# Basement Impact Assessment

238 Haverstock Hill, London, NW3 2AE


DECEMBER 1, 2022

IE IMPERIUM ENGINEERING
20-22 Wenlock Road, London N1 7GU

IE IMPERIUM ENGINEERING
20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



# Introduction

This report has been prepared for Wayne Everitt in relation to the proposed basement extension to form a light well.

No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

Imperium Engineering Ltd was appointed by its client to provide a Basement Impact Assessment (BIA)

to achieve Planning Approval at said property.

This report has been structured to cover the topics outlined below:

1. Basement impact assessment including highlighting the locations of the retaining walls to determine the structural stability of the basement lightwell extension.
2. A Flood Risk Assessment to highlight the possible impact of the basement extension on increasing the flood risks in the local area.
3. Impact of the proposals on surface flow and flooding.
4. Impact of the proposals on groundwater flow, levels and quality.
5. Impact of the proposals on structural stability including potential impacts on adjacent /nearby properties.
6. Impact on archaeology.
7. The identification of suitable construction methods and mitigation measures for developments.
8. A method for monitoring local ground conditions, water movement, subsidence and drainage.
9. The cumulative impact of basement development (built or proposed) in the surrounding area.

Note that the structural 'design' is sufficiently comprehensive for planning purposes only.

It is not intended as a fully worked up design to comply with current Building Regulations.

Documents Provided to Imperium Engineering Ltd for the BIA

The following documents have been referred to during the preparation of this report:

| **Document Description** | **Document Reference** | **Document Author** | **Date** |
|---|---|---|---|
| *Proposed Plans* | *20350/01/A* | H*LS Structural* | 07/2021 |
| Proposed Sections, General Notes | 20350/02/0 | H*LS Structural* | 07/2021 |
| Plans as Existing | 3408/1/PD02 | H*LS Structural* | 05/2020 |
| Plans as Proposed | 3408/1/PD04 | Wilby & Burnett | 11/2021 |
| External Works, Section A-A & Detail 1 | 3408/1/PD16/B | Wilby & Burnett | 11/2021 |

# About us

**Imperium Engineering Limited**

We are experienced in undertaking both private and public civil and structural engineering projects. Members of our board have been providing engineering services since 1987 in fields as diverse as the residential, transportation, oil and gas industries, and a broad range of commercial projects. We have specialists in each of these fields and draw on the knowledge of associates outside of our organisation when necessary to provide high-quality services.

In our history we have completed many basement designs in and around the London area. This has given us a significant amount of experience with all the idiosyncrasies of building and designing basements in one of the world's biggest cities where detailed knowledge of the soil conditions is of vital importance is finding the correct course of action for the type of soil on site.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



Our engineers have worked in the Structural Engineering field for more than 20 years. The majority have only worked in the Greater London and Kent area and are especially suited to dealing with London Clay Formation and the challenges it can sometimes present.

This report has been prepared by:

Christopher Holt BSc Structural Engineer and Temporary Works Engineer

Report Checked By:

Matthew Hargreaves: BSc, CEng, MICE, MIStructE

## Existing Structure

The property in question is an existing two storey semi-detached property with an existing basement. The existing structure is of traditional construction, comprising loadbearing masonry flank, front, and rear elevation walls. These walls support a timber-pitched roof and timber-suspended floors.

The suggested sequencing of the basement lightwell construction has been provided in order to limit the potential effect on the neighbouring property and to the existing structure.

The calculations in this report are for the purposes of impact assessment only.

Please refer to Appendix A for the site location.

Please refer to Appendix D for the existing and proposed drawings.

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T: 02034 417606
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# Site Assessment

## Site Details

| Site Details | Applicant Information |
|---|---|
| **Planning application reference (if applicable)** | N/A |
| **Address & postcode** | 238 Haverstock Hill, Belsize Park, London, NW3 2AE |
| **Brief description of the proposed works** | Excavation and creation of a lightwell at basement level adjacent to the existing basement |
| **Geology type** | London Clay Formation |
| **Presence of aquifer?** | No |
| **Total site area (Ha)** | 0.1 Ha (Estimated) |
| **Is the site currently known to be at risk of flooding from any sources?** | No |

## Chartered Professional Verification

| Professional Details | Applicant Information |
|---|---|
| **Name** | Matthew Hargreaves: BSc, CEng, MICE, MIStructE |
| **Profession / area of expertise** | Structural and Civil Engineering |
| **Chartered institution and membership level** | Chartered Member IStructE & ICE |
| **Brief description of assessment involvement** | Checking Engineer for BIA and Screening Assessment |
| **Brief summary of the assessment results** | BIA Impact Low Risk |
| **Declaration of assessment results** | BIA Required |
| **Signature** | *Matthew Hargreaves* |

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# Section 4: Screening Questions

| | |
|---|---|
| **Subterranean Characteristics** | |
| Does the recorded water table extend above the base of the proposed subsurface structure? | NO |
| Is the proposed subsurface development structure within 100m of a watercourse or spring line? | NO |
| Are infiltration methods proposed as part of the site's drainage strategy? | NO |
| Does the proposed excavation during the construction phase extend below the local water table level or spring line (if applicable)? | NO |
| Is the shallowest geological strata at the site London Clay? | YES |
| Is the site underlain by an aquifer and/or permeable geology? | NO |
| **Land Stability** | |
| Does the site, or neighbouring area, topography include slopes that are greater than 7˚? | NO |
| Will changes to the site's topography result in slopes that are greater than 7˚? | NO |
| Will the proposed subsurface structure extend significantly deeper underground compared to the foundations of the neighbouring properties? | YES – BY approximately 3m |
| Will the implementation of the proposed subsurface structure require any trees to be felled or uprooted? | NO |
| Has the ground at the site been previously worked? | NO |
| Is the site within the vicinity of any tunnels or railway lines? | NO |
| **Flood Risk and Drainage** | |
| Will the proposed subsurface development result in a change in impermeable area coverage on the site? | Negligible |
| Will the proposed subsurface development impact the flow profile of throughflow, surface water or groundwater to downstream areas? | No |
| Will the proposed subsurface development increase throughflow or groundwater flood risk to neighbouring properties? | No |

Please refer to Appendix B for the Aquifer map, Flood Zone map and Ground water map.

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## Structural stability

Provide details of ongoing drainage measures and their maintenance regimes; include appropriate basement construction methods to maintain the structural stability of the host building and neighbouring properties.

Please check Appendix E for our structural method statement which assesses how the structural stability of the existing structure will be maintained during construction and provides both temporary works and permanent works proposals. Appendix E also includes the following: Basement Retaining Wall Calculations, General Details, Hit and Miss Layout, Hit and miss Sequence Drawings, Temporary works Calculations, in addition to these we have also provided general construction notes and additional notes detailing the regulations to which the construction must adhere too.

## Impact on Archaeology

The site has already been developed with existing foundations however, due to the depth it is possible that there might be some artifacts, we suggest that an archaeologist is instructed to determine if the area is an area of significant historical interest and if so what measures they deem necessary for the site. It is possible that they will request to be present on site during the excavation works and that all excavation is carried out using hand tools only, however, as part of our SMS we have already suggested that any excavation worked are carried out using hand tools.

Please check appendix F which shows the archaeology map showing that there are no areas of interest.

## Noise, Disruption and Vibrations

Include details of how noise, disruption and vibrations to neighbouring properties would be minimised during the construction process.

Vibrations:

Due to the sectional staged approach for constructing the basement, the risk of movement between the basement and the neighbour's foundations is negligible, especially since the properties are detached and not terraced.

We are not able to state that the neighbours will have no damage; however, the existing properties are in good order, and we consider (based on previous projects of this nature) that any cracking would be within Category 1 of the Burland Scale. This is defined as fine cracks which are easily treated during normal decoration and forms part of the BRE Digest 251.

Noise and Disruption:

The contractor must ensure that working hours adhere to the council's code of practice for construction sites. The contractor must identify and implement measures to minimise noise and vibration impacts throughout the construction process. Such measures are related to but not limited to the selection of plant. For example, selecting plant with the lowers decibels is possible and using acoustic dampening methods such as acoustic screens and covers whenever possible.

We suggest that the excavation is carried out using small plant or by hand, no large machinery is to be used.

The main contractor and any subcontractors shall take reasonable steps to minimise any noise disruption to adjacent occupiers.

1. Design and use of site hoardings and sound shielding around noisy work areas. Keep doors and windows closed where possible.
2. Where it is necessary to carry out noisy activities, identify any adjacent neighbours in advance and give notice.
3. Operatives working in noisy areas will be monitored to ensure they are wearing the necessary protective equipment and that they are not exceeding their permitted exposure periods. Careful selection of quiet equipment and processes, programming, and the use of local screening of plant:
4. Use, where practical, electrically powered tools rather than air-powered tools - electrical tools do not need a compressor unit.
5. Use relatively low-power handheld breaking tools for demolitions.
6. Use, where practical, non-percussive methods for removing concrete, including diamond saws, diamond drills, concrete bursters and concrete crunchers.

7. Using cutting methods for demolition, such as sawing or water-jetting, to eliminate the use of high volume pneumatic and hydraulic breakers, before further breaking down of demolition materials is carried out off-site using conventional techniques.
8. Adoption of manual excavation techniques instead of diesel-powered excavators, where appropriate.

All plant and equipment associated with the construction works should be properly maintained, provided with effective silencers and operated in such a manner as to avoid causing excessive noise emission.

Where plant has been designed to operate with engine covers to reduce noise, these should be used and remain closed while the plant is in operation.

Unless otherwise directed by the project manager, items of plant in intermittent use should be shut down during idle periods.

No externally audible radios or other audio equipment will be allowed on site. Audible warning systems, such as vehicle reversing sirens, would normally be set to as low a setting as it compatible with safety requirements. The transport of materials on or off site should be generally taking place during normal daytime working hours and would use routes agreed in the Construction Traffic Management Plan.

Site personnel should be informed about the need to minimise noise to the neighbouring community as well as about the health hazards of exposure to excessive noise. Their training should include advice relating to the proper use and maintenance of tools and equipment, the positioning of machinery on site to reduce noise emissions to neighbouring communities, and the avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment. Construction contractors should adhere to the codes of practice for construction working set out in BS 5228 'Code of Practice for noise and vibration control on construction and open sites' as far as these are reasonably practicable and applicable to the construction works.

Dust management and mitigation:

Water should be used as a suppressant to reduce the amount of dust created during construction activities for example, when diamond disk cutters are used, and when excavation is carried out, the ground should be lightly wetted prior to digging. The contractor should ensure that they comply with The Control of Pollution Act, 1972; The Health & Safety at Work Act, 1974; The Environmental Protection Act, 1990; Construction Design and Management Regulations, 1994 and The Clean Air Act, 1993.

The contractor should ensure that Noise, vibration, and dust monitoring is implemented, and all skips are covered.

The contractor shall make reasonable attempts to wash and clean vehicles before leaving site and to make sure vehicles are not left idling.

Measures shall be taken to avoid creating a dust nuisance, including the following practices:

1. Provision of easily cleaned hard-standing areas for vehicles
2. Demolition activities will use water as a dust suppressant.
3. Adjacent road surfaces will be frequently swept clean.
4. All loads delivered to or collected from the site will be covered where appropriate.
5. All road vehicles will be requested to comply with set emission standards.
6. Skips will be securely covered.
7. The air quality within the site will be continually monitored
8. Establishing and enforcing appropriate speed limits over all unmade surfaces.

Management of Mud and site runoff

Measures will be adopted to prevent site runoff of water or mud these are listed below:

Measures shall be taken to minimise mud on roads. These will include, but not necessarily be limited to:

1. The provision of easily cleaned hard standings for vehicles parking next to the site. This also serves to minimise dust nuisance.
2. The provision of wheel washing facilities
3. The use of an approved mechanical jet washer to clean the site hard-standing and any mud or debris deposited by the site vehicles on roads or footpaths in the vicinity of the site.
4. The adequate sheeting of each load of spoil removed, to prevent spoil falling off during its journey; and measures will be taken to ensure that mud and detritus is not swept into gullies.

Fly-tipping will not be permitted. Loads must only be deposited at licensed tips or to designated sites. Deposition will be in accordance with the requirements of the Environment Agency under the Landfill (England and Wales) Regulations 2002.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



# Logistics and Site Management

The assessment should also detail the programme duration, construction vehicles' routing and movements, the number, and types of construction vehicles; site access and egress arrangements, and any temporary arrangements proposed for the highway.

The contractor will be required to submit their own Construction Management Plan and Site Waste Management Plan prior to the work commencing on site. The contents of this plan must be in accordance with the council's guidance and be agreed by them. The Contractor will be required to follow the principles and adhere to councils Code of Practice for Construction Sites as well as the requirements of this basement impact assessment in relation to sequencing and temporary works.

The contractor shall be required to establish a local point of contact for any enquires and or complaints relating to the construction works and nominate a member of staff to consult with the Council, residents, and commercial operators.

They will be required to circulate a regular newsletter explaining the forthcoming programme of works, progress so far and key events scheduled in the next phase of works. Prior to any unavoidable noisy periods of activity, the contractor will be required to write to the residents to inform them of these works.

The main contractor shall display on the site boundary details of their name, address, and telephone number, together with an indication of the likely duration of the works.

The Contractor shall avoid road closures where practical. All vehicles parked on the road will need to be aware of parking restrictions. The contractor must ensure that any skips do not inhibit the flow of traffic and, if possible, to use the property's driveway.

For any necessary road closures, the Contractor shall follow the council's procedures with regards to advance notification.

The contractor will need to produce a Traffic Management Plan. This should carefully consider vehicle movements and their impact on other road users, pedestrians, residents and the environment. Mitigation measures should be implemented where necessary.

Access to the site is to be via the front of the property. All personnel, plant and equipment will be brought to and from site via this route. The size of plant and construction methods used will reflect this constraint.

Deliveries and collections will be scheduled to coincide with normal working hours, and the Contractor shall aim to stagger vehicle movements to avoid queueing on the road. There is space for skips and some construction vehicles on the front driveway.

The contractor will be required to be signed up to the Considerate Constructors Scheme.

The contractor will be required to demonstrate due diligence and commitment toward minimising environmental disturbance to residents and will be required to complete the work in accordance with the Considerate Constructors Scheme standards.

All temporary works are to be designed by an engineer with appropriate qualifications.

Movements of surrounding structures should be monitored throughout construction, the results reviewed, and action taken to mitigate movements greater than anticipated.

A temporary hoarding will be erected to safely secure the site.

In terms of vehicles a list has been supplied below of anticipated vehicles:

Mini excavator, Site vans, Delivery lorries/trucks, Conveyors (Not a vehicle but is a form of plant), Concrete mixer truck for deliveries Skip delivery trucks.

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# Construction Sequence Plan

General Scope

It is proposed to construct a basement the materials and debris present within the structures will consist predominantly soil and fill material along with the lean to structure/outbuilding. The contractor will ensure that they are safely removed from the site and that they are disposed of at an appropriately licenced waste site.

Imperium Engineering does not take any responsibility for the construction sequence should the contractors work vary from what has been described below.

It is the contractors' obligation to contact Imperium Engineering should there be any doubts over the demolition sequence or the drawings.

Preparation works before the structural demolition

All workers employed to work on the project will be briefed about the project and be informed of the potential hazards by attending site induction sessions.

All equipment will be tested and properly stored and maintained over the duration of the demolition. Protective screen covers will be placed, where necessary.

At all times during the construction works, the works will be supervised by a competent supervisor that will be appointed by the main contractor.

Only the required workers are to be present during any demolition works. Access points will be established and only worker(s) who have been inducted with the authority of the Project Manager or supervisor may enter these zones. Preparation works before the structural demolition.

All workers employed to work on the demolition will be briefed about the project and be informed of the potential hazards by attending site induction sessions.

Construction sequence

It is proposed to create a new basement which will be formed of a cantilevered concrete wall; the retaining walls forming the lightwell will be cast adjacent to the existing neighbouring foundations of the detached; however, there is some distance between them, so it is unlikely that the line of influence for the adjacent building will intersect with the cantilevered retaining wall forming the perimeter of the basement lightwell.

The retaining wall will be cast in the hit-and-miss sequence as shown in the drawings provided.

A bay should be excavated and then cast with concrete using braced timber shutters at the sides. Allow for minimum 24 hours to cure and then before excavating the second adjacent bay.

