Oriel

Basement Impact Assessment

Structural Engineering

April 2021

File: ORL-INF-XX-XX-RP-PL-330-Basement Impact Assessment.
Revision 3.0

Oriel
Creating the centre for advancing eye health

Moorfields Eye Hospital NHS Foundation Trust

NHS

Moorfields Eye Charity

UCL INSTITUTE OF OPHTHALMOLOGY

Oriel
Creating the centre for advancing eye health

CONTACTS

Applicant:
Moorfields Eye Hospital NHS Foundation Trust
62 City Road
London EC1V 2PD
T: +44 **(**0)20 7253 3411
W: www.moorfields.nhs.uk

UCL Institute of Ophthalmology
Bidborough House
38-50 Bidborough Street
London WC1H 9BT
T: +44 (0) 20 7679 2000
W: www.ucl.ac.uk/ioo/

Moorfields Eye Charity
Kemp House
152-160 City Road
London EC1V 2NX
T: +44 (0)20 7566 2565
W: www.moorfieldseyecharity.org.uk

Development Manager:
Moorfields Eye Hospital NHS Foundation Trust
62 City Road
London EC1V 2PD
T: +44 (0)20 7501 0688
W: www.moorfields.nhs.uk

Project Manager:
AECOM
Aldgate Tower,
2 Leman Street
London E1 8FA
T: +44 (0)20 7061 7000
W: www.aecom.com

Lead Designer & Multi-Disciplinary Design Team including Specialists:
AECOM
Aldgate Tower
2 Leman Street
London E1 8FA
T: +44 (0)20 7061 7000
W: www.aecom.com

Lead Architect:
Penoyre & Prasad
The White Chapel Building
10 Whitechapel High Street
London, E1 8QS
T: +44 (0)20 7250 3477
W: penoyreprasad.com

Interiors / Landscape Architect:
White Arkitekter
Östgötagatan 100
Box 4700
11692 Stockholm
T: +46 8 402 25 00
W: whitearkitekter.com

Environmental Consultant:
AECOM
Aldgate Tower,
2 Leman Street
London E1 8FA
T: +44 (0)20 7834 7267
W: www.aecom.com

Planning Consultant:
JLL
30 Warwick Street
London W1B 5NH
T: +44 (0) 20 7493 4933
W: www.jll.co.uk

Heritage & Townscape:
KM Heritage
72 Pymer's Mead
London SE21 8NJ
T: +44(0) 20 8670 9057
W: www.kmheritage.com

Wind Microclimate:
BRE
Watford
Hertfordshire
WD25 9XX
T: +44(0) 333 321 8811
W: www.bregroup.com

Oriel
Creating the centre for advancing eye health

CONTACTS

Rights of Light:
GIA
The Whitehouse
Belvedere Road
LondonSE1 8GA
T: +44 (0)20 7202 1400
W: www.gia.uk.com

Public Affairs Consultant:
London Communication Agency
8th Floor
Berkshire House
168-173 High Holborn
London WC1V 7AA
T: +44 (0) 20 7612 8480
W: www.londoncommunications.co.uk

Client Accessibility Adviser:
Buro Happold
17 Newman Street
London W1T 1PD
T: +44 (0)2079 279 700
W: www.burohappold.com

Legal advisor:
CMS LLP
Cannon Place
78 Cannon Street
London EC4N 6A
T: +44 (0)20 7367 3000
W: cms.law/en/gbr

Cost Consultant:
Gardiner & Theobald LLP
10 South Crescent
London WC1E 7BD
T: +44 (0)20 3597 1000
W: www.gardiner.com


Oriel
Creating the centre for
advancing eye health


Moorfields
Eye Hospital
NHS Foundation Trust


JLL


UCL
INSTITUTE OF
OPHTHALMOLOGY


white


Moorfields
Eye Charity


KMHeritage


AECOM


bre


Penoyre
&Prasad


gia
CHARTERED SURVEYORS


BURO HAPPOLD


LCA


GT
GARDINER
&THEOBALD


CMS
Law . Tax

Oriel
Basement Impact Assessment

Prepared for:

Moorfields Eye Hospital NHS Foundation Trust
UCL Institute of Ophthalmology
Moorfields Eye Charity

Prepared by:

AECOM Limited

Mike Brace, MEng CEng MICE
Structural Engineer

Martin Webb, BEng CEng MIStructE
Associate Director

Michael Wright, BSc MSc CEng MIStructE
Regional Director

Contents

Figures

Tables

Non-Technical Summary

This report provides an assessment of the likely impact of the new basement construction as part of the proposed Moorfields Eye Hospital development on the existing St. Pancras Hospital site. The Proposed Development comprises a single building, between seven and ten storeys in height (including a partially submerged lower ground floor level).

A Phase 1 Geotechnical and Geo-environmental Desk Study and a Flood Risk Assessment and Drainage Strategy has been prepared in conjunction with this Basement Impact Assessment.

The Geotechnical and Geo-environmental Desk Study identified the ground water table at the Site to be 60m below ground level, beyond the depth of the proposed building's foundations. The London Clay Formation which extends to approximately 36m below ground level is classified as an 'unproductive strata' preventing risk to the ground water below from the proposed structure.

Review of historical mapping did not reveal the Site to have been previously worked ground such as old pits, brick yards, etc. The design of the proposed development has been considered to maintain the integrity of the surrounding structures and infrastructure in both the temporary and permanent condition through the use of steel sheet piling and reinforcement concrete retaining walls.

A Desktop Ground Movement Assessment (GMA) has been undertaken utilising the preliminary ground model for the Site developed within the Geotechnical and Geo-environmental Desk Study (ORL-INF-XX-XX-RP-PL-260). This assessment considers ground movements associated with deflection of the temporary embedded sheet pile wall, short term unloading following demolition and excavation works and vertical loading resulting from construction of the new building. The Desktop GMA concluded that movements that may arise from the demolition of existing building and excavation to proposed basement level within the scope of the Proposed Development are not anticipated to adversely affect impact the neighbouring structures, with damage categories falling within the 'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. The Desktop GMA was submitted to the London Borough of Camden on 9 March 2021 and revised in April 2021.

The Desktop GMA will be revised upon completion of the Phase 2 Ground Investigation, enabling a less conservative analysis of building movements to be undertaken, which will be secured through an appropriately worded planning condition or through the S106 agreement. This BIA will be updated in- line with the findings of the revised GMA.

The Flood Risk Assessment and Drainage Strategy has considered surface water flooding from fluvial sources, surface water (pluvial), sewers, ground water and artificial sources for the site and a strategy developed to mitigate these risks. On site

attenuation is proposed to reduce the existing 100 year event discharge rate by 85%, with an appropriate climate change allowance. St. Pancras Way has been identified as a source for localised flooding. The Proposed Development shall be designed so that finished floor levels sit higher than St. Pancras way, with external landscaping to fall away from the building and linear drainage features located at entrances.

1 Introduction

1.1 Overview

1.1.1 AECOM has been commissioned by Moorfields Eye Hospital NHS Trust, on behalf of Oriel[1], to prepare a Basement Impact Assessment (BIA) which has the potential to be affected by the construction of a new facility that would allow the existing Moorfields Eye Hospital at City Road (Moorfields at City Road) and University College London (UCL) Institute of Ophthalmology (IoO) on Bath Street to relocate from the existing sites into a single building at the existing St. Pancras Hospital site (hereafter referred to as the 'Proposed Development').

1.1.2 This report provides an assessment of the likely impact of the new basement construction for the Proposed Development at part of the existing St. Pancras Hospital site within the London Borough of Camden (LBC) (hereafter referred to as the 'Site').

1.1.3 The Proposed Development comprises a single building, between seven and ten storeys in height (including Ground Level and Lower Ground Level, as well as plant at Roof Level), as well as provision of public realm at ground level, blue badge parking, and vehicular drop off points along St Pancras Way. The building is arranged around a central atrium and connection space. There is also a roof terrace on the Sixth Floor Level on the south-western corners of the building.

1.1.4 The Proposed Development will comprise a mix of uses including clinical, research and education purposes, including accident and emergency (A&E) department, outpatients, operating theatres, research areas, education space, café and retail areas, facilities management, office space and plant space.

1.1.5 The methodology adopted to carry out the BIA follows the approach detailed in the Camden Planning Guidance for Basements 2018 (Ref. 1)and online guidance on the LBC website (Ref. 2 and Ref. 3). This report describes the basement construction methodology, the proposed demolition of existing buildings and the impact on the surrounding area directly adjacent to the footprint of the proposed building. The BIA Proforma, as required by LBC, is submitted as a separate document with the planning application.

1.2 Existing Site

1.2.1 The Site is bound by St Pancras Way to the west and Granary Street to the north and comprises the north-western part of the existing St Pancras Hospital. It is occupied by five large existing buildings, several smaller buildings and internal roads. For ease of reference these buildings have been assigned a number which is used throughout this report.

1.2.2 Figure 1-1 below shows the existing site (Buildings 1, 2, 3, 4, 5 and 6 are located within the Site boundary, which is shown in red) with Figure 1-2

[1] Oriel is a joint venture between Moorfields Eye Hospital NHS Foundation Trust, UCL Institute of Ophthalmology and Moorfields Eye Charity

showing an extract from a corresponding topographical survey (the full drawing is also provided in Appendix A). Construction of the Proposed Development will be undertaken entirely within the Site boundary.

1.2.3 The remaining buildings to the south and east of the Site, including buildings A (the North Wing) and B (the Boiler Room), form part of the wider St Pancras Hospital, which is to be redeveloped in the future as part of a separate development scheme by King's Cross Central Limited Partnership ('KCCLP'). The design is at an early stage, however, it is understood that KCCLP intend to submit a planning application for the remaining part of the St Pancras Hospital site in 2021. It is currently envisaged that the development will retain the existing Chapel, Gatehouse and Workhouse buildings. The buildings to the east of the Site would be demolished and replaced by new buildings.

Figure 1-1 Existing site layout

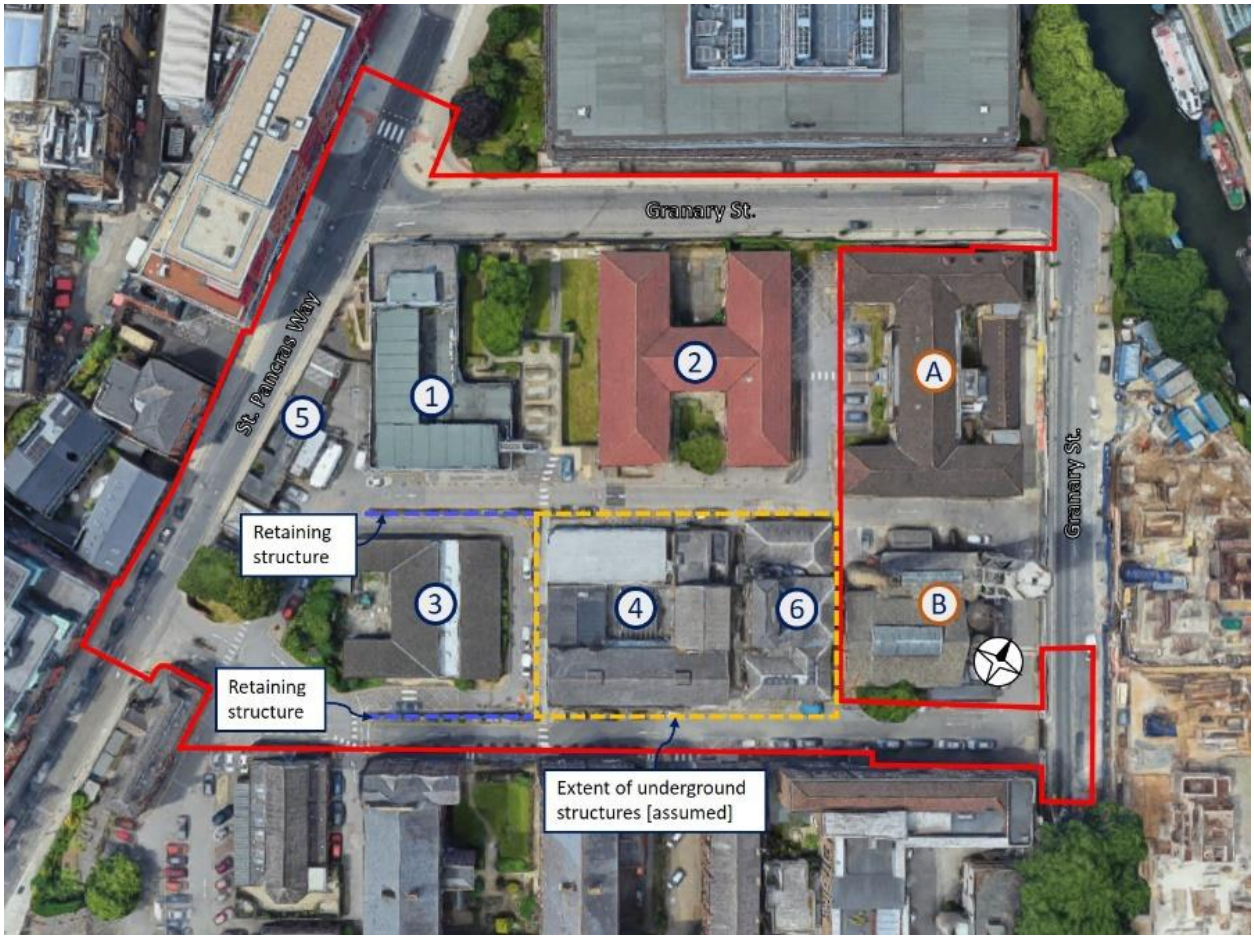
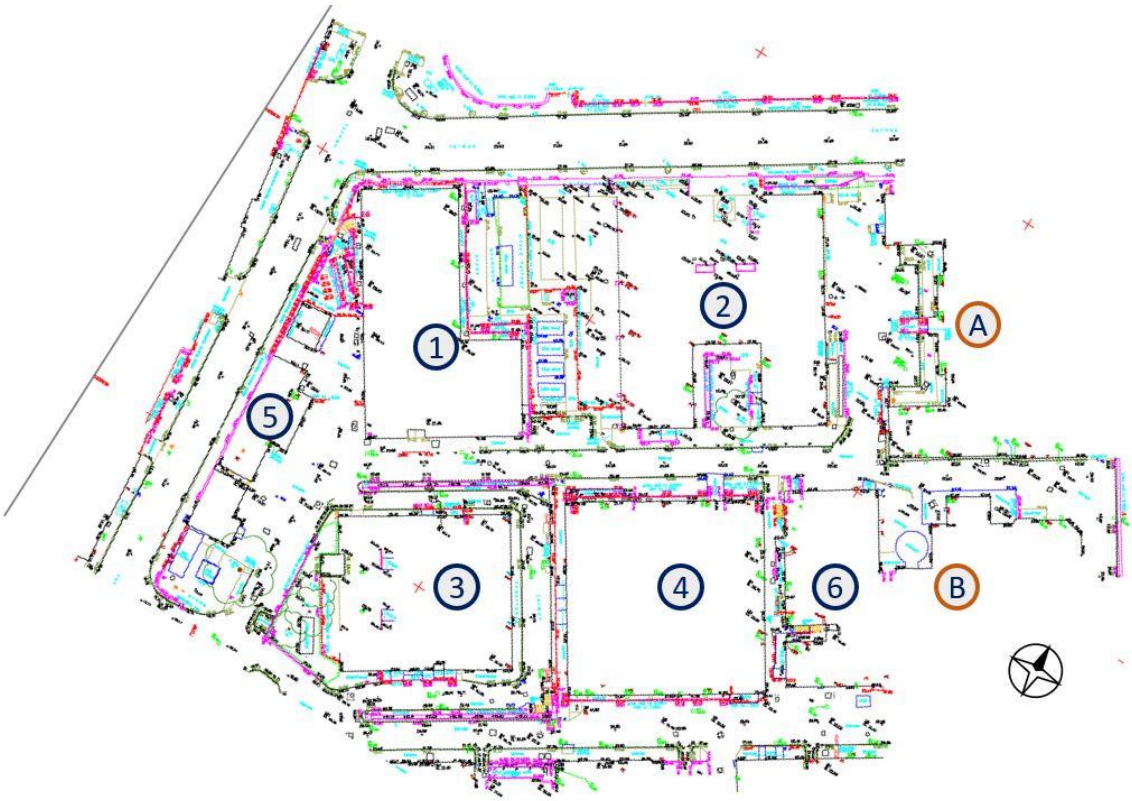


