BASEMENT IMPACT ASSESSMENT

AT

2B COURTHOPE ROAD
CAMDEN, LONDON, NW3 2LB

FOR

Ms D MODI-SARDA

REPORT REF: DMS 3343

Engineering Geologists and Environmental Scientists

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May 2018

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Project	2B Courthope Road, Camden, London, NW3 2LB		
Client	Ms Divya Modi-Sarda		
Date	May 2018		
Version	Issue 1		
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EXECUTIVE SUMMARY

Site Location	2B Courthope Road, London, NW3 2LB
Site Description	New extension with basement to 2B Courthope Road
Historical Land Use	Open land with use as house garden after 1894 and use as an electricity sub station after 1974. No local historic or current industrial land use that could detrimentally affect the site.
Current Land Use	Former electricity sub station with hard cover.
Potential Contamination	Low Risk. Elevated cadmium, but no harm to humans as site will be hard covered.
Archaeological Potential	Low Risk.
Geology	London Clay with no overlying superficial deposits.
Hydrogeology	Non productive strata of the London Clay.
Hydrology and Flooding	Very low risk of flooding from seas and rivers.

Underground rivers	None that could affect the basement or be affected by the basement
Critical Drainage Areas	Within a CDA, not within Local Flood Risk Zone. Site Area never Flooded. Courthope Road not flooded in 1975 or 2002. Site specific FRA compiled by RAB Consultants in Appendix E.
Flooding from Surface Water	Low Risk
Flooding Incidents	None recorded in the vicinity of the site.
Flooding from Sewers	Low Risk
Flooding from Reservoirs	Very Low Risk
Flooding from Groundwater	Low Risk
SUDS	Ground not suitable for soakaways
Landfill and Radon gas potential	No landfill within 250m. Radon gas protection is not required.
Geotechnical Properties	London Clay has good bearing strength where unweathered for housing and has high to very high plasticity.
Extra hard cover	None. All areas are hard covered and will remain hard covered.
Groundwater	Local historic borehole indicate groundwater at >60m bgl. Groundwater seepage at 0.70m monitored and may be due to run off from services.
Concrete	Underground concrete to be designed to DS-2 due to selenite content of London Clay.
Ground Movement	Calculations to CIRIA 580 indicate a very slight Damage Category to neighbouring properties.
Monitoring Strategy	Party Wall Surveyor will undertake structural survey of adjacent properties and monitoring. Monitoring strategy is given in the SMS in Appendix D.
Waste Disposal	Waste disposal is responsibility of owner to ensure it is disposed appropriately to landfill. WACS tests indicate soil will be inert waste.
Tunnels	None recorded within 20m of the site boundary.
Structural design	The basement will be underpinned in sequence as per drawings in SMS in Appendix D.
Bearing Capacity	The London Clay has an allowable bearing capacity of 120kN/m2. Vertical dead load exceeds the uplift force therefore the building will be stable.
Retaining walls	Calculations for bearing capacity, heave and retaining walls are presented in the SMS in Appendix D.
Programme	A Construction Programme is presented in the SMS in Appendix D.
Conceptual Model	A Conceptual Model is presented in Appendix F.

The development of the basements, provided they are constructed competently, will not harm neighbouring properties or have any significant effects on the stability or bearing capacity of adjacent land generally.

The development of the basements will not harm the water environment or ground permeability, will not have a cumulative impact on the water environment or flooding.

The development, provided it is constructed competently, will not impact on the structural stability of the property. The development will not detrimentally affect biodiversity.

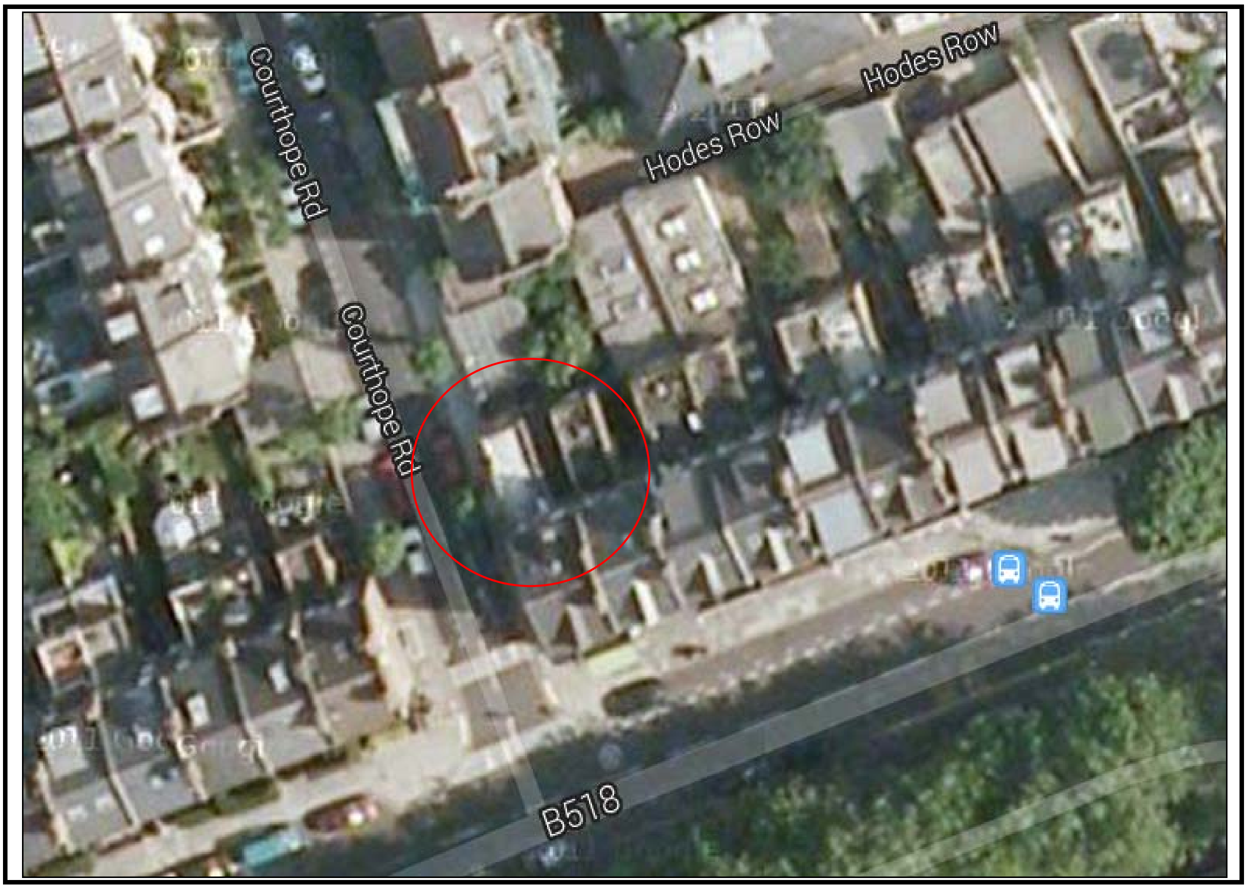
The damage category for the neighbouring building is very slight.

Risks include a seepage of groundwater in the London Clay and monitoring should be undertaken before construction.

Recommendations include:

- The basement floor should be constructed at the similar level to the adjoining building.
- The building should be constructed on reinforced concrete pins with a raft slab foundation.
- Underpinning to 2-4 Courthope Road to the lower ground level.
- Temporary propping of excavations.
- Monitoring of adjacent buildings during construction.
- Party Wall Surveyor to be employed.
- Service Drawings to be obtained.
- Compressible material beneath basement slab to accommodate heave.
- Foundation stratum to be London Clay.
- Finished floor levels should be set no lower than 150mm above ground level.
- Proposed basement should be tanked and waterproofed to the height of the finished ground floor levels.
- The basement must provide internal access to higher ground.
- The basement must include a positive pumped device such as a sump pump, in line with the 2017 London Borough of Camden Basement Planning Guidance. There are two already in place in the existing building..
- A non-return valve should be installed at the foul water sewer manhole serving the property.
- Surface water should be managed by the use of SuDS where practicable.

In conclusion, the research and fieldwork undertaken for the Basement Impact Assessment indicate the site is suitable for development of living quarters in the basement, provided the recommendations are undertaken.



1. INTRODUCTION

This report describes the results of a Basement Impact Assessment undertaken for a development on the site of the former electricity sub-station site adjacent to the rear garden of 62 Mansfield Road, and known as 2B Courthope Road, London, NW3 2LB. It is proposed to develop a single storey house with basement. The work was undertaken on behalf of Ms Divya Modi-Sarda and was carried out by the Ashton Bennett Consultancy. Plans of the proposed development including the basement are provided in Appendix A.

The purpose of this Report is to ascertain the potential impacts that the proposed basement may have on the ground stability, the hydrogeology and the hydrology in the vicinity of the site. In addition, the Report includes a Structural Method Statement, Construction Method Statement and monitoring strategy by Martin Redston Associates and a Flood Risk Assessment by RAB Consultants in the Appendices.

The site lies within the Administrative Boundary of Gospel Oak within the London Borough of Camden. The assessments were carried out in general accordance with the London Borough of Camden Development Policy 27 “Basements and Lightwells” and Camden

Planning Guidance 1 "Design Note prepared by London Borough of Camden for New Basement Development and Extensions to Existing Basement Accommodation" (LBC, 2010) and Camden Planning Guidance Basements March 2018.

As stated in Camden Development Policy DP27 paragraph 27.1, LB Camden "will only permit (basement and other underground development that) does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability".

The approach followed in this report is to initially provide a full site characterisation by a desk study of available geological, hydrological, hydrogeological, environmental and historical and topographic information together with a site visit. The screening indicated that an intrusive ground investigation was required to establish ground conditions. The Basement Impact Assessment (BIA) is provided in full and is undertaken in general accordance with the recommended methodologies highlighted in Arup document "Guidance for Subterranean Development", prepared for the London Borough of Camden.

The approach taken comprises of:

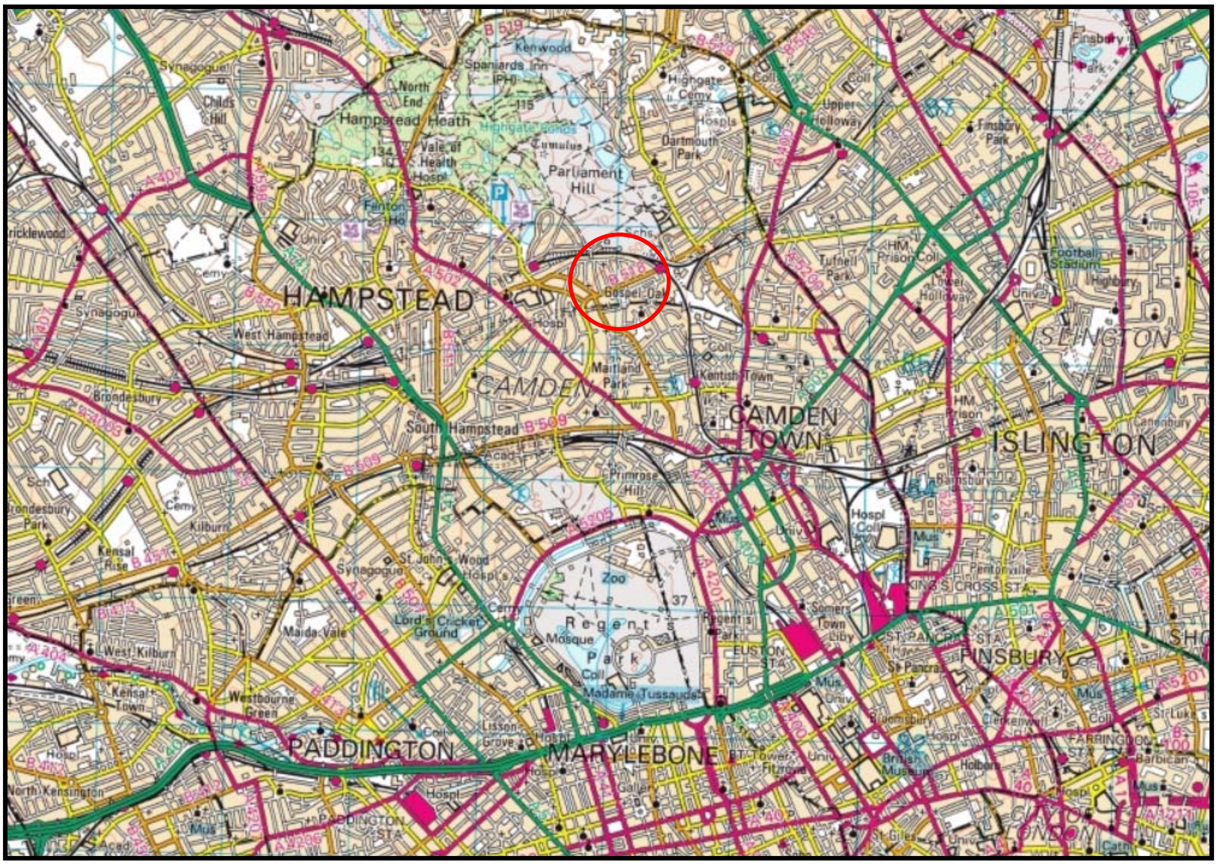
- Screening – Identification of matters of concern using checklists.
- Scoping – Definition of the matters of concern identified in the screening.
- Site Investigation and Study – Establishment of the baseline conditions.
- Structural Method Statement, Construction Method Statement and monitoring strategy
- Ground Movement Calculations
- Flood Risk Assessment
- Impact Assessment – Determination of the impact of the proposed basement on the baseline conditions.
- Review and decision making – Undertaken by London Borough of Camden.

2. THE SITE

2.1 Site Description

The site is located at number 2B Courthope Road, Hampstead, London NW3 2LB, which is located to the north west of London City Centre in the London Borough of Camden. The site lies adjacent to the house of 62 Mansfield Road to the south and 2 to 4 Courthope Road to the north. A site walkover was undertaken on 19th February 2014 during intrusive works to collect soil samples. At this time the site was occupied by an electricity substation surrounded by hard cover. Photographs taken during the site walkover are presented in Appendix C.

The site area formed the location of an electricity substation to the rear garden of No 62 Mansfield Road, London NW3 2HU. The site is hard covered with gates leading onto Courthope Road. It is proposed to construct a single storey house comprising a ground floor and a basement. The ground floor will comprise a kitchen, living/dining and toilet and the basement will comprise 2 bedrooms a bathroom and study. The building will be set back from the existing boundary to accommodate a lightwell. The site is 76m^2.



