Structural Report

For

47 Albert Street
London
NW1 7LX

Structural Methodology Statement In Support Of Planning Application

22/08/16 2016044/CC : Rev P1

Symmetrys Limited
Consulting Structural Engineers

A: 6 The Courtyard, Lynton Road, London. N8 8SL
T: 0208 340 4041
E: info@symmetrys.com
W: www.symmetrys.com

Contents

1.0 Introduction
2.0 Existing Condition
3.0 Ground Investigation
4.0 Design Proposals
5.0 Proposed Sequence of Works
6.0 Construction Method Statements
7.0 Stability of Neighbouring Structures
8.0 Party Wall Matters
9.0 Drainage
10.0 Sustainability
11.0
12.0 Summary

Appendices

A: Proposed Drawings and Structural Methodology Statement – *Symmetrys*
B: Structural Calculations – *Symmetrys*
C: Ground Investigation – *LMB Geosolutions Ltd*

Symmetrys Limited
Consulting Structural Engineers

1. INTRODUCTION

1.1 Symmetrys Limited has been engaged by inside out architecture to carry out a structural report for the proposed extension of the existing lower ground floor and ground floor of a 4 storeys building at 47 Albert Street, North West London. The proposal is to extend the existing lower ground floor and ground floor in the back garden by demolishing and rebuilding the rear extension. The front vaults will also be extended below the existing front garden. The remaining parts of the house will be refurbished and new structural elements will be introduced in order to reinforce the existing structure.

1.2 Our drawings and this report will be included within our client's planning application. Our documents are not intended for, and should not be relied upon by, any third party for any other purpose. Proposed and existing general arrangement drawings were passed to us from inside out architecture.

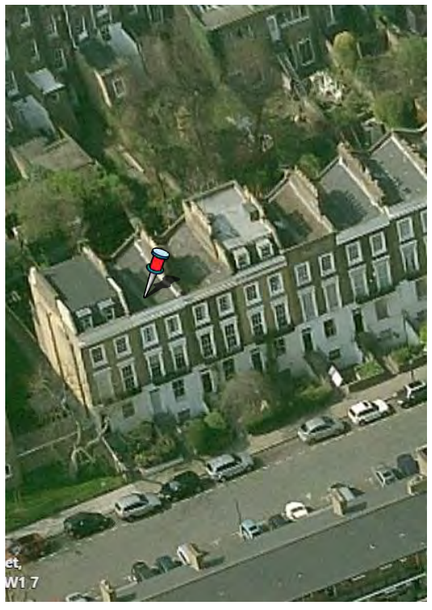


Photo 1 – Birds eye view front elevation

Photo 2 – Birds eye view rear elevation

1.3 <u>Reference documents</u>

The following documents have been used as guidance to complete this Structural Report:

1, Camden Planning guidance: Basements and Lightwells – July 2015
2, Camden's Core Strategy CS14
3, Camden Development Policy DP25
4, National Planning Policy Framework: Section 12.
5, The Lost Rivers of London, Nicholas Barton

2. EXISTING CONDITION

2.1. The existing dwelling is located in Camden.

2.2 The existing structure is 4 storeys high with a two storey outrigger to the rear. The structure is load bearing masonry with timber floor joists spanning front to back and a butterfly roof. The property exhibits no signs of excessive deformation or cracking other than would be expected of a property of this type and age.

2.3 Symmetrys envisage opening up works will be undertaken to further establish the condition of the existing building prior to undertaking detailed design to enable existing defects to be considered.

3.0 GROUND INVESTIGATION

3.1 <u>Ground Conditions</u>

The local geographical survey maps, accessible via the British Geological Society website http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes, indicated that the underlying soil strata, much like the rest of London, is London Clay. Having reviewed borehole-s cut in the vicinity of the property on Albert Street, with particular respect to Northeast, with the BGS reference TQ28SE311 (see figure 1), stiff clay was confirmed down to 9m.

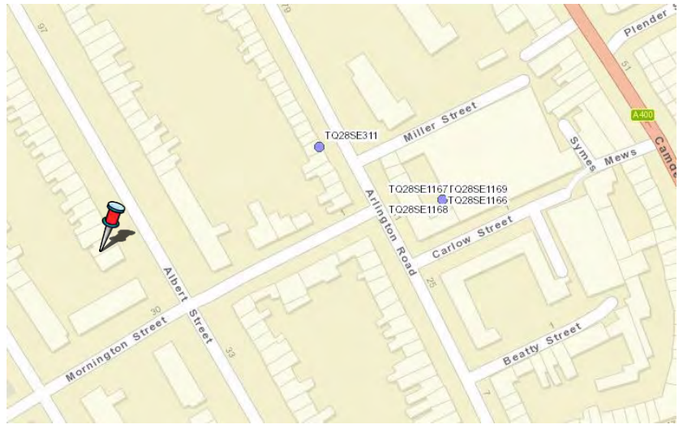


Figure 1 - Historical bore hole log map taken from the British Geological Surveys

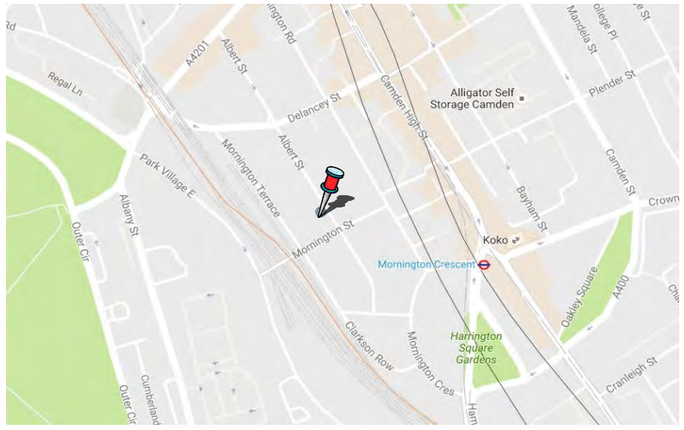


Figure 2 : Map showing local transport tunnels

3.2 Investigation / Opening-Up Works Undertaken:

3.2.1 One window sampler was cut in the front light well at lower ground floor level to determine safe bearing loads and cohesion values, traditional foundations. Furthermore the extent of any ground contamination and ground water levels was established. Should planning be granted then additional trial pits will be undertaken.

3.2.2 Four trial pits were excavated along the exterior walls of the house to reveal the existing foundations and to take samples of soil for laboratory testing.

3.3 Existing foundations

Trial pits were dug by LMB Geosolutions Ltd on the 18th of July 2016 to reveal the full profile of the existing foundations. Sections representing the results of the trial pits can be found in the factual report of the basement impact assessment in appendix C.

3.4 Ground Investigation and Geology

3.4.1 The interpretative report of the site specific investigation has been undertaken by LMB Geosolutions Ltd. The findings and recommendations are described in their report dated August 2016.

3.4.2 The ground conditions are summarised as follows:

Window Sampler 1

G.L to 1.70m	Made Ground
1.1m to 4.0m	Soft Brown Clay – London Clay
4.0m to 7.0m	Stiff Brown Clay – London Clay
7.0m to 8.35m	Stiff Dark Grey / Brown Clay – London Clay

3.4.3 Ground Water Monitoring :

No groundwater strikes were recorded during the ground investigation works and groundwater was not recorded during return monitoring visits.

3.4.4 The report confirms that the proposed lower ground flood extension can be founded on London Clay which would allow a safe bearing pressure of 120KN/m^2.

3.5 Hydrology

Referring to the “The Lost Rivers of London” by Nicholas Barton the closest known watercourse is described to be on the east of the site approximately 500m away which is known as the Fleet which runs from Hampstead Heath heading southwards. This is a significant distance away and is unlikely to have any impact on the local hydrology, see figure 3 below.

Figure 3 : Extract from the Lost River of London by Nicholas Barton

3.6 Flooding

Referring to the Camden strategic flood risk assessment, the proposed basement does not lie in a Local Flood Risk and therefore having a less than 1 in 1000 annual probability of river or sea flooding any year.

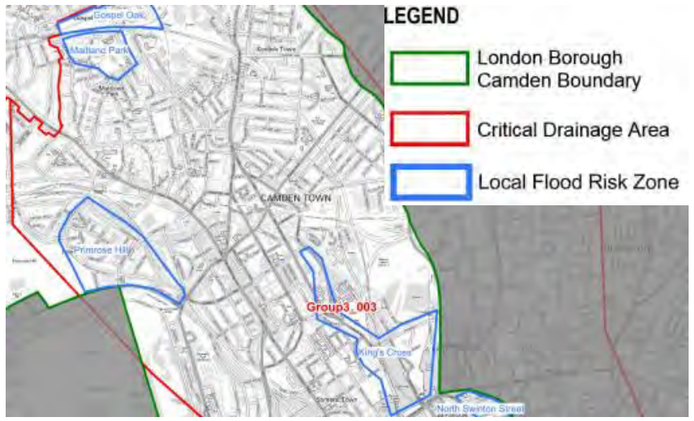


Figure 4 : Extract from Camden Strategic Flood Risk Assessment

4.0 DESIGN PROPOSALS

4.1 The proposal is to extend the existing lower ground floor below the front and into the rear gardens of the property, see structural drawings in Appendix A. The extended areas will be undertaken by using sequential reinforced concrete underpins which is a well-known and frequently used technique to form basements. The use of temporary propping will ensure that the basement does not cause any local ground movements whilst the construction is taking place.

4.2 Front vault

To form the lower ground floor extension under the front courtyard, the structure forming the previously altered coal holes will be demolished. It is proposed to reinstate the historic the shape of the vaults within the new retaining wall. This retaining wall will be formed in an underpinned sequence using reinforced concrete L-shaped pins. This will ensure that the basement slab resists any potential soil pressure due to heave of hydrostatic loads from localised perched water, leaking pipes, etc. The floor level of one of the vaults will also be lowered using mass concrete underpins under the existing brick wall supporting the new ground bearing slab.

4.3 Rear Extension

The rear extension at lower ground floor will be formed using reinforced concrete L-shaped pins excavated within the rear garden. It is also proposed to lower the existing lower ground floor by 100mm for the courtyard and 260mm for the bathroom by using a concrete ground bearing slab within the depth of the existing brick wall foundations. Two trial pits were undertaken in those areas which show that the floor level can be lowered without undermining the adjoining properties. Please refer to the ground investigation report by LMB Gesolutions for details. Foundations are 300mm below ground level in the courtyard and 600mm below ground level in the bathroom.

Heave forces can cause short and long term deformation. Short term heave deformation occurs instantaneously and can be remediated by removing the expanded ground during the excavation. According to LMB Geosolutions report, see Appendix C, the long term heave deformation is not likely to produce relevant cracking in the building. Nevertheless, the new lower ground floor slab would be required to be sufficiently stiff to withstand the local heave pressures and to transfer the forces to the perimeter retaining walls. These uplift forces would be resisted by the significant dead load of the existing building. Our structural calculations also demonstrate that the existing structure can be safely supported on the proposed retaining wall structure within parameters provided by LMB Geosolutions for ground bearing capacity.

The new front and rear extension concrete slabs at ground floor will act as a permanent prop to the heads of the new basement walls. To ensure continuity between the RC retaining walls and the masonry walls, dowels will be drilled into the underside of the masonry walls and cast in with the RC walls.

4.4 Rear Garden

The lower ground floor courtyard will extend into the rear garden, by 1.8 meters. The remaining garden will be landscaped as per architect's drawings. Also green roofs are proposed on top of the new rear extension as part of the SuDS strategy for the development.

4.5 Waterproofing

BS8102 sets out guidance for the waterproofing of basement structures according to their use. With this in mind the use of tanked, integral and/or drained methods of waterproofing will have to be considered. These items will be considered once a tanking specialist has been employed.

4.6 Roof

It is proposed to reinstate the roof by carrying out structural repair where necessary. This will involve replacing the existing rotten rafters to avoid any risk of failure and water ingress and strengthen the existing spine wall support.

5.0 PROPOSED SEQUENCE OF WORKS

5.1 The structural method statement provided, (see Appendix A), is for the purpose of the design team's design development and for the purpose of the client's planning application. The appointed contractor will be responsible for all temporary supports and for the stability of the

structure during the works. The method of construction adopted minimises the need for temporary works. However, propping during the underpinning sequencing will be required to minimise the risk of ground movement occurring.

To ensure that the retained engineer's intent is correctly interpreted by the contactor, they will be required to submit all temporary works proposals to review a minimum of 7 working days prior to commencing excavation. The contractor should also submit a dewatering strategy to ensure a strategy is agreed should water be encountered.

5.2 Below Existing Building

Temporary propping to the newly formed retaining walls forming the extensions will be required until the ground floor has been formed. For further details please see Appendix A for construction sequence and method statements.

5.3 Dewatering Strategy

As ground water was not recorded during site investigation, a dewatering strategy is not necessary for this planning application.

6.0 CONSTRUCTION METHOD STATEMENTS

Please see Appendix A for construction sequence and method statements.

7.0 STABILITY OF NEIGHBOURING STRUCTURES

7.1 Due to the robust engineering principles and construction method applied, the extent of movement is limited in accordance with British and European codes. We can confirm that the proposed structural design and method of construction of the basement has been developed with a view to ensuring structural safety, and that if constructed in accordance with this document the works will be able to be completed without any adverse impact on the structural stability of the neighbouring properties, other adjacent structures, adjoining land and gardens or the adjoining Public Highway.

7.2 The reinforced concrete structure will be designed to accommodate surcharges from the neighbouring property, public highway and ground pressures. The structure will have adequate stiffness to ensure that the lateral deflections do not exceed the appropriate limits recommended by British Standards Codes of Practice in order to ensure that potential ground movements be kept to acceptable limits.

7.3 The structures will be designed to transfer vertical loads into the ground safely. As the basement extension will involve very limited excavation works and will be carried out in an underpinned sequence, it is unlikely to cause any critical damages to the neighbouring structures.

Figure 2, shows the position of the Northern Line and Overground relative to the proposed basement. Due to the tunnels being 90m away, which is considered a significant distance, no consultation with the London Underground Asset Protection team will be undertaken.

8.0 PARTY WALL MATTERS

The scope of works falls within the Party Wall Act 1996. Procedures under the Act will be dealt with by the client's Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the provision of the Acts and agree Party Wall Awards in event of disputes. The Contractor will be required to provide the Party Wall Surveyor with the appropriate drawings, method statements and all other relevant information covering the works notifiable under the Act. The resolution of the matters under the Act and provision of Party Wall Awards will protect the interests of all owners.

9.0 DRAINAGE

9.1 The development is a subterranean extension of a single family dwelling house. As no additional utilities or units are being created there will be no material change in the requirements of the local drainage infrastructure.

9.2 The above ground drainage will be subject to invert levels, drained by gravity to the existing combined sewage system. The below ground drainage will be drained to a submersible package sewage station situated below the basement slab which will then be pumped via a rising drain to the nearest available inspection chamber on the existing gravity drainage system. This can then flow by gravity into the existing combined sewage system. To mitigate the risk of back flow suitable measures such as non-return valves will be incorporated into the drainage design.

10.0 SUSTAINABILITY

As the proposed extension at lower ground floor will involve significant amounts of concrete, cement replacement alternatives should be considered. Cement replacements can used to replace up to 40% of the cement in concrete mix. These replacements are typically waste products from the energy production industry such as PFA (pulverised fuel ash) and GBFS (granulated blast furnace slag) are recycled and not sent to landfill sites. Furthermore this also

reduces the amount of cement that needs to be mined. Concrete should be bought from a local supplier to further reduce the carbon footprint of transport.

There is a significant amount of reinforced concrete on the project for which steel reinforcement bars will be required. By specifying reinforcement from a UK supplier it ensures that the rebar is made from 100% recycled steel. Any structural steelwork should be sourced from a British manufacturer to ensure that rolled sections are made from at least 60% recycled steel. Sourcing the steel from a local supplier will further reduce the transport carbon footprint.

The use of timber as a structural element is to be maximised as timber production actively negates greenhouse gas production. Furthermore all timber is to be FSC certified insuring that the timber is produced from a sustainable source.

11.0 BASEMENT IMPACT ASSESSMENT

Having sent a pre-planning application enquiry we've been advised that given the very limited excavation work it is unlikely that a full BIA would be required.

As part of Camden basement policy we carried out the screening stage to identify the relevant matters to be investigated for this basement proposal. By referring to the guidance in chapter 3 of CPG4-Basements and light wells and following the flow screening charts, we can confirm that no further investigation is required for this application.

