Northwood Investors

Templar House

Basement Impact Assessment

REP/237116/G004

Rev.1 | 2 February 2018

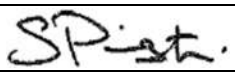
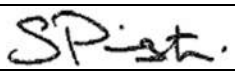
Job number 237116

Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ
United Kingdom
www.arup.com

ARUP

Document Verification

ARUP

Job title		Templar House			**Job number** 237116
Document title		Basement Impact Assessment			**File reference** 60-1
Document ref		REP/237116/G004			
Revision	**Date**	**Filename**	20171201_BIA (issue).docx		
Issue	1 Dec 2017	**Description**	Issued for planning		
			Prepared by	Checked by	Approved by
		Name	Stuart Pennington Jon Leech	Sarah Glover	Sarah Glover
		Signature			
Rev.1	2 Feb 2018	**Filename**	20180202_BIA (rev1).docx		
		Description	Incorporates responses to comments made by Campbell Reith dated 30 Jan 2018. Revised text shown in with a red box.		
			Prepared by	Checked by	Approved by
		Name	Stuart Pennington Jon Leech	Sarah Glover	Sarah Glover
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

Contents

1 Introduction

Northwood Investors are proposing to redevelop the site of Templar House, on High Holborn in the south of the London Borough of Camden. Ove Arup and Partners Ltd (Arup) has been commissioned by Northwood Investors to provide multi-disciplinary design services to facilitate the redevelopment.

The redevelopment comprises demolition of a 1950s building; the existing Templar House. It is proposed to replace the building with two new buildings, one with a residential end use and one with a commercial end use. The existing single story basement will be deepened by a maximum of 2m.

The purpose of a Basement Impact Assessment (BIA) is to assess the potential impact of the proposed development on surface water, groundwater and land stability in the immediate vicinity.

Camden Local Plan (2017), Policy A5 – Basements, sets out the policy approach to subterranean development in the Borough, and the requirement for a BIA is introduced in Camden Planning Guidance – Basements and Lightwells (CPG4).

The recommended methodology for carrying out a BIA is given in the report "Guidance for Subterranean Development" referenced in CPG4 and available on the London Borough of Camden internet website. The BIA methodology comprises the following stages:

1. Initial Screening to identify whether there are matters of concern;
2. Scoping to further define the matters of concern identified in the screening stage and devise an approach to evaluate the potential impacts;
3. Site investigation and study to establish baseline conditions;
4. Assessment of the information to determine the impact of the proposed basement on baseline conditions.

Arup has been appointed by Northwood Investors to undertake the BIA for the proposed development.

This report has been prepared by the following appropriately qualified people:

- Sarah Glover, CEng MICE
- Jon Leech, CGeol, FGS
- Stuart Pennington, CEng MICE

2 Background

Arup previously prepared a BIA Screening Report to support a planning application in 2015. The conclusion of the screening process was that a BIA was unnecessary; for the reasons stated in that report.

Since the 2015 report was published the proposed development has evolved though it essentially remains the same from a basement perspective.

A meeting was recently held with Campbell Reith (the current planning consultant for Camden Council) and a key outcome of this meeting was that a full BIA would be required. However, it was agreed that the scale of the basement was sufficiently small and simple for the BIA to be based on qualitative impact assessments without the need to undertake quantitative modelling.

In addition to the BIA report, Arup has also produced a detailed geotechnical desk study which was published in 2014[13]. Relevant information has been extracted from the desk study and used in this report.

3 Site context

3.1 Location

The Site is located at 81-87 High Holborn and also with an address at 24-27 Eagle Street in the London Borough of Camden, WC1. The location of the Site is shown in Figure 1.

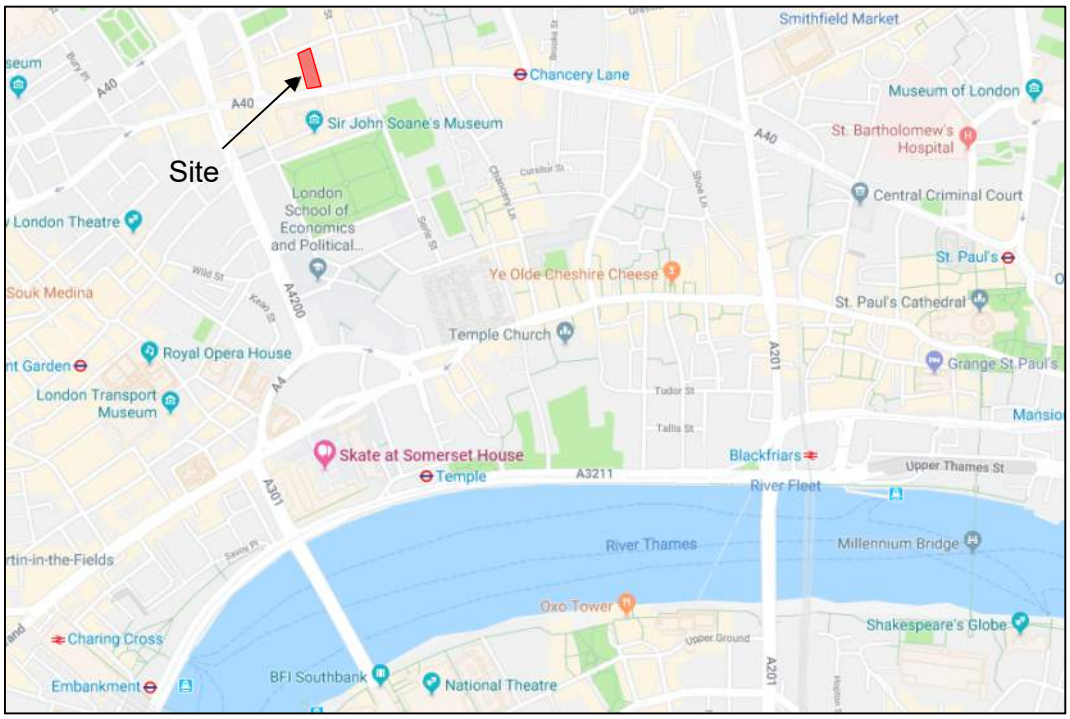


Figure 1 – Site location plan[1]

3.2 Topography

A more detailed site location plan showing neighbouring buildings is presented in Figure 2. The Site covers an area which is approximately 80m north to south and 35m east to west.

The Site is currently occupied by an existing building (Templar House) which covers the entire area.

The site is accessible by pedestrians from both High Holborn and Eagle Street. Vehicle access is only available onto the site and directly onto the basement ramp, from Eagle Street.

[1] Copyright Google 2017.