The stems and bases are joined by distribution reinforcement hence every third bay, a full-width Slimshor prop should be used to restrain the RC walls during the construction. Once the ground slab has been cast, both the Slimshor and Acrow props can be safely removed. Temporary works specification: the structural specification of the permanent works is provided by the permanent works Engineer.

By following our construction sequence, the following material will be used. - 203UC 46kg/m steel needles –- Super Props – They can be hired from HSS (www.hss.com/hire/p/super-prop). Similar props could be used, once approved by the Engineer. At a minimum, they should have a minimum safe working load of 118kN.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



# Conclusion

This report provides methods that mitigate most of the risks associated with these types of works and outlines sequencing, which maintains the stability of the existing surrounding structures without compromising their integrity. This report also covered best practices in terms of avoiding causing unnecessary disturbance to the neighbours.

We have prepared a structural scheme and construction sequence to demonstrate that the proposed works can be constructed safely by a contractor that follows the guidance provided in this report along with their own due diligence. We recommend that a skilled contractor with a proven track record of projects of this type is employed to carry out these works as they require a specialist.

The methods of construction mentioned in this report are typical for basement excavation and construction and are tried and tested, the Structural method Statement we have provided in this report has been created in a way that makes the design simple and easy to follow and has been created with buildability in mind.

# Engineers Comments / Recommendations

- From the BGS maps and topographic maps, it is unlikely that any groundwater will be present during construction. The contractor should however provide pumps in the event of adverse weather.
- Risk from Fluvial and Tidal Flooding is minimal, with the area at risk of flood less than 1 in 1000 years. The area is not within Flood Zone 2, 3a or 3b where there are strict restrictions on basement developments.
- The basement should be designed to resist some hydrostatic pressure, both during the construction phase and as a finished structure, as the permeable layers will be in contact with the retaining wall.
- The depth of the existing footings should be confirmed prior to finalising the design structural design, an allowance should be made to create a mass-poured foundation beneath the existing foundation to match the depth of the retaining wall's slab to avoid surcharge loading on the retaining wall.
- During the excavation phase, groundwater levels should be monitored on-site and adequate pumps, and drainage should be provided. This should be detailed in the contractor's method statement.
- The basement should be designed as a combined system to achieve a Grade 3 Waterproofing as required in NHBC 5.4.3. This is due to the contractor and engineer being unable to confirm that the water table will be permanently below the substructure.
- To use a singular system, Designers who have successfully completed the Certified Surveyor in Structural Waterproofing (CSSW) qualification available from the Property Care Association (PCA) are generally acceptable. An alternative demonstration of competence may be acceptable, subject to a successful review.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



# Appendix A
## Site Location Map

The site lies at a level of approximately 76m above sea level.

Latitude: 51.5516 / 51°33'5"N Longitude: -0.1661 / 0°9'57"W

OS Eastings: 527249 OS Northings: 185230 OS Grid: TQ272852

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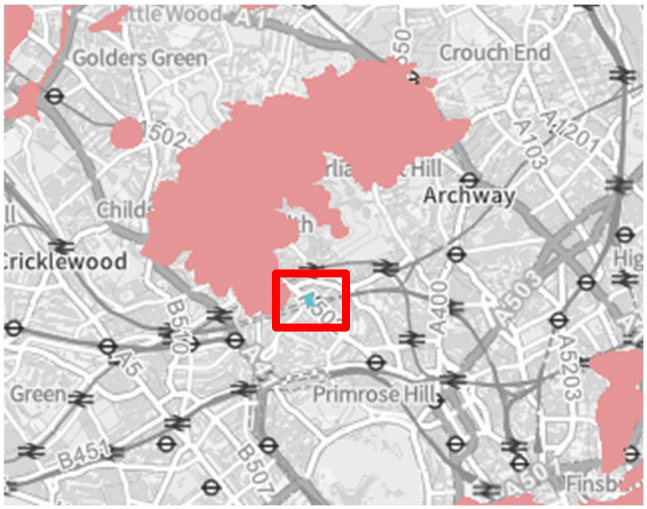
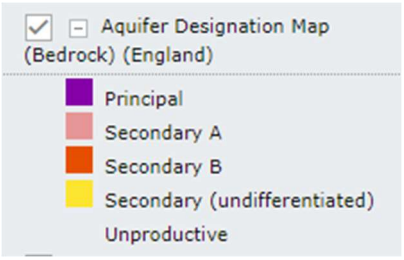
# Appendix B
# DEFRA Groundwater Maps

Aquifer Map (Bedrock)




Comments

There are no active aquifers noted/ Unproductive

Source: Magic Map Application (defra.gov.uk)

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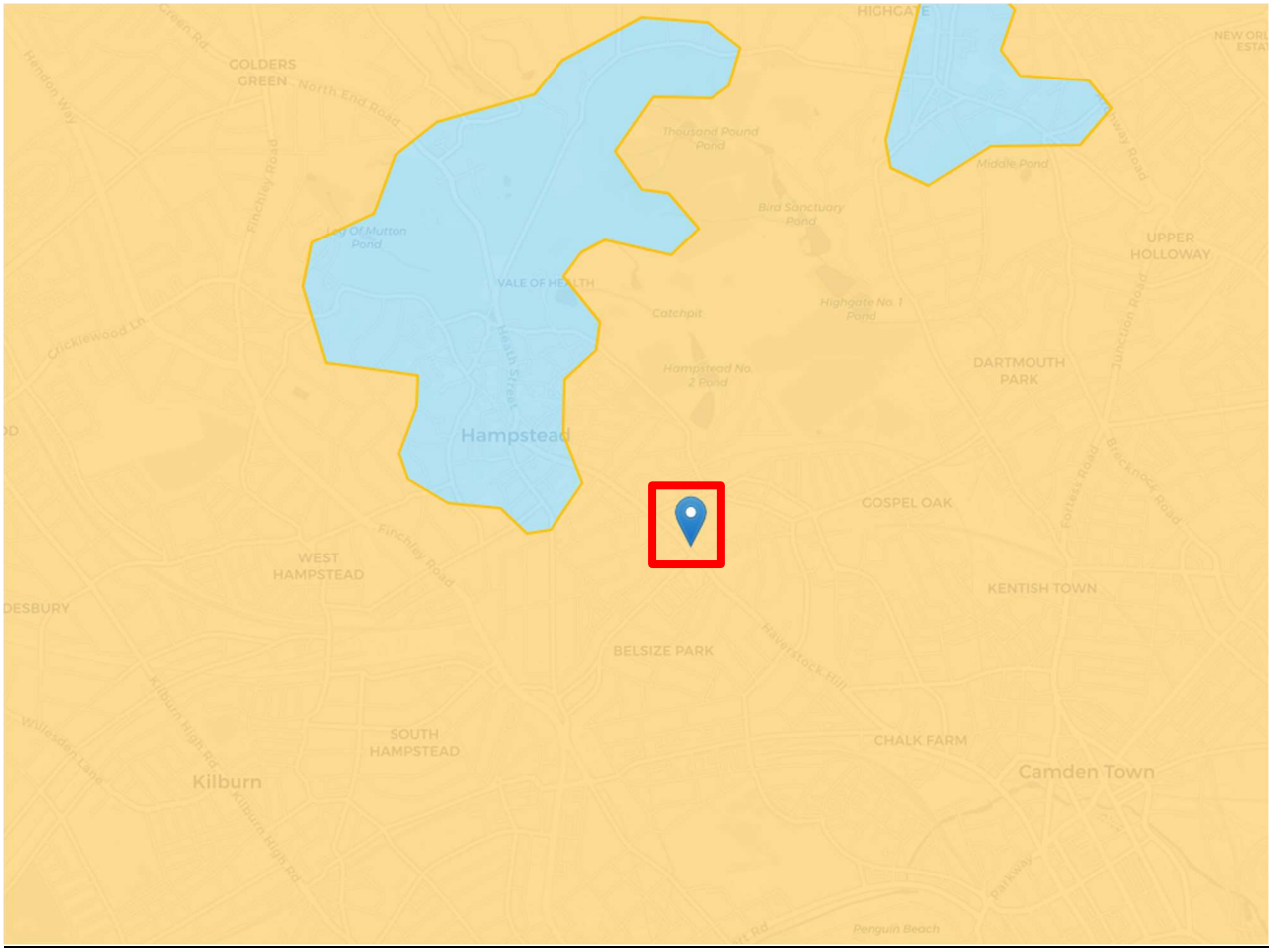
Ground Water Map




**Groundwater Aquifer Productivity**

- 1A - Highly productive aquifer
- 1B - Moderately productive aquifer
- 1C - Low productive aquifer
- 2A - Highly productive aquifer
- 2B - Moderately productive aquifer
- 2C - Low productive aquifer
- 3 - Rocks with essentially no ground...

Comments

Rocks with essentially no ground water

Source: Groundwater Productivity - UK - Interactive Web Map (mangomap.com)

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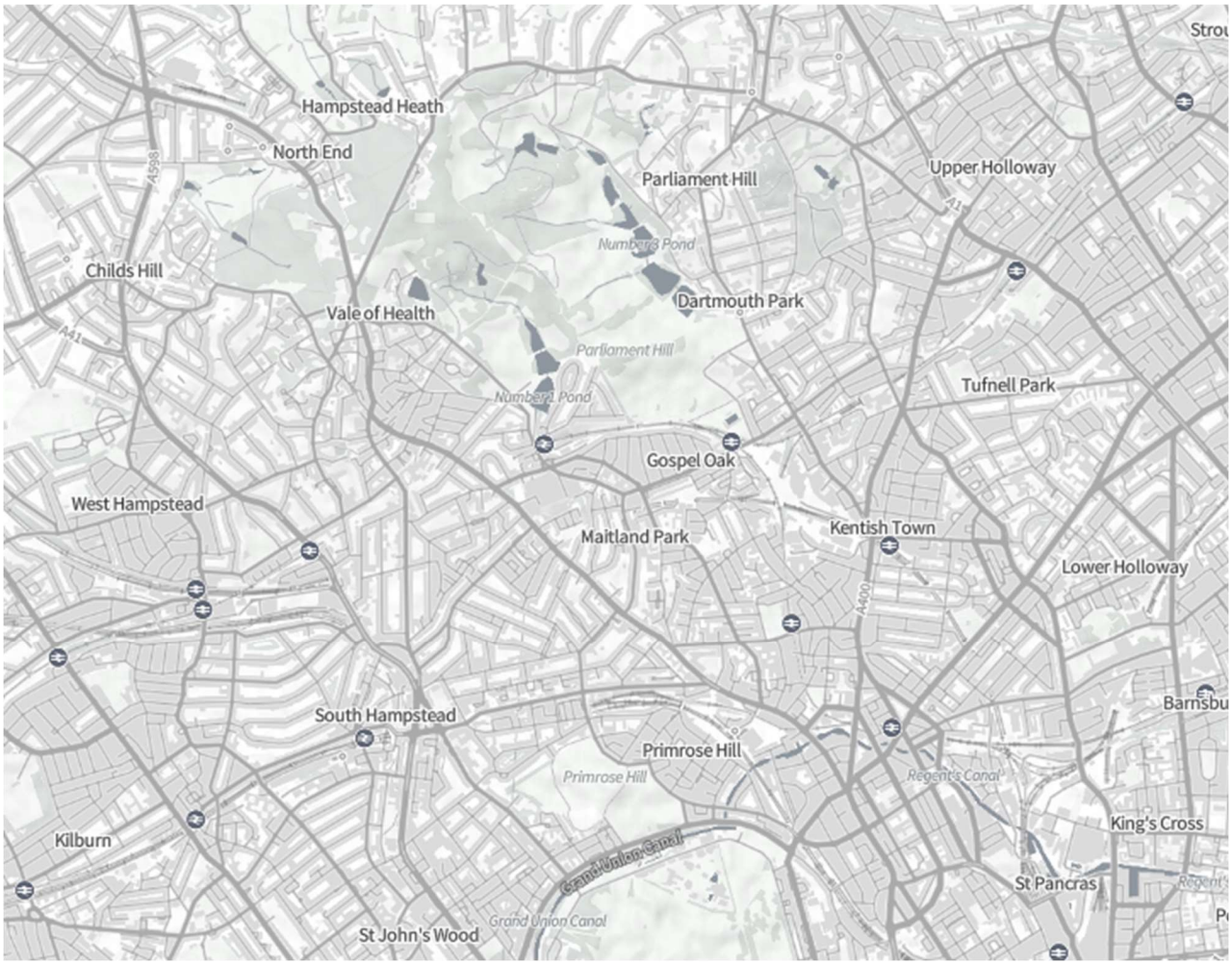
Flood Zones

Environment Agency: March 2021 – Source: https://parallel.co.uk/rofrs/#14.63/51.451/-0.31858




Comments

Flood risk negligible > 0.1% probability.

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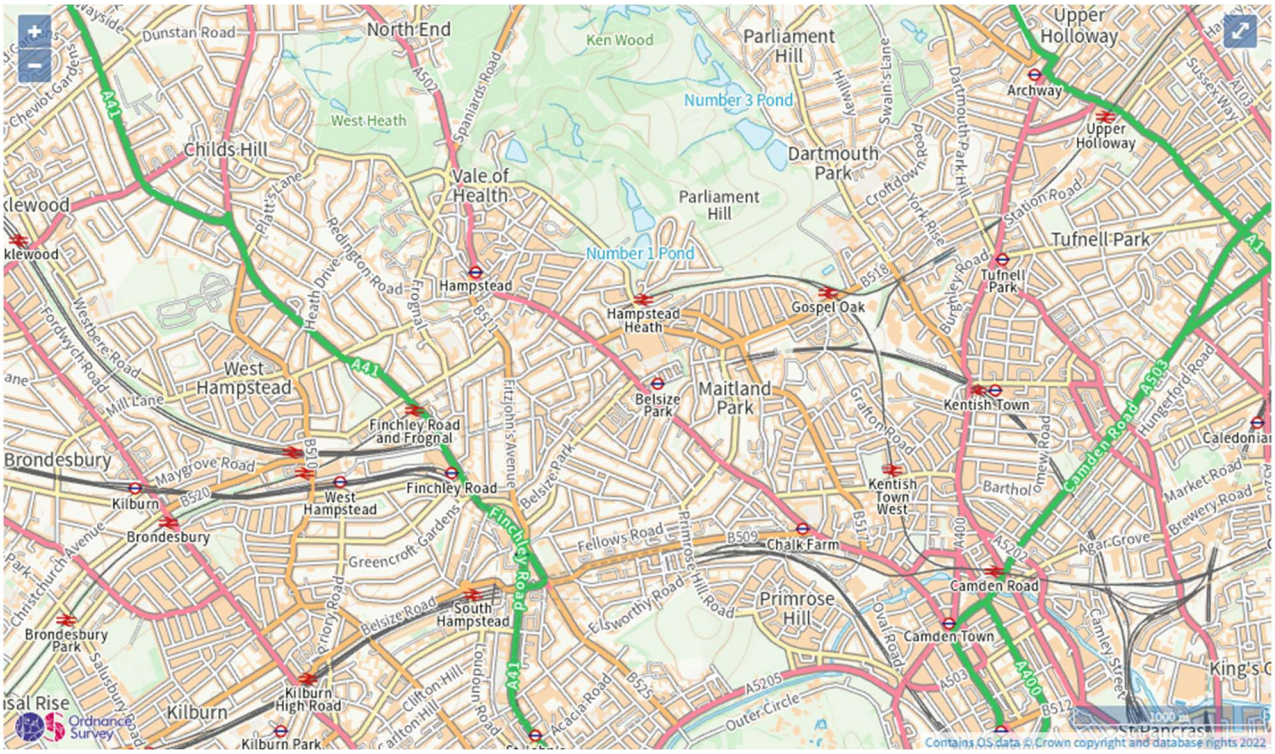


Source: [Learn more about this area's flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk)]