Figure 1-2 St. Pancras Topographical Survey [Extract]



2 Geotechnical Considerations

2.1 Overview

2.1.1 A Phase 1 Geotechnical and Geo-environmental Desk Study has been undertaken for the Site (centered at National Grid Reference TQ 29689 83612) and is submitted with the planning application. The Phase 1 Geotechnical and Geo-environmental Desk Study report (also referred to as the Phase 1 Desk Study report) evaluates the risks associated with the ground conditions at the Site and the key information is summarised in this section.

2.1.2 A Desktop GMA has been prepared utilising the preliminary ground model developed within the Phase 1 Geotechnical and Geo-environmental Desk Study report. This assessment considers movement of the ground due to demolition, excavation and construction works and determines the anticipated impact on adjacent building structures.

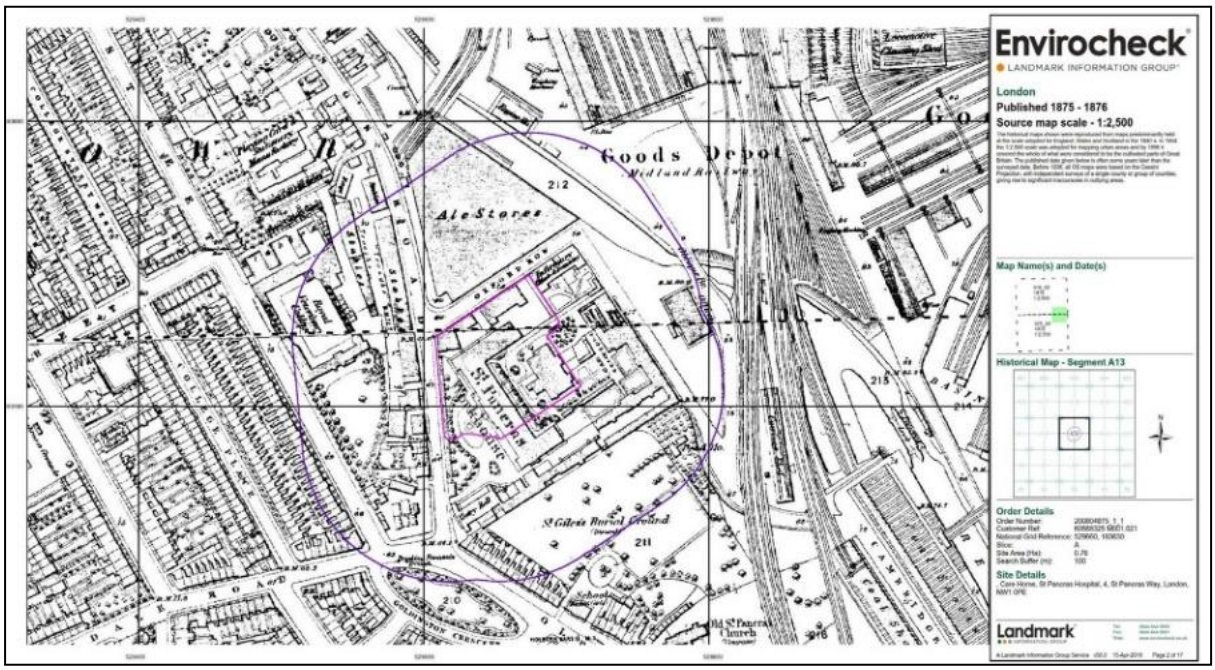
2.1.3 An intrusive ground investigation will be undertaken during the RIBA Stage 4 detailed design stage. The proposed scope of this investigation includes well installations, soil and ground water sampling and groundwater monitoring. An interpretive report will be prepared, setting out the results of the investigation including laboratory testing data and recommendations for remediation if appropriate. The Desktop GMA will be revised upon completion of the Phase 2 Geotechnical Investigation and the BIA updated in line with the findings.

2.2 Site History

2.2.1 The historical Ordnance Survey (OS) maps of the Site which have been reviewed date between 1851 and 2019. Key historical developments on and around the Site are listed below:

- The historical maps indicate that the Site was originally part of the St. Pancras Workhouse (see Figure 2-1 which dates from 1875-1876).
- Minor alterations to building layout arise from 1895 through to 1920.
- The 1953 map shows changes to the Site following bomb damage during World War Two. The Site is also named as St. Pancras Hospital.
- Minor modifications continue from 1953, with construction of tennis courts, new hospital buildings and an electricity substation.
- From 1987, no significant changes to the Site occur through to present day, except for a few building alterations in 1999.

Figure 2-1 St. Pancras Hospital historical map[2]



2.3 Geology

2.3.1 Published records of the geology show that the Site comprises the London Clay Formation to a depth of 30m, underlain by the Harwich Formation (when present), Lambeth Group, Thanet Formation and then the White Chalk Subgroup.

2.3.2 Figure 2-2 presents a geological map of the area and the location of archived boreholes from the Phase 1 Desk Study report that have been used to develop a Site ground model. The ground model (Figure 2-3) is indicatively represented based on available stratigraphical information and logs from three of the archived boreholes.

[2] Reproduced from the EnviroCheck Report included in the Phase 1 Geotechnical and Geo-environmental Desk Study report

Figure 2-2 Geological map

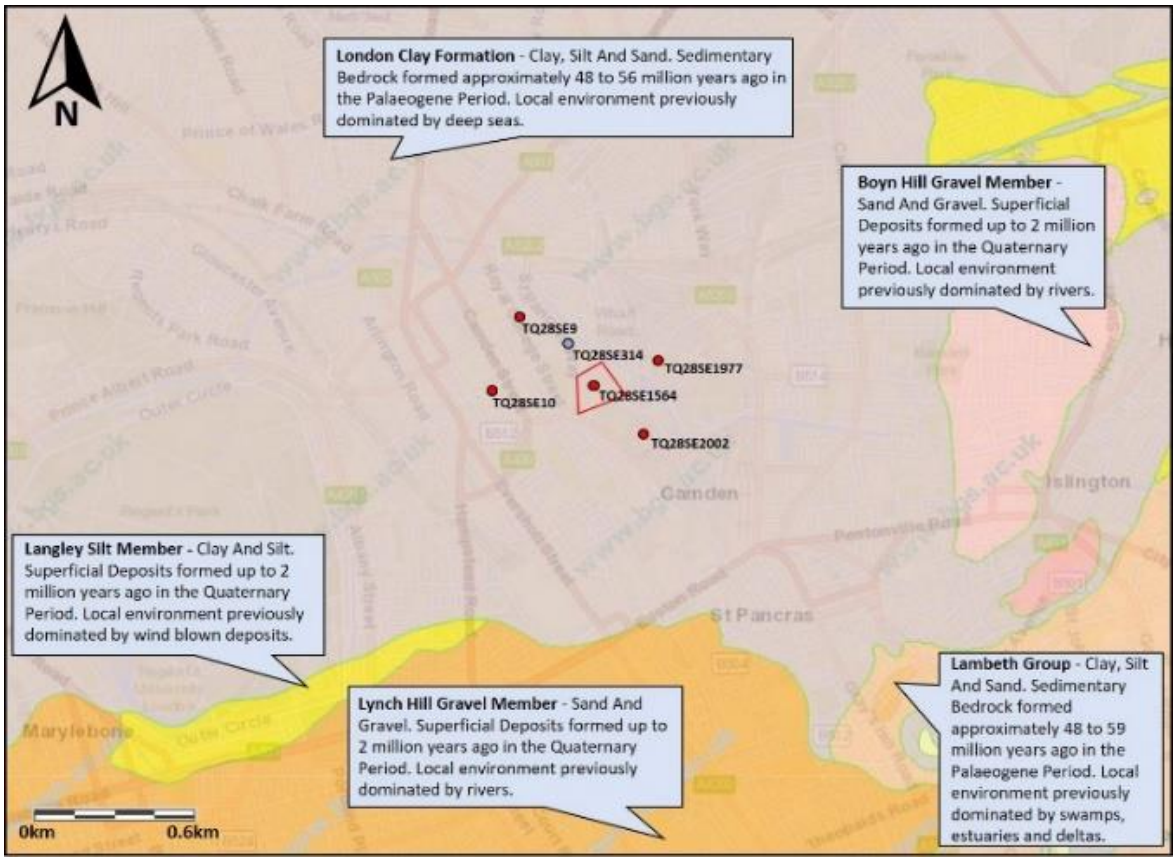
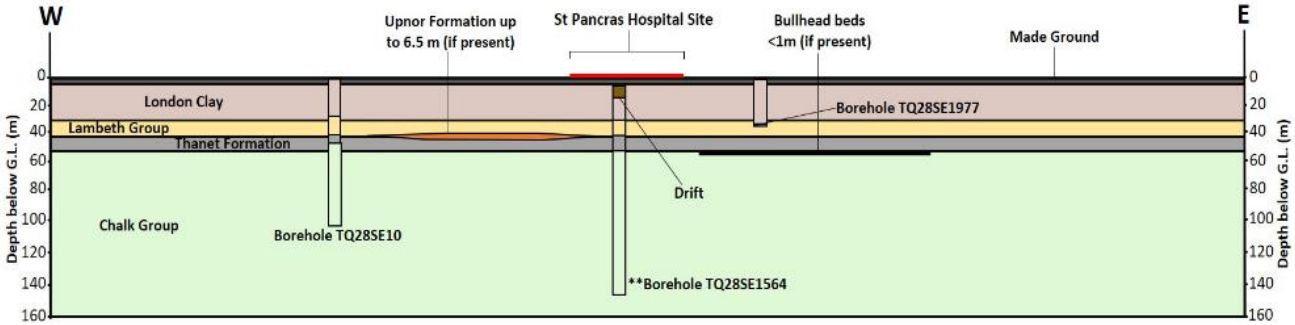


Figure 2-3 Site ground model



*This cross section is only a schematic diagram, and therefore, the geology represented here is not indicative of the exact geology in the region. Borehole data has been overlain to show how the ground conditions may change from place to place. The closest deep boreholes to the E-W cross-section passing through borehole TQ28SE1564 were selected.

** The borehole TQ28SE1564 was created for a pumping station, and therefore, the log was not taken from ground level. There is no evidence provided to suggest the exact depth below ground level where the borehole log was started. Therefore, the borehole shown is only in an approximate location relative to the ground level.

