Great Ormond Street Hospital for Children
NHS Foundation Trust

Great Ormond Street Hospital Charity

UCL INSTITUTE OF CHILD HEALTH

Basement Impact Assessment

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05 September 2014

Centre for Children's Rare Disease Research
at Great Ormond Street Hospital

REVISION RECORD

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1. INTRODUCTION TO SCHEME

1.1 DESCRIPTION OF DEVELOPMENT

The Centre for Research into Rare Diseases in Children (CRRDC) will combine the specialist research expertise of University College London (UCL) with the unique patient care skills of Great Ormond Street NHS Foundation Trust (GOSH) with the goal of identifying treatments and cures to rare diseases. The CRRDC will create an infrastructure facilitating and promoting the translation of rare disease research into tangible therapies and treatments.

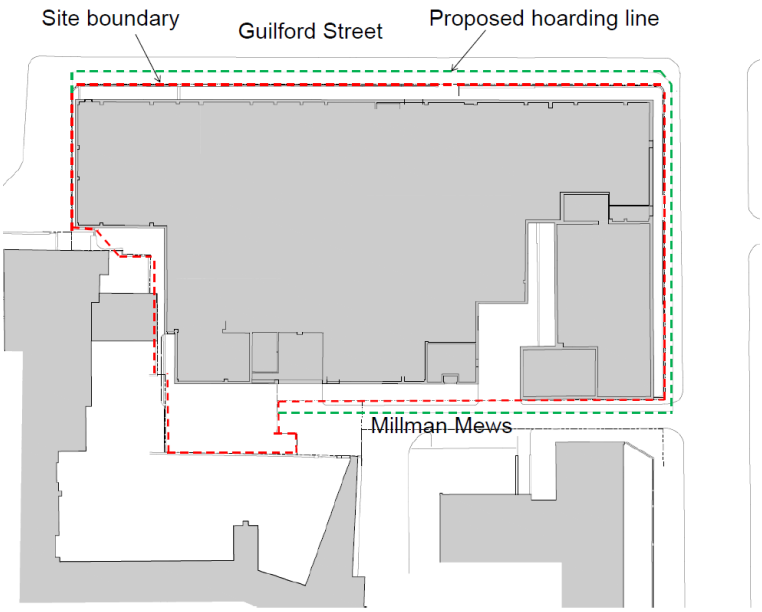


Figure 1: Location Plan indicating boundary and hoarding line

1.2 SITE DESCRIPTION

The site currently occupies an area to the south of Guilford Street and to the west of Millman Street and is located at National Grid Reference 530622, 182189. Currently the site is predominantly occupied by a 1960's building known as the Computer Centre with areas of hardstanding parking and pedestrian access areas.

Figure 2: Location key plan from CRRDC stage C report

The site is bound to the north by Guilford Street, Coram's Fields, to the west by hospital and research buildings and to the east and south by a mixture of commercial and residential properties.

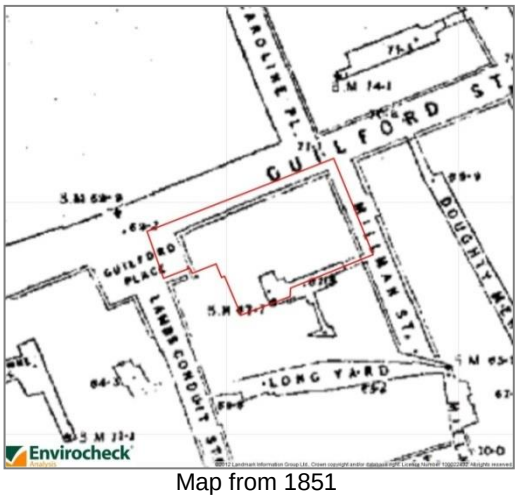
The site measures approximately 61 x 39m on plan. The proposed building is to occupy the majority of the footprint of the site, and is slightly larger on plan than the existing buildings. Below ground the proposed building extends the basement area on plan slightly while deepening it significantly from a predominantly single to a double basement.

Figure 3: Existing building

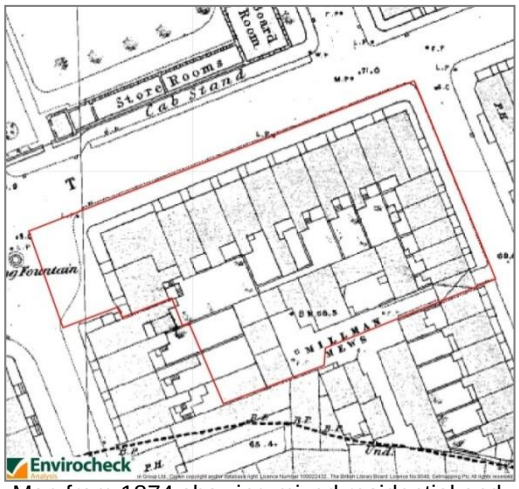
1.3 SITE HISTORY

Historic Ordnance Survey (OS) maps and aerial photographs (sourced from Envirocheck Analysis) have been reviewed to provide a summary of the site's history and extracts are included in the table below. The maps indicate the following:

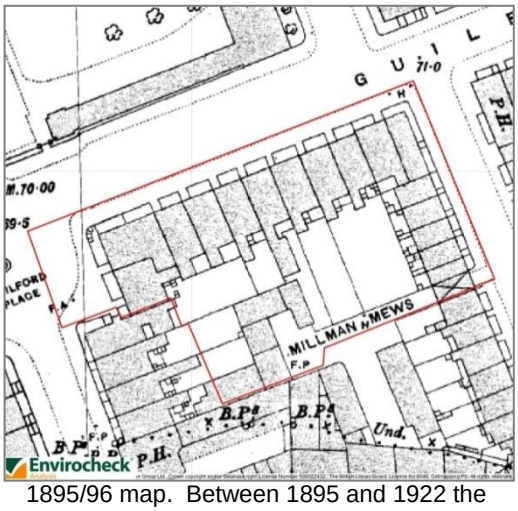
- The site was predominantly occupied by residential developments with a few commercial/industrial sized properties between the mid to late 1800s and the late 1950s;
- Part of the site may have sustained bomb damage during the Second World War (therefore the potential for unexploded ordnance have been taken into account as part of the site's development, see below), and
- In the 1960s and 70s the site was redeveloped towards the present day configuration comprising a Computer Centre and the British Postgraduate Medical Federation buildings.



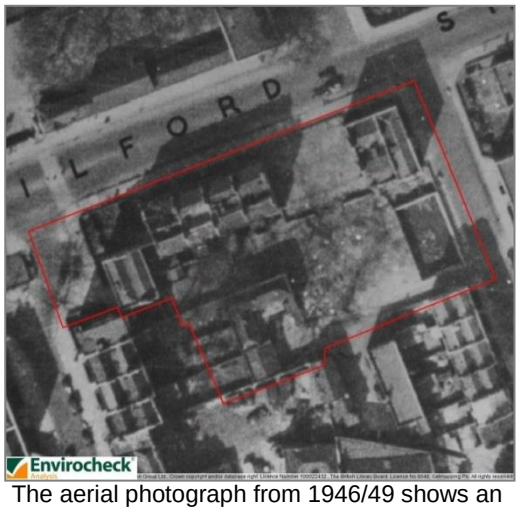
Map from 1851



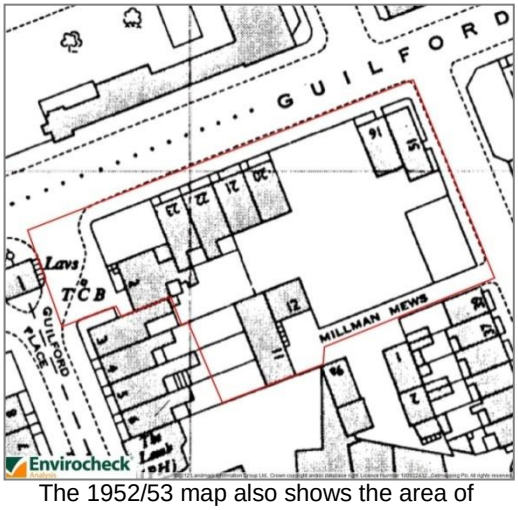
Map from 1874 showing mixed residential and commercial/industrial properties on the site.