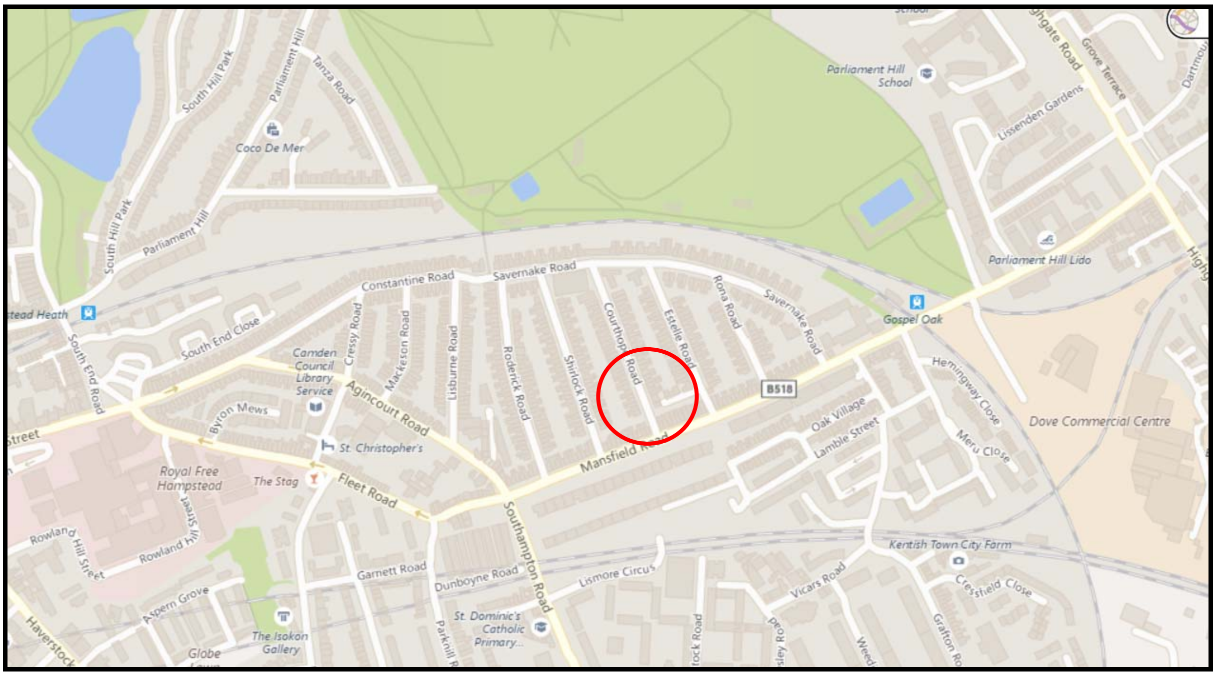


Figure 1 Site Location Plans

The site is bounded to the north by a 2metre high brick wall with 2 to 4 Courthope Road beyond and further residential properties beyond that. The site is bounded to the west by Courthorpe Road with residential properties beyond. The site is bounded to the south by 62 Mansfield Road property with Mansfield Road beyond and residential flats looking onto Mansfield Road beyond that. The site is bounded to the east by a 2metre high brick wall with residential garden and patio areas beyond.

All land on the site was relatively flat. The ground level is generally level with the pavement, and level with the side access and rear garden.

Roof drainage from the existing property is taken via down pipes into a drainage system in the front of the property which is understood to run northwards collecting drainage from the adjoining properties.

There are no lawn areas which would allow infiltration of rainwater into the ground.

The site lies around National Grid Reference 527984^{E}, 185513^{N} at a height of around 45m above Ordnance Datum. Site Location Plana are presented as Figure 1 and a Site Plan is presented as Figure 2. The Site Façade is presented as Figure 3 and the New Build 2B Courthope Road as Figure 4. The Proposed Front, Side and Rear Elevations are presented as Figure 5 and Proposed Block Plans as Figure 6. Proposed Floor Plans are presented as Figure 7 and Proposed Front Elevations with Section A-A' are presented as Figure 8.

A Ground Workings Plan is presented as Figure 9 and Current Industrial Land Use as Figure 10. EA Landfill Sites within 250m is presented as Figure 11 and a Geological Plan as Figure 12. A Landslip Plan is presented as Figure 13 and a Local Boreholes Plan as Figure 14. Site Hydrogeology is presented as Figure 15. Course of River Westbourne is presented as Figure 16A and Plan of Surface Water Floods as Figure 16B. Figure 17 is a Flooded Roads from 1975 to 2002 Plan and Figure 18 presents a NW Storm Relief Sewer Plan. EA Flood Risk from Reservoirs and from Groundwater Maps are presented as Figures 19 and 20 respectively. A Borehole Location Plan is presented as Figure 21.

Proposed Plans are presented in Appendix A and Archival Maps are presented in Appendix B. The Ground Investigation including borehole logs, geotechnical and environmental test results are presented in Appendix C. Structural Method Statement, Construction Method Statement and Monitoring Strategy are presented by Martin Redston Associates in Appendix D and a Flood Risk Assessment is presented by RAB Consultants in Appendix E. A Conceptual Model and Ground Movement Calculation Methodology are presented in Appendix F.

Figure 2 Site Plan

Figure 3 Site Facade

Figure 4 New build 2B Courthope Road

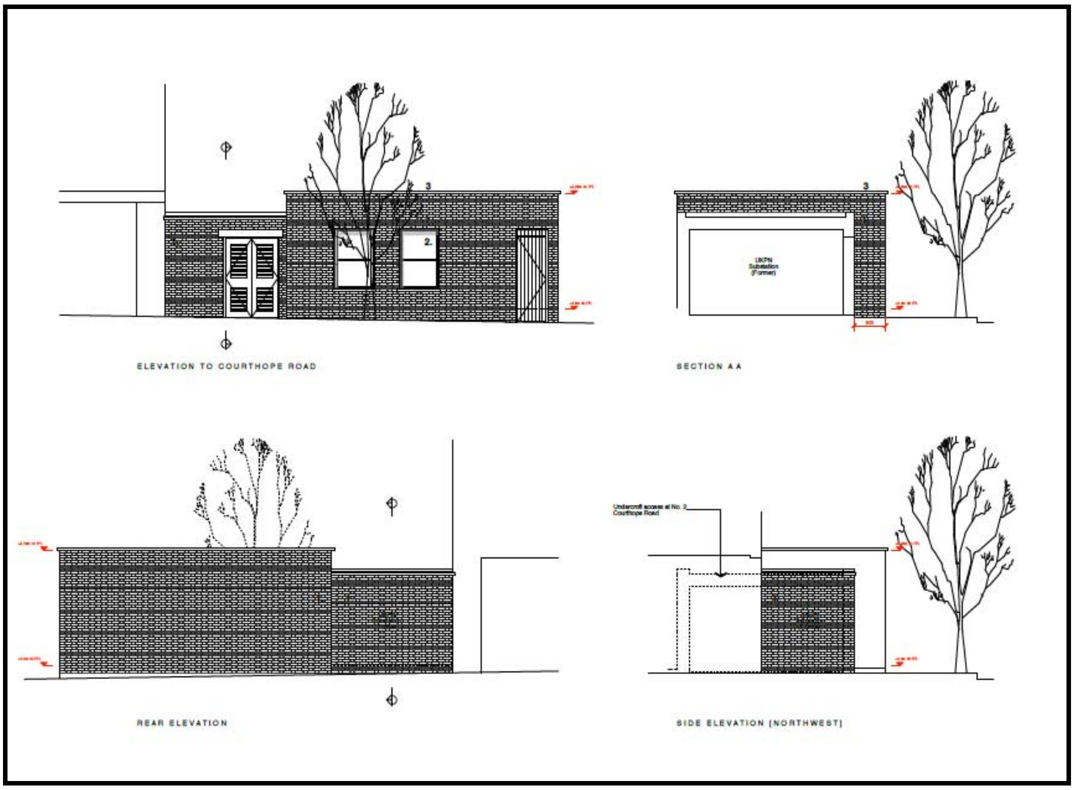


Figure 5 Proposed Front, Side and Rear Elevations

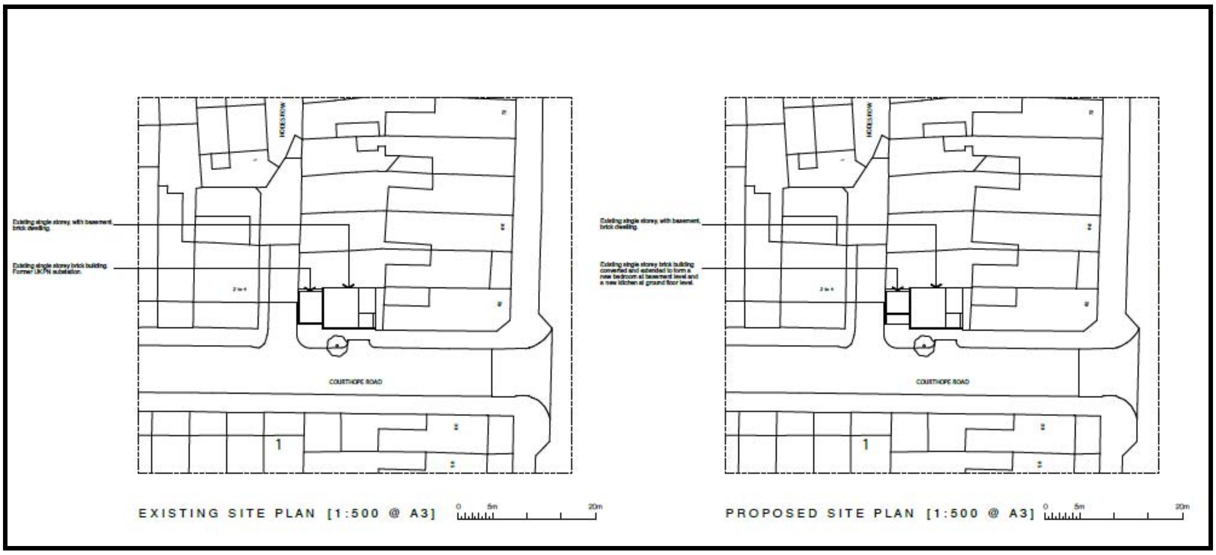


Figure 6 Proposed Block Plans

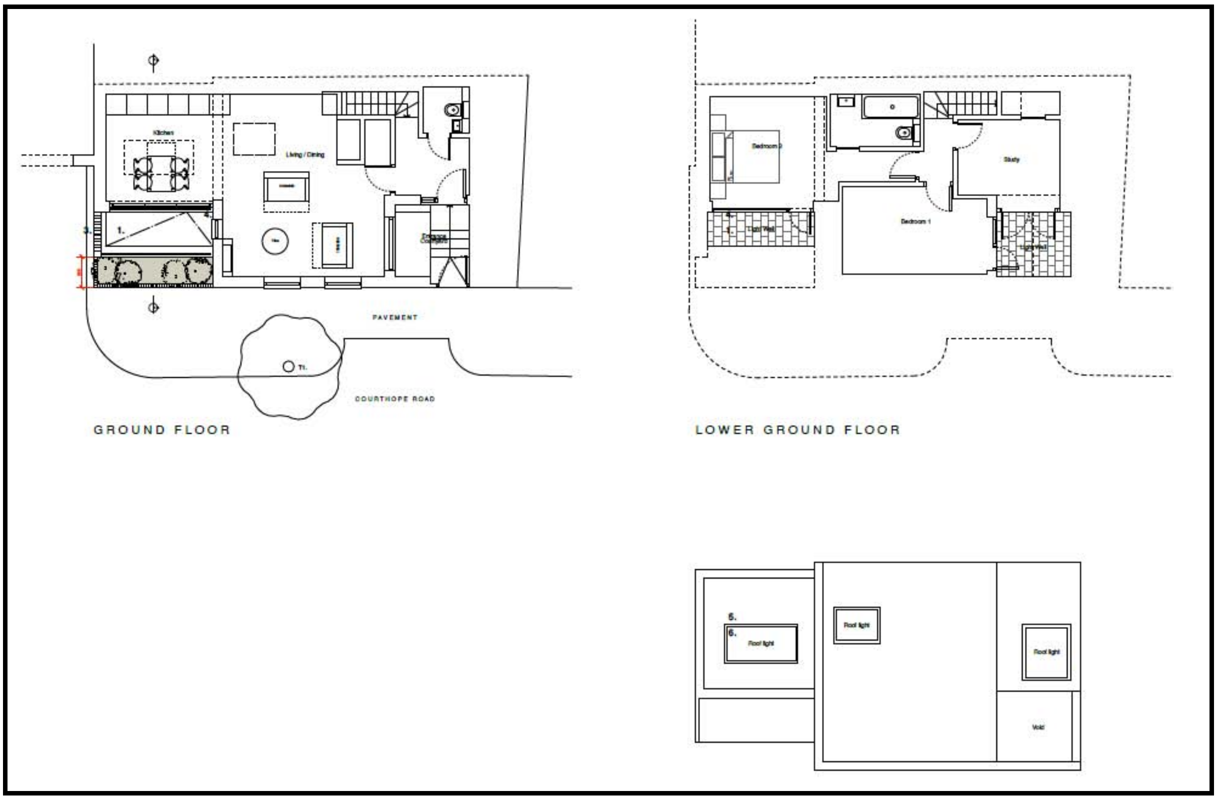


Figure 7 Proposed Floor Plans

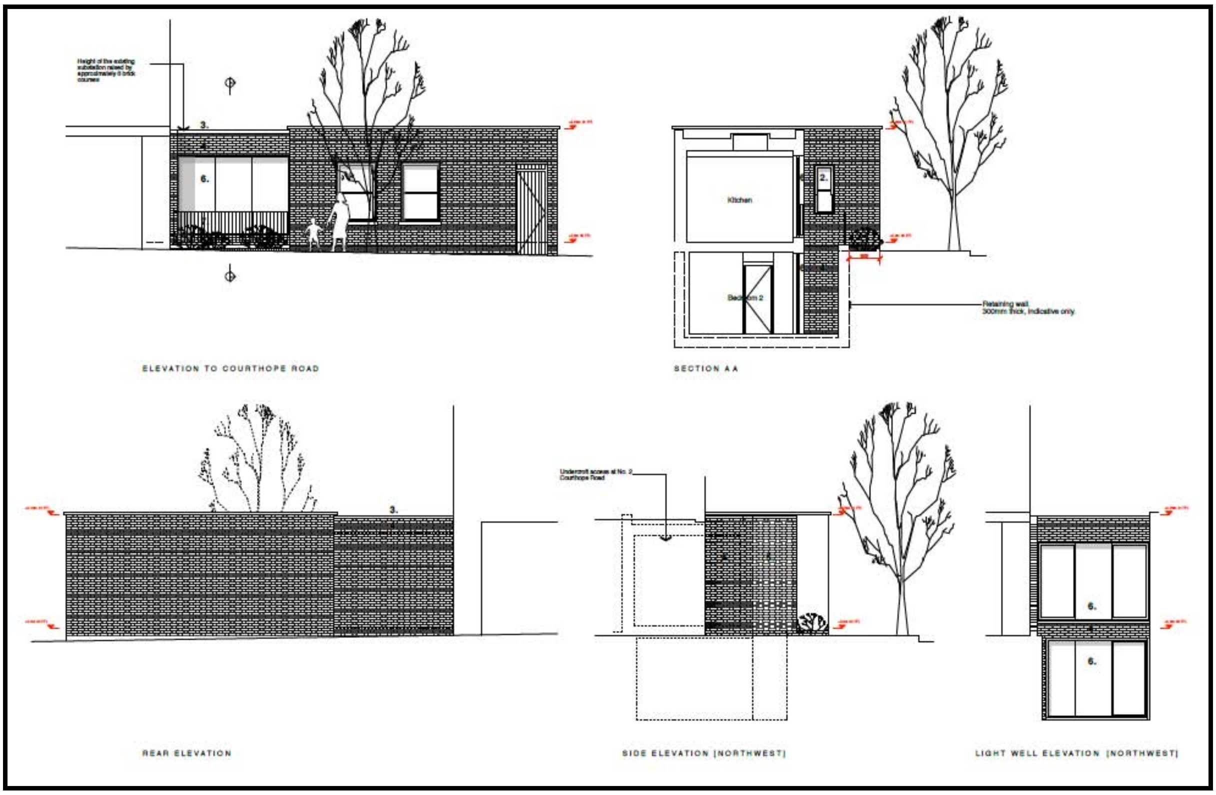


Figure 8 Proposed Front Elevation and Section A-A’

3. HISTORY, HISTORIC MAPS, HISTORIC AND CURRENT LAND USE

3.1 History

The history of the site is that it lay as open ground until 1894 when it became the garden to 62 Mansfield Road. From 1974 an electricity sub station is annotated on the site. This is now disused and will be demolished.

3.2 Historic Maps

The following maps and plans were inspected to assess the history of the site and its past environments. The maps are presented in Appendix B.