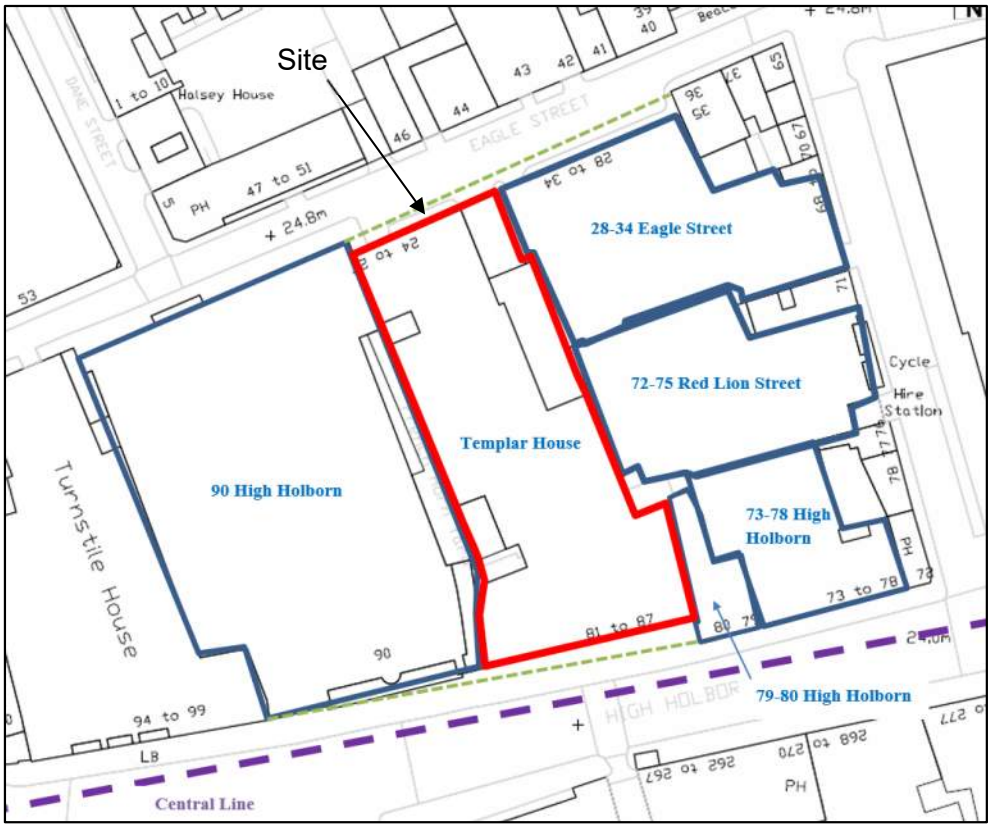


Figure 2 – Detailed site location plan[2]

The site is bounded by Eagle Street (to the north), High Holborn (to the south), 28-34 Eagle Street, 72-75 Red Lion Street and 79-80 High Holborn (to the east), and 90 High Holborn (to the west).

Outside the site there is a gentle slope in the ground level, falling from north to south. Ordnance Survey mapping indicates that the ground level to the north of the site on Eagle Street is +24.8mOD and south of the site, on High Holborn, is +23.8mOD. There is also an even gentler slope across the site, falling from east to west.

3.3 Structures on site

Templar House

A plaque at the entrance to Templar House indicates that it was completed in 1959. The building comprises seven to nine storeys above ground level and appears to comprise reinforced concrete slab and beam construction; however, this has not been confirmed. See Figure 3.

The above ground structure of the building is approximately 71m (north to south) and 28m (east to west). The ground floor level is at approximately +24.0mOD.

There is a single level basement which is understood to occupy the full footprint of the site and is therefore slightly larger than the superstructure footprint above.

[2] Crown Copyright (2013). Licence 100039628.

The basement does not appear to extend under Eagle Street; however, it does extend under High Holborn. The basement walls appear to be constructed from reinforced concrete and are likely to be propped by the ground and basement slabs. The basement floor level is typically +21.2mOD.

To date no foundation plans have been found. However, based on the size and age of the building, and the presence of a single level basement, the possibility of both shallow and deep foundations is a consideration.

Figure 3 – Street view of Templar House on High Holborn[1]

3.4 Structures on adjacent sites

90 High Holborn

The building was constructed in 2001. The building comprises nine storeys though the form of superstructure construction is not known. See Figure 4.

The building is approximately 72m (north to south) and 46m (east to west).

There is a double level basement within a secant pile retaining wall. The floor levels are +19.7mOD and +13.7mOD.

Design information shows the building to be founded on bored pile foundations ranging from 600mm to 1500mm diameter with toe levels between +4.0 and -13.0mOD.

Figure 4 – Street view of 90 High Holborn[1]

79-80 High Holborn

The estimated construction date is late 19th century / early 20th century. The building comprises five storeys and appears to be brick masonry construction. See Figure 5.

The building is approximately 20m (north to south) and 10m (east to west).

There appears to be a single level basement based on planning drawings.

To date no foundation plans have been found. However, based on the size and age of the building, shallow foundations are anticipated.

Figure 5 – Street view of 79-80 High Holborn[1]

28-34 Eagle Street

The estimated construction date is post-WW2 but before 1958. The building comprises eight storeys though the form of construction is not known; perhaps steel/concrete. See Figure 6.

The building is approximately 25m (north to south) and 31m (east to west).

There is a basement which is likely to be single level.

To date no foundation plans have been found.

Figure 6 – Street view of 28-34 Eagle Street[1]

72-75 Red Lion Street

The estimated construction date is late 20th century. The building appears to be six storeys and of concrete/masonry construction. See Figure 7.

The building is approximately 20m (north to south) and 45m (east to west).

There appears to be a single level basement based on planning drawings.

To date no foundation plans have been found.

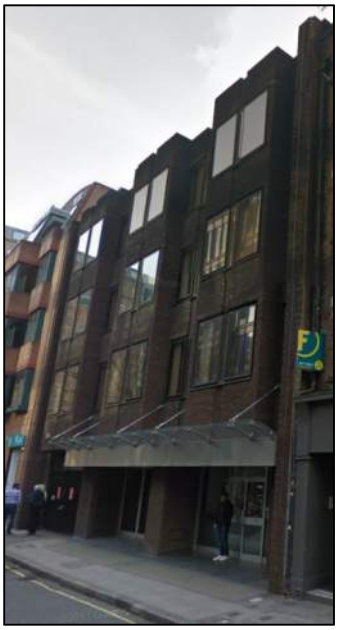


Figure 7 – Street view of 72-75 Red Lion Street[1]

73-78 High Holborn

The estimated construction date is late 19th century / early 20th century. The building appears to be six storeys though the form of construction is not known. See Figure 8.

The building is approximately 20m (north to south) and 25m (east to west).

There is a basement which is anticipated to be single level.

To date no foundation plans have been found.

Figure 8 – Street view of 73-78 High Holborn[1]

Listed structures

A search of the Historic England[3] site indicates that one listed property lies with 25m of the Site. The property is Grade II and is located at 247-252 High Holborn to the south of the Site. See Figure 9.

Figure 9 – Street view of 247-252 High Holborn[1]

Increasing the search buffer to 50m includes five further listed properties. The properties are Grade II, and are located at 12 and 14-17 Red Lion Square to the northwest of the Site. See Figure 10.