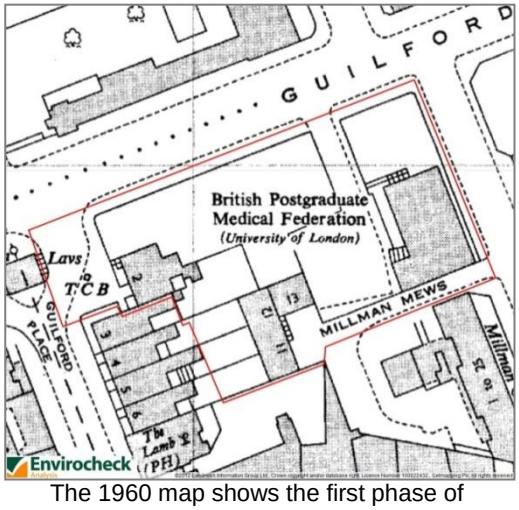
1895/96 map. Between 1895 and 1922 the maps show localised reconfiguration only.



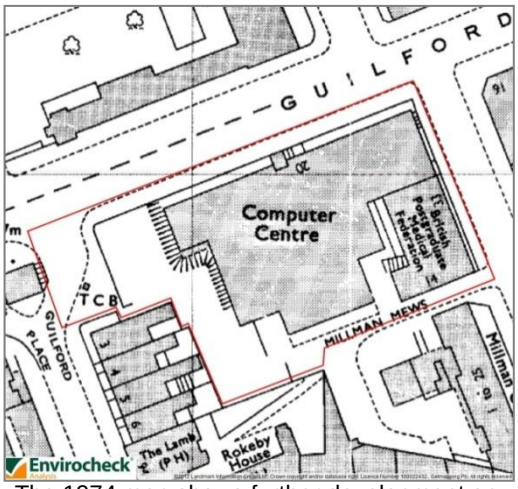
The aerial photograph from 1946/49 shows an area of potential bomb damage.



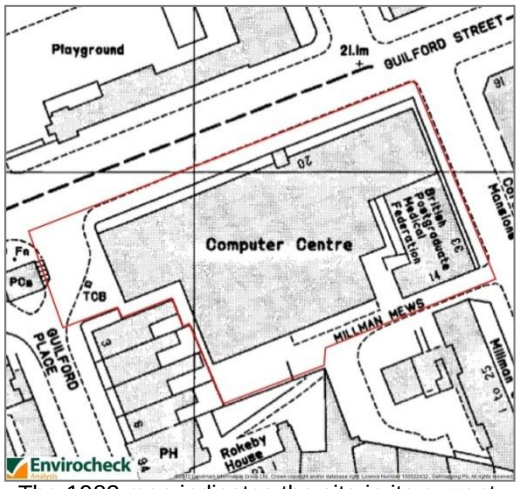
The 1952/53 map also shows the area of potential bomb damage.



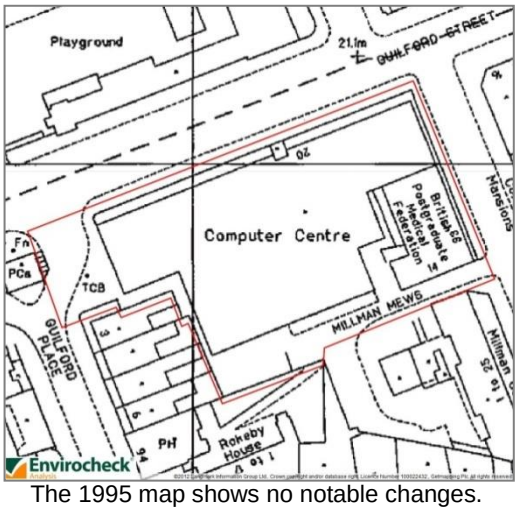
The 1960 map shows the first phase of buildings now on site.



The 1974 map shows further development on site.



The 1983 map indicates the site in its current layout.



The 1995 map shows no notable changes.

A recent aerial photograph.

Table 1: Historical maps

1.4 UNEXPLODED ORDNANCE

As introduced earlier a review of the site's history indicates that part of the site may have sustained bomb damage during the Second World War and as such the potential for unexploded ordnance has been taken into account as part of the site's development. The risk although low for encountering unexploded bombs will be managed throughout groundworks to prevent accidents.

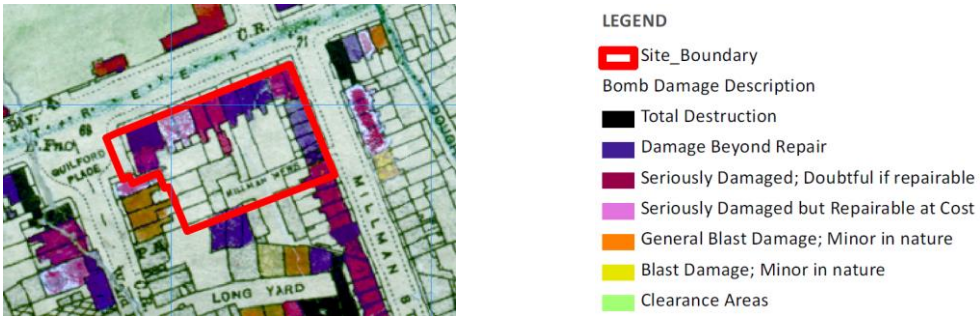


Figure 4: Unexploded ordnance risk assessment

1.5 THE PROPOSED BUILDING AND CONSTRUCTION TECHNIQUES

In its place the proposed building will comprise of two basements, ground and five upper levels with cladding predominantly in terracotta brick and glass. The new basement is to consist of sheet piled retaining walls with a reinforced and post tensioned concrete frame rising from within it.

Construction techniques for basement formation are designed to mitigate and to manage both ground bourn vibration and ground movement from construction activities in order to minimise disturbance and to avoid damage to neighbouring properties as well as to utilities and infrastructure. Limits for each will be agreed with Camden Highways Department and via Party Wall Awards.

Both the desk studies and site investigations suggest that below the level of the existing buildings we should not expect to find existing structures with the exception of the small cross section piles from the building currently on site. This is greatly beneficial as it means that the new retaining wall should not require the need for chiselling in order to reach the required pile depths and as such will reduce the associated ground vibrations and lower the impact of the basement construction on neighbours.

The construction sequence of the demolition and new basement construction has been carefully planned to manage ground movement through the use of sequential propping and excavation. Ground movements will be predicted using advanced ground assessment techniques and computational methods to avoid undue ground movement and the associated impact on neighbouring buildings and infrastructure. To ensure that theory marries up with application a surveying strategy will be developed to monitor actual against theoretical movements.

2. BASEMENT IMPACT ASSESSMENT

The following risk assessment follows guidance set out in CPG4 Camden Planning Guidance Document for Basements and Lightwells 2013 and the Camden Geological, Hydrogeological and Hydrological Study.

The process of basement impact assessment is a staged process as follows:

- **Stage 1: Screening -** to identify areas for study;
- **Stage 2: Scoping -** to identify data required for detailed study;
- **Stage 3: Site investigation and study** - which provides the data;
- **Stage 4: Impact assessment** which compares the present situation with the proposed one; and
- **Stage 5: Review and decision making** - the proposed solution

3. STAGE 1 – SCREENING

The following assessment uses the flow chart method of assessment from appendix E of the Camden Geological, Hydrogeological and Hydrological Study:

3.1 SURFACE FLOW AND FLOODING SCREENING

Question	***Response***
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No - The site is not within the catchment of the pool chains on Hampstead Heath.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No - The surface water run-off from the site will be equal or less than the existing condition using an attenuation tank to store and slow release surface water.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No - The site will not increase the proportion of the site which is hard surfaces.
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 - The site will not increase the profile of surface water to the sewer as it is designed to utilise SUDs technology to prevent and increase in surface water load compared to the existing development.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No - The site utilises SUDs technology to manage peak surface water loads.
6. Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, 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 within an area identified as being of flood risk or near a static water feature.

Table 2: Surface flow and flooding screening exercise.

Surface flow and flood screening will not therefore require further consideration.

3.2 SUBTERRANEAN (GROUNDWATER) FLOW SCREENING

Question	***Response***
1a. Is the site located directly above an aquifer?	Yes - The eastern part of the site is underlain by superficial deposits of Hackney Gravel which are hydrogeologically classified as a Secondary Aquifer.
1b. Will the proposed basement extend beneath the water table surface?	Yes - The eastern part of the basement will extend into the Hackney Gravel where perched groundwater is likely to be encountered.
2. Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No - The former tributary of the River Fleet which formerly ran adjacent to the site has been Culverted and is now considered to be a sewer, therefore it is not a sensitive receptor for changes to the ground water regime. There are no wells (used/disused) or spring lines within 100m of the site.
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No - The site is not within the catchment of the Hampstead heath pond chain.
4. Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No - The proposed redevelopment will not alter the hard area of the site.
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 development is not designed to discharge water into the ground.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line.	No - There are no local ponds or spring lines.