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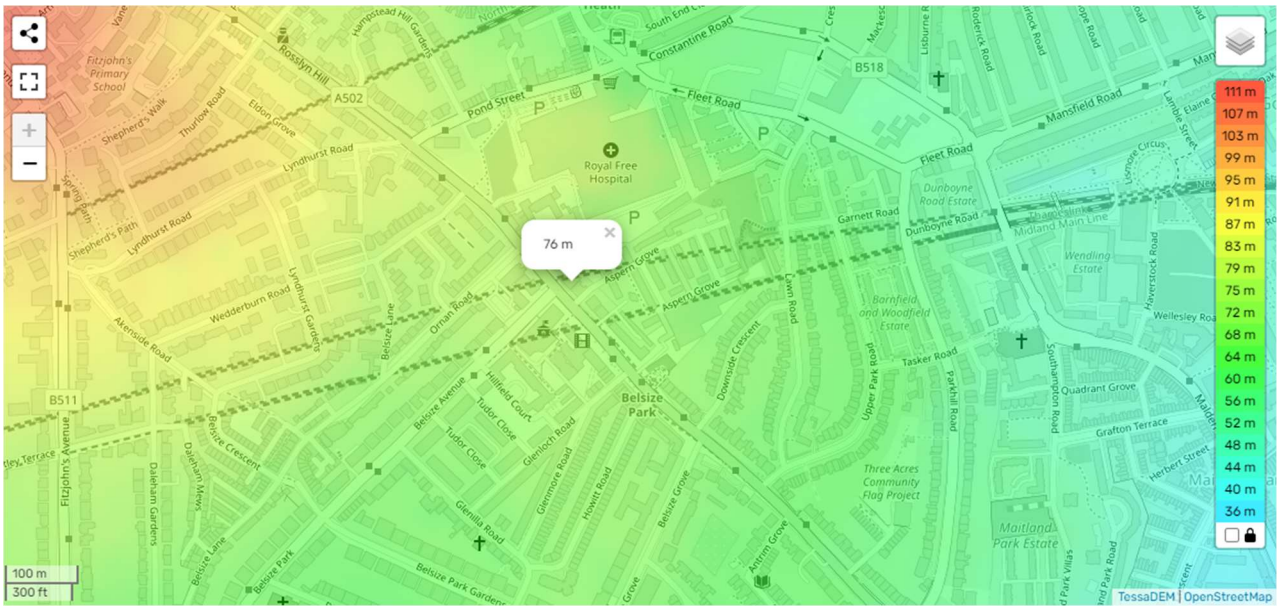
Site Topography




Source: [England topographic map, elevation, relief (topographic-map.com)]

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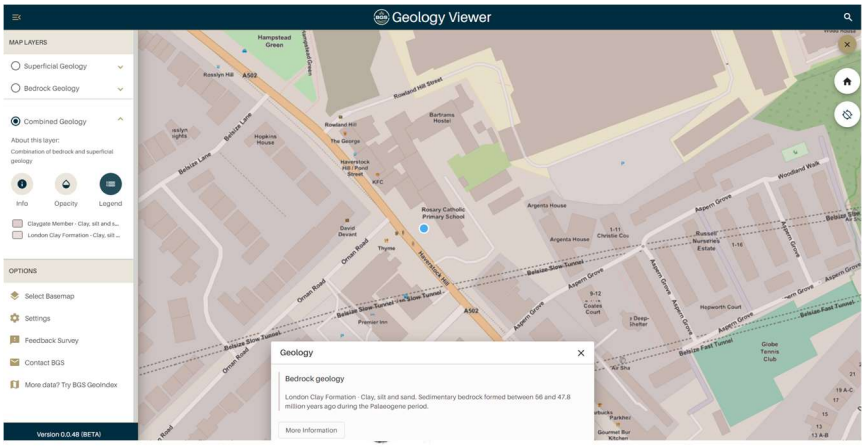
# Appendix C
# Geotechnical Data

Source British Geological Survey




GEOLOGICAL SURVEY OF GREAT BRITAIN

**RECORD OF SHAFT OR BORE FOR MINERALS**

(For Survey use only) 6-inch Map Registered No. TQ28NE/38

Name of Shaft or Bore given by Geological Survey:

Name and Number given by owner: c 16:

Nat. Grid Reference 2722. 8520

For whom made

Town or Village Hampstead. County

Exact site Stonchion ff Belsize Av. and Haverstock Hill. (Attach a tracing from a map, or a sketch-map, if possible.)

1" N.B.Map No. 256 | 1" O.S.Map No. | Confidential or not

Purpose for which made

Ground Level at shaft bore relative to O.D. 234' If not ground level give O.D. of beginning of shaft bore 1900.

Made by Date of sinking

Information from LCC. Date received

Examined by

SPECIMEN NUMBERS AND ADDITIONAL NOTES

| (For Survey use only) Geological Classification | DESCRIPTION OF STRATA | Thickness Ft. | Thickness In. | Depth Ft. | Depth In. |
|---|---|---|---|---|---|
| | Made Ground | 4 | - | | |
| | Clay | 16 | - | 20 | - |
| | For Hampstead Tube Rly. | | | | |

ROYAL FREE HOSPITAL 256

TQ 28/198

Owner ROYAL FREE HAMPSTEAD NHS Licence No.

Occupier IGS Ref. No.

Nat. Grid Ref. TQ 2739 8538

Status OBH

Ground Level m OD ft. OD

Level of Well Top 59.28 m OD ft. OD

Rest Water Level 95.65 m bwt ft. bwt

(Date 26/7/09 m OD ft. OD

Construction

UPPER CHALK

| Depth bwt m | Dia. mm | Linings (below well top) From | To m | Dia mm | Type |
|---|---|---|---|---|---|
| 114 | 300 | 0 | 114 | 200 | plain |
| 177 | 200 | | | | |

| Summary of Geological Section | Thickness m | Depth m |
|---|---|---|
| LONDON CLAY | 69 | 69 |
| W & RB. | 21 | 90 |
| Thanet Sands | 11 | 101 |
| UPPER CHALK | 76 | 177 |

Abstraction Rates

gph

gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller Soil Mechanics

If insufficient space has been allowed, continue in 'Notes' overleaf.

This record has already been entered, but contains some geological information.

* Not found as registered!

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T: 02034 417606
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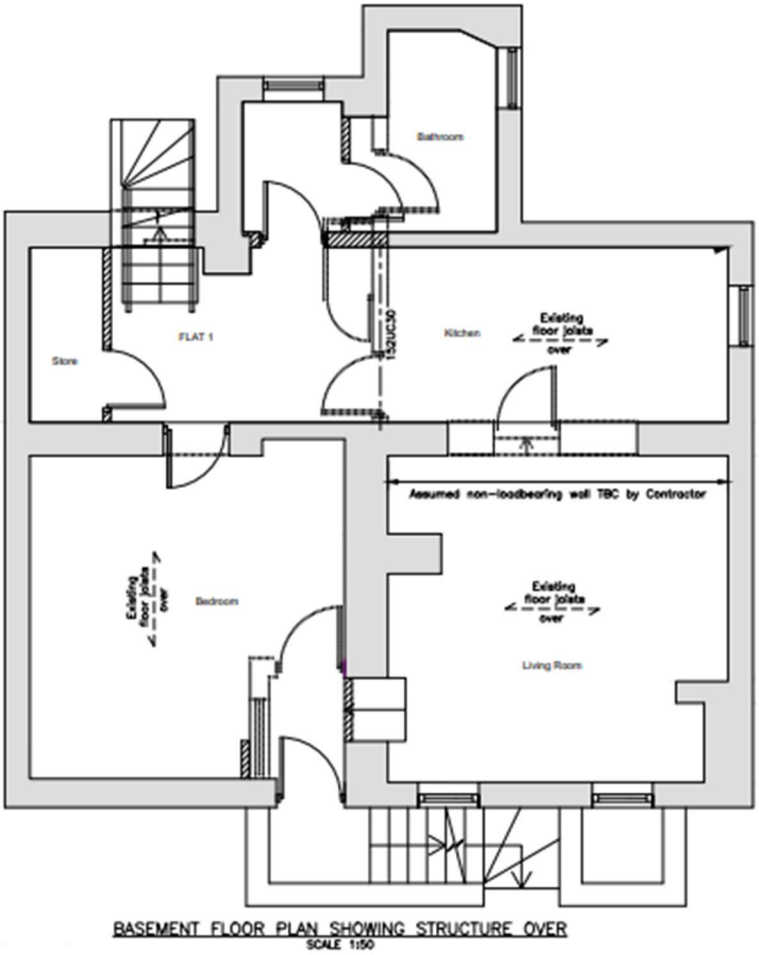
# APPENDIX D
## Architect's & Structural Scheme Drawings Completed by others




BASEMENT FLOOR PLAN SHOWING STRUCTURE OVER
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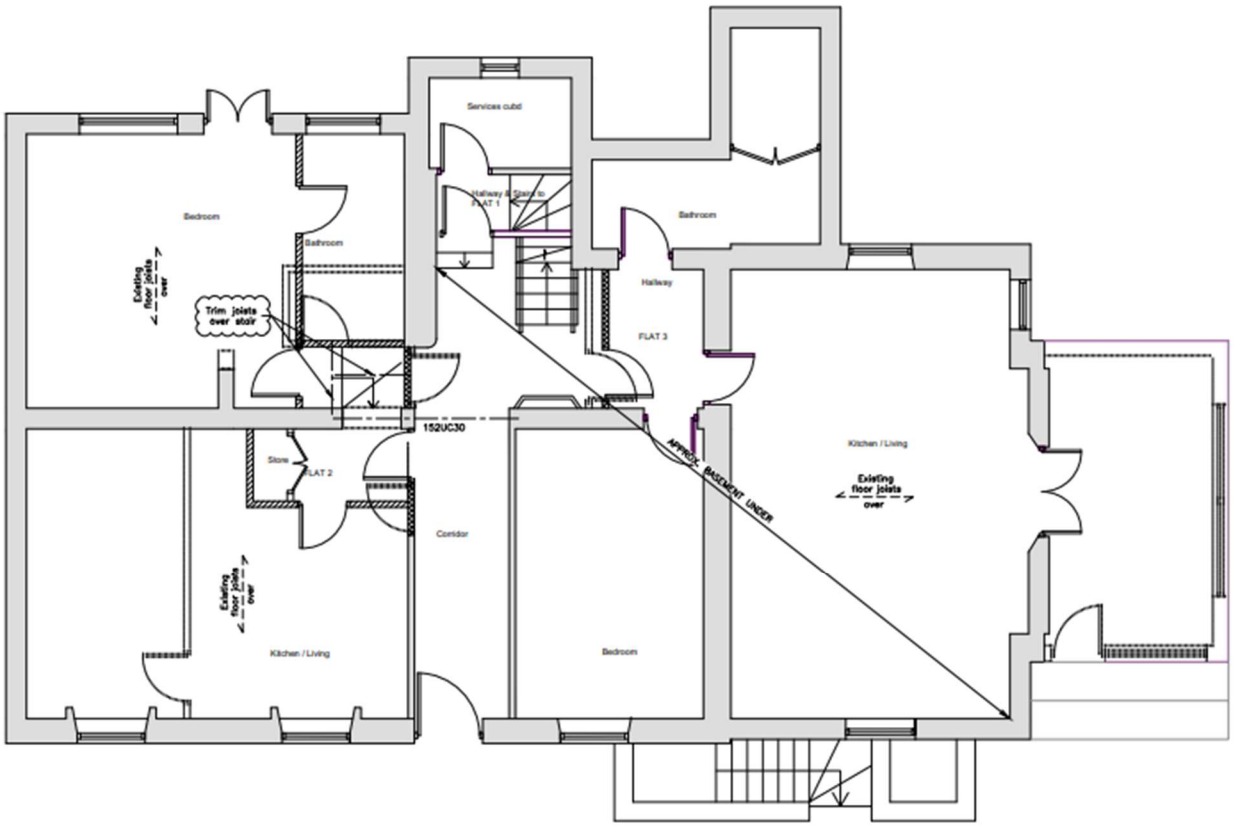


GROUND FLOOR PLAN SHOWING STRUCTURE OVER
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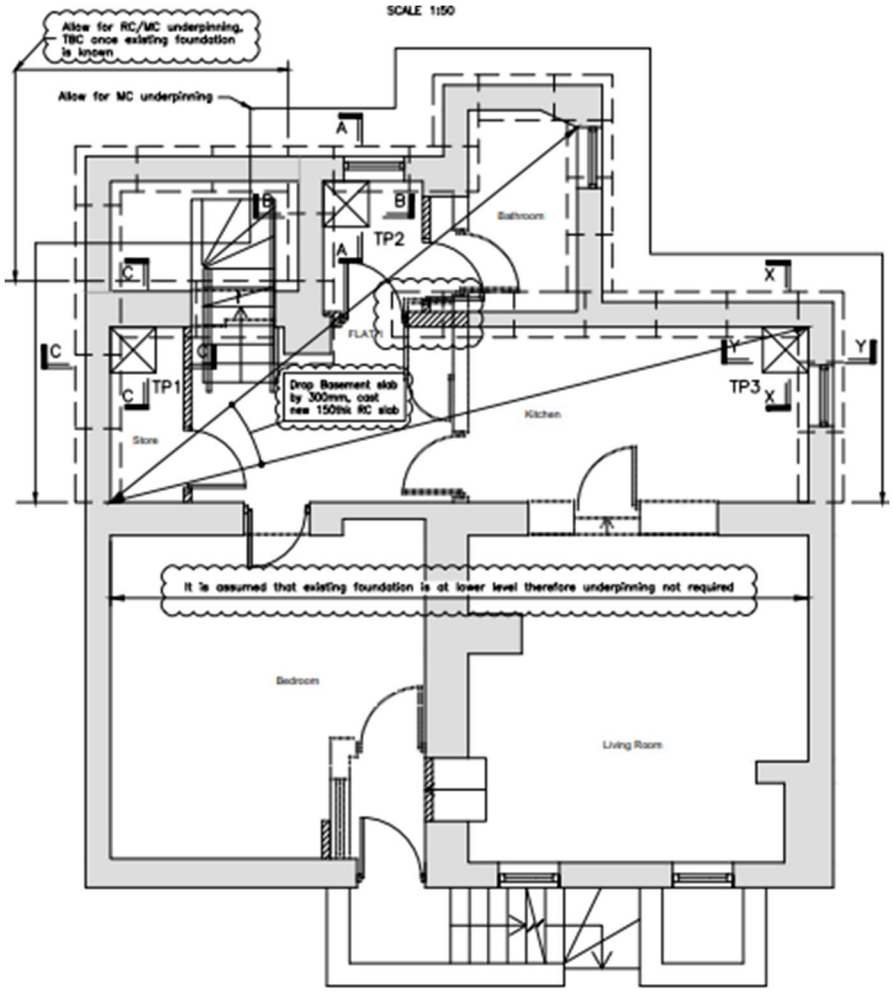


BASEMENT FLOOR PLAN SHOWING FOUNDATION
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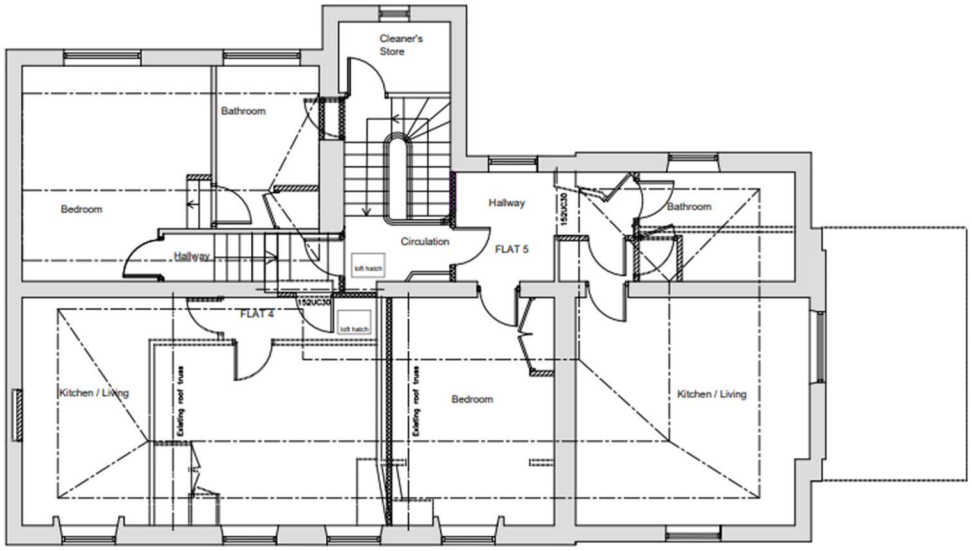


FIRST FLOOR PLAN SHOWING STRUCTURE OVER
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READ IN CONJUNCTION WITH DRAWING 20350/02

| Rev | Date | Description | Dn. | Ckd |
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| A | 10/11/21 | Underpinning, trimmers & notes added. | SD | CPM |

PRELIMINARY

Project:-
238 HAVERSTOCK HILL
LONDON
NW3

Drawing:-
PROPOSED PLANS

| Scale | Drawn | Checked | Date |
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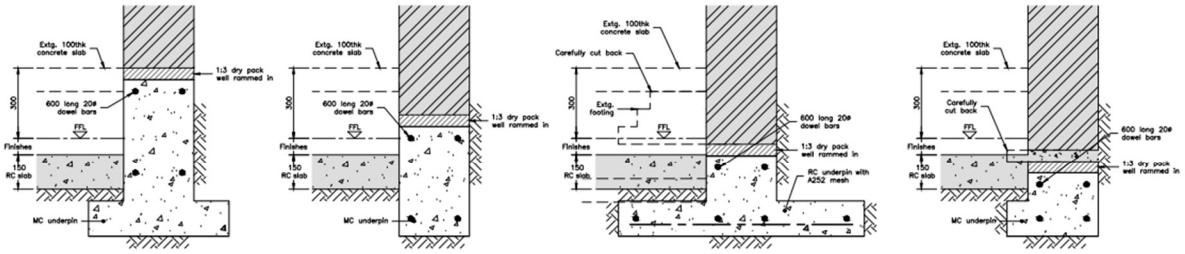
Job No 20350 | Drg No 01 | Rev A




TRIAL PIT TP1 SECTION C–C
SCALE 1:10

TRIAL PIT TP3 SECTION X–X & Y–Y
SCALE 1:10

TRIAL PIT TP2 SECTION A–A
SCALE 1:10

TRIAL PIT TP2 SECTION B–B
SCALE 1:10

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Email: info@imperiumengineering.co.uk



**General Notes**

1. All works are to be in accordance with the current British Standard and Building Regulations.
2. This drawing to be read in conjunction with all relevant drawings issued by the Architect and specialist sub-contractors together with the specifications.
3. DO NOT SCALE from the drawing. Work to dimensioned figures only.
4. All setting out, levels, DPC, insulation, fire protection & weatherproofing information is to be obtained from the Architect's drawings/specification.
5. The Contractor is to inform the Engineer of any discrepancies on the drawing.
6. If any detail is found to be different from those shown then please notify the Engineer and seek advice.

