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11-15 KING'S TERRACE
LONDON NW1

Construction Method Statement for Subterranean Development

MBP-8292-June 2021

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Preamble

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1.0 PREMIS

N°. 11-15 King's Terrace is a mid-terrace property, currently of commercial occupancy with office space on the ground and first floors, located approximately 500m south-east of Camden Town London Underground station. The properties along King's Terrace to the north-west and south-east of N°. 11-15 vary in their construction; the majority are between two and three storeys of traditional masonry wall and timber floor construction and have either duo pitched slate roofs or mansard roofs. To the property's rear, four-story, masonry buildings with mixed-use residential and commercial occupancy front onto Camden High Street.

N°. 11-15 King's Terrace is arranged over two floors with masonry walls and timber floors. The building footprint is rectangular in shape and measures approximately 10.0m x 13.0m. A corrugated sheet hipped roof is supported on numerous exposed steel double-fink-style trusses spanning from party wall to party wall. Under the proposed development, a new single level of basement will be constructed beneath the property and will match the existing footprint of 11-15 King's Terrace.

This report sets out to describe the likely structural solution for the construction of this development, the interaction of the subterranean extension with the local geology and hydrology and its impact on surrounding buildings. Construction techniques are highlighted along with requirements for temporary works and excavations.

2.0 THE SITE AND AREA

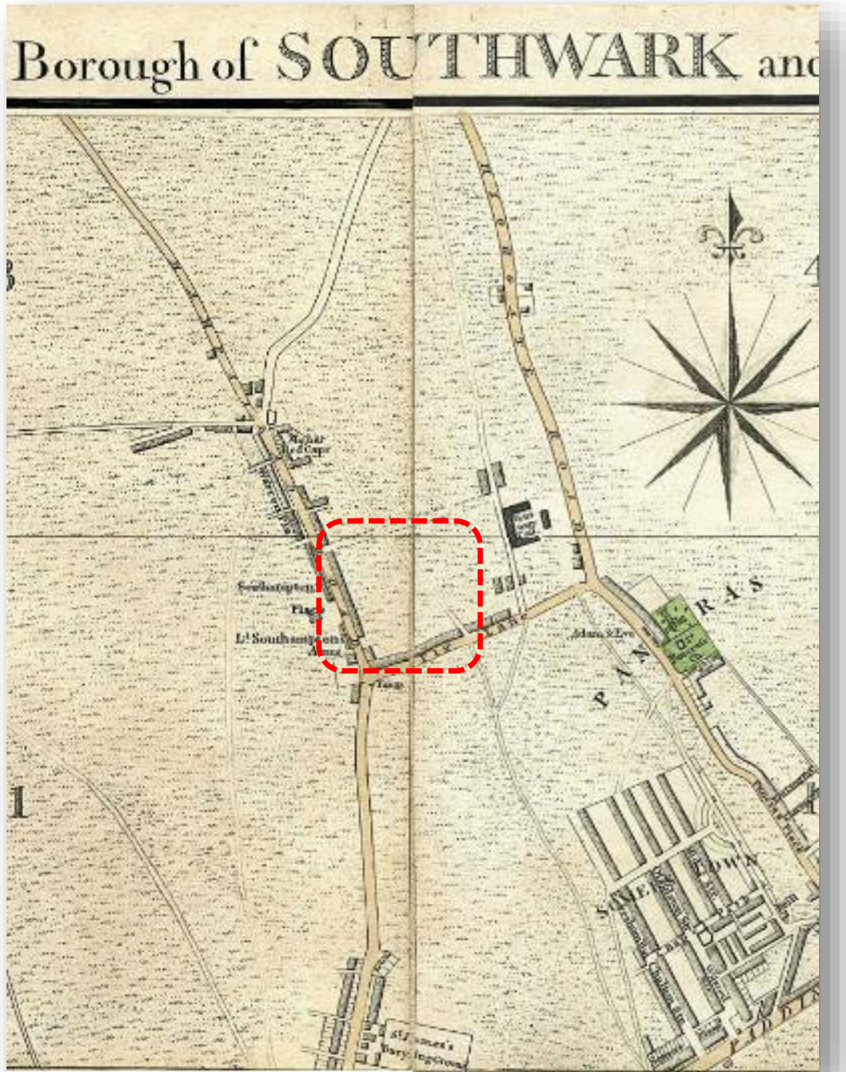
King's Terrace lies between, and is parallel with, Camden High Street and Bayham Street.

Charles Pratt, the first Earl of Camden, started the areas development in 1791 and Camden Town began as a collection of buildings beside a main road. This road was named *Hampstead Road*, and is known now as Camden High Street. This collection of buildings can be seen opposite in Cary's New and Accurate Plan of London and Westminster, 1795. At this time, King's Terrace had not yet been constructed.

Between 1795 and 1817, the area underwent significant development. Darton's New Plan of the Cities of London and Westminster, 1817, shows King's Terrace was constructed alongside the establishment of Regents Park and the beginnings of the Regents Canal waterway. Regents Canal was opened to traffic in 1820 and with it, further expansion to Camden Town.

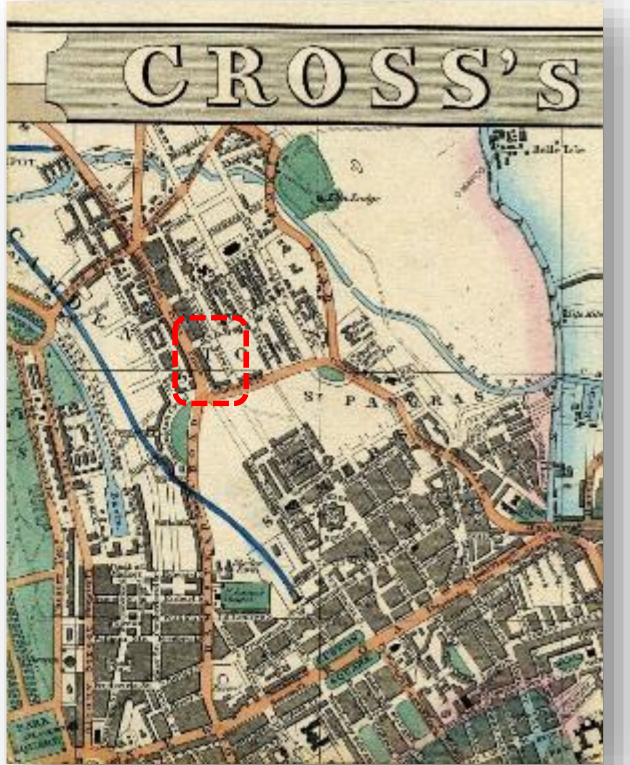
In the mid-1800s, Camden Town and the surrounding area became a major hub for industry with the arrival of Euston station (1837), King Cross (1852) and St Pancras (1868). The extent of this expansion can be seen in Stanford's Map of London, 1864, and King's Terrace is shown to be well established with its terraced buildings.

Mornington Crescent underground station opened in 1807 as part of the original route of the Charing Cross, Euston and Hampstead Railway and is now part of the Charing Cross branch of the Northern Line. The Northern Line is approximately 15m below ground level between Camden Town and Mornington Crescent follows the line of Camden High Street. It was common when the rail network was built to disperse arisings from cutting excavations over adjacent land, which was poorly compacted and led to settlement problems when that land was developed. As this part of the Northern Line, then the Charing Cross, Euston and Hampstead Railway, is of deep construction, and not constructed using the earlier cut and cover construction, this is unlikely to be the case in this area.