Table 3: Subterranean (groundwater) flow screening exercise.

Subterranean (groundwater) flow will require further, more detailed consideration; in particular with respect to questions 1a and b, referring to the presence of an aquifer directly below the proposed development and the extension of the proposed basement beneath the water table surface.

3.3 SLOPE STABILITY SCREENING

Question	*Response*
1. Does the existing site include slopes, natural or manmade, greater than 7º? (approximately 1 in 8)	No - Falls on the site are around 1:50.
2. Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7º?	No – The proposed development does not involve re-profiling the site.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7º?	No - The surrounding area has no embankments and the streets are of a shallow gradient
4. Is the site within a wider hillside setting in which the general slope is greater than 7º?	No - The surrounding area is similarly flat.
5. Is the London Clay the shallowest strata at the site?	No – The London Clay is overlain by Made Ground across the site and a sequence of Made Ground over Hackney Gravel in the eastern part of the site.
6. Will any tree/s 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 - 2 trees are to be felled and others pruned.
7. Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Yes – There is likely to be some shrink-swell subsidence locally given the presence of London Clay, trees and London stock buildings although the building currently on site is piled and shows no signs of damage from shrink swell issues.
8. Is the site within 100m of a watercourse or a potential spring line?	No - The former tributary of the River Fleet which formerly ran adjacent to the site has been Culverted and is now considered to be a sewer. There are no wells (used/disused) or spring lines within 100m of the site.
9. Is the site within an area of previously worked ground?	No - The site has only been used for buildings according to our historical map search.
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 eastern part of the basement will extend into the Hackney Gravel where perched groundwater is likely to be encountered. Limited dewatering is likely to be required during construction.
11. Is the site within 50m of the Hampstead Heath ponds?	No.
12. Is the site within 5m of a highway or pedestrian right of way?	Yes - The site is bound by highways to 3 sides.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes - The new basement will stand upon a raft which is deeper than the pilecap level of the existing piled building and is likely to be deeper that the adjoining buildings.

14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No - The building is not near any tunnels.

Table 4: Slope stability screening exercise

Slope stability will therefore require scoping by a structural engineer with input from an arborist.

4. STAGE 2 – SCOPING

Scoping is required where any of the answers to the flowchart questions in the screening exercise were answered "yes" or "unknown". Those parameters are taken forward and considered in more detail.

The scoping stage aims to define the scope of investigation required in order to provide the information necessary to make an assessment of the impact of the issues identified.

4.1 POTENTIAL IMPACTS

The potential impacts identified by the Stage 1 – Screening Exercise (undertaken in accordance with the LBC guidance) are summarised in the following table:

Surface Flow & Flooding	
No potential impacts have been identified for scoping and inclusion in the Basement Impact Assessment	
Subterranean (Groundwater Flow)	
LBC Screening flowchart question	Potential impact
1a. Is the site located directly above an aquifer?	Yes - The eastern part of the site is underlain by superficial deposits of Hackney Gravel which are hydrogeologically classified as a Secondary Aquifer. The proposed basement will extend into the Hackney Gravel and any perched groundwater within the gravel. Therefore, site investigation has been undertaken to establish the presence of Hackney Gravel and to establish groundwater levels beneath the site.
1b. Will the proposed basement extend beneath the water table surface?	It is anticipated that the proposed basement will extend beneath any perched water within the Hackney Gravel. However it is considered unlikely that the basement will extend into the water table within the underlying London Clay. Therefore, site investigation has been undertaken to establish the ground and groundwater conditions beneath the site.
Slope Stability	
LBC Screening flowchart question	Potential impact
6. Will any tree/s 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?	The soil moisture deficit associated with felled tree will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value. To advise on tree cropping and felling an arborist has been retained by the client who will advise on how the works should be undertaken to avoid slope stability or more likely on the rate of felling and its impact on ground swell affecting neighbouring buildings.

7. Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	The new building design should take account of seasonal shrink/swell effects. To this end a site geotechnical investigation has taken place which has quantified soil plasticity.
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?	Basement construction will need to be constructed in such a way as to prevent dewatering of a wider area. Our proposal is therefore to form a cofferdam of sheet piles to the perimeter of the basement to limit the ingress of surrounding groundwater and to maintain groundwater levels beyond the cofferdam.
12. Is the site within 5m of a highway or pedestrian right of way?	With the new basement being constructed close to the site boundary it will be imperative that ground movements outside the sheet piled cofferdam are minimised. A site specific geotechnical investigation has been commissioned to provide data for geotechnical, retaining wall and temporary works design.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	The new basement is lower than those of surrounding buildings or the building we propose to replace. As such as site specific geotechnical investigation has been commissioned to provide data for geotechnical design.

Figure 5

Each of the potential impacts highlighted above have been subject to further investigation and assessment and are included in the Basement Impact Assessment that follows.

5. STAGE 3 – SITE INVESTIGATION AND STUDY

To provide local context to detailed design and decision making a number of studies have been commissioned and completed in conjunction which are listed below and available under separate cover:

- Phase 1 Geo-environmental desk Study, Pell Frischmann, 8 January 2014
- Factual Geo-Environmental Site Assessment, RSK, July 2014
- Detailed Unexploded Ordnance (UXO) Risk Assessment, 6 Alpha, 18 July 2014
- Arboricultural Implications Report, Simon Jones Associates, July 2014
- Flood Risk Assessment, Pell Frischmann, rev A, 8 August 2014

6. STAGE 4 – IMPACT ASSESSMENT

During development and upon completion of the proposed project the site will see a number of changes and this chapter defines their impact.

The screening and scoping processes have allowed for a number of potential impacts to be identified and the information required to quantify their impact. Now that studies and investigations are complete these impacts may be properly quantified.

6.1 SUBTERRANEAN (GROUNDWATER) FLOW

Each of the potential impacts identified by the screening exercise are discussed below. Although no current water courses have been identified within 100m of the proposed development information pertaining to an historic tributary of the River Fleet has been included below for completeness.

Question 1a. Is the site located directly above an aquifer?

Published Geology

The published geology for the site (taken from British Geological Survey maps and the GroundSure Geoinsight report; referenced as part of the Pell Frischmann Desk Study) indicates that the site is underlain by superficial deposits of the Hackney Gravel Formation; which typically comprise sand and gravel with local lenses of silt, clay or peat. The superficial geology is underlain by units of the London Clay Formation. London Clay typically comprises of fine, sandy, silty clay/silty clay.

Overleaf is an extract of the published superficial geological map (from GroundSure), which highlights the extent to which the site is underlain by the Hackney Gravel Formation. The map indicates that only a small proportion of the eastern side of the site is underlain by the Hackney Gravel.

Hydrogeology

Hydrogeologically the underlying geological strata are classified as follows:

- Hackney Gravel Formation is categorised as a Secondary 'A' Aquifer (permeable layers). This is defined by the Environment Agency (EA) to be "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".*
- The London Clay is categorised as an unproductive strata which is defined as *"rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow"* by the EA.

On this basis, the Hackney Gravel Formation will be the main strata of interest with respect to any potential groundwater impact associated with the proposed basement. Note: the area is not within a Source Protection Zone (SPZ) and the closest groundwater abstraction is 745m NW and does not relate to potable water supply.