Please refer to the tables below for the assessment of the flow screening charts.

Subterranean ground water flow screening chart

1a : Is the site located directly above an aquifer ?	No	No Groundwater was recorded during the site investigation and monitoring visit. Ground condition is London Clay.
1b : Will the proposed basement extend beneath the water table surface ?	No	No Groundwater was recorded during the site investigation and monitoring visit.
2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line ?	No	First watercourse at 1km north from site. The Lost River of London extract in figure 3 shows the river Fleet 500m away from site.
3: Is the site within the catchment of the pond chains on Hampstead Heath ?	No	The site is located near Morning Crescent, around 2 km from Hampstead Heath.
4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas ?	No	There is a decrease of hard surfaced area (≈ 3m2) provided by the landscape arrangement of the rear garden and the two green roofs over the rear extension.
5: As part of the site drainage, will more surface water than at present be discharged to the ground ?	No	The surface of permeable ground in the rear garden is not increased.
6: Is the lowest point of the proposed excavation close to, or lower than, the mean water level in any local pond or spring line?	No	There is no local pond or spring line nearby.

Slope stability screening flowchart

1: Does the existing site include slopes, natural or manmade, greater than 7 degrees ?	No	The site is levelled.
2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7 degrees ?	No	There is no proposed change in the slope of the site.
3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees ?	No	There is a railway track 90 meters from the site, see figure 2. As this is a reasonable distance, the development will not affect the railway line.
4: Is the site within a wider hillside setting in which the general slope is greater than 7 degrees ?	No	The site is not located on a wider hillside.
5: Is the London Clay the shallowest strata at the site ?	**Yes**	However London Clay is the only strata identified on site. According to BGS, see figure 1 and the Site investigation, London Clay goes down to at least 9 meters.
6: Will any tree(s) be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained ?	No	The proposed scheme will not impact any tree protection zones. No tree is to be fell as part of the proposed lower ground floor extension.
7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site ?	No	The building does not show significant cracks that could be caused by ground movement.

8: Is the site within 100m of a watercourse or a potential spring line ?	No	First watercourse at 1km north from site. The Lost River of London extract in figure 3 shows the river Fleet 500m away from site.
9: Is the site within an area of previously worked ground ?	No	The house at 47 Albert Street is a listed building from mid-19th century.
10: Is the site within an aquifer ? Is so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	No Groundwater was encountered.
11: Is the site within 50m of the Hampstead Heath ponds ?	No	The site is located near Morning Crescent, around 2 km from Hampstead Heath.
12: Is the site within 5m of a highway or pedestrian right of way?	**Yes**	The site is located on Albert Street, the proposed development will be at less than 5 meters from the public street. However the new vault retaining wall has been designed to resist public highway surcharge. Construction of the retaining wall will be constructed in an underpinned sequence - well known construction technique to limit ground movements.
13: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	No	There is no significant increase in the depth foundation as the floor will only be lowered in some area up to 260mm.
14: Is the site over any tunnels, railway lines ?	No	The closest line is the Overground, 90 meters away from the site.

Surface flow and flooding screening flowchart

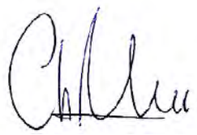
1: Is the site within the catchment of the pond chains on Hampstead Heath ?	No	The site is located near Morning Crescent, around 2 km from Hampstead Heath.
2: As part of the proposed site drainage, will surface water flows be materially changed from the existing route ?	**Yes**	However a new drainage scheme is proposed for the development to collect the surface water.
3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas ?	**Yes**	There will be a decrease of hard surfaced area (≈ 3m2). This will reduce the volume of surface water discharged in the existing combined sewage system.
4: Will the proposed basement result in changes to the profile of the inflows of surface water being received by adjacent properties or downstream watercourses ?	No	There is no change in the surface water received by the neighbouring properties.
5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses ?	No	There is no change in the surface water received by the neighbouring properties.
6: Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Asssessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature ?	No	No Ground water was encountered during the site investigation and the site is not located in flood risk zone, as shown on figure 4.

12.0 SUMMARY

12.1 It is essential that a thorough review of all temporary works, contractors' method statements and calculations for these works is undertaken by a suitable qualified structural engineer prior to works starting. The permanent works will also be submitted to Building Control and the necessary Party Wall Surveyors for approval prior to the works commencing on site.

12.2 The proposed works at 47 Albert Street have been designed with robust structural principles and methods of construction that are widely used and known. This will ensure the integrity of neighbouring structures and roadways are not compromised during its construction.
This assumed Method Statement and Structural report has been completed by Symmetrys Limited and checked by Christopher Atkins CEng MIStructE who is the Managing Director of Symmetrys Limited.

Camille Corvec
MEng
Structural Engineer



Christopher Atkins
CEng MIStructE
Managing Director

APPENDICES

APPENDIX A: PROPOSED DRAWINGS AND STRUCTURAL METHOD STATEMENTS

QD A1

REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING WORKS

LEGEND

- DENOTES EXISTING MASONRY OR TIMBER WALLS
- DENOTES NEW MASONRY WALLS BUILT IN 15N/mm² COMPRESSIVE STRENGTH BRICKWORK AND GRADE iii MORTAR
- DENOTES NEW MASONRY WALLS BUILT IN 7N/mm² COMPRESSIVE STRENGTH BLOCKWORK AND GRADE iii MORTAR
- DENOTES NEW NON LOAD BEARING STUD WALL BY ARCHITECT
- SEE DETAIL FOR TYPICAL RESTRAINT
- DENOTES ASSUMED SPAN OF EXISTING JOISTS
- DENOTES NEW TIMBER FLOOR JOISTS
- PS — DENOTES NEW MASS CONCRETE C30 PADSTONE U.N.O
- DENOTES REINFORCED CONCRETE SLAB
- (4) DENOTES SEQUENCE OF PROPOSED UNDERPINS. THE CONTRACTOR WILL HAVE TO PROVIDE HIS OWN SEQUENCE OF WORKS AND ALL METHOD STATEMENTS ONCE APPOINTED.

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

1. ALL TEMPORARY WORKS
2. ALL TANKING DETAILS
3. ALL REINFORCEMENT DRAWINGS AND BAR BENDING SCHEDULES
4. DESIGN OF ALL STEELWORK CONNECTIONS. THE FABRICATOR WILL HAVE TO SUBMIT THEIR CALCULATIONS TO BUILDING CONTROL FOR APPROVAL
5. STEEL FABRICATION DRAWINGS

NOTES

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS AND ALL DAMP PROOF COURSES

– ALL STEELWORK IN THE EXTERNAL WALLS ARE TO BE GALVANISED (80 MICRONS)

– LOCATION OF EXISTING AND PROPOSED DRAIN RUNS ARE TO BE CONFIRMED BY THE SERVICE ENGINEER

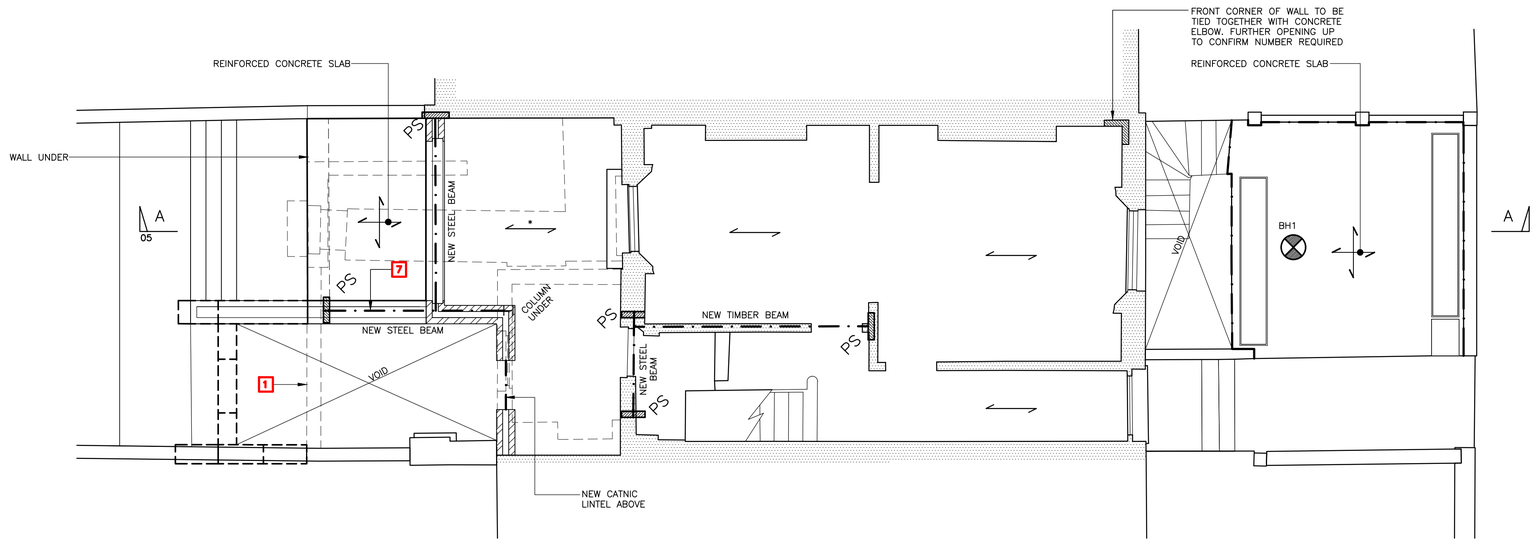
– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS, DAMP PROOF COURSES AND ALL TANKING DETAILS

– FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

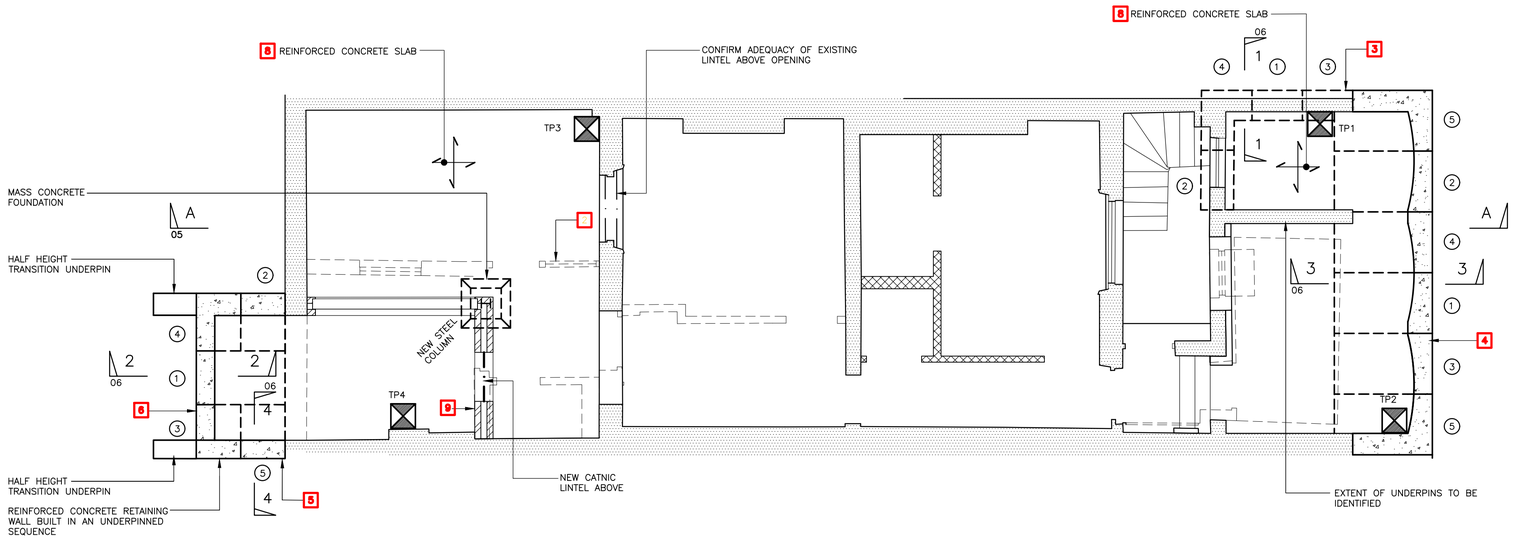
– CONTRACTOR SHOULD ALSO REVIEW MECHANICAL ENGINEERS DRAWINGS FOR EXACT LOCATION OF SERVICE PENETRATION PRIOR TO CUTTING

PROPOSED METHOD STATEMENT/ SUGGESTED SEQUENCE OF WORKS

1. DEMOLISH EXISTING REAR EXTENSION
2. DEMOLISH NON LOAD BEARING WALLS IN LOWER GROUND FLOOR
3. UNDERPIN EXISTING VAULT WALLS AS PER SECTION 1–1
4. BUILD NEW RETAINING WALLS IN AN UNDERPINNED SEQUENCE AS PER SECTION AND 3–3
5. UNDERPIN EXISTING GARDEN PARTY WALL AS PER SECTION 4–4
6. BUILD NEW RETAINING WALLS IN REAR GARDEN IN AN UNDERPINNED SEQUENCE AS PER SECTION 2–2 AND EXCAVATE REAR EXTENSION
7. INSTALL ALL PERMANENT STEEL WORK
8. INSTALL ALL DRAINAGE AND THEN FORM LOWER GROUND FLOOR SLAB
9. FORM NEW REAR EXTENSION
10. REMOVE TEMPORARY WORKS IN REVERSE ORDER OF INSTALLATION
11. INSTALL WATERPROOFING



UPPER GROUND FLOOR



LOWER GROUND FLOOR

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Chkd	Amendments
P3	19.08.16	CC	ISSUE FOR PLANNING
P2	05.08.16	CC	REVISED AS CLOUDED
P1	03.08.16	CC	PRELIMINARY ISSUE

Drawing Status: PRELIMINARY

Symmetrys Limited
Consulting Structural Engineers
6 The Courtyard, Lynton Road
London, N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Job Title

47 ALBERT STREET
LONDON, NW1

Drawing Title

LOWER GROUND AND UPPER GROUND FLOOR PLANS

Job No.	Drawing No.	Revision
2016044	01	P3

Scales 1:50 AT A1 — Original Size A1

Drawn By JNS Date JUNE 2016

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

QD A1

REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING WORKS

LEGEND

- DENOTES EXISTING MASONRY OR TIMBER WALLS
- DENOTES NEW MASONRY WALLS BUILT IN 15N/mm² COMPRESSIVE STRENGTH BRICKWORK AND GRADE iii MORTAR
- DENOTES NEW MASONRY WALLS BUILT IN 7N/mm² COMPRESSIVE STRENGTH BLOCKWORK AND GRADE iii MORTAR
- DENOTES NEW NON LOAD BEARING STUD WALL BY ARCHITECT
- SEE DETAIL FOR TYPICAL RESTRAINT
- DENOTES ASSUMED SPAN OF EXISTING JOISTS
- * DENOTES NEW TIMBER FLOOR JOISTS
- PS DENOTES NEW MASS CONCRETE C30 PADSTONE U.N.O

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

1. ALL TEMPORARY WORKS
2. ALL TANKING DETAILS
3. ALL REINFORCEMENT DRAWINGS AND BAR BENDING SCHEDULES
4. DESIGN OF ALL STEELWORK CONNECTIONS. THE FABRICATOR WILL HAVE TO SUBMIT THEIR CALCULATIONS TO BUILDING CONTROL FOR APPROVAL
5. STEEL FABRICATION DRAWINGS

NOTES

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS AND ALL DAMP PROOF COURSES

– ALL STEELWORK IN THE EXTERNAL WALLS ARE TO BE GALVANISED (80 MICRONS)

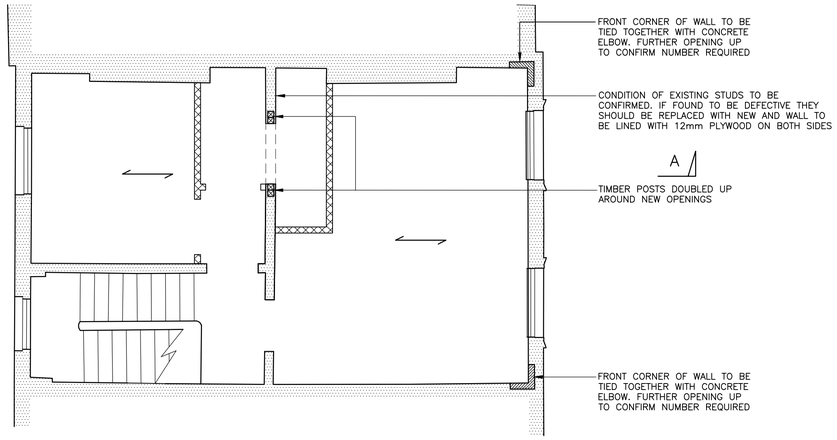
– LOCATION OF EXISTING AND PROPOSED DRAIN RUNS ARE TO BE CONFIRMED BY THE SERVICE ENGINEER