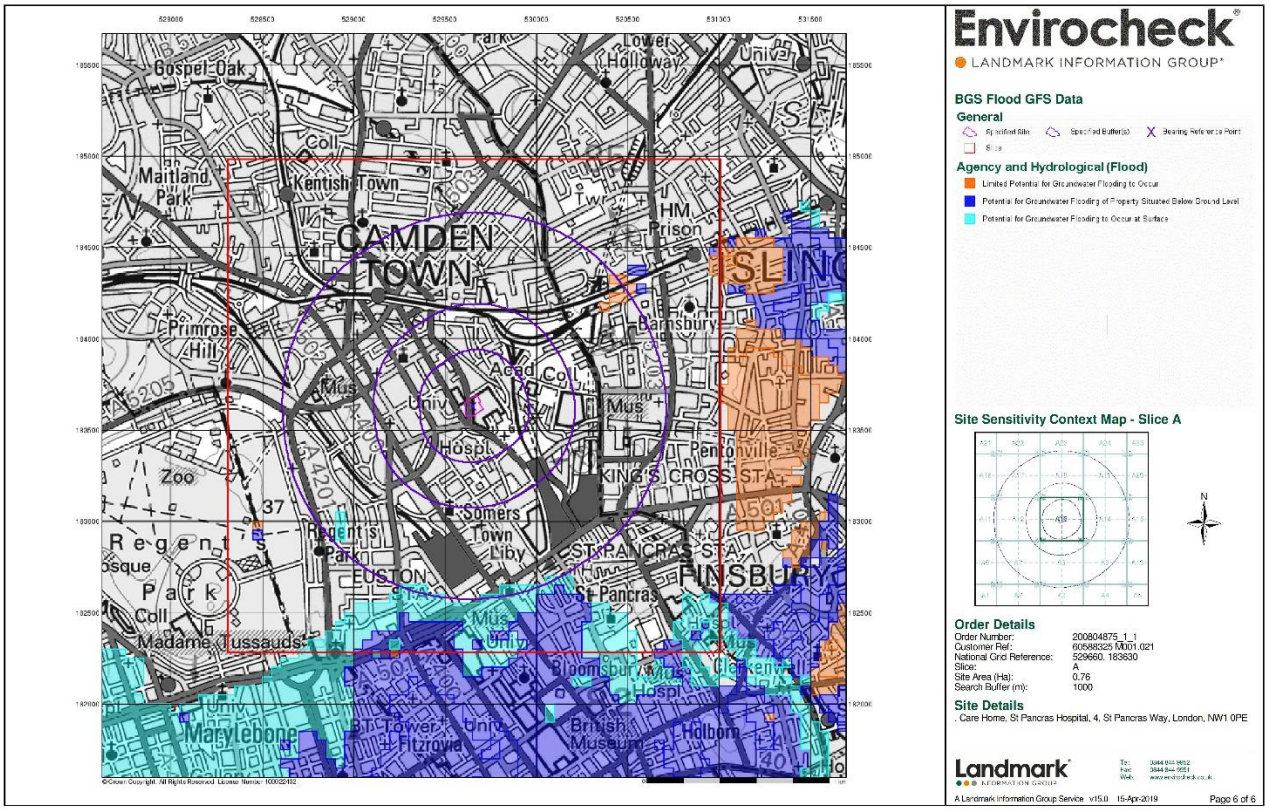
2.4 Hydrogeology

2.4.1 The London Clay Formation is classified as an Unproductive Strata. The presence of a significant thickness of London Clay beneath the Site means that groundwater resources present in the deeper Principal Aquifer are perceived to be at no risk from activities carried out on the Site. The Hydrogeological Map of England and Wales published by the British

Geological Survey (BGS) indicates that the groundwater level at the Site is 60m below ground level.

2.4.2 The variable layer of Made Ground overlaying the London Clay formation can be expected to contain localized perched water, however this would not be considered a secondary aquifer. The flood risk map (Figure 2-4) extracted from the Geotechnical and Geo-environmental Desk Study does not identify the Site to be as risk from surface flooding caused by ground water.

Figure 2-4 St. Pancras Hospital ground water flood risk map (reproduced from EnviroCheck Report)



2.5 Hydrology

2.5.1 The nearest watercourse to the Site is the Regent's Canal, an arm of the Grand Union Canal, which is located at the end of Granary Street, approximately 10m from the site boundary and 95m from the Proposed Development boundary. Regent's Canal is a manmade structure that is maintained by the Canal and River Trust.

2.5.2 The Regent's Canal is not classified as a Main River by the Environment Agency (Figure 3-4). The nearest Environment Agency Main River is the River Thames, located approximately 3 km to the south-south east of the Site.

2.5.3 The Environment Agency Flood Map indicates that Regent's Canal has a risk of flooding of less than 0.1% (or 1 in 1000 year) probability each year.

2.6 Unexploded Ordnance

2.6.1 The potential risk from Unexploded Ordnance (UXO) should be considered as the piled foundations and basements are designed to be deeper than previous construction on the Site.

2.6.2 A detailed UXO Risk Assessment has been carried out by SafeLane Global. The current risk for UXO to be present on the Site is considered a medium risk. This is typical for the central London area.

2.6.3 Risk mitigation measures recommended in the risk assessment include:

- UXO awareness briefings for all groundworkers;
- Provision of unexploded ordnance site safety instructions;
- Explosive Ordnance Disposal (EOD) Engineer to be present on site during shallow intrusive works;
- Intrusive magnetometer survey of all borehole and pile locations.

2.6.4 These standard procedures will be implemented prior to intrusive investigation work and prior to piling to mitigate the risk from UXO at a minimal cost relative to the total cost of the project. The recommended mitigations were intrusive magnetometer clearance of all borehole and pile locations.

2.7 Adjacent and Below Ground Infrastructure

2.7.1 To investigate the potential of discovering an underground network of tunnels beneath the Site, an extensive enquiry into existing underground tunnel services has been conducted. As illustrated in Table 1, this included searches of published mapping and literature, and the submission of information requests to infrastructure operating companies. No records of tunnel infrastructure operated by third parties beneath the Site have been identified, though shallow buried utilities are known to be present.

Table 1 Adjacent and below ground infrastructure

Source	Outcome
Network Rail - Asset Enquiry	HS1 have no assets on the site. No foreseeable issues unless tower crane erected with collapse radius within 4m of HS1 railway (90m from the Site). There are no other above ground Network Rail Assets on site.
Network Rail - Buried Services Search	No Network Rail assets on the Site.
London Overground - Asset Enquiry	No Rail for London/London Overground assets within close proximity to the Site.
London Underground/DLR - Asset Enquiry	No London Underground/DLR assets within 50m of the Site.
Mail Rail Map	No Royal Mail tunnels anticipated under the Site.
London Sewer Map	No sewers pass under the Site.
London Underground Map	No London Underground tunnels anticipated at the Site.
The Lost Rivers of London (Nicholas Barton)	No historical rivers/sewers pass under the Site.
Previous Utilities Survey	No Network Rail buried services on the Site. No Thames Water & Sewer pipelines on the Site. Potential Vodafone services under the western area of the Site. There are local site services that will either be removed or diverted as part of the works.

3 Screening

3.1 Screening Assessment

3.1.1 The Camden Planning Guidance: Basements requires that any development that includes a basement should be screened to determine whether a BIA is required.

3.1.2 LBC's Planning Guidance Document contains a series of Screening Flowcharts with questions which address three categories: Groundwater flow, Land stability and Surface flow and flooding.

3.1.3 Responses to these questions are presented in Tables 3.1 – 3.3 below.

Groundwater Screening Assessment

Table 2 Screening Assessment for Groundwater Flow

Question	Response for Site
1a. Is the site located directly above an aquifer?	No. The basement of the Proposed Development will be excavated in Made Ground and London Clay. Neither of these strata are recognised as primary or secondary aquifers. The London Clay is an impermeable strata with negligible groundwater flow (classified as Unproductive Strata) and the Made Ground is a highly variable material which may contain localised pockets of perched groundwater but is not a significant groundwater bearing layer. It is also noted that the Site is not considered to be at risk from groundwater flooding. On this basis, it is considered that the Proposed Development is not expected to significantly impact the local groundwater regime and therefore no mitigation measures are required.
1b. Will the proposed basement extend beneath the water table surface?	No. The London Clay Formation is classified as an Unproductive Strata. The presence of a significant thickness of London Clay beneath the Site means that groundwater resources present in the deeper Principal Aquifer are perceived to be at no risk from activities carried out on the Site. The Hydrogeological Map of England and Wales published by the British Geological Survey (BGS) indicates that the groundwater level at the Site is 60m below ground level.
2. Is the site within 100m of a watercourse, well (used/ disused) or potential spring line?	Yes. The Regent's Canal is situated approximately 10m from the Site boundary. No other known spring or well was identified within 100m of the Site. Historical mapping of the Lost River Fleet indicates it once passed within the vicinity of the Site, however it is now deemed to be fully culverted and integrated into the sewer network which do not pass directly beneath the Site.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	Not applicable

Question	Response for Site
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No
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 ground conditions preclude the use of any infiltration devices and therefore surface water will not be discharged to ground in line with the current regime of drainage.
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 or spring line?	No

3.1.4 The above assessment has not identified any potential issues regarding groundwater in relation to the Proposed Development.

Stability Screening Assessment

Table 3 Screening Assessment for Land Stability

Question	Response for Site
1. Does the existing site include slopes, natural or manmade, greater than 7°?	No
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	No
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	No
5. Is the London Clay Formation the shallowest strata at the site?	Yes, although there is a variable depth of made ground across the Site
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?	Yes – refer to the Tree Constraints Plan and the Tree Protection Plan provided within the Tree Survey and the Arboriculture Impact Assessment which are submitted with the planning application.
7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site?	No subsidence events at the Site are known of at the time of preparing this report.

Question	Response for Site
8. Is the site within 100m of a watercourse or potential spring line?	Yes. The Regent's Canal is situated approximately 10m from the Site boundary. No other known spring or well was identified within 100m of the Site. Historical mapping of the Lost River Fleet indicates it once passed within the vicinity of the Site, however it is now deemed to be fully culverted and integrated into the sewer network which do not pass directly beneath the Site.
9. Is the site within an area of previously worked ground?	No – there is a history of building development on the site since at least the 1850's but no historic evidence of old pits, brick yards etc.
10. Is the site within an aquifer?	No. The basement of the Proposed Development will be excavated in Made Ground and London Clay. Neither of these strata are recognised as primary or secondary aquifers. The London Clay is an impermeable strata with negligible groundwater flow (classified as Unproductive Strata) and the Made Ground is a highly variable material which may contain localised pockets of perched groundwater but is not a significant groundwater bearing layer. The Hydrogeological Map of England and Wales published by the British Geological Survey (BGS) indicates that the groundwater level at the Site is 60m below ground level. It is also noted that the Site is not considered to be at risk from groundwater flooding. On this basis, it is considered that the Proposed Development is not expected to significantly impact the local groundwater regime and therefore no mitigation measures are required.
11. Is the site within 50m of Hampstead Heath ponds?	No
12. Is the site within 5m of a highway or pedestrian right of way?	Yes – the Site is bordered by Granary Street to the North, St Pancras Way to the west and existing site access roads/paths to the east and south.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes – the basement depths within neighbouring properties are not known at the time of writing but appear to be no deeper than the at grade level on the western side of the Site. Parts of the new basement will be deeper than this. Therefore, it is assumed that the proposed basement foundation will be deeper than those of the existing neighbouring properties.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No. An enquiry into existing underground tunnel services showed no record of tunnel infrastructure operated by third parties beneath the Site.

3.1.5 The above screening assessment has identified the following potential issues regarding Land Stability in relation to the Proposed Development.

Q5 The London Clay is the shallowest stratum at the site (although there is a variable depth of made ground across the site)

Q6 Trees will be felled as part of the Proposed Development.

Q12 The site is within 5m of both highways (Granary Street and St Pancras Way) and pedestrian rights of way.

Q13 The basement of the proposed development is assumed to be deeper than the existing neighbouring properties.

Surface Flow and Flooding Screening Assessment

Table 4 Screening assessment For Surface Water Flow

Question	Response for Site
1. Is the site within the catchment of the pond chains on Hampstead Heath?	N/A
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. All water will be discharged to the combined drains in a similar way to the existing regime. However, the proposed system will include flow controls and large attenuation volumes which will significantly (85% min) reduce the peak runoff rates for all storms up to the 100 year event plus 40% CC) and therefore provide significant betterment to the capacity of downstream systems.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No
4. Will the proposed basement development 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 surface water from the Proposed Development will be attenuated with flow restricted by 85% to limit the instantaneous surface water flows. The long-term inflows will remain unchanged.
5. Will the proposed basement result in changes to the quantity of surface water being received by adjacent properties or downstream watercourses?	No. All water will be discharged to the combined drains in a similar way to the existing regime. However, the proposed system will include flow controls and large attenuation volumes which will significantly (85% min) reduce the peak runoff rates for all storms up to the 100 year event plus 40% CC) and therefore provide significant betterment to the capacity of downstream systems.
6. Is the site in an area known to be at risk from surface water flooding, or is it at risk of flooding because the proposed basement is below the static water level of a nearby surface water feature?	Yes – the Proposed Development is potentially at risk from local surface water flooding as the Site borders the King's Cross local Flood Risk Zone.

3.1.6 The above screening assessment has identified the following potential issues regarding Surface Water Flows in relation to the proposed development.

Q4 The proposed development will change the profile of instantaneous inflows being received.

Q6 The site borders an area known to be at risk from local surface water flooding.

4 Scoping

4.1 Potential Impacts

4.1.1 The purpose of scoping is to assess in more detail the factors to be investigated in the BIA. Potential consequences are assessed for each of the identified potential impacts.

4.1.2 The following potential impacts summarised in Table 5 have been identified from the land stability and surface water flow screening.