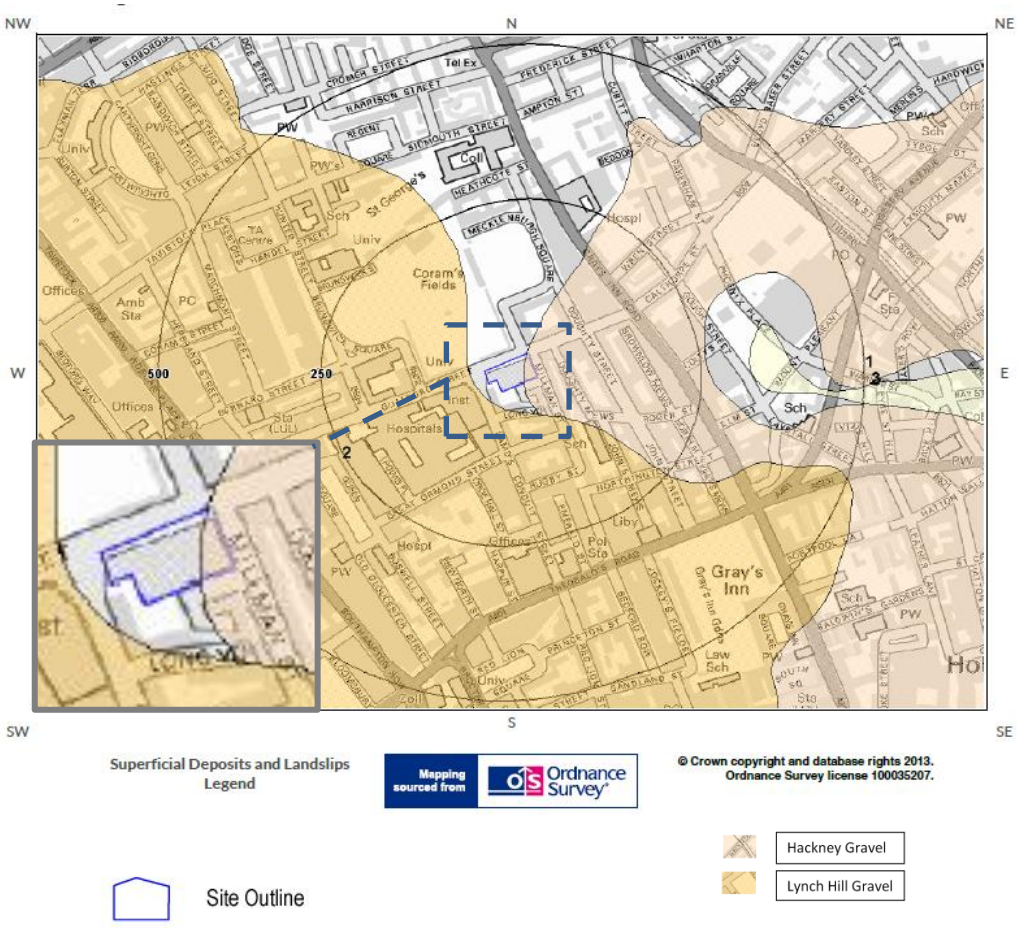


Figure 6: Superficial Geological map of site.

Site Investigation Ground Conditions

The Phase 2 intrusive site investigation works included the formation 4 cable percussive boreholes, each bored to a depth of 30m bgl (below ground level). A sketch showing the borehole locations relative to the existing site layout is included overleaf. All four boreholes were formed from within the existing basement and so encountered concrete over Made Ground which was either directly underlain by London Clay or by a sequence of Hackney Gravel over London Clay, as follows:

- Hackney Gravel was only encountered in BH3, on the eastern edge of the site. The 1.0m thick layer of Hackney Gravel was recorded between 1.10m below existing first basement level and 2.10m below the level of the existing first basement which is at ~19.35mAOD and was immediately overlain by Made Ground (recorded up to 1.1m below existing first basement level) and underlain by London Clay.
- BH1, BH2 and BH4 recorded a layer of Made Ground immediately overlying London Clay. Made Ground was recorded up to depths of 1.8m below the level of the existing first basement which is at ~19.35mAOD in BH1 and BH2 and 3.2m below existing first basement level in BH4.

The surface of the London Clay was recorded at depths of 1.8m below existing first basement level in BH1 and BH2, 2.1m below existing first basement level in BH3 and 3.2m bgl in BH4. In all 4 boreholes a weathered layer of the London Clay was recorded at the top of the clay sequence.

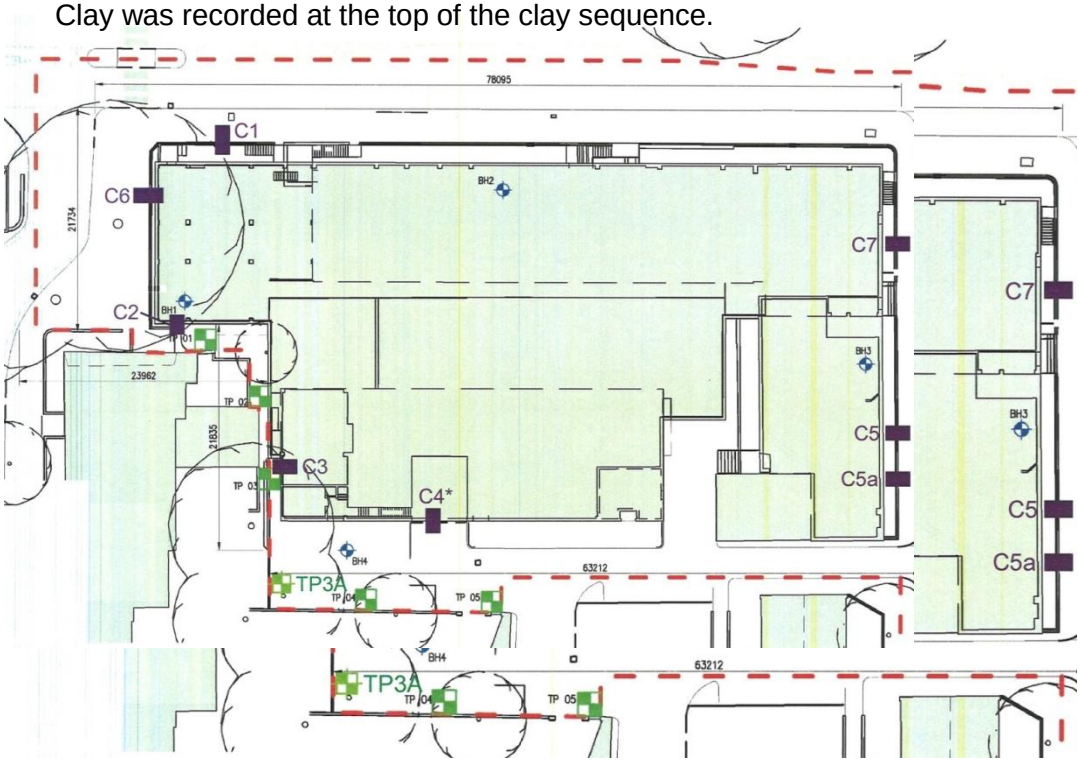


Figure 7: Borehole Location Plan (BH1 - BH4 shown in blue)

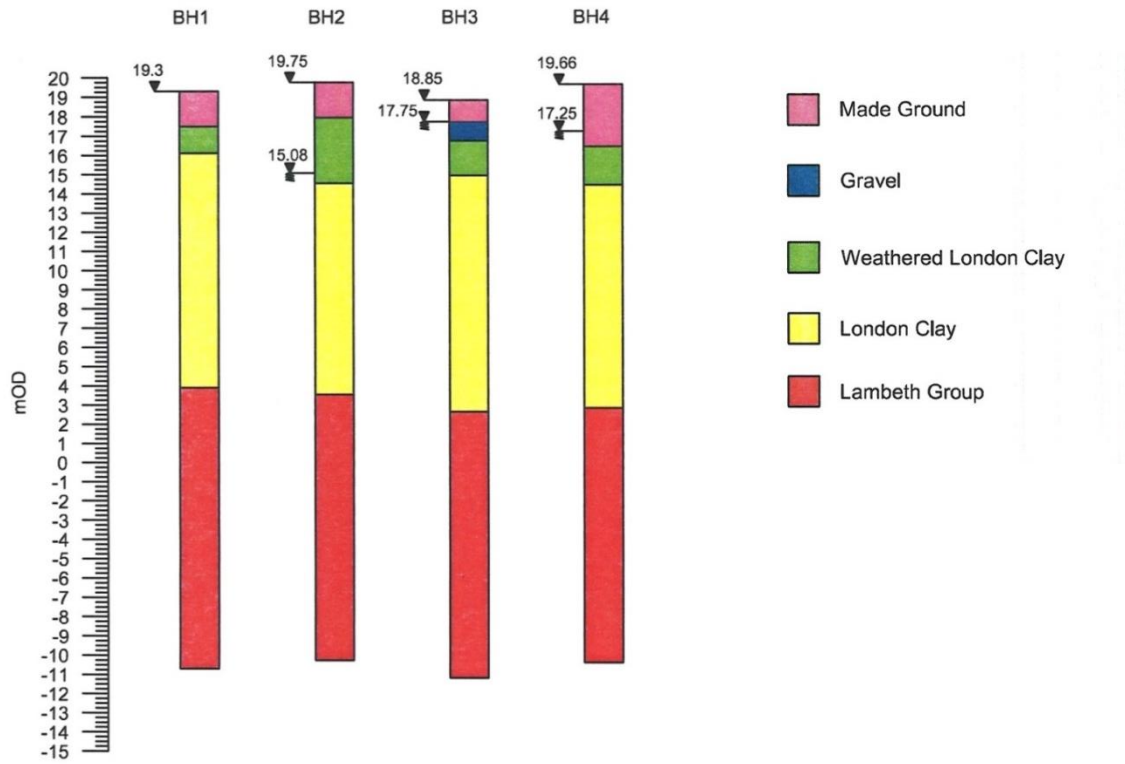


Figure 8: Bore hole logs

Question 1b. Will the proposed basement extend beneath the water table surface?