[3] https://historicengland.org.uk

Figure 10 – Street view of 12 and 14-17 Red Lion Square[1]

Underground structures

A key underground asset is the London Underground Central Line whose tunnels run beneath High Holborn. The nearest tunnel is understood to lie approximately 5m to the south of the Site with a soffit level of approximately +0.1mOD. London Underground Ltd (LUL) has been consulted to agree the potential impact of the proposed development on their assets.

Other relevant structures include: possible Pneumatic Dispatch Company tunnel (under High Holborn), Crossrail tunnels (approximately 60m north) and utilities. It is anticipated based on the information collected to date that these assets are in favourable locations with respect to the proposed works, that is, sufficiently distant or at high level (behind the existing retaining wall).

Nearby basements

In addition to the review above of adjacent properties, a search was undertaken of the Camden online planning database to locate other potential nearby basements. The north side of Eagle St (between No. 39 and No. 53) and the south side of High Holborn (between No. 247 and No. 277) were examined. For all of the properties there is either evidence of a basement or planning approval for a basement. It is anticipated that the majority of these will be single level basements.

3.5 Geology

The 2006 British Geological Survey (BGS) 1:50000 geological map (South London, Sheet 270) for the site shows the site to be underlain by Lynch Hill Gravel (River Terrace Deposits) of the Quaternary. See Figure 11.

The stratigraphic sequence for the underlying solid geology comprises London Clay, Lambeth Group, Thanet Formation and Chalk.

No lost rivers or scour hollows are known to be close to the Site.

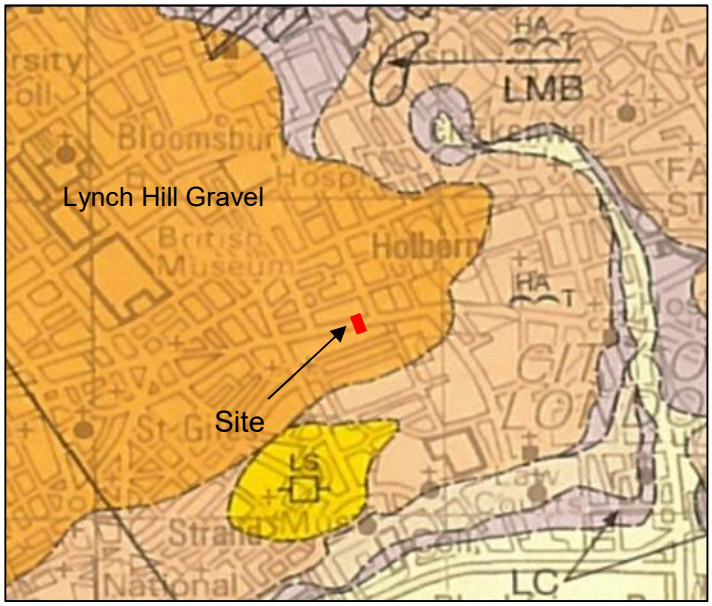


Figure 11 – Extract from BGS geological map[4]

An online search of the BGS recorded archives[5] has identified fourteen boreholes in the vicinity of the site (BGS Refs: TQ38SW548, TQ38SW554, TQ38SW3166, TQ38SW597, TQ38SW749, TQ38SW152, TQ38SW2931 and TQ38SW2932; dated 1891 to 1955). Four Crossrail boreholes in the vicinity of the site have also been interrogated (Crossrail Ref: RT33, RT35, RT36 and RT37; dated 1992). The boreholes confirm the stratigraphic sequence obtained from geological mapping.

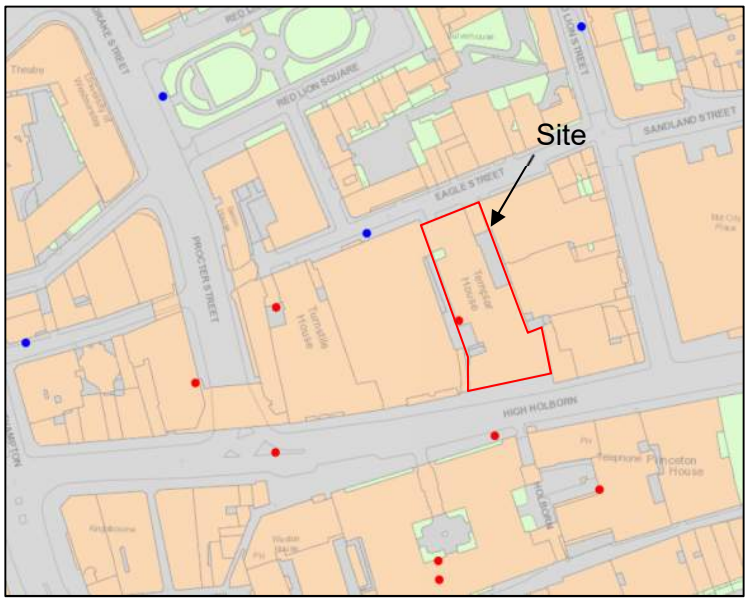


Figure 12 – BGS (red) and Crossrail boreholes (blue)

[4] C08/006-CCSL British Geological Survey ©NERC. All rights reserved.
[5] http://www.bgs.ac.uk/geoindex

Copies of the boreholes reviewed are presented in the Arup geotechnical desk study[13]. A general description of the stratigraphic succession beneath the site taken from the published geological information is given in Table 1.

Table 1 – Summary of anticipated geological sequence beneath the site

Stratum	General Description
Made Ground	• Highly variable in nature and composition • Likely to comprise a mixture of granular/cohesive imported fills and in-situ soils • Material typically includes various portions of clay, silt, sand, gravel, brick, concrete rubble, timber and metal
Langley Silt (Brickearth)	• Variable deposit comprising a firm mottled red/brown/yellow sandy and silty clay with occasional gravel, of windblown (Aeolian) origin • Silts prone to rapid collapse settlement under loading when saturated (metastable)
River Terrace Deposits	• Terrace Gravels in the London Basin floodplain deposited during seasonal snow-melt run off and so their distribution varied with time • Typically comprises a well graded sand/gravel mixture (fine to coarse) with some cobbles and clay/silt material
London Clay	• Predominantly a firm to very stiff fissured dark blue/brown/grey silty clay • Upper part is weathered and mottled orange/brown in colour • Unweathered material locally contains vertical variations in particle size with occasional water bearing sand partings and clay stone bands present
Lambeth Group	• Highly variable material deposited in a series of layers in a marine environment • Undifferentiated pattern apart from upper beds being predominantly clayey and lower beds being predominantly sandy • Generally comprises the following interbedded units: • Upper mottled clay – slightly sandy clay • Laminated sands and clayey silts; • Lower Shelly clay - clay with pyrite and shell fragments; • Lower Mottled clay - clay with limestone concretions; • Pebbly beds and glauconitic sand with some conglomerate and clay matrix
Thanet Formation	• Relatively uniform sequence of very dense sand (fine to medium grading)
Chalk	• Moderately weak porous very fine-grained limestone • Contains bands of gravel and cobble-sized masses of hard flint

Using borehole logs obtained from Crossrail, the BGS archive and from internal Arup data[13] for the area, the anticipated stratigraphic sequence is summarised in Table 2. The basis for not undertaking further investigation at the current design stage is described in Section 6.

