SYMMETRYS
STRUCTURAL / CIVIL ENGINEERS

43A REDINGTON ROAD BASEMENT IMPACT ASSESSMENT

43a Redington Road
London
NW3 7RA

21141
31st August 2021, Draft Rev. P1

SYMMETRYS.COM

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REVISION HISTORY

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
P1	31/08/21	Draft	21141	SB	DS	CA

APPENDICES

1.0 Non-technical summary

1.1.1 The site location is 43a Redington Road, London, NW3 7RA.

1.1.2 The site consists of a basement and ground floor flat within a four-storey residential building, overall divided into four flats.

1.1.3 Local opening up works carried out within the basement and ground floor flat confirmed the existing structure being a load-bearing masonry walls with timber floors.

Figure 1 – Front Elevation

1.1.4 The proposed development comprises of the partial refurbishment of the basement and ground floor structure and includes:

- Conversion of the existing garage at ground floor level into a 2-storey habitable space, including lowering existing finishes floor level approximately 2.2m).
- Lowering part of the existing basement to match the existing basement living area finishes floor level, currently the lower point of the basement (finishes floor level to be lowered approximately between 0.65m to 1m).
- Reconfiguration of some of the internal walls.
- New back extension.

1.1.5 The following assessments are presented:

- Desk Study;
- Screening;
- Scoping;
- Additional evidence/assessments;
- Site investigation;
- Ground movement assessment;
- Surface water drainage strategy/SUDS assessment;
- Others;
- Impact Assessment;

1.1.6 The authors and reviewers of these assessments are listed below in Clause 2.3.

1.1.7 The ground conditions beneath the site are the following:

- Made ground of a depth varying between 0.6 to 1.4m below ground level (BGL).
- Claygate Member (Soft to firm orange brown mottled grey silty slightly sandy clay) at a depth varying between 0.6m to 1.4m BGL.
- London Clay Formation (firm grey mottled brown silty clay) at a depth varying between 5.5m to 6.3m BGL.

1.1.8 Results of ground investigation indicate long-term ground water levels at 1.01m and 4.04m BGL. The contractor should allow for possibility of dewatering.

1.1.9 The construction method to create the new basement space consists of underpinning the existing external and internal walls with reinforced concrete walls, to be cast in hit and miss sequence.

1.1.10 The Contractor shall monitor the position and movements of the elevations of the adjacent properties around the perimeter of the proposed excavation. The monitoring shall be undertaken by a specialist survey company.

1.1.11 The BIA has assessed land stability and the impacts of the proposed development on neighbouring structures. Based on analytical models, the predicted damage category will be Category 0 of the Burland Scale Impacts.

1.1.12 The BIA has identified no potential slope stability impacts.

1.1.13 The BIA has identified no potential hydrogeological impacts to the existing site and surroundings.

1.1.14 The BIA has identified low flood risk from the proposed development.

1.1.15 This is a live document and further detailed assessment will be ongoing as the design and construction progress.

1.1.16 This document is to be read in conjunction with reports by others. Refer to Architect's drawings for site layout, plans and sections of the properties.

2.0 Introduction

2.1 The purpose of this assessment is to consider the effects of a proposed basement development at 43a Redington Road, London, NW3 7RB on the local geology, hydrology and hydrogeology and potential impacts to neighbours and the wider environment. The site location is presented in Figure 3.