During the site investigation perched groundwater was encountered within the Hackney Gravel at 1.1m below the existing basement level (in BH3). In the remaining boreholes BH1, BH2 and BH4 (where London Clay was directly overlain by Made Ground) groundwater strikes were only recorded within the London Clay and at depths of between 11.0 and 12.0m below existing basement level, as summarised below:

- BH1 - 11.00m below existing basement level in the London Clay;
- BH2 - 11.00m below existing basement level in the London Clay;
- BH3 - 1.10m below existing basement level in the Hackney Gravel; and
- BH4 - 12.00m below existing basement level l in the London Clay.

Potential Impacts on the Groundwater Flow Regime

In the proposed redevelopment a two storey basement will occupy the plan area of the site down to a depth of ~9m bgl with a raft footing. Based on the findings of the intrusive site investigation the base of the basement will be found within the London Clay. All materials within the plan area, above this depth, including Made Ground, Hackney Gravel (in the east) and London Clay will need to be excavated to accommodate the new basement.

With respect to the Hackney Gravel Secondary Aquifer, the intrusive site investigation has confirmed that the proposed basement will extend through the Hackney Gravel and beyond into the underlying London Clay. Therefore, as part of the basement construction the relatively shallow 1m thick layer of Hackney Gravel will be excavated away from within the plan area of the basement. As the proposed development is located at the western extent of the Hackney Gravel (see Figure 6: Superficial Geological map of site.) the introduction of the basement will locally reduce the western boundary of the aquifer to that of the east wall of the basement. This will only affect a small localised volume of gravel at the very perimeter of the aquifer.

Based on the available information (including the location of current and historic water courses and the location of the Hackney Gravel) the local groundwater flow in the aquifer is likely to be towards the south east and away from the proposed development site. Based on this groundwater flow direction, the orientation of the proposed basement and the minor relocation of the aquifer boundary that will occur with the introduction of the basement it is considered that both the local groundwater flow regime and groundwater levels around the perimeter of the basement are unlikely to change significantly.

During construction, localised and limited dewatering will be required on site due to the excavation of the water bearing Hackney Gravel. To limit this incursion construction will take place within a sheet piled cofferdam which will be toed into the London Clay to cut off the perched groundwater from flowing into the basement excavation. Shallow groundwater intrusion from the remaining Hackney Gravel (outside the proposed basement walls) to the east and south east should be anticipated and appropriate mitigation measures should be implemented by the contractor for the duration of the basement construction.

Groundwater intrusion will be reduced to a high degree in the permanent works as the sheet piles of the cofferdam will be welded together to become water tight. As a result the only ground water to be removed will be to remove the long term water percolating through the clay which may otherwise float the building in the very long term. During the permanent state, groundwater could only find its way inside the cofferdam by finding a way around the toe of the sheet piles or by percolating through the clay both of which are expected to be very low permeability routes.

The results of the intrusive site investigation indicate that groundwater is present within the London Clay at depths of between 11.0 and 12.0m bgl. The proposed basement is not due to extend to this depth and therefore it is not envisaged that the groundwater flow regime and/or groundwater levels within the London Clay will be impacted by the construction and/or existence of the basement. (It should be noted that the London Clay is hydrogeologically classified as a non-productive strata in any case).

Question 2. Is the site within 100m of a watercourse?

The Stage 1 – Screening exercise indicated that the site is not within 100m of an existing watercourse. However, reference to Nicholas Barton's book '*Lost Rivers of London*', indicated that a historic tributary of the River Fleet had previously flowed from approximately north west to south east adjacent to the site, as shown in the map extracts below. For completeness information regarding the status of this tributary has been included below.

Figure 9: Map Extract from the 'Lost Rivers of London'.

As stated in the Camden Surface Water Management Plan "*The River Fleet, which is formed from two springs on Hampstead Heath, is the largest of London's subterranean rivers and historically drained the Camden area. … Through Camden and the City of London The Fleet is entirely incorporated within the sewer network, owned and maintained by Thames Water*".

Correspondence with LBC regarding the River Fleet also indicated that the Fleet has been fully incorporated into the Thames Water Network. The sewer asset maps provided by Thames Water indicate that the tributary of the Fleet, which

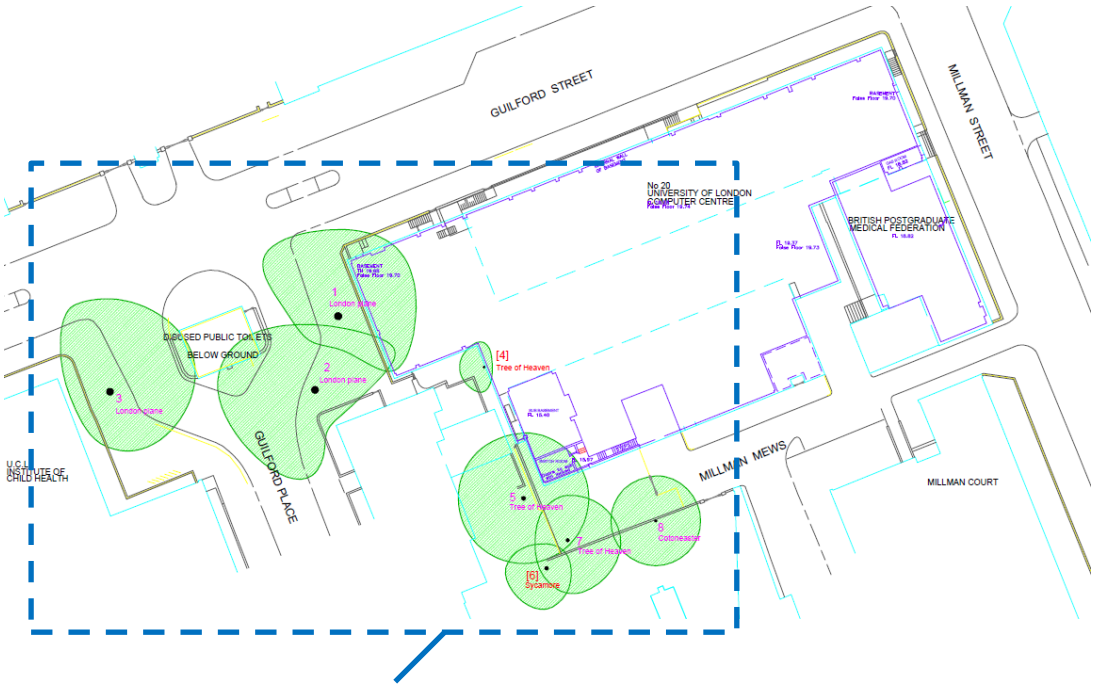
previously ran adjacent to the site, has been incorporated into a combined trunk sewer with local invert levels of between 15.6m and 16.2m bgl. Therefore, the site is no longer within 100m of a watercourse that would be sensitive to changes in the groundwater regime. A combined sewer would not be sensitive to changes in the ground water regime and therefore does not need to be considered further in the basement impact assessment.

6.2 SLOPE STABILITY

Each of the potential impacts identified by the screening exercise are discussed below. The process of forming a new basement for CRRDC has been carefully planned so as to avoid harming trees and neighbouring buildings, to control ground water to enable construction and to control ground movement though control of the stiffness of temporary works in construction.

Question 6. Will any tree/s 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?