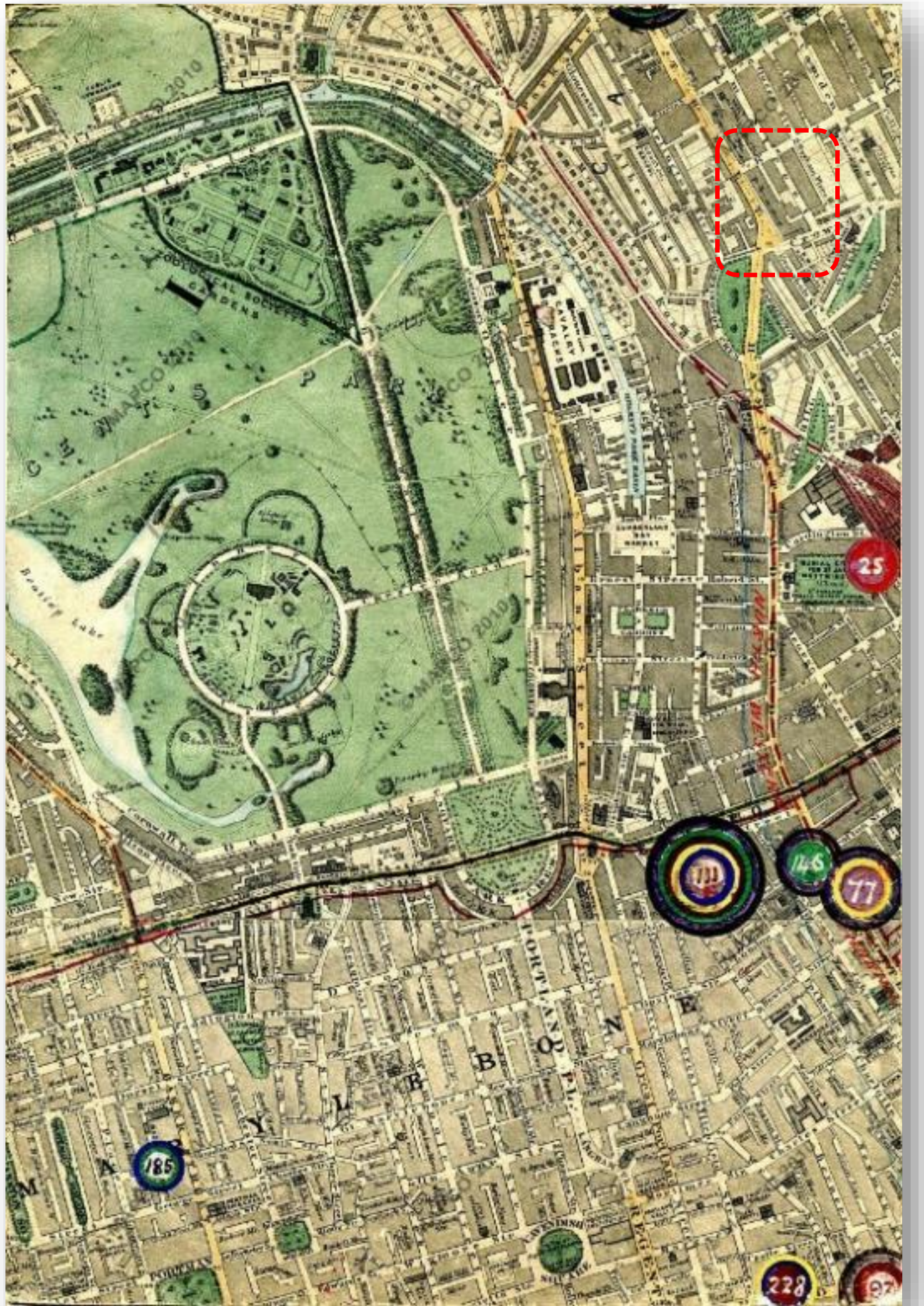


Cary's New and Accurate Plan of London and Westminster, 1795

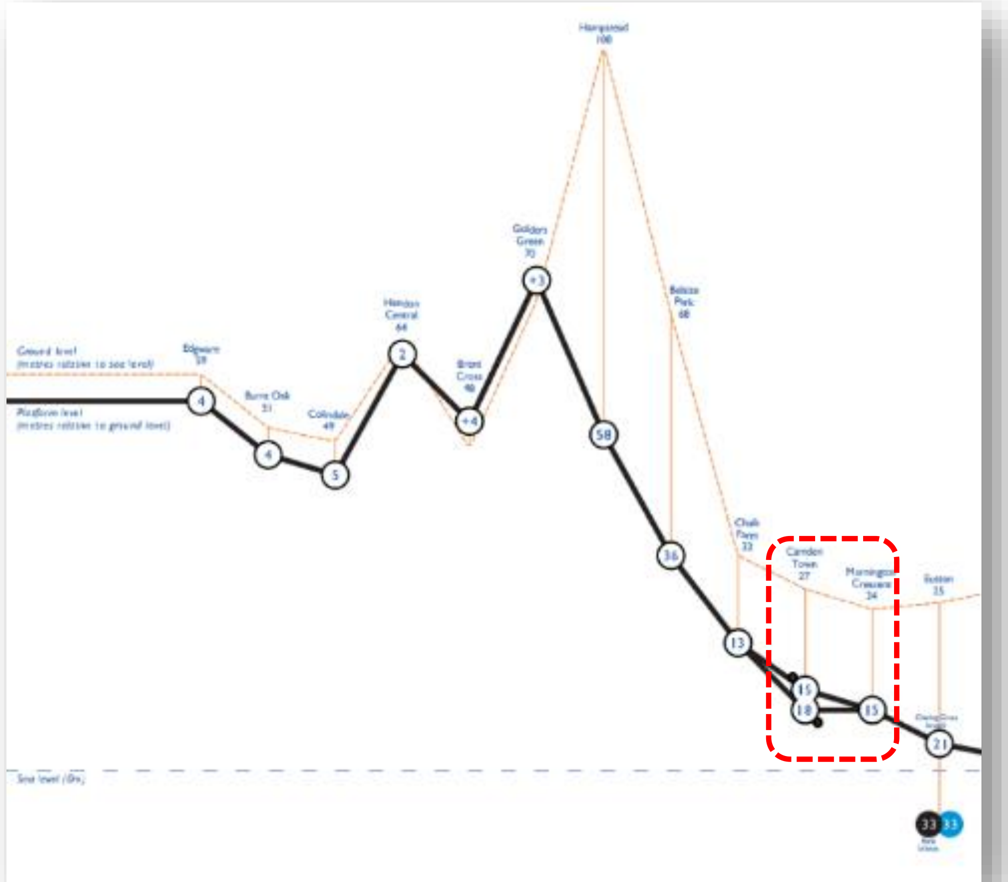
Darton's New Plan of the Cities of London and Westminster, 1817



Cross's London Guide, 1844


Stanford's Map of London, 1864


Bartholomew's Handy Reference Atlas of London, 1908

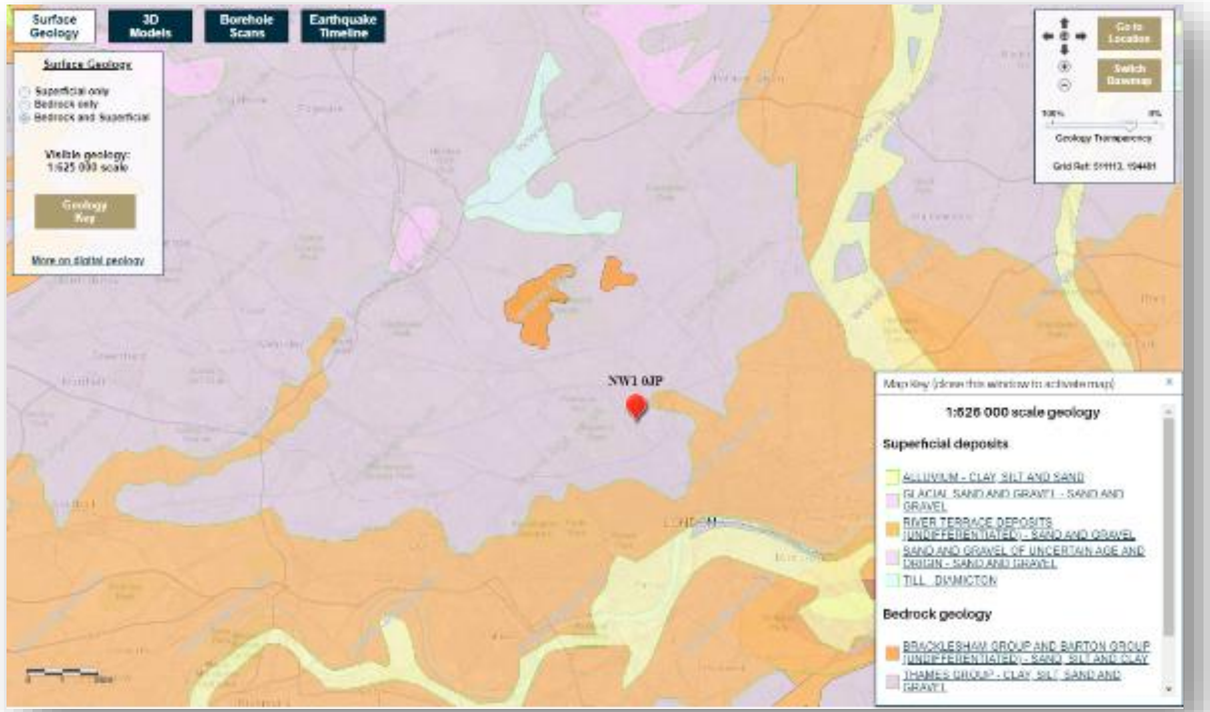

London Underground Elevations

Booth's Poverty Map, 1889

London City Council Bomb Damage Maps, 1939-45

Booth's Poverty Map of 1889 records residents living immediately beside Regents Park as "Middle class" and "Upper middle class". Residents living a little further into Camden Town were recorded to be "Fairly comfortable" to "Mixed – Some comfortable and some poor". This is typical of the area; however, Booth's Poverty Map shows residents of King's Terrace as "Poor".

From records made of damage due to ordnance during the Second World War, there was no damage recorded to property along King's Terrace, including Nº. 11-15. There was, however, significant damage to buildings to the west of Nº. 11-15 King's Terrace, along Camden High Street, many beyond repair. Two buildings immediately behind and straddling the site of Nº. 11-15 King's Terrace, highlighted orange, are shown to have suffered general damage in the period between 1939-1945.



British Geological Survey, bedrock and superficial geology

British Geological Survey, surrounding historical borehole logs

3.0 LOCAL GEOLOGY & HYDROGEOLOGY

The geology of London and the Thames Basin lies above a deep concave layer of chalk which outcrops to the north as the Chilterns and to the south as the North Downs. The material within the chalk basin comprises Thanet Sands at depth overlain by the Lambeth Beds formerly known as the Woolwich and Reading Beds) which are generally a mixture of sand and clay. Above this is London Clay which Is approximately 50m deep generally and which outcrops at the surface around Notting Hill and north of it, encompassing Chalk Farm, Swiss Cottage and St John's Wood. In places there are deposits of Langley Silt (sometimes called brickearth) which is a mixture of silts, clays and sands. These formed the basic material for London stock bricks. Typically, this overlies the sands and gravels. Because of its use for making bricks, Langley Silt has been excavated in many areas and the resulting pits backfilled generally with poor quality material. In some locations, the sands and gravels may also have been excavated for use in general construction associated with the development and expansion of London in the late 19th century, particularly for the new infrastructures, though this is less the case in this area where the Langley Silts are thin, if present. On top of these natural deposits there is often a layer of fill or made ground the result of many years of human occupation which, in parts of Central London can be 4 to 6m thick. The depth of the proposed basement will not affect The London Aquifer which is to be found around 100m below the London Clay.

However, other than in localised areas, the London Borough of Camden experienced its most significant development over the last 150 years, so there is less fill, typically no more than 1 to 2m. The British Geological Survey's online Geology of Britain viewer shows the site to be underlain with the Thames group of clay, silt and gravel with little to no superficial deposits.