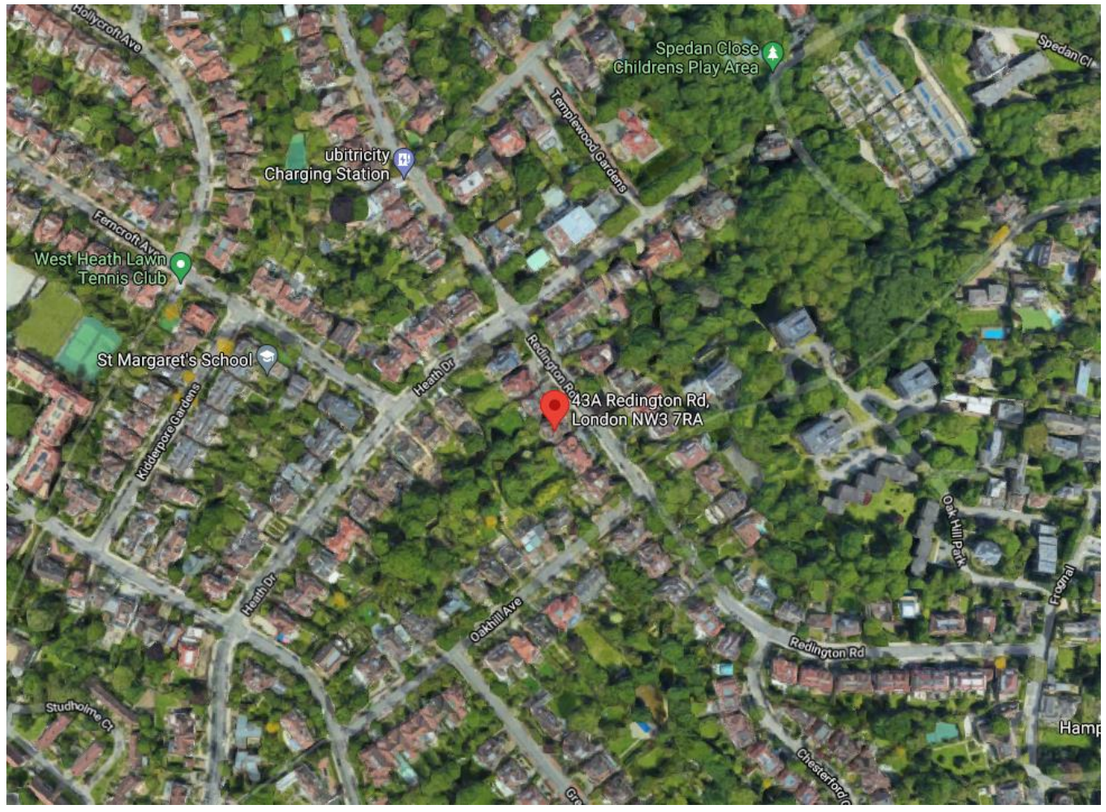

Figure 2 – Site Location.

2.2 The BIA approach follows current planning procedure for basements and lightwells adopted by LB Camden and comprises the following elements (CPG4 "Basements and Lightwells"):

- Desk Study;
- Screening;
- Scoping;
- Site Investigation, monitoring, interpretation and ground movement assessment;
- Impact Assessment

2.3 Authors

2.3.1 The BIA Report has been authored by Simone Boncio (BSc MSc), Senior Structural Engineer at Symmetrys, and the SuDS Strategy Report has been authored by James Robinson, environmental consultant at Geosmart.

2.3.2 It has been reviewed by David Snaith (BEng PG Cert), Associate at Symmetrys with over 10 years of experience.

2.3.3 The Geotechnical Site Investigation Report and the Ground Movement Assessment Report were prepared and authored by Ebenezer Adenmosun (BEng ACGI MSc DIC CEng MICE FGS), Registered Ground Engineering Adviser and Director at Geofirma.

2.3.4 This BIA has been approved by Chris Atkins (CEng, MIStructE), managing director of Symmetrys with 30 years of experience in Structural Engineering.

2.4 Sources of Information

The following baseline data have been referenced to complete the BIA in relation to the proposed development:

- Current/historical mapping;
- Geological mapping;
- Hydrogeological data;
- Current/historical hydrological data;
- 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 (CPG) – Basements (March 2018);
- LB Camden, Camden Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development (produced by Arup, 2010);
- LB Camden, Local Plan Policy A5 Basements (2017);
- LB Camden's Audit Process Terms of Reference;
- The History of Lost Rivers in Camden (March 2010);
- Association of Specialist Underpinning Contractors (ASUC), Guidelines of safe and efficient basement construction directly under or near to existing structures. (October, 2013).

2.5 Existing and Proposed Development

2.5.1 The Application site is located on Redington Road, approximately 500 metres from the TFL Northern Line zone of influence (source: Property Asset Register Public Map, website: https://tfl.maps.arcgis.com/apps/webappviewer/index.html?id=5129c766255941d3be16a6828faa8f18 Accessed 20.08.2021, refer to Figure 3).