In January of 2014 Simon Jones Associates visited the site to undertake a tree survey and categorised the trees on and around the site in line with BS 5837 Trees in Relation to design, demolition and construction. The plan below illustrates their findings:



Area blown up in scale below

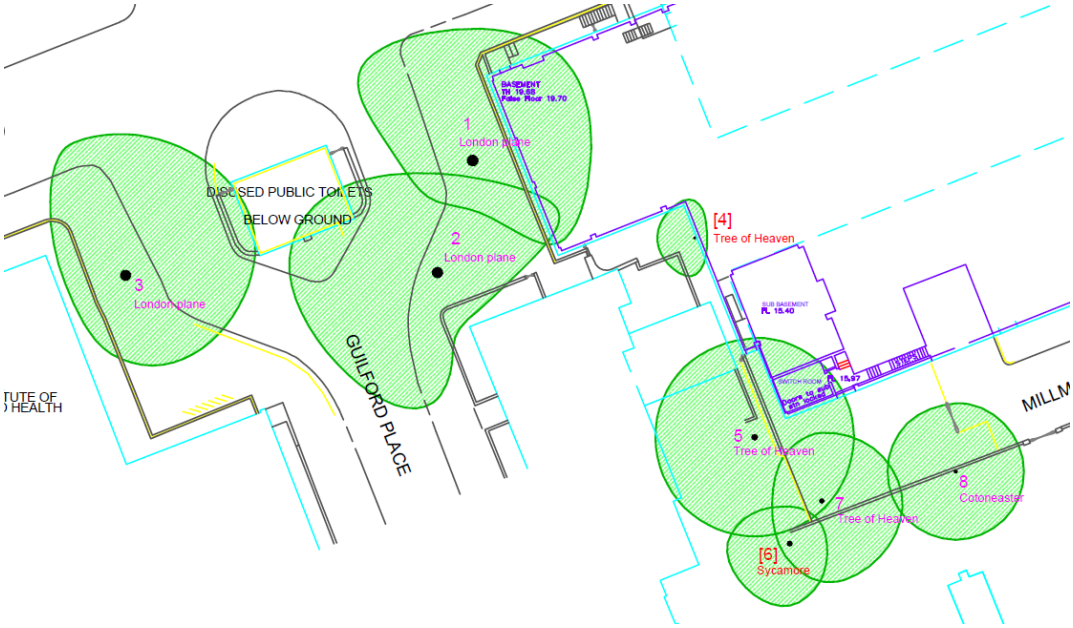


Figure 10: Tree survey

Following this survey and having liaised with Stanton Williams on the scheme SJA then undertook an impact study on the trees and advised on root and canopy protection. To underpin their work they undertook a number of inspection pits on site to identify whether existing features such as the foundations to garden walls had acted as barriers to roots to date.

The result of the exercise was that two trees are proposed to be removed and that the remaining trees would have no incursion on the Root Protection Area although some pruning is planned. As a result SJA conclude that the proposed redevelopment would not have a significant impact on character and appearance of the conservation area with regard to trees and that the proposals comply with national planning guidance.

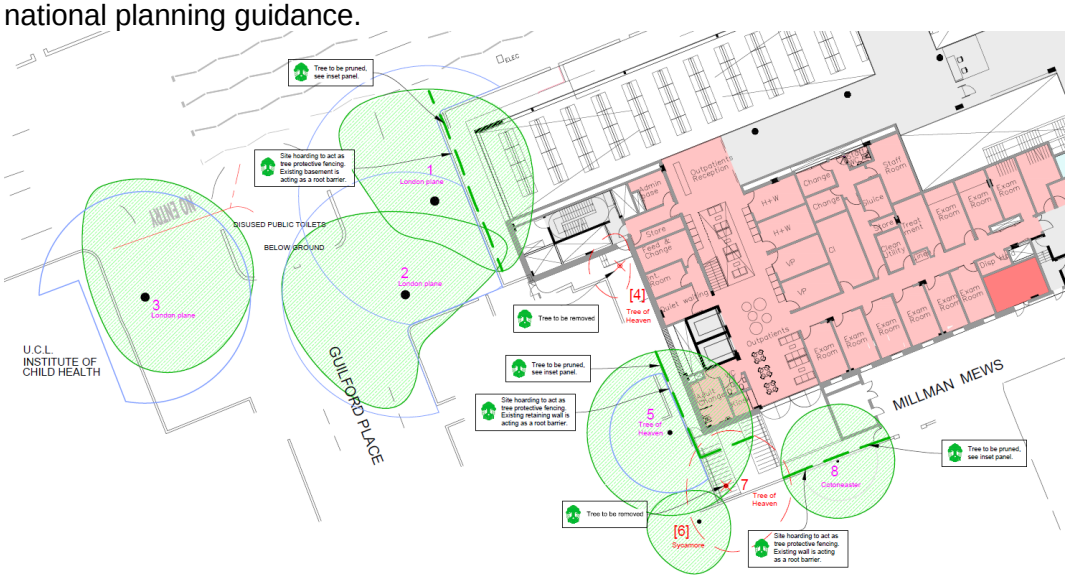


Figure 11: Tree action plan

Question 7. Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?

The site investigations undertaken confirmed that the site is underlain by London Clay which is commonly recognised as having a high plasticity index and this has been verified by soil testing. As a result the clay will be susceptible to seasonal shrink-swell as is much of central London. While no specific damage has been identified to surrounding buildings the soil properties have been identified and design will be accounted for in foundation design.

In addition to shrink-swell effects the ground is expected to heave as a result of the swelling of the soil caused by the removal of overburden during excavation of the new proposed basement with the removal of the mass of soil decompressing the soil at formation level of the proposed basement. As a result the ground will swell at the base of excavation.

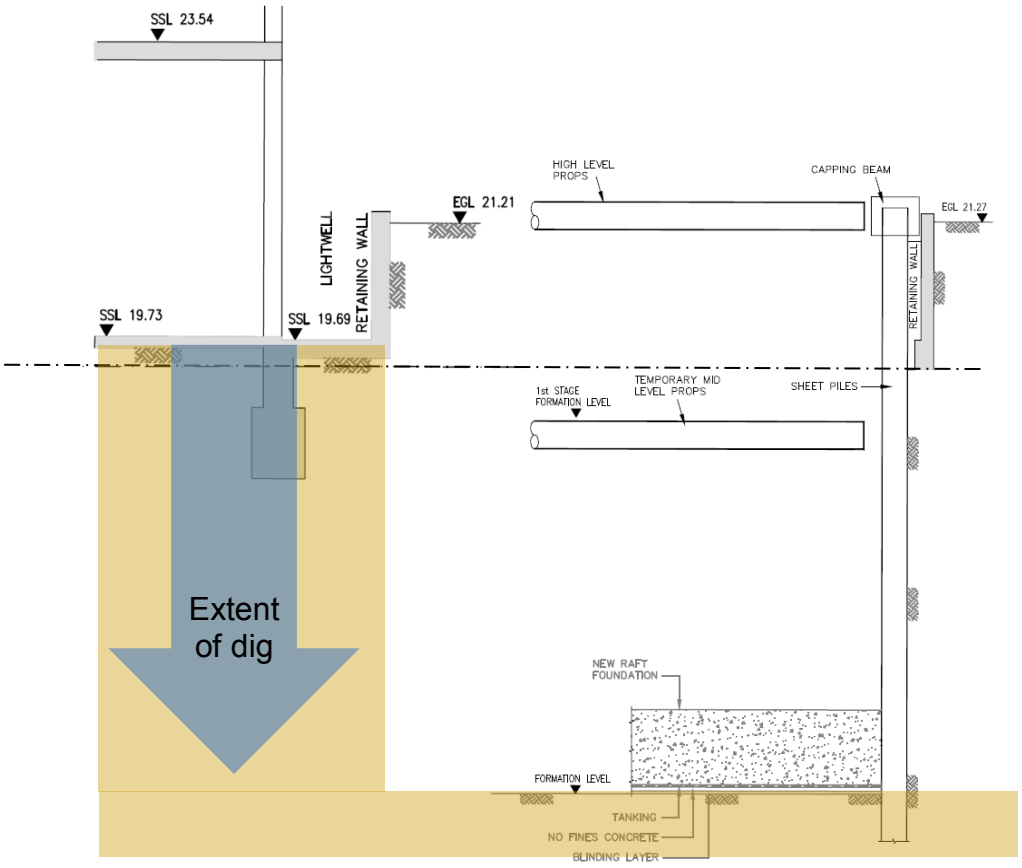


Figure 12: Illustration of new basement excavation

The effects of heave due to overburden removal are however understood by geotechnical engineers and have been identified as requiring a ground model in detailed design to enable prediction of the rate of heave of the soil throughout basement works. To avoid detrimental impacts the building raft design will be developed in line with the contractors programme as part of the ground movement study. The basement depth meanwhile avoids season's shrink-swell effects on the new building as this phenomenon is limited to shallow soils.

Question 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?

A detailed geo-environmental site investigation has been undertaken and included the use of standpipes from which ground water levels were monitored. These identified the level of the perched water table as well as the main water table within the London Clay. The results were as follows:

- BH1 - 11.00m below existing basement level in the London Clay
- BH2 - 11.00m below existing basement level in the London Clay
- BH3 - 1.10m below existing basement level in the Hackney Gravel
- BH4 - 12.00m below existing basement level l in the London Clay

This reinforced the findings of our desk study which predicted Hackney Gravel beneath one corner of the site.

The proposed basement construction methodology will therefore need to take account of the perched water table within the Gravel and for the potential for a lesser presence of ground water within the shallow fill. The extent of the Hackney Gravel strata is indicated in figure 13 below.