TABLE 1
Historical Maps Inspected

DATE	SCALE	DESCRIPTION	
		SITE	SURROUNDING AREA
1866-69	1:10,560	The site is open land	Mansfield Road located immediately south of site. Residential properties to the south of site. Railway lines surrounding site to south, north and north east.
1872-3	1: 1,056 & 1: 10,560	No visible change to the site area.	No change to the surrounding area.
1879-84	1:10,560	There is no significant change to the site area.	The surrounding area remains largely unchanged during this time.
1894	1:1,056 & 1:10,560	Site area now acts as land behind newly constructed 62 Mansfield Road.	The surrounding area has been constructed as residential, including 62 Mansfield Road, immediately south of site area. Hospital annotated to the west of site and reservoir to the north west and far north.
1896	1:2,500	No significant change.	Garden allotments shown to the north east of site. Air shafts annotated to the far south west of site.
1915-6	1:2,500	No significant change.	Garden allotments to the north east of site have been replaced by a school.
1920	1:10,560	No significant change.	No significant change.
1936 & 1938	1:2,500 & 1:10,560	A small structure been constructed in the site area, extending to the north.	The surrounding area remains largely unchanged. A timber yard is annotated to the south east of site.
1948-9	1:10,560	No significant change.	No significant change.
1952 1952-3	1:1,250 and 1:2,500	No significant change.	No significant change to the surrounding area.
1957-58	1:10,560	No significant change.	No significant change to the surrounding area.
1965-68	1:2,500 & 1:10,560	No change to the site area.	The timber yard to the south east of site no longer exists. Various engineering works annotated to the west of site. a depot and shaft are annotated to the east of site.
1973-4	1:10,000	No significant change.	No significant change.
1974-8	1:2,500	An electricity sub station is annotated on the site.	Extensive redevelopment to the south of the site including residential, commercial and industrial premises.
1991	1:2,500	No significant change.	No significant change.
1991-5	1:2,500	No significant change.	No significant change.
2002	1:1,250	No significant change.	No significant change.
2012	1:1,250 and 1:10,000	No significant change.	No significant change.

In summary, the site was occupied by open land until around 1974 when an electricity sub station is annotated as occupying the site. The site is hard covered.

3.3 Historic Land Use

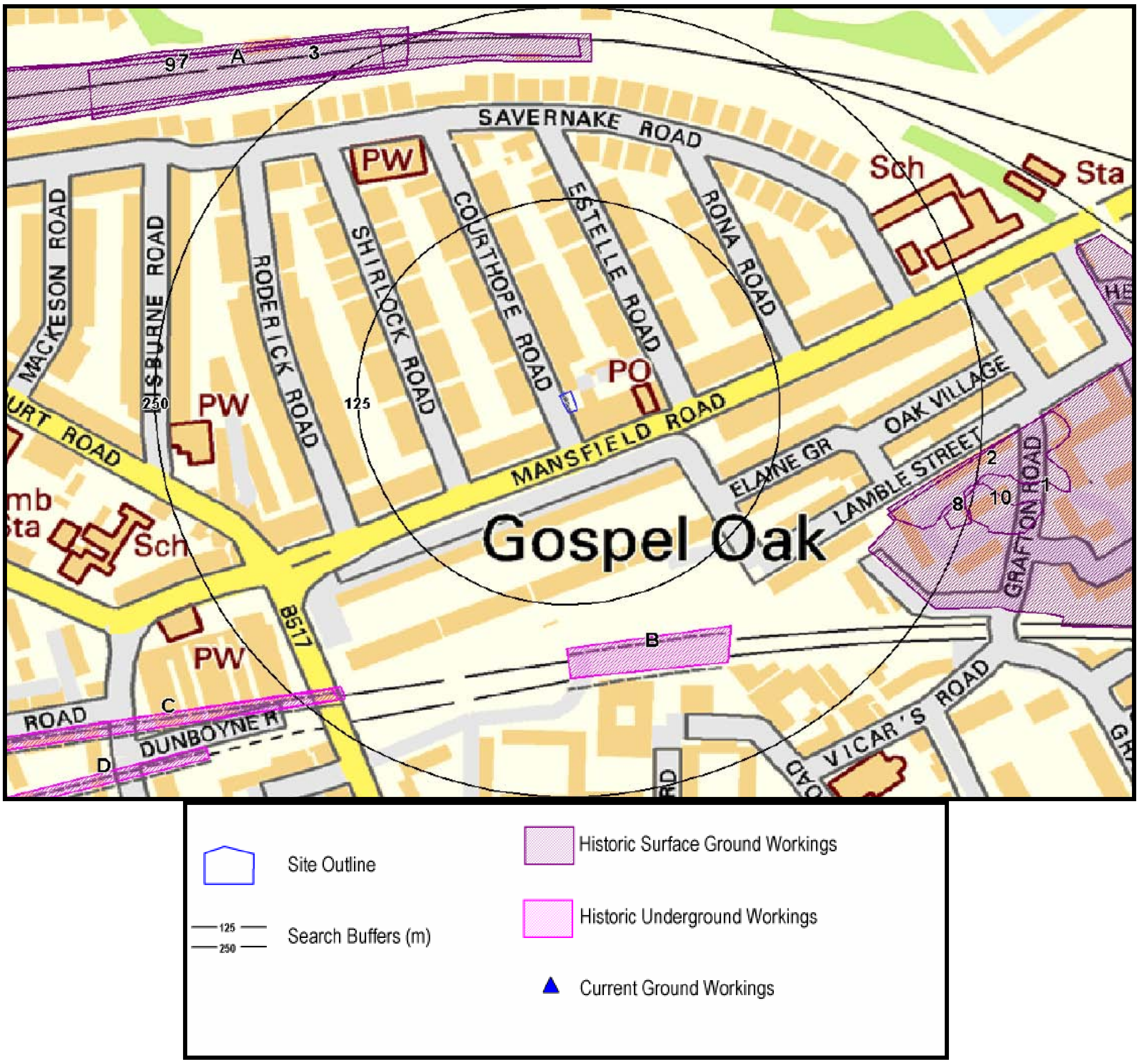


Figure 9 Ground Workings Plan

Local ground workings include brickworks at 201m south east, unspecified workings at 202m east, railway cuttings at 214m north, north west and a pond 244m east. There are underground workings at 152m south, 227m south west, 231m south west, 312m south west in the form of tunnels. These are at a distance from the site where they are unlikely to detrimentally affect the site.

Historic land use includes an electricity sub station on the site, and railway land to the north and south.

3.4 Current Industrial Land Use

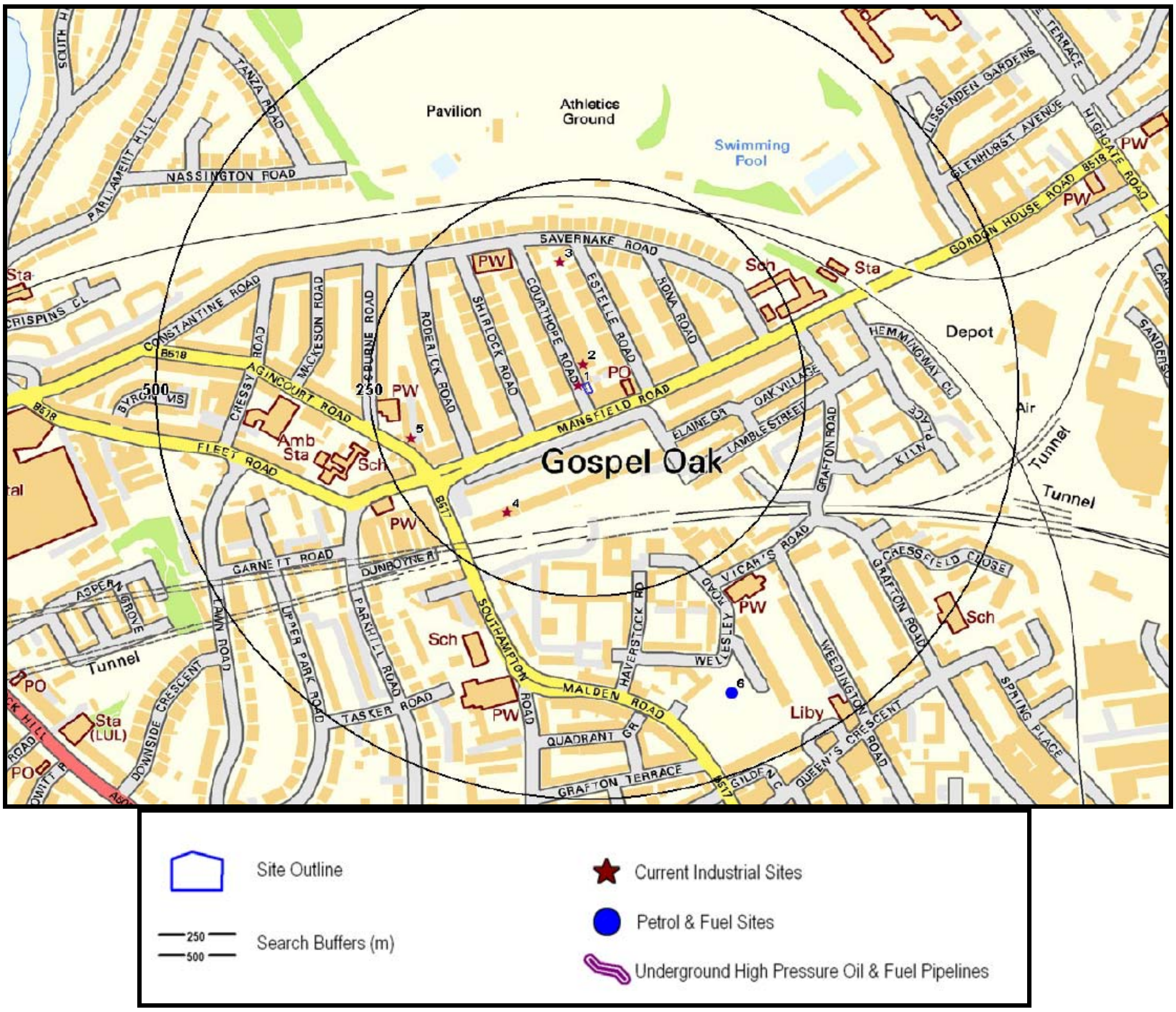


Figure 10 Current Industrial Use

Current industrial uses include a former electricity sub station on site, Grapevine Publishing Ltd at 23m north, Electricity substation at 152m north, The Floorrester Construction Services 174m south west and Cognetix Ltd Electronic Equipment at 212m west of the site.

There are no petrol fuel stations within 250m of the site. There are no underground high pressure oil or gas pipelines within 500m.

4. LANDFILL

According to the Environment Agency there are no landfill sites within 250m of the site and therefore the site does not require monitoring for landfill gas and does not require landfill gas protection in construction of the basement.

There is a very low risk that the site is affected by radon gas and as such, radon protection measures will not be required in the basement as part of the proposed development.

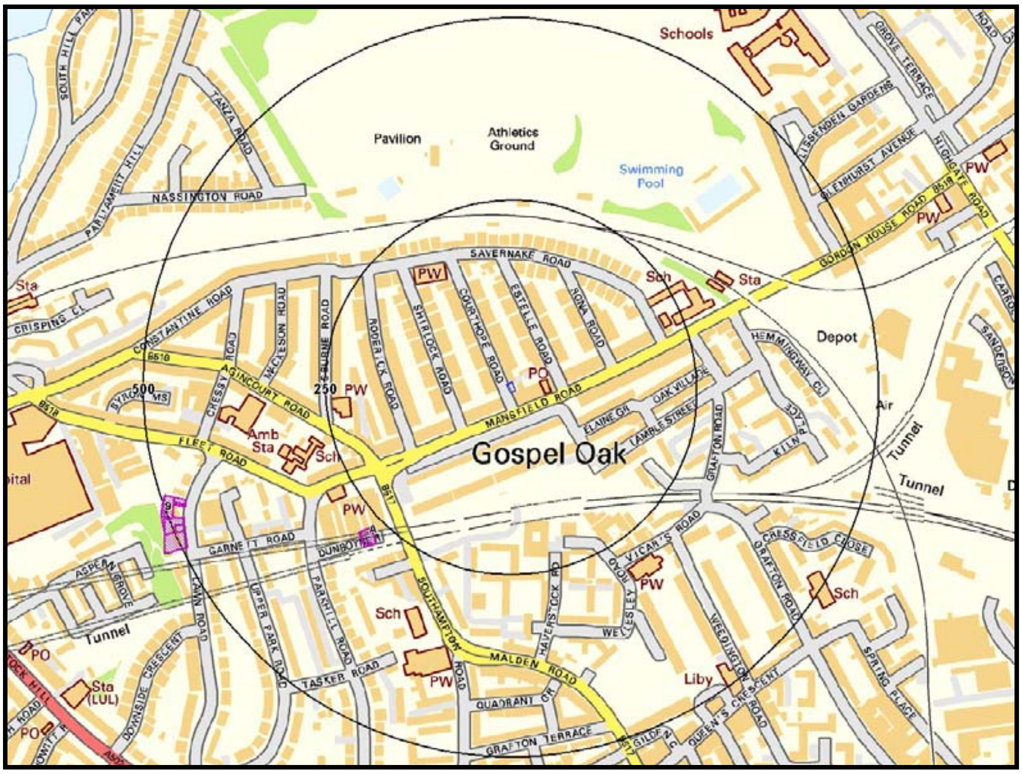


Figure 11 EA recorded Landfill Sites within 250m

5. REGULATED INDUSTRIES

Results of searches for regulated industries are presented in Table 2.

TABLE 2
Authorisations, Incidents and Registers

Regulated Industry	On SITE	Within 250m	DETAILS
Historic IPC Authorisations	None	None	-
Part A(1) and IPPC Authorised Activities	None	None	-
Water Industry Referrals	None	None	-

Records of Red List Discharge Consents	None	None	-
Records of List 1 Dangerous Substances Inventory Sites	None	None	-
Records of List 2 Dangerous Substances Inventory Sites	None	None	-
Records of Part A(2) and Part B activities and enforcements	None	None	-
Records of Category 3 or 4 Radioactive Consents	None	None	-
Records of Licensed Discharge Consents	None	None	-
Records of Planning Hazardous Substance Consents and Enforcements	None	1	-
Records of COMAH and NIHHS sites	None	None	-
Records of National Incidents Recording System List 2	None	1	-
Records of National Incidents Recording System List 1	None	None	-
Records of sites determined as contaminated land under Section 78R of EPA 1990	None	None	-
Records of Made Ground	None	None	-
Records from EA landfill Data	None	None	-
Records of Operational Landfill Sites	None	None	-
Records of EA historic landfill sites	None	None	-
Records of non operational landfill sites	None	None	-
Records of local authority landfill sites	None	None	-
Records of operational waste treatment, transfer or disposal sites	None	None	-
Records of non operational waste treatment, transfer or disposal sites	None	None	-
Records of EA licensed waste sites	None	None	-
Current Industrial Land Use	None	9	5m west and 152m north of site, Electricity Sub Station. 23m north of site. Grapevine Publishing Ltd. 174m south west of site. The Floorrestor er. Construction Completion Services. 212m west of site. Cognetix Ltd. Electronic Equipment.
Petrol and Fuel Sites	None	None	334m east of site Fulwood Express, Esso
Underground High Pressure Oil and Gas Pipelines	None	None	-
Residential Property (within 250m)	Yes	Yes	Residential and commercial
Radon Protection Required	No	-	The property is not in a Radon Affected Area, as <1% of properties lie above action level.