Table 2 – Anticipated Site stratigraphy

Stratum	Approximate thickness (m)	Approximate depth to top of stratum (m)	Approximate level at top of stratum (mOD)*
Made Ground	2	0	+24.0
Langley Silt/Brickearth	0	Intermittent (1 BH only)	
River Terrace Deposits	4.5	2	+21.5
London Clay	20	6.5	+17.7
Lambeth Group	17	31.5	-2.5
Thanet Formation	8	48.5	-19.5
Chalk	>110	56.5	-27.5

3.6 Hydrology

Drainage

The Site is located in a part of central London with almost no natural drainage, owing to the complete urbanisation of the area. The nearest surface water feature is the River Thames, located approximately 500m to the south of the site.

The former River Fleet (a former tributary of the Thames) is known to have flowed to the north and the east of the site; however, its former course is estimated to be over 500m from the Site and is not considered relevant.

The current Site is completely developed with no unpaved areas. It is anticipated that all rainfall which currently falls on the site will eventually discharge to the Thames Water sewer system.

Rainfall and runoff

Met Office climate data[6] for the period 1971-2000 for the region in which the Site lies suggests that the average rainfall ranged from between 450 and 700mm per annum. This value is slightly lower than the UK national average of 900mm per annum.

Flooding

Most of the rainfall in the area will run off hard surfaces and be collected by the Thames Water sewer network. Whilst the Camden flood report[7] indicates there is a history of local flooding in the borough, which is prone to occasional storm water overflows caused by intense rainstorms, none of the streets adjacent to the Site have previously been affected.

[6] https://www.metoffice.gov.uk/
[7] Camden, Managing Flood Risk in Camden, 2013.

The Site is located within a Flood Zone 1 which has a low risk of flooding from river or sea flooding (less than a 1 in 1,000 annual probability) [8].

3.7 Hydrogeology

The site is located above two disconnected aquifers which are known as the shallow and deep aquifers. The deep aquifer, which comprises of the Chalk and Thanet Sand is approximately 50mbgl at the site. The groundwater level in the deep aquifer is approximately -35mOD[9]. Given its depth (and separation from the proposed development), the deep aquifer is not considered further in this assessment.

The upper aquifer comprises of the River Terrace Gravels (Lynch Hill Gravel) and is disconnected from the deep aquifer by the London Clay and Lambeth Group which have a high clay content and are considered to act as a barrier to groundwater flow.

Using borehole logs obtained from Crossrail, the BGS archive and from internal Arup data[13] for the area, the groundwater level in the upper aquifer at the Site is estimated to be +18.5mOD though for the purposes of this BIA it has been conservatively assumed to lie at +20.5mOD.

Groundwater in the aquifer appears to flow in a south-easterly direction. This follows the general slope of the London Clay surface below the River Terrace Gravels which is estimated to be at a gradient of 0.9%. The saturated thickness of water within the River Terrace Gravels is estimated to between 0.5m and 1m, which is broadly similar to the wider area around the Site.

Due to the urbanised nature of the area surrounding the Site, recharge to the upper aquifer is likely to be controlled by leaky water mains and sewers. There are very few green spaces near to the Site which is where most natural recharge would be expected to occur. The nearest significant area of green space uphill of the Site is Russell Square, approximately 300m to the northwest of the site.

3.8 Site model

Using the information described in the previous sections, preliminary cross sectional models of the Site have been developed. These are illustrated in Figure 13 and Figure 14.

A load takedown for the existing structure has been undertaken to understand the net change in loading due to the proposed development. The estimated average unfactored realistic load for the existing building is 145kPa dead + 45kPa live.

[8] https://flood-map-for-planning.service.gov.uk/
[9] Environment Agency, Management of the London Basin Chalk Aquifer, Status Report 2017.

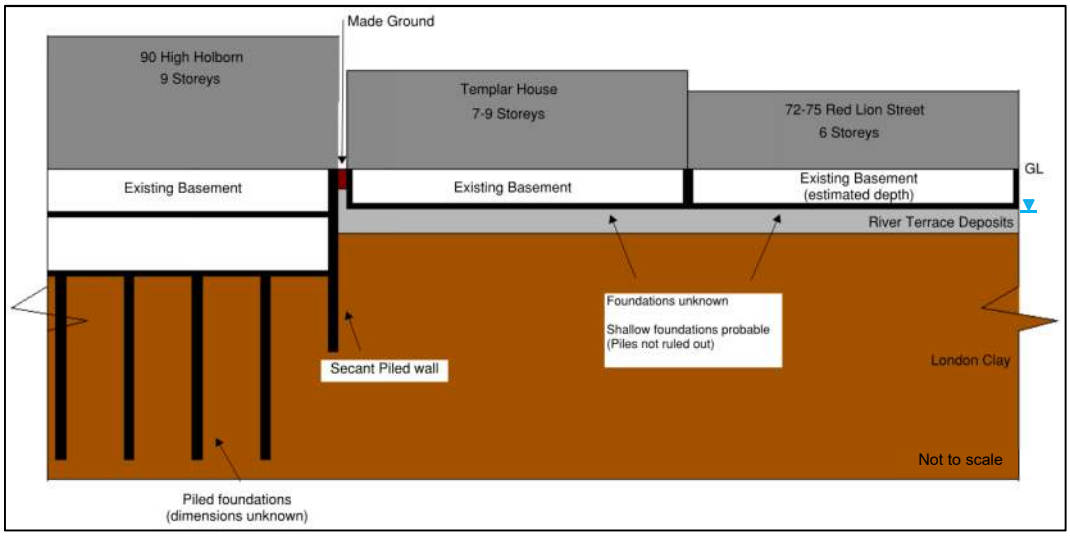


Figure 13 – East (left) / west cross section

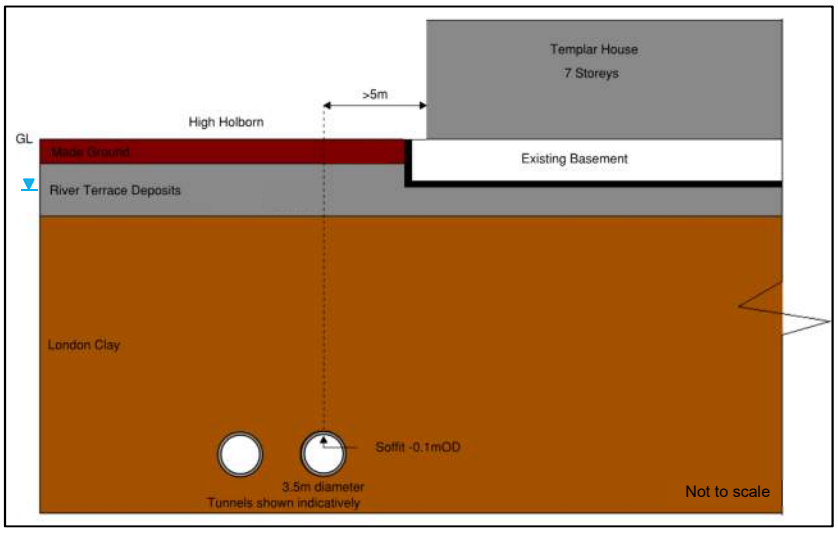


Figure 14 – South (left) / north partial cross section

3.9 Proposed development

The proposed redevelopment of the Site comprises demolition of the existing building and construction of a new mixed use development comprising an office building to the south and a residential building to the north. The existing basement will be deepened by up to 2m.