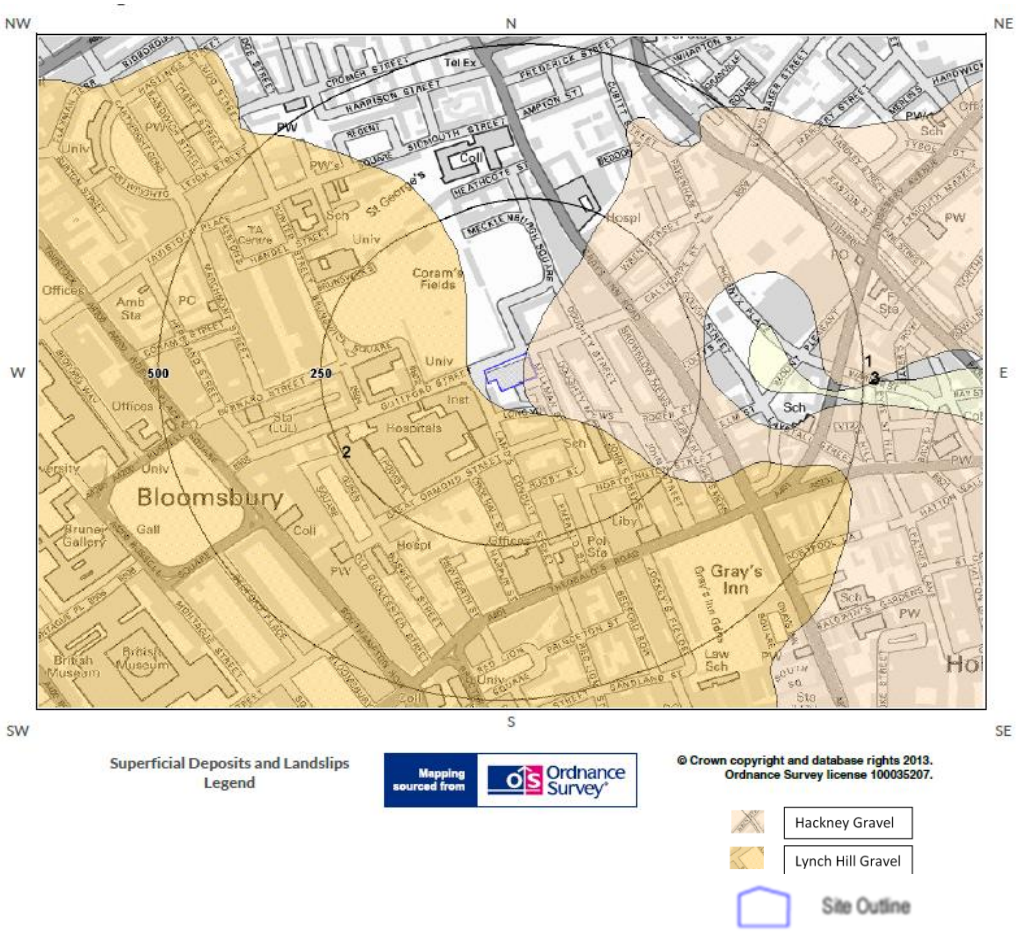


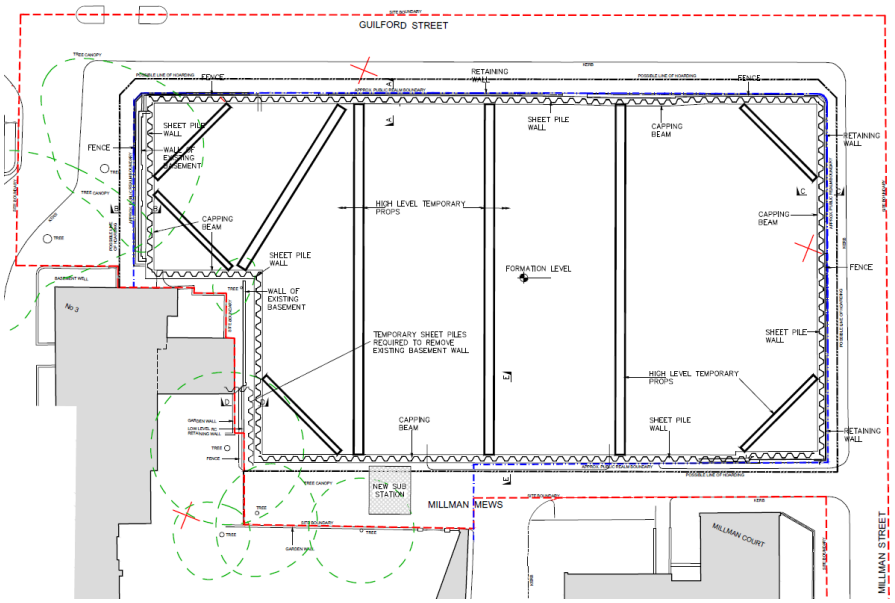
Figure 13: Geological map indicating Computer Centre at 20 Guilford Street

To resolve the inflow of ground water within the construction phase we have proposed that the basement be formed of sheet piles installed from existing ground level to the full basement perimeter. This will form a cofferdam with low seepage rates through the clutches of the sheet piles. To seal the base of the sheet piled wall the sheets will be driven into the low permeability London Clay. Any water which then seeps in to the excavation may be pumped away to enable a safe construction phase for workers. Inflows will then reduce as construction progresses and as sheet piles are welded together to form the permanent waterproof retaining wall. The basement slab will then be waterproofed to prevent water ingress into the building.

In the permanent building a significant head of water risks building up and floating the building as groundwater slowly seeps through the clay. To prevent this, a sub-basement change system has been schemed to remove the slow ingress of groundwater in the long term.

Question 12. Is the site within 5m of a highway or pedestrian right of way?

The proposed basement covers the majority of the site footprint and as such backs onto the public highway leading to the majority of the perimeter being within 5m of the highway as indicated below:

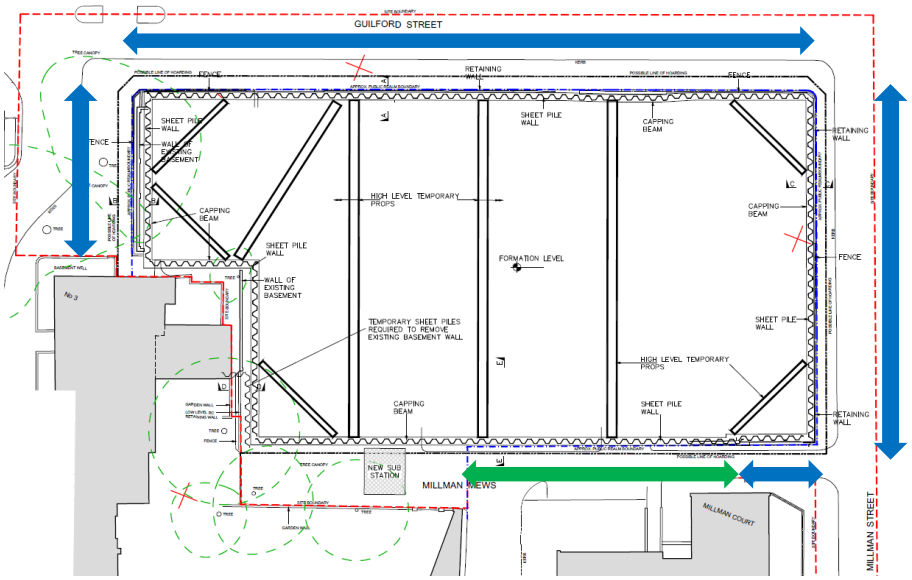


Key

Denotes Adopted Highway Boundary
Denotes Deed Boundary

Figure 14: Construction phase plan indicating boundaries around the site and temporary propping