The British Geological Survey have historic records online available to view. The geology from the surrounding area was observed from the historic records of the following boreholes, which can be seen marked on the map around the site:

From **Borehole log TQ25SE1172**, approximately 100m north-west of site:

- **0.40m of MADE GROUND** over increasingly stiff **LONDON CLAY to depth**

From **Borehole log TQ28SE1166**, approximately 140m west from site:

- **0.40m OF MADE GROUND** over increasingly stiff **LONDON CLAY to depth**

From **Borehole log TQ28SE10**, approximately 130m north-east of site:

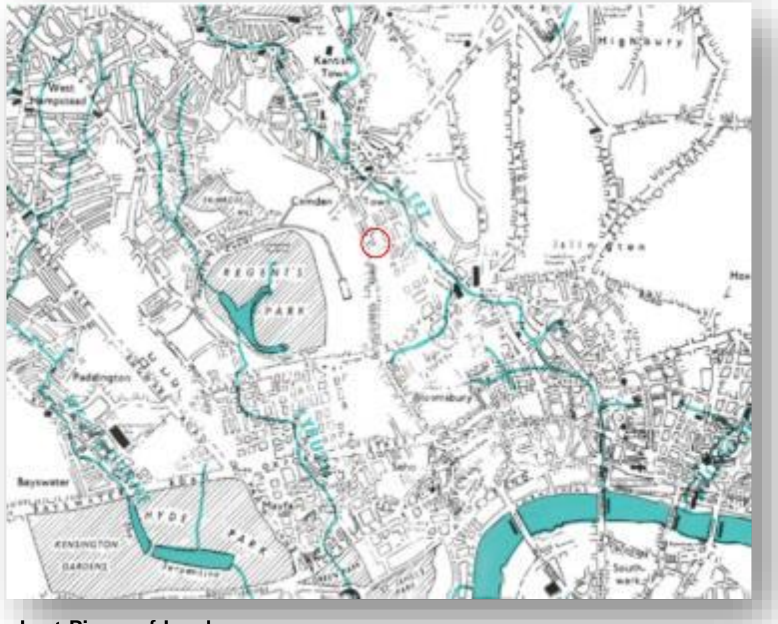
- **0.91m OF MADE GROUND** over increasingly stiff **LONDON CLAY to depth**

No ground water was observed in any of the boreholes according to the historic logs.

Each of these investigations is within a reasonable distance of N$^{o.}$ 11-15 King's Terrace and are can be taken to be representative of the near-surface geology in the area; the observations made can be expected with a high degree certainty at the site.

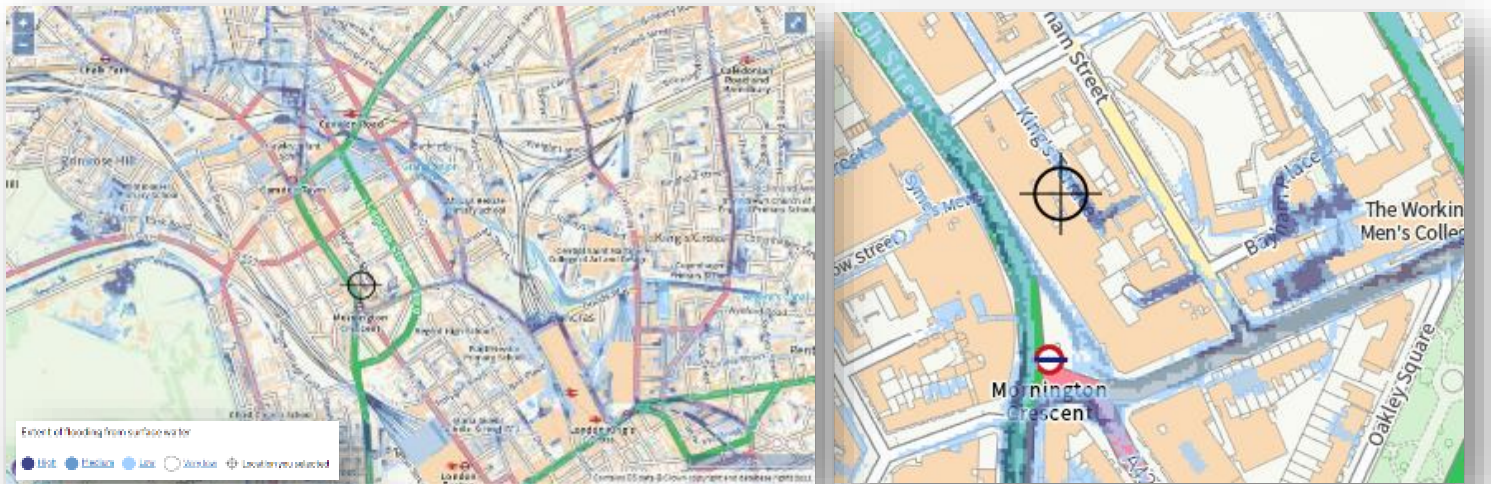
A site-specific investigation, completed by **GEA on June 2nd 2013** confirmed the near-surface geology to be identical to those summarised above; 0.85m of made ground was observed to overlay increasingly stiff clay to the borehole depth of 4.80m. The site log from that SI is included as in Appendix A.

Groundwater was not encountered during GEA's site investigation and a standpipe was installed for future inspection. The standpipe was observed to be dry when checked.



Lost Rivers of London

Environment Agency Flood Map – Rivers and Seas



Environment Agency Flood Map – Surface water flood risk

The London basin contains a Lower Aquifer which lies deep below ground within the Thanet Sands and Chalk and an Upper Aquifer within the River Terrace Deposits where they overly the London Clay. It is fed from the chalk outcrops to the north and south of the Thames Valley. However, because of the impermeable London Clay which lies beneath the gravel terraces there is a local perched water table which is fed by precipitation within the Thames Valley, known as London's Upper Aquifer and a significant contributor to the water in the upper aquifer is burst or leaking water mains. The water on this upper aquifer tends to flow slowly across the surface of the London Clay depending on the permeability of the overlying sands and gravels. London's development has altered what were natural open ditches which flowed into tributaries of the River Thames; Counters Creek and the River Westbourne. However, the upper aquifer water levels do not vary significantly as water drains away into the Thames basin. The flows across the surface of the London Clay have historically eroded shallow channels in the surface of the clay which tend to be filled with sand and gravel. These can have an influence on local ground water levels and ground water flows. This upper aquifer does not affect the site at Nº 11-15. No groundwater was observed in the historic borehole logs from the surrounding area and this was also confirmed through GEA's site specific investigation.

There are numerous 'lost' rivers running below the ground in London, and the Fleet did run close by on its route to the Thames. The River Fleet was covered when Hampstead was expanded in the late 19th Century and is now exists as a large underground sewer. It flows southwards towards King's Terrace, however, north of Camden Town, the 'lost' river circumvents the site and flows south-east through Kings Cross, Clerkenwell and into the Thames at Blackfriars. The site is not within significant proximity to the lost reiver Fleet and does not lie within the catchment of the Hampstead Heath Pond Chains.

The Environment Agency Flood Maps record that the site lies very-much in Flood Zone 1, which is to be expected given its elevation, is significantly outside Flood zone 3, and therefore is not considered to be at risk of flooding from the river or sea.

King's Terrace is classified as an area of high risk of surface water flooding due to the high proportion of hard standing in the borough and low proportion of permeable land. The drainage for the proposed development and waterproofing systems in of the basement will reflect this level of risk in its design.

The design of the foundations will be to the current design standards (British or Euro) which require the water table to be considered to a reasonable height, so allowing for the impact and influence of burst water mains etc and the basement will be designed for a ½ depth of water for similar reasons.

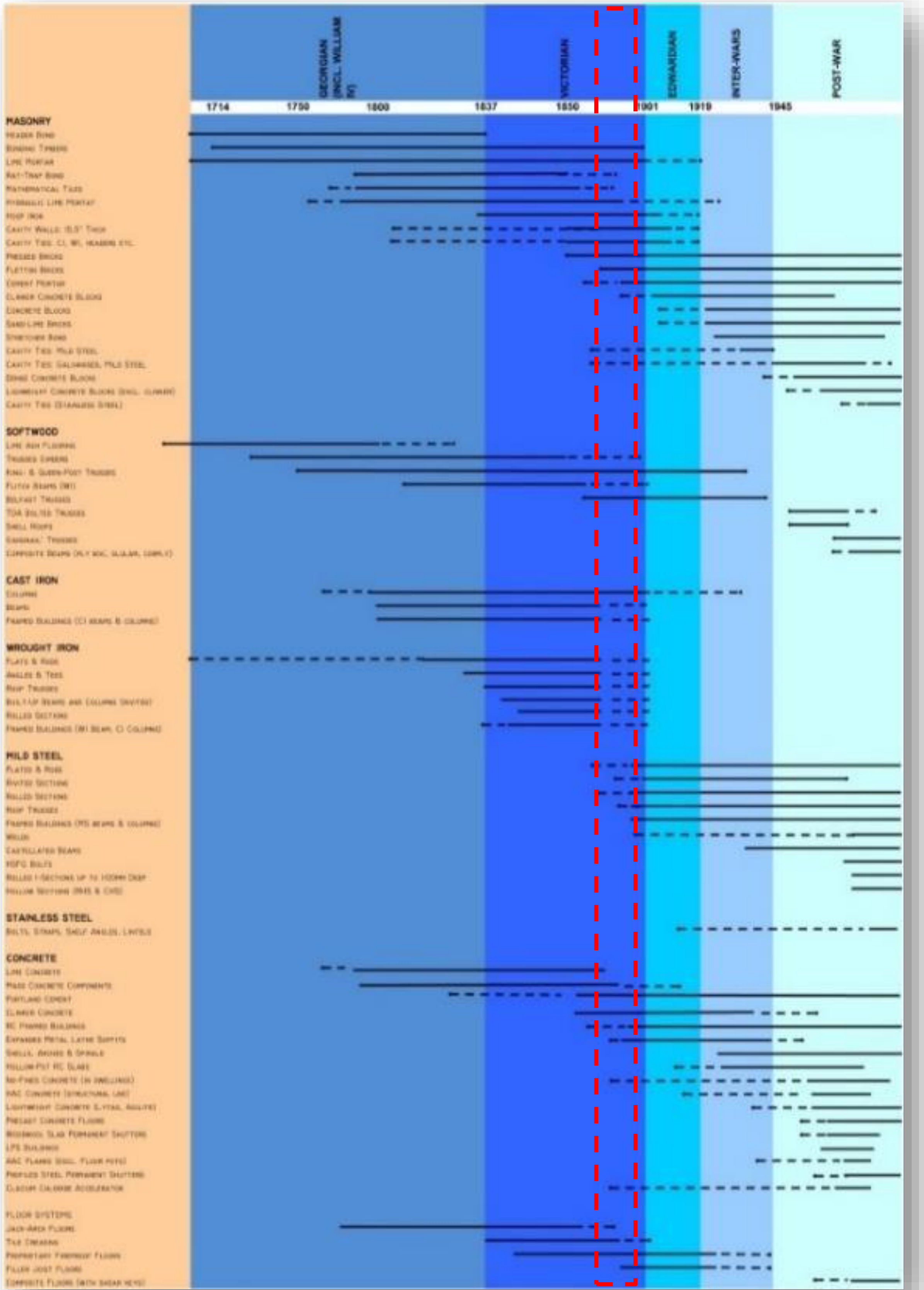
The impact of the basement on the local hydrogeology, drainage and SuDs, including groundwater flows, is addressed further in Appendix A where GEA's report J21098 concludes that there will be no risk of hydrogeological issues nor a need for further investigation.