The proposed new basement floor levels are +20.4mOD beneath the residential building and +19.3mOD beneath the commercial building. The basement slab is expected to be 0.5m thick. It is anticipated that the excavation formation level will be within the River Terrace Deposits but below the assumed groundwater level.

Figure 15 and Figure 16 outline the proposed development. The existing basement line is shown approximately in red.

Figure 15 – Proposed development (long section, left: residential, right: office)[10]

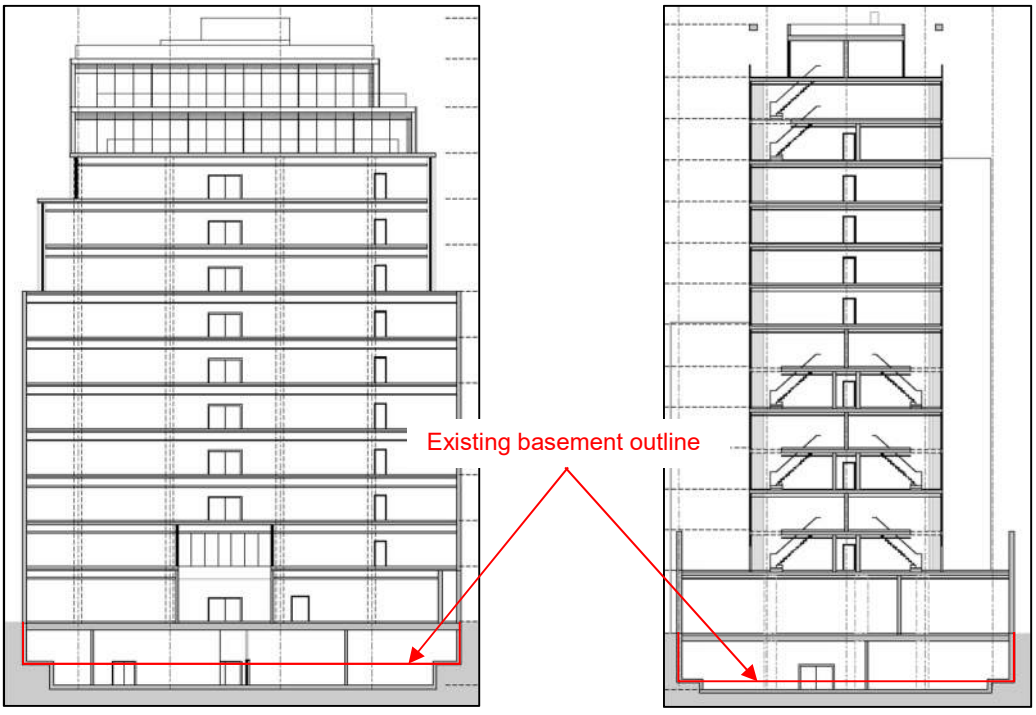


Figure 16 – Proposed development (cross sections, left: office, right: residential)[11]

[10] Astudio Drawing TH-AS-A-00-PL-0100-SEAA-3001-P3.
[11] Astudio Drawing TH-AS-A-00-PL-0100-SEBC-3005-P3.

The estimated average unfactored design load for the residential building is 219kPa dead + 33kPa live and for the office building is 126kPa dead + 57kPa live.

Figure 17 presents a comparison of the existing superstructure footprints at Level 1. For the residential building the footprint is similar though the structural loads indicate a net increase. For the office building the footprint has increased and the load change varies from a net increase to a net decrease.

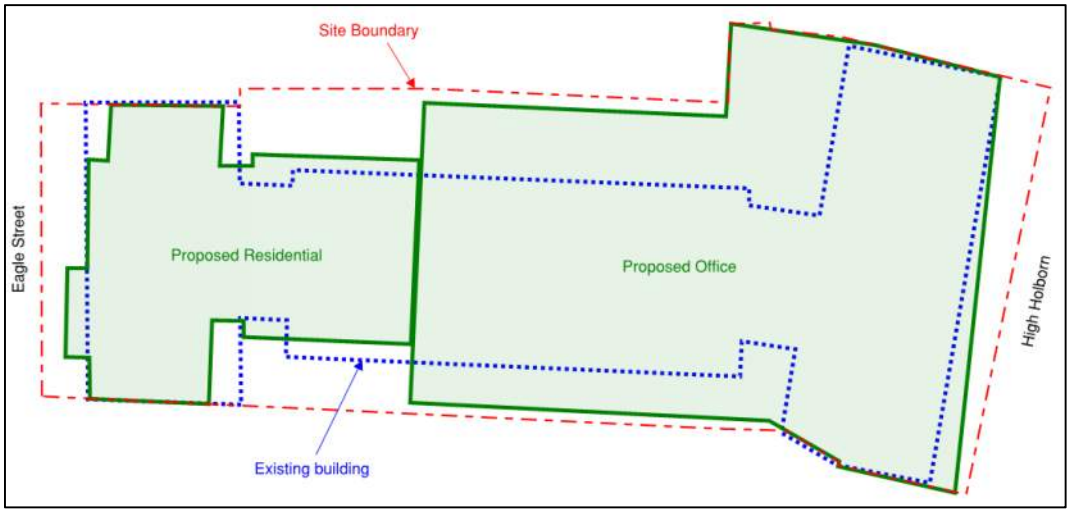


Figure 17 – Comparison of existing and proposed building footprints

It is envisaged that the basement construction will take place within a propped secant pile wall due to the need to control ground movements and groundwater, and support building loads. However, alternative methods of construction may be considered once the results of future investigations become available.

The current proposed construction sequence for the deepening of the existing basement is illustrated in Figure 18. The sequence shows a section through the neighbouring buildings to the east. A similar construction sequence will be used for the north and south basement sections, although these have highways rather than buildings beyond the basement walls. To the west of the Site, 90 High Holborn already has a basement that is deeper than the proposed new basement at Templar House. Along the western elevation it may not be necessary to install a new secant piled wall to support the new excavation.