In summary, results of searches for regulated industries, pollution incidents or registered authorisations presented in Table 2 above indicate that potentially contaminative land uses are not present on and within close vicinity to the site and there are no records of an environmentally sensitive nature which could be detrimentally affected by the construction of a basement. An electricity substation was present on the site in recent years.

6. POTENTIAL CONTAMINATION & ARCHAEOLOGY

With the exception of made ground that may have been associated with the past residential development on the site and in the surrounding area, the research and historical map search has not identified any potential sources of contamination or archaeological features that could be present on the site.

A search of environmental databases via an EnviroInsight report (provided by Centremaps) did not reveal any offsite sources of contamination that are considered likely to pose a risk to the site and the proposed development. However, in the interests of Health and Safety the soil was screen tested for contamination at three locations and the results are presented in Section 11.6.

7. SITE GEOLOGY

7.1 Geology

The published 1:50,000 scale British Geological Survey (BGS) geological map of the area (Sheet 256 “North London”) shows the site to be underlain by the London Clay Formation of the Eocene geological epoch. An extract of the BGS Geological Map is provided in Figure 12 below.

The London Clay is shown not to be overlain by any superficial deposits. Given the historical development of the site and surrounding areas, there may be made ground present on the site.

The London Clay comprises medium to high strength silty clay with thin bands of siltstone and selenite crystals.

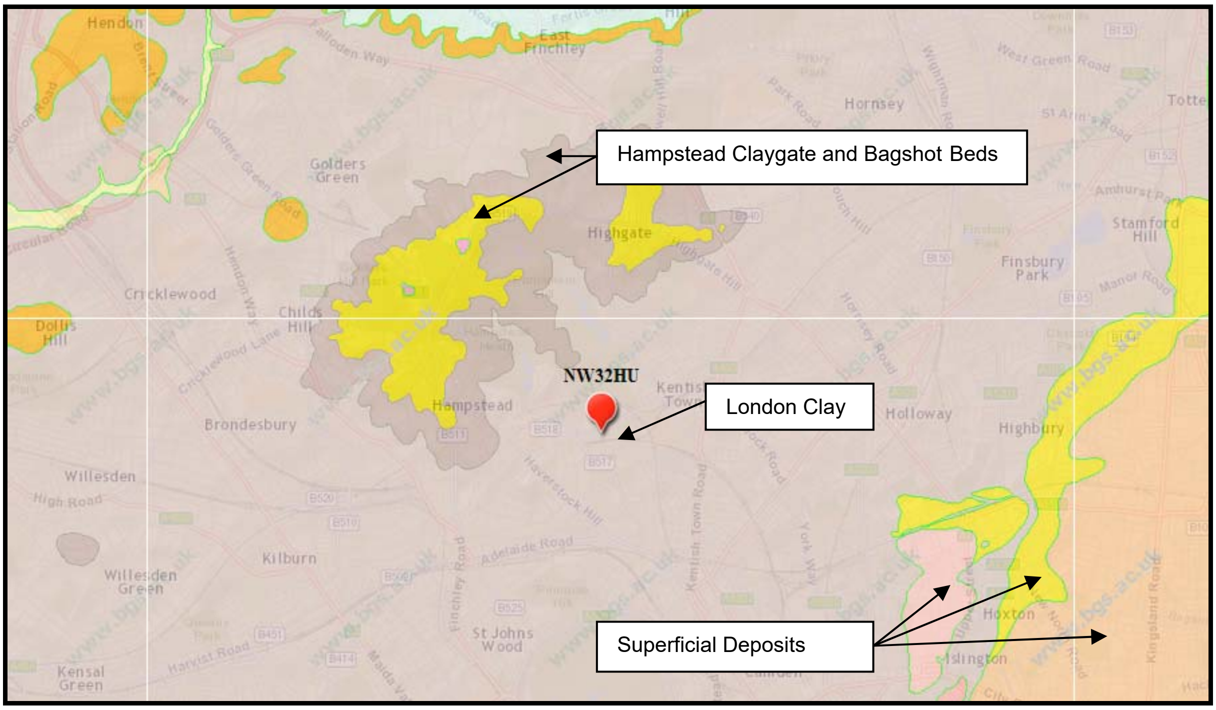


Figure 12 Geological Plan

No geological faults are shown to be present within close proximity to the site.

7.2 Mining

There is no evidence of past or present mining or quarrying activity in the vicinity of the site. The site does not lie in a mining area for coal, tin, gypsum, stone or other recorded mineral works.

7.3 Landslips

The site is shown not to be within an area of significant landslide potential as shown in Figure 13 Landslip Plan. (reference Figure 17 of Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010). This is reinforced by the very low slope angles recorded during the site walk over and the geology of the London Clay with no overlying deposits.

The slopes identified on the map immediately north and south of the site are within the railway corridor and too distant to detrimentally affect the site.

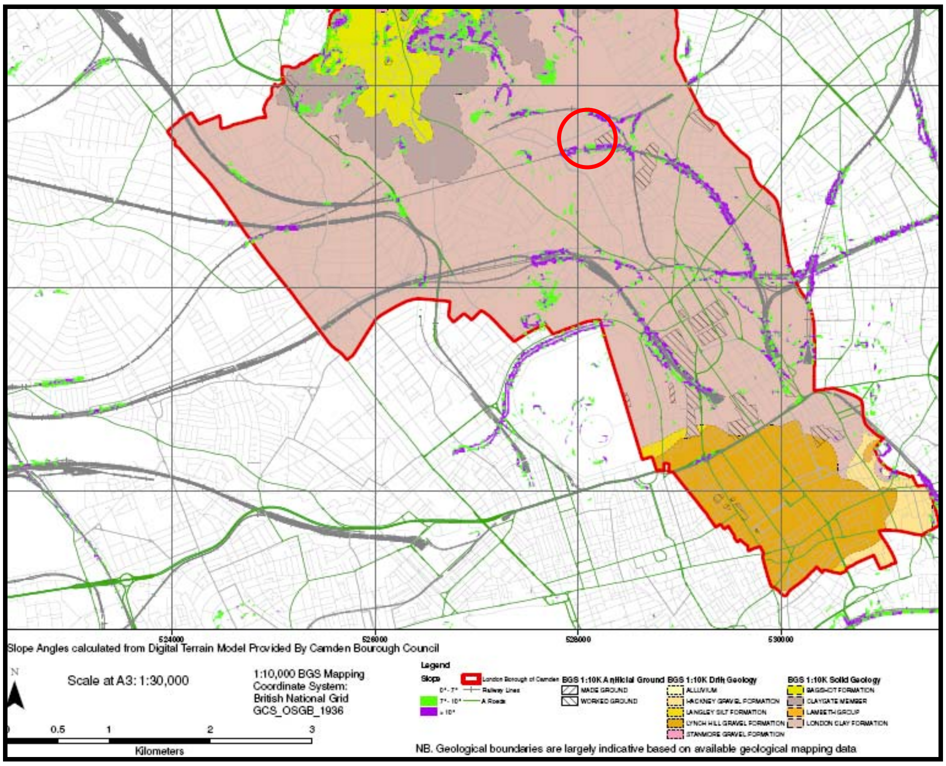


Figure 13 Landslip Plan

7.4 Local Boreholes

A number of relevant available historic borehole logs have been obtained from the BGS website and are summarised in Table 3 below. A plan showing the available local borehole locations is presented in Figure 14.

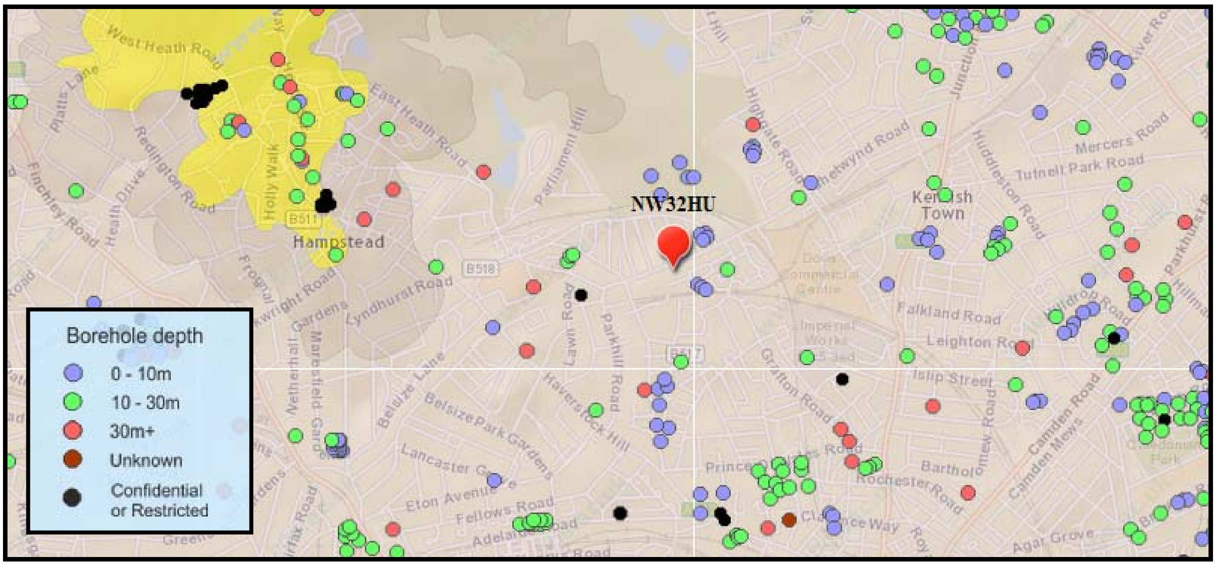


Figure 14 Local Borehole Plan

TABLE 3
Summary of Historical Borehole Logs

BGS Reference	Distance from Site	Brief Summary of Ground Conditions	Depth to water in m bgl
TQ28NE 31/A	235m	Made ground to 4m, London Clay 4m to 10.7m	-
TQ28NE255	100m	Made Ground 0.25m London Clay to 1.90m	DRY
TQ28NE14	336m	London Clay GL to 69m,Woolwich and Reading Beds 69m to 90.60m, Thanet Sands 90.60m to 98.90m, Chalk 98.90m to 285m, Gault 285m to 339m, Old Red Sandstone 339 to 396m	64m
TQ28SE1490	575m	London Clay/Woolwich and Thanet Sands to 95m Chalk 95m to 118.87m	-
TQ28NE277	612m	London Clay GL to 69m, Woolwich and Reading Beds 69m to 90m, Thanet Sands 90m to 101m, Chalk 101m to 177m	95.65m

These boreholes confirm the geology of the area surrounding the site and confirm that the local water abstraction wells are from generally >60m depth into the Thanet Sand and Chalk aquifers.

8. HYDROGEOLOGY

The above referenced geological map indicates the site to be underlain by the London Clay Formation, which is relatively impermeable. The Environment Agency have designated the London Clay Formation beneath the site as an “Unproductive Aquifer” which means the strata has a low permeability and negligible significance to water supply or base flow to rivers. Permeability of the London Clay varies from 5 x10^{-6} to 1 x10^{-10}m/sec.(BS 8004, 1986). The site does not lie on a Groundwater Vulnerability Zone.

The natural soils underlying the site are likely to comprise a superficial covering of made ground (potentially absent) overlying weathered London Clay (clay soils). The London Clay soils have very low permeability and do not readily permit the downwards transfer of surface water or percolating groundwater.

The development of a basement is unlikely to detrimentally affect any groundwater which lies circa 60m bgl in the Chalk Aquifer. There are no Superficial Deposits overlying the London Clay which could hold perched water.

There are no groundwater or potable water abstraction licences within 1300m of the site. The site does not lie within a Source Protection Zone for a potable water supply.

Other unrecorded or unlicensed wells may be present close to the site, however abstractions are unlikely to be from the London Clay Formation and likely to be from the underlying Chalk Formation at circa >60m bgl. The development is unlikely to detrimentally affect any water abstractions.

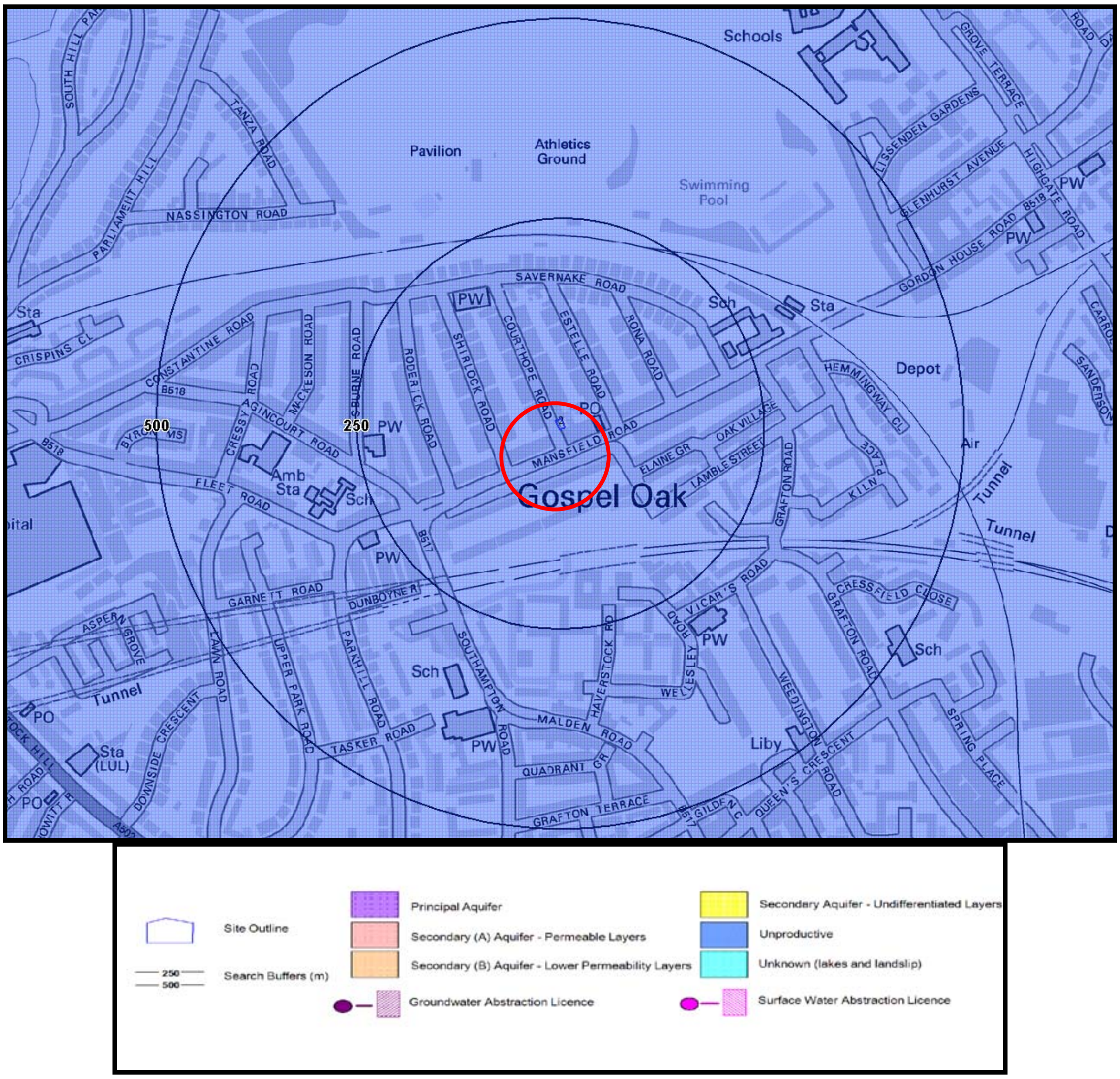


Figure 15 Hydrogeology Plan

9. HYDROLOGY AND FLOOD RISK

9.1 Hydrology

Prior to the commencement of the redevelopment of the site, the rainfall over the area of the site drains in one of the following ways:

- Surface water from the rear roof drains into the drainage system via underground pipes leading to the front of the site.
- Surface water from the front roof drains into the drainage system that runs under the front area and to the north east of the site.
- Surface water from the rear yard drains into surface drains.