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS, DAMP PROOF COURSES AND ALL TANKING DETAILS

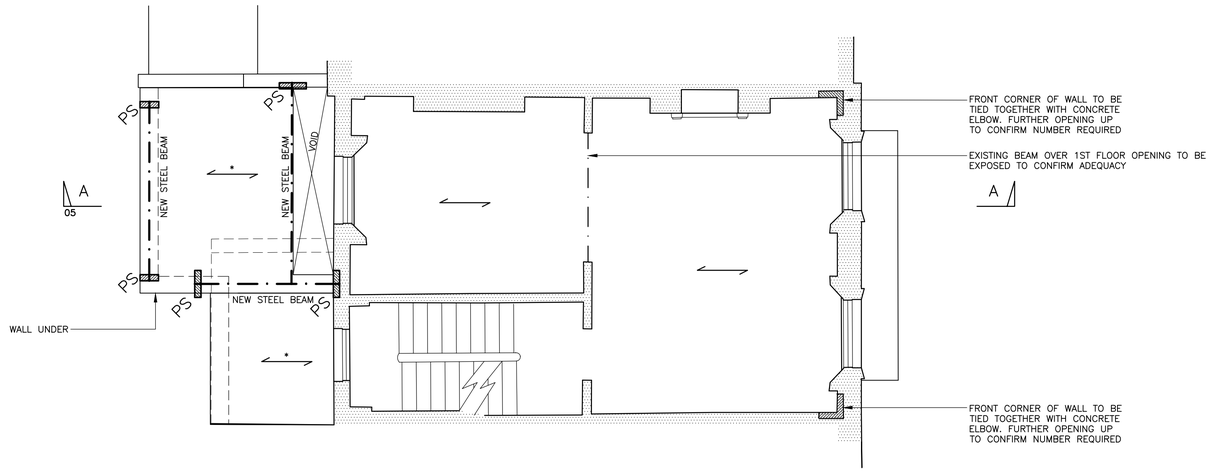
– FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

– CONTRACTOR SHOULD ALSO REVIEW MECHANICAL ENGINEERS DRAWINGS FOR EXACT LOCATION OF SERVICE PENETRATION PRIOR TO CUTTING

A 05



SECOND FLOOR



FIRST FLOOR

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Chkd	Amendments
P3	19.08.16	CC	ISSUE FOR PLANNING
P2	05.08.16	CC	REVISED AS CLOUDED
P1	03.08.16	CC	PRELIMINARY ISSUE

Drawing Status

PRELIMINARY

Symmetrys Limited
Consulting Structural Engineers

6 The Courtyard, Lynton Road
London, N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Job Title

47 ALBERT STREET
LONDON, NW1

Drawing Title

FIRST AND SECOND FLOOR PLANS

Job No.	Drawing No.	Revision
2016044	02	P3

Scales 1:50 AT A1 — Original Size A1

Drawn By JNS Date JUNE 2016

QD A1

REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING WORKS

LEGEND

- DENOTES EXISTING MASONRY OR TIMBER WALLS
- DENOTES NEW MASONRY WALLS BUILT IN 15N/mm² COMPRESSIVE STRENGTH BRICKWORK AND GRADE iii MORTAR
- DENOTES NEW MASONRY WALLS BUILT IN 7N/mm² COMPRESSIVE STRENGTH BLOCKWORK AND GRADE iii MORTAR
- DENOTES NEW NON LOAD BEARING STUD WALL BY ARCHITECT
- SEE DETAIL FOR TYPICAL RESTRAINT
- DENOTES ASSUMED SPAN OF EXISTING JOISTS
- DENOTES NEW TIMBER FLOOR JOISTS
- PS — DENOTES NEW MASS CONCRETE C30 PADSTONE U.N.O

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

1. ALL TEMPORARY WORKS
2. ALL TANKING DETAILS
3. ALL REINFORCEMENT DRAWINGS AND BAR BENDING SCHEDULES
4. DESIGN OF ALL STEELWORK CONNECTIONS. THE FABRICATOR WILL HAVE TO SUBMIT THEIR CALCULATIONS TO BUILDING CONTROL FOR APPROVAL
5. STEEL FABRICATION DRAWINGS

NOTES

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS AND ALL DAMP PROOF COURSES

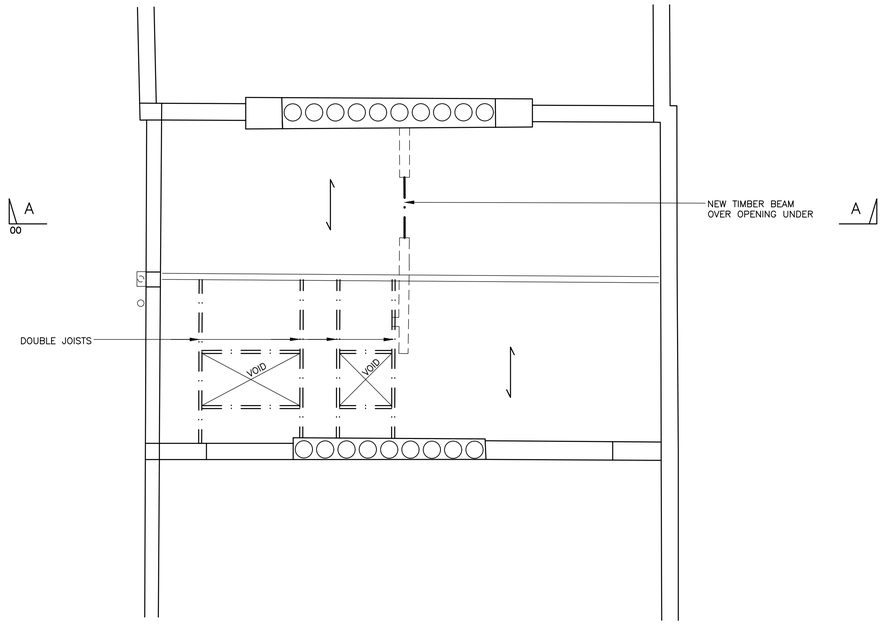
– ALL STEELWORK IN THE EXTERNAL WALLS ARE TO BE GALVANISED (80 MICRONS)

– LOCATION OF EXISTING AND PROPOSED DRAIN RUNS ARE TO BE CONFIRMED BY THE SERVICE ENGINEER

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS, DAMP PROOF COURSES AND ALL TANKING DETAILS

– FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

– CONTRACTOR SHOULD ALSO REVIEW MECHANICAL ENGINEERS DRAWINGS FOR EXACT LOCATION OF SERVICE PENETRATION PRIOR TO CUTTING



ROOF PLAN

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Chkd	Amendments
P3	19.08.16	CC	ISSUE FOR PLANNING
P2	05.08.16	CC	REVISED AS CLOUDED
P1	03.08.16	CC	PRELIMINARY ISSUE

Drawing Status: PRELIMINARY

Symmetrys Limited
Consulting Structural Engineers
6 The Courtyard, Lynton Road
London, N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Job Title: 47 ALBERT STREET LONDON, NW1

Drawing Title: ROOF PLAN

Job No.	Drawing No.	Revision
2016044	03	P3

Scales 1:50 AT A1 — Original Size A1

Drawn By JNS — Date JUNE 2016

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

QD A1

REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TEMPORARY SUPPORTS AND RESPONSIBLE FOR STABILITY OF THE STRUCTURE DURING WORKS

LEGEND

- DENOTES EXISTING MASONRY OR TIMBER WALLS
- DENOTES NEW MASONRY WALLS BUILT IN 15N/mm² COMPRESSIVE STRENGTH BRICKWORK AND GRADE iii MORTAR
- DENOTES NEW MASONRY WALLS BUILT IN 7N/mm² COMPRESSIVE STRENGTH BLOCKWORK AND GRADE iii MORTAR
- DENOTES NEW NON LOAD BEARING STUD WALL BY ARCHITECT
- SEE DETAIL FOR TYPICAL RESTRAINT

CONTRACTOR/SPECIALIST DESIGN ELEMENTS

1. ALL TEMPORARY WORKS
2. ALL TANKING DETAILS
3. ALL REINFORCEMENT DRAWINGS AND BAR BENDING SCHEDULES
4. DESIGN OF ALL STEELWORK CONNECTIONS. THE FABRICATOR WILL HAVE TO SUBMIT THEIR CALCULATIONS TO BUILDING CONTROL FOR APPROVAL
5. STEEL FABRICATION DRAWINGS

NOTES

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS AND ALL DAMP PROOF COURSES

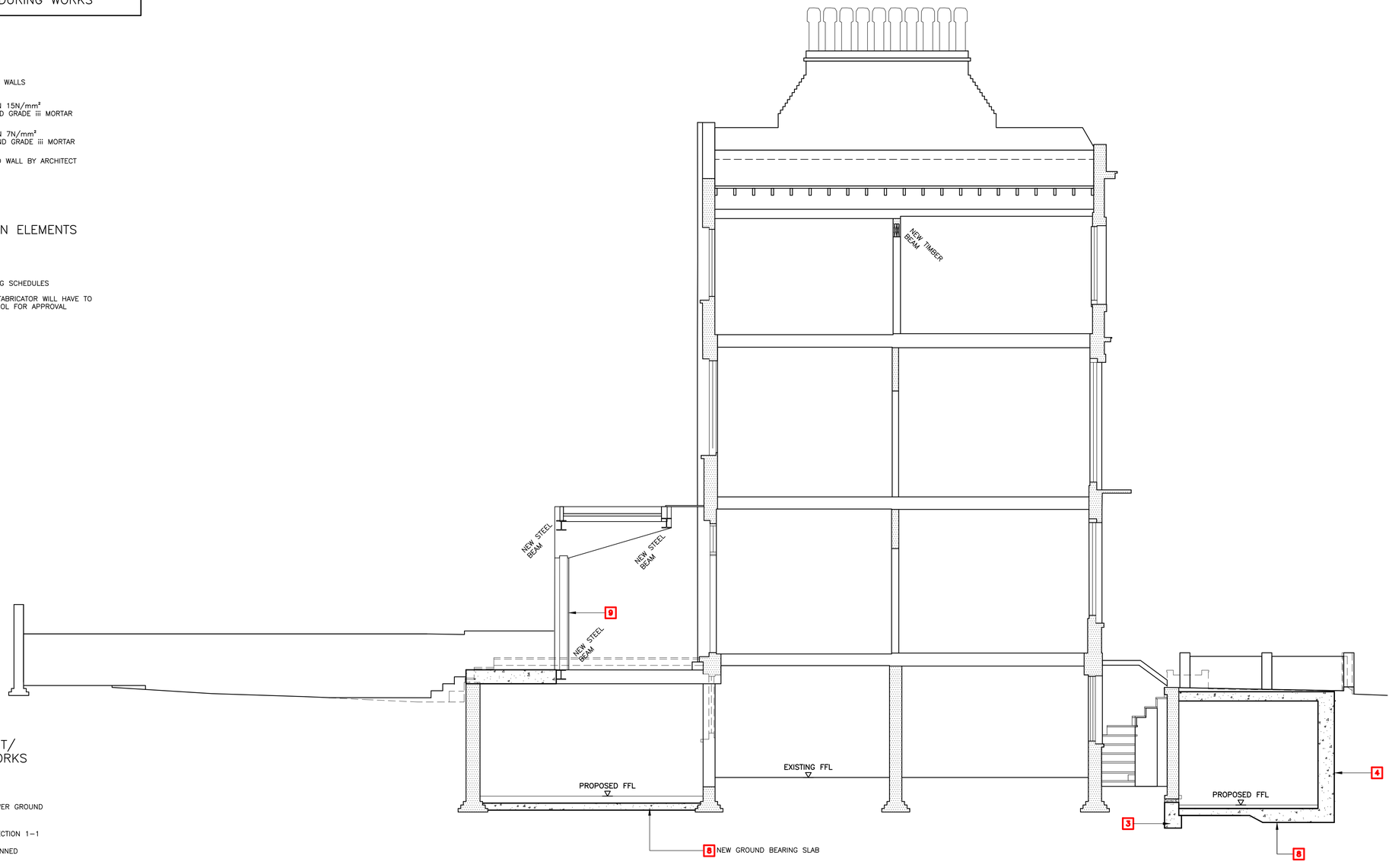
– ALL STEELWORK IN THE EXTERNAL WALLS ARE TO BE GALVANISED (80 MICRONS)

– LOCATION OF EXISTING AND PROPOSED DRAIN RUNS ARE TO BE CONFIRMED BY THE SERVICE ENGINEER

– PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DETAILS, INSULATION AND VENTILATION DETAILS, DAMP PROOF COURSES AND ALL TANKING DETAILS

– FOR ALL FIRE WORK PROTECTION TO STEELWORK REFER TO THE ARCHITECTS DRAWINGS

– CONTRACTOR SHOULD ALSO REVIEW MECHANICAL ENGINEERS DRAWINGS FOR EXACT LOCATION OF SERVICE PENETRATION PRIOR TO CUTTING



SECTION A–A

PROPOSED METHOD STATEMENT/ SUGGESTED SEQUENCE OF WORKS

1. DEMOLISH EXISTING REAR EXTENSION
2. DEMOLISH NON LOAD BEARING WALLS IN LOWER GROUND FLOOR
3. UNDERPIN EXISTING VAULT WALLS AS PER SECTION 1–1
4. BUILD NEW RETAINING WALLS IN AN UNDERPINNED SEQUENCE AS PER SECTION AND 3–3
5. UNDERPIN EXISTING GARDEN PARTY WALL AS PER SECTION 4–4
6. BUILD NEW RETAINING WALLS IN REAR GARDEN IN AN UNDERPINNED SEQUENCE AS PER SECTION 2–2 AND EXCAVATE REAR EXTENSION
7. INSTALL ALL PERMANENT STEEL WORK
8. INSTALL ALL DRAINAGE AND THEN FORM LOWER GROUND FLOOR SLAB
9. FORM NEW REAR EXTENSION
10. REMOVE TEMPORARY WORKS IN REVERSE ORDER OF INSTALLATION
11. INSTALL WATERPROOFING

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Chkd	Amendments
P3	19.08.16	CC	ISSUE FOR PLANNING
P2	05.08.16	CC	REVISED AS CLOUDED
P1	03.08.16	CC	PRELIMINARY ISSUE