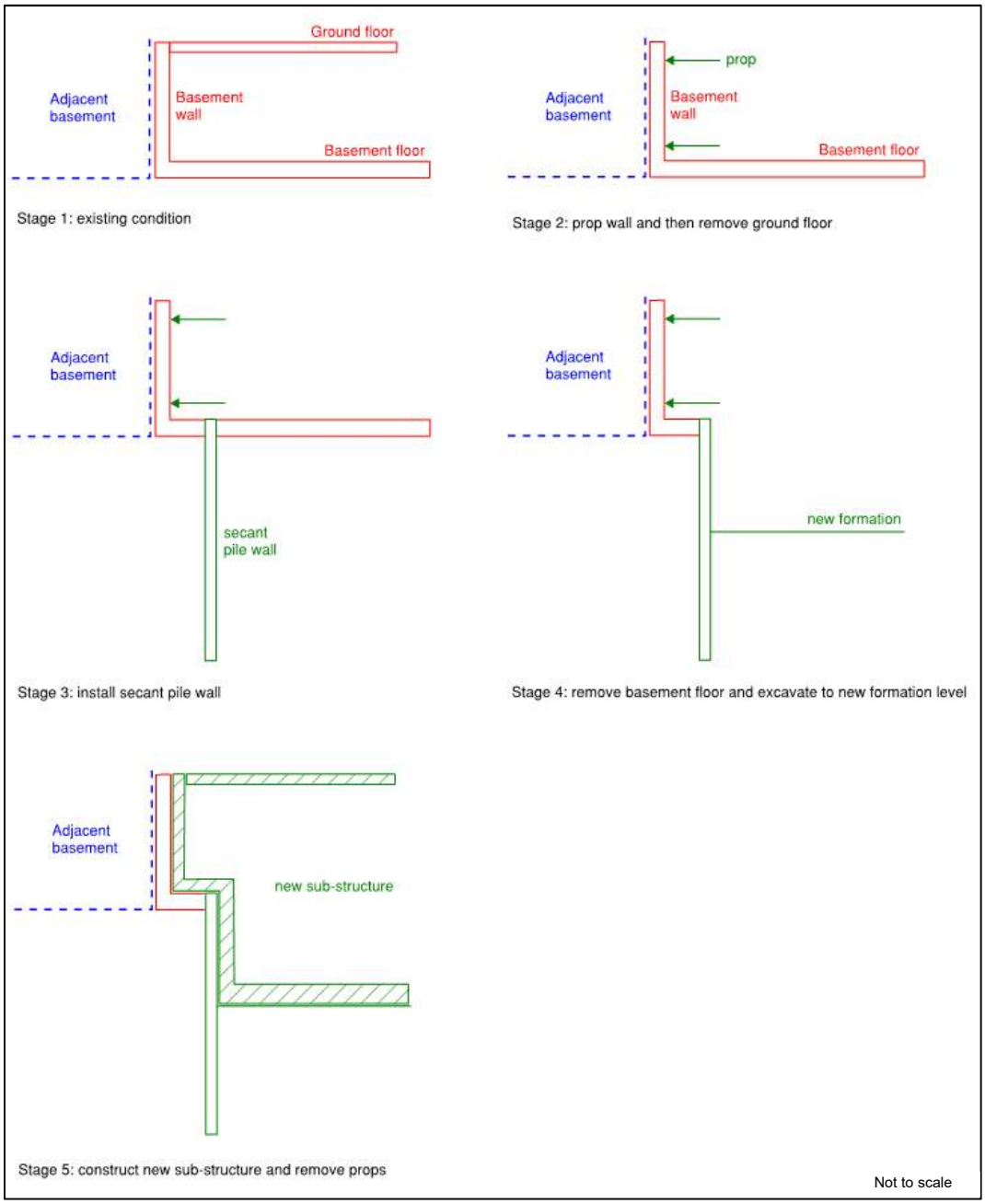


Figure 18 – Proposed basement construction sequence

4 Stage 1: screening

The first stage in assessing the impact of a proposed basement development is to recognise what issues are relevant to the proposed site. This is done by using the screening flowchart found in the Camden planning guidance together with the screening checklists[12].

The checklists dealing with surface flow and flooding, groundwater flow and land stability are presented in Table 3, Table 4 and Table 5 respectively.

Where an impact has been identified, the relevant screening question is presented in bold and the issue is carried forward to Stage 2.

[12] Camden Council, Camden Planning Guidance – Basements and Lightwells – CPG4, 2015.

Table 3 – Surface flow and flooding screening checklist

No.	Screening Question	Impact	Source/Comment
1.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site lies outside the Hampstead Heath surface water catchment area.
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 site is fully paved and all surface water is directed into nearby sewers. The proposed scheme is also fully paved and directs water into nearby sewers albeit with a lesser impact due to proposed on site detention.
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	The existing site is fully paved and the proposed scheme is also fully paved.
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?	No	There is no notable change to the size of the basement at the site that would result in changes to surface water flow profiles received by adjacent properties. The nearest surface water feature is over 500m away and disconnected from surface water flows at the site.
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 material change to water quality at adjacent properties as the site will remain fully paved and all water will be directed to nearby sewers.
6	Is the site in an area known to be at risk from surface water flooding, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site is not located in an area known to be at risk of flooding. The proposed basement depth is well above the level of the nearest water feature (River Thames, 500m to the south)

Table 4 – Groundwater screening checklist

No.	Screening Question	Impact	Source/Comment
1a.	**Is the site located directly above an aquifer?**	**Yes**	**The site is underlain by River Terrace Deposits which is classified as a Secondary A aquifer.**
1b.	**Will the proposed basement extend beneath the water table surface?**	**Yes**	**Groundwater levels are estimated to be +18.5mOD though it has been conservatively assumed to lie at +20.5mOD. The deepest basement slab will be at approximately +18.8mOD (underside of slab); however, a secant pile wall around the basement perimeter will provide a complete cut-off for groundwater in the gravels.**
2.	Is the site within 100m of a watercourse, well (open/disused) or potential spring line?	No	The nearest watercourse is the River Thames which is located approximately 500m south of the site. The nearest water abstraction point is 660m from the site. There are no springlines within 100m.
3	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site lies outside the Hampstead Heath surface water catchment area.
4	Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	No	The existing site is fully paved and the proposed scheme is also fully paved.
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 soak-away and/or SUDS)?	No	The existing site is fully paved and all surface water is directed into nearby sewers. The proposed scheme is also fully paved and directs water into nearby sewers albeit with a lesser impact due to proposed on site attenuation.
6	Is the lowest point of the 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 or spring line?	No	There are no ponds or springlines close to the site. The nearest surface water feature is the River Thames (500m to the south).

Table 5 – Land stability screening checklist

No.	Screening Question	Impact	Source/Comment
1.	**Does the existing site include slopes, natural or manmade, greater than 7º? (approximately 1 in 8)**	**Yes**	**The existing basement is formed by near vertical slopes supported by retaining walls.**
2.	Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7º? (approximately 1 in 8)	No	The existing basement occupies the site footprint. The slope at the boundary is already near vertical. Basement deepening will be addressed under the Q1 and Q3.
3.	**Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7º? (approximately 1 in 8)**	**Yes**	**There is adjacent land with basements.**
4.	Is the site within a wider hillside setting in which the general slope is greater than 7º? (approximately 1 in 8)	No	The wider area around the site is relatively flat.
5.	Is the London Clay the shallowest stratum at the site?	No	Made ground is the shallowest stratum.
6.	Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	No	There are no trees on the site.
7.	Is there a history of seasonal shrink-swell subsidence in the local area (Claygate Beds), and/or evidence of such effects at the site?	No	We are not aware of the area having a history of shrink-swell subsidence. The effects of shrink-swell subsidence are not evident at the site.
8.	Is the site within 100m of a watercourse or a potential spring line?	No	The nearest watercourse is the River Thames which is located approximately 500m south of the site. The nearest water abstraction point is 660m from the site. There are no springlines within 100m.