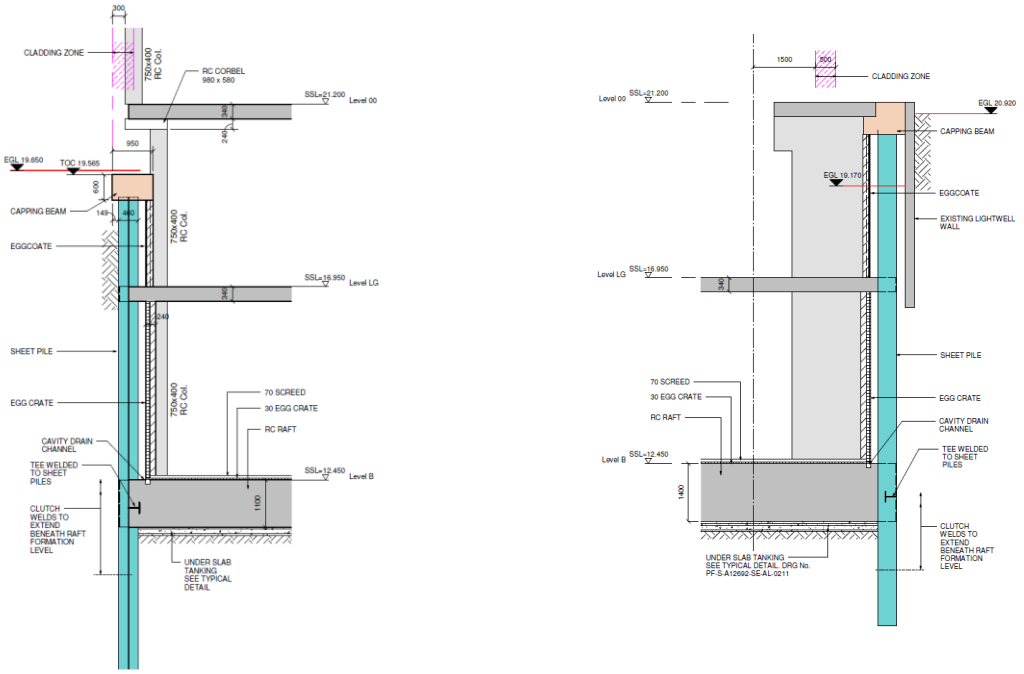
The existing building has a basement to much of its footprint and as such the new basement is partly to be constructed within and partly beyond the existing retaining walls. Highway bound parts of four sides of the site and the proposed basement would be constructed to one of two conditions depending upon the presence or not of an existing retaining wall to the site boundary:



Key

Denotes new retaining wall inside existing
Denotes new wall beyond existing structures

Figure 15: Notation of proposed basement edge conditions



Typical detail to street beyond existing basement

Typical detail to street within existing basement

Figure 16: Typical sections through proposed basement

As can be seen above the construction process of the new basement has been studied with close attention paid to the alignment of the new basement with existing.

To ensure retention of the highways and to prevent excessive ground movement damaging utilities in the pavement we have considered not only the retaining wall design but also the construction sequence in order to control ground movement. This design will then be presented to Camden Highways for approval of ground movements at the appropriate time prior to construction.

Question 13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?

In our initial desk studies of the site we obtained a number of existing drawings of The Computer Centre and from these were able to show that the existing building is founded on small cross section piles. The piles are working in friction within the London Clay and so taking bearing along the majority of their length in locations as below:

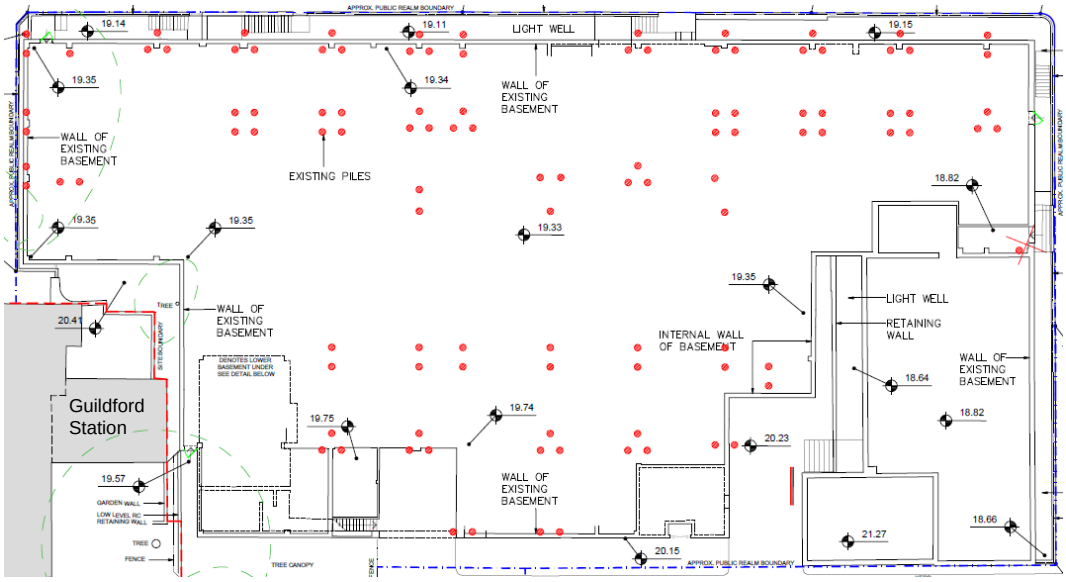


Figure 17: Existing foundation plan with existing piles in red

The new basement is intended to be founded on a raft foundation which will provide a basement 7m deeper than the existing building and lower than the likely foundation depth of the neighbouring building at 3 Guilford Street.

Formation of the new basement excavation will cause the base of the excavation to heave before the new building weighs the ground back down. Meanwhile the temporary works to the new retaining wall formation will lead to a slight relaxation of surrounding soil all of which will cause ground movements around the redevelopment. These effects are, however, calculable and well understood and with the aid of data collected during site investigations will be assessed for agreement with neighbours and highways before being monitored during site works for verification.

Approval of our proposed decision will then be reached via a Party Wall Award and in preparation we have already undertaken a ground movement study to ensure that vertical and horizontal ground movements affecting 3 Guilford Street are within the criteria set out in Boscardin, Cording and Burland's Classification which is commonly used in Party Wall Agreement.

7. STAGE 5 – REVIEW AND DECISION MAKING

The proposed basement and its construction has been carefully considered to take account of its surroundings and to defining the design performance required of them in use.

During construction the basement is planned to be formed of a new sheet piled wall which will be toed into the London Clay to form a cofferdam around the new basement. This will isolate the soil within the new basement to enable excavation from the surrounding soil and cut the shallow layer of Hackney Gravels off from the surrounding gravels which containing the perched water table. Once the soils within the sheet piled cofferdam have been cut off from the surrounding perched water it may be excavated in a dry environment with ground water initially removed through pumping.

Upon completion of bulk dig pumps will continue to remove any ground water penetrating the cofferdam. Before the retaining wall is sealed by welding of the sheet piles to one another. A new raft foundation will be constructed at its base with design and construction taking account ground movements and of the new building loads.

7.1 SUBTERRANEAN (GROUNDWATER) FLOW

The new basement is to be constructed over an aquifer but is only to be constructed with in the Hackney Gravels (a non-productive secondary aquifer) and not within the primary aquifer. The incursion into this perched water table is relatively small in volume and the temporary and permanent works will be designed so as to limit the flow rate of water through isolating the excavation from the perched water.

No water courses will be impacted as the nearby River Fleet has been shown to have been diverted into the local sewer system.

7.2 SLOPE STABILITY

The proposals will lead to some removal and pruning of trees which have been assessed by Simon Jones Associates and found to comply with national planning guidance. The tree works are also being discussed with Camden's Tree and Landscape Officer for agreement of the works.

The basement will be formed in a planned and controlled manner to install retaining walls, excavate soil and install new foundations and basement waterproofing to best practice. The foundations will be designed to deal with ground swell and heave so as to control movements of the proposed building and the formation of the basement will be undertaken with a full understanding of surrounding features such as:

- Perched ground water
- Highways
- Surrounding buildings

A temporary cofferdam will be formed from sheet piles to cut off ground water and to enable safe construction. It will then be progressively propped during bulk excavation to control ground movement of highways and neighbouring buildings before being welded into a continuous steel wall to prevent water ingress into the permanent basement. The base of the excavation will then be waterproofed with tanking below the raft foundation and a secondary waterproofing system will be provided via a drained cavity to reinforce the first barrier. To prevent floatation of the building in the long term a permanent state sub raft ground water drainage system is to be detailed below the raft. This will remove any significant water build up at this level cause by seepage around or through the sheet piles below raft level which could otherwise cause a large head of water to build up in the long term.

Throughout this process the predicted ground movements which will have been agreed with the relevant parties prior to the works will be correlated by site surveys of ground movement and party walls to reach actual movements and to correlate the with predictions. In so doing the proposed building works may be shown to avoid excessive impacts on water courses and neighbours.

8. APPENDIX

The following documents should be referred to as substantiation of this report:

- Phase 1 Geo-environmental desk Study, Pell Frischmann, 8 January 2014
- Factual Geo-Environmental Site Assessment, RSK, July 2014
- Detailed Unexploded Ordnance (UXO) Risk Assessment, 6 Alpha, 18 July 2014
- Arboricultural Implications Report, Simon Jones Associates, July 2014
- Flood Risk Assessment, Pell Frischmann, rev A, 8 August 2014