Drawing Status

PRELIMINARY

Symmetrys Limited
Consulting Structural Engineers

6 The Courtyard, Lynton Road
London, N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Job Title

47 ALBERT STREET
LONDON, NW1

Drawing Title

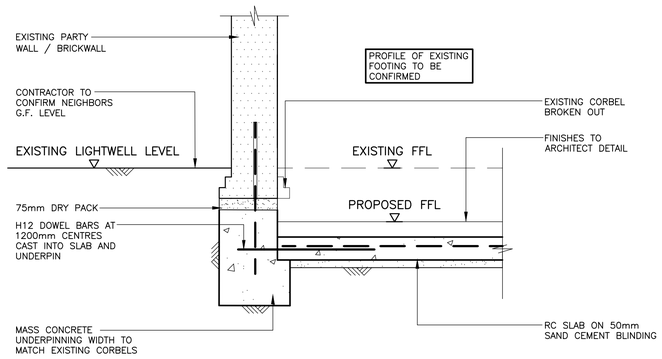
SECTION A – A

Job No.	Drawing No.	Revision
2016044	05	P3

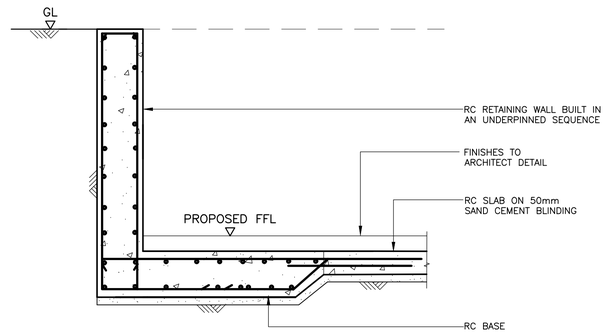
Scales 1:50 AT A1 | Original Size A1

Drawn By JNS Date JUNE 2016

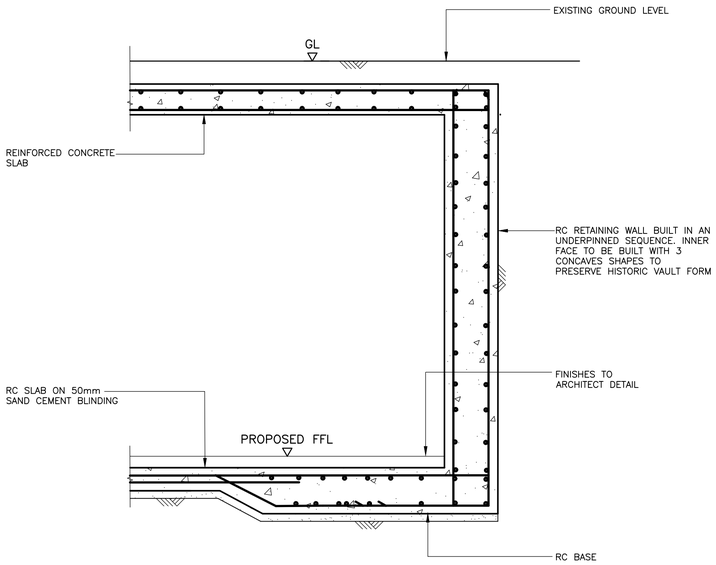
QD A1



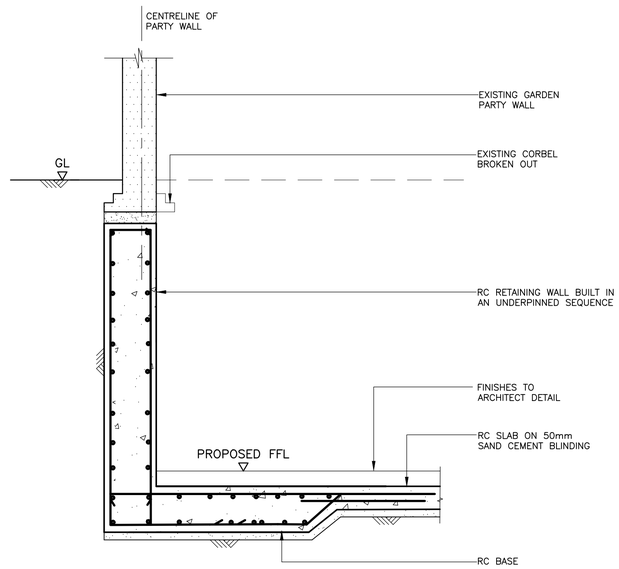
SECTION 1 – 1
1:20



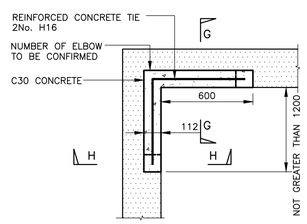
SECTION 2–2
1:20



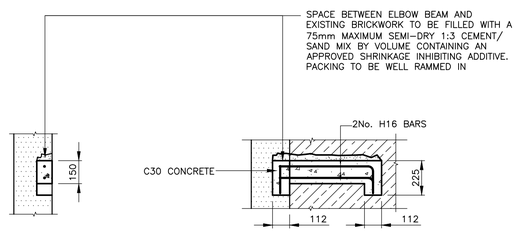
SECTION 3–3
1:20



SECTION 4–4
1:20



TYPICAL ELBOW BEAM DETAILS
1:20



SECTION G – G
1:20

SECTION H – H
1:20

Notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Chkd	Amendments
P3	22.08.16	CC	ISSUE FOR PLANNING
P2	05.08.16	CC	REVISED AS CLOUDED
P1	03.08.16	CC	PRELIMINARY ISSUE

Drawing Status
PRELIMINARY

Symmetrys Limited
Consulting Structural Engineers
6 The Courtyard, Lynton Road
London, N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Job Title
47 ALBERT STREET
LONDON, NW1

Drawing Title
RETAINING WALL AND UNDERPINNING SECTIONS

Job No.	Drawing No.	Revision
2016044	06	P3

Scales 1:20 AT A1 | Original Size A1
Drawn By JNS Date JUNE 2016

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

APPENDIX B: STRUCTURAL CALCULATIONS

Symmetrys Limited
Consulting Structural Engineers

6 The Courtyard, Lynton Road,
London. N8 8SL
T: 020 8340 4041
W: www.symmetrys.com
E: info@symmetrys.com

Structural Calculations
For
47 Albert Street,
London,
NW1 7LX

2016044 **August 2016**

Company No. 5873122
VAT Registration No. 894 2993 61
Registered In England And Wales

		Job No	Sheet No.	Revision
		2016044	1	01
Job Title	47 Albert Street	Date	Made By	Checked By
Section	Loads assumptions	Aug.2016	C.C	DB

ARCHITECT

INSIDE OUT ARCHITECTURE

CODES USED

- NHBC
- BS 648: 1964 – Weights of Building Materials
- BS 6399: Pt 1: 1984 – Design Loads
- BS 5950: Pt 1: 1990 – Structural Steel
- BS 5628: Pt 1: 1992 – Masonry
- BS 5268: Pt 2: 1991 – Structural Timber
- BS 8110: 1985 – Reinforced Concrete

IMPOSED LOADS

- Domestic Floors – 1.5 kN/m^2

GROUND CONDITIONS

- London Clay – Allowable Safe Ground Bearing Pressure – 120 kN/m^2
  (Provided by LMB Geosolutions Ltd)

Symmetrys Limited
Consulting Structural Engineers

		Job No	Sheet No.	Revision
		2016044	2	01
Job Title	47 Albert Street	Date	Made By	Checked By
Section	Loads assumptions	Aug.2016	C.C	DB

LOADS		**kg/m²**	**DEAD kN/m²**	**LIVE kN/m²**
Older Cavity (or 215 Solid)	102 Brick 102 Brick 12mm Plaster	210 210 24		
		444 kg/m²	4.44	
Reinforced Concrete Slab over front vault	200mm thick		4.8	1.5
Public Highway				10
Garden live load				2.5

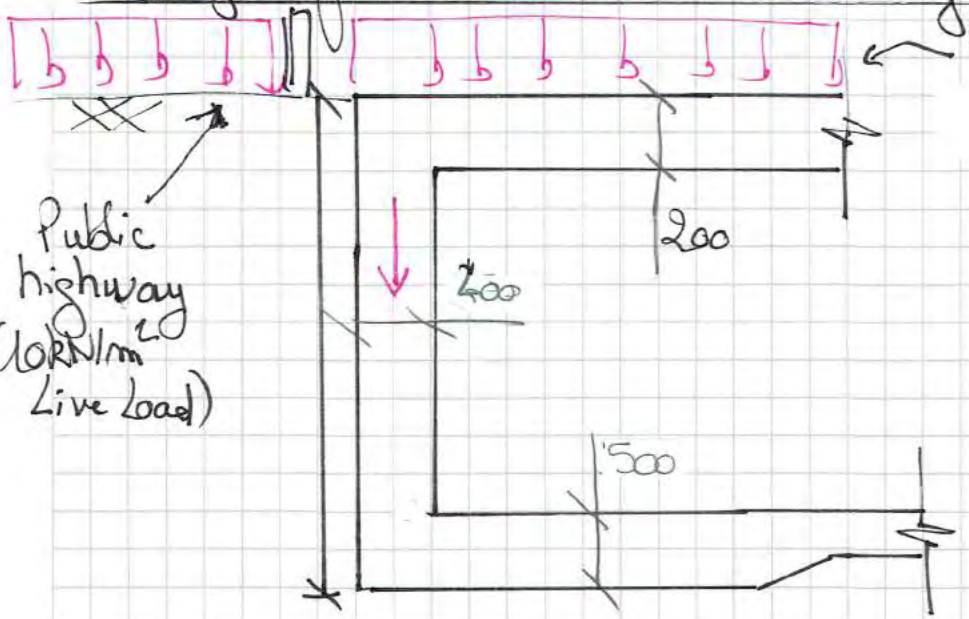
Symmetrys Limited
Consulting Structural Engineers

W: www.symmetrys.com
E: info@symmetrys.com

Job No.	Sheet No.	Revision
2016044	04	

Job Title	Date	Made By	Checked By
47 Albert Square			
Section Planning Application – Struct calculations	08/16	CC	

Design of the front vault retaining wall (RC)



Ground Condition : London Clay : 120 kN/m² (from SI Report)
Water level : −1m bgl

Symmetrys Limited
Consulting Structural Engineers

W: www.symmetrys.com
E: info@symmetrys.com

Job No.	Sheet No.	Revision
2016044	05	

Job Title	Date	Made By	Checked By
47 Albert Square			
Section Planning App - Structural calculations	08/16	CC	

- **Dead Loads on Retaining Wall Front vault**
  - Slab 0.2m thick x 24 kN/m² x 1.85m
- **Live load**
  - 1.5kN/m² : Residential

(kN/m²)

DL	IL
g	
	1.5
g	1.5

→ See Tedds Calculation For design

- **Dead load on Slab**
  - Ground + Finishes
- **Live load**
  - 1.5kN/m²

(kN/m²)

DL	IL
0.4	
	1.5

→ See Tedds Calculations (p6-)

Temporary Works

Prop Force (From Tedds calculations) = 30.0 kN/m

Ultimate = 1.6 x 30.0 = 48 kN/m

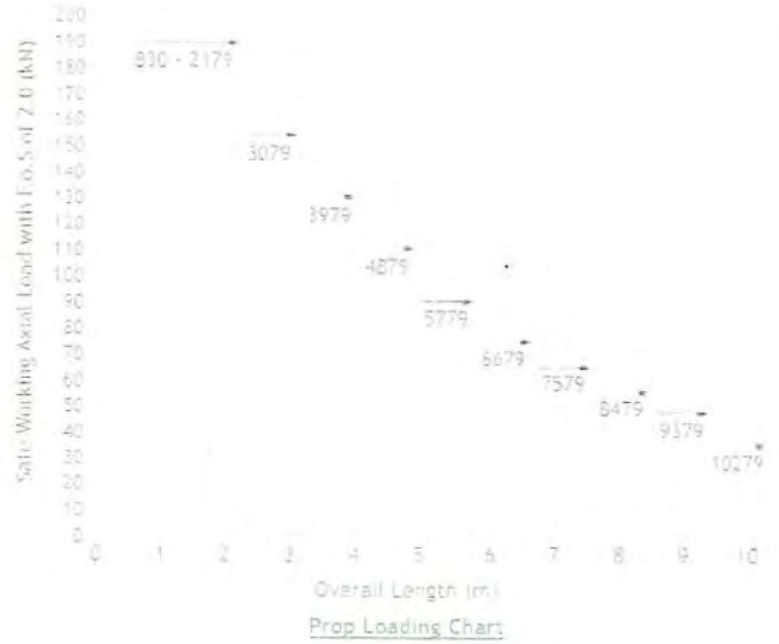
Provide S3/10 Mayhey props = 140kN (FoS = 2.0)

$F = 140kN / 1.5 = 93.3kN > 48\ kN$ → OK

2 centres

↳ Provide props at 1.5 m centres

push pull props - lengths and capacities



Prop Loading Chart

Head of prop will comprise S3/10 or S310A used viz:
S3/10 Use A - To prop Mk3 soldiers
S3/10A Use B - To prop vertical members other than soldiers
S3/10A Use C - To prop Mk2 soldiers

For general use a Factor of Safety of 2 is recommended. However, for controlled situations where the loading is predictable a Factor of Safety of 1.7 may be used.

The safe working loads shown in the table are for props used in compression either vertically or horizontally. In horizontal applications, the props should always be used with the soldier webs/lightening holes in the vertical plane.

When used in tension the safe working load should not exceed 120kN.

Mabey tubular props are an alternative to Mk3 Soldiers for any of the applications shown. Tubular props and soldiers should not be combined in any single prop.

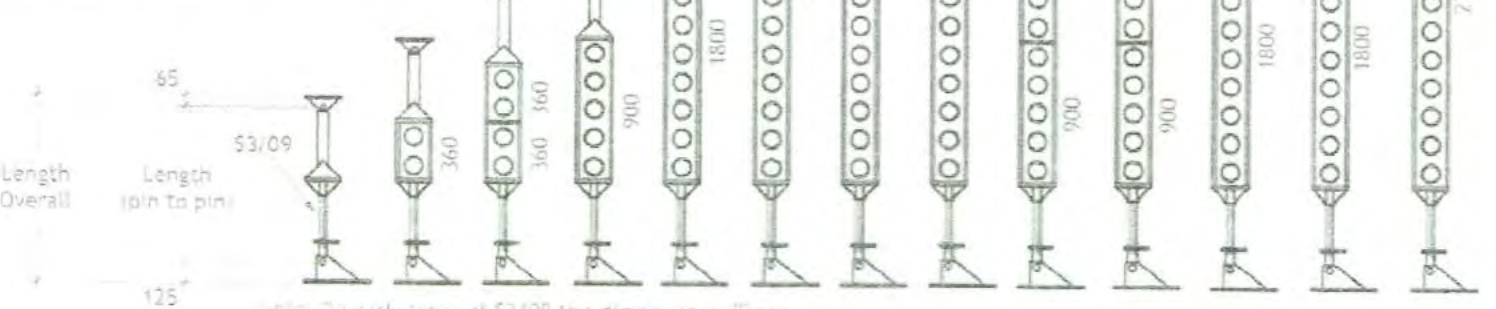
For props a recommended straightness tolerance is given below, indicated by Max Offset Dim (mm). Should the prop fall outside the range shown, the components should be checked for local damage to end plates.

All bolted joints require 6 No. S3/22 bolts.

Intermediate lengths may be obtained by adding 1 or 2 360mm Units (S3/1-360 or S3/24), or in some cases screw jacks can be fixed at each end.

Allowance to be made for elastic shortening of Push Pull Prop = 0.05mm/tonne/metre.

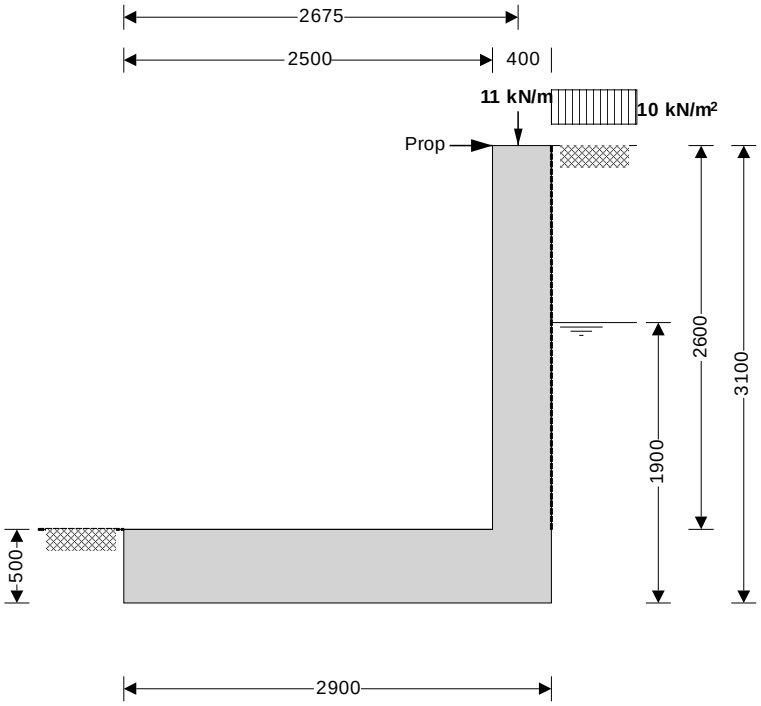
A kit assembly reference is given to assist in ordering the props. The kit includes all parts and bolts necessary depending upon the manner in which the prop is used. The kit assembly reference number must be followed by the A, B or C suffix i.e. a Type 9 Prop to support Mk2 soldiers would be called off as S3/KP/9C.