4.0 THE EXISTING BUILDING

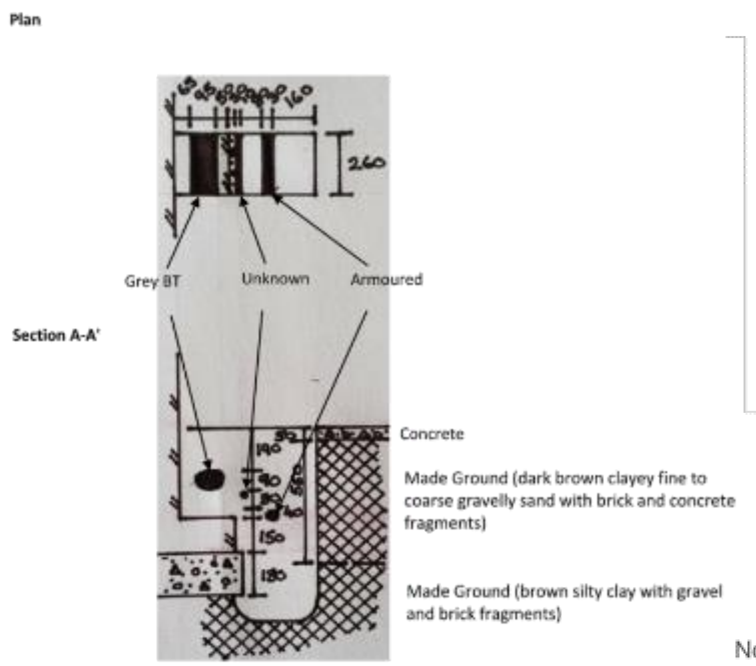
The existing building is most-likely the first and only construction on this site and, if any buildings were sited here, they were of slight construction and low impact. It has, like similar period properties, loadbearing masonry walls, with brick corbel foundations formed off the underlying sandy clay, which support timber upper floor joists. The hipped roof, consisting of a series of steel trusses, is finished with corrugated sheeting.

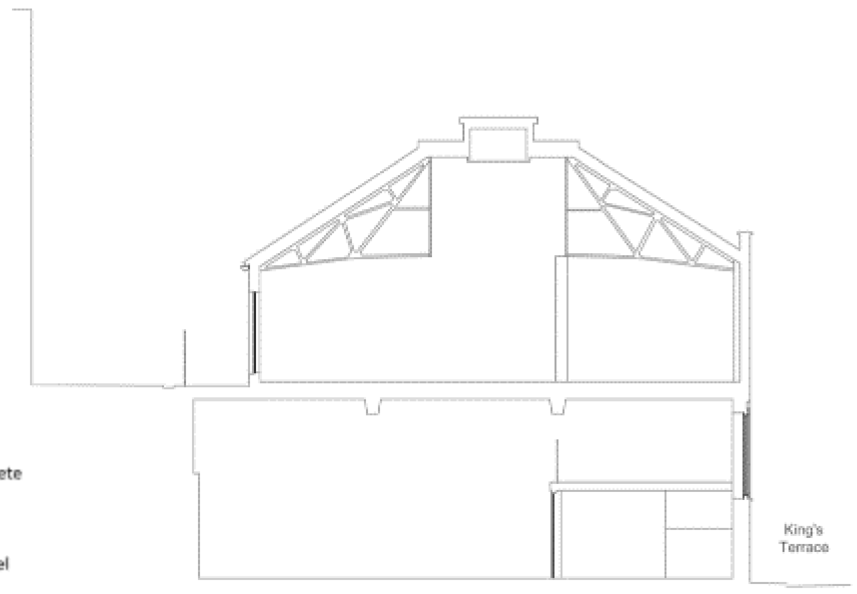
The building is in good condition and benefits from good maintenance, upkeep and repair. A search of historical planning applications on the London Borough of Camden's Planning Portal shows that no significant changes to the building structure or fabric were approved; records for King's Terrace on the Planning Portal date back to 1965. There were two applications made in 1975 for the ground and first floor for 'continued use for the manufacture and finishing of clothing' and 'continued use for light industrial purposes' respectively. From observation of the front elevation, it is noticed that the building has had some adaptation/repair/reconfiguration of the lower façade at ground floor level, possibly to suit its current occupancy. It appears that the work done in this area is of good quality and no signs of damage or distress to the structure are apparent.

At existing ground level, the original loadbearing walls are still in place; the staircase to first floor is likely original or in the original position. There is no evidence of distress or damage to the construction or fabric of the building, such as bulges, cracks, disruption, dampness or decay; the floors are level and the walls are plumb and sound. There is therefore no indication or suggestion in the fabric and form of the house that its construction cannot support the proposed works, both in their execution or when complete.



Construction Timeline

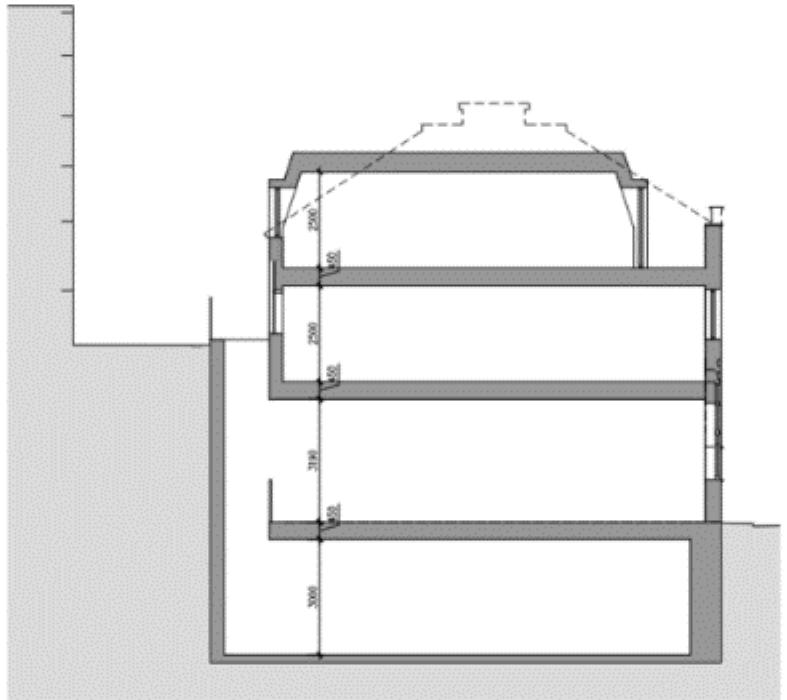




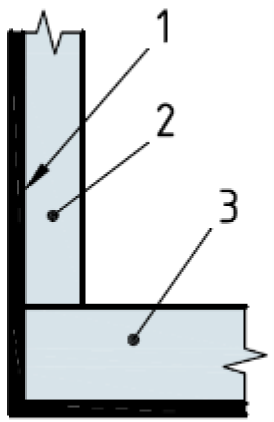
No.11-13 Section

MICHAEL BARCLAY PARTNERSHIP

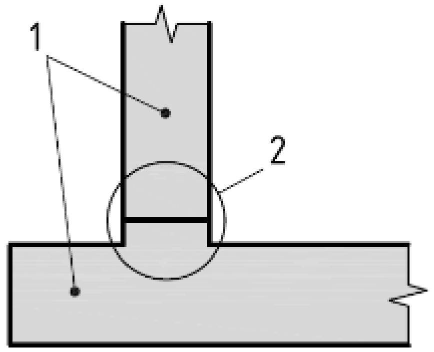
MBP



Proposed section



a) Type A (barrier) protection



b) Type B (structurally integral) protection

5.0 THE PROPOSED DEVELOPMENT

The proposed development will construct a single level of basement beneath the existing footprint of the current building to the extents of that in length & width. The existing ground floor will be replaced in the final scheme to prop the basement walls but could be retained throughout the works to maintain the support and stability that it currently provides to the side, front and rear walls. Additional works above ground floor are planned with the lowering of the existing first floor level, an addition of a second floor with new roof and relocation of internal staircases.

Office space will occupy the ground and basement levels of the proposed development, whilst residential occupancy will be located on the first and second floors. The front elevation is to remain as current, with an addition of the new roof.

BELOW GROUND LEVEL

The proposed basement will be an entirely new construction using reinforced and unreinforced concrete. Beneath the property, the existing walls will be underpinned following traditional techniques and hit-&-miss sequences.

The excavation of around 3.00 m of soil will result in an unloading of approximately 60 kN/m^2, an unloading that will allow a heave of the underlying London Clay, which will comprise an "immediate" elastic component of around 50-75% that can be expected to occur within the excavation and construction period, together with long term swelling movement that would theoretically occur over a period of many years. The effects of heave will be mitigated to some extent by the loads applied by the existing building, but the movements could yet be noticeable. The variation in unloading across the excavation is relatively uniform; differential movement is unlikely to occur, however a more detailed analysis of any potential movements will be undertaken once the basement design has been finalised. There are no known services that run beneath the property but a survey before works commence will be required to establish and protect any services, if necessary, during the construction process.