Table 5 Summary of Potential Impacts

Question	Comment
The London Clay is the shallowest stratum at the site (although there is a variable depth of made ground across the site)	The London Clay Formation is prone to seasonal shrink-swell (subsidence and heave). It is also prone to movement from unloading and reloading during the construction of basements.
Trees will be felled as part of the proposed development.	Trees may be subject to Tree Protection orders and will require consent to be felled/replaced.
The Site is within 100m of a watercourse (The Regent's Canal).	The close proximity of a watercourse can be a source of fluvial flooding.
The site is within 5m of both highways (Granary Street and St Pancras Way) and pedestrian rights of way.	Excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.
The basement of the proposed development is assumed to be deeper than the existing neighbouring properties.	Excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.
The proposed development will change the profile of instantaneous inflows being received.	Changing the profile of inflows may result in flooding to neighbouring properties and overloading of the sewer network.
The site borders an area known to be at risk from local surface water flooding.	Potential for flooding of the proposed development and adjacent properties during local flood events.

4.2 Impact Mitigation

4.2.1 The screening exercise has identified a number of potential impacts, the scope of which are identified in Table 5 above. A desk-based study and the limited site investigation information so far available has been used below to further review the potential impacts, assess the likelihood of them occurring and the scope for engineering mitigation. This is summarised in Table 6 below.

Table 6 Summary of Potential Impacts and Mitigation

Question	Mitigation for Site
The London Clay is the shallowest stratum at the site (although there is a variable depth of made ground across the site)	The foundations for the basement will be piled and heave protection (collapsible void former) will be provided to protect the basement slab and foundations. Temporary sheet piled retaining walls or open excavation are proposed to be utilised during the basement construction to ensure stability of adjacent structures and infrastructure. A Desktop GMA has been prepared to assess ground movements associated with deflection of the temporary retaining wall, release of overburden pressure during demolition and excavation and vertical loading from construction of the new building. The Desktop GMA concluded that the Proposed Development is not anticipated to adversely affect impact the neighbouring structures, with damage categories falling within the 'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. Final design of the temporary retaining walls shall be undertaken considering the requirements of the GMA as part of the next design phase and the Basement Construction Plan. The Desktop GMA will be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement. The presence of the London Clay Formation as the shallowest stratum on Site is not considered to represent a risk in terms of land stability.

Table 6 Summary of Potential Impacts and Mitigation

Question	Mitigation for Site
Trees will be felled as part of the proposed development.	An Arboricultural Impact Assessment has been prepared by a suitably qualified arboriculturist and is provided as part of the planning application. Trees shall be removed concurrently with demolition of the buildings and will be sequenced to maintain ground/building stability. Retained buildings adjacent to the Site within close proximity to the removed trees are anticipated to utilise deep piled foundations. These deep foundations are unlikely to be affected by the removal of trees. A final impact assessment of the tree removal on adjacent buildings should be carried out as part of the detailed design phase following completion of the Phase 2 Geotechnical Investigation, tree removal and demolition methodology. This should be incorporated as part of the Basement Construction Plan.
The site is within 100m of a watercourse (The Regent's Canal).	The Environment Agency Flood Map indicates that Regent's Canal has a low risk of flooding of less than 0.1% (or 1 in 1000 year) probability each year. In addition, the canal will be maintained in perpetuity by the Canal and River Trust and therefore is unlikely to suffer catastrophic failure of its banks that could lead to flooding of the Site. Due to this, no mitigation measures are proposed for the Regent's Canal.

Table 6 Summary of Potential Impacts and Mitigation

Question	Mitigation for Site
The site is within 5m of both highways (Granary Street and St Pancras Way) and pedestrian rights of way.	Temporary works (sheet piling) and hoarding will be installed. Services that may be affected by the Proposed Development basement construction will either be protected, diverted or abandoned and removed. The Desktop GMA assessed ground movements associated with deflection of the temporary retaining wall and enabled the development of outline trigger levels that could form part of a monitoring strategy to ensure the stability of adjacent infrastructure. The Desktop GMA shall be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement. This will enable final trigger levels and monitoring requirements to be developed as part of the Stage 4 design. Therefore, the proximity of the public footpath is considered to represent a manageable risk to the adjoining road, pathway and entrenched underground services. This risk would be managed by the Principal Contractor via the Construction Management Plan to provide safe routes for traffic and pedestrians around the perimeter of the site. An Outline Construction Management Plan (CMP) is submitted with the planning application, and will be updated by the Principal Contractor, once appointed, secured through an appropriately worded planning condition or Section 106 obligation.

Table 6 Summary of Potential Impacts and Mitigation

Question	Mitigation for Site
The basement of the proposed development is assumed to be deeper than the existing neighbouring properties.	The neighbouring properties are in most cases situated some distance from the Proposed Development (at a greater distance than a 45-degree slope between the bottom of the new basement and any existing foundations). Where there is sufficient space to adjacent structures open cut excavation will be used. However, where there is insufficient space, the construction of a propped sheet piled temporary works retaining wall followed by a permanent reinforced concrete retaining wall is proposed. A Desktop GMA has been prepared to assess ground movements associated with deflection of the temporary retaining wall, release of overburden pressure during demolition and excavation and vertical loading from construction of the new building. The Desktop GMA concluded that the Proposed Development is not anticipated to adversely affect impact the neighbouring structures, with damage categories falling within the 'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. (Refer to the Desktop GMA report submitted to LBC in April 2021 for further information). The Desktop GMA will be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement. .
The proposed development will change the profile of instantaneous inflows being received.	Attenuation will be provided to restrict the surface water run-off rate by 85% by using SuDS which represents a betterment of the existing situation.
The site borders an area known to be at risk from local surface water flooding.	A Flood Risk Assessment for the site has been prepared and is submitted as part of the planning application. The Local Flood Risk Zone will be addressed in this assessment and the results applied to the BIA.

4.2.2 Initial details of the proposed extent of demolition, indicative details of the Proposed Development basement, an indicative Construction Sequence Methodology (CSM) and a summary of the proposed operational drainage strategy are provided in the following sections of this report. Further details are provided in the Outline CMP which is submitted with the planning application.

5 Demolition

5.1 Overview

5.1.1 The footprint of the proposed building is located over the current location of buildings 1-5. It is intended to demolish all buildings within the Site, including excavation of the basement and removal of excavated foundations. Building 6 will also need to be demolished to allow for adequate excavation and complete removal of the existing underground structure (see Figure 1-1). The buildings vary in age, with some dating back to the Victoria era and several examples of mid to late 20th Century framed buildings. Each building type is described in Section 5.4 below and further investigation will be undertaken post-planning to identify the type of construction.

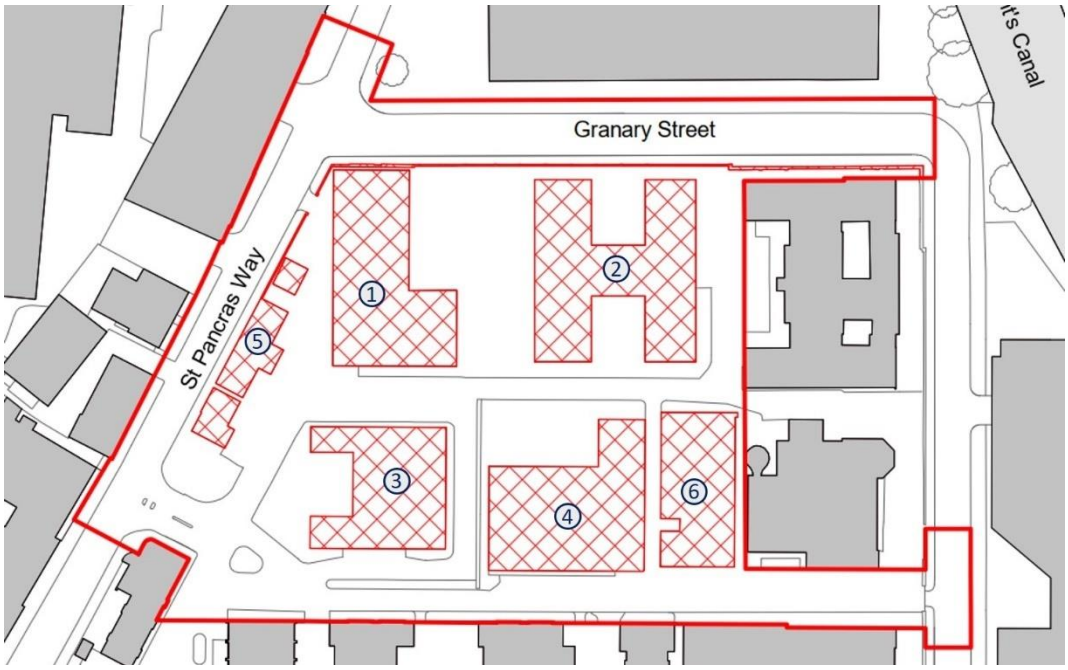
5.1.2 The former Workhouse buildings to the south of the Proposed Development are locally listed and fall outside the Site. It is understood that these buildings will be retained as part of a future separate development. Consideration has been given to these buildings in this report since they may have an impact on the retention of any associated services distribution that overlap within the Site boundary.

5.1.3 Granary Street, to the north of the Proposed Development, will require the roadway, pavement and associated below ground services to be protected and retained whilst the demolition and excavation works are progressed. There is an extensive concrete retaining wall along part of the Site boundary that will eventually need to be removed in accordance to an agreed methodology, possibly after the bulk of the demolition has occurred. Detailed consideration will be given to the sequencing of works in this area given the Site's proximity to St Pancras Way.

5.1.4 The internal road running east-west centrally through the Site is also within the proposed building footprint and will be removed. The internal road along the southern boundary of the Site may be required for site access and therefore it is intended to protect it and will to be operational during demolition works.

5.1.5 The extent of the anticipated building demolition is shown in Figure 5-1, shown by red hatching. The surrounding buildings that are not scheduled for demolition (buildings A, B and the workhouse buildings located to the south of the Proposed Development) will be monitored for movement and vibration during the demolition works, with appropriate trigger levels for limiting accelerations. A monitoring regime will be developed in stage 4 to reflect the final design and contractor's method and sequence of demolition and construction.

Figure 5-1 Anticipated extent of building demolition



5.2 Sustainability

5.2.1 Sustainability is a key component of the demolition works and is aligned with the approach to promote a circular economy that improves resource efficiency and innovation to keep products and materials at their 'highest use' for as long as possible. Where practicable, any brickwork, tiles, and other materials will be removed from the building in such a way to facilitate such materials being re-used as reclaimed materials. Where this is not possible, any clean concrete, brick and other suitable material should be crushed on site and retained as far as practicable, for example used as granular material, a piling mat, a sub-base to the lower ground slab or a sub-base to hard landscaping areas. Further details relating to re-use of materials are detailed in the Circular Economy Statement which is submitted within the planning application.

5.3 Below ground services and ducts

5.3.1 Any below ground services will be identified and capped off prior to removal. Some infrastructure that supplies buildings outside the Site boundary may require reinstatement or diverting prior to demolition. Where required, live foul and surface water drains shall be left clean and in working order at completion of the demolition works.

5.3.2 Any underground services ducts and trenches will be removed once any contamination, such as asbestos containing materials, has been cleared. Whilst the network of underground service ducts and trenches is not currently fully mapped due to restrictions in gaining access (partly due to the limited size of the openings and partly due to the contamination risk), the entire network within the footprint of the basement and the overall excavation (both at the shallower western side and the eastern side where

there is a full basement) will be removed as it falls within the zone of excavation for the foundations of the proposed building.

5.4 Existing structures

Foundations

5.4.1 The foundations of the Victorian buildings are likely to be modest early-use concrete footings or strip foundations underneath the walls. The foundations of the mid to late 20th Century framed buildings are likely to be either pad foundations or piles. It is likely that a concrete ground beam is present around the perimeter of the modern buildings to support the brickwork outer cladding.

5.4.2 If footings or other pad foundations are encountered, they will be removed fully to allow the installation of the new foundations and services. If pile foundations are encountered, then the pile caps will be broken down to the top of the pile. The size, location and top of pile levels will be recorded in detail to allow for the design of the new foundations and services to avoid the existing piles.

Building 1 – lightweight modular construction

5.4.3 Building 1, the Bloomsbury Day Centre (see Figure 5.2), located in the north-west of the Site looks to be formed from prefabricated modules stacked two storeys high. Around the base of the building is a brickwork wall up to the underside of the ground floor windows. To the east and west of the building are masonry retaining walls around the ramps and walkways. Foundations are likely to be pad foundations, however, if the clay layer is too deep or too weak then piles may have been used.

5.4.4 Demolition will occur by unbolting and lifting the modules out one by one down to the foundations. The modules may be able to be reused or sold on, depending on their condition. Any ground floor slab or ground beams will be broken out with a digger.

Figure 5.2 Building 1

Building 2 – Brick clad modern frame

5.4.5 Building 2, Ash House (see Figure 5-3), is a two-storey masonry clad building most likely to consist of a steel frame with concrete floors or in-situ concrete construction, however the construction type is to be confirmed.

5.4.6 Further survey work will be conducted to determine the structural type and foundation system to inform the method of demolition.

Figure 5-3 Building 2

Building 3 – Single storey brick clad

5.4.7 Building 3, the Jules Thorn Day Centre (see Figure 5-4), is a single-storey masonry walled building with timber upper cladding. The full construction type is unknown; however, it is likely to be timber roof joists supported off

the masonry outer walls. Further survey work will be conducted on the building to determine the structural type and foundation system to inform the method of demolition.