2.5.2 The site gradually slopes falling to the South West (refer to Geosmart SuDSmart report No. 75105.01R1).

2.5.3 The existing structure is a 4-storey detached house divided into four flats, with load bearing masonry walls supporting floors and roof timber structure. The current property shows no significant signs of deformation.

2.5.4 The information available on the Camden Planning portal confirmed the existence of a basement at No.45 Redington Road. No information is available in relation to No.41 Redington Road.

2.5.5 There are a number of listed buildings in Redington Road. The nearest to No. 28 is One Oak, a Grade II listed building, at No. 16 Redington Road (source: Historic England. Website: https://historicengland.org.uk/listing/the-list/results/?searchType=NHLE+Simple&search=redington+road Accessed 20.08.2021).

2.5.6 Neighbouring gardens are present at the rear of the properties, and will be protected in accordance with the Camden Local Plan from 2017.

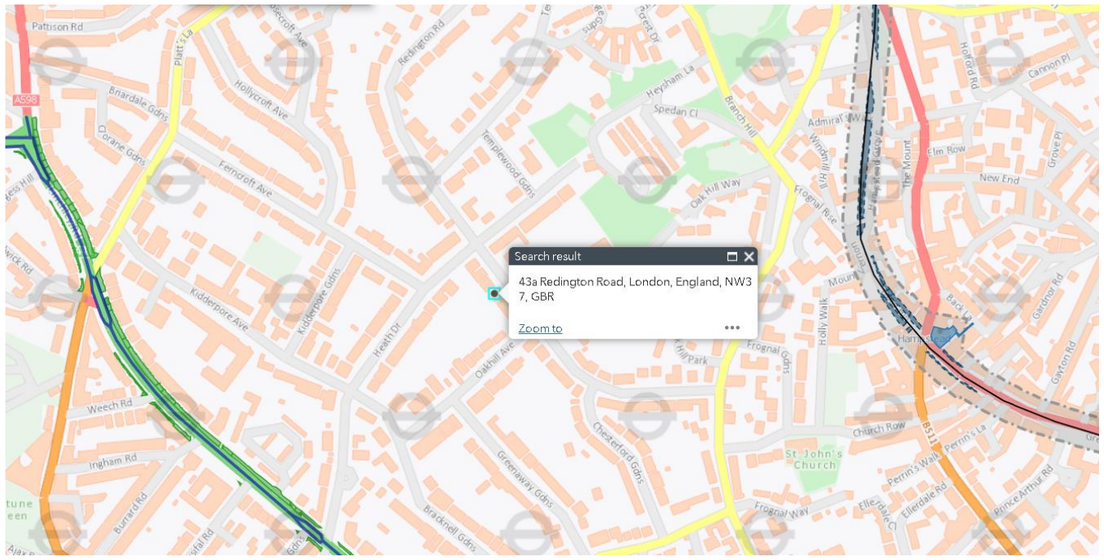

Figure 3 - Site location relative to the close railway asset, consisting of the TFL Northern Line, 500m to the East.

2.5.7 Existing and Proposed development drawings are presented in Appendix A.

2.5.8 The proposed development will utilise sequential reinforced concrete underpins to form the new level of the basement. The use of temporary propping will ensure that the works to the basement do not cause any local ground movements whilst construction is taking place.

2.5.9 The underpinning sequence is proposed to be carried out in maximum 1.0m width bays.

2.5.10 The new basement floor will be formed with a reinforced concrete slab.

2.5.11 All subjected to structural engineer detailed design and drawings.

2.5.12 The outline construction programme for the proposed development is as shown below (indicative only)*:*

- The works are expected to be completed over an 18-month program split in the four phases listed below (All subject to successful/appointed Contractor's schedule of works):
- No.1 month for demolition
- No.1 month for excavation
- No.8 months for construction
- No.8 months for fit-out.

3.0 Desk study

3.1 Site History

3.1.1 The existing building was built approximately around 1915. Neighbouring buildings surrounding the site were constructed around the same period.

3.1.2 The building is within a predominantly residential area.

3.1.3 A preliminary Unexploded Ordnance risk assessment has been undertaken for the site by SafeLane Global Ltd. The full report is included within the Geotechnical Phase 1 report (refer to Appendix C for full report).

3.1.4 The assessment has resulted in an overall Low-Medium risk from UXO for the site and it has been recommended to undertake a detailed UXO threat assessment.