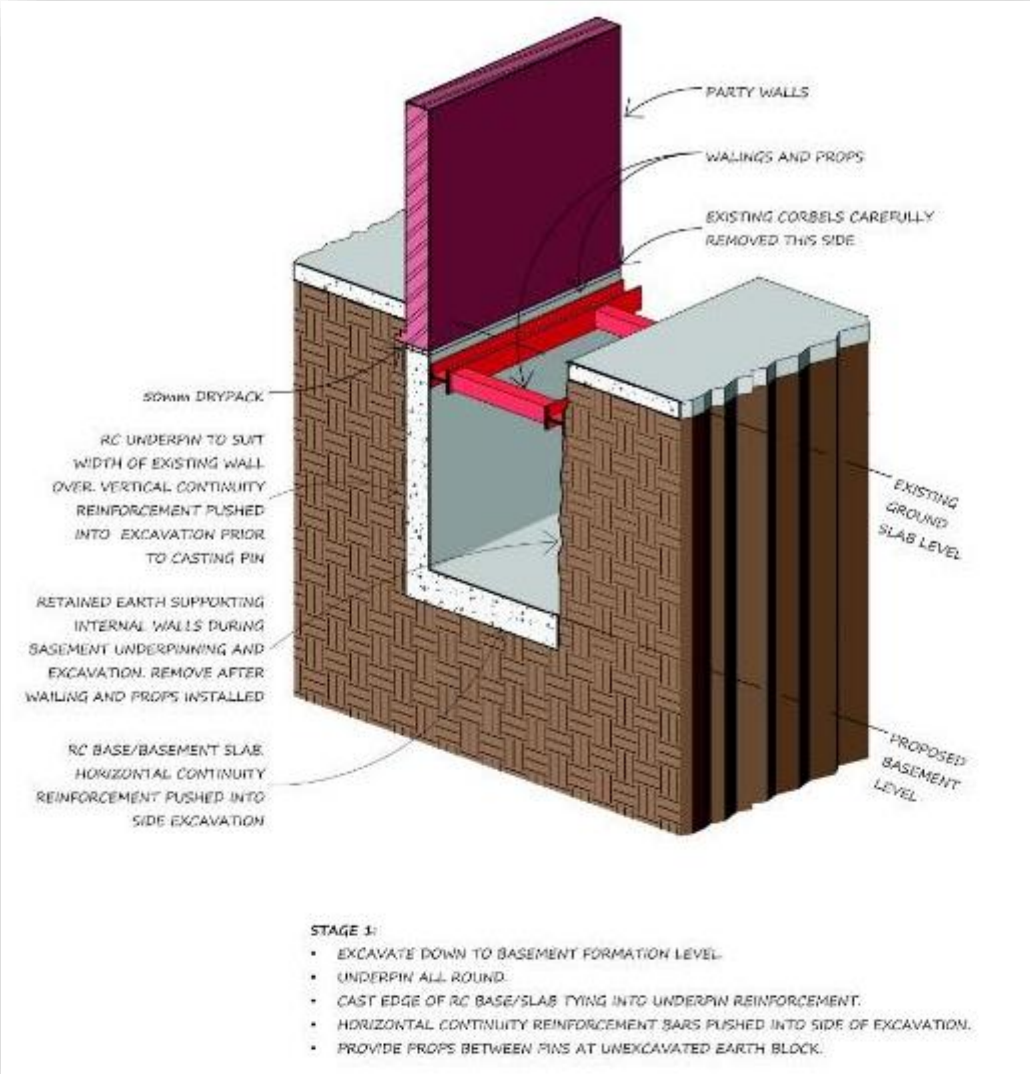
Although considerably above the prevailing groundwater level the new construction will be provided with Types A (barrier), B (structurally integrated) or C (drained) protection against ingress of water, as defined by BS 8102:2009 and constructed and detailed to achieve a Grade 3 Level of Performance, as defined by BS 8102:2009.

Table 2 Grades of waterproofing protection

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

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

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



Construction of a Basement Wall by Hit-&Miss Sequence

UNDERPINNING IN A HIT-&-MISS SEQUENCE

Although a lengthy process, underpinning by hit-&-miss-sequencing is a low-impact technique that permits the maximum space to be achieved and has the least impact on existing constructions, boundaries and the like and requires the least amount of plant.

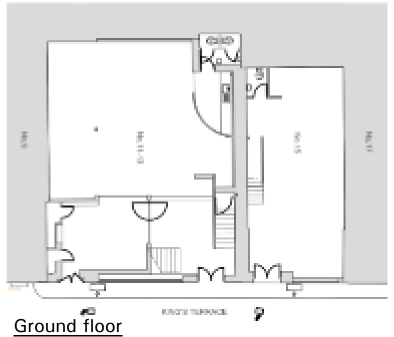
Any excavation leads to some horizontal movement within the adjoining ground, because soil exists in a three-dimensional stress condition that deforms under the influence of those stresses. If lateral stress is relieved by excavation, the soil will expand accordingly in a lateral direction into the new void and simultaneously compress vertically to maintain its volume. The sides of each pit prepared for an underpin will move horizontally into the excavation, resulting in vertical downward movement of the ground around the excavation, as the soil maintains its volume. The amount of this movement depends on a number of factors, including the density, consistency and plasticity of the soil, the existing load condition, and the shoring used as the excavation proceeds and in stiff London Clay is usually very small.

Casting the wall in pins controls the extent of soil exposed, avoids extensive temporary works and they can be controlled in size and sequence to reflect and accommodate the condition and capability of the walls they will be built beneath. Two-stage vertical sequencing can be integrated into the process to further minimise the depth of exposed excavation to minimise the movement required to maintain volume and to control loose material. As each pit or stage of pit is excavated beneath the wall, and prior to concreting, the vertical sides or faces of that excavation are shored up to prevent the adjacent soil collapsing into the new void.

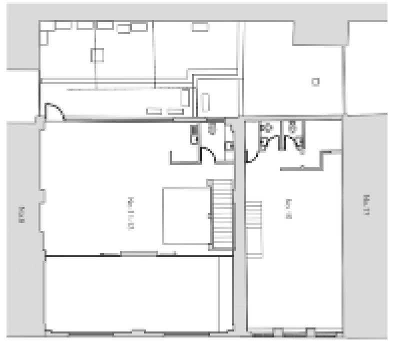
Construction of a Basement Wall by Hit-&-Miss Sequence

Construction of a Basement Wall by Hit-&-Miss Sequence

Underpinning To A Masonry Wall



Ground floor

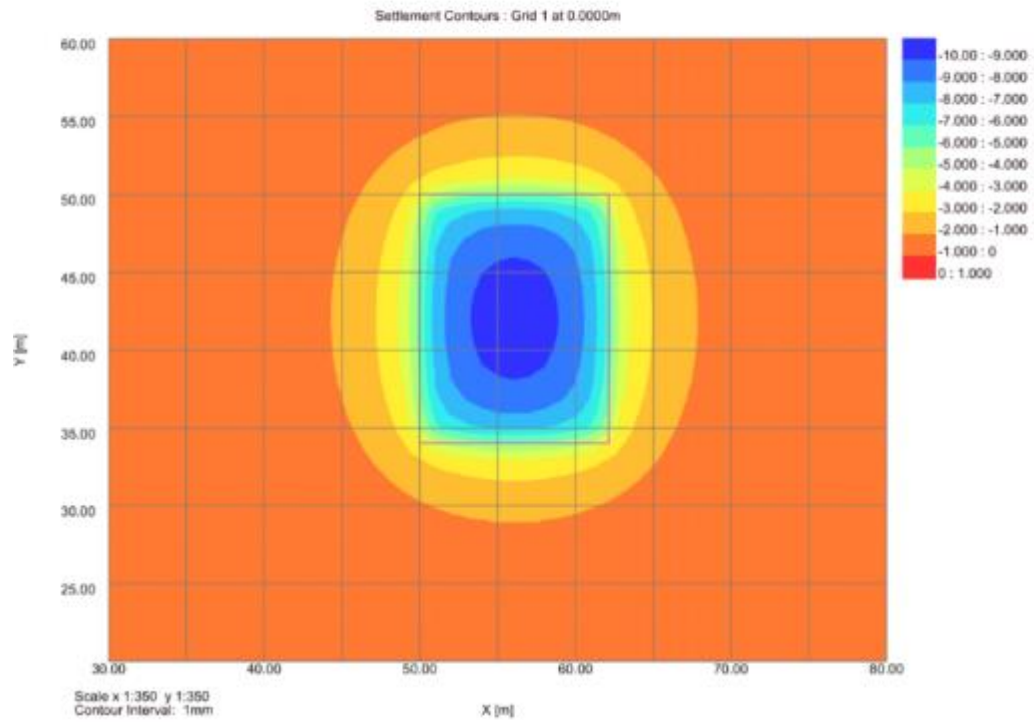


First floor

Existing plans

Proposed plans

The material removed will be made ground and the top layer of clay, which will relieve pressure on the London Clay that underlies the site, and we estimate that this relief will not be significant, will not lead to noticeable swelling of the clay and so will not impact significantly on the surrounding buildings and foundations, as concluded in the *Basement Impact Assessment* provided with the site investigation report by GEA. The predicted heave at the centre of the excavation is 5mm in the short term and 10mm in the long term. The basement slab can be either a suspended reinforced plate which allows for the vertical heave of the ground below or ground bearing plate that is sufficiently reinforced to resist the pressures that arise from the anticipated heave. A ground bearing basement slab will act in such a way to reduce the anticipated heave as the loading from the building will remain on the footprint of the excavation.



Long term settlement/heave from GEA report

There is no active groundwater within the proposed construction zone; an external waterproofing layer to the underpin walls is proposed, which will be the first layer of defence in the Grade 3 Performance Waterproofing Specification & a bentonite-impregnated membrane is suggested to be installed between the back of the concrete wall elements and the retained soil, such as VOLCAY supplied by CETCO.

The basement slab will be a reinforced concrete raft cast on a suitable sub-base and will be formed off the underlying London Clay. While neither pad nor strip foundations are intended the slab may need to be thicker beneath the relocated staircase. Any localised thickenings to the reinforced basement slab will be confirmed following a detailed analysis of the structure.