**Earthworks & Excavations**

1. The Contractor is to refer to the Geotechnical report, for details of ground conditions.
2. The Contractor is to submit a method statement for the excavation works.
3. All below ground works are to be in accordance with BS8004, 'Code of Practice for Foundations'
4. The excavations shall be kept free from water by pumping, bailing or other approved means.
5. The Contractor shall provide, maintain and operate suitable pumping equipment and plant and shall, if necessary, construct such drains and sumps, etc. as may be required to remove water from the excavations or prevent entry thereto. Water in the excavations shall be dealt with in such a manner so as to prevent the deterioration of the surface on which foundations or other work will be constructed.
6. All fill material other than concrete shall be MOT Type 1 granular material. The fill material shall be compacted in layers not exceeding 225mm in thickness by suitable mechanical rollers or rammers, and each layer shall be thoroughly compacted before the next layer is placed. The Contractor shall submit material samples and appropriate test certificates to the Structural Engineer for approval prior to the placement of the fill, and shall also provide a method statement for compaction. Any sand or gravel arising from excavations cannot be assumed to be suitable fill material. The use of clay as fill material will not be permitted. Where suitable, all fill material is to be laid at a moisture content close to its natural moisture content. The contractor is to exercise care in filling behind retaining walls, so as to ensure that no additional loads are applied to the wall for which it was not designed for.
7. The Contractor shall notify the Structural Engineer immediately if any areas of soft or unsuitable material are encountered.
8. All soft spots and overdig below the formation level of the foundations are to be backfilled with mass concrete, standard mix type ST1.
9. The Structural Engineer and Local Authority are to be given ample opportunity to inspect formation levels and temporary surfaces. Such formations are to be protected from deterioration. No concrete shall be placed on frost, ice, snow or water.
10. The Contractor is to take precautions to control noise and vibration being transmitted to the surrounding buildings and shall avoid disturbance to the existing foundations to the neighbouring buildings.

**Foundations**

1. The foundations have been designed using an assumed allowable safe bearing pressure of 100kN/m². The agreement of this assumed bearing pressure is to be obtained from the Building Inspector prior to the formation of any foundations.
2. All foundations to be taken at least 300mm below any made ground & be bearing on good natural sub-strata of clay.
3. The formation level for all foundations is to be a minimum of 1m below the existing or proposed ground level (whichever is lower) unless noted otherwise on the drawings or 500mm below the depth of the deepest root or desiccation observed in the excavation, whichever is the deeper when founding in clay soils.
4. Any existing foundations & slabs within the footprint of new foundations to be taken out & new foundations in these areas are to be taken down a min. of 300mm below any disturbed ground.
5. If new foundation passes close to a sewer/drain or trench/trial pit or existing building & the underside of foundation of the new building is below a line projected at 45° from the nearest bottom corner of the adjacent foundation/excavation then contact the Engineer for revised foundation details.
6. The Site Manager is to notify the Drainage Engineer immediately if any existing drainage is broken through when excavating trenches for the new footings.
7. The formation level within all excavations is subject to the inspection of the Building Inspector prior to the formation of any foundations.
8. All mass concrete foundations to be grade GEN3 concrete unless noted otherwise.
9. Reinforced concrete foundations to be grade RC28/35 unless noted otherwise.
10. Top of all foundations to be a minimum of 300mm below finished ground level.
11. All foundations are to be formed within 12 hours of exposure to the formation level.
12. In clay soils 150mm thick claymaster to be provided to the inner face edge of foundations to external walls.
13. Allowance should be made by the contractor for localised underpinning of existing foundations where new adjacent foundations are at a great depth.
14. Min. cover to all reinforcement to be 40mm. All reinforcement to be fixed with min. laps equal to 40x the smaller bar diameter.
15. For further details of reinforcement refer to bending schedules and drawings.
16. No reinforcement to be cut or displaced without the approval of the Engineer.
17. The Engineer is to be informed if any detail indicated or implied on this drawing can not be maintained.

**Fixings**

1. All joist hangers, frame clips, restraint straps, fixings, Bolts and masonry support systems to be installed in strict accordance with the manufacturers instructions.
2. All new timber joists and/or timber beams are to be supported using joist hangers unless noted otherwise.

**Mass Concrete Underpinning Notes**

1. All underpinning works are to be undertaken in accordance with Guidance and Good Practice Documents as published by The Association of Specialist Underpinning Contractors.
2. All concrete works to be undertaken in accordance with the Engineers Specification & National Structural Concrete Specification for Building Third Edition (NSCS) by Construct.
3. Underpinning sections shall be excavated in bays not exceeding 1.0m in length, concreted, and pinned up to the existing footing before proceeding to the next section in the sequence. The sequence of construction shall be as given on the plan; like numbered sections may be constructed simultaneously. Deviation from the stipulated sequence or configuration of sections may be permitted at the discretion of the Engineer, but under no circumstances shall the unsupported length of the structure to be underpinned exceed 25%
4. The concrete in underpinning sections shall be placed immediately after the excavation is complete, and has been approved by the Engineer and Local Authority Building Inspector. If delay is anticipated, the excavation shall be blinded to protect the bottom, or a further 150mm layer removed immediately prior to concreting.
5. The underside of the existing footing shall be thoroughly cleaned and, if very irregular, carefully trimmed to create an essentially flat and horizontal surface that will not impede the placement of dry-pack mortar.
6. Mass concrete in underpinning sections shall be grade C20, 20mm maximum aggregate size, with a minimum cement content of 275kg/cu.m. and a maximum free water/cement ratio of 0.65. Note that this specification is suitable for sulphate conditions up to Class 2 (of BRE digest 363)
7. Concrete shall be placed employing a shute or other means to avoid segregation of the mix, and vibrated to ensure proper compaction. Shuttering shall be provided, as required, to restrict overspill into the access excavation.
8. Underpinning sections shall be keyed together with min. 600mm long H16 dowel bars at 500mm vertical and 300 horizontal centres, or toggle joints.
9. Dry pack shall be carried out not earlier than 24 hours after casting the section. Dry-pack mortar (1:3 fresh sulphate-resisting portland cement/sharp sand, mixed with sufficient water to produce 'earth damp' consistency) shall be rammed in so as to completely fill the void with dense, compact material.
10. At least 48 hours shall elapse before commencement of the excavation for the next sections in the sequence.
11. Care shall be taken to avoid damage to service connections to the building. Gas, water and electrical mains shall be properly supported and protected when exposed, and re-buried or sleeved in accordance with the requirements of the relevant statutory authority. Drainage connections shall be similarly protected to avoid damage, but where temporary disconnection is unavoidable, this must be by arrangement with the occupiers. In any event reconnection of services must be made at the end of each working day.
12. Proprietary anti-heave precautions, when specified, shall be installed strictly in accordance with the manufacturers directions, taking particular care to avoid excessive pre-compression of the materials during placement of concrete.
13. Backfilling of access excavations should be either lean-mix concrete (nominally 15:1 all-in aggregate to OPC) or selected fill, where excavations occur in graded areas or pathways for pedestrian use only, or in internal areas where suspended floors require no support from the fill material, selected fill (which may include as-dug material) may be used, taking care to compact it in layers not exceeding 200mm in thickness. In all other situations lean-mix concrete shall be used, unless specific directions are given otherwise.

**RC Notes**

1. No reinforcement to be cut or displaced on site without prior approval from the Engineer.
2. All reinforcement to be bent in accordance with BS8666
3. Reinforcement is listed on schedule sheet numbers
4. Standard reinforcement abbreviations:

   T Top Layer
   B Bottom Layer
   NF Near Face
   FF Far Face
   EF Each Face
   AB Alternate Bars
   ABR Alternate Bars reversed
   STGD Staggered
5. Concrete to be Grade RC30/37
6. All concrete construction to be in accordance with BS8110, 1985
7. Concrete cover to be 40mm
8. All reinforcement to be fixed in position using proprietary spacer blocks to obtain min. cover.

**Steelwork Notes**

1. All steel to be min. grade S275 to BS EN 10025.
2. All steelwork to be fabricated & erected in accordance with the current edition of the National Specification for Structural Steelwork in Buildings.
3. All internal steelwork to be blast cleaned to grade SA2.5 & factory painted with primer within 4 hours of cleaning-min 60microns of high build zinc phosphate. Colour to suit topcoat colour where applicable.
4. All internal steelwork faces abutting or adjacent to an outside leaf of a masonry wall to be site painted with 2 No. coats of bituminous paint in addition to the primer.
5. All exposed internal steelwork to be fireproofed to Architects specification/Building Control approval.
6. All galvanised steelwork to be blast cleaned to SA2.5 & be free of all mill scale rust and contamination. Cleaned steel to be hot dipped galvanised to BS 729 to produce a minimum coating thickness of 85 microns. Where galvanised steelwork is to be painted it is to be degreased & acid etched to allow adhesion of subsequent coats of paint.
7. Any concrete encased steelwork shall be cleaned of all loose scale, rust or dirt & be free of any grease.
8. All bolts to be min M16 grade 8.8 unless otherwise stated.
9. Steel to steel connections to be min 4No. Grade 8.8 M16 bolts with min 10thk fins/angles unless otherwise stated.
10. All welds to be min 6mm fillet welds.
11. All bolts on baseplates are to be 50mm from plate edge to centre unless stated otherwise.

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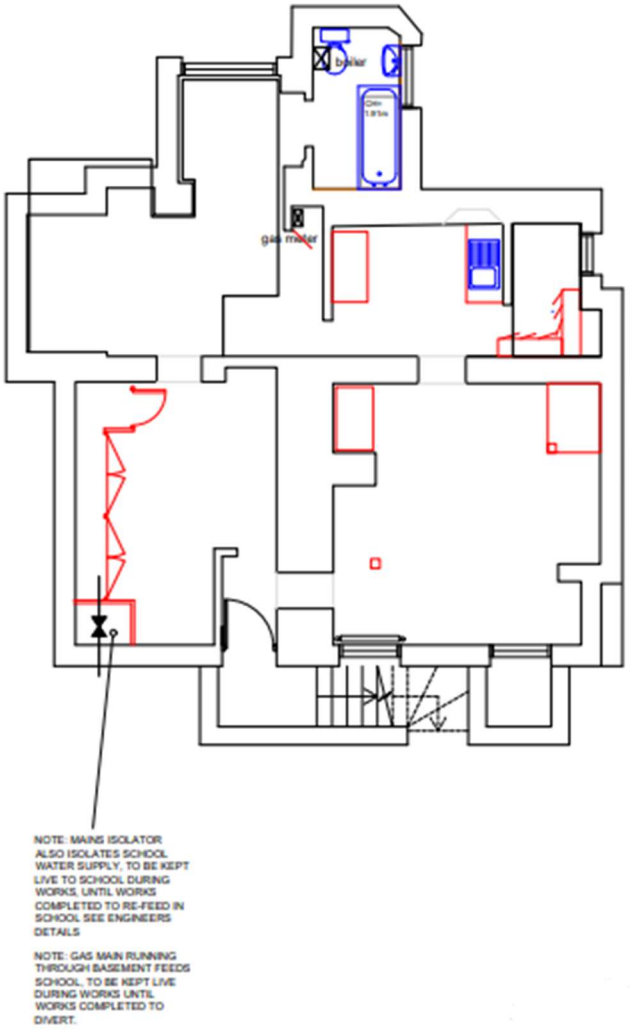
20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk





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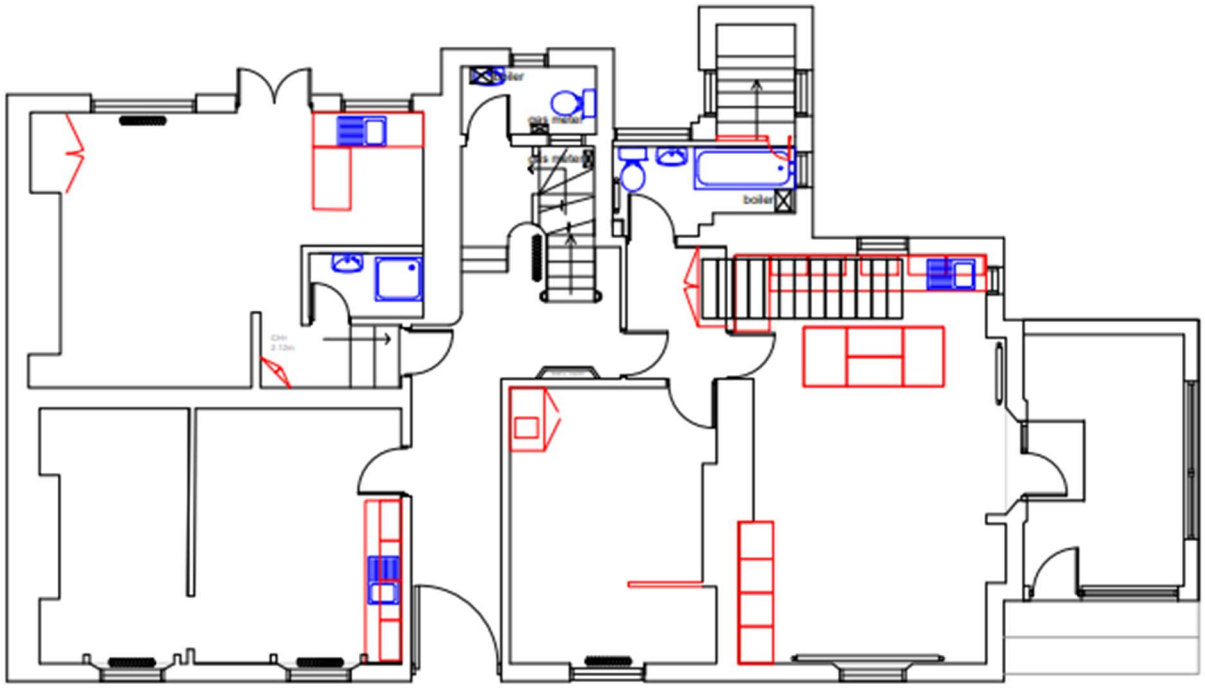
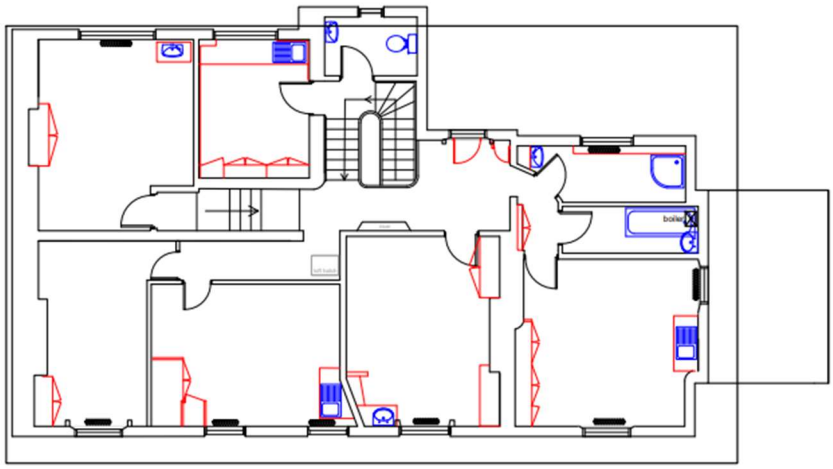
Email: info@imperiumengineering.co.uk