Figure 4 – Map showing the risk of UXO based on WWII German Bomb Strikes (source: Preliminary Unexploded Ordance Risk Assessment, carried out by SafeLane Global Ltd.

3.2 Geology

3.2.1 The British Geological Survey Map indicates that the site is underlain by the Claygate Member of the London Clay Formation, the composition of which is clay, silt and sand.

3.2.2 The findings of the boreholes confirm the data available on the aforementioned web site, confirming a Made Ground stratum above Claygate Member and London Clay Formation (refer to Figure 5).

3.2.3 Refer to the Soil Investigation by Geofirma in Appendix C for details of the local Geology and site investigations undertaken.

Strata	Depth to Top (m bgl)	Thickness (m)	Exploratory Holes
Made Ground	0.00	0.60 – 1.40	All
Claygate Member	0.60 to 1.40	0.40 – 5.70	All
London Clay Formation (possible)	5.50 to 6.30	0.95 – 1.15 (Full thickness unproven)	All exploratory holes except TP1 and TP2

Figure 5– Proven ground condition following testing of the soil samples.

3.3 Hydrogeology

3.3.1 The Claygate Member underlying the site constitute a Secondary A Aquifer. It must be noted that the majority of the London Clay Formation below the Claygate Member is designated 'unproductive'.

3.3.2 Refer to Soil Investigation in Appendix C and Flood Risk Assessment in Appendix E for details of the local Hydrogeology.

3.4 Hydrology, Drainage and Flood Risk

3.4.1 The site is located approximately 690m from the catchment of the pond chains on Hampstead Heath.

3.4.2 There are no mapped surface water features within 500m of the site.

3.4.3 The lost river Westbourne runs underground and approximately in line with Redington Gardens, 60m to the west of the site.

3.4.4 The proposed basement extension includes the construction of a new rear extension at the back of the house, resulting in an increase of the total impermeable area (refer to SuDS report, Appendix E).

3.4.5 A SuDS strategy, consisting of rainwater harvesting butts, a rain garden and a soakaway for surface water runoff, is proposed to ensure surface water runoff can be managed over the lifetime of the development.

3.4.6 The drainage strategy is to be confirmed. All subject to Thames Water approval.

3.4.7 The floor risk for the site is negligible for surface water and groundwater flooding.

Source of Flood Risk	Baseline	After Mitigation
River (fluvial) and Sea (coastal/tidal)	Very Low	N/A
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Negligible	N/A
Other flood risk factors present	No	No

N/A = mitigation not required

Figure 6 – Risk ratings of flooding (source: Floor Risk Assessment (FloodSmart report), carried out by GeoSmart)

4.0 Screening

4.1 Subterranean ground water flow

4.1.1 A screening process has been undertaken and the findings are described below.

Question	Response	Details
1a. Is the site located directly above an aquifer?	Yes	The site is located above a Secondary A Aquifer, defined as permeable layers capable of supporting water supplies at a local scale. Refer to Desk Study, clause 3.2
1b. Will the proposed basement extend beneath the water table surface?	Yes	Groundwater was recorded at a datum level of 8.8. The lower new foundations formation level will be 8.81m. It is assumed perched or trapped water may be present within granular lenses of the Claygate Bed and groundwater inflows may occur into the excavation. Refer to GEOFIRMA report in Appendix 3.
2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line?	No	Historically a stream crossed the site and it is recorded until maps of 1896. It is believed to be representative of a spring line from the Bagshot Beds (refer to Appendix 3, Phase 1 Desk study from Geofirma, clause 6.3)
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No	Refer to clause 3.4.1
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes	The proposed basement extension includes the construction of a new rear extension at the back of the house, resulting in increase of the total impermeable area (refer to SuDS report, Appendix E).
5. As part of 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)?	Yes	An increase in the impermeable area on a site will result in greater rainfall run-off.
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 site is located approximately 690m from the catchment of the pond chains on Hampstead Heath. No live spring line have been recorded on the site.

4.2 Slope Stability

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 gradually slopes falling to the South West. The front access to the basement will be via stairs, with structure consisting of RC retaining walls.