The existing ground slab will be replaced by a suspended reinforced concrete slab which, when complete, will permanently prop the basement walls below.

ABOVE GROUND LEVEL

Internal remodelling of the upper floors will involve the replacement of the first floor at a lower level and the addition of a second floor beneath a new flat roof which replaces the existing hipped roof. Partition walls will be installed at first and second floor dividing the separate residential units and support of those new internal partitions will be considered when designing the first-floor structure.
Each residential unit will have its own staircase installed from ground to first and from first to second.

6.0 DRAINAGE & SUDS

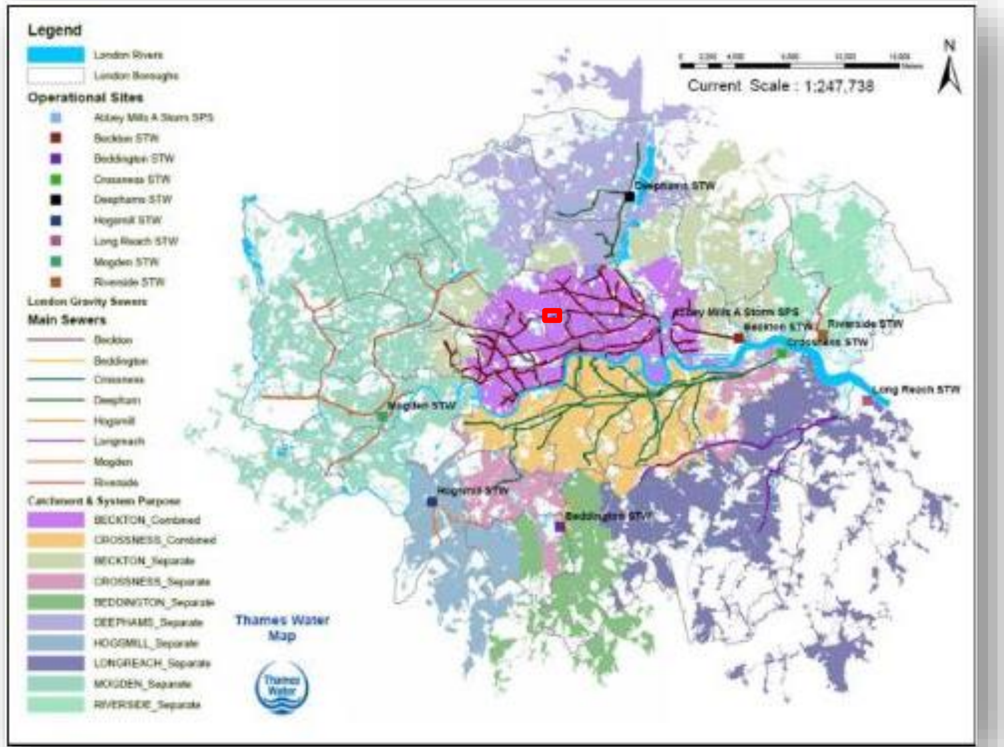
Nº. 11-15 King's Terrace is classified as an area of High Risk of surface water flooding by the Environment Agency owing to few areas of permeable surfaces within the borough.

The London Borough of Camden's Flood Risk Management Strategy indicates that the site is within Group 3-005 Critical Drainage Area, which the council's Surface Water Management Plan defines as "A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure."

The proposed development remains within the existing footprint of the building and there will be no increase of in hardstanding and impermeable areas; there will not be an increase in surface water run-off from the site in volume or flowrate than is the current case. Surface water run-off will be discharged, as it is currently, directly to the public sewer. Protection to the basement is nevertheless necessary and will be provided by a non-return valve in the discharge line that will prevent back-wash from flooding of the local drains entering the basement in particular.

Whilst the proposed works creates two separate residential units above a two storey office space, the discharge into the existing sewer is not likely to experience any significant increase in volume due to the low risk of bathrooms and facilities across all occupancies being used simultaneously.

The scale and scope of the basement works will require a new below-ground drainage system to be provided by combining gravity flow from the above-ground accommodation and new pumped flow from the basement accommodation. The final connection between this system and the public sewer will include and anti-flood valve to protect the property from surcharges in the public sewers. Foul drainage from the basement will be positively-pumped via a **Flygt Compit Pump Station,** or equally approved, **f**itted with a non-return check valve. The system will be designed to cope with local surface flooding, as the site is at high risk of surface water flooding, as well as the required uplift for climate change.



Combined and separated sewer system (Source: Thames Water/London Sustainable Drainage Action Plan)

Most Suitable	SuDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Green roofs	✓	✓	✓
	Basins and ponds 1. Constructed wetland 2. Balancing ponds 3. Detention basins 4. Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices 5. Soakaways 6. Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains 7. Gravelled areas 8. Solid paving blocks 9. Porous paviours	✓	✓	
Least Suitable	**Tanked systems** 10. Oversized pipes/ tanks 11. Box storage systems	✓		

Box 1: London Plan Policy 5:13 Sustainable Drainage

Planning decisions

A. Development should utilise sustainable urban drainage systems (Sustainable drainage) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:
   1 store rainwater for later use
   2 use infiltration techniques, such as porous surfaces in non-clay areas
   3 attenuate rainwater in ponds or open water features for gradual release
   4 attenuate rainwater by storing in tanks or sealed water features for gradual release
   5 discharge rainwater direct to a watercourse
   6 discharge rainwater to a surface water sewer/drain
   7 discharge rainwater to the combined sewer.

   Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

LDF preparation

B. Within LDFs boroughs should, in line with the Flood and Water Management Act 2010, utilise Surface Water Management Plans to identify areas where there are particular surface water management issues and develop actions and policy approaches aimed at reducing these risks.

SuDS hierarchy (from the London SDA Plan Table 1 & Box

Flgyt Pump Station

Table B.2 — Classification of buildings according to their resistance to vibration and the tolerance that can be accepted for vibrational effects

Class of building[a]	Category of structure (see Table B.1) 1	2	3	4	5	6	7	8
	Categories of foundations (upper case letter) and types of soil (lower case letter) (see B.5 and B.6)							
1	A a							
2	A b	A a	A a	A a				
3		A b B a	A b B a	A b	A a A b			
4		A c B b	B b	A c	A c B a B b			
5		B c	A c		B c	B a		
6		A f		A d	B d	B b C a	B a	
7			A f	A e	B e	B c C b	B b C a	
8						B e C c	B c C b	
9		B f				C d	B d C c	A a
10			B f			C e	B e C d	A b
11				C f	C f		C e	B a
12						C f		B c C a
13							C f	B d C b C c
14								C d C e C f

← Level of acceptable vibration decreasing

[a] High class number = high degree of protection required

Table B.2 of BS ISO 4866:2010

Damage Category	Description of Typical Damage	Approximate Individual Crack Width
Negligible (0)	Hairline cracks	< 0.1 mm
Very Slight (1)	Very slight damage includes fine cracks which can be easily treated during normal decoration, perhaps an isolated slight fracture in building, and cracks in external brickwork visible on close inspection.	1 mm
Slight (2)	Slight damage includes cracks which can be easily filled and redecoration would probably be required, several slight fractures may appear showing the inside of the building, cracks which are visible externally and some repointing may be required, and doors and windows may stick.	< 5 mm
Moderate (3)	Moderate damage includes cracks that require some opening up and can be patched by a mason, recurrent cracks that can be masked by suitable linings, repointing of external brickwork and possibly a small amount of brickwork replacement may be required, doors and windows stick, service pipes may fracture, and weather-tightness is often impaired.	5 mm to 15 mm or a number of cracks > 3 mm
Severe (4)	Severe damage includes large cracks requiring extensive repair work involving breaking-out and replacing sections of walls (especially over doors and windows), distorted windows and door frames, noticeably sloping floors, leaning or bulging walls, some loss of bearing in beams, and disrupted service pipes.	15 mm to 25 mm but also depends on the number of cracks
Very Severe (5)	Very severe damage often requires a major repair job involving partial or complete rebuilding, beams lose bearing, walls lean and require shoring, windows are broken with distortion, and there is danger of structural instability.	> 25 mm

Table 1: Severity of Cracking Damage[4,5]

7.0 RISKS TO & IMPACT ON SURROUNDING BUILDINGS

The proposed development is a relatively low-level, low-density construction which will occupy the same overall footprint as the existing building nd will incorporate the existing boundaries in its envelope.

In accordance with definitions set out in Annex B of BS ISO 4866:2010:

- From section B.4, the surrounding buildings fall within Group 1a, i.e. **Ancient, Historical** or **Old**; buildings in this group are generally of heavier construction and have a higher damping coefficient due to the materials used in their construction.
- From section B.5, the surrounding buildings are likely to have foundations that fall within Class B, i.e spread wall footings through brick corbelling at their bases.
- From section B.6, the area consists of soil defined by type e, i.e. soft cohesive soils such as clay.

From table B.1 of BS ISO 4866:2010, the surround buildings fall within categories 5 and 6, i.e two-storey buildings and four- to -six-storey buildings made of brickwork with timber floors and roof. Buildings of category 6 can be considered to have moderate resistance to vibration.

From table B.2 of BS ISO 4866:2010, and taking the surrounding buildings to be category 6, foundations to be class B and the soil type e, buildings in the surrounding area fall within Classes 7 and 8 which are deemed to have medium levels of resistance to vibrations. It can be taken that buildings of such a class require little to no protection against vibration for the types of works intended.

- Although the construction will be further below ground level than the existing building it will not be significantly deeper than the lowest level of surrounding buildings.
- The basement construction will not be lower than the prevailing groundwater level in this area so will not interfere with the natural flow of the groundwater.
- The new construction will be formed off and within London Clays, which are firm and have a significant bearing capacity, and the foundations will be designed to reflect the recommended permissible pressures and ensure they will not be compressed by more than 10mm, the consolidation predicted by the GMA.
- Removal of the existing construction will generate relief and consequent heave in the London Clay, although at levels that are manageable and contained within the plot.
- The boundary walls on four sides can be retained safely and easily following industry-standard practices and, by following a pre-determined sequence will allow the basement walls to be constructed without detriment to the existing surrounding construction.
- Excavations for the pins that will form the new basement walls can be undertaken using small excavators, which will be a low-impact technique and unlikely to generate excessive vibration.