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BELSIZE PARK
LONDON
NW3 2AE

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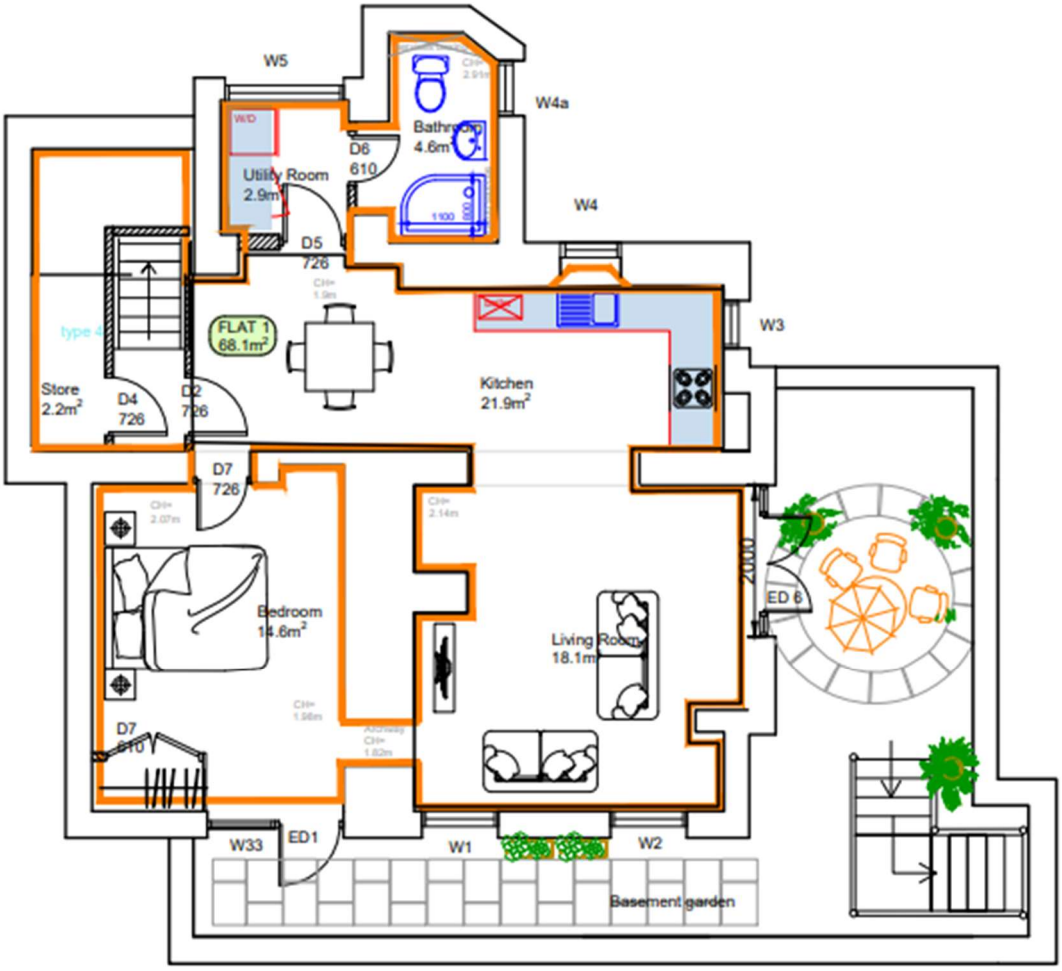

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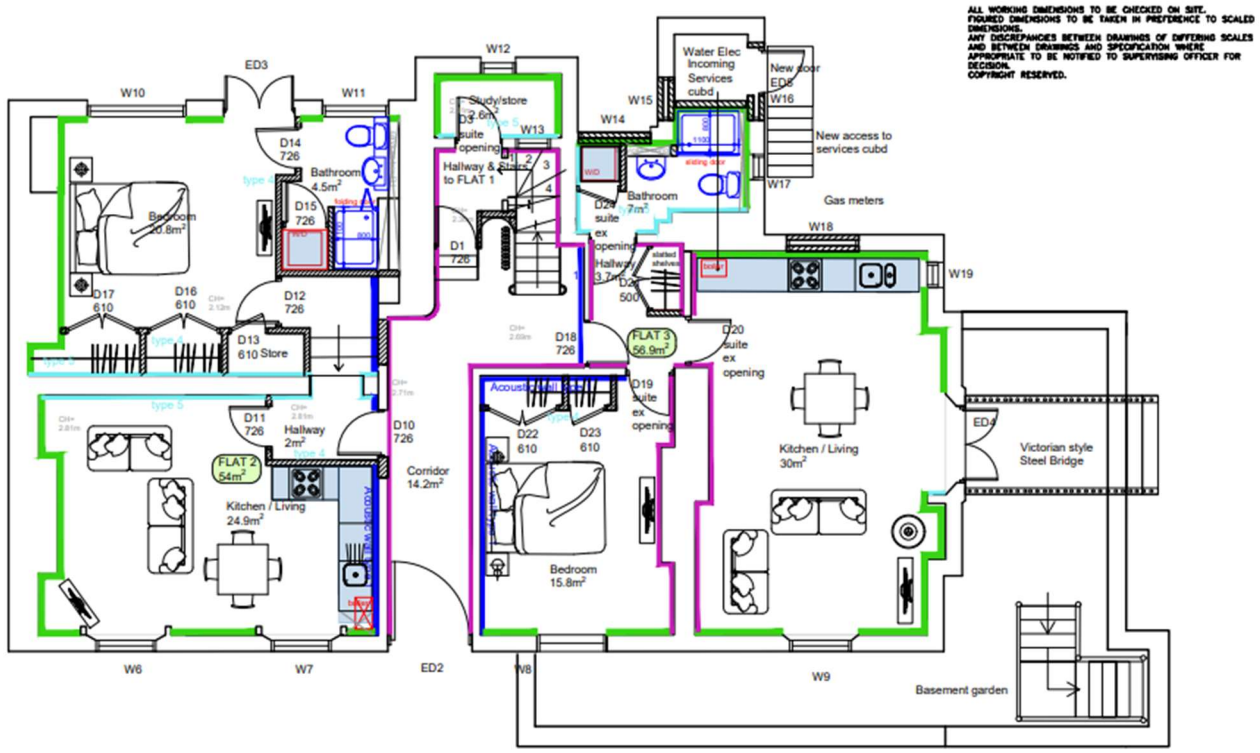


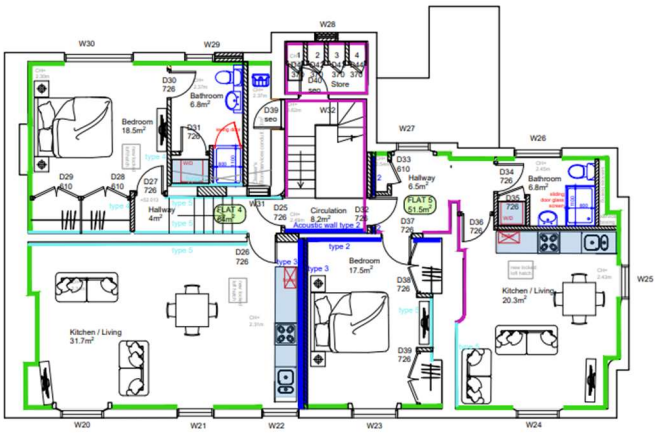



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BELSIZE PARK
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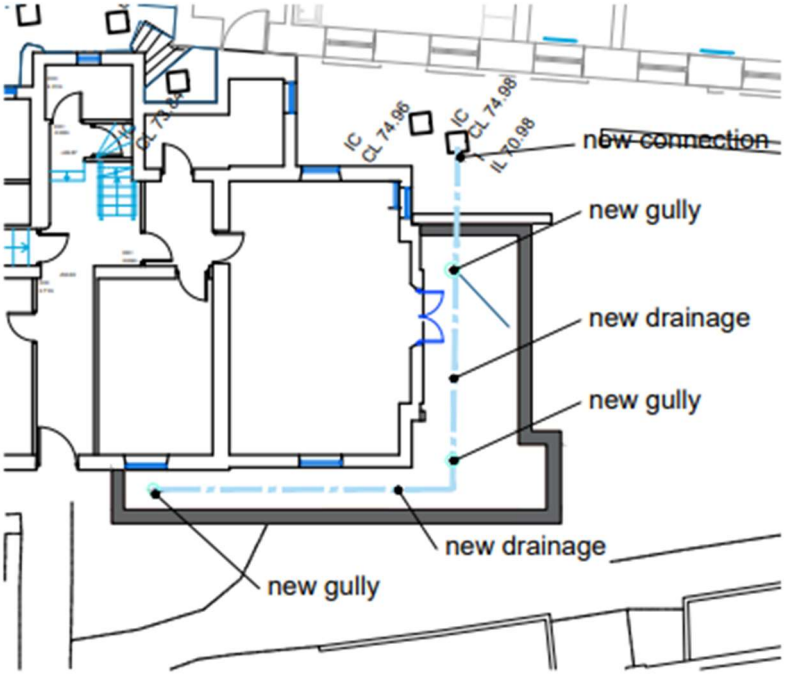

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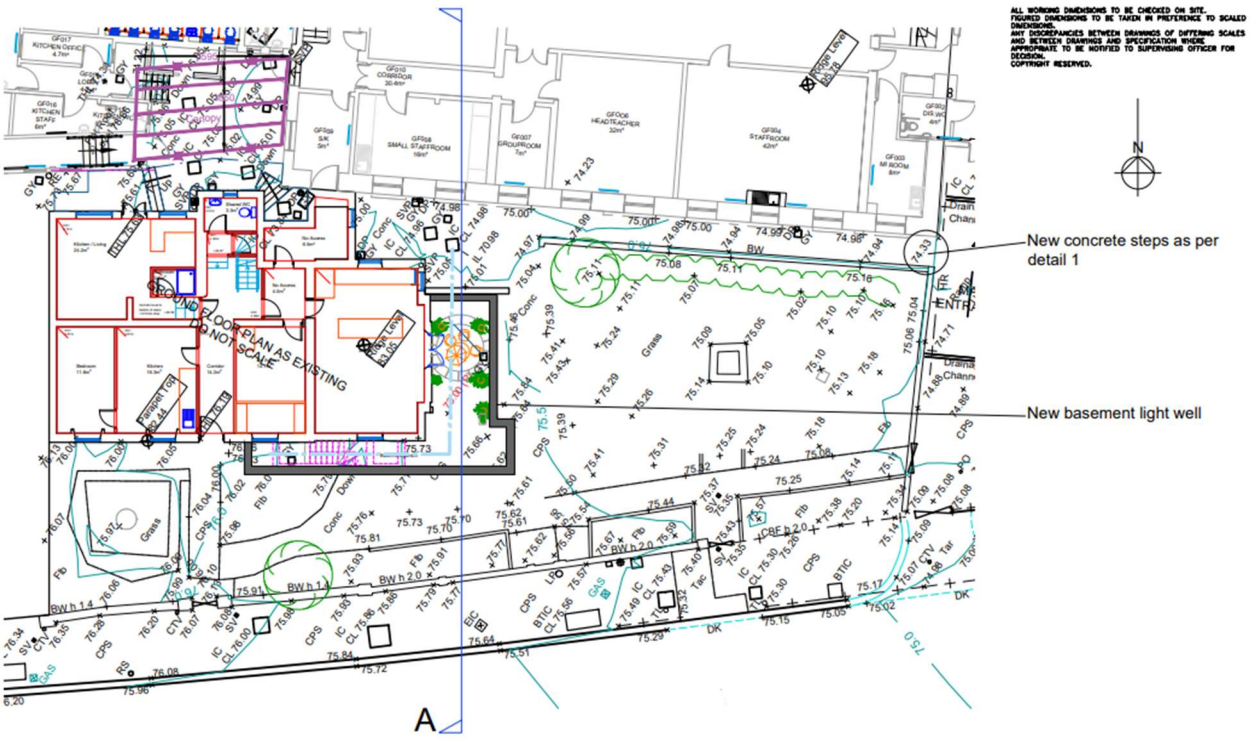


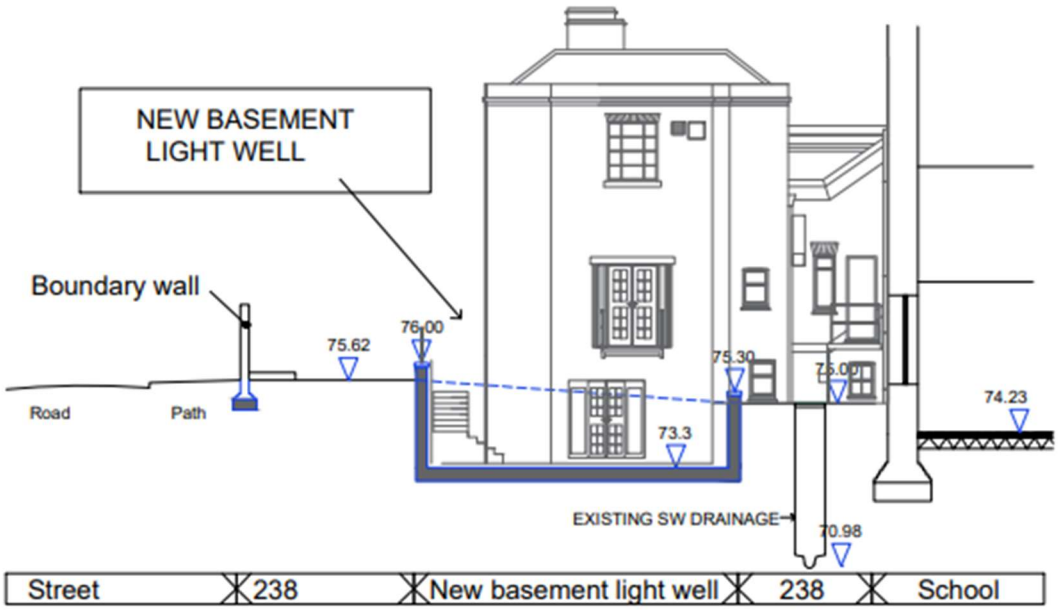


Section A-A

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T: 02034 417606
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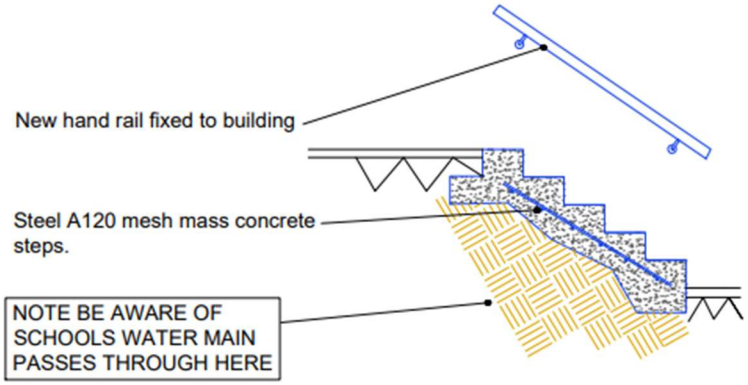


DETAIL 1 A new concrete steps

B revised to show client alterations

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EXTERNAL WORKS
SECTION A-A AND DETAIL 1

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# APPENDIX E
# Structural Method Statement

We have been instructed to provide a methodology for carrying out the construction works to form a lightwell at basement level ensuring continued structural stability throughout the construction process, without adversely affecting the existing structure and the neighbouring properties. Therefore, we have completed a structural method statement otherwise known as an SMS. This SMS has been completed by Imperium Engineering Limited for use in support of the Basement Impact Assessment. The following method statement is related to the substructure works required for the construction of a basement lightwell construction.