Figure 5-4 Building 3

Building 4 – Victorian masonry with basement

5.4.8 Building 4, which comprises the Camley Centre and the Estates and Facilities department (see Figure 5-5), is a brick built Victorian building split between single-storey above ground and lower ground floor/basement with masonry retaining walls around three edges. It has timber and wrought iron roofs and a single-storey lightweight modern extension to north of the building. This building will be demolished by firstly removing the roof then collapsing the masonry walls inwards via a demolition digger. Masonry rubble will then be removed along with internal foundations. The perimeter retaining walls will be broken down last while maintaining the stability of retained soil to the outside.

Figure 5-5 Building 4

Building 5 – Single storey garages and workshops

5.4.9 Building 5, which includes the Post Room and Former Mortuary (see Figure 5-6), comprises a single-storey masonry walled garage and workshops adjacent to St. Pancras Way. The building is likely supported off concrete raft foundations or ground beams. This building will be demolished by firstly removing the roof then collapsing the masonry walls inwards via a demolition digger. Masonry rubble will then be removed along with the internal foundations.

Figure 5-6 Building 5

Building 6 – Kitchen Block

5.4.10 Building 6, the Kitchen Block (see Figure 5-7), is a masonry building split between single, two and three storey sections above ground and a lower ground floor/basement with retaining walls around three edges. It has timber and wrought iron roofs. This building will be demolished by firstly removing the roof then collapsing the masonry walls inwards via a demolition digger. Masonry rubble will then be removed along with internal foundations

5.4.11 Further survey work will be conducted to determine the structural type of the retaining walls and foundation system to inform the method of demolition of this building.

Figure 5-7 Building 6

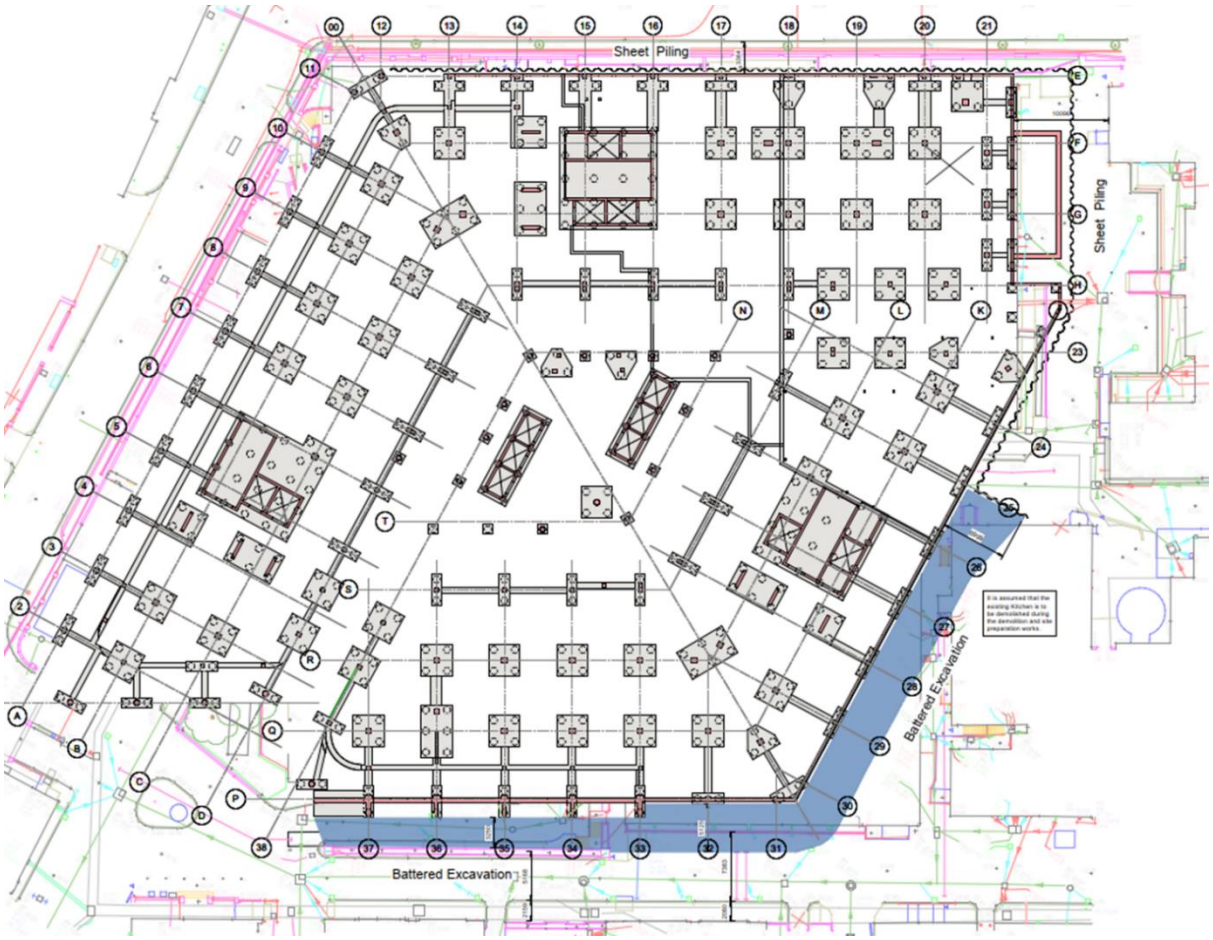
6 Proposed Basement Construction

6.1 Overview

6.1.1 The construction of the basement is proposed to utilise a combination of open excavation and steel sheet piled walls to provide temporary stability where there is limited available space adjacent to the building's footprint. Figure 6-1 shows the location and extent of excavation and sheet piling (with further details provided in Appendix A). During the permanent condition all open excavation will be infilled, and reinforced concrete retaining walls will be constructed to resist lateral earth loads.

6.1.2 The Desktop GMA has analysed the release of overburden pressure due to demolition and excavation works and the potential movement of adjacent foundations. This assessment concluded that the Proposed Development is not anticipated to adversely impact neighboring structures, with damage categories falling within the 'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. The Desktop GMA will be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement.

Figure 6-1 Basement excavation and sheet piling plan [Extract]



6.1.3 The methodology for construction of the basement and associated substructure is proposed to consist of five stages (all levels provided are metres AoD). The final basement construction shall be determined by the Principal Contractor within the Construction Sequence Methodology and set out within the CMP, secured through an appropriately worded planning condition or Section 106 obligation. An Outline CMP is submitted with the planning application.

6.1.4 The below stages are accompanied by illustrative sections of the basement construction methodology provided in Appendix B.

1. Install equipment and prepare monitoring regime of existing buildings.
2. Steel sheet piles are to be installed adjacent to Granary Street (northern elevation) and adjacent to building A (eastern elevation). Final design of the temporary retaining wall shall be undertaken following the Phase 2 Geotechnical Investigation and considering the requirements of the GMA.
3. Excavation to 20.000m AoD and removal of all existing buildings and underground structures within the proposed building footprint. The pile mat is to be installed and all piling undertaken at this level.
4. Excavation to the required levels of the lower ground floor, this is typically 16.450m AoD and 18.450m AoD for the lowered plant area. An earth batter with the crest retained at 20.000m AoD shall be utilised to

provide lateral support for the steel sheet piled wall. Piles are to be cropped to the specified cut off level following this excavation. All substructure and the lower ground floor slab are to be constructed apart from at the location of the earth batter adjacent to the sheet piled walls.

5. After the substructure has reached sufficient strength, raking props (Figure 6-2) will be installed to support the steel sheet piles allowing for removal of the earth batter and construction of the remaining substructure. The reinforcement concrete facing wall will be installed to its partial height below the props. All other reinforced concrete retaining walls are to be constructed in open excavation.
6. The diagonal prop supporting the steel sheet piles will be lowered to the newly constructed reinforced concrete facing wall, allowing the remaining wall and ground floor structure to be cast. Once the ground floor structure can provide adequate restraint to all retaining walls the open excavation will be infilled.

Figure 6-2 Propped sheet piled wall

6.2 Excavation

6.2.1 Open excavation is to be utilised wherever possible during the basement construction. Using preliminary geotechnical information, a stable batter at 45° is anticipated. This must be verified using the results of the Phase 2 Geotechnical Investigation and the final construction methodology shall be determined by the Contractor or temporary works sub-contractor incorporating development through the Stage 4 design. A 1m wide working zone will be required between all proposed structure and the base of the battered sides of the excavation.

6.2.2 Initial excavation to 20.000m AoD is below the anticipated level of all existing building foundations and substructures and will result in an excavated depth of 2.95m (the highest ground level directly adjacent to the building has been identified as 22.950m on topographical information). The

remaining excavation to 18.450m and 16.450m allowing for construction of the substructure and lower ground floor slab will be undertaken after installation of the reinforced concrete piles with all changes in the base level to be accommodated through earth batters.

6.3 Steel sheet piling

6.3.1 Steel sheet piled walls will be required along the north and east elevations of the building, as shown on Figure 6-1. This is due to the proximity of St. Pancras Way and the Mary Rankin dialysis unit, located in the North Wing building (Building A), which would be affected by the use of open excavation along the eastern elevation.

6.3.2 Consultation with sheet piling specialists (Fussey Piling Ltd) has highlighted that a maximum vertical cantilever of 3m must be maintained to ensure deflection of the top of the sheet pile remains within acceptable limits (10-20mm). A proposed initial excavation of 2.95m is within this limit. When excavation extends beyond this depth (as per the dig sequence in 6.1.2) earth batters or raking props will be used to ensure horizontal deflection is reduced to no more this.

6.4 Piling

6.4.1 It is proposed to install the pile mat at 20.000m AoD and undertake all piling work at this level. Maintaining a single level for piling will eliminate the need for multiple piling mats and vertical relocation of the piling rig. Additionally, given the requirement for an earth batter, it will not be possible to install piles directly adjacent to the sheet piled wall at an excavated depth greater than 3m.

6.4.2 All piles will be installed during a single work phase to prevent re-deployment of the piling contractor and equipment and minimise noise and vibration impacts. Any piles required for ground source heat pumps will be installed at this time from the same platform level. These piles will be separate from the structural piles and will be to a depth and diameter to suit the requirements of the ground source heat pump. It is possible that a separate piling rig will be used to install the ground source heat pump piles due to the likely depth required.

6.5 Substructure construction

6.5.1 It is proposed that all pile caps and ground beams will be constructed first, allowing the base slabs to be constructed at the level above. This is anticipated to reduce formwork requirements as the base slabs can be cast directly onto the external insultation/void former.

6.5.2 The substructure will be utilised as a support for raked props restraining the sheet piled wall.

6.6 Basement construction issues and mitigation

6.6.1 Table 7 provides information of the potential issues and proposed mitigation measures associated with the basement construction for the Proposed Development.

Table 7 Issues and mitigation

Potential Issue	Mitigation Measure
Temporary stability of existing structures and roads	Steel sheet piled walls will provide temporary stability to adjacent structures where there is not adequate room for open excavation. This sheet piling shall be designed by the Contractor's temporary works sub-contractor. A Desktop GMA has been carried out and concluded that the Proposed Development is not anticipated to adversely impact the neighbouring structures during the construction process, with damage categories falling within the 'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. The Desktop GMA will be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement. Movement and vibration monitoring of adjacent structures shall be implemented. An indicative monitoring strategy is provided within this report, however this strategy shall be updated in-line with the final building design, construction methodology and results of the Phase 2 Geotechnical Investigation.
Existing underground structures	All existing foundations are to be removed or surveyed (if removal is not possible). The existing basement below buildings 4 and 6 shall be removed as part of the initial excavation works.
Existing underground services	Existing underground services have been identified on the topographical survey. All services shall be re-routed if required as part of the design and preliminary works. Foul and service water runs that will be required by retained structures shall be diverted and maintained through the demolition and basement construction.
Stability of excavations	A stable excavation of 45° has been identified from the geotechnical desktop study. This must be verified following the results of the Phase 2 Ground Investigation. However, further space is available if the geotechnical investigation reveals a shallower slop will be required.
Restraint to retaining walls	The ground floor slab shall be constructed and reach adequate strength to provide restraint before any open excavation is infilled.
Sheet pile deflections	Sheet piling suppliers have indicated a maximum vertical cantilever of 3.0m. This shall be accommodated through an initial excavation of 2.95m with earth batter or raked props to provide support and greater depths.
Ground Movement	A Desktop GMA has been carried out and concluded that the Proposed Development is not anticipated to adversely impact the neighbouring structures, with damage categories falling within the

Potential Issue	Mitigation Measure
	'visual appearance or aesthetic' range of building strains (Damage Category 1 in Burland Scale, "very slight" damage). Some walls were shown to be in the range of "slight" or "moderate", however due to the simplified and conservative approach taken within the movement analysis the damage category is expected to be an over-estimate at this stage. Additional support stiffness for the temporary retaining wall could also be considered for the most significantly affected building. The Desktop GMA will be updated upon completion of the Phase 2 Ground Investigation which will be secured through an appropriately worded planning condition or through the S106 agreement.
Shrink/swell impact due to the addition/removal of trees	Trees will be removed concurrent with the adjacent building demolitions and would be managed to minimise the impact on surrounding buildings or infrastructure. Retained buildings adjacent to the site within close proximity to the removed trees are anticipated to utilise deep piled foundations. These deep foundations are unlikely to be affected by the removal of trees. A final impact assessment of the tree removal on adjacent buildings should be carried out as part of the detailed design phase following completion of the Phase 2 Geotechnical Investigation, tree removal and demolition methodology. This should be incorporated as part of the Basement Construction Plan.