2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8)?	No	There are no proposed changes in slope. The front access to the basement will be via stairs, with structure consisting of RC retaining walls.
3. Does the development neighbour land, including railway cuttings and the like, have a slope greater than 7 degrees (approximately 1 in 8)?	No	The adjoining properties gradually slope falling to the South West, similarly to the 43a Redington Road site land.
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 gradually slopes falling to the South West
5. Is the London Clay the shallowest strata at the site?	No	Claygate Member is the shallowest strata at the site. Refer to Appendix C.
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 are proposed to be felled as part of the landscaping works.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	No	No evidence of shrink swell subsidence at the site or neighbouring buildings.
8. Is the site within 100m of a watercourse or a potential spring line?	No	There is no record of watercourse of spring line in the vicinity of the site. The lost river Westbourne runs underground and approximately in line with Redington Gardens, 60m to the west of the site
9. Is the site within an area of previously worked ground?	No	Refer to Appendix C
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?	Yes	The Bagshot Formation and Claygate Formation are classed as Secondary A aquifer. The proposed basement maximum dig would extend right above the water table. Perched water is envisaged. Refer to the report in Appendix C.
11. Is the site within 50m of the Hampstead Heath Ponds?	No	Refer to clause 3.4.1
12. Is the site within 5m of a highway or pedestrian right of way?	No	The extent of the proposed basement is not within 5m of the highway. Refer to Figure 1.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	The maximum dig will be approximately 2.7m, at 1m distance from the adjacent No.41 Redington Road flank wall. The foundation profile of the latter is unknown.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	Refer to clause 2.3.6.

4.3 Surface Water and Flooding

Question	**Response**	**Details**
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No	Refer to clause 3.4.1
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?	Yes	An increase in the impermeable area on a site will result in greater rainfall run-off.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The proposed basement extension includes the construction of a new rear extension at the back of the house, resulting in increase of the total impermeable area (refer to SuDS report).
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	Yes	The proposed basement includes a new extension at the back of the main building, with a retaining wall along the boundary line with No.41 Redington Road. Any excess of surface water from 41 Redington Road is expected to flow to Southwest towards the landscape area, following the gradual land slope.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	There will be no changes in the quality of surface water received by neighbouring properties of downstream watercourses.
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	This has been taken into consideration and managed. Refer to clauses 3.4.5, 3.4.7, and the SuDS Strategy report in Appendix E.

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:

- The site is located directly above an aquifer.
- The proposed basement extends beneath the water table surface.
- The proposed basement development will result in a change in the proportion of hard surfaced / paved areas.
- 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?
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?
- Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?
- Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?

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

5.0 Scoping

The following issues have been brought forward from the Screening process for further assessment:

5.1 The site is located directly above an aquifer.

5.1.1 The Bagshot Member and Claygate Formation are classed as Secondary A aquifer. Ground water strikes were observed just below the proposed lower formation level (+8.81m below ground level). Also perched water is expected within granular lenses of the Claygate Bed.

5.1.2 Therefore, some localised dewatering might be required during construction and this could be achieved by sump pumping.

5.2 The proposed basement extends beneath the water table surface.

5.2.1 Groundwater was recorded at a datum level of 8.8m. The lower new foundations formation level will be 8.81m. It is assumed perched or trapped water may be present within granular lenses of the Claygate Bed and groundwater inflows may occur into the excavation. Refer to GEOFIRMA report in Appendix 3.

5.2.2 Dewatering measures might be required (refer to point 5.1.2.)

5.3 The proposed basement development results in a change in the proportion of hard surfaced / paved areas.

5.3.1 The proposed basement extension includes the construction of a new rear extension at the back of the house, resulting in increase of the total impermeable area (refer to SuDS report).

5.3.2 A SuDS strategy, consisting of a rainwater harvesting butt, a rain garden and a soakaway for surface water runoff, is proposed to ensure surface water runoff can be managed over the lifetime of the development.

5.4 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?

5.4.1 The Claygate Member underlying the site constitute a Secondary A Aquifer. It must be noted that the majority of the London Clay Formation below the Claygate Member is designated 'unproductive'.

5.4.2 The lower new foundations formation level will be 8.81m. It is assumed perched or trapped water may be present within granular lenses of the Claygate Bed and groundwater inflows may occur into the excavation. Refer to GEOFIRMA report in Appendix 3.