The works include the following alterations: Creation of a lightwell at basement level adjacent to the existing structure.

This SMS only describes the construction of the basement works.

The basement construction will be completed in sections to avoid causing instability to the sub-soil. These sections will be a maximum of 1000mm wide. Each strip is to be excavated and concreted. Minimum curing periods are to be observed to allow the sections to be stable before further works are carried out to the adjacent sections. Dry packing is to be completed tightly with expanding dry pack Conbex 100 or a similar (approved) expanding grout product if preferred by the Contractor.

Due to the sectional staged approach for constructing the basement lightwell the risk of movement between the basement and the existing foundations near to the property is negligible. This is exceptionally true as the existing structure already has a basement at the same level, the basement light well is also located several meters away from any neighbouring properties, therefore if the sectional approach is followed the chances of an structural movement to the surrounding properties is negligible.

There should be no risk to the stability of the existing or the adjacent building during or as a result of these works. The reinforced concrete retaining walls are proposed to be constructed in a traditional hit-and-miss sequence. These will relate to steel dowels in the normal manner for this type of construction. The retaining walls must be back-propped until cured. It is a normal procedure to strike the shutter 24 hours after pouring the wall and to then back prop the concrete to the earth using trench props.

The sections of the partially constructed retaining wall will be within cohesive soils. These are usually stable in the medium term for the width of excavation proposed during these works. Once the perimeter of the excavation has been completed, waling beams and lateral props will be introduced, spanning the width of the basement lightwell. This will prevent inwards sliding of the newly formed wall and will allow the bulk excavation of the central bund to be carried out safely down to formation level and for the temporary props, initially taken back onto the central bund, to be removed.

The new basement lightwell slab will be designed as a reinforced concrete raft. Once installed and cured, it will act as lateral propping to the opposite retaining walls and will tie the basement level together robustly. At that stage, the temporary lateral props can be safely removed.

This method maintains the stability of the works and of the adjoining premises during construction and (given good workmanship by an experienced contractor) ensures that the proposed work does not have a detrimental impact on the existing or adjoining structures.

We are not able to state that the neighbours will have no damage; however, the existing properties are in good order, and we consider (based on previous projects of this nature) that any cracking would be within Category 1 of the Burland Scale. This is defined as fine cracks which are easily treated during normal decoration and form part of the BRE Digest 251; however, due to the distance in-between the properties, any cracking to the neighbouring property seems very unlikely.

The new foundations will be designed in accordance with the geotechnical information obtained. As one story is being excavated, advice on previous projects from other geotechnical consultants is that any movement would be of the same (or less) order than

we would allow when considering the deflection of a suspended floor. This has been confirmed by past basement projects in London, where the has been no heave present which would cause any problems with the client's house or their neighbours. In addition, settlement is not predicted to be a concern; the proposed basement will pose no significant threat to the structural stability of the existing property or neighbouring property.

As part of the party wall process, condition surveys of the adjoining properties will be prepared prior to the works commencing.

The excavations will need to be hand dug using power tools. Only electric Kangos will be used; no compressors will be allowed. This will minimise any noise and vibrations to neighbouring properties. Special protections will not be required when these low impact techniques are employed.

It is envisaged that the existing utilities serving the property will be maintained throughout the works or diverted if required. The exact location of these services will be investigated prior to the works commencing on site. Any impact on these will be negligible. The utility owners will be contacted should their services have to be diverted.

There are no underground tunnels near the site which would affect the proposed works. There are no other known man-made cavities near the proposed basement.

The basement proposals do not involve felling any existing trees during construction.

The proposed method of construction eliminates the risk of any potential slope instability. It should be noted that the surrounding area is predominantly level which reduces any risk of slope instability.

In areas where the basement is to be excavated, the works will be carried out in such a way as to eliminate the impact on local drainage, sewerage and surface water levels. Any utilities found, or any type of infrastructure next to and adjacent to the property will be adequately supported and reinstated using the appropriate specialist where required as part of the works. The fact that the works will be completed in a hit-and-miss fashion (in maximum 1m sections) will avoid damage or movement of the adjacent structures.

The basement lightwells retaining walls will be constructed using concrete classed as grade C35. This is accepted as a watertight concrete mix.

A minor amount of additional water flow will be created because of the basement lightwell construction.

The existing drainage systems already collect the surface water run-off; we suggest that the additional increase of surface water run-off should run into a newly installed soakaway; we suggest that any new soakaway is designed by a drainage engineer to suit the increased catchment area.

As part of the works, the foul and rainwater drainage systems will be rerouted to the existing sewers. All the new pipework will be below the proposed basement slab, and sump pumps will be used where required.

Access for the works will be through the front of the property off Haverstock hill road.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



**Proposed Construction Sequence**

1. The excavation will progress from the front towards the rear with the spoil being removed via a conveyor and onto a skip placed on either a parking bay or within the garden.

2. Excavate the first section surface by removing the existing concrete floor.

3. Excavate and install the 1st retaining wall base following the agreed sequence.

4. Continue excavating and casting new sections of retaining wall whilst maintaining all new pins back propped to the central earth mound.

5. With the perimeter fully pinned and back propped to the central earth mound, install waling beams and lateral props spanning the width of the new excavation.

6. With the new retaining walls laterally propped, reduce the central mound down to formation level..

7. Install the below ground drainage followed by the basement lightwell slab. Allow to cure for a minimum of 14 days prior to removing the lateral props.

8. A drained cavity system; insulation and finishes will be installed to the basement, as detailed by others.

Any works carried out to the basement lightwell is to be supervised by a Chartered Structural Engineer throughout its duration.

The works to the basement lightwell are to be carried out by a specialist contractor who is experienced in dealing with the intricacies that occur during a sequenced construction below ground level. There is to be a project manager on-site supervising the works who will be appointed by the main contractor.

We recommend that any contractor carrying out the works should be a member of construction line, CHAS and the Considerate Construction Scheme.

In terms of the party walls, it is important to protect the interests of the client carrying out the works and of the neighbouring properties. Party Wall agreements are to be prepared to include condition surveys for both neighbouring properties.

Detailed temporary works, permanent works drawings and construction sequence requirements will be designed by a Structural Engineer and will comply with current Building Control requirements.

Hoarding is to be erected at the front of the site to provide adequate working space and space for skips.

Sump pumps will be available during the excavation process to remove any water due to ponding.

Reinforcing starter bars will be driven into the ground on each side. Shutters will be constructed to retain the wet concrete.

While the works are ongoing, the structure above will be propped as determined by the appointed temporary works engineer to maintain support, using heavy Acrow props or other similar supports. These will be propped from either the new concrete slab or cast concrete bases, purpose built to carry the main structure and any local areas of loading.

All demolitions are to be adequately sign posted and any demolitions are to be zoned and fenced off to prevent any unauthorised access.

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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



# Basement Retaining Wall Calculations
# Design Philosophy – Basement Design

Geology

A conservative safe ground bearing pressure of 140kN/m$^2$ has been assumed using Empirical data from nearby site which are within the same soil formation.

Retaining Wall Design

Retaining walls will be designed using "at rest" pressures to minimise the amount of movement in the walls. This will minimise the risk of damage to this and adjacent structures and when carried out in the correct sequence no structural damage is expected as experienced on many similar projects.

The basement retaining walls have been designed with the following geotechnical design parameters:

SOIL PARAMETERS

| | |
|---|---|
| Dry soil | = 18 kN/m$^3$ |
| Water | = 10 kN/m$^3$ |
| ϕ | = 33˚ |

Ground – bearing pressures below the bases will be calculated for the temporary condition. In the permanent condition, the new basement slab will be tied into the retaining wall bases, hence the entire substructure will act as a raft foundation. Ground – bearing pressures will not be an issue in this condition.

Water Table

We have check numerous borehole records for this area and therefore have made the assumption a high-water table is not present.

An assumed accidental case will be assumed of 1.0 m below ground level for design of uplift on the slab and lateral forces on the retaining walls.

Temporary Works

The retaining walls will be designed where possible to be self-supporting under soil loading in the construction stage of the project. The underpins will need to be propped during construction to avoid any sliding failure at the base.

In the permanent case the retaining wall bases will be propped by the basement slab therefore the most onerous design case is the temporary condition.

All temporary works design is to be carried out by the contractor.

The basement retaining walls will follow the footprint of the existing external walls, the basement construction is to be completed in sections. These sections are to be a maximum of 1000mm. Each strip is to be excavated, concreted curing periods are to be observed to allow the sections to stabilise before further works are carried out to the adjacent sections, dry packing is to be completed tightly with expanding dry pack Conbex 100 or a similar product can be used if preferred.

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T: 02034 417606
Email: info@imperiumengineering.co.uk



Due to the sectional staged approach for constructing the basement and the distance between the proposed basement level lightwell and the neighbouring property the risk of long-term differential movement between the basement and the neighbour's foundations is negligible.

There should be no risk to the stability of the existing or the adjacent building during or as a result of these works, since the reinforced concrete retaining walls are proposed to be carried out in a traditional hit and miss sequence which are to be connected with steel dowels in the normal manner for this type of construction. Please note the walls must be back proposed until cured. It is normal procedure to strike the shutter 24 hours after pouring the wall and back prop the concrete to the earth using trench props.

Excavations in granular materials need to be carried out with care. The contractor will need sacrificial steel trench sheeting or concrete poling boards and props to support any pockets of weak ground encountered. Excavations for each underpin will require temporary support using timber boards and props. Once the sequencing for the perimeter of the excavation has been completed, waling beams and lateral props will be introduced spanning the width of the basement lightwell. This will prevent inwards sliding of the newly formed retaining walls and will allow the bulk excavation of the central bund to be carried out safely down to formation level.

The new basement slab will be designed as a reinforced concrete raft. Once installed and cured it will act as lateral propping to opposite retaining walls and will be tying the basement level together. At that stage, the temporary lateral props can be safely removed.

This method assists in maintaining stability of the works and of the neighbouring premises during construction and under good workmanship ensures the proposed work does not have a detrimental impact upon the existing or adjoining structures.

The new foundations will be designed in accordance with well-established permissible pressures. The granular soil underlying the basement is reasonably dense and provides adequate bearing strata for the new foundations. Settlement is not predicted to be a concern; the proposed basement will pose no significant threat to the structural stability of the existing property or adjoining premises.

Due to access limitations, the excavations will need to be hand dug using power tools. Only electric Kangos will be required, no compressors. This will minimise noise and vibrations to neighbouring properties. Special protection will not be required when these low-impact techniques are employed.

Basement grade category 3 (habitable) will be required for the purpose of designing its waterproofing. It is not practical to provide external tanking as in new construction, given the sequential nature of the works. Therefore, an internal waterproofing strategy comprising a drained cavity system to details by others will be required. It is envisaged that the existing utilities serving the property will need to be maintained throughout the works or diverted if required. Please note that the light well is only category 3 if the area is to be enclosed.

The exact location of these services will need to be investigated prior to the works commencing on site. Any impact on these will be negligible. The utility owners would have to be contacted should their services have to be diverted.

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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



# Indicative Retaining Wall Calculation (Below External Walls)

This retaining wall calculation is partial and checks only sliding, overturning, and bearing pressure. A full detailed design will need to be provided during the structural design of the basement.

## RETAINING WALL ANALYSIS

**In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1**

Tedds calculation version 2.9.16

### Retaining wall details

| | |
|---|---|
| Stem type | Cantilever |
| Stem height | $h_{stem}$ = **3100** mm |
| Stem thickness | $t_{stem}$ = **300** mm |
| Angle to rear face of stem | $\alpha$ = **90** deg |
| Stem density | $\gamma_{stem}$ = **25** kN/m$^3$ |
| Toe length | $l_{toe}$ = **2000** mm |
| Base thickness | $t_{base}$ = **350** mm |
| Base density | $\gamma_{base}$ = **25** kN/m$^3$ |
| Height of retained soil | $h_{ret}$ = **3100** mm |
| Angle of soil surface | $\beta$ = **0** deg |
| Depth of cover | $d_{cover}$ = **0** mm |

### Retained soil properties

| | |
|---|---|
| Soil type | Medium dense well graded sand |
| Moist density | $\gamma_{mr}$ = **21** kN/m$^3$ |
| Saturated density | $\gamma_{sr}$ = **23** kN/m$^3$ |
| Characteristic effective shear resistance angle | $\phi'_{r.k}$ = **30** deg |
| Characteristic wall friction angle | $\delta_{r.k}$ = **0** deg |

### Base soil properties

| | |
|---|---|
| Soil type | Medium dense well graded sand |
| Soil density | $\gamma_b$ = **18** kN/m$^3$ |
| Characteristic effective shear resistance angle | $\phi'_{b.k}$ = **30** deg |
| Characteristic wall friction angle | $\delta_{b.k}$ = **15** deg |
| Characteristic base friction angle | $\delta_{bb.k}$ = **30** deg |
| Presumed bearing capacity | $P_{bearing}$ = **140** kN/m$^2$ |

### Loading details

| | |
|---|---|
| Variable surcharge load | $Surcharge_Q$ = **10** kN/m$^2$ |
| Vertical line load at 1000 mm | $P_{G1}$ = **54.3** kN/m |
| | $P_{Q1}$ = **12.3** kN/m |

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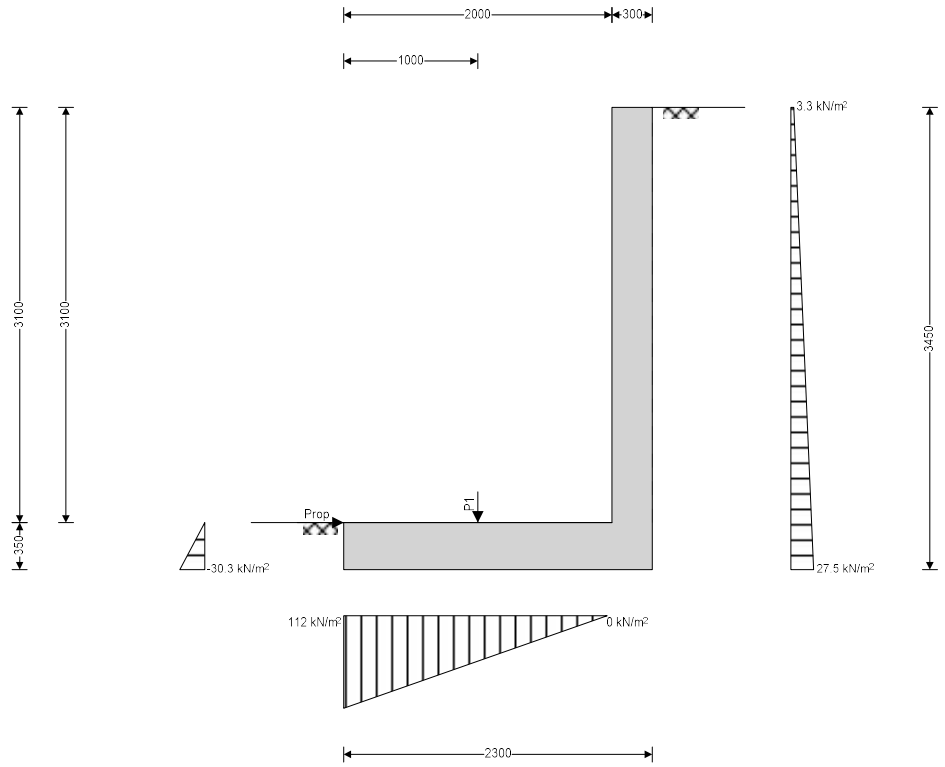
T: 02034 417606
Email: info@imperiumengineering.co.uk