6.7 Indicative monitoring strategy

6.7.1 The following indicative monitoring strategy has been developed based on the Desktop GMA, submitted to LBC on 9 March 2021 and revised in April 2021, and are therefore subject to change following the results of the Phase 2 Geotechnical Investigation and update of the Ground Movement Assessment, the final design of the building after RIBA Stage 4 and the Contractor's preferred construction methodology. Indicative trigger levels have been provided based on the information currently available.

6.7.2 For adjacent structures affected by the proposed building construction, a condition survey should be carried out to identify any existing defects prior to commencement of works. These records will be used as a basis for the current condition of the buildings and identifying any changes that might occur as a result of the Proposed Development. Adjacent structures should be maintained in position to prevent the manifestation of any cracking greater than 1.0mm in width (Burland Scale Category 1 'slight' damage).

6.7.3 The Desktop GMA highlighted the relationship between deflection of the proposed temporary retaining wall and ground movements affecting adjacent structures. During excavation and construction works the movement at the top of the retaining walls should be monitored regularly (not more than 7-day intervals) and compared against predicted lateral movements. A Red, Amber Green (RAG) warning system could be adopted based on the potential lateral movement trigger levels shown in Table 8 as

deviation from the original baseline condition at the time of the installation of the temporary retaining wall.

Table 8 Example of a Red, Amber Green (RAG) warning system for lateral movement

Lateral Movement	Severity	Actions
Less than 10mm	Low	No action necessary
Between 10mm and 15mm	Medium	Frequency of monitoring increased (daily) and engineer informed for review.
Above 15mm	High	Cease all works in the vicinity to establish the cause of excessive movement and implement necessary remedial actions.

6.7.4 Vibration levels within adjacent buildings should also be monitored. Continuous monitoring through autologgers fixed to existing facades could be utilised with typical trigger levels and actions shown in the table below.

Table 9 Example of a RAG warning system for vibration levels

Vibration Level	Severity	Actions
Under 1mm/s	Low	No action necessary
Above 3mm/s	Medium	Investigate why vibrations have risen and formulate mitigating measures to attempt to lover vibration.
Above 5mm/s	High	Cease all works in the vicinity and investigate vibration levels. Implement plan to complete works using alternate working operations in order to lower vibration omissions.

7 Retaining walls

7.1.1 The existing ground level increases across the Site towards the east, to be a full-storey level higher at the north-east compared to the western part of the Site. There are several external factors that require alternative approaches to be adopted for the retaining wall solution around the perimeter of the Site, given the proximity of Granary Street to the north and Buildings A and B to the east, which will not allow adequate space for open excavation.

7.1.2 Where possible, the starting position for the structural philosophy is to allow the ground to be naturally battered back with sufficient working room beyond the outer face of the structure. This is the most cost-efficient solution. The typical permanent works design of the retaining wall consists of a 300mm thick wall spanning vertically between the lower ground floor and the ground floor. The floors act as diaphragms, transferring the lateral load into the

cores and then into the foundations. The battered ground would then be backfilled.

7.1.3 Whilst the battered ground open excavation is the optimum buildability solution, the construction beside the road along Granary Street will require the pavement to be retained in the temporary condition whilst the basement is being dug. This can be provided by temporary sheet piling with a waling beam and raking props. Construction of the concrete permanent works will then proceed, but the integration between temporary works and permanent works needs coordination to provide a cost-efficient system of building the basement.

7.1.4 The south perimeter retaining wall presents a variation to the typical situation as the head of the wall will not extend to the ground floor slab. This will mean the wall does not benefit from the horizontal restraint at upper slab level. The double height columns that are in the same alignment as the retaining wall will restrict the permissible lateral deflection of the top of the wall, which will lead to an arrangement of buttressing walls to the outside face beneath ground level, as shown below.

7.1.5 Buildings A and B, the Victorian workhouses to the south of the Site and adjacent roads will require monitoring whilst the groundworks are being constructed to ensure vibration and any movements are within pre-prescribed limits. Further detail of which buildings and the type of monitoring required will be determined within the Ground Movement Assessment, undertaken by the Contractor's design team following the results of the Phase 2 Geotechnical Investigations.

Figure 7-1 Typical retaining wall (open excavation)

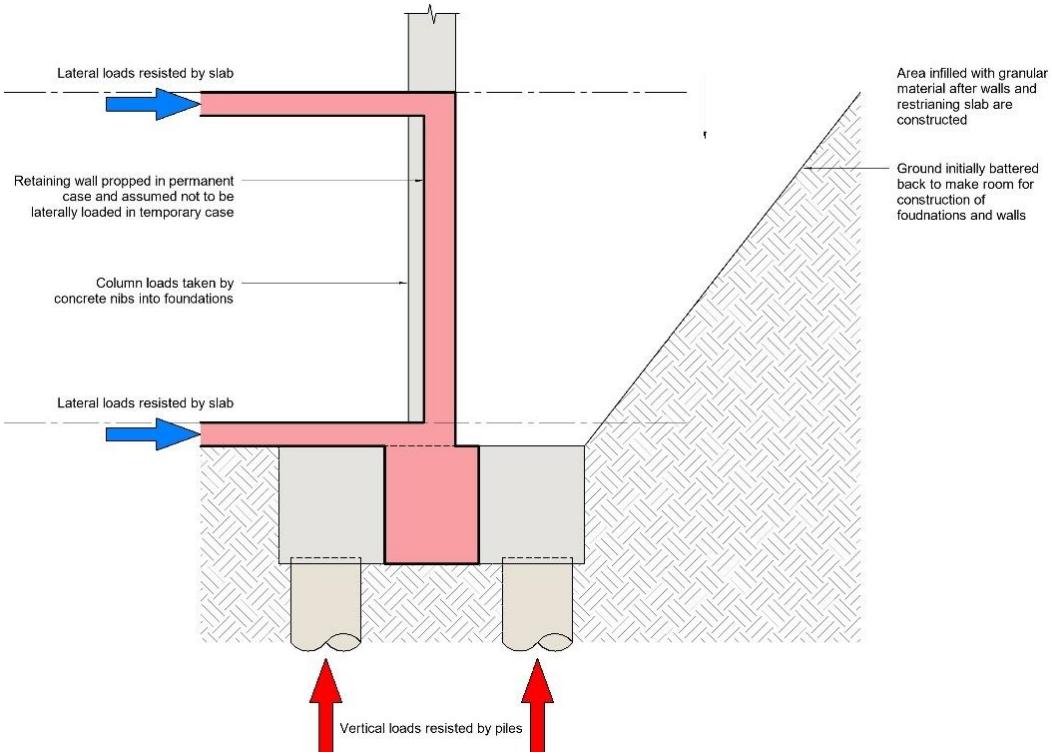


Figure 7-2 Reinforced Concrete wall against sheet piles

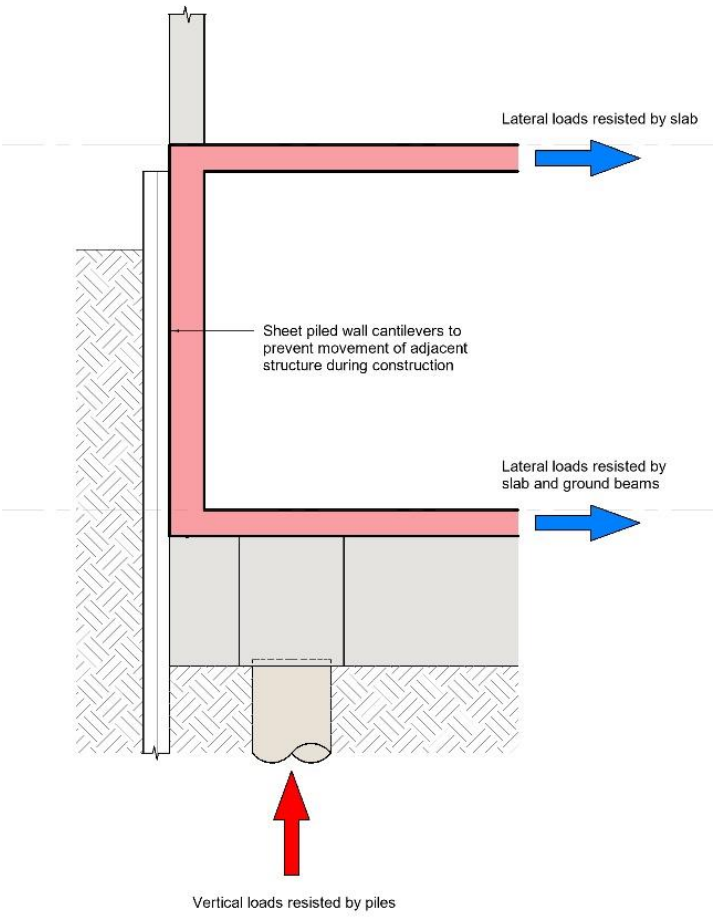
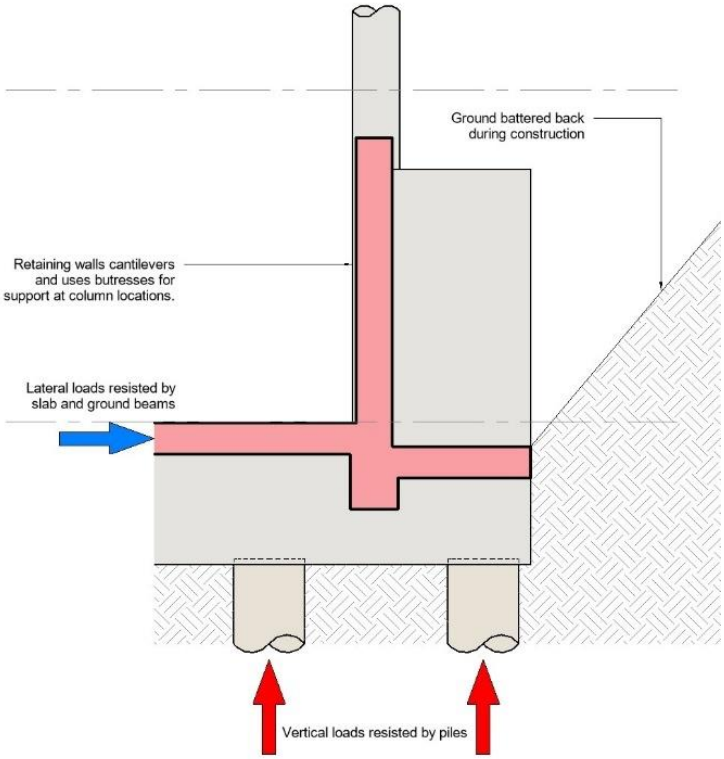


Figure 7-3 Buttressed retaining wall



8 Drainage

8.1 Existing foul and surface water drainage

8.1.1 In accordance with regulatory requirements the Proposed Development will have separate foul and surface water drainage. A Flood Risk Assessment and Drainage Strategy incorporating further details on the proposed drainage strategy will be submitted separately with the planning application.

8.1.2 There are existing foul and surface water drainage networks running across the Site from east to west down two existing site access roads discharging into a main drainage run to the west of the site running from north to south). The existing Site drainage discharges into the wider St. Pancras hospital drainage network within the main access road and continues south before connecting into the Thames Water Public Sewers within St Pancras Way. It is proposed that the drainage network currently serving the Site will be abandoned in order to accommodate the Proposed Development with any drainage upstream of the Site serving areas of the wider St. Pancras Hospital to be diverted as required.

8.2 Proposed foul water strategy

8.2.1 It is proposed that foul water drainage from the Proposed Development will discharge largely via gravity into the existing combined water sewers within the St. Pancras Hospital Site. This ultimately discharges into public sewers within St Pancras Way.

8.2.2 New foul water drains will be sized using the discharge unit method contained within BS EN 752 Parts 1 to 6 and the current Building Regulations requirements. The system will be designed to flow not more than three-quarters full and will be laid at gradients that allow self-cleansing velocities to be achieved. The maximum design velocity within the system will be no greater than 3m/s.

8.2.3 All below ground foul drainage connections from toilet areas will be 150mm in diameter to reduce the risk of blockages.

8.2.4 There is a requirement for vulcathene drainage in some areas due to the nature of chemicals used within laboratory areas. The extent of this is to be confirmed at the detailed design stage. It is currently unknown whether there is a requirement for radioactive waste disposal at the Proposed Development. If this is required it will be drained to a separate tank and removed from the Site in order to prevent radioactive waste from entering the main drainage system, and in accordance with any necessary permits and/or licenses.

8.2.5 Internal manholes will be avoided wherever practicable, however, where used these will incorporate double seals, recessed and lockable covers, and will be located in back of house areas and areas of low sensitivity.

8.3 Proposed surface water strategy

8.3.1 Surface water from the Site will be discharged into the existing combined sewers within the wider St. Pancras Hospital site to the south-west, which in turn discharge into the Thames Water public sewer within St. Pancras Way.

8.3.2 Due to the nature of the Site, with very limited area outside the footprint of the proposed building and foundations and existing highways, there is a limited space available to accommodate attenuation storage while maintaining a gravity outfall. Due to this, attenuation volumes have been calculated for a range of discharge rates as summarised in Table 10 below. These rates are based on a site area of 0.739ha in order to reflect the area of the site where changes are being made. The roads incorporated by the site boundary of 1.330ha are undergoing no changes and are not being considered as part of the drainage system.

8.3.3 The LBC Drainage Pro Forma identifies that where greenfield is not achievable, a minimum of 50% improvement on the existing 1 in 100 year discharge rate should be targeted, and where possible exceeded.