5.4.3 Dewatering measures might be required (refer to point 5.2.2.)

5.5 Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

5.5.1 The maximum dig will be approximately 2.7m, at 1m distance from the adjacent No.41 Redington Road flank wall. The foundation profile of the latter is unknown.

5.5.2 The retaining walls will be designed to accommodate the surcharge from the neighbouring building.

5.6 Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?

5.6.1 The proposed basement extension includes the construction of a new rear extension at the back of the house, resulting in an increase of the total impermeable area (refer to SuDS report).

5.6.2 A SuDS strategy, consisting of a rainwater harvesting butt, a rain garden and a soakaway for surface water runoff, is proposed to ensure surface water runoff can be managed over the lifetime of the development.

5.7 Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?

5.7.1 The proposed basement includes a new extension at the back of the main building, with a retaining wall along the boundary line with No.41 Redington Road. Any excess of surface water from 41 Redington Road is expected to flow to Southwest towards the landscape area, following the gradual land slope.

6.0 Site investigation / additional assessments

6.1 Site Investigation

6.1.1 A complete Site Investigation has been undertaken by Geofirma. Refer to Appendix 3.

6.2 Ground Movement Assessment

6.2.1 Following the results of the screening and scoping process, a Ground Movement Assessment has been undertaken by Geofirma; refer to Appendix 4.

7.0 **Construction methodology / engineering statements**

7.1 Outline of Underground Utilities and Obstructions

7.1.1 A full survey shall be carried out prior to works beginning on site to map all existing underground utilities in and around the site.

7.1.2 A full UXO Survey shall also be carried out as this area was bombed during WWII.

7.2 Outline Geotechnical Design Parameters

7.2.1 The design geotechnical parameters have been determined, based on the site investigation carried out by GEOFIRMA, with the data presented in Appendix C.

7.2.2 The allowable bearing pressure of 95KN/m2 has been considered (refer to Figure 7).

7.2.3 The Claygate Member angle of friction of 28 degrees has been considered to determine the active pressure on the retaining wall (refer to Figure 8).

Depth below ground level (base of footing)	1.0 m	1.5 m	2.0 m
Foundation Width (m)	0.6	0.6	0.6
Undrained Shear Strength Cu (kN/m²)	35	40	45
Overburden Pressure (kN/m²)	19.0	28	38.0
Allowable Bearing Capacity (kN/m²) (assuming foundations are a 0.6 m strip and FOS = 3)	95	125	145

Figure 7: Summary of assessment of allowable bearing capacity (source: "Geotechnical interpretative report", produced by Geofirma. Refer to Appendix C for full report).

Stratum	Typical thickness Range (m)	Bulk Density (kN/m³)	C_u (kN/m²)	Φ'_{cv} (°)	m_v (m²/MN)	$E_{u\ wall}$ (MN/m²)	$E_{u\ settlement}$ (MN/m²)	E'_{wall} (MN/m²)	$E'_{settlement}$ (MN/m²)
Made Ground	0.60 – 1.40	18	-	28	-	-	-	10	5
Claygate Member	0.40 - 5.70	19	35+6.7z	27	0.15	21+4z	11.5+2z	15.75+3z[1]	7.9+1.5z
London Clay Formation (Properties at surface)	0.95 – 1.15 (Full thickness unproven)	19	60	24	0.1	36	18	27	13.5

Figure 8: Summary of geotechnical parameters (source: "Geotechnical interpretative report", produced by Geofirma. Refer to Appendix C for full report).

7.3 Outline Temporary and Permanent Works Proposals

7.3.1 The works proposals include the following works:

- Conversion of the existing garage at ground floor level into a 2-storey habitable space, including lowering existing finishes floor level approximately 2.2m).
- Lowering part of the existing basement to match the existing basement living area finishes floor level, currently the lower point of the basement (finished floor level to be lowered approximately between 0.65m to 1m).
- Reconfiguration of some of the internal walls.
- New back extension.

7.3.2 The permanent works will mainly consist of partially underpinning the internal walls and forming a new retaining wall in hit/miss sequence to achieve the required formation level.

7.3.3 The temporary works strategy will be outlined in Appendix A, and shall be confirmed by a temporary works designer post planning prior to any construction works.