PROP	1	2	3	4	5	6	7	8	9	10	11	12	13
KIT ASSEMBLY REF	S3/KP/1	S3/KP/2	S3/KP/3	S3/KP/4	S3/KP/5	S3/KP/6	S3/KP/7	S3/KP/8	S3/KP/9	S3/KP/10	S3/KP/11	S3/KP/12	S3/KP/13
MAX LENGTH Overall (mm)	1279	1639	1999	2179	3079	3979	4879	5779	6679	7579	8479	9379	10279
MIN LENGTH Overall (mm)	830	1190	1550	1730	2630	3530	4430	5330	6230	7130	8030	8930	9830
WEIGHT (kg)	50	69	87	75	90	113	132	151	182	201	212	231	257
LOAD CAPACITY (FOS 2.0) (kN)	200	200	200	200	170	140	120	100	80	70	60	50	45
LOAD CAPACITY (FOS 1.7) (kN)	200	200	200	200	200	165	140	118	94	82	70	59	53
MAX OFFSET DIM (mm)	2.0	3.0	3.5	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

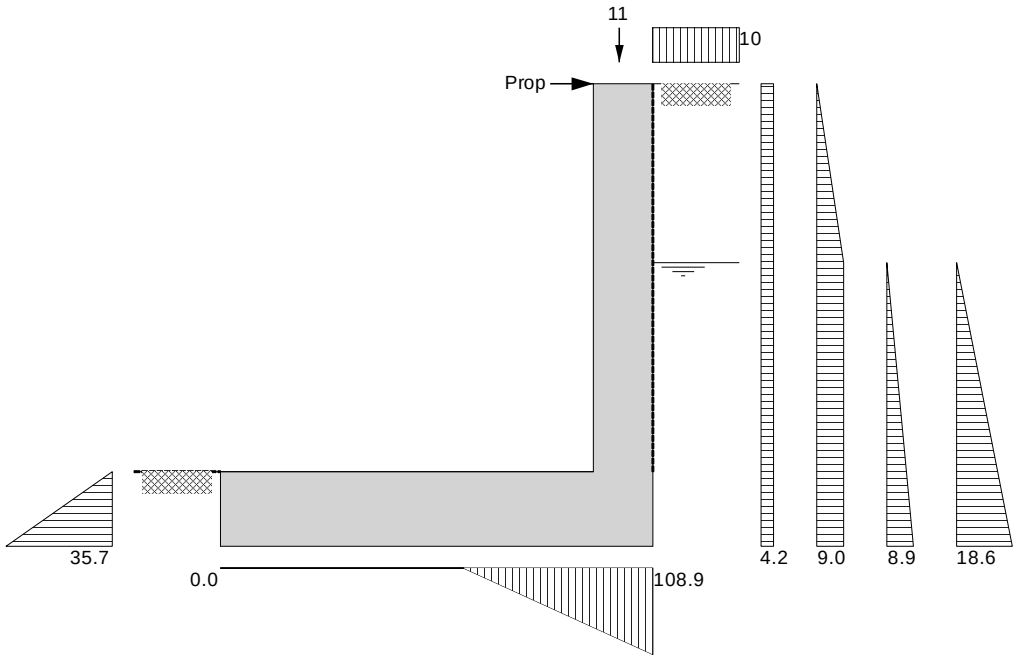
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2600** mm	Wall stem thickness	t_{wall} = **400** mm
Length of toe	l_{toe} = **2500** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **2900** mm	Base thickness	t_{base} = **500** mm
Height of retaining wall	h_{wall} = **3100** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **500** mm
Position of downstand	l_{ds} = **900** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **1900** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **3100** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **120** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **10.0** kN/m^2		
Vertical dead load	W_{dead} = **9.0** kN/m	Vertical live load	W_{live} = **1.5** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **2675** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **30.0** kN/m

Check bearing pressure

Total vertical reaction	R = **69.3** kN/m	Distance to reaction	x_{bar} = **2476** mm
Eccentricity of reaction	e = **1026** mm		

Reaction acts outside middle third of base

Bearing pressure at toe	p_{toe} = **0.0** kN/m^2	Bearing pressure at heel	p_{heel} = **108.9** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **30.0** kN/m

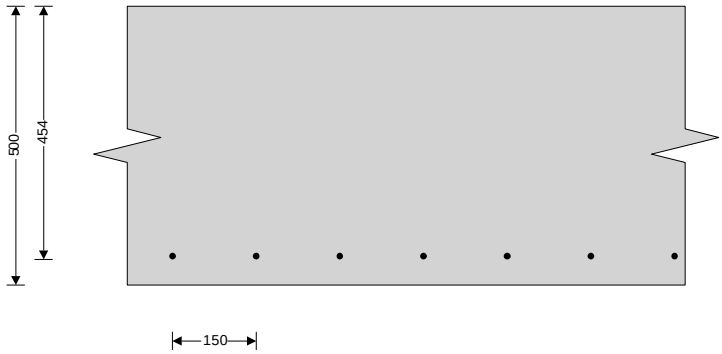
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **40** mm



Design of retaining wall toe

Shear at heel V_{toe} = **41.3** kN/m Moment at heel M_{toe} = **60.2** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_toe\_req}$ = **650.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.091** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.406** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

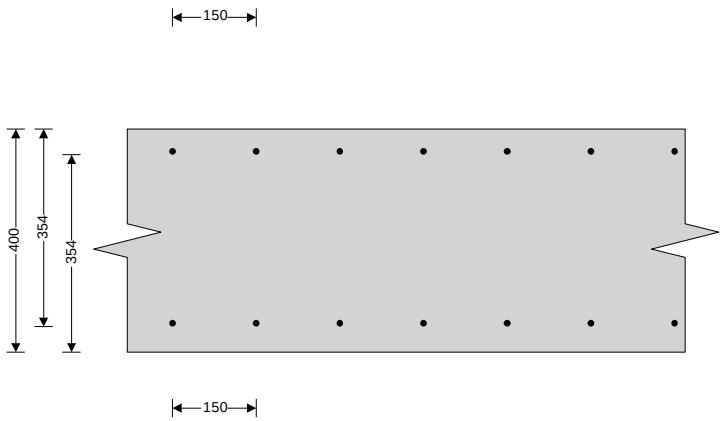
Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **40** mm Cover in wall c_{wall} = **40** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **61.9** kN/m Moment at base of stem M_{stem} = **30.6** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_stem\_req}$ = **520.0** mm²/m Area provided $A_{s\_stem\_prov}$ = **754** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.175** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.455** N/mm²

v_{stem} < v_{c_stem} - No shear reinforcement required

Design of retaining wall at mid height

Moment at mid height M_{wall} = **15.7** kNm/m

Compression reinforcement is not required

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_wall\_req}$ = **520.0** mm²/m Area provided $A_{s\_wall\_prov}$ = **754** mm²/m

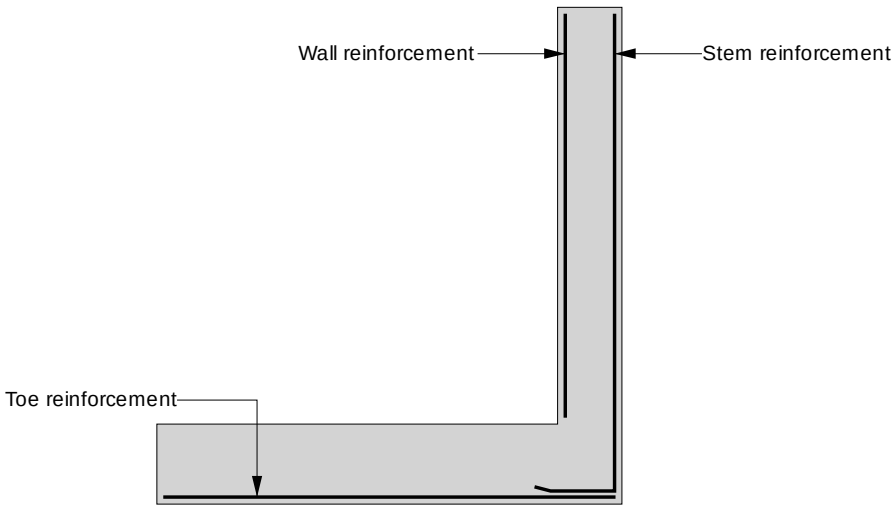
PASS - Reinforcement provided to the retaining wall at mid height is adequate

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **40.00** Actual span/depth ratio $ratio_{act}$ = **7.34**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Wall bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)
Stem bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

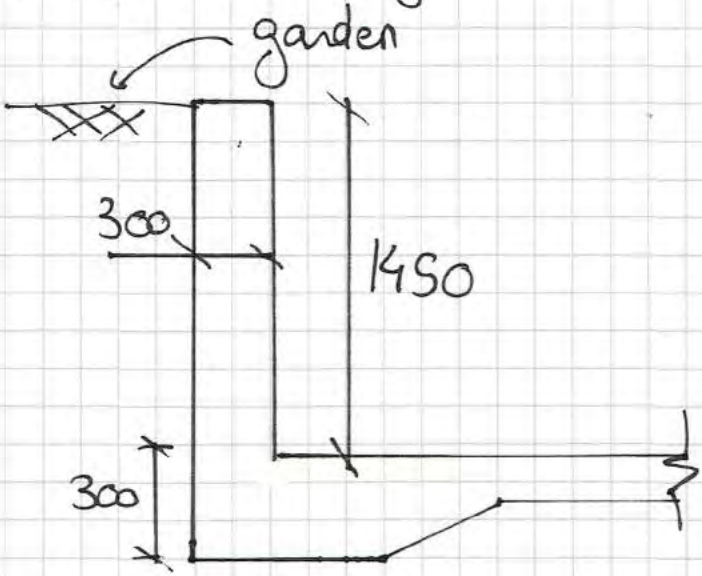
Symmetrys Limited
Consulting Structural Engineers

W: www.symmetrys.com
E: info@symmetrys.com

Job No.	Sheet No.	Revision
2016044	12	

Job Title	47 Albert Street	Date	Made By	Checked By
Section	Planning App - Structural calculations	08/16	CC	

Design of the retaining wall at the rear garden



Ground Water 1m bgl

- **Dead Load**

  No specific charge on retaining wall
  - handrail 0.3kN/m

- **Live Load**

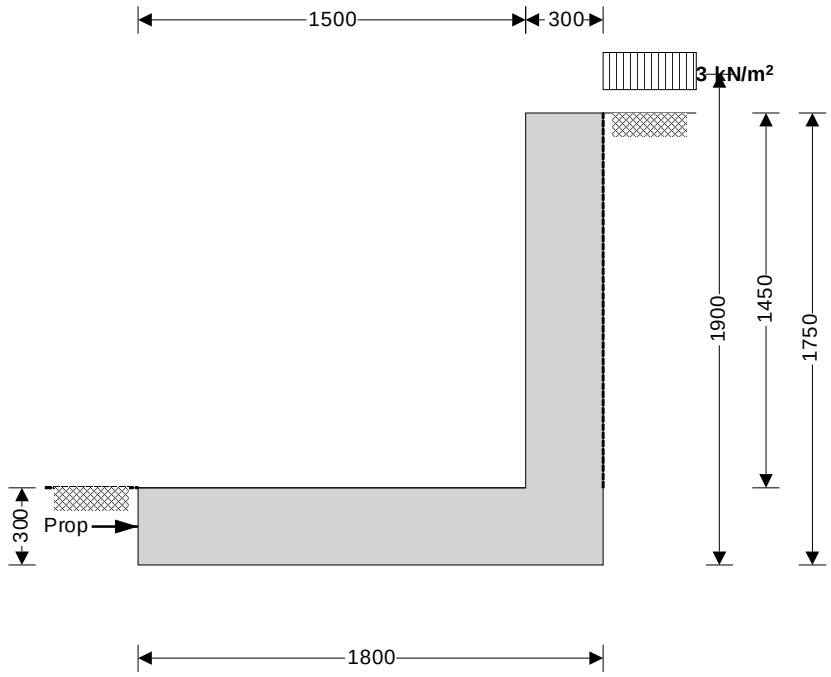
  Garden Load 2.5kN/m²

  → See Tedds calculation.

  Temporary works: $F_{prop} \leq F_{prop}$ front wall
  17.1kN/m ↳ Same Temp. Works.

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

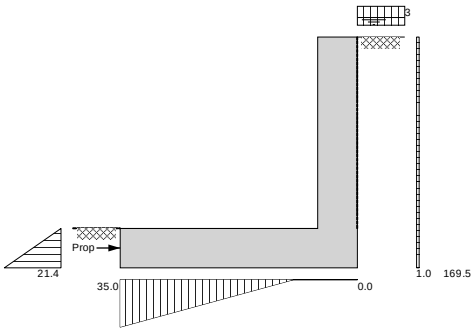
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **1450** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1800** mm	Base thickness	t_{base} = **300** mm
Height of retaining wall	h_{wall} = **1750** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **900** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **1900** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **1750** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **120** kN/m^2

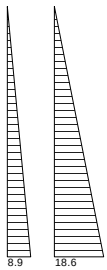
Using Coulomb theory

Active pressure	K_a =**0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **2.5** kN/m^2		
Vertical dead load	W_{dead} = **0.0** kN/m	Vertical live load	W_{live} = **0.0** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **0** mm	Height of horizontal load	h_{load} = **0** mm





Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **17.1** kN/m

Check bearing pressure

Total vertical reaction	R = **23.0** kN/m	Distance to reaction	x_{bar} = **438** mm
Eccentricity of reaction	e = **462** mm		

Reaction acts outside middle third of base

Bearing pressure at toe	p_{toe} = **35.0** kN/m^2	Bearing pressure at heel	p_{heel} = **0.0** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **17.1** kN/m

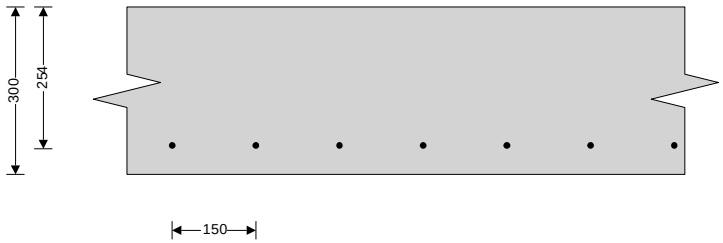
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **40** mm



Design of retaining wall toe

Shear at heel V_{toe} = **17.3** kN/m Moment at heel M_{toe} = **30.1** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_toe\_req}$ = **390.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.068** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.552** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

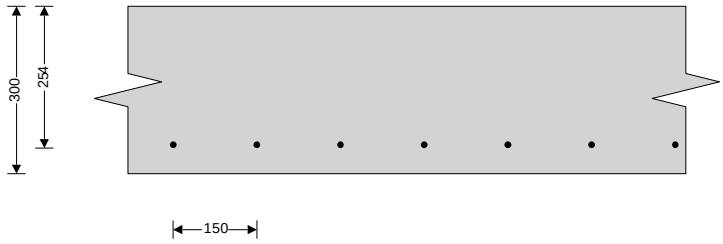
Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **40** mm Cover in wall c_{wall} = **40** mm

Symmetrys Limited Consulting Structural Engineers	Project 47 Albert Street				Job no. 2016044	
Symmetrys Limited Unit 6, The Courtyard Lynton Road N8 8SL London	Calcs for Retaining wall rear garden				Start page no./Revision 10	
	Calcs by C.C	Calcs date 22/08/2016	Checked by D.B	Checked date	Approved by D.B	Approved date



Design of retaining wall stem

Shear at base of stem V_{stem} = **2.6** kN/m Moment at base of stem M_{stem} = **19.0** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_stem\_req}$ = **390.0** mm^2/m Area provided $A_{s\_stem\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.010** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.552** N/mm^2

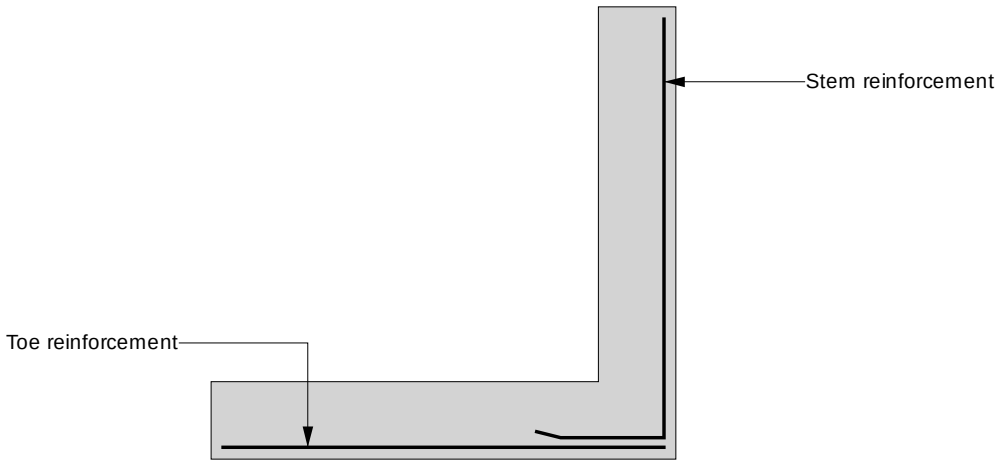
v_{stem} < v_{c_stem} - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **14.00** Actual span/depth ratio $ratio_{act}$ = **5.71**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