On completion of redevelopment the rainfall will drain in the same manner. The area of new build will not extend further than the existing concrete cover and paved areas.

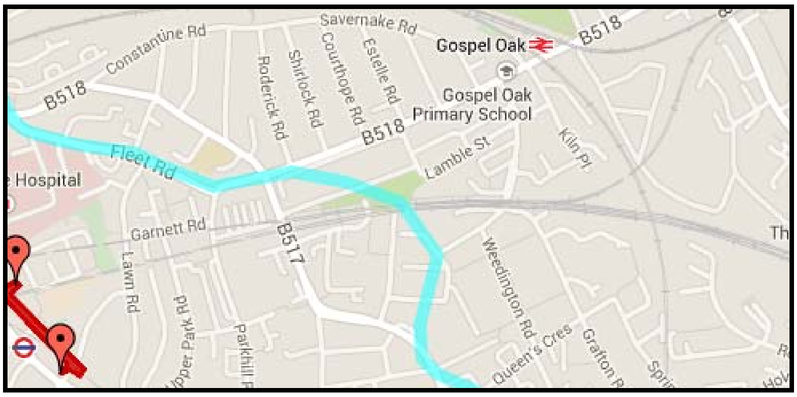


Figure 16A River Westbourne

Investigation undertaken as to the original route of the River Westbourne confirms that it lies at a distance from the site where it is unlikely to detrimentally affect the site as shown on Figure 16A. This evidence is from 'Lost Rivers of London' by Nicholas Barton. The river is now culverted as the NW Relief Sewer.

There are surface water features within 760m of the site, the closest being the ponds on Hampstead Heath to the immediate north and north west. An underground river flows from these ponds in the north west across Constantine Road and eastwards along Mansfield Road and turns south eastwards adjacent to and south of the site. This river adjoins an underground river from the eastern ponds on Hampstead Heath and becomes the River Fleet to the south of the site. The river is not culverted beneath the site and unlikely to be detrimentally affected or to detrimentally affect the development of the site.

There are no biological river quality assessments within 1.5km of the site. There are no surface water abstraction licences within 1.5km of the site.

9.2. Flood Risk From Surface Water

Mansfield Road is shown to have been affected (flooded) by the 1975 floods but not by the 2002 floods (reference Figure 15 of Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010). The flood risk was alleviated by the NW Storm Relief Sewer constructed in 1987. Courthope Road is not recorded as flooded on either dates.

There is a very low risk of the site being flooded from surface water and a higher risk that Courthope Road could be flooded by surface water.

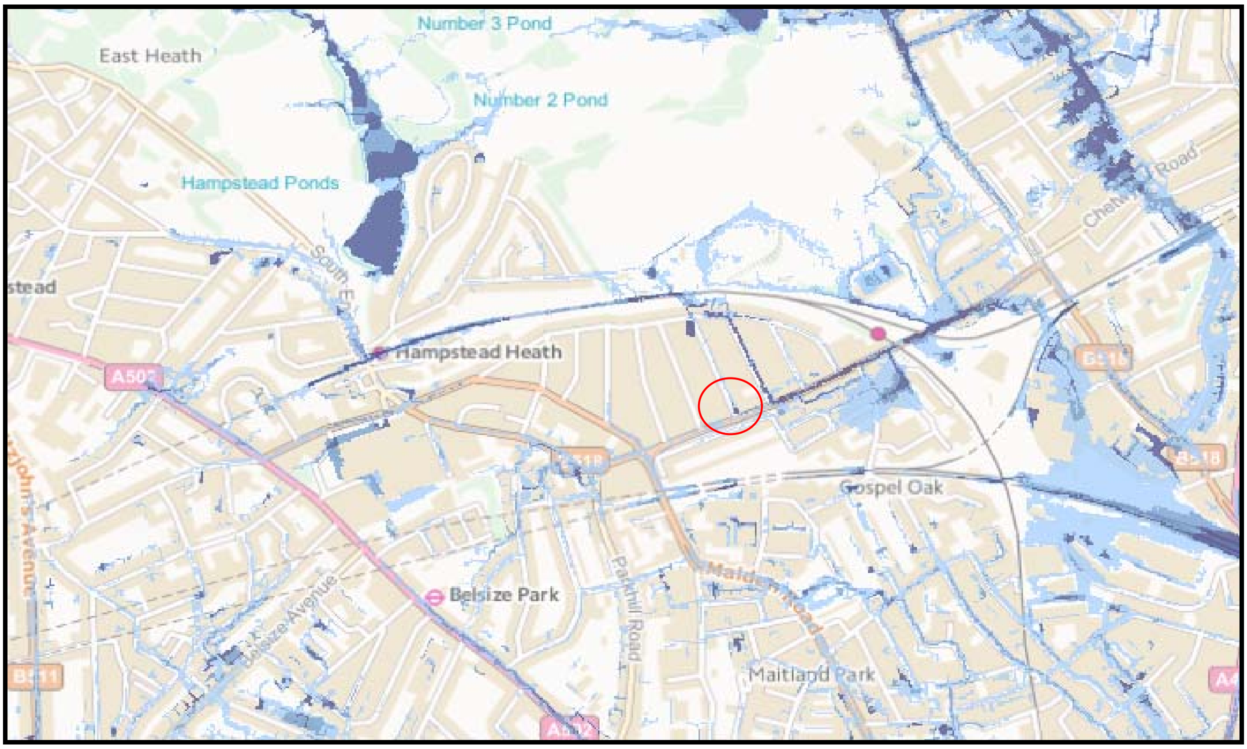


Figure 16B Surface Water Flood Risk

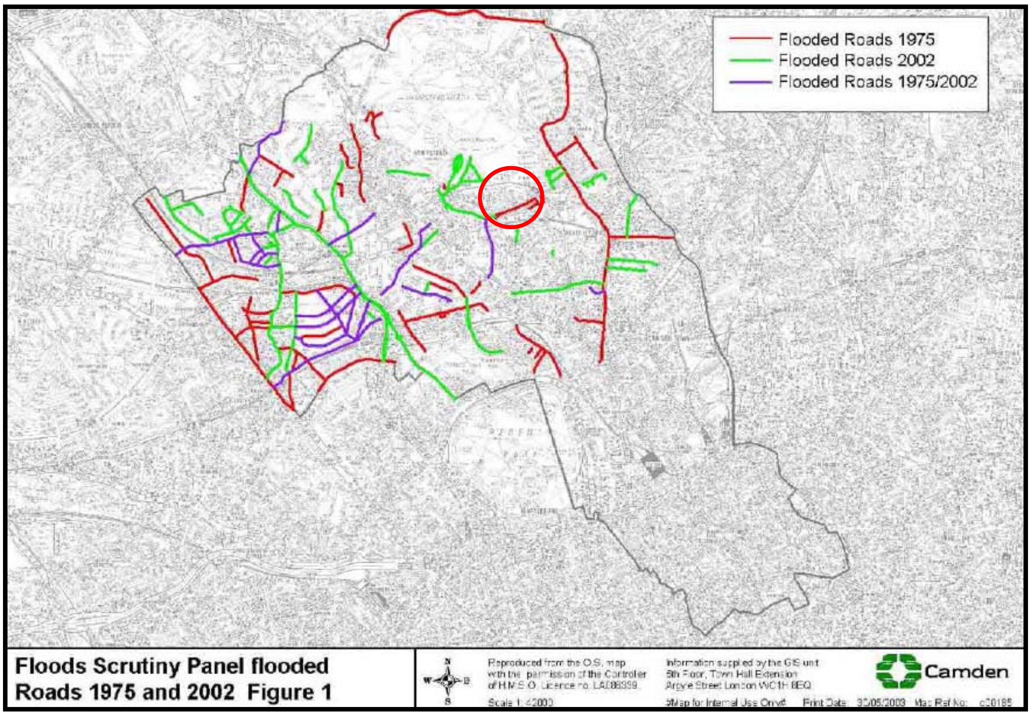


Figure 17 Flooded Roads 1975 and 2002

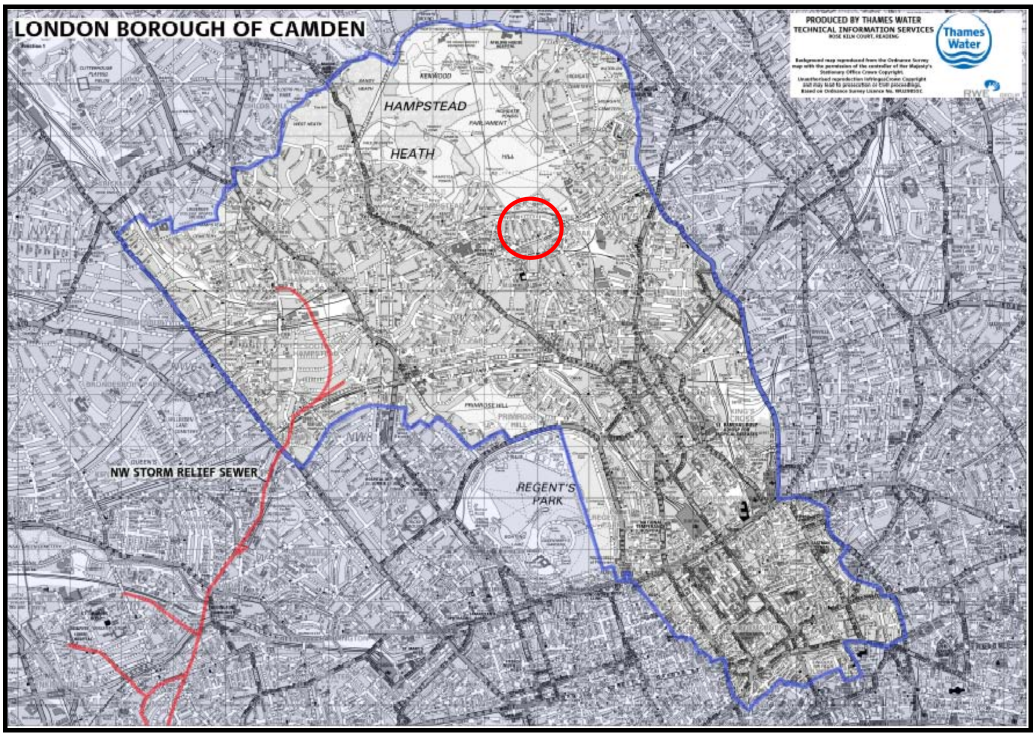


Figure 18 NW Storm Relief Sewer

9.3 Flood Risk From Rivers and Seas

The Flood Zone maps produced by the Environment Agency provide an initial assessment of flood risk. The Flood Zones are divided into four categories of flood probability and do not take into account any flood defences. PPS25 defines the flood zones as:

Zone 1: Low Probability-This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Zone 2: Medium Probability-This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% to 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% to 0.1%) in any year.

Zone 3: High Probability- This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3B 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood.

The site is shown by the Environment Agency to lie within a low risk for flooding from rivers and very low from the sea.

9.4 Flood Risk From Reservoirs

The Environment Agency are the enforcement authority for the Reservoirs Act (1975) and all large reservoirs are inspected and monitored by reservoir panel engineers. The risk of flooding from reservoirs is therefore very low. The Environment Agency Reservoir Flood Risk Maps for large reservoirs (>25,000m3) for this area indicate the site is at very low risk of flooding from reservoirs. There is a risk from the Hampstead Heath Reservoir 760m to the north west of the site as detailed in Figure 19.

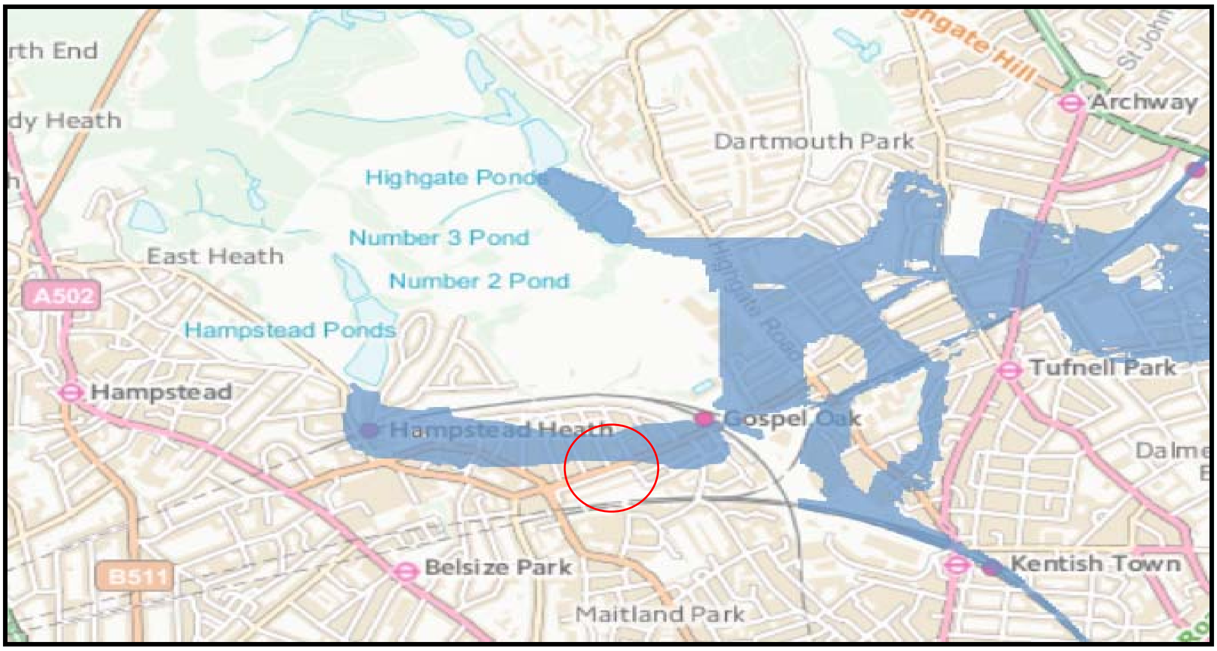


Figure 19 EA Flood Risk From Reservoirs

Below are the reservoirs that could affect this area.

Hampstead Pond No.1		
Reservoir Owner: Corporation of London		
Reservoir location (grid reference):527210, 185750	**Environment Agency Area:** North East Thames Area in South East Region	**Local Authority:**Camden

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly and essential safety work is carried out.

9.5 Flood Risk From Groundwater

According to the BGS there are no groundwater flood susceptibility flood areas within 50m of the site. There is according to the BGS a negligible risk of groundwater flooding based on the underlying geology.

The Environment Agency Map reproduced in Figure 20 indicates there is no risk of flooding from groundwater on the site.