7.4 Design Proposals

7.4.1 To form the new basement, sequential reinforced concrete underpins will be cast below some of the internal walls to achieve the required formation level. The underpinning methodology of construction is a well-known and frequently used technique to form subterranean structures. The underpinning sequence is proposed to be carried out in maximum 1.0m width bays.

7.4.2 The use of temporary propping will ensure that the basement works do not cause any local ground movements whilst construction is taking place. The temporary works design is outlined in principle in the Appendix A, and it shall be confirmed by a temporary works designer appointed by the contractor prior to any construction works.

7.4.3 New RC retaining walls are to be constructed in underpinned sequence as shown on Symmetrys Drawings attached to this report in Appendix A. The retaining walls are designed to resist both vertical and horizontal loads such as surcharge and soil pressure with the basement reinforced concrete slab designed to resist potential soil pressure due to heave, hydrostatic pressure and buoyancy forces. The RC slab works as a permanent prop at the base

7.4.4 The expected heave forces cause short and long-term deformation. Short term heave deformation occurs instantaneously and can be remediated by removing the expanded ground during the excavation.

7.4.5 The structural calculations attached to this report in Appendix B also demonstrate that the existing structure can be safely supported on the proposed retaining wall structure.

7.4.6 To ensure continuity between the RC retaining walls and the masonry walls, dowels will be drilled into the underside of the masonry walls and cast in with the RC walls.

7.5 Proposed Sequence of Works

7.5.1 The structural method statement provided, (see Appendix A), is for the purpose of the design team's design development and for the purpose of the client's planning application. The appointed contractor will be responsible for all temporary supports and for the stability of the structure during the works.

7.5.2 The suggested sequence of works consists of reaching the new formation level starting from the section of the house along the boundary with No.41 Redington Road. Once secured the existing building with temporary props, the new basement slab is formed. The following steps shall consist in underpinning the property perimeter wall at the front and side (near No.45 Redington Road) and the internal walls. Once perimeter and internal walls have been formed to achieve the new formation level, the new basement slab shall be cast.

7.5.3 The method of construction adopted minimises the need for temporary works. However, propping during the underpinning sequencing will be required to minimise the risk of ground movement occurring.

7.5.4 To ensure that the retained engineer's intent is correctly interpreted by the contactor, they will be required to submit all temporary works proposals to review a minimum of 7 working days prior to commencing excavation. The contractor should also submit a dewatering strategy to ensure a strategy is agreed should water be encountered.

7.5.5 Temporary propping to the newly formed retaining walls will be required until the ground floor has been formed. It is contractor's responsibility to take all the necessary steps to ensure that the structure is adequately propped, shored, and braced during the progress of the works and excess of deflections and deformations of structure do not occur. For further details please see Appendix 1 for Construction Sequence and Method Statements

7.6 De-watering Strategy

7.6.1 As the site does lies above an aquifer and perched water is expected within granular lenses of the Claygate Bed, some localised dewatering might be required during construction and this could be achieved by sump pumping.

7.7 Stability of Neighbouring Structures

7.8 Due to the robust engineering principles and construction method applied, the extent of movement is limited in accordance with British and European codes. We can confirm that the proposed structural design and method of construction of the basement has been developed with a view to ensuring structural safety, and that if constructed in accordance with this document the works will be completed without any adverse impact on the structural stability of the neighbouring properties, other adjacent structures, adjoining land and gardens or the adjoining Public Highway.

7.9 The reinforced concrete structure will be designed to accommodate surcharges from the neighbouring property, public highway and ground pressures. The structure will have adequate stiffness to ensure that the lateral deflections do not exceed the appropriate limits recommended by British Standards Codes of Practice in order to ensure that potential ground movements be kept to acceptable limits. The structures will be designed to withstand any uplift due to hydrostatic pressures as well as being designed to transfer vertical loads into the ground safely. Refer to Structural calculations in Appendix B.

7.10 Waterproofing

7.10.1 BS8102:2009 sets out guidance for the waterproofing of basement structures according to their use. With this in mind the use of tanked, integral and/or drained methods of waterproofing will have to be considered. All subject to Architect's/Contractor detailing.