GEA's Ground Movement Analysis, provided as Appendix A to this report, determined that the damage categories of neighbouring properties are, for the most part, category 0 and category 1, negligible to very slight: there is a wall situated at N°. 28-30 Camden High Street – to the rear of N°. 11-15 Kings Terrace - that falls above the threshold of Category 2, slight. It has been concluded that this wall will have a greater stiffness than that used in GEA's model as it acts in a system with other masonry walls and, as a result, damage experienced will be reduced such that it falls within category 1 and category 2, very slight to slight.

To ensure that any damage is limited to category 1, a controlled and sequenced work process needs to be adopted and a robust temporary support system employed during the works to ensure that lateral movements of the retaining structure are minimised. In the permanent case, the retaining wall is to be designed to have lateral restraint provided by the ground floor.

Table 6.1 Ground surface movements due to bored pile and diaphragm wall installation in stiff clay

Wall type	Horizontal movements		Vertical movements	
	Surface movement at wall (per cent of wall depth)	*Distance behind wall to negligible movement (multiple of wall depth)*	*Surface movement at wall (per cent of wall depth)*	*Distance behind wall to negligible movement (multiple of wall depth)*
Bored piles				
Contiguous	0.04	1.5	0.04	2
Secant	0.08	1.5	0.05	2

CIRIA Report C760 provides comprehensive consideration and recommendations of ground movements behind embedded retaining wall, from which it has been summarised that the distance from the wall that movements are negligible are a multiple of the wall height. While that data is based on walls constructed by piling, the results are not dissimilar for cast in situ walls so this data can be used with confidence to suggest that movements consequent of these works will, too, be very slight.

Ariel view of King's Terrace

Street view of King's Terrace looking towards Plender Street and towards the dead end respectively

Shored Excavation for an underpin

Conveyor to remove arisings

8.0 CONSTRUCTION METHODS & SEQUENCE

The excavation for, and construction of the basement will need to be completed without involving or disturbing the surrounding buildings. The sequence of the works for the construction phase of this project will, ultimately, be prepared by the contractor who will undertake the works but we expect, and will guide them towards a sequence similar to the following:

- Sequenced construction of the underpinning of the house starting from the middle and working down from existing footing level,
- Pins to start at four or five locations reducing to one at completion, following a traditional 1 3 5 2 4 sequence,
- Backfill each pin when complete,
- Arisings removed by conveyor to skips or wagons. It may not be possible to for the contractor to store arising temporarily on site due to a lack of space to do so.
- Installation of lateral props between the house walls just above existing ground level.
- Excavation down to slab formation level.
- Installation of new below ground drainage.
- Formation of reinforced concrete basement slab.
- Formation of reinforced concrete liner wall.
- Installation of new ground floor plate and, ∴, permanent propping to the basement walls
- Removal of temporary props.

Underpinning is done following a hit-&-miss sequence using local props and sheeting as required to support the excavations. With the conclusion until the new basement slab and liner wall are constructed. Continuity reinforcement between the pins will allow lateral props to be provided at 2-3m c/c rather than to each pin.

Groundwater was not encountered in the site-specific investigation by GEA and, as a result, will not be a significant risk whilst excavating on site. GEA concluded that groundwater inflows may arise from perched water tables within the made ground which overlays the London clay but any such flows can be adequately dealt with through sump pumping whilst on site.

The programme of works will be confirmed once the contractor is appointed but it is expected that the subterranean construction will take approximately 6-8 months.

King's Terrace is a quiet cul-de-sac with mostly converted residential units lining the street. The street is narrow and has only one point of access at the north-westerly end at Plender Street. Traffic is two-way, and the road is wide enough for traffic to pass in both directions provided vehicles are not parked on either side. It is a road that can accommodate construction traffic although a traffic management plan will be necessary for the control of construction vehicles particularly during excavation. Attention should be given to the lack of space needed for vehicles to turn; it may be necessary for any construction traffic to reverse into King's Terrace from Plender Street. Consideration should be given to the methods in which arising from excavation will be handled. No. 11-15 King's Terrace fronts directly onto the street and has no garden space at its rear for the temporary storage of arising before transporting away from site.

Small Excavator used near Boundaries

Small Disposal Waggon for Removing Arisings

9.0 NOISE & NUISANCE

Construction works generally are a source of noise and nuisance which can affect operatives within the site as well as neighbours and passing members of the public. Demolition and excavation works are particular sources of this potential harm so it will be necessary during these works, at Nº. 11-15 King's Terrace, for the contractor to mitigate the extent and impact of noise, dust, traffic and vibration.

Noise: Generated by the mechanical equipment used to excavate for the new basement:
Mitigated by using electrical equipment where possible and mufflers or attenuators on diesel engines or generators, by working only within agreed and designated hours:

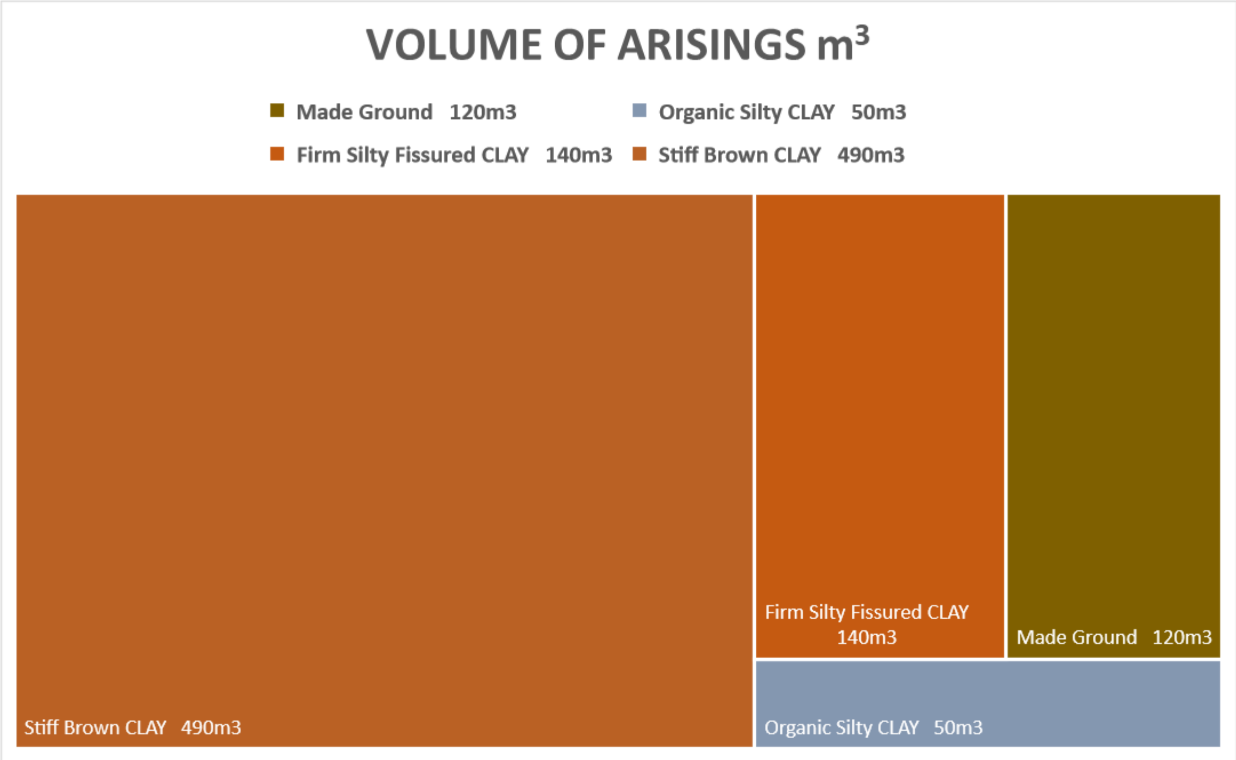
Dust: Generated by excavation works and the transfer of arisings from the works area to the disposal skip or wagon:
Mitigated by damping conveyors when in operation, by installing a weatherproof cover over the site, by washing-down vehicle wheels before leaving site:

Traffic: Generated by delivery and removal vehicles travelling to and from site:
Mitigated by establishing a traffic management plan, by identifying and using routes appropriate to the vehicles, by scheduling Vehicle movements to avoid peak traffic periods, by ensuring vehicles are low emission standard:

Vibration: Generated by use of heavy breakers for sustained periods and by heavy vehicles or plant
Mitigated by using light, hand-held and electrical breakers, by avoiding excessively heavy plant.

Protection: Robust hoarding will be erected around the site, front, rear and sides, to secure the site from intrusion as well as provide protection to neighbours and passing public from noise, dust and material arisings.

The works will cover around 200m^2 and excavate to ~4.0m over the area, which will generate approximately 800m^3 of spoil as scheduled alongside. Removal of this volume will need around 600 vehicle trips.



10.0 CONCLUSIONS

The proposed development of No. 11-15 King's Terrace can be achieved using standard construction techniques and materials. The new construction will not be beneath the prevailing groundwater level. The basement can be constructed using relatively light techniques, in controlled and pre-determined sequences and without the need for a large open excavation before construction can start and consequent extensive temporary works. Where mechanical means are necessary to construct permanent works these can be of a type that generates low vibrations to which the surrounding buildings have a form and construction that is robust and resistant to.

