed works.
- Contingency actions and project team lines of responsibility.

8. Basement Impact Assessment

8.1. General

8.1.1. The Conceptual Site Model (CSM) is described below:

- The ground conditions of the site comprise Made Ground overlying London Clay Formation.
- Whilst groundwater monitoring did not encounter groundwater, it is anticipated that finite bodies of local perched groundwater are present within the Made Ground above the London Clay Formation, and it is assumed that the pore pressure distribution within the London Clay Formation will be approximately hydrostatic from the top of the formation.
- The site is within a wider hillside setting and is founded on a slope, with increasing ground level towards the west.
- The current development / property comprises a four-storey terraced masonry residential property, inclusive of a lower ground floor. The development shares Party Walls with the adjacent properties.
- The proposed development works comprise the extension of the lower ground floor level by approximately 0.7m and demolition and reconstruction of the two-storey out-rigger at the back of the property.
- Neighbouring buildings are assumed to be founded near surface.
- The proposed development may result in damage to the neighbouring buildings. Any potential damage will be mitigated by appropriate construction means and methods (such as temporary propping/shoring and controlled excavation operations).

8.2. Land Stability / Slope Stability

8.2.1. It is assumed that all new substructure elements will be founded on the London Clay Formation, which is considered to be a suitable founding stratum.

8.2.2. The risk of movement and damage to this development due to volumetric changes of the London Clay Formation will be considered as part of the scheme design of the development. Heave mitigation measures (if appropriate) will be adopted, and the relevant soil structure interaction mechanisms will be reviewed.

8.2.3. A GMA has concluded that ground movements caused by excavation and construction of the proposed development will be limited. The upper bound damage category for surrounding structures within the zone of influence of the proposed development has been assessed as Category 1 – Very Slight in accordance with the Burland Scale.

8.2.4. The BIA has concluded that risks to the adjacent properties, slopes and infrastructure (including ultimate and serviceability limit state considerations) are limited and will be mitigated in a reasonable fashion as part of design development.

8.3. Hydrology and Groundwater Flooding

8.3.1. The BIA has concluded that there is a very low risk of groundwater flooding.

8.3.2. The BIA has concluded that there are no impacts to the wider hydrogeological environment.

8.4. Hydrology, Surface Water Flooding and Sewer Flooding

8.4.1. The BIA has concluded that there is a very low risk of surface water flooding.

8.4.2. The BIA has concluded that there are no impacts to the wider hydrological environment.

Appendix A: Phase I Desk Study

Appendix B: Structural Engineers Report

Appendix C: Site Investigation Factual Report

Appendix D: Ground Movement and Damage Assessment

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