Table 2 Grades of waterproofing protection

Grade	Example of use of structure[A)]	Performance level
1	Car parking; plant rooms (excluding electrical equipment); workshops	Some seepage and damp areas tolerable, dependent on the intended use[B)] Local drainage might be necessary to deal with seepage
2	Plant rooms and workshops requiring a drier environment (than Grade 1); storage areas	No water penetration acceptable Damp areas tolerable; ventilation might be required
3	Ventilated residential and commercial areas, including offices, restaurants etc.; leisure centres	No water penetration acceptable Ventilation, dehumidification or air conditioning necessary, appropriate to the intended use

A) The previous edition of this standard referred to Grade 4 environments. However, this grade has not been retained as its only difference from Grade 3 is the performance level related to ventilation, dehumidification or air conditioning (see BS 5454 for recommendations for the storage and exhibition of archival documents). The structural form for Grade 4 could be the same or similar to Grade 3.

B) Seepage and damp areas for some forms of construction can be quantified by reference to industry standards, such as the ICE's *Specification for piling and embedded retaining walls* [1].

Figure 9: Grades of waterproofing protection (BS8102:2009)

7.11 Ground Movement and Damage Impact Assessment

7.11.1 A Ground Movement Assessment (GMA) has been carried out by GEOFIRMA in accordance with CIRIA publication C760 'Guidance on embedded retaining wall design' and takes into account the construction methodology and site-specific ground and groundwater conditions presented in this report. This assessment is attached to this report in Appendix D.

7.11.2 The results presented in this report describe the predicted ground movement to fall within Burland Category 0 (Negligible).

7.12 Control of Construction Works

7.12.1 It is proposed that the structural stability of the surrounding/adjacent properties is safeguarded by a system of movement monitoring.

7.12.2 The Contractor shall monitor the position and movements of the elevations of the adjacent properties around the perimeter of the proposed excavation. The monitoring shall be undertaken by a specialist survey company. The monitoring system will have at least the following characteristics:

1. The existing facades of the neighbouring properties as well as the flank wall of the neighbouring building will be monitored near ground level and at roof level, at intervals not exceeding 3m centres horizontally and vertically.

2. Monitoring points (targets) shall be firmly attached, to allow 3D position measurement, for the duration of the work, to a continuous and uninterrupted accuracy of -/+ 1mm. A suitable remote reference base/datum unaffected by the works will be adopted, one located at least 50m from the site.

3. Points/targets shall be measured for 3D positioning on, at not less than the following intervals:

   - Before any works commence (base reading)
   - Weekly during the period of basement excavation/construction
   - Monthly during the course of the remainder of the works.
   - Six months after the completion of all construction works.

Category of damage	Description of typical damage	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0-0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05-0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075-0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5-15 or a number of cracks > 3	0.15-0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15-25 but also depends on number of cracks.	>0.3

Figure 9 – Burland Damage Category Chart (CIRIA C580)

4. All measurements shall be plotted graphically, to clearly indicate the fluctuation of movement with time. The survey company shall submit the monitoring results to the Engineer (Symmetrys Ltd) and to the Adjoining Owners Party Wall Surveyors/Engineer within 24 hours of measurement, graphically and numerically.

5. The following trigger levels for movement are proposed for agreement. In the event of a trigger value being reached the Contractor will immediately stop any work that might cause further movement, assess the situation and propose alternative methods for proceeding, with definitive further movement limits for those later steps.

6. Trigger movement limits are proposed as follows:

   - Existing Buildings Horizontal/Vertical movement
   - Amber: +/-7mm All parties notified.
   - Red: +/-10mm Works reviewed

8.0 Basement impact assessment

8.1.1 A Conceptual Site Model (CSM) is presented in Appendix D.

8.2 Land Stability/Slope Stability

8.2.1 The site investigation has identified the London Clay formation to be the founding stratum.

8.2.2 The risk of movement and damage to this development due to shrink and swell of the London Clay is manageable with the design of a new substructure sufficiently stiff to withstand the actions of the heave.

8.2.3 A Ground Movement Assessment has concluded that the Damage Impact to surrounding structures within the zone of influence will be within Category 0 in accordance with the Burland Scale.

8.2.4 The BIA has concluded that there will be no risks or stability impacts to the development and/or adjacent sites due to slope.

8.3 Hydrogeology and Groundwater Flooding

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

8.3.2 The BIA has concluded 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 there is low risk of flooding from sewers and surface water.

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