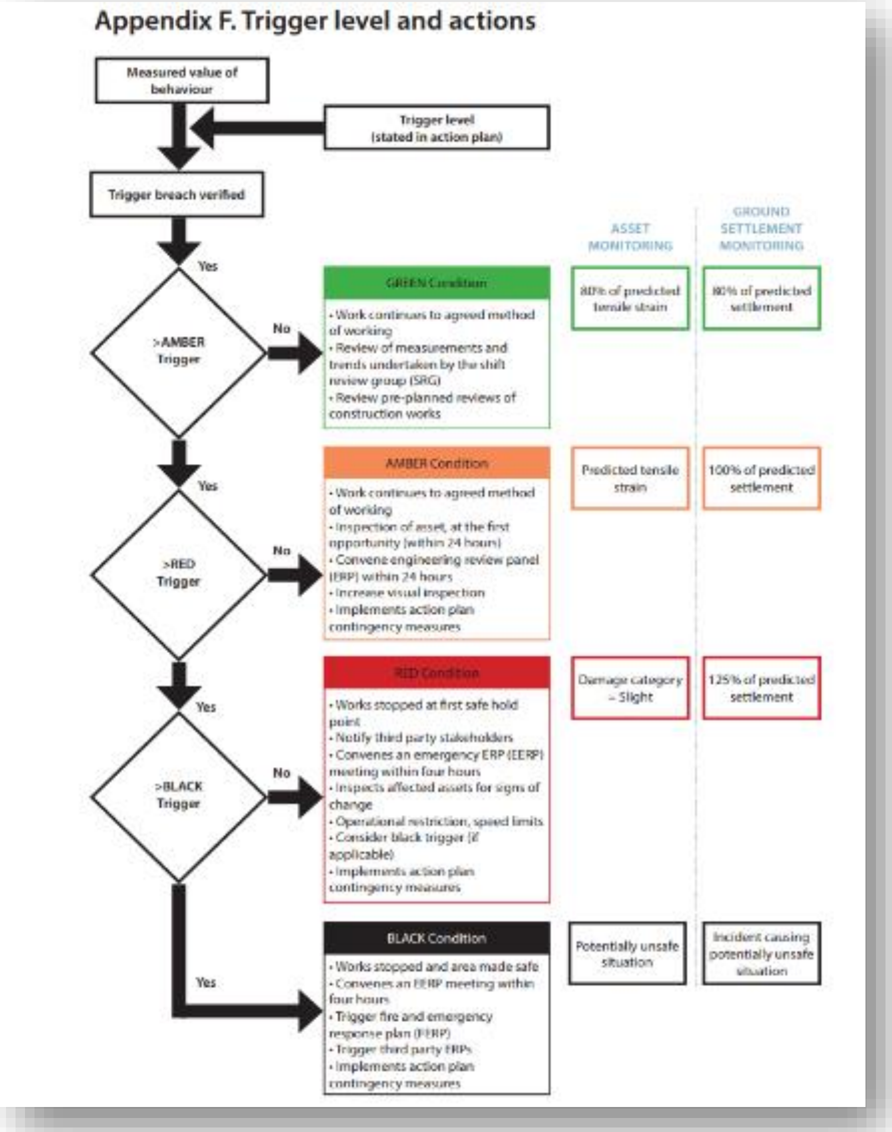
- The site-specific site investigation has established the near-surface soil profile to be the London Clay Formation overlain by a moderate layer of made ground.
- The site is over an unproductive stratum in relation to the underlying aquifers.
- As outlined, the construction of the subterranean basement will not affect the integrity of the surrounding building stock, will not disturb underlying hydrogeology or overload the near-surface geology.
- The site is on level ground in any case but, notwithstanding this, the construction techniques and sequences proposed minimises the risk of instability, ground slip and movement.
- There are no critical utilities or infrastructure beneath the site that cannot be relocated easily to accommodate the construction and, as there is no change in use or level of occupancy proposed there will be no significant increase in foul discharge to the public sewer.
- The proposed construction will not be beneath the prevailing groundwater level. The basement can be constructed using relatively light techniques, in controlled and pre-determined sequences and without the need for a large open excavation before construction can start and consequent extensive temporary works. Where mechanical means are necessary to construct permanent works these can be of a type that generates low vibrations to which the surrounding buildings have a form and construction that is robust and resistant to.
- The excavation for, and construction of, the basement will need to be completed without involving or disturbing the existing ground and upper floors or the fabric of the retained walls. Underpinning will commence from the middle of the walls and will be cast in 1m-sections of reinforced concrete. The existing lower ground floor will, where possible, be left in place; where part or all is removed props will be installed between the party walls. Refer to sections 7 and 8 above.
- By adopting an underpinning technique and following a hit-&-miss sequence, as described it will be possible to construct the basement without extensive temporary works.
- Any temporary works, however required, will be designed by the Contractor to current British Standards.
- The proposed development is not above the Upper Aquifer, not within the catchment of The Hampstead Heath Pond Chains and is in Flood Zone 1 for flood risk from rivers and seas.
- King's Terrace is at high risk of surface water flooding – the London Borough of Camden's Planning Guidance for Water and Flooding, March 2019, a Flood Risk Assessment is needed for all basement developments on streets identified as being at flood risk.
- The proposed development is contained within the current boundaries of the building and does not increase the area or number of hard surface area and hence maintains the current regime for surface water run-off.

Report Prepared By	Qualifications	Position	Signature	Date
James Ellis	BEng MSc	Engineer		June 23rd 2021

APPENDIX A GEA's SI REPORT BIA & GMA

APPENDIX B MBP DRAWING SET 8292

APPENDIX C MBP CALCULATION SET 8292



APPENDIX D PROCEDURE FOR MONITORING ADJACENT STRUCTURES

An independent surveyor will monitor the adjacent structures and party walls for movements throughout the principal demonstration & construction works and, in the event of any movements exceeding the agreed target levels the method of works will be reviewed and altered as necessary.

- The proposed monitoring points will be agreed with the contractor
- The Green/Amber trigger level will be 5mm
- The Amber/Red trigger level will be 10mm

The monitoring regime and frequency proposed is:

Activity	Frequency of monitoring
Site set up	Bi-Weekly
Demolition & Excavation	Weekly
Underpinning & Ground Works	Weekly
Principal Construction Works	Bi-Weekly

Target monitoring will monitor the party walls and front and rear elevations with an accuracy of +/- 2mm. The results of the monitoring are to be recorded and issued by email to the project engineer, CA and engineers for the adjoining properties, on the day that the results are taken. The results are to be presented both in table and graphical form with the graphs for each point plotting the readings taken against time. The following actions will be taken if the trigger levels are exceeded:

Trigger Level	Action
Green/Amber	Immediately notify the engineers. Increase frequency of monitoring to a daily basis.
Amber/Red	Contractor to stop all works and immediately notify the engineers. Contractor and project engineer to put forward proposals, such as additional propping, to limit further movement to an acceptable level.

APPENDIX E PROCEDURE FOR CONTROL OF NOISE, DUST & NUISANCE

To control the disturbance due to noise and vibrations, all works on site will be restricted to the hours of Monday to Friday 8am to 6pm, Saturdays 8am to 1pm. Works that create excessive noise and/or vibration are prohibited, as are any works on Sundays and the bank holidays. The contractor employed to undertake the work will be a member of the Considerate Constructor Scheme.

Appropriate measures will be taken to keep dust pollution to a minimum. These measures are compliant with Camden Planning Guidance – Basements dated 2018. Such measures will include the use of water to suppress dust and soil being excavated from basement level, covers for conveyors and skips, and barriers installed around dusty activities that are undertaken externally.

All work will be carried out in accordance with BS 5228-1:2009 and BS 5228-2:2009. All works will employ Best Practicable Means as defined by section 72 of the Control of Pollution Act 1972 to minimise the effects of noise and vibration. All means of managing and reducing noise and vibration which can be practicably applied at reasonable cost will be implemented.

The following measures will be taken:

- Consultation/ communication with neighbours/affected others prior to the start of the works.
- Use only of modern, quiet and well-maintained equipment, all of which will comply with the EC Directives and UK regulations set out in BS 5228-1:2009
- Use of electrically powered hand tools rather than air powered tools and a compressor will be used for to the minimum extent practicable
- Avoidance of unnecessary noise (such as engines idling between operations or excessive engine revving, no radios, no shouting)
- Use of screws and drills rather than nails for fixing hoarding.
- Careful handling of materials, so no dropping off materials from an excessive height (no more than 2m) into skip etc.
- Ensuring that the conveyor is well maintained with rollers in good working order and well oiled.
- Collection /delivery times will be as given in the CTMP
- Collection/delivery vehicles will not wait/loiter in the area before the allowed times.
- No site run-off of water or mud until the water has been left to settle and is free from particles

During Demolition:

- Special Care to ensure the site is closed-over
- Dust suppression with water if necessary if needed (recommended)
- Cutting equipment to use water suppressant or local extraction & ventilation

If measures to control dust are unsuccessful works will be stopped and alternative methods proposed and implemented

A detailed CTMP will be prepared by the contractor undertaking the works d

APPENDIX F CMS CHECKLIST USING THE LONDON BOROUGH OF CAMDEN PLANNING GUIDANCE – BASEMENTS MARCH 2018 AS REFERENCE

Screening – the screening process is to determine whether there is any need for a full BIA	BIA included
Scoping – the identification of the potential impact of the proposed scheme this is done through the geological, hydrogeological and hydrological study	Included
Site investigation and study - ground movement potential impact on neighbouring properties, if there is a risk of subsidence this should be described using the Burland Scale	Included
Impact Assessment – evaluating the direct and indirect implications including Flood risk Assessment, Landscaping, watercourses, Historical Ground information through OS Maps, identification of Aquifers,	Included
Building Regulations – the submission of building regulations is required with the full details of works planned, full site investigation and Structural Engineers report on the investigation and development proposals	Next phase – detail design
Detailed site specific analysis of hydrological and geotechnical local ground conditions	Considered
Analysis of how the excavation of the basement may impact on the water table and any ground water flow, and whether perched water is present	Considered
Details of how flood risk, including risk from groundwater and surface water flooding has been addressed in the design, including details of any proposed mitigation measures	Considered
Details of measures proposed to mitigate any risks in relation to land instability	Considered
A comprehensive non- technical summary document of the assessments	Included
Identify the location of the development in relation to an aquifer or a water course	Included
Impact on flooding and drainage including measures to reduce the risk of flooding to the proposed basement and neighbouring properties	Considered
Appropriate basement construction methods to maintain structural stability of the statutory listed host building and neighbouring statutory listed properties	Considered
Details of noise, disruption and vibrations to neighbouring properties would be minimised during the construction process	Considered
Programme duration	Included
Construction vehicles' routing and movements, The number and types of construction vehicles, Site access and egress arrangements	Considered