General arrangement - sketch pressures relate to bearing check

**Calculate retaining wall geometry**

| | |
|---|---|
| Base length | $l_{base} = l_{toe} + t_{stem}$ = **2300** mm |
| Moist soil height | $h_{moist} = h_{soil}$ = **3100** mm |
| Length of surcharge load | $l_{sur} = l_{heel}$ = **0** mm |
| - Distance to vertical component | $x_{sur\_v} = l_{base} - l_{heel} / 2$ = **2300** mm |
| Effective height of wall | $h_{eff} = h_{base} + d_{cover} + h_{ret}$ = **3450** mm |
| - Distance to horizontal component | $x_{sur\_h} = h_{eff} / 2$ = **1725** mm |
| Area of wall stem | $A_{stem} = h_{stem} \times t_{stem}$ = **0.93** $m^2$ |
| - Distance to vertical component | $x_{stem} = l_{toe} + t_{stem} / 2$ = **2150** mm |
| Area of wall base | $A_{base} = l_{base} \times t_{base}$ = **0.805** $m^2$ |
| - Distance to vertical component | $x_{base} = l_{base} / 2$ = **1150** mm |

**Using Coulomb theory**

Active pressure coefficient

$K_A = \sin(\alpha + \phi'_{r.k})^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta_{r.k}) \times [1 + \sqrt{[\sin(\phi'_{r.k} + \delta_{r.k}) \times \sin(\phi'_{r.k} - \beta) / (\sin(\alpha - \delta_{r.k}) \times \sin(\alpha + \beta))]]^2)$ = **0.333**

Passive pressure coefficient

$K_P = \sin(90 - \phi'_{b.k})^2 / (\sin(90 + \delta_{b.k}) \times [1 - \sqrt{[\sin(\phi'_{b.k} + \delta_{b.k}) \times \sin(\phi'_{b.k}) / (\sin(90 + \delta_{b.k}))]]^2)$ = **4.977**

**Bearing pressure check**

**Vertical forces on wall**

Wall stem

$F_{stem} = A_{stem} \times \gamma_{stem}$ = **23.3** kN/m

| | |
|---|---|
| Wall base | $F_{base} = A_{base} \times \gamma_{base}$ = **20.1** kN/m |
| Line loads | $F_{P\_v} = P_{G1} + P_{Q1}$ = **66.7** kN/m |
| Total | $F_{total\_v} = F_{stem} + F_{base} + F_{P\_v}$ = **110** kN/m |

**Horizontal forces on wall**

| | |
|---|---|
| Surcharge load | $F_{sur\_h} = K_A \times Surcharge_Q \times h_{eff}$ = **11.5** kN/m |
| Moist retained soil | $F_{moist\_h} = K_A \times \gamma_{mr} \times h_{eff}^2 / 2$ = **41.7** kN/m |
| Base soil | $F_{pass\_h} = -K_P \times \cos(\delta_{b.k}) \times \gamma_b \times (d_{cover} + h_{base})^2 / 2$ = **-5.3** kN/m |
| Total | $F_{total\_h} = F_{sur\_h} + F_{moist\_h} + F_{pass\_h}$ = **47.9** kN/m |

**Moments on wall**

| | |
|---|---|
| Wall stem | $M_{stem} = F_{stem} \times x_{stem}$ = **50** kNm/m |
| Wall base | $M_{base} = F_{base} \times x_{base}$ = **23.1** kNm/m |
| Surcharge load | $M_{sur} = -F_{sur\_h} \times x_{sur\_h}$ = **-19.8** kNm/m |
| Line loads | $M_P = (P_{G1} + P_{Q1}) \times p_1$ = **66.7** kNm/m |
| Moist retained soil | $M_{moist} = -F_{moist\_h} \times x_{moist\_h}$ = **-47.9** kNm/m |
| Total | $M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{moist}$ = **72** kNm/m |

**Check bearing pressure**

| | |
|---|---|
| Propping force | $F_{prop\_base} = F_{total\_h}$ = **47.9** kN/m |
| Distance to reaction | $\bar{x} = M_{total} / F_{total\_v}$ = **655** mm |
| Eccentricity of reaction | $e = \bar{x} - l_{base} / 2$ = **-495** mm |
| Loaded length of base | $l_{load} = 3 \times \bar{x}$ = **1964** mm |
| Bearing pressure at toe | $q_{toe} = 2 \times F_{total\_v} / l_{load}$ = **112** kN/m$^2$ |
| Bearing pressure at heel | $q_{heel}$ = **0** kN/m$^2$ |
| Factor of safety | $FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel})$ = **1.339** |

***PASS - Allowable bearing pressure exceeds maximum applied bearing pressure***

**Side Wall Check**

**RETAINING WALL ANALYSIS**

**In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1**

Tedds calculation version 2.9.16

**Retaining wall details**

| | |
|---|---|
| Stem type | Cantilever |
| Stem height | $h_{stem}$ = **3100** mm |
| Stem thickness | $t_{stem}$ = **300** mm |
| Angle to rear face of stem | $\alpha$ = **90** deg |
| Stem density | $\gamma_{stem}$ = **25** kN/m$^3$ |
| Toe length | $l_{toe}$ = **2000** mm |
| Base thickness | $t_{base}$ = **350** mm |
| Base density | $\gamma_{base}$ = **25** kN/m$^3$ |
| Height of retained soil | $h_{ret}$ = **3100** mm |
| Angle of soil surface | $\beta$ = **0** deg |
| Depth of cover | $d_{cover}$ = **0** mm |

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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



**Retained soil properties**

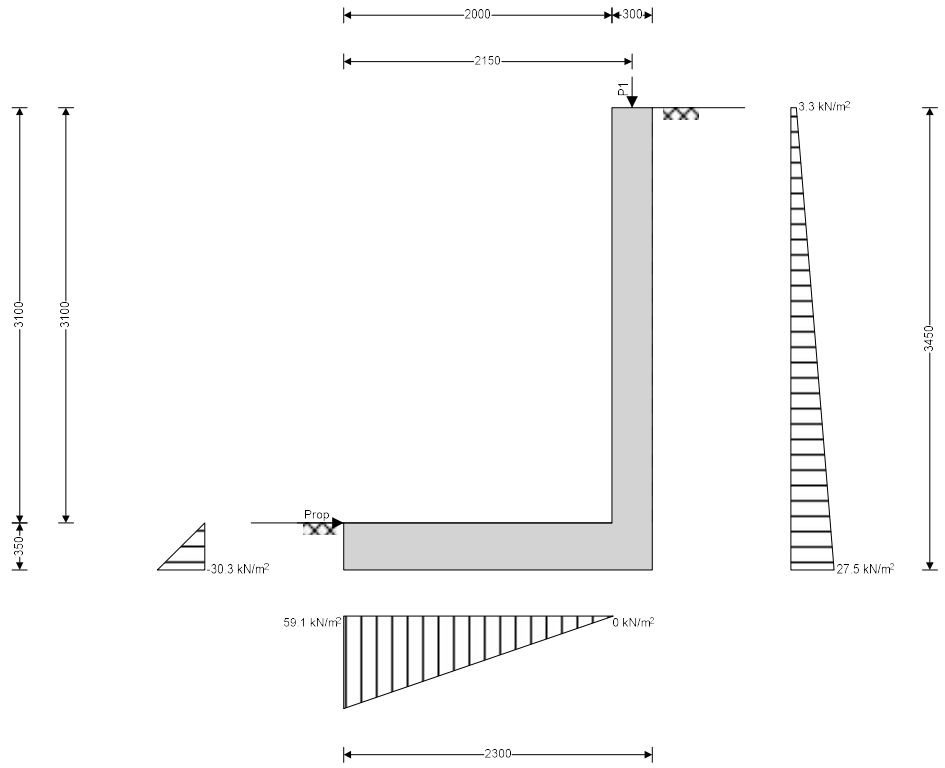
| | |
|---|---|
| Soil type | Medium dense well graded sand |
| Moist density | $\gamma_{mr}$ = **21** kN/m$^3$ |
| Saturated density | $\gamma_{sr}$ = **23** kN/m$^3$ |
| Characteristic effective shear resistance angle | $\phi'_{r.k}$ = **30** deg |
| Characteristic wall friction angle | $\delta_{r.k}$ = **0** deg |

**Base soil properties**

| | |
|---|---|
| Soil type | Medium dense well graded sand |
| Soil density | $\gamma_b$ = **18** kN/m$^3$ |
| Characteristic effective shear resistance angle | $\phi'_{b.k}$ = **30** deg |
| Characteristic wall friction angle | $\delta_{b.k}$ = **15** deg |
| Characteristic base friction angle | $\delta_{bb.k}$ = **30** deg |
| Presumed bearing capacity | $P_{bearing}$ = **150** kN/m$^2$ |

**Loading details**

| | |
|---|---|
| Variable surcharge load | Surcharge$_Q$ = **10** kN/m$^2$ |
| Vertical line load at 2150 mm | $P_{G1}$ = **16** kN/m |




General arrangement - sketch pressures relate to bearing check

**Calculate retaining wall geometry**

| | |
|---|---|
| Base length | $l_{base}$ = $l_{toe}$ + $t_{stem}$ = **2300** mm |
| Moist soil height | $h_{moist}$ = $h_{soil}$ = **3100** mm |

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Length of surcharge load — $l_{sur} = l_{heel} =$ **0** mm
- Distance to vertical component — $x_{sur\_v} = l_{base} - l_{heel} / 2 =$ **2300** mm

Effective height of wall — $h_{eff} = h_{base} + d_{cover} + h_{ret} =$ **3450** mm
- Distance to horizontal component — $x_{sur\_h} = h_{eff} / 2 =$ **1725** mm

Area of wall stem — $A_{stem} = h_{stem} \times t_{stem} =$ **0.93** $m^2$
- Distance to vertical component — $x_{stem} = l_{toe} + t_{stem} / 2 =$ **2150** mm

Area of wall base — $A_{base} = l_{base} \times t_{base} =$ **0.805** $m^2$
- Distance to vertical component — $x_{base} = l_{base} / 2 =$ **1150** mm

**Using Coulomb theory**

Active pressure coefficient — $K_A = \sin(\alpha + \phi'_{r.k})^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta_{r.k}) \times [1 + \sqrt{[\sin(\phi'_{r.k} + \delta_{r.k}) \times \sin(\phi'_{r.k} - \beta) / (\sin(\alpha - \delta_{r.k}) \times \sin(\alpha + \beta))]}]^2) =$ **0.333**

Passive pressure coefficient — $K_P = \sin(90 - \phi'_{b.k})^2 / (\sin(90 + \delta_{b.k}) \times [1 - \sqrt{[\sin(\phi'_{b.k} + \delta_{b.k}) \times \sin(\phi'_{b.k}) / (\sin(90 + \delta_{b.k}))]}]^2) =$ **4.977**

**Bearing pressure check**

**Vertical forces on wall**

Wall stem — $F_{stem} = A_{stem} \times \gamma_{stem} =$ **23.3** kN/m

Wall base — $F_{base} = A_{base} \times \gamma_{base} =$ **20.1** kN/m

Line loads — $F_{P\_v} = P_{G1} =$ **16** kN/m

Total — $F_{total\_v} = F_{stem} + F_{base} + F_{P\_v} =$ **59.4** kN/m

**Horizontal forces on wall**

Surcharge load — $F_{sur\_h} = K_A \times Surcharge_Q \times h_{eff} =$ **11.5** kN/m

Moist retained soil — $F_{moist\_h} = K_A \times \gamma_{mr} \times h_{eff}^2 / 2 =$ **41.7** kN/m

Base soil — $F_{pass\_h} = -K_P \times \cos(\delta_{b.k}) \times \gamma_b \times (d_{cover} + h_{base})^2 / 2 =$ **-5.3** kN/m

Total — $F_{total\_h} = F_{sur\_h} + F_{moist\_h} + F_{pass\_h} =$ **47.9** kN/m

**Moments on wall**

Wall stem — $M_{stem} = F_{stem} \times x_{stem} =$ **50** kNm/m

Wall base — $M_{base} = F_{base} \times x_{base} =$ **23.1** kNm/m

Surcharge load — $M_{sur} = -F_{sur\_h} \times x_{sur\_h} =$ **-19.8** kNm/m

Line loads — $M_P = P_{G1} \times p_1 =$ **34.4** kNm/m

Moist retained soil — $M_{moist} = -F_{moist\_h} \times x_{moist\_h} =$ **-47.9** kNm/m

Total — $M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{moist} =$ **39.8** kNm/m

**Check bearing pressure**

Propping force — $F_{prop\_base} = F_{total\_h} =$ **47.9** kN/m

Distance to reaction — $\bar{x} = M_{total} / F_{total\_v} =$ **670** mm

Eccentricity of reaction — $e = \bar{x} - l_{base} / 2 =$ **-480** mm

Loaded length of base — $l_{load} = 3 \times \bar{x} =$ **2010** mm

Bearing pressure at toe — $q_{toe} = 2 \times F_{total\_v} / l_{load} =$ **59.1** $kN/m^2$

Bearing pressure at heel — $q_{heel} =$ **0** $kN/m^2$

Factor of safety — $FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) =$ **2.539**

***PASS - Allowable bearing pressure exceeds maximum applied bearing pressure***

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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk

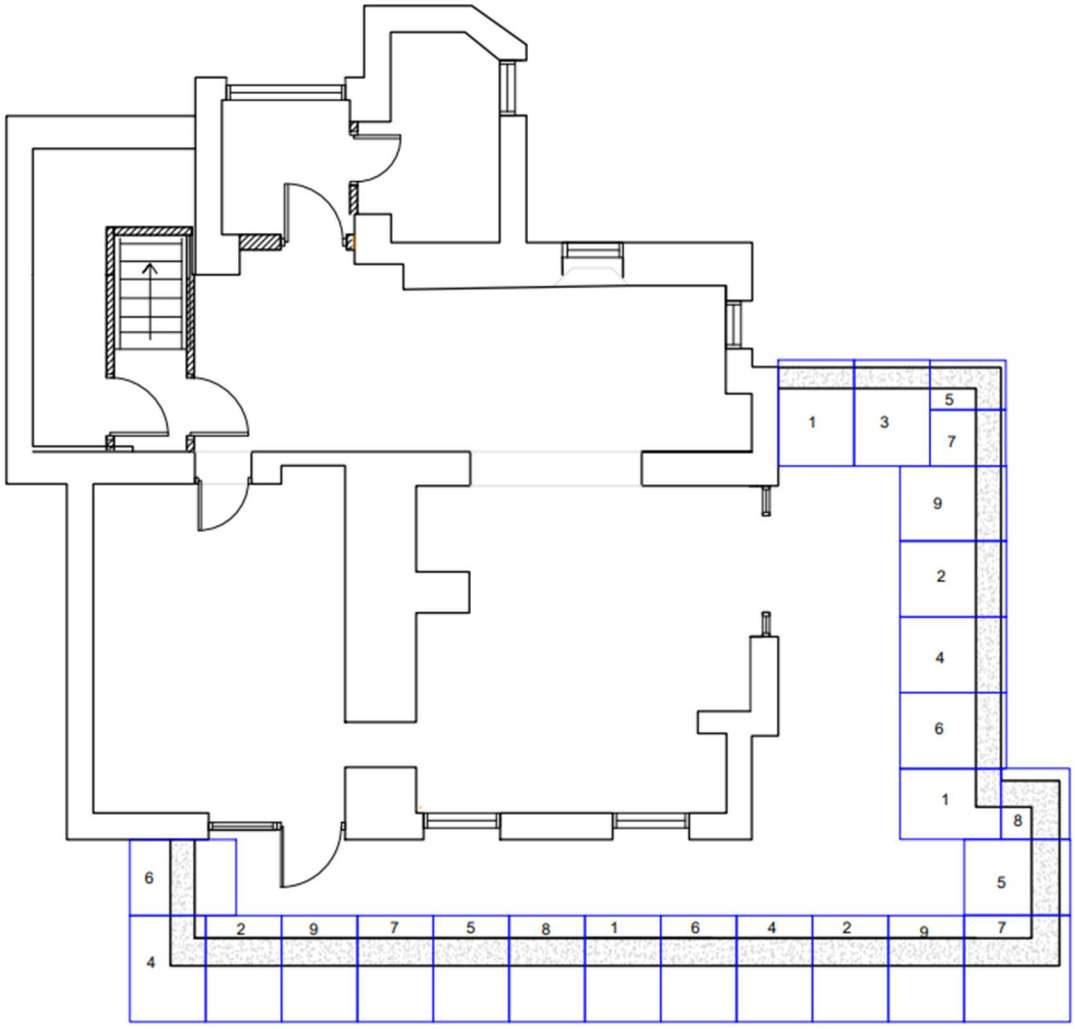


## Hit & Miss Layout

Contractor is to set out the pins according to the final permanent works design. Below is an example of a hit-and-miss layout.