No.	Screening Question	Impact	Source/Comment
9.	**Is the site within an area of previously worked ground?**	**Yes**	**Made Ground is present on the site.**
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 site is within the River Terrace Gravel aquifer. The basement is likely to extend below the water table.**
11.	Is the site within 50m of the Hampstead Heath ponds?	No	The site is more than 50m away.
12.	**Is the site within 5m of a highway or pedestrian right of way?**	**Yes**	**The site abuts High Holborn and Eagle Street.**
13.	**Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**	**Possible**	**Details of existing foundations have yet to be found. It is thought that a combination of shallow and deep foundations are present. To the west of the Site piles are present, to the east shallow footings are probable whilst for the Site itself, it is likely that shallow footings are present but piles cannot be ruled out. In terms of changes in basement level, there would be a decrease in differential to the east whilst to the west there would be an increase of ≤ 2m.**
14.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No	The nearest tunnel exclusion zones are beneath High Holborn.

5 Stage 2: scoping

The aim of the scoping stage is to identify the potential impacts for each of the matters identified during Stage 1 and then define the scope for further investigation.

There are no issues to carry forward for surface flow and flooding.

The potential impacts for groundwater and land stability issues carried forward are presented in Table 6 and Table 7.

Table 6 – Groundwater: issues carried forward

No.	Screening Question	Source/Comment	Potential Impact / Further investigation
1a.	Is the site located directly above an aquifer?	The site is underlain by River Terrace Deposits which is classified as a Secondary A aquifer.	The issue here is potential for change to the groundwater flow regime. The proposed retaining wall will penetrate into the London Clay and may cut flow through the River Terrace Deposits if secant piles (as opposed to contiguous) are used. Changes to the regime may lead to local changes in groundwater levels which may affect nearby structures. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation will be needed to confirm the existing groundwater regime. Should groundwater conditions prove favourable a contiguous pile (rather than secant pile) wall may be employed which would lessen the potential impact on the groundwater regime.
1b.	Will the proposed basement extend beneath the water table surface?	Groundwater levels are estimated to be +18.5mOD though it has been conservatively assumed to lie at +20.5mOD. The deepest basement slab will be at approximately +18.8mOD (underside of slab); however, a secant pile wall around the basement perimeter will provide a complete cut-off for groundwater in the gravels.	

Table 7 – Land stability: issues carried forward

No.	Screening Question	Source/Comment	Potential Impact / Further investigation
1.	Does the existing site include slopes, natural or manmade, greater than 7º? (approximately 1 in 8)	The existing basement is formed by near vertical slopes supported by retaining walls.	The issue here is ground instability. The basement effectively comprises vertically cut faces which derive their stability from the basement structure. Any changes to the basement (such as deepening) would need to consider how that stability is maintained. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation may be needed to define some of the characteristics of the existing basement structure.
3.	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7º? (approximately 1 in 8)	There is adjacent land with basements.	The issue here is ground instability on neighbouring land. Typically, basements will be designed to be self-supporting, i.e. not reliant on the adjacent basement for support. It is anticipated that this is the case. However, an adjacent basement may rely on adjacent ground for support. Taking that ground away by deepening may cause instability. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation may be needed to define some of the characteristics of the existing basement structure such as wall thickness.
9.	Is the site within an area of previously worked ground?	Made Ground is present on the site.	The issue is that worked ground can be variable and it can be more difficult to predict its behaviour. In terms of this site, Made Ground is anticipated to be limited to a thickness of around 2m behind the basement walls on each street frontage. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation will be needed to confirm that the Made Ground is as anticipated.

No.	Screening Question	Source/Comment	Potential Impact / Further investigation
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?	The site is within the River Terrace Gravel aquifer. The basement is likely to extend below the water table.	The issue is that dewatering may cause ground settlement outside the site. However, as the proposed basement will be constructed using a secant pile wall sealed into the London Clay and no underslab drainage is proposed, the impacts of dewatering will be limited to the ground within the site. No further investigation is needed.
12.	Is the site within 5m of a highway or pedestrian right of way?	The site abuts High Holborn and Eagle Street.	The issue is that ground movements due to basement construction may damage infrastructure outside the site. However, the continued presence of the existing wall during basement deepening, a robust propping arrangement and controlled excavation is favourable. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation may be needed to further define the location of utilities on High Holborn and Eagle Street.
13.	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Details of existing foundations have yet to be found. It is thought that a combination of shallow and deep foundations are present. To the west of the Site piles are present, to the east shallow footings are probable whilst for the Site itself, it is likely that shallow footings are present but piles cannot be ruled out. In terms of changes in basement level, there would be a decrease in differential to the east whilst to the west there would be an increase of ≤ 2m.	The issue is that an increase in the depth differential between foundations has the potential to cause structural damage due to: changes in foundation characteristics and poorly supported excavations. However, the proposed controlled excavation and pile support to building loads is favourable. This BIA has been based on existing available ground investigation data. The assumptions made will be verified by further investigation prior to construction. For future design, investigation will be needed to understand the characteristics of the foundations on the site and of those on adjacent properties. Investigation will also be needed to confirm the characteristics of the party walls.

6 Stage 3: site investigation and study

6.1 Introduction

This stage aims to develop an understanding of the site and its surroundings through site investigation.

To date a detailed geotechnical desk study[13] has been written, and nearby site investigation data collected and assessed (as described in Section 3).

For the purposes of this BIA no further investigation is proposed at present.

A site investigation has not been carried out at this stage in design development because, (i) the existing building is currently occupied by LUL and investigative works would be extremely disruptive at this stage and (ii) there is a wealth of nearby ground investigation data that provides a sufficient level of information for the BIA.

A thorough ground investigation will be carried out during RIBA Stage 3 design as described below.

6.2 Future investigation

Further investigation will be necessary to inform detailed design and assessment (as opposed to investigation for the BIA). It is proposed that this be undertaken post-planning.

In Stage 2 the need for investigation has been mentioned. An outline of the methods of investigation proposed is as follows:

- Intrusive ground investigation on and adjacent to the Site to: confirm the anticipated ground and groundwater conditions, obtain geotechnical parameters for design, and allow installation of groundwater monitoring points.
- Intrusive structural investigation of the basement on the Site to provide information on the characteristics of the existing sub-structure and party walls, as necessary.
- Possible further investigation into the location of utilities.
- Possible further investigation into the characteristics of adjacent buildings and basements.

[13] Arup, Templar House - Geotechnical Desk Study, Dec 2014.