Table 10 Greenfield runoff rates and discharge rates

	Discharge Rate	Attenuation Required
Greenfield Runoff	2.6l/s	554 - 717m^3
Existing 1 in 100	138.6l/s	114 - 251m^3
50% Reduction	69.3l/s	205 - 336m^3
90% Reduction	13.9l/s	369 - 499m^3
85% Reduction	20.8l/s	324 - 452m^3

8.3.4 Due to the space available and limited potential depth, a reduction of 85% is proposed as the lowest reasonable discharge rate from the Proposed Development.

9 References

Ref. 1 London Borough of Camden, (2018); Camden Planning Guidance: Basements.
https://www.camden.gov.uk/basement-developments

Ref. 2 London Borough of Camden; Basement Impact Assessment: Defining the scope of Engineering input.
https://www.camden.gov.uk/basement-developments

Ref. 3 Arup, (2010); London Borough of Camden geological, hydrogeological and hydrological study: Guidance for subterranean development.
https://www.camden.gov.uk/basement-developments

Ref. 4 Environment Agency, Management of the London Basin Chalk Aquifer Status Report 2018.

Ref. 5 Google Maps, (2020); St. Pancras Hospital Google Maps Image.

Appendix A Drawings

Co-ordinate Table			
Station	Easting	Northing	Level
1	529625.545	183607.397	20.332
2	529639.130	183563.833	19.766
3	529678.890	183594.666	22.323
4	529712.280	183609.800	22.546
5	529683.667	183647.941	22.684
20	529615.639	183571.660	19.301
30	529659.281	183626.047	22.434
40	529702.246	183625.676	22.709
50	529703.091	183653.343	22.792
300	529623.499	183599.912	20.026
301	529658.549	183623.089	20.336
302	529670.990	183596.327	20.231
3000	529622.446	183625.682	20.413
3001	529618.423	183632.089	20.405
P3	529703.073	183725.791	23.637
P4	529594.320	183649.692	19.924
P5	529604.098	183588.220	19.296

GPS Note:
This survey is related to OSGB36(15) coordinate system by GPS 'rapid static' methods. No scale factor has been applied to the survey information. All horizontal distances taken from this drawing are ground distances.

Every effort has been made to confirm tree species on site, yet it is advised to confirm these details with an arborist before proceeding with any design.

Revision	Description	Date

LEGEND

Survey control station △ 5
Banking
Building
Gate (single)
Gate (double)
Fence
Contour 22.50
Wall
Tree Spread and Girth shown to scale
Ordnance Survey Value 15.37m

Abbreviations

Belisha Beacon	BB	Pipe	PE
Bollard	BD	Road Sign	RS
Borehole	BH	Rodding Eye	RE
British Telecom Box	BTB	Service Marker	MK
BT Inspection Cover	BT	Sign Post	SP
Concrete Paving Slabs	CPS	Sluice Valve	SV
Cable Television Cover	CTV	Stop Tap	ST
Electricity Cable Pit	EC	Stop Cock	SC
Electricity Pole	EP	Telegraph Pole	TP
Earth Rod	ER	Telephone Call Box	TCB
Fire Hydrant	FH	Traffic Light	TL
Flag Staff	FS	Unsurfaced	U\S
Gas Valve	GV	Vent Pipe	VP
Gate Post	GP	Water Meter	WM
Gully	GY	Eaves Level	EL
Inspection Cover	IC	Ridge Level	RL
Kerb Outlet	KO	Roof Level	RFL
Lamp Post	LP	Soffit Level	SFL
Manhole	MH	Threshold Level	THL
Marker Post	MK	Parapet Wall Level	PWL
Parking Meter	PM	Finished Floor Level	FFL
Post	P		
Retaining Wall	RTW	Cover Level	CL
Barbed Wire Fence	BWF	Invert Level	IL
Close Boarded Fence	CBF	No Visible Connection	NVC
Chainlink Fence	CLF	Unable to Lift	UTL
Chestnut Paling Fence	CPF	Surface Water	SW
Post and Chain Fence	PCF	Foul Water	FW
Post and Rail Fence	PRF	Brick Retaining Wall	BRTW
Post and Wire Fence	PWF	Flower Bed	F\B
Wooden Panel Fence	WPF	Shrub Bed	S\B

terrain
Land and Architectural Surveyors
Terrain Surveys Ltd
Bridge Chambers
2Bo High Street
Welwyn
Herts
AL6 9EQ
Tel 01438 841300
Fax 01438 841301
enquiries@terrainsurveys.co.uk
www.terrainsurveys.co.uk

Client
ROYAL FREE LONDON NHS FOUNDATION TRUST

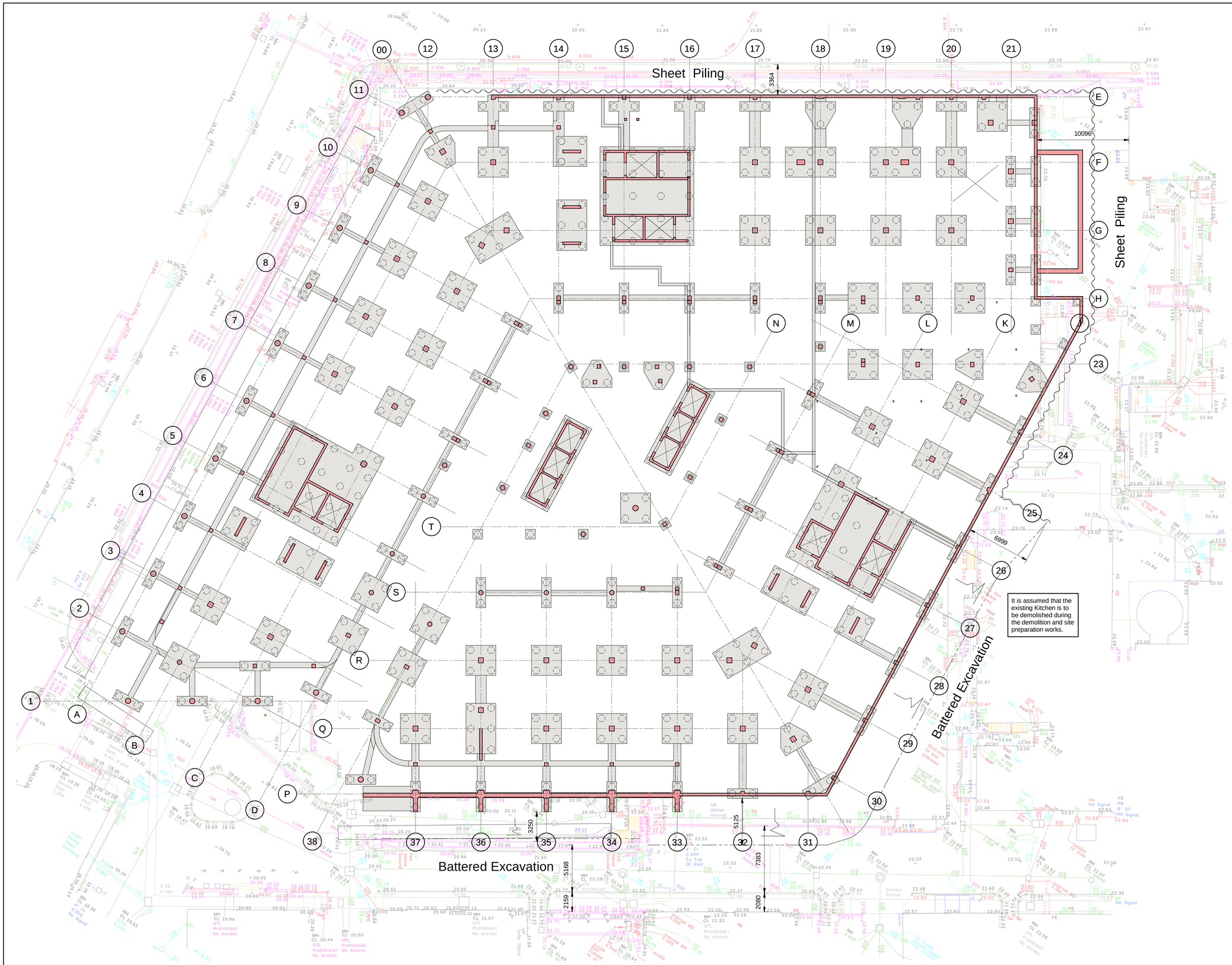
Project
ST PANCRAS HOSPITAL, ST PANCRAS WAY, LONDON, NW1 0PE

Title
TOPOGRAPHICAL SURVEY

Drawn by	Checked by
HB	PG
Scale 1:200@A0	Date NOV 2018
Drawing Number TS18-4647\1	Revision –
Sheet 1 of 1	

All levels related to Ordnance Survey active GPS network, at survey station 30.
Value 22.434m

Project Management Initials: Designer: MB Checked: MKW Approved: MPW Drawn By: NP ISO A1 594mm x 841mm



Sheet Piling Plan
1 : 200

AECOM

Project

The Oriel Moorfields Eye Hospital

UK & IRELAND

Client

Oriel

Consultant

AECOM
Aecom House
63-77 Victoria Street
St Albans,Herts
AL1 3ER
United Kingdom
Tel +44 (0)1727 535000
www.aecom.com

Notes

- Do not scale from this drawing. Work to figured dimensions only.
- This drawing is to be read in conjunction with:
  - Design reports
  - Survey and Interpretative Reports
  - Project Specifications and Performance Specifications
  - Health and Safety Hazard Register
  - Relevant drawings and documentation issued by the architect, engineers and specialists.
  - Building Information Model (BIM)
  - Outline Construction Methodology
  - Movements and Tolerances Report
- All dimensions are in mm except levels which are in metres and relate to ordnance datum.
- Any discrepancies shall be referred to the Designer before work commences.

Issue/Revision

Rev.	Date	Description	Drn/Chk/Apr
P02	05/02/21	Issued for Comment	MB/MB/MKW
P01	03/09/20	Issued for Comment	NP/MB/MKW