The extent of the Excavation will be determined on site as to where the retained soil is deep enough to require a retaining wall.

### Hit and Miss Sequence Drawings



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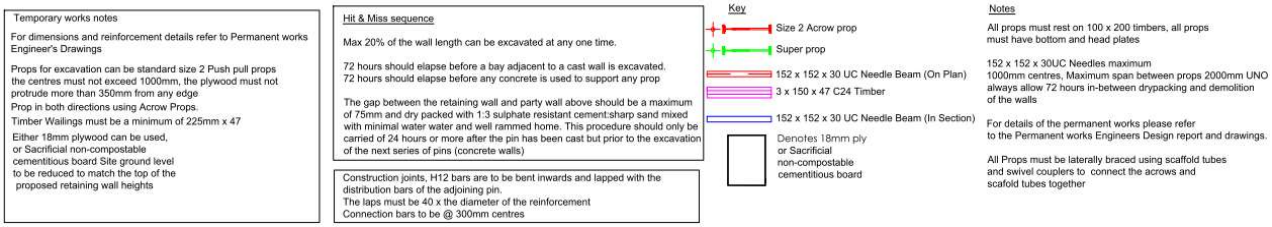
Email: info@imperiumengineering.co.uk






## PROPS

It is proposed to use Acrows and then full width Multiprops to prop the retaining wall during the temporary phase.

As can be seen in our temporary work calculation above, the maximum propping force will be 22.2kN/m.

We propose to use Acrow props for every bay and then replace them with full width Multiprops installed every other bay at 2m c/c's.

The safe working load for a Acrow Props is 32kN, thus OK. The contractor will conservatively use an additional prop at higher level to better prop the RC wall during the temporary phase.

**Safe Working Load (kN) for props loaded Concentrically and 1.5° Max. Out-of-Plumb.**

Recommended safe working loads for props supporting Metriform or similar formwork systems ensuring concentric loading. Also for timber bearers where fork heads are used to ensure concentric loading, but load on prop may be limited by allowable stress in timber.

| Height (m) Prop Size | 1.25 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 | 2.75 | 3.0 | 3.25 | 3.5 | 3.75 | 4.0 | 4.25 | 4.5 | 4.75 | 5 | 5.25 | 5.5 | 5.75 | 6.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 32 | 32 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1,2,3 | - | - | 32 | 32 | 32 | 26 | 23 | 19 | 17 | 15 | 13 | - | - | - | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - | - | - | 24 | 19 | 15 | 12 | 11 | 10 | 9 | - | - | - | - | - |
| 5 | - | - | - | - | - | - | - | - | - | - | - | 18 | 15 | 12 | 11 | 9 | 8 | 7 | 6 | 6 |

Source: Based on CIRIA Technical Note 79 (1977), (Except for size '0' props).

The safe working load for the Multiprops MP 625 at 4.8m is 44.5kN,

2 (m) x 22.2(kN/m) = 44.5kN, thus OK.

The maximum propping force will be 58.6kN/m.

We propose to use SuperSlim Soldier with end jacks that have a safe working load of 100kN at 1m c/c's.

They will be installed at 45 degrees so the load supported will be: 58.6/cos(45) = 82.9kN, OK

Four M16 threaded rods will be used to fix to the RC wall. Vrd = 4*52.1 = 208.4kN. OK

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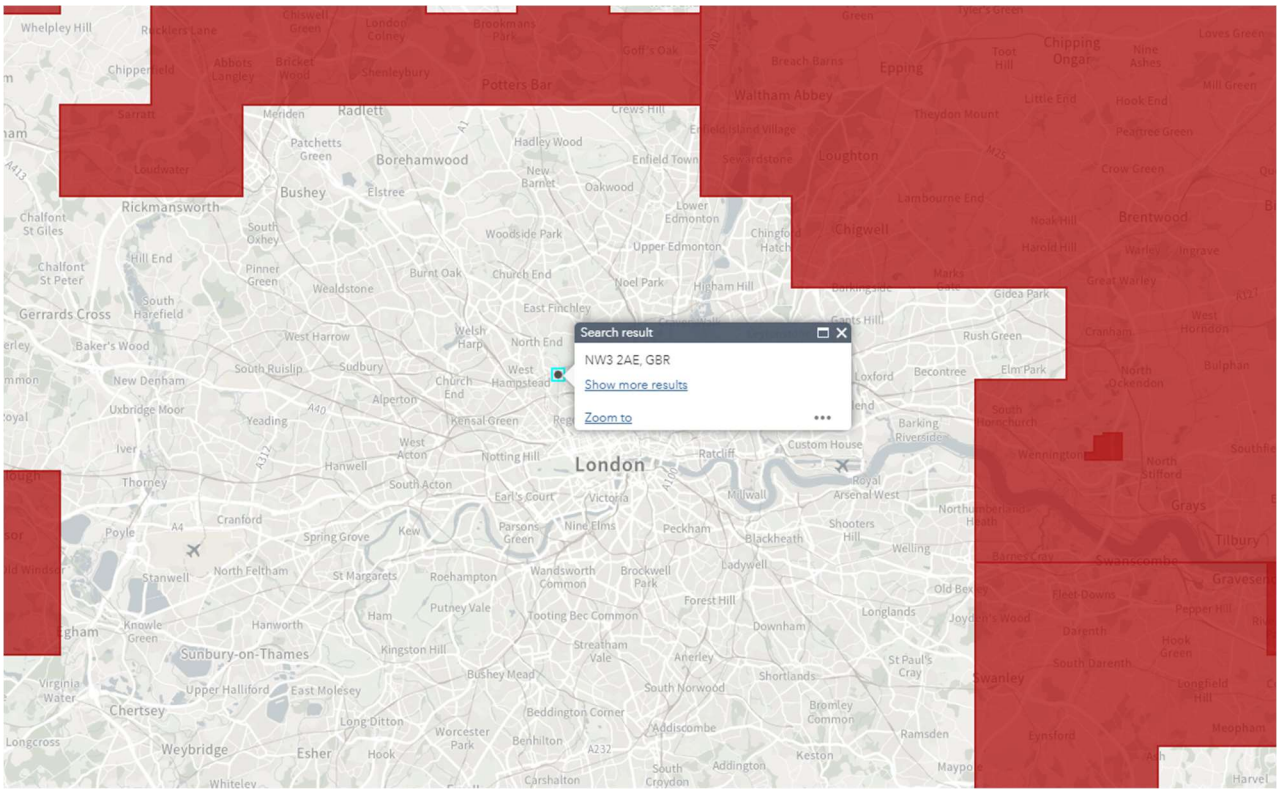
# APPENDIX F




Source: [Aerial Archaeology Mapping Explorer (arcgis.com)]

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T: 02034 417606
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# General Construction Notes

FOUNDATIONS & EXCAVATIONS

1. Where foundations are in clay soils and within the zone of influence of trees the depths are to be in accordance with N.H.B.C. guidelines 'Building Near Trees'. Where available, reference must be made to the soil report. All excavations are to be kept dry and the bottom of excavations for foundations must be protected from weathering.

2. Concrete for trench fill foundations is to be grade C28/35.

3. Where new foundations abut existing footings, the Contractor is to allow for local underpinning of the existing foundations.

4. Any drains or service ducts which passing through foundations are to be sleeved, with flexible couplings both sides of footings for drain runs. Tops of foundations may be reduced locally to allow services to pass over subject to Engineers approval with minimum 600mm depth of concrete below services. Precast concrete lintels may be used to support walls over, the Engineer must be consulted for lintel sizes. The Contractor must notify the Engineer if for any reason formation levels vary from those anticipated. Records of all final levels must be kept by the Contractor and issued to the Engineer if requested. The Contractor to agree with the Engineer the method of forming day-joints in foundations.

All foundations are to be agreed with building control, if the foundations cannot be agreed with building control, then we will be required to provide additional calculations and designs, this would be an additional fee. To provide the calculations it would be necessary to conduct a trial hole and inspection site visit and if this is not adequate then it may be necessary to obtain a site investigation from a geotechnical engineer.

GENERAL SPECIFICATION FOR UNDERPINNING: -

RESPONSIBILITIES

1. The Contractor to confirm with the Client that all required party wall awards are in place prior to works commencing.

2. The Contractor shall be completely responsible for the safety of the existing structure during the underpinning operations, and he shall design, supply and erect all the temporary supports that may be required or prove necessary during the course of the work.

3. The details of such supports shall be agreed with the Engineer and other interested parties prior to their erection.

SURVEY AND CONDITION OF BUILDING

1. Before commencing work the Contractor shall request a copy of the Schedule of Conditions prepared as part of the party wall award or carry out an inspection and produce a Schedule of Conditions for the building to be underpinned. This shall be agreed with the Client / Architect / Adjoining owner before commencing work. Where necessary repairs shall be affected to enable the underpinning to be carried out.

PROTECTION

1. The Contractor shall protect the area in which the work is being carried out by the provision of suitable hoarding, fences etc.

2. Unless otherwise instructed by the Architect all work shall be carried out from within the site.

EXCAVATION

1. The underpinning shall be carried out in sections not exceeding 1000mm. The excavation and construction of the sections shall be carried out in a "hit and miss" pattern such that a maximum degree of support is offered to the wall at all times.

2. Unless otherwise stated on the drawings the underpinning shall be carried out for the whole width of the existing foundation.

3. Where excavations exceed 1000mm in depth or wherever it is found necessary or called for on the drawings, all excavations shall be fully planked and strutted. Reference should be made to Specification "Earthworks", in this regard.

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T: 02034 417606
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4. The material providing the support to the remote earth face below the foundations shall, if necessary, be left in position. It must not therefore be subject to deterioration. Any gaps between this support and the earth face shall be filled with cementitious grout. All timber planking and strutting shall be removed.

5. The underside of the exposed foundations shall be thoroughly cleaned of all soil and other loose material before the section of underpinning is constructed.

6. Excavations which are left open overnight shall be blinded with 50 mm of 1.8 concrete with sulphate resisting cement.

7. If water is struck during excavation, excavation shall cease until a method of dewatering has been devised which will not be detrimental to the adjoining foundations & has been agreed with the Engineer.

RECORDS

1. The contractor shall keep an accurate record of the progress of underpinning operations which shall be available for reference at any time.

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20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



# Additional Notes

Building Regulations apply to all works of a structural nature. A set of these calculations should be submitted to an Approved Inspector or Local Authority Building Control for approval under the Building Regulations.

We would recommend that an early application is made for Full Plans Building Regulation approval. Should Building Control make any comments on the structural design please pass these back to us for consideration. There is a risk that they may raise queries which will require an amendment to our design, so it is important to seek approval prior to commencing any work.

Should you commence work without Full Plans approval under the Building Act you do so at your own risk - we will not accept liability for alterations, costs or delays resulting from the need to address Building Control's requirements.

Planning consent may also be required for the works you are proposing. Unless you or your agent have already done so or you have made alternative arrangements, you should contact your Local Authority Planning Department, to check whether planning consent will be required.

These calculations relate only to the proposed works and their effect on the building structure. We have not considered the structural adequacy of other parts of the building except those directly affected by the proposed works or other areas where the calculations specifically identify design checks.

The structural design has been reviewed in accordance with regulation II of the Construction (Design and Management) Regulations 2015. My addition to the usual risks associated with building works and construction material, of which a competent and experienced building contractor should be aware, the following project specific health and safety risks have been identified:

• Demolition / excavation / drilling and cutting into existing structures or the ground should be carried out with extreme caution as there is a risk that unforeseen services will be encountered.

• All walls / beams / slabs / floor structures etc, which are to be demolished or removed should be assessed for any load bearing or stability function and temporary propping provided, as necessary. The design of temporary works support is outside of our brief for the project.

• Any existing structure of fabric to be interfered with by the work should be assessed for the potential presence of asbestos and appropriate action is taken if discovered.

Where new beams are to be installed to support the existing structure, temporary support will be required. When new beams are installed, before removing temporary support, steel or hardwood wedges should be driven into the gap between the top of the new beam and the underside of the retained structure above. The remaining gap should then be packed with a 1:3 dry sand-cement mix or otherwise permanently filled to transfer the load from above. Even with these precautions, some inevitable deflection of the temporary and permanent structure support will occur, and this may result in cracking to the structure above. This is normal and should be repaired and redecorated at the completion of the works. Such works should only be undertaken by an experienced and competent building contractor.

Where new foundations are required, the allowable bearing pressure of the soil at the proposed foundation depth should be assessed against the values assumed in the calculations - Table 10 of the approved document of the building regulations gives guidance in this regard.

References:

BS 648: 1994 Weights of Building Materials
BS 5950: Part I: 2000: Design a Structural Steelwork
BS 5977: Part I: 1981: Lintels Method of Assessment of Load
BS 5628: Part I: 2005: Structural use of Unreinforced Masonry
BS 5628: Part 3: 2005: Masonry - Materials, Components, Design & Workmanship
BS 5268: Part 2: 2002: Structural use of Timber - Permissible Stress Design
BS 6399: Part 1: 1996: Loading for Buildings: Dead and Imposed Loads
BS 6399: Part 2: 1997: Loading For Buildings: Wind Loads
BS 6399: Part 3: 1988: Loading for Buildings: Imposed Roof Loads

Construction Notes:

Concrete Mixes to be designated mixes to BS 8500. The method of placing and the workability of the mix is to be specified by the Contractor to the approval of Local Authority Building Control Admixtures shall not be used without prior approval.

Placing, compacting, finishing and curing to be in accordance with BS8000 Section 2.2

IE IMPERIUM ENGINEERING

20-22 Wenlock Road, London N1 7GU
T: 02034 417606
Email: info@imperiumengineering.co.uk



Mass concrete foundation to be mix ref. GEN3 unless stated otherwise in the site investigation report

The following calculations assume that the foundations bear at onto ground capable resisting a bearing pressure of 75kN/m2 without failure of excessive settlement. Where weaker soils are present on-site foundation widths will need to be revised as appropriate.

Minimum block strength to be used in the works shall be 2.8 N/mm2. All blocks used below ground shall be suitable for such use

Mortar Designation: Above ground (iii) 1:1:6 Cement: Lime: Sand
Below ground (iii) 1:0.5:4.5 Cement: Lime: Sand

Where beam lengths and other span dimensions are quoted in the following calculations, they are approximate and shall not be used as a basis for ordering materials. The main contractors shall make his own measured survey of the site to determine precise lengths and details for construction.

All dimensions and levels to be check by the builder before ordering any steelwork,

All steelwork is to be grade S275, shot blasted and painted with 2 coats of zinc phosphate primer or red oxide primer unless noted on drawing as galvanised or concrete encased.

All bolts are to be grade 8.8, all fabrications to be completed in accordance with BS5950.

All new timbers are to be Grade C24 unless noted as C16 on the drawing and must be tantalised. Paint all cut ends with timber preservative on site. Plywood must comply with EN636 Class 3.

All brickwork to be a minimum of 20.5n/mm2 in 1:1:6 Mortar

All concrete (except blinding concrete) is to be a minimum of 30n/mm2 with 20mm diameter aggregate and is to be mechanically vibrated when placed.

All concrete work must comply with BS8110.

Beam supporting cavity walls to have 15mm thick steel plates welded to top of beam and the width of the plate is to suit the width of the supported wall

All external walls to have straps at 2m c/c's horizontally and vertically for the roof

Timber joists with a span over 2.5m are to ha e one row of noggins at one third the span, noggins can be replaced with herringbone strutting.

All joists in walls are to be cross nailed.

All stud walls parallel to the floor joists must be support by a minimum of a double joist which is to be bolted together using M12 bolts with dog toothed washers @ 500mm c/c

All beams are to be centrally loaded on pad-stone and beams are to extend to the end of any given pad-stone.

The contractor must provide full details on their proposed temporary works, before commencing the structural works.

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# Appendix G Party Wall Act 1996:

The following extract has been taken from the Party wall act explanatory booklet.