7 Stage 4: impact assessment

7.1 Introduction

Surface flow and flooding have not been identified as issues requiring assessment. Groundwater and land stability have been identified and are addressed below.

With respect to groundwater the key change is that the proposed development includes basement deepening works that may intersect the Site groundwater level and result in a change in the flow regime.

With respect to land stability the key change is that the development includes basement deepening works that will alter the existing ground stress conditions, and result in ground movement.

7.2 Groundwater

General

Impermeable basements can impede groundwater flow which can lead to an increase in uphill water levels and a decrease in downhill water levels.

The proposed development comprises the deepening of a single level basement by up to 2m. Whilst the proposed basement slab level lies within the River Terrace Deposits, the use of a secant pile retaining wall embedded into the London Clay around the Site perimeter effectively acts as a complete barrier to groundwater flow.

Assessment

As the proposed construction effects a permanent change to groundwater flow which in practice cannot be avoided, a preliminary assessment of the impact has been undertaken using Darcy's Law. This method of assessment is considered to be conservative.

Currently the groundwater is expected to flow unimpeded across the Site; however, following installation of a secant pile wall it would be forced to flow around the Site via a longer flow path. To take the new flow path (and assuming no change to the hydraulic conductivity) the piezometric head needs to change. This change presents as a rise in groundwater level uphill of the basement and a drop downhill. The estimated change is ±0.2m which is considered to be insignificant in the context of the Site and its surroundings.

The assessment described above assumes no interaction with nearby basements. Apart from the adjacent site at 90 High Holburn where there is a two-level basement, it is currently understood that within the vicinity of the Site there are only single level basements founded above the groundwater level and no proposed basements. Give the presence of the deep adjacent basement, a cumulative impact assessment has been untaken using the same methodology described in the previous paragraph. The estimated change considering cumulative effects is

±0.3m which is also considered to be insignificant in the context of the Site and its surroundings.

These estimates of groundwater level change are consistent with our previous experience of the effects of basements penetrating the upper aquifer in London.

7.3 Ground movement

General

Ground movement resulting from basement construction arises from various ground based activities. In the context of the proposed development activities such as, bulk excavation, propping (and its removal) and the installation of a piled retaining wall, will cause movement. The magnitude of the movement can be controlled though it cannot be completely eliminated.

Ground movement resulting from basement construction can also be thought of in terms of (i) local movement to the rear of retaining walls and (ii) wider movement attributable to bulk excavation and foundation loading.

The component of ground movement that is of concern for the purposes of BIA is that part which occurs outside the development site, in particular the magnitude of differential movements.

Uncontrolled ground movement has the potential to impact a number of assets around the Site. The key assets which have been identified include, neighbouring buildings, tunnels and utilities.

Based upon past experience, empirical evidence present in Section 6.2.1 of CIRIA Report C760 and preliminary ground movement assessment using Oasys PDisp software, our estimate of the ground surface movement at the Site boundary is 4mm vertical displacement and 6mm horizontal displacement. Our estimate of the limit of vertical and horizontal ground movement (that is, where they are less than 1mm) is 5-10m from the Site boundary.

Assessment

The proposed redevelopment of Templar House involves a modest deepening of the basement and net change in foundation loading.

With reference to the Burland method of damage categorisation (referred to in CPG4[12]), the estimated contours of ground movement result in a potential Damage Category ranging from 0 “negligible” to 1 “very slight”.

Design and construction of the redevelopment works will take due consideration of the neighbouring buildings, tunnels and utilities. For the neighbouring buildings, construction methods for deepening the basement and foundation solutions for supporting the new buildings will be planned with the objective of not exceeding Category 1 damage as defined by Burland.

For the tunnels and utilities, construction methods will be planned with the objective of achieving the requirements (which we are familiar with based on recent project experience) of the respective stakeholders.

Given the proximity of adjacent structures it is proposed that basement excavation will take place within an embedded secant pile retaining wall (or contiguous pile wall if groundwater conditions prove to be more favourable than assumed) with propping as required to limit wall deflections to an acceptable level.

Given the estimated net changes in load and proximity of adjacent structures it is proposed that the new buildings will be supported on piles founded in the London Clay; a robust solution. However, the possibility of a raft solution will be reviewed for suitability after more site investigation data is collected.

Ground movement assessments will be carried out and a monitoring regime will be developed to ensure the construction works are adequately controlled. The limits on ground movements and building damage will be captured within the construction specifications and drawings to ensure an appropriate level of care is taken by the contractor.

The monitoring regime will comprise of 3D reflective targets attached to neighbouring buildings and settlement studs in surrounding pavements. These will be monitored at regular intervals during existing building demolition and throughout the basement construction works. The movements will be checked against pre-established trigger levels that are related to the anticipated ground movements. Contingency measures will also be identified for use in the event that trigger levels are breached.

Design analyses covering local and overall stability will be carried out to ensure the stability of retaining walls, the basement and the completed structure.

Liaison with third parties will be formalised through the party wall approvals process for the neighbouring buildings and through the planning process for the tunnels and utilities.

It is noted that an assessment of the impact of the proposed development on the Central Line tunnels[14] has been accepted and a ‘letter of no objection’ issued by LUL. Whilst the report was prepared in 2015 for a slightly different scheme, the analyses undertaken are sufficiently broad to still be valid for the current scheme.

[14] Arup, Templar House – Tunnel Impact Assessment, Rev.A, Oct 2015.

8 Conclusions

A BIA has been carried out for the proposed redevelopment of Templar House which comprises deepening the existing basement by up to 2m. The new basement excavation will be supported by a new embedded retaining wall formed from either a contiguous or secant piled wall, the latter if the groundwater table is penetrated by the construction works.

Screening and scoping assessments have been carried out in accordance with the London Borough of Camden guidance and these have concluded that:

- The site is not in an area at risk of flooding.
- The proposed development will not materially change surface water flows.
- The basement has the potential to cause a small rise in groundwater level of up to 0.3m in the areas surrounding the Site. This potential rise will not have a detrimental impact on the neighbouring buildings.
- During construction, movements of the neighbouring buildings, services and utilities will be controlled using an embedded retaining wall. The wall and propping will be designed taking account of neighbouring buildings and ground movements. The wall will be designed such that neighbouring buildings do not experience damage greater than damage category 1.
- With the exception of the LU Central Line, the utilities near the site are contained at shallow depth behind the existing retaining walls which will be retained in the proposed development. The walls will be sufficiently propped during construction to prevent significant movement of the utilities.
- The impact on the LU Central Line is the subject of a separate Impact Assessment Report and a letter of no objection for the works has been obtained from LU.

The assessments that have been carried out are largely qualitative and are based on experience of issues from other similar projects in London. This approach is considered appropriate in light of the modest deepening of the basement and the relatively straightforward nature of the construction works.

The assessments are based on site investigation data from a number of sources. Further site investigation will be carried out post planning (and once the site is vacated) to validate the assumptions in this report.

During construction, a monitoring regime will be established to ensure the impacts of the works are no more severe that have been assessed in this report.