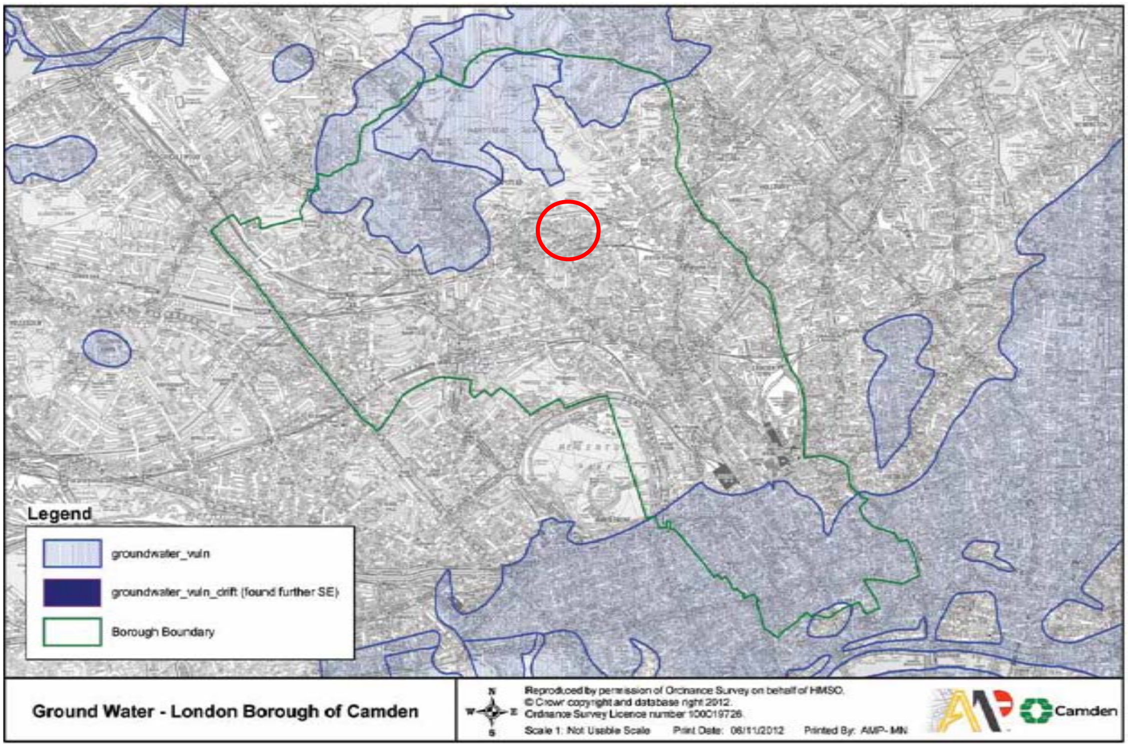


Figure 20 EA Risk of Flooding from Groundwater

9.6 Flood Risk From Sewers

Thames Water are responsible for the adopted foul and storm water sewer network. The site has not been affected by sewer flooding

9.7 Summary of Flood Risk

The site is not at risk of being flooded by rivers and seas or surface water, although there is a risk Courthope Road and Mansfield Road could be affected by surface water flooding. The site is not at risk of flooding from groundwater or sewers. The site is at risk of flooding from reservoirs although this is unlikely to occur.

A Flood Risk Assessment is presented in full in Appendix E.

10. BASEMENT IMPACT ASSESSMENT

10.1 Screening

Screening is the process of determining whether or not there are areas of concern which require a BIA for a particular project. This was undertaken in previous sections by the site characterisation. Scoping is the process of producing a statement which defines further matters of concern identified in the screening stage. This defining is in terms of ground processes in order that a site specific BIA can be designed and executed by deciding what aspects identified in the screening stage require further investigation by desk research or intrusive drilling and monitoring or other work.

The scoping stage highlights areas of concern where further investigation, intrusive soil and water testing and groundwater monitoring may be required.

A series of flowcharts have been used to identify what issues are relevant to the site. Each question posed in the flowcharts is completed by answering “Yes”, “No” or “Unknown”. Any question answered with “Yes” or “Unknown” is then subsequently carried forward to the scoping phase of the assessment.

The results of the screening process for the site are provided in Table 4 below. Where further discussion is required the items have been carried forward to scoping.

A Site Investigation is undertaken where necessary to establish base conditions and the impact assessment determines the impact of the proposed basement on the baseline conditions, taking into account any mitigating measures proposed.

Table 4
Screening For Basement Impact Assessment

	Question	Response	Details
	Surface Flow and Flooding		
1	Is the site within the catchment of the ponds chain on Hampstead Heath?	No	Refer to Maps, Appendix B
2	As part of the site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The runoff will not increase as the site is already hard covered.
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	Refer to Appendix A drawings. Site is hard covered as existing.
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	Surface water originating from the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	Surface water originating from the site is not received by adjacent properties or downstream watercourses (other than run-off to sewers).
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?	Yes	Mansfield Road was affected by surface flooding in 1975 but not in 2002. Courthope Road was not affected. The site does not lie below the water level of any surface water within 100m. The site lies on the south edge of a reservoir flood area. Carried forward to Scoping
	Subterranean (groundwater) Flow		
1	Is the site located directly above an aquifer?	No	Site underlain by London Clay.
2	Will the proposed basement extend below the surface of the water table?	No	Site underlain by London Clay. Water table >100m bgl.
3	Is the site within 100m of a watercourse, well (disused / used) or a potential spring line?	Yes within 100m of former watercourse	Historic watercourse identified from "Lost Rivers of London" 100m Carried forward to scoping.
4	Is the site within the catchment of the pond chains on Hampstead Heath?	No	Refer to Appendix A
5	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	No	Refer to Appendix A. Existing site is hard covered.
6	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	Refer to Appendix A
7	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement	No	No surface water feature within 750m of the site.

Table 4
Screening For Basement Impact Assessment

	Question	Response	Details
	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?		
	Slope Stability		
1	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Refer to site description. Site is level.
2	Will the proposed re-profiling of landscaping at site change slopes at the property to more than 7°?	No	Refer to Appendix A. There will be no reprofiling and no slopes on the site.
3	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No	Refer to site description.
4	Is the site within a wider hillside setting in which the general slope is greater than 7degrees?	No	Refer to site description
5	Is the London Clay the shallowest strata at the site?	Yes	London Clay has the potential to shrink and swell under varying moisture conditions Carried forward to Scoping
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?	No	No trees to be felled as part of proposed development.
7	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Yes	London Clay. Carried forward to scoping.
8	Is the site within 100m of a watercourse or a potential spring line?	Yes	See 3 subterranean flow Carried forward to scoping
9	Is the site within an area of previously worked ground?	No	Not according to mapping
8	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	Site underlain by impermeable London Clay a non productive aquifer
9	Is the site within 50m of the Hampstead Heath ponds?	No	No it is 750m distant
10	Is the site within an Aquifer?	No	London Clay is non productive
11	Is the site within 50m of the Hampstead Heath Ponds	No	See mapping Appendix B
12	Is the site within 5m of a pedestrian right of way?	Yes	Courthope Road. Carried forward to Scoping
13	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	No 2-4 Courthope does not have a basement. 2B has a basement. Carried forward to scoping
14	Is the site over (or within the exclusion of) any tunnels, e.g. railway lines?	No	Site is not located over any railway tunnels.

10.2 Scoping

Scoping is the activity of defining in further detail the matters to be investigated as part of the BIA process. Scoping comprises of the definition of the required investigation needed in order to determine in detail the nature and significance of the potential impacts identified during screening.

The potential impacts for each of the matters highlighted in Table 4 above are discussed in further detail below together with the requirements for further investigations. Detailed assessment of the potential impacts and recommendations are provided where possible.

These issues include historic water courses within 100m, the nature of the London Clay, Flooding Risk and Stability of Adjacent Buildings/Roadways.

It was recommended that an intrusive investigation should be undertaken to confirm ground conditions, test the London Clay for plasticity and monitor for groundwater levels. This is reported in Section 11.

Table 5
Scoping for Basement Impact Assessment

Reference	Issue	Potential Impact and Action
	Surface Flow and Flooding	
6	Site lies within Gospel Oak CDA	**Impact:** Possible flooding **Action:** Flood Risk Assessment**.** Mitigating measures to protect basement from flooding
	Ground Stability	
5	London Clay is shallowest strata	**Impact:** Shrinking and swelling under varying moisture conditions **Action:** Test clay for plasticity to determine level of potential shrink and swell
7	A history of shrink and swell	**Impact**: Shrinking and swelling of clay **Action:** Test clay for plasticity to determine level of potential shrink and swell
12	Basement is within 5m of pavement	**Impact:** Damage to services **Action:** Collect service drawings
13	Adjacent properties to north do not have basements. Basement will be attached to existing basement to the south.	**Impact:** None provided foundations are similar or lower than neighbours foundations. **Action:** None
	Subterreanean Flow	
3	Is the site within 100m of a watercourse, well (disused / used) or a potential spring line? The site lies <100m from culverted River Fleet. The site lies >100m from existing watercourses/rivers/canals/springs	**Impact:** None the culverted River Fleet (Westbourne) is >50m distance and unlikely to detrimentally affect the site. **Action:** None

The screening and scoping stage of the BIA indicated the requirement for a ground investigation. In addition a requirement for a Structural Method Statement and Construction Method Statement and Ground Movement Calculations and a Flood Risk Assessment for recommendations for mitigating measures in case of flooding in the road.

The ground investigation should comprise:

1. Two boreholes
2. In situ shear strength tests in strata
3. Collection of soil samples
4. Installation of standpipes
5. Monitoring of groundwater levels
6. Contamination testing on soil samples
7. Geotechnical testing of soil samples
8. Factual and Interpretative Report

11. GROUND INVESTIGATION
11.1 Fieldwork

In order to confirm ground conditions beneath the site and to collect soil samples for testing for contamination and engineering properties of the strata, particularly potential shrinkage and swelling of the London Clay, a ground investigation was undertaken.

The ground investigation comprised the drilling of three 80mm diameter window sampler boreholes (WS1 to WS3) on Thursday February 19th 2014 and included insitu soil tests for strength and sampling of the soil for geotechnical and environmental testing.

It was not possible to drill on the site itself, so boreholes were sunk in the adjacent yard. Ground conditions are expected to be the same beneath the site as those encountered in the yard due to the short distance between the two. Three boreholes were considered adequate to determine the ground and groundwater conditions and to sample adequately for geotechnical and environmental testing, to allow design of mitigating measures to any areas of concern to the development.

Soil samples were sent to UKAS accredited laboratories and were selected for testing for the engineering parameters and the presence of contamination. One window sampler borehole (WS2) was allocated for testing for groundwater and installed with a standpipe to facilitate monitoring. Monitoring was undertaken on February 25th, Match 4th and March 11th 2014.

Borehole results are presented in Table 6 and in Appendix C. Geotechnical and Environmental Test Results are presented in Appendix C. All exploratory points were marked out on site by reference to existing physical features on the site.

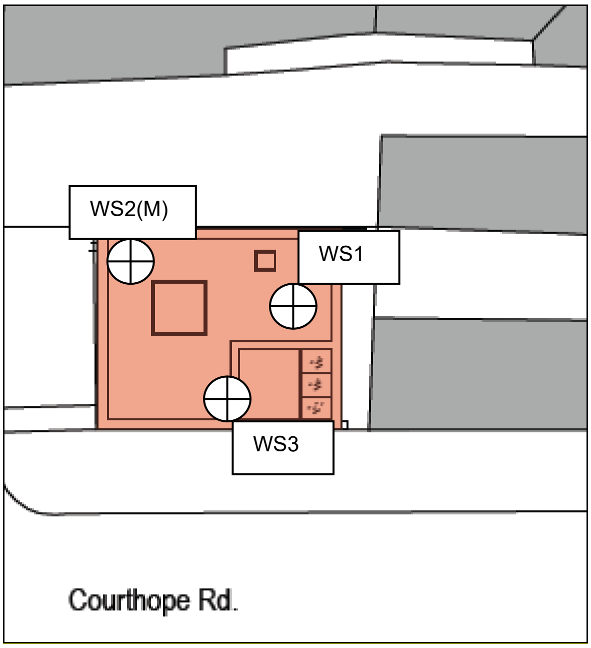


Figure 21 Borehole Location Plan

11.2 Ground Conditions

The ground conditions encountered in the window sampler boreholes comprised of a concrete top between 0.05m and 0.14m in thickness, overlying made ground down to a maximum of 0.45m. The made ground was everywhere underlain by medium strength clays of the London Clay Formation. At a depth of 1.25m to 1.45 bgl rounded and fractured flint gravel was encountered within the clay. This was underlain by brown, blue veined silty London Clay at depths of between 1.95m bgl and 2.20m bgl. The depth of the London Clay was not proven past 4.45m bgl.

The made ground generally comprised brown clay with fragments of red brick, limestone, roots and carbonaceous material and was in a loose state of compaction. The ground conditions encountered are summarised in Table 6 below.

TABLE 6
Ground Conditions Encountered in WS Boreholes

Hole Ref.	CONCRETE Depth in mbgl	MADE GROUND Depth in mbgl	CLAY* Depth in mbgl	CLAY with Flint Depth in mbgl	LONDON CLAY* Depth in mbgl
WS1	GL to 0.14	0.14 to 0.45	0.45 to 1.30	1.30-1.95	1.95 to 4.45+
WS2	GL to 0.05	0.05 to 0.45	0.45 to 1.25	1.25-2.20	2.20 to 4.25+
WS3	GL to 0.10	0.10 to 0.30	0.30 to 1.45	1.45-2.00	2.00 to 4.45+

* Firm Clay/Medium Strength

11.3 Geotechnical Test Results

The Standard Penetration Test (SPT) is made in boreholes by means of a standard 50.80mm outside diameter split spoon sampler to determine the approximate in situ density of cohesionless soils and when modified by a cone end (CPT) the relative strength or deformity of rock. The SPT N values indicate the clay is medium strength to 4.45m bgl with the exception of WS2 at 4.00m bgl where the clay is becoming high strength.

TABLE 7
Standard Penetration Test N Value Results (SPT)

Depth in m	Made Ground	High Strength Clay/Clay with Flint	London Clay
GL-1.00			
1.00-1.45		21, 12, 27	
2.00-2.45		14, 15, 13	
3.00-3.45			13, 14, 12
4.00-4.45			16, 18, 15

Atterberg Limit Tests are used to predict the compressibility of clays and silts and their behaviour under varying ground moisture conditions. Tests were undertaken on the clays.

TABLE 8
Atterberg Limit Test Results

Sample	Depth in mbgl	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
WS1	3.00	33	75	26	49
WS3	3.00	35	76	26	50
WS3	4.00	32	71	27	44

The results summarised above show the clay to be of very high plasticity with high volume change potential which indicates that the clay is highly likely to swell and shrink under varying seasonal rainfall conditions. Full results are presented in Appendix C.

Shear strength calculated according to Stroud and Butler using N values of 14 and for a plasticity index of 50% gives shear strengths of 58kN/m^2. Taking a shear strength of 60kN/m2, ultimate bearing capacity will be 360kN/m^2 and with a Factor of safety of 3 the allowable bearing capacity will be 120kN/m^2.

11.4 Groundwater Conditions

Groundwater was not encountered except as seepage during drilling or during monitoring of the borehole installation on three occasions over three weeks.

In summary it is expected that limited perched groundwater may be encountered within the made ground during construction, or within thin siltstone bands in the clay, however, inflows into excavations are unlikely to be significant and are expected to be dealt with by sump pumping.

11.5 Gas Conditions

As there are no recorded landfill sites within 250m of the site and no significant made ground, monitoring for landfill gas was not required.

There is a very low risk that the site is affected by radon gas and as such, radon protection measures will not be required in the basement as part of the proposed development.

11.6 Environmental Test Results

The UK Risk Assessment Framework is based on a tiered approach, Tier 1 being a risk screening or qualitative risk assessment, Tier 2 is a generic quantitative risk assessment and Tier 3 is a detailed quantitative risk assessment. Where the Tier 2 identifies a potentially unacceptable risk to human health either a Tier 3 Detailed Quantitative Risk Assessment

(DQRA) is undertaken or risk management action recommended to remove the pathway and the risk.

For this site both a Tier 1 and Tier 2 assessment have been undertaken using generic assessment criteria and site specific assessment criteria based on CLEA 2009 and ATRISK 2009 which are based on the new CLEA guidance 2008 and 2009 (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report), SC050021/SR4, CLEA Software version 1.06 (2009) and toxicological reports and SGV technical notes (2009)). The risk assessment has used a scenario of residential use as the model for assessment. In deriving the SSVs a child has been chosen as the critical receptor with exposure over a lifetime being the most appropriate and conservative scenario.