Stem bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

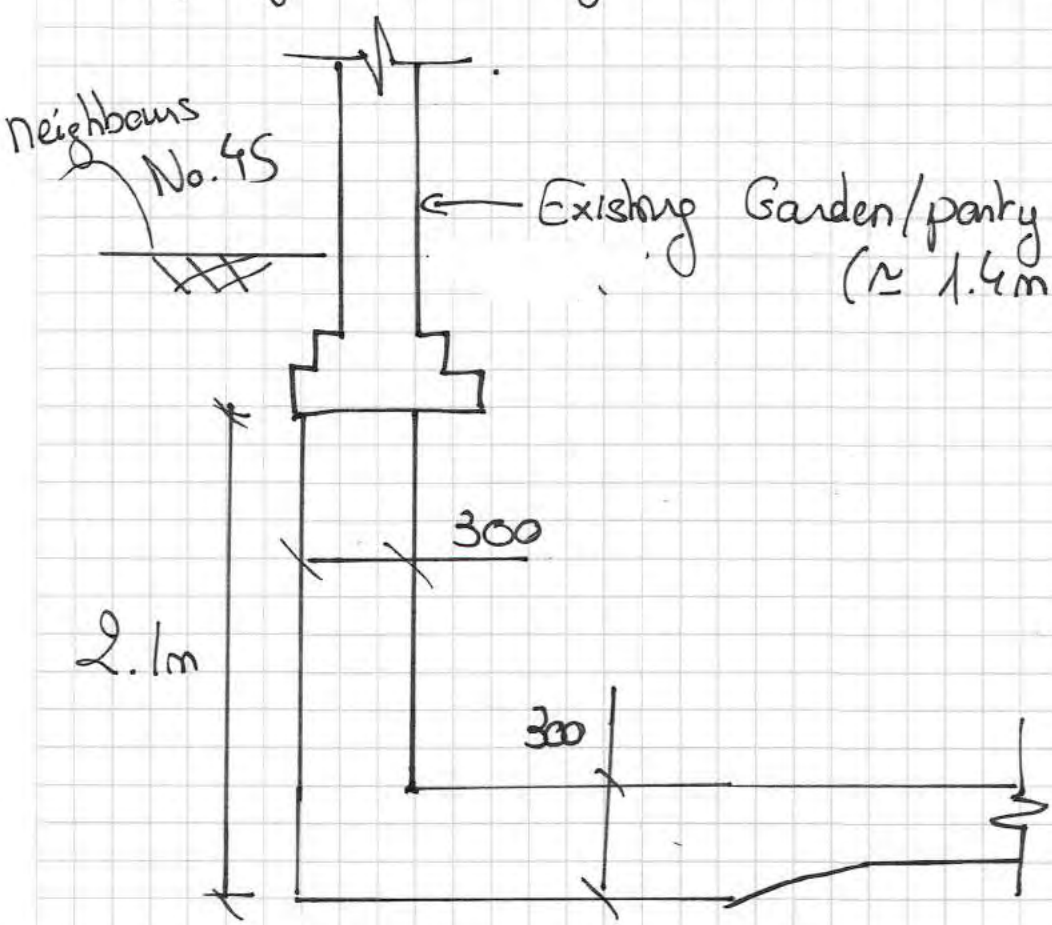
Symmetrys Limited
Consulting Structural Engineers

W: www.symmetrys.com
E: info@symmetrys.com

Job No.	Sheet No.	Revision
2016044	18	

Job Title	Date	Made By	Checked By
47 Albert Street			
Section Planning App - Structural calculations	08/16	CC	

1 Design of the retaining wall below party wall / Garden wall.



Dead Load

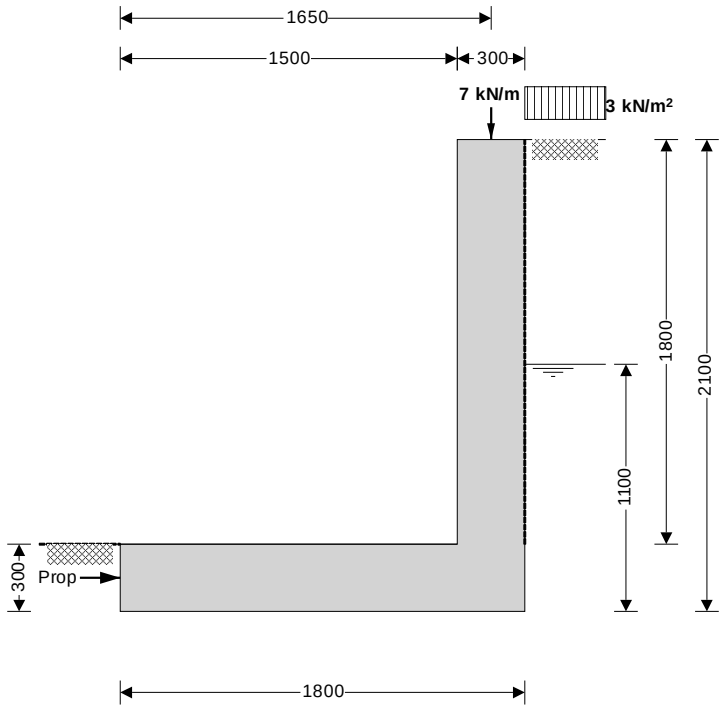
- brickwork : 1.6m × 4.44kN/m² = 7.1 kN

Live Load:

- Garden Load 2.5kN/m²
  → See Tedds calculations

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

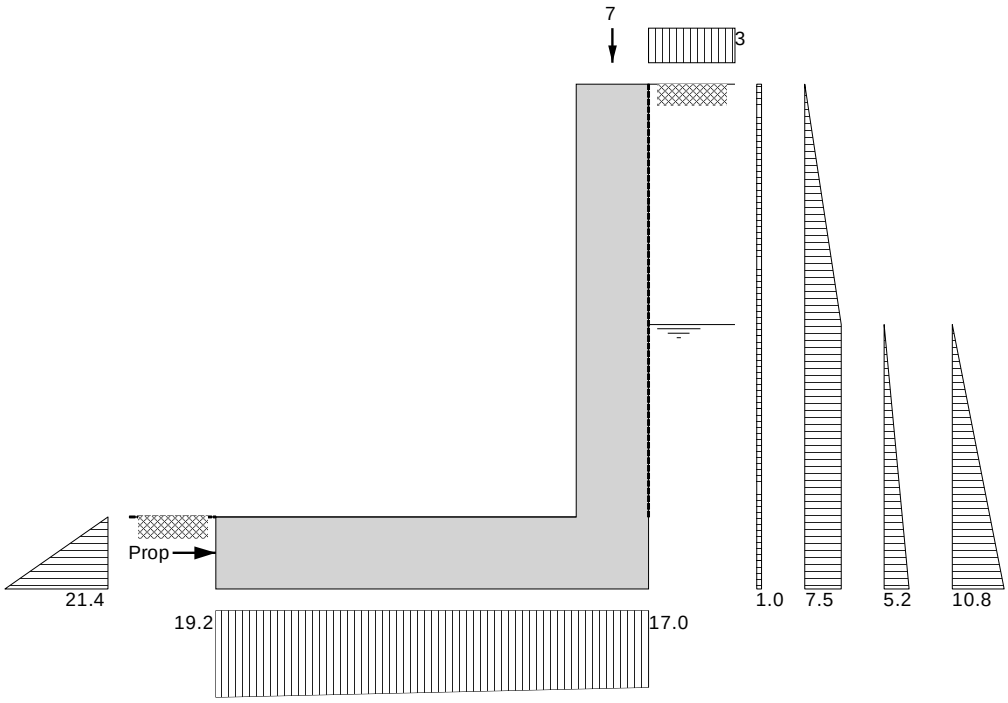
Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **1800** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **0** mm
Overall length of base	l_{base} = **1800** mm	Base thickness	t_{base} = **300** mm
Height of retaining wall	h_{wall} = **2100** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **900** mm		
Depth of cover in front of wall	d_{cover} = **0** mm	Unplanned excavation depth	d_{exc} = **0** mm
Height of ground water	h_{water} = **1100** mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = **23.6** kN/m^3	Density of base construction	γ_{base} = **23.6** kN/m^3
Angle of soil surface	β = **0.0** deg	Effective height at back of wall	h_{eff} = **2100** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **120** kN/m^2

Using Coulomb theory

Active pressure	K_a = **0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **2.5** kN/m^2		
Vertical dead load	W_{dead} = **7.1** kN/m	Vertical live load	W_{live} = **0.0** kN/m
Horizontal dead load	F_{dead} = **0.0** kN/m	Horizontal live load	F_{live} = **0.0** kN/m
Position of vertical load	l_{load} = **1650** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force

Propping force F_{prop} = **8.8** kN/m

Check bearing pressure

Total vertical reaction	R = **32.6** kN/m	Distance to reaction	x_{bar} = **882** mm
Eccentricity of reaction	e = **18** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **19.2** kN/m^2	Bearing pressure at heel	p_{heel} = **17.0** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor γ_{f_d} = **1.4** Live load factor γ_{f_l} = **1.6**

Earth pressure factor γ_{f_e} = **1.4**

Calculate propping force

Propping force F_{prop} = **8.8** kN/m

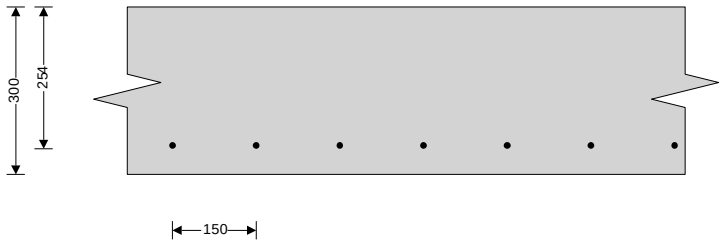
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Base details

Minimum reinforcement k = **0.13** % Cover in toe c_{toe} = **40** mm



Design of retaining wall toe

Shear at heel V_{toe} = **27.4** kN/m Moment at heel M_{toe} = **29.9** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_toe\_req}$ = **390.0** mm^2/m Area provided $A_{s\_toe\_prov}$ = **754** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.108** N/mm^2 Allowable shear stress v_{adm} = **5.000** N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.552** N/mm^2

v_{toe} < v_{c_toe} - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

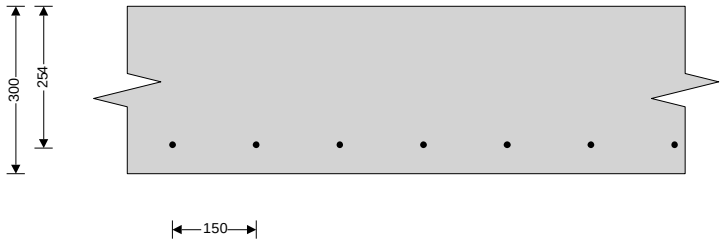
Strength of concrete f_{cu} = **40** N/mm^2 Strength of reinforcement f_y = **500** N/mm^2

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **40** mm Cover in wall c_{wall} = **40** mm

Symmetrys Limited Consulting Structural Engineers	Project 47 Albert Street				Job no. 2016044	
Symmetrys Limited Unit 6, The Courtyard Lynton Road N8 8SL London	Calcs for Retaining wall under garden wall				Start page no./Revision 22	
	Calcs by C.C	Calcs date 19/08/2016	Checked by D.B	Checked date	Approved by D.B	Approved date



Design of retaining wall stem

Shear at base of stem V_{stem} = **8.1** kN/m Moment at base of stem M_{stem} = **20.7** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_stem\_req}$ = **390.0** mm²/m Area provided $A_{s\_stem\_prov}$ = **754** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.032** N/mm² Allowable shear stress v_{adm} = **5.000** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.552** N/mm²

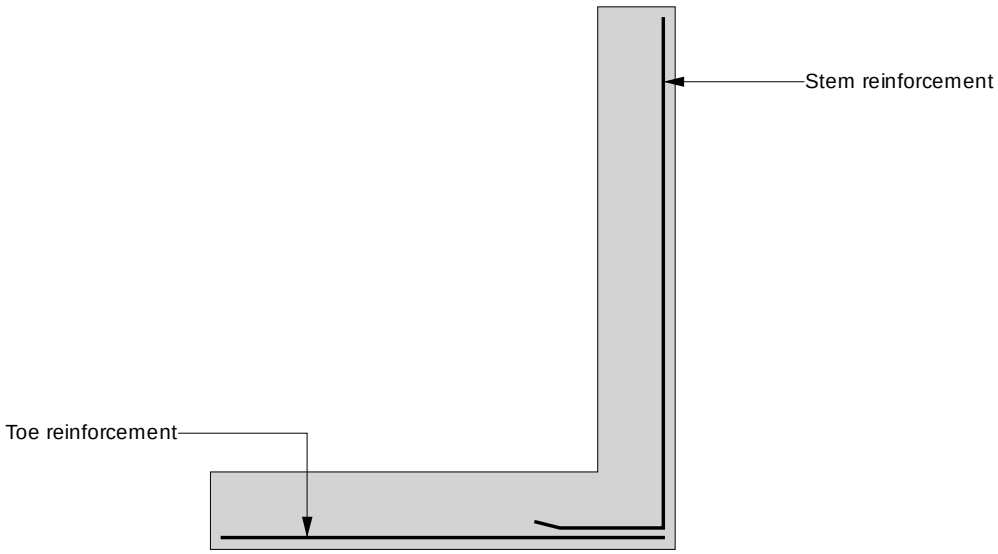
v_{stem} < v_{c_stem} - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max}$ = **14.00** Actual span/depth ratio $ratio_{act}$ = **7.09**

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

Stem bars - 12 mm dia.@ 150 mm centres - (754 mm^2/m)

APPENDIX C: GROUND INVESTIGATION AND BASEMENT IMPACT ASSESSMENT – LMB GEOSOLUTIONS LTD

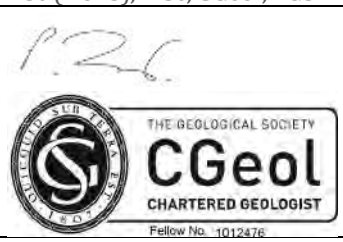
LMB GEOSOLUTIONS LTD

GROUND INVESTIGATION & ASSESSMENT

47 ALBERT STREET, LONDON NW1

August 2016

DOCUMENT RECORD

Document Title	Ground Investigation & Assessment
Site	47 Albert Street, London NW1 7LX
Document Date	17th August 2016
Document Version	Issue 1
Document Authorisation	Philip Lewis BSc (Hons), MSc, CGeol, FGS
	

Company No. 8303397
LMB Home

TABLE OF CONTENTS

Contents

Executive Summary ____ 0
Introduction ____ 1
Ground Investigation & Findings ____ 3
Geotechnical Advice ____ 6
REFERENCES & GUIDANCE ____ 10

FIGURES ____
Appendices ____

EXECUTIVE SUMMARY

Executive Summary

Site Details	47 Albert Street, London NW1 7LX
Proposed Development	The development proposals include extension of the existing lower ground floor.
Ground & Groundwater Conditions	Made Ground overlying the London Clay Formation. Groundwater was not encountered during the drilling or during the subsequent monitoring visit.
Geotechnical Advice	For traditional spread foundations placed within the London Clay Formation at the assumed formation level (approx. 3.0m below ground level) a net safe bearing pressure of 85kN/m^2 should be available. Should formation level be extended to 4.0m bgl a net safe bearing pressure of 120kN/m^2 should be available. It is recommended that the undrained shear strength of soils at formation level be confirmed using a hand shear vane and should exceed 40kN/m^2 at 3.0m and 50kN/m^2 at 4.0m. The above advice assumes that the proposed basement development and in particular foundations would not be within the influence of any trees or tree routes. Retaining walls constructed in open cut would be the preferred solution, but given the size of the excavation and the adjacent and nearby residential structures it is considered likely that temporary support (sheet piles or similar) will be needed for construction. Coefficient of active earth pressure: Made Ground: 0.35. London Clay Formation: 0.42. Coefficient of passive earth resistance: Made Ground: 3.0. London Clay Formation: 2.5. Buried concrete: Made Ground: DS-1, AC-1s. London Clay Formation: DS-1, AC-1s.
This executive summary is not a stand alone document and should be read in conjunction with the full report text, including conclusions and recommendations.	