Key Plan

Suitability Status

S2 - Suitable For Information

Project Number

60588325

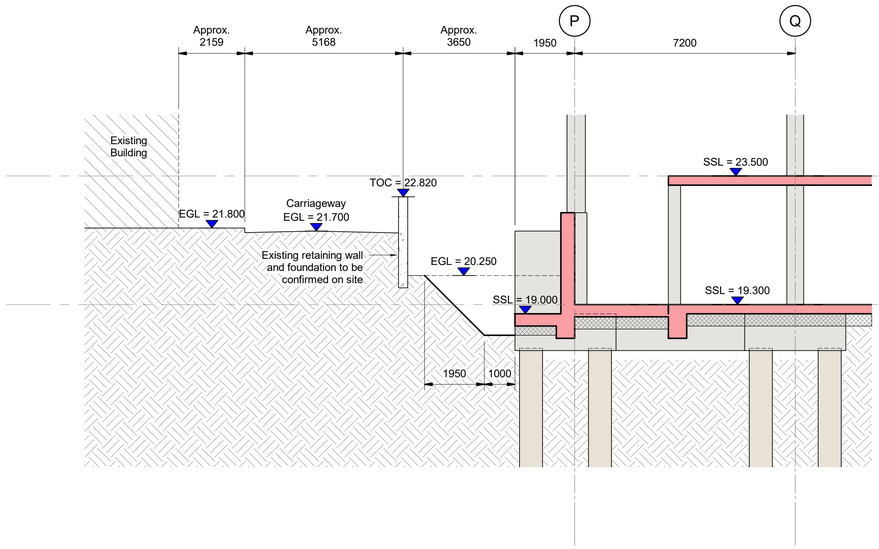
Sheet Title

Moorfields Eye Hospital
Plans
Excavation & Sheet Pile
General Arrangement

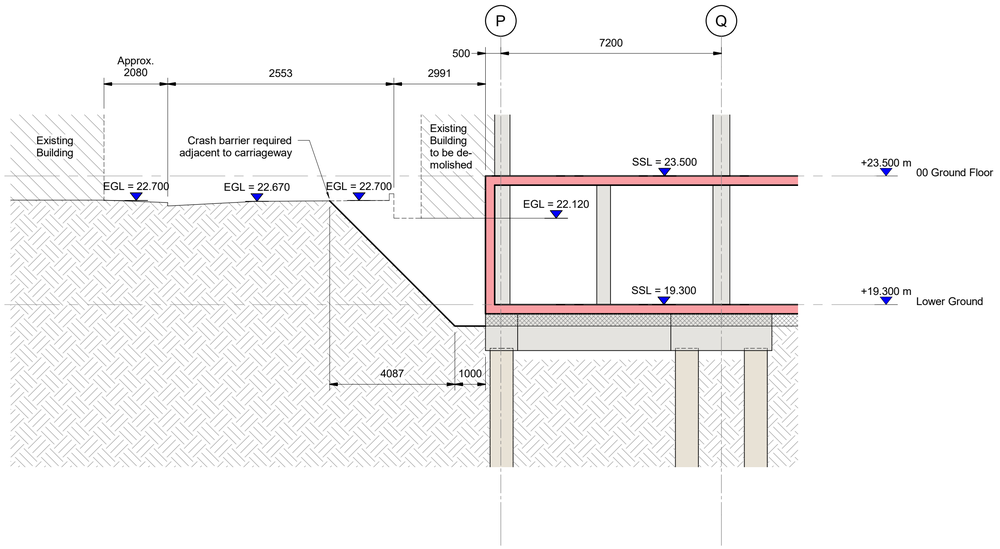
Sheet Number

ORL-ACM-00-F1-DR-SE-01501

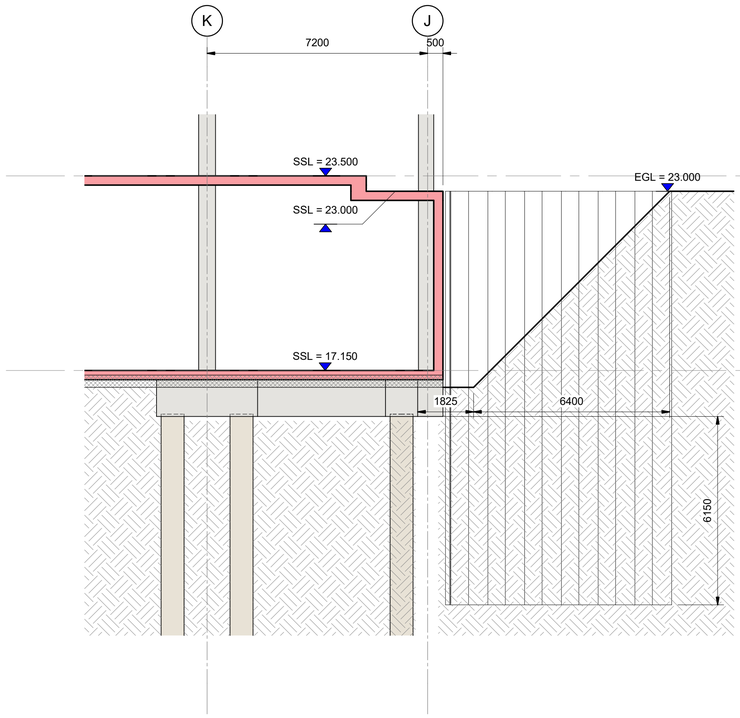
Scale: 1 : 200@A1 **Rev:** P02



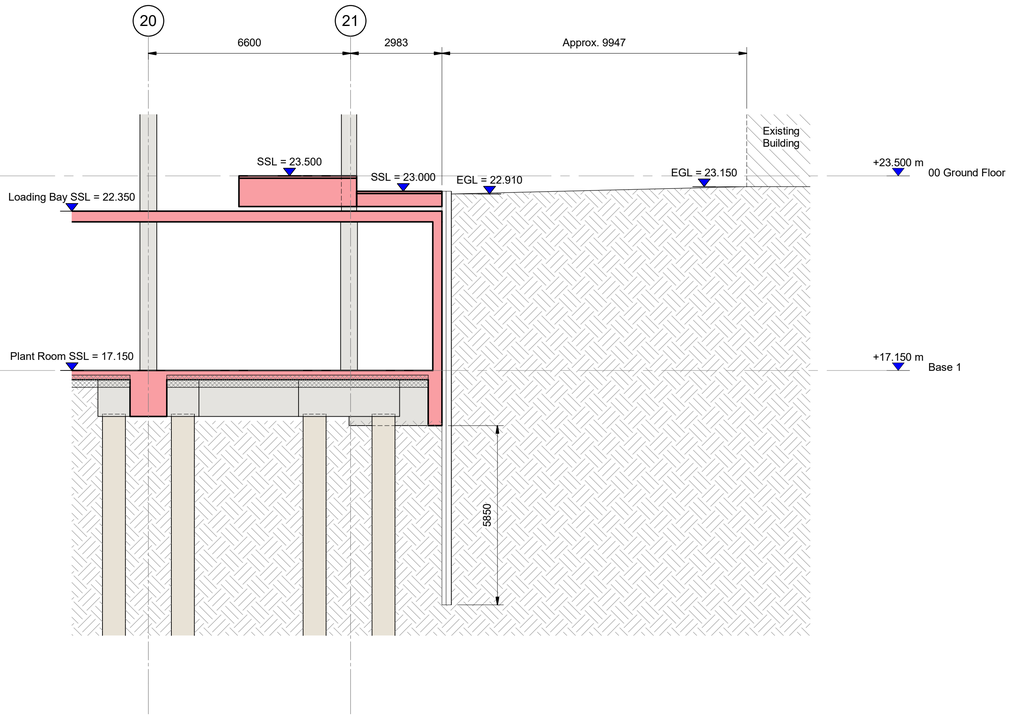
Sheet Piling Section 1
1 : 100



Sheet Piling Section 2
1 : 100



Sheet Piling Section 3
1 : 100



Sheet Piling Section 4
1 : 100

AECOM

Project

The Oriel Moorfields Eye Hospital

UK & IRELAND

Client

Oriel

Consultant

AECOM
Aecom House
63-77 Victoria Street
St Albans,Herts
AL1 3ER
United Kingdom
Tel +44 (0)1727 535000
www.aecom.com

Notes

- Do not scale from this drawing. Work to figured dimensions only.
- This drawing is to be read in conjunction with:
  - Design reports
  - Survey and Interpretative Reports
  - Project Specifications and Performance Specifications
  - Health and Safety Hazard Register
  - Relevant drawings and documentation issued by the architect, engineers and specialists.
  - Building Information Model (BIM)
  - Outline Construction Methodology
  - Movements and Tolerances Report
- All dimensions are in mm except levels which are in metres and relate to ordnance datum.
- Any discrepancies shall be referred to the Designer before work commences.

Issue/Revision

Rev.	Date	Description	Drn/Chk/Apr
P01	03/09/20	Issued for Comment	NP/MB/MKW

Key Plan

Suitability Status

S2 - Suitable For Information

Project Number

60588325

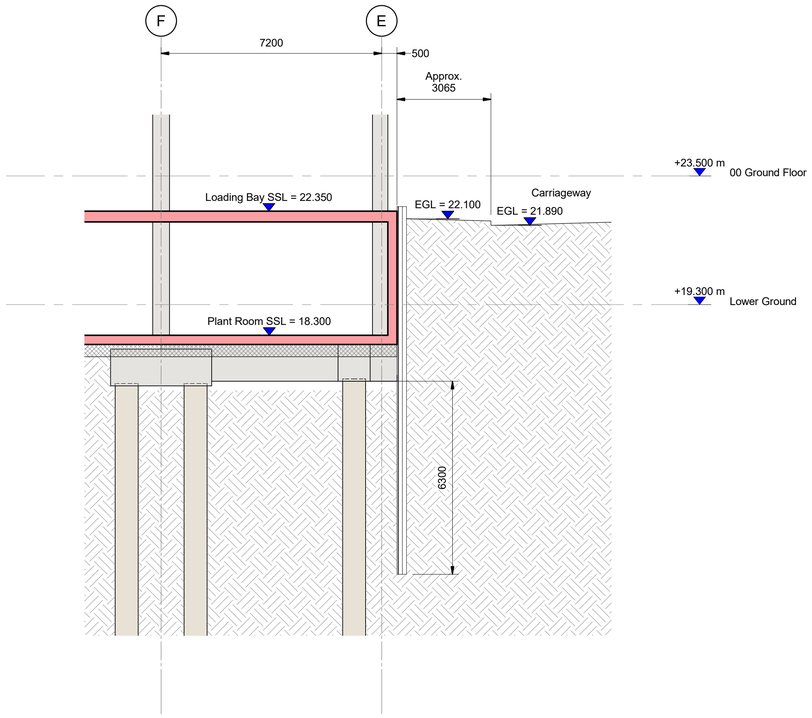
Sheet Title

Moorfields Eye Hospital
Sections
Excavation & Sheet Pile Sections
Sheet 1

Sheet Number

ORL-ACM-00-ZZ-DR-SE-04501

Scale: 1 : 100@A1 **Rev:** P01



Sheet Piling Section 5
1 : 100

AECOM

Project

The Oriel Moorfields Eye Hospital

UK & IRELAND

Client

Oriel

Consultant

AECOM
Aecom House
63-77 Victoria Street
St Albans,Herts
AL1 3ER
United Kingdom
Tel +44 (0)1727 535000
www.aecom.com

Notes

- Do not scale from this drawing. Work to figured dimensions only.
- This drawing is to be read in conjunction with:
  - Design reports
  - Survey and Interpretative Reports
  - Project Specifications and Performance Specifications
  - Health and Safety Hazard Register
  - Relevant drawings and documentation issued by the architect, engineers and specialists.
  - Building Information Model (BIM)
  - Outline Construction Methodology
  - Movements and Tolerances Report
- All dimensions are in mm except levels which are in metres and relate to ordnance datum.
- Any discrepancies shall be referred to the Designer before work commences.

Issue/Revision

P01	03/09/20	Issued for Comment	NP/MB/MKW
Rev.	Date	Description	Drn/Chk/Apr

Key Plan

Suitability Status

S2 - Suitable For Information

Project Number

60588325

Sheet Title

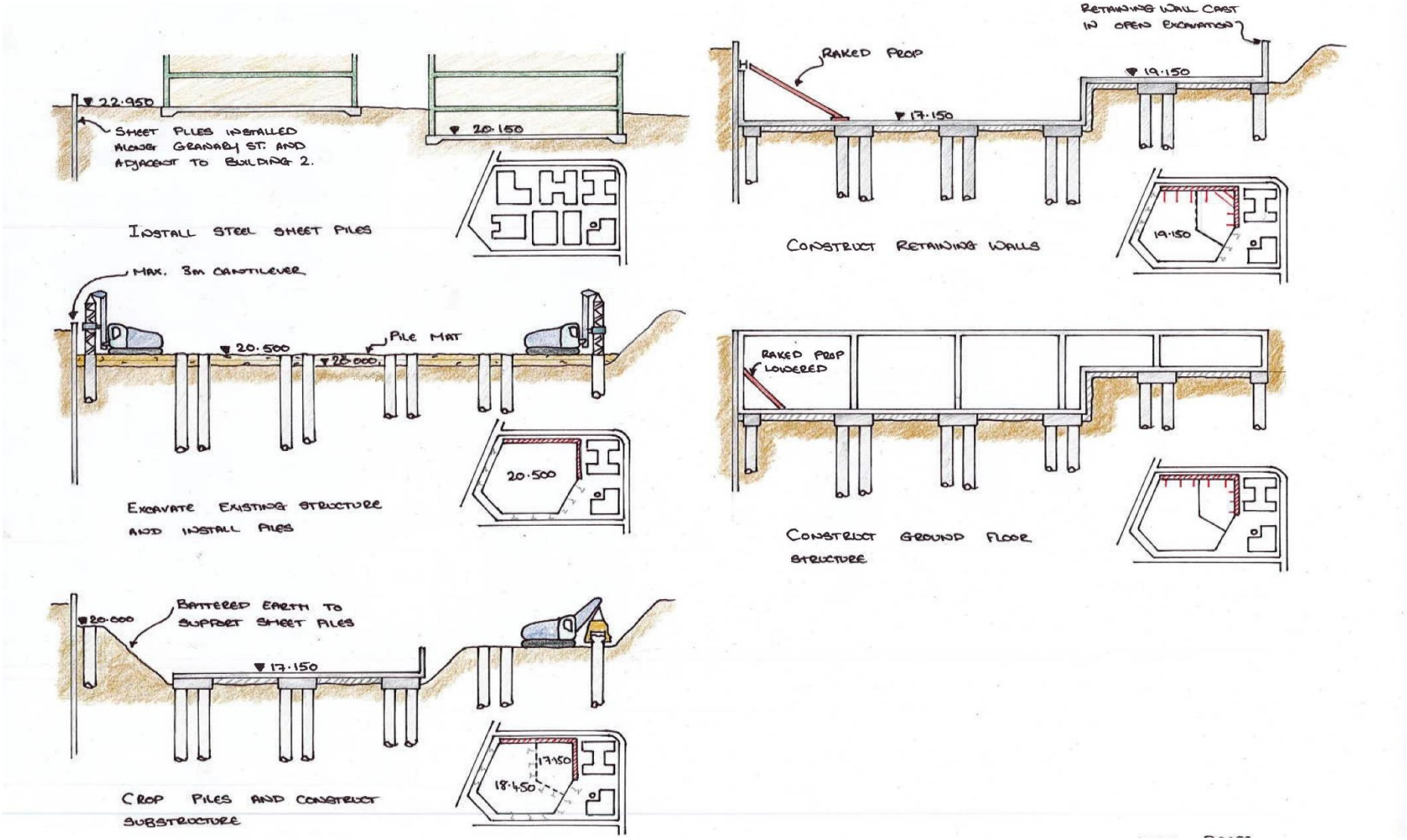
Moorfields Eye Hospital
Sections
Excavation & Sheet Pile Sections
Sheet 2

Sheet Number

ORL-ACM-00-ZZ-DR-SE-04502

Scale: 1 : 100@A1 **Rev:** P01

Appendix B Basement construction methodology


22.950
SHEET PILES INSTALLED ALONG GRANARY ST. AND ADJACENT TO BUILDING 2.
20.150
INSTALL STEEL SHEET PILES
MAX. 3m CANTILEVER
20.500
PILE MAT
20.500
EXCAVATE EXISTING STRUCTURE AND INSTALL PILES
20.000
BATTERED EARTH TO SUPPORT SHEET PILES
17.150
17.150
18.450
CROP PILES AND CONSTRUCT SUBSTRUCTURE
RETAINING WALL CAST IN OPEN EXCAVATION
RAKED PROP
17.150
19.150
19.150
CONSTRUCT RETAINING WALLS
RAKED PROP LOWERED
CONSTRUCT GROUND FLOOR STRUCTURE

\

Oriel
Creating the centre for advancing eye health

Oriel-london.org.uk

Moorfields Eye Hospital NHS Foundation Trust

NHS

Moorfields Eye Charity

UCL INSTITUTE OF OPHTHALMOLOGY