The Contaminated Land Exposure Assessment (CLEA) model provides a means of establishing concentrations of contamination in soils at a site. If results exceed these concentrations then further assessment or intervention by mitigation or remediation may be required to reduce risks to human health.

Three soil samples were selected from the window sampler boreholes for testing for the presence of contamination. The samples were tested for heavy metals, speciated PAH, TPH, sulphate and pH and asbestos fibres. No olfactory evidence of organic contamination was noted during the investigation. Results are presented in full in Appendix C. Groundwater was not encountered for testing.

TABLE 9
Results of Environmental Tests on Soils

Compound	No of samples tested	Min value mg/kg	Max value mg/kg	SSV guideline Residential Land Use mg/kg	Samples exceeding SSV guidelines
Phytotoxic					
Copper	3	17	29	4020	None
Nickel	3	32	49	130	None
Zinc	3	51	120	17200	None
Metals					
Arsenic	3	14	21	32	None
Cadmium	3	<1	<1	10	None
Chromium VI	3	<1	<1	14.7	None
Lead	3	18	30	168	None
Mercury	3	<1	<1	1	None
Selenium	3	<3	<3	350	None
Organics					
TPH total	4	<1	20	500	None
PAH speciated	4	<0.10	7.3	See Table 6	None
Others					
Sulphate %	3	0.05	0.07	2.4	None
pH	3	7.3	8.1	5-9	None
Asbestos	3	ND	ND	ND	None

*BRE Special Digest 2007
ND=None Detected

TABLE 10
Results of Tests for Polyaromatic Hydrocarbons

Polyaromatic Hydrocarbons	Polyaromatic Hydrocarbons In mg/kg		SSV Guideline Residential Land Use mg/kg	CLEA Combined Assessment Criterion Where No Free Product mg/kg	Samples exceeding SSV guidelines	Samples exceeding combined criteria
	Min Value	Max Value				
Anthracene	<0.1	0.1	20.9	18300	None	None
Acenaphthene	<0.1	<0.1	937	2130	None	None
Acenaphthylene	<0.1	<0.1	20.9	-	None	None
Benzo(a)anthracene	<0.1	0.4	8.54	-	None	None
Benzo(a)pyrene	<0.1	0.5	0.998	-	None	None
Benzo(b)fluoranthene	<0.1	0.2	7.29	9.86	None	None
Benzo(ghi)perylene	<0.1	0.3	0.112	103	None	None
Benzo(k)fluoranthene	<0.1	1.3	4.12	100	None	None
Chrysene	<0.1	0.4	2.64	927	None	None
Dibenzo(ah)anthracene	<0.1	<0.1	0.0236	1.00	None	None
Fluoranthene	<0.1	1.7	113	2160	None	None
Fluorene	<0.1	<0.1	746	1930	None	None
Indeno (1,2,3,cd)pyrene	<0.1	0.3	0.368	9.75	None	None
Naphthalene	<0.1	<0.1	8.71	-	None	None
Phenanthrene	<0.1	0.8	NGV	-	None	None
Pyrene	<0.1	1.5	13.2	1550	None	None
TOTAL PAH	**<0.1**	**7.30**	**-**	**-**	None	None

Red Highlight = Exceed SSV
Blue Highlight = Exceed SSV and CLEA Combined Assessment Criterion Where No Free Product Present

The site was found to be uncontaminated by phytotoxic compounds and heavy metals in the samples tested. Three soil samples were tested for polyaromatic hydrocarbons (PAHs) and TPHs and were uncontaminated. The site was uncontaminated with respect to sulphate with a redox value near normal. No asbestos was detected in the soil samples.

Environmental risk considerations on the site have been assessed by adopting a site specific qualitative approach to identify the risk, if any, of environmental harm. In accordance with the DETR Draft Statutory Guidance on Contaminated Land the approach is by identifying a hazardous source and establishing possible links between the source via exposure pathways to a potential receptor.

The hazard is a contaminant or potentially polluting substance that is in, on or under the land and which has the potential to cause harm or to cause pollution to controlled waters. The receptor is a living organism or organisms, an ecological system or piece of property, which is being harmed, interfered with or polluted by the contaminant. The pollutant linkage is by means of the pathway which is one or more routes by or through which that receptor is being, or could be, exposed to, or affected by, that contaminant. Thus the presence of a hazard on a site does not necessarily mean that there are risks unless pathways and receptors are present and are receptive to being affected by that specific hazard or contaminant.

- SOURCE - release of pollutant - eg. oil spills
- PATHWAY - route to receptor - eg. permeable strata
- RECEPTOR eg. - river

The likelihood of contamination affecting the environment depends on the migration and persistence of contaminants which varies with the nature of the contaminant and the ground and groundwater conditions, and the presence of sensitive receptors.

The following tables (Table 11 and 12) which are extracted from CIRIA C552 'Contaminated Land Risk Assessment – A Guide to Good Practice' have been used to assess the risk to sensitive receptors from site contamination.

TABLE 11
Risk Matrix – Comparison of Consequence and Probability

Risk = Probability x Consequences		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

TABLE 12
Categorisation of Risk

Risk Classification	Definition
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe. If any harm were to occur, it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Any category which shows as moderate risk or above may require remediation.

The potential pathways for carrying the contamination present on the site to reach sensitive receptors may include:

a) *Ingestion of and/or skin contact with contamination in the soil*
Low likelihood – As the site where tested will be hard covered, sensitive receptors will be protected from any undetected contamination. There may be a low risk to workmen which may be mitigated by appropriate use of Personal Protective Equipment.

b) *Ingestion of contamination and uptake of contamination in plants/vegetables/animals/pets*
Low likelihood – The site will be hard covered and vegetables and plants will not be grown for consumption. It is considered that animals in the food chain and pets are unlikely to be present on site.

c) *Ingestion of contaminated drinking water through leaching of contamination into groundwater flowing to underlying aquifers/water abstractions*
Unlikely – Leaching of the contamination is unlikely to detrimentally affect groundwater which lies >60m bgl. The site lies on Non Productive strata regarding groundwater and the site is not within a Source Protection Zone for potable water.

d) *Inhalation of vapours produced by landfill/radon/hydrocarbons/old mines*
Unlikely – There are no landfill sites within 250m and the risk of landfill gas affecting the site is very low. Radon gas protection is not required. The site is not undermined.

e) *Inhalation of contaminated airborne dust*
Low Likelihood – The appropriate safety measures must be exercised to protect both the workers and the local residents from dust during any demolition and construction. Provided this work is carried out diligently, the ongoing risk is low.

f) *Contamination of controlled surface waters*
Unlikely – There is no surface water within 760m of the site.

The risk is assessed by the combination of the probability of the risk and the severity of the risk in line with CIRIA recommendations. With an unlikely to low likelihood of probability and a mild to medium consequence the risk of the detected contamination detrimentally affecting sensitive receptors classifies as very low to low according to CIRIA Tables above, provided recommended mitigating measures are applied.

12 CONCEPTUAL SITE MODEL and IMPACTS

12.1 Introduction

The BIA has been undertaken for the proposed construction of a new ground floor and basement and lightwell. The anticipated bearing pressure of the new structure has not been provided.

The comprehensive desk based assessment together with the site inspection and walkover and ground and groundwater investigation have been sufficient to allow the potential impacts of the issues identified during the screening and scoping stage and ground investigation to be assessed and a Conceptual Site Model drawn.

This section of the report provides an interpretation of the findings of the Desk Study and Ground Investigation, in the form of a ground model, and provides recommendations with respect to temporary and permanent works and foundation options. The detailed Structural Engineers Report is reported by Martin Redston Associates in Appendix D. An FRA is presented by RAB Associates in Appendix E. A Conceptual Model is presented in Appendix F.

12.2 Geological and Hydrogeological Setting

The ground conditions encountered in the window sampler boreholes comprised of a concrete top between 0.05m and 0.14m in thickness, overlying made ground down to a maximum of 0.45m. The made ground was everywhere underlain by medium strength clays of the London Clay Formation. At a depth of 1.25m to 1.45 bgl rounded and fractured flint gravel was encountered within the clay. This was underlain by brown, blue veined silty London clay at depths of between 1.95m bgl and 2.20m bgl. The depth of the London Clay was not proven past 4.45m bgl.

Laboratory tests for plasticity on the clay indicated it to be the clay of high to very high plasticity and the clay is expected therefore to swell and shrink under varying moisture conditions.

There are no recorded abstraction licences which could be detrimentally affected by the basement development. The underlying London Clay is an aquiclude and protects the underlying major chalk aquifer.

The construction of the basement is unlikely to detrimentally affect groundwater flow, and will not adversely affect any wells, springs or potable water supplies.

12.3 Hydrology and Flood Risk

The screening indicated a Flood Risk Assessment may be required due to the site lying within a CDA and the adjacent Mansfield Road being flooded in 1975. A site specific flood risk assessment has been completed by RAB Consultants and is presented in Appendix E.

The site is not at risk of being flooded by rivers and seas or surface water, although there is a risk Courthope Road and Mansfield Road could be affected by surface water flooding. The site is not at risk of flooding from groundwater or sewers or lost rivers. The site is at risk of flooding from reservoirs although this is unlikely to occur.

12.4 Contamination

Ordnance Survey maps inspected indicated the site had been open land until 1894 when it served as a garden to No 62 Mansfield Road and in 1974 was occupied by an electricity sub-station. As such there is a low risk of contamination being present on the site. The ground investigation did not reveal any soil that contained potentially contaminating or odorous material apart from one elevated level of cadmium. Results of soil tests undertaken for potentially contaminating compounds indicated the samples to be generally uncontaminated. As the site will remain hard covered there is therefore no risk of the construction causing harm to humans, animals or the environment from the soils. As a precaution all builders should also use gloves when handling soil for Health and Safety and work in accordance with HSE and CIRIA guidelines.

There is no risk that the site will detrimentally affecting controlled waters due to the distance to surface water and the depth to groundwater, and the low level of contamination detected.

12.5 Excavations

The excavation for the basement will be circa 3.00m below existing ground floor level. The foundation formation level will be on the London Clay.

Excavation in the made ground and London Clay could be achieved by mechanical excavator. All excavations will require temporary support for construction.

Groundwater may be encountered especially during and after heavy rainfall. Temporary works may require sump pumping. If rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of the clay strata should be removed prior to any pouring of concrete for the floor.

In accordance with Eurocode 7 (BSEN 1997-1) groundwater should be taken at ground level for short and long term design. Such design must resist the buoyant uplift pressures generated by groundwater at ground level. The design for the basement accounts for the weight of the building and the uplift forces due to the groundwater. The weight being greater than the uplift force, the building is stable.

Excavations for the proposed structure will require temporary support in all strata to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements. Refer to Structural Engineers Report and Construction Method Statement in Appendix D.

Construction of the proposed basement will need to be supported by new retaining walls. Formation level for the proposed development will be the clay beneath any topsoil or made ground, which are unsuitable bearing strata. The clay should provide a suitable bearing stratum for foundations, provided the bearing pressure is low, ie less than 120kN/m^2.

The support for the temporary and permanent conditions must take account of maintaining the stability of the excavation and the stability of the adjacent properties and surrounding structures. Design of the walls may be decided as to whether the temporary support is also incorporated into the permanent solution. The Structural Method Statement by Martin Redston details the structural proposals and describes the proposed construction methodology.

Based on the plasticity tests of the clay it is possible that ground heave will occur on excavation. It is recommended that compressible material is laid beneath the floor slab or a void is created to accommodate any heave. Calculations undertaken by Martin Redston are presented in Appendix D.

12.6 Foundation Design

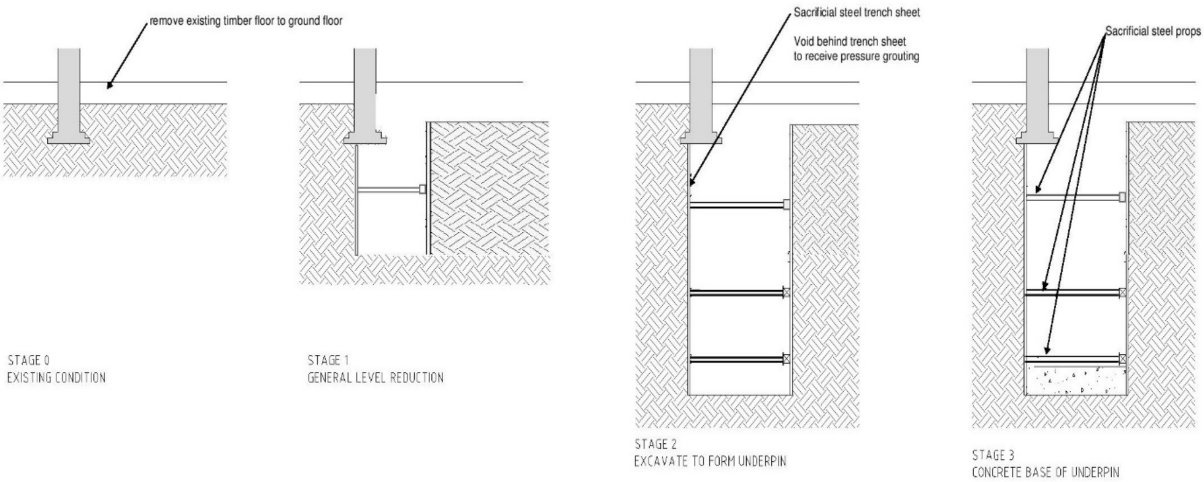
The clay should provide a suitable bearing stratum for foundations, provided the allowable bearing pressure is low, ie less than $120kN/m^2$. Bulk Density should be taken as $1900kg/m^3$, effective cohesion as 60kPa and effective friction angle as 0 degrees. Based on these figures the ultimate bearing capacity of the London Clay is $357kN/m^2$ and with a Factor of Safety of 3 is $120kN/m^2$.

As the foundations of adjacent buildings lie close to ground level, the foundation loads of the new development at 3.00m bgl will not add bearing weight to the foundations of adjacent buildings.

Existing foundations should be underpinned to support the basement as designed by the structural engineers in the SMS in Appendix D.

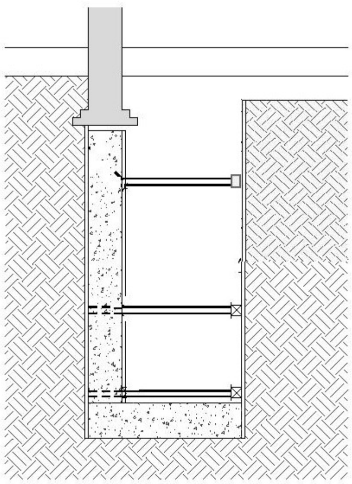
General underpinning temporary works:

1. Carry out soft strip and prop upper floor as required.
2. Install conveyor belt with appropriate boxing in to the front of the property to provide safe usage.
3. Follow proposed sequence of underpinning as per drawing by structural engineer - dig down to half depth while progressively installing temporary sacrificial propping, complete toe of underpin.

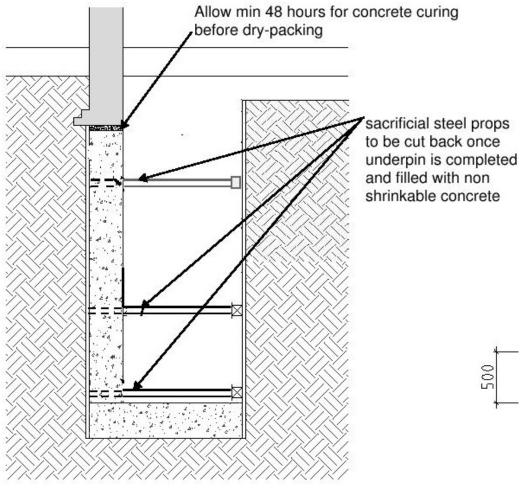


4. Install underpin –Allow a minimum curing duration of 24 hours between casting underpins and dry packing and a minimum of 48 hours curing period between dry packing and excavation of next underpin.