INTRODUCTION

Introduction

AUTHORISATION

LMB Geosolutions Ltd (LMB) was instructed Symmetrys Ltd (Consultant Engineers) on behalf of Mr Neil and Mrs Angela Moran (the Client) in July 2016 to undertake ground investigation and assessment works in relation to the proposed development at 47 Albert Street, London NW1 7LX (the Site).

project and site details

Site Address	47 Albert Street, London NW1 7LX. A Site Location Plan is provided as **Figure 1**.
Proposed Development	The site comprises a two storey residential mews property. It is understood that the Client wishes to construct an extension to the existing lower ground floor of the property.
Background	The scope of works and requirements of this report were based on the information provided by the Consultant Engineers within the following documents: • Email specification from Camille Corvec to Philip Lewis (21st June 2016); • Site Investigation Plan (attached with above email); & • Revised Site Investigation Plan and photos following site visit by representative of Consultant Engineers.

AIMS & OBJECTIVES

This report aims to provide information sufficient to meet the requirements of the specification provided by the Consultant Engineers.

SCOPE OF WORKS

The following scope of works has been completed:

- Site set up including liaison with Consultant Engineers, Client and appointment of sub-contractors;
- Mobilisation to site and transport of the rig to the proposed location;
- Completion of 1No. dynamic (windowless) sampler borehole to a depth of 8.35m bgl (or refusal) with insitu SPTs and collection of disturbed samples for laboratory testing;
- Completion of 4no. hand excavated trial pits to a maximum depth of 0.66m bgl to inspect and log the existing building foundations;
- Supervision and geological logging of the soil arisings in accordance with BS5930 by an appropriately experienced geo-environmental engineer;

INTRODUCTION

- Installation of a monitoring well to a maximum depth of 6.0m below ground level and return monitoring of groundwater levels on 1no. occasion;
- Geotechnical laboratory testing of the soil samples for an appropriate suite of determinands (including pH, sulphate, atterberg limits, and moisture content);
- Chemical analysis of 1no. sample of Made Ground, including Waste Acceptance Criteria (WAC);
- Completion of a factual and interpretive report that includes;
  - Details of the ground and groundwater conditions encountered;
  - Schematic sections detailing the existing ground floor slabs and foundations;
  - Presentation of chemical analytical results;
  - Geotechnical laboratory testing and provision of advice on the material properties of the shallow soil horizon including parameters to aid in retaining wall design and foundation options; &
  - Conclusions and recommendations.

LIMITATIONS

LMB has prepared this report solely for the use of the named Client and those parties with whom a warranty agreement and/or assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from LMB and the Client.

LMB accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) issue of this document to any third party with whom an agreement has not been executed.

The risk assessment and opinions provided, among other things, take in to consideration currently available guidance and best available techniques relating to acceptable contamination concentrations and interpretation of these values. No liability can be accepted for the retrospective effects of any future changes or amendments to these value.

Ground Investigation & Findings

INTRODUCTION

The ground investigation works were undertaken on 18th July 2016 and comprised the progression of a dynamic (windowless) sampler borehole to 8.35m bgl and excavation of 4no. hand excavated trial pits with sampling of soil for laboratory testing (see **Figure 2**).

Groundwater monitoring was undertaken following completion of the fieldworks on 28th July 2016.

Details of the ground investigation completed, along with the findings of the investigation, are provided in the following sections. The exploratory hole logs and laboratory results are presented in **Appendix A, B** and **C** respectively.

Guidance Documents

Details of the best practice guidance documents and reference information used in undertaking the ground investigation and assessment are provided at the end of this report (see REFERENCES & GUIDANCE).

INVESTIGATION STRATEGY

The ground investigation was designed based on the requirements of the Consultant Engineers communicated via email and drawings.

Soil Chemical Analysis & Laboratory Testing

Soil samples were submitted to the UKAS and MCERTS accredited laboratories of i2 Analytical for chemical analysis and geotechnical testing.

The results of the chemical analysis (including waste acceptance criteria testing) are presented in **Appendix C**.

GROUND & GROUNDWATER CONDITIONS

Ground Conditions

The table below provides a summary of ground conditions encountered with full descriptions provided in the associated exploratory hole logs provided in **Appendix A**:

GROUND INVESTIGATION & FINDINGS

Strata	Depth Range to Top (m bgl)	Depth Range to (Base (m bgl)	Summary Description
Made Ground	Ground Level	0.45 – 1.70	In the trial pit locations, the ground surface was generally found to comprise concrete. In BH1 (front garden) the ground surface comprised floor pavers over concrete screed. The Made Ground soils were generally found to comprise locally gravelly and sandy clay with varying proportions of brick and concrete.
London Clay Formation	0.45 – 1.70	8.35(1)	The London Clay was found to comprise an upper sequence (c.0.5m) of soft clay overlying firm becoming stiff very closely fissured clay.

(1) Base of the London Clay was not determined.

Visual and Olfactory Observations

No visual or olfactory evidence of contamination was observed during the ground investigation works. However, Made Ground soils were encountered in all exploratory hole locations and can be indicative of the presence of contaminants.

Groundwater Conditions

No groundwater strikes were recorded during the ground investigation works.

During the return monitoring visit completed on 29th July 2016 no groundwater was recorded to the base of the monitoring well at 6.00m bgl.

Existing Foundations

Hand excavated trial pits were completed at one internal location and three external locations and suggest that the existing structure is supported on traditional shallow footings.

Sections, photographs and descriptions of the observations described above are provided in **Appendix A**.

Characteristic Values of Soil Parameters

A summary of the geotechnical properties of the strata based on the field and laboratory testing is provided in the table below.

GROUND INVESTIGATION & FINDINGS

Soil Property	**Stratum**	
	Made Ground	London Clay
SPT 'N' Value	6	9 – 39
Bulk Density (mg/m^3)	1.70(2)	1.83 – 2.35 (1)
Moisture Content (%)	18 – 31	29 – 32
Plasticity Index (%)	-	45 – 47
pH	8.1 – 8.3	8.3
Sulphate (g/l)	0.026	0.13

(1) Literature values taken from Forster (1997)
(2) Value based on BS8002

A plot of SPT 'N' value against depth is provided in **Appendix D.**

The plot indicates that there is a fairly uniform correlation between depth and relative density (SPT N Value).

Geotechnical Advice

INTRODUCTION

It is understood that the proposed development will comprise an extension to the existing lower ground floor of the property.

On this basis it the following assumptions have been made:

- The formation level for the floor of the extension will be at approximately 3.0m bgl;
- The load from the existing four storey structure will be in the region of 40-60KN/m^2 which is not anticipated to significantly alter following the extension. No additional loads are envisaged;
- For a four storey structure (including the roof) the existing wall load is estimated at approximately 80-100kN/m run, which is not anticipated to significantly alter following basement deepening and extension.
- There will be no significant changes in elevation over the proposed basement development.
- Foundations will not be eccentrically loaded.

GROUND CONDITIONS SUMMARY AND ENGINEERING PARAMETERS

The ground conditions encountered in the exploratory holes are broadly consistent with the geological sequence as described in the BGS Geological Map (Sheet 256, North London) and comprise Made Ground soil overlying the London Clay Formation.

No groundwater was encountered during the drilling or during the subsequent monitoring visit.

FOUNDATION SOLUTIONS

Spread Foundations

Based on the findings of the ground investigation and the subsequent laboratory testing it has been concluded that for traditional spread foundations (placed on the competent firm London Clay) at the assumed formation level of 3.0m bgl a net safe bearing pressure of 85kN/m^2 should be available.

It is recommended that the undrained shear strength of soils at formation level be confirmed using a hand shear vane and should exceed 40kN/m^2.

Should formation level be extended to 4.0m bgl a net safe bearing pressure of 120kN/m^2 should be available. In this case, it is recommended that the undrained shear strength of soils at formation level be confirmed using a hand shear vane and should exceed 50kN/m^2.

The bearing pressure is based on a factor of safety of 3 to ensure that settlement remains within normally acceptable limits.

The above advice assumes that the proposed basement development and in particular foundations would not be within the influence of any trees or tree routes.

Piled Foundations

Based on the proposed development and the ground conditions encountered it is considered unlikely that a piled foundation would be the most feasible solution. However, it is possible that sheet piling may be considered as part of the temporary works.

GROUND STABILITY & RETAINING STRUCTURES

Retaining walls constructed in open cut would be the preferred solution, but given the size of the excavation and the adjacent and nearby residential structures it is considered likely that temporary support (sheet piles or similar) will be needed for construction.

Although no groundwater was encountered over the anticipated excavation depth (3.0m bgl), the stability of unsupported excavations at the site should not be relied upon. Zones loosened by the removal of existing and relict construction may be particularly unpredictable and liable to collapse.

It may be beneficial to install the retaining wall and floor slab sequentially to provide propping and lateral restraint, which could help to minimise deflections. It is likely that this will need to be given particular consideration beneath the party walls of the adjoining property (no. 45).

Safe working conditions should be ensured where persons are required to work in excavations. It is recommended that reference be made to CIRIA Report No. 97,"Trenching Practice" 1992.

The parameters presented in the table below may be considered within the design of the retaining walls for the extension:

Strata	Depth Range (m bgl)		Angle of Shearing Resistance(2)	Coefficient of Active Earth Pressure (Ka) (2)	Coefficient of Passive Earth Resistance (Kp) (2)	Bulk Density(1)
	Top	Base				
Made Ground	Ground Level	0.45 – 1.70	27	0.35	3.0	1.70
London Clay Formation	0.45 – 1.70	8.35	21	0.42	2.5	1.83 – 2.35(3)

(1) Values based on BS8002
(2) Based on soil properties and reference to BS8002 & Tomlinson, M.J. (1986)
(3) Literature values taken from Forster (1997)

GEOTECHNICAL ADVICE

BURIED CONCRETE

The laboratory testing results summarised in the Ground Investigation & Findings section and presented in **Appendix B** and **C** have been reviewed in accordance with BRE Special Digest 1 (2005).

The results indicate that the design sulphate class and corresponding Aggressive Chemical Environment for Concrete (ACEC) class (mobile groundwater conditions) are as follows:

- Made Ground: DS1 & AC-1s.
- London Clay Formation: DS1 & AC-1s.

ADDITIONAL CONSIDERATIONS

Existing Structures

If feasible, it is recommended that any existing buried construction is broken out and removed. However, if buried construction (such as existing foundations) are to remain close to the new basement structure, then care should be taken to avoid interaction i.e. to prevent the slab 'breaking its back' over the existing construction.

Potential for Settlement & Inward Yielding

The removal of the overburden during the excavation of the basement is likely to result in some inward yielding of soils at formation level and possibly a subsequent settlement of the soils outside the excavation. In sandy soils the effects tend to be limited by their relatively low compressibility (as compared to soft clay soils). Inward yielding in firm to stiff clays is typically in the range of 5-40mm (Tomlinson, M.J. (1986).

The estimated depth of excavation is 4.0m below current ground level, assuming an unsaturated unit weight of 18-20kN/m^3, the estimated unload due to the excavation would be in the order of 60-80kN/m^2.

As the lower ground floor extension will be beneath the front garden area, there will be a difference in load at formation inside and outside that could result in differential settlement.

As outlined, groundwater was not encountered at the anticipated formation level of the basement. However, it would be prudent to adopt a conservative approach in relation to the basement design and account for groundwater at a depth of approximately 1m bgl.

Management of Formation Level

Should pockets of inferior material be present during the inspection of the foundation excavation, they should be removed and replaced with well graded, well compacted hardcore or lean mix concrete.

GEOTECHNICAL ADVICE

The excavated surface should be protected from deterioration and a blinding layer of concrete used where foundations are not completed without delay. Any surface or perched water should not be allowed to collect in the base of excavations.

Groundwater Management

Significant dewatering is not anticipated during the construction of these foundations but some groundwater seepages and/or surface water infiltration into the excavation should be anticipated. It is anticipated that any seepages or rates of inflow of groundwater would be slow and it is recommended that seepages be dealt with by pumping from sumps.

Potential Project Risk

It should be noted that the excavation of the basement may undermine adjacent/nearby properties and could lead to settlement and damage to buildings and below ground services. The principle contractor should allow for suitable mitigation measures that may include:

- A survey of existing ground levels and buildings;
- A survey of existing below ground services;
- Monitoring of adjacent buildings during construction; and
- Monitoring of adjacent ground levels during construction.

REFERENCES & GUIDANCE

1. RBKC (2004). Remediation Strategy.
2. Environment Agency/Defra (2002). Model procedures for the Management of Land Contamination (CLR 11)
3. Environment Agency/Defra.. Contaminated Land Statutory Guidance (April 2012)
4. BS 10175 (2011) Investigation of Potentially Contaminated Sites. Code of Practice.
5. BS5930 (2007) Code of Practice for Site Investigations.
6. BS 5667-11:2009. Water quality sampling. Part 11: Guidance on sampling of groundwaters.
7. BS 8002 (1994) Code of Practice for Earth Retaining Structures
8. Tomlinson, M.J. (1986) Foundation Design and Construction.
9. Department of the Environment Industry Profiles.
10. Environment Agency/Defra (2002). Sampling strategies for contaminated land (CLR4)1
11. Environment Agency/Defra (2002). Priority Contaminants for the Assessment of Land (CLR8)2
12. CIRIA (2007). Assessing risks posed by hazardous ground gases to buildings
13. BS 8485:2007. Code of Practice for the Characterisation and Remediation from Ground Gas in affected Development.
14. NHBC (2007). Guidance on the Evaluation of Development proposals on sites where Methane and Carbon dioxide are present.
15. CL:AIRE (December 2013). Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.
16. CL:AIRE / CIEH (2008), Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008;
17. CL:AIRE / EIC (2009), The Soil Generic Assessment Criteria for Human Health, December 2009.
18. Environment Agency (2003), Review of fate & transport of selected contaminants in the Environment, Report P5-079-TR1;
19. Environment Agency (2004), Model Procedures for the Management of Land Contamination, September 2004, ISBN: 1844322955;
20. Environment Agency (2008a), Compilation of Data for Priority Organic Pollutants, Report SC050021/SR7, November 2008;
21. Environment Agency (2009a), Human Health Toxicological Assessment of Contaminants in Soil, Report SC050021/SR2, January 2009;
22. Environment Agency (2009b), CLEA Software (Version 1.04) Handbook (and Software), Report SC050021/SR4, January 2009;

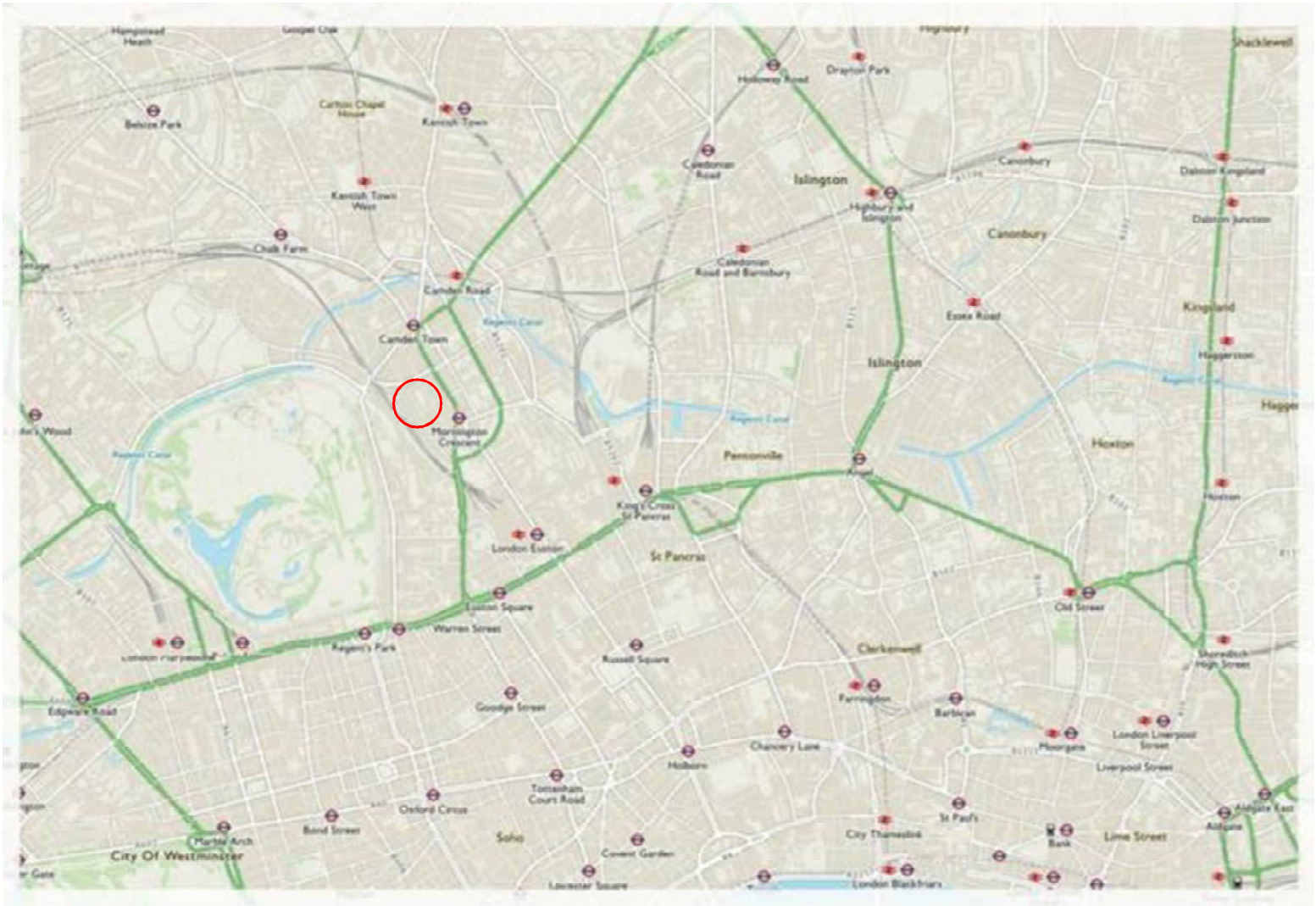
[1] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

[2] This document has been withdrawn but is considered to remain useful in proving technical background for designing ground investigation works.