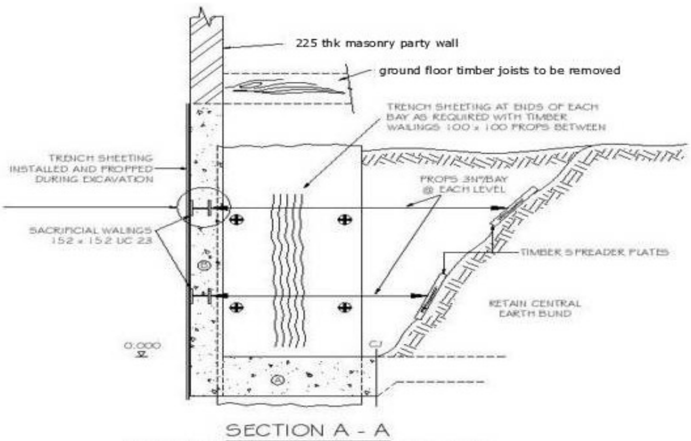
5. Waling beams may be used with individual underpins as well as retaining wall sections, as per the indicative drawing below.
6. On completion of each underpin sacrificial jacks/props can be cut back and the newly cast underpin propped against the middle earth with type 1 acrows or jacks at low, mid and high level until all RC walls are completed and excavation of middle earth is started.
7. Once underpinning is completed including RC walls, dig out of middle earth is undertaken. After removing 1 meter of earth, super slim soldier props can be installed across the basement. Installation of soldier beams can be done progressively with the excavation.
8. Install reinforcement and cast basement slab.



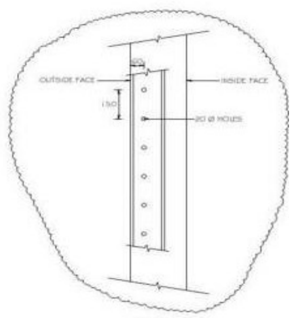
STAGE 4
ERECT SHUTTER
CONCRETE STEM OF UNDERPIN



STAGE 5
STRIKE SHUTTER WHEN CONCRETE HAS GAINED SUFFICIENT STRENGTH, DRYPACK, TRIM - OFF PROJECTING FOOTING, RE-PROP UNTIL BASEMENT SLAB IS CAST



SECTION A - A
INDICATIVE CONSTRUCTION FOR INDIVIDUAL BAYS
A - B SEQUENCE



DETAIL
TYPICAL PLAN OF WALING BEAM INCLUDING HOLES FOR VERTICAL REINFORCEMENT

12.7 Adjacent Structures

The development of the basement is unlikely to impact on adjacent properties provided mitigating measures and appropriate temporary and permanent design are undertaken.

The Party Wall Surveyor will undertake a structural condition survey of adjacent properties before work commences on the main development. The Party Wall Act (1996) will apply to the construction of the basement because the basement lies within 3m of the adjacent structures, the foundations will extend deeper than adjacent structures of 2-4 Courthope Road.

The proposed basement will lie within 5m of the pavement. Lateral movements associated with the excavations must be controlled by temporary and permanent works so as not to impact on the stability of any adjacent structures. It would be prudent to check all service locations before excavation.

Martin Redstone structural engineers have inspected the adjacent properties and confirm there is no evidence of subsidence and confirm that no adjacent structures have basements apart from the building being extended.

Basement construction may cause some ground movements to the surrounding ground and structural damage to overlying properties. It is proposed to redevelop the site using underpinned foundations. Consideration therefore has to be given to the extent of potential damage to adjacent properties.

Likely ground movements and building strains can be estimated by empirical methods based on previous case studies of similar developments or by computer analysis. Empirical methods are used initially to establish the category of likely damage according to Burland et al (1977 and 2001) and Boscardin and Cording (1989) in line with CIRIA C580.

Ground movement calculations undertaken in accordance with CIRIA 580 indicate very slight Damage Category according to Burland and Boscardin Scale of Damage. Calculation Methodology is presented in Appendix F.

12.8 Groundwater

Groundwater was not encountered during drilling and monitoring of a standpipe on three occasions in February and March 2014. Monitoring of the borehole on March 26th 2015 gave a seepage level of 0.70m below ground level. It is considered that the water may be entering the site via the backfill of the numerous underground electric cables emerging from the electricity sub station. It is unlikely that there will be any necessity to dewater the site for basement excavation and any perched water is expected to be dealt with by sump pumping.

12.9 Underground Concrete

Results of testing for the levels of pH and sulphates in the clay do not indicate an elevated level of sulphate. However, as the London Clay contains selenite it is recommended that sulphate resisting cement is used for underground concrete. The recommendation design of underground concrete is ACEC Class DS2-AC-2s from Table C2 of BRE Digest 1 Part C (2005). This assumes static or mobile water conditions on natural strata.

12.10 Service Excavations

Shallow excavations for services and the like are unlikely to be stable in the made ground or clay in the short or long term and will require substantial support. Some sump pumping may be required to keep the trenches dry.

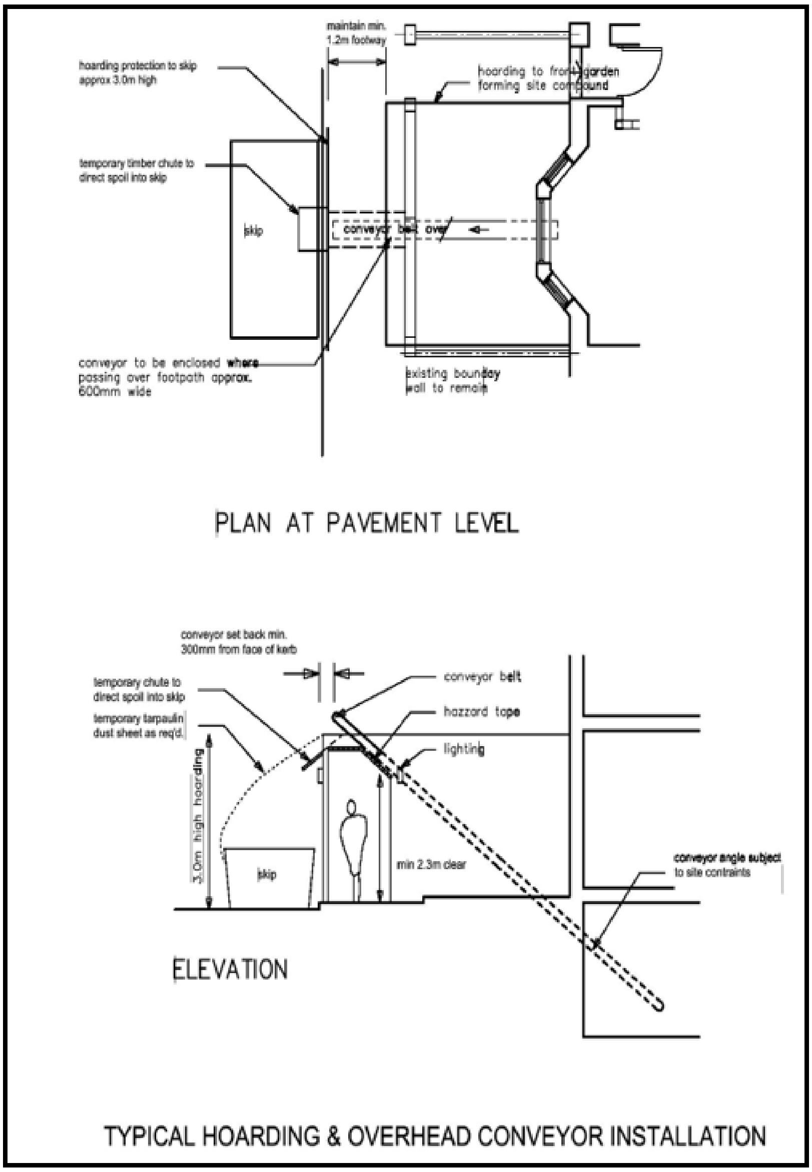
12.11 Waste Disposal

Any spoil arising from excavations or landscaping works will need to be disposed of to a licensed tip in accordance with the EP (Duty of Care) Regs 1991 and Landfill (England and Wales) Regulations (2002) amended. Under the European Waste Directive landfills are classified as accepting inert non-hazardous or hazardous wastes in accordance with the EU Waste Directive. Based on the technical guidance provided by the Environment Agency it is considered likely that the soil from this site, would be classified as inert waste

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material if provided with the results of environmental and Waste Acceptance Criteria Tests (WACS).

12.12 Hoarding and Conveyor System

The diagrams below illustrate a typical hoarding and conveyor system for basement excavation.



12.13 Tunnels

The proposed basement excavation will not be within the zone of influence of any of the London Underground (rail) tunnels shown on Figure 18 of Arup Report for London Borough of Camden "Guidance for Subterranean Development", 2010).

It is possible that other tunnels owned and maintained by other service providers may exist beneath the site that could be affected by the proposed excavation and construction works.

A full search of potential tunnels that may underlie the site has been commissioned and will be presented in a separate report. On the assumption that it is confirmed that the site is not within the "zone of influence" of any underlying tunnels then no further activities in this regard will be required (the zone of influence is normally defined as the strip of land present above a tunnel with boundaries defined from a line drawn at 45° from the invert level of the tunnel to the ground surface). Alternatively, it will be necessary to liaise with the tunnel owner and undertake further engineering analysis to determine the potential impacts that the proposed basements could have on the tunnel.

13. CONCLUSIONS AND RECOMMENDATIONS

The comprehensive desk based assessment together with the site inspection and ground investigation has been sufficient to allow the potential impacts of the issues identified during the scoping stage of the project to be assessed. This section of the report provides conclusions and recommendations for development.

It will be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations.

With regard to the geology, hydrogeology and hydrology of the site, the report concludes that the site is immediately underlain by the relatively impermeable London Clay which is classified as a non productive aquifer by the Environment Agency. There is no recorded groundwater during the ground investigation and no abstraction licences which could be detrimentally affected by the basement development. There is no surface water within 760m of the site which could be affected by the development. Courthope Road did not suffer from flooding during 1975 or 2002 flood incidents. There is no change of hard cover which could increase flooding risk.

The BIA has been undertaken for the proposed construction of a new extension to the existing ground floor and basement house within the area of a former electricity sub station. The depth of the basement is anticipated to be 3m bgl. The anticipated bearing pressure of the new structure has not been provided.

The desk study has revealed that the site is underlain by relatively impermeable London Clay, has not had a potentially contaminative history having been occupied by a garden for a residential property and an electricity sub station and on the basis of the fieldwork, the ground conditions at this site can be characterised as follows.

- the topsoil and made ground extend to depths of between 0.30m to 0.45m bgl and comprised loose soil with brick, gravel and soil.
- The underlying strata of the London Clay Formation was a brown grey medium strength clay to a maximum proven depth of 4.50m.
- Groundwater was not encountered in the boreholes during drilling or monitoring except as seepage.
- Geotechnical tests on the clay indicated a high to very high potential for swelling and shrinkage of the clay under varying moisture conditions.
- Based on a shear strength of $60kN/m^2$ an allowable bearing capacity for the London Clay at <4m depth is $120kN/m^2$.

- Environmental tests on the topsoil and shallow clay indicated the soils to be uncontaminated according to CLEA guidelines for residential use of the site.
- Due to the low permeability of the London Clay, the site is not suitable for the use of soakaways to infiltrate excess surface water into the ground.

Excavations for the proposed basement structure will require temporary support to maintain stability of the surrounding structures and to prevent any excessive horizontal ground movements. Groundwater is unlikely to be encountered and if rainwater falls into the excavation it can easily be dealt with by sump pumping. If this occurs the softened surface of the clay should be removed prior to any pouring of concrete for the basement floor.

Construction of the proposed basement will need to be supported by new retaining walls. Formation level for the proposed development will be the London Clay beneath any topsoil and made ground which are unsuitable bearing strata. The London Clay should provide a suitable bearing stratum for spread foundations, a raft, box construction or piles whichever is required based on the bearing pressure or ground loading of the structure.

The basement support for the temporary and permanent conditions must take account of maintaining the stability of the excavation and the stability of the attached structures. The retaining solution should ensure maintenance of lateral support to existing foundations.

The potential for ground movement during the excavation and construction of the basement has been considered as outlined in Appendix D1 of the Camden Geological, Hydrogeological and Hydrological Study. Any significant ground movements could cause structural damage to adjacent properties. Ground movement could occur from heave of the ground following removal of overburden. Following the excavation of the basement, it is likely that the floor slab for the proposed basement will need to be suspended over a void to accommodate the anticipated heave, unless the slab can be suitably reinforced to cope with these movements. This should be reviewed once the levels and loads are known.

Damage to existing foundations could occur if removal of lateral support occurs. However as illustrated in the Appendix D1study, for clay subsoils this effect is not usually significant and results in circa 10% reduction in the soil capacity locally. Since there are no current signs of distress in the existing wall foundations it is considered that very short term reductions in soil stiffness are unlikely to cause any significant settlements, and hence any damage to adjacent properties. Ground movement calculations to CIRIA 580 indicate very slight movements, which should be checked by the monitoring during construction. It would be prudent to undertake a structural condition survey of adjacent properties before work commences.

Any spoil arising from excavations or landscaping works will need to be disposed of to a licensed tip. Under the European Waste Directive landfills are classified as accepting inert non-hazardous or hazardous wastes in accordance with the EU Waste Directive. Based on the technical guidance provided by the Environment Agency it is considered likely that the made ground from this site, as represented by the chemical tests carried out, would be classified as a NON-HAZARDOUS waste, and the natural soils would be classified as

INERT waste. It is likely that only a small proportion of excess material will be made ground and most of the waste will be natural clay.

The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require Waste Acceptance Criteria Tests (WACS) testing.

The development of the basement may impact on adjacent properties if mitigating measures and appropriate temporary and permanent design are not undertaken. The development of the basement if unlikely to impact on groundwater, surface water or flooding, unlikely to impact on drainage or ground infiltration of rainwater.

Recommendations include:

- The basement floor should be constructed at the similar level to the adjoining building.
- The building should be constructed on reinforced concrete pins with a raft slab foundation.
- Underpinning to 2-4 Courthope Road to the lower ground level.
- Temporary propping of excavations.
- Monitoring of adjacent buildings during construction.
- Party Wall Surveyor to be employed.
- Service Drawings to be obtained.
- Compressible material beneath basement slab to accommodate heave.
- Foundation stratum to be London Clay.
- Finished floor levels should be set no lower than 150mm above ground level.
- Proposed basement should be tanked and waterproofed to the height of the finished ground floor levels.
- The basement must provide internal access to higher ground.
- The basement must include a positive pumped device such as a sump pump, in line with the 2017 London Borough of Camden Basement Planning Guidance. There are already two such devices in the building.
- A non-return valve should be installed at the foul water sewer manhole serving the property.
- Surface water should be managed by the use of SuDS where practicable.

14. GENERAL REMARKS

This report truly reflects the conditions found during the desk study and ground investigation. Whilst the desk study and ground investigation were undertaken in a professional manner taking due regard of additional information which became available as a result of ongoing research, the results portrayed only pertain to the information attained, and it is possible that other undetected information and undetected ground and gas conditions, undetected mining conditions and undetected contamination may exist. The investigation was only undertaken within the site boundaries and should not be used for interpretation purposes elsewhere.

These conclusions are only a brief summary of the report, and it is recommended that the report is read in full to ensure that all recommendations have been understood.

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