REFERENCES & GUIDANCE

23. Environment Agency (2009c), Updated Technical Background to the CLEA Model, Report SC050021/SR3, January 2009;
24. Environment Agency (2009d), A Review of Body Weight and Height Data Used in the CLEA Model, Report SC050021/Final Technical Review 1, January 2009;
25. Nathanial et. al., (2009), The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition), Land Quality Press, Nottingham, ISBN 0-9547474-7-X
26. USEPA (2004), User's Guide for Evaluating Subsurface Vapour Intrusion into Buildings
27. Environment Agency (2013). Groundwater Protection: Principles and Practice (GP3)
28. Water Framework Directive (2000/60/EC)
29. Groundwater Regulations (2009).
30. Drinking Water Quality Standards England & Wales 2000 (Amended 2004, DWS).
31. World Health Organisation (WHO) Petroleum Products in Drinking Water.
32. Environmental Quality Standards (EQS). The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010.
33. Environment Agency (2006). Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination.
34. Environment Agency (2013). Technical Guidance WM2 (v3). Interpretation of the definition and classification of hazardous waste.

FIGURES



Key:

Approximate site location

IMPORTANT – Please Read

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.

LMB

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

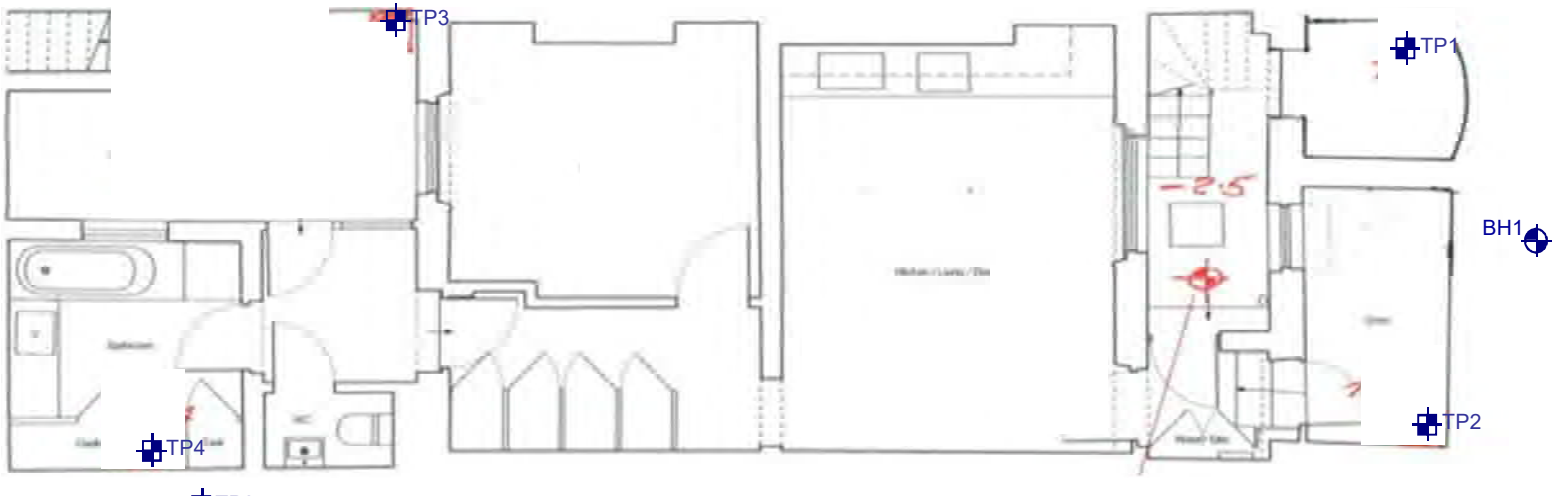
Site: 47 Albert Street, London NW1

Figure Number: Figure 1

Title: Site Location Plan

Project No:	Created By:	Date:
	PIL	August 2016

Client: Mr Neil & Mrs Angela Moran



Key:

BH Borehole location

TP Trial Pit location

IMPORTANT – Please Read

This drawing is for illustrative purposes only and is for use only in conjunction with associated reports relating to the project details below. LMB accepts no liability for the mis-interpretation or use of this illustration by any other parties.

LMB

Ground Investigation
Land Contamination
Hydrogeology
Engineering Geology

Site: 47 Albert Street, London NW1

Figure Number: Figure 2

Title: Exploratory Hole Location Plan

Project No:	Created By:	Date:
	PIL	August 2016

Client: Mr Neil & Mrs Angela Moran

APPENDICES

Appendices

APPENDIX A EXPLORATORY HOLE LOGS

Borehole Log

Borehole No. **BH1**

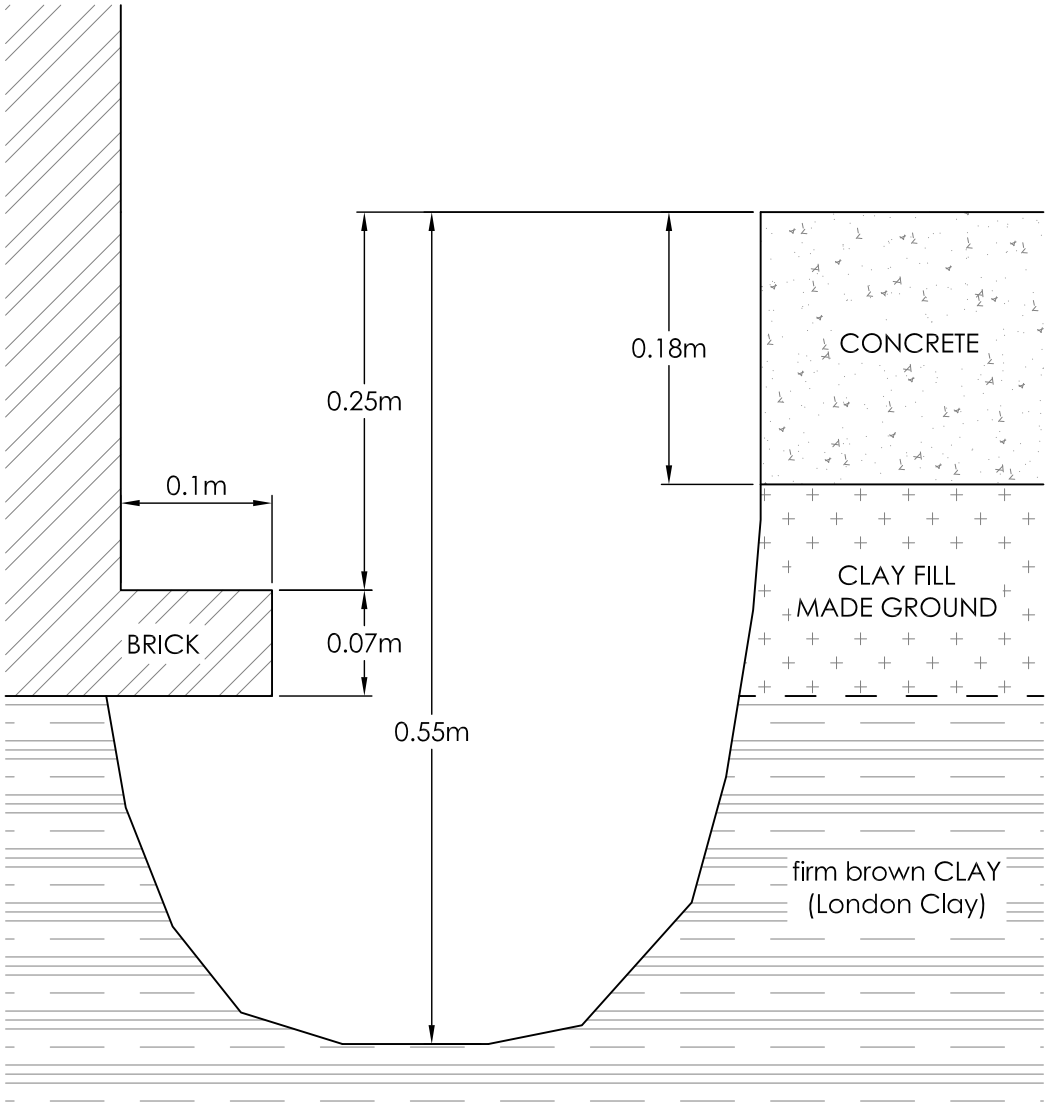
Sheet 1 of 1

Project Name: 47 Albert Street	Project No. LMB_Albert St	Co-ords: -	Hole Type WLS
Location: Camden, London		Level:	Scale 1:50
Client: Neil & Angela Moran		Dates: 18/07/2016 - 18/07/2016	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.04			FLoor pavers.
					0.10			Concrete.
					0.40			MADE GROUND: dark brown sandy clay with occasional to rare fine brick and fine to medium flint gravel.
		0.60	ES					MADE GROUND: soft brown clay with brick gravel and occasional cobbles.
		1.00		N=6 (0,1/1,1,2,2)				
		1.00	SPTL S					
					1.70			Soft becoming firm brown CLAY. (LONDON CLAY FORMATION).
		2.00		N=9 (1,2/2,2,2,3)				
		2.00	SPTL S					*becomes firm.*
								orange/brown mottling and blue/grey veining.
		3.00		N=10 (2,2/2,3,2,3)				
		3.00	SPTL S					*becoming closely fissured.*
		4.00		N=14 (2,3/3,3,4,4)	4.00			Stiff brown with blue/grey veining CLAY. Very closely fissured. (LONDON CLAY FORMATION).
		4.00	SPTL S					*mottled orange/brown and cream silty sandy partings.*
		5.00		N=17 (3,3/4,4,4,5)				*orange/brown sandy pockets.*
		5.00	SPTL S					
		6.00		N=19 (3,4/4,4,5,6)				
		6.00	SPTL S					
		7.00		N=18 (4,3/4,4,5,5)	7.00			Stiff becoming very stiff dark grey/brown with occasional blue/grey veining CLAY. (LONDON CLAY FORMATION).
		7.00	D					
		7.45		N=30 (5,8/8,8,7,7)				
		7.90		N=39 (10,10/8,10,11,10)				
					8.35			End of borehole at 8.35 m

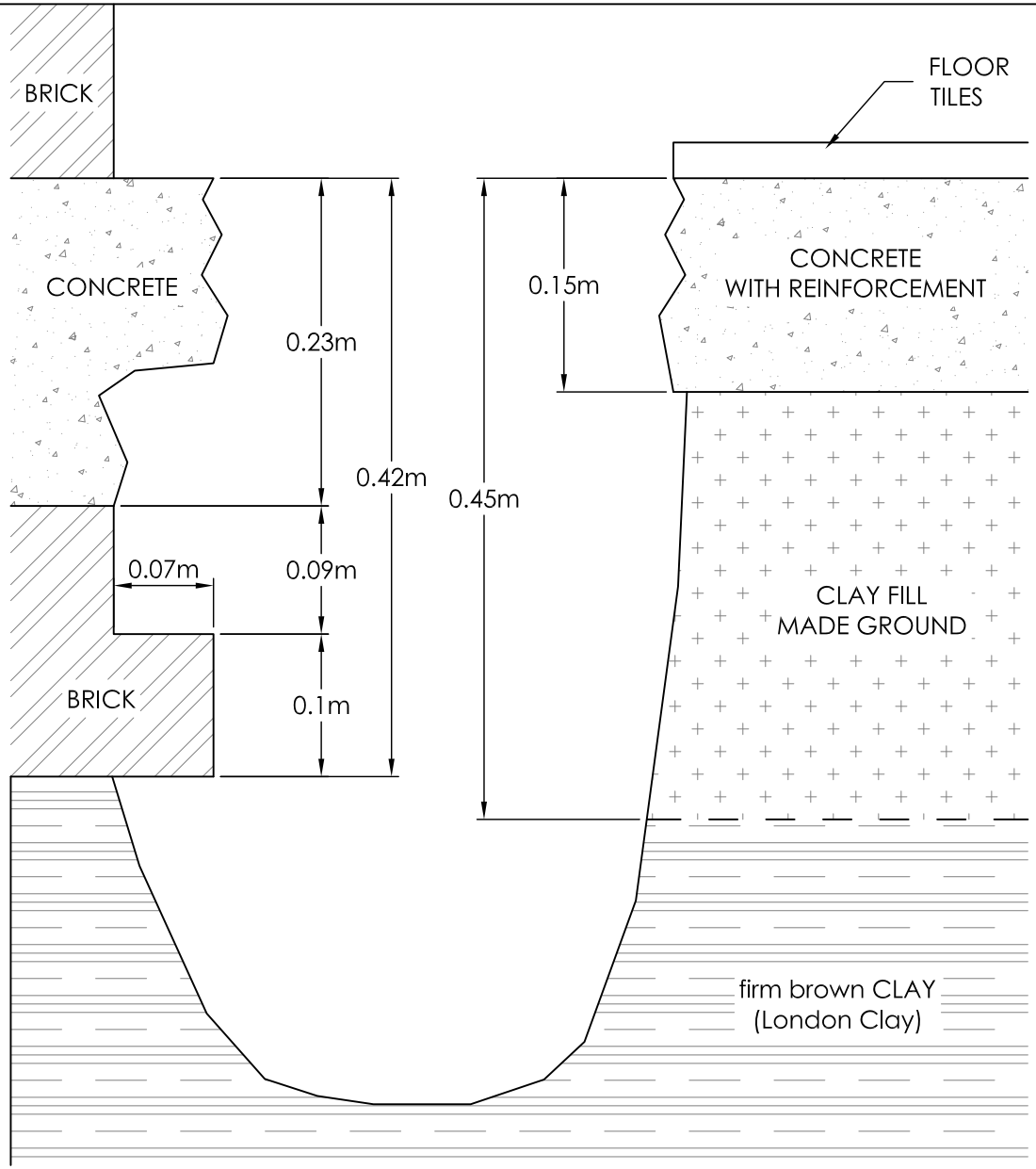
Remarks

AGS



TRIAL PIT 1
SCALE 1:5

PLATE 1: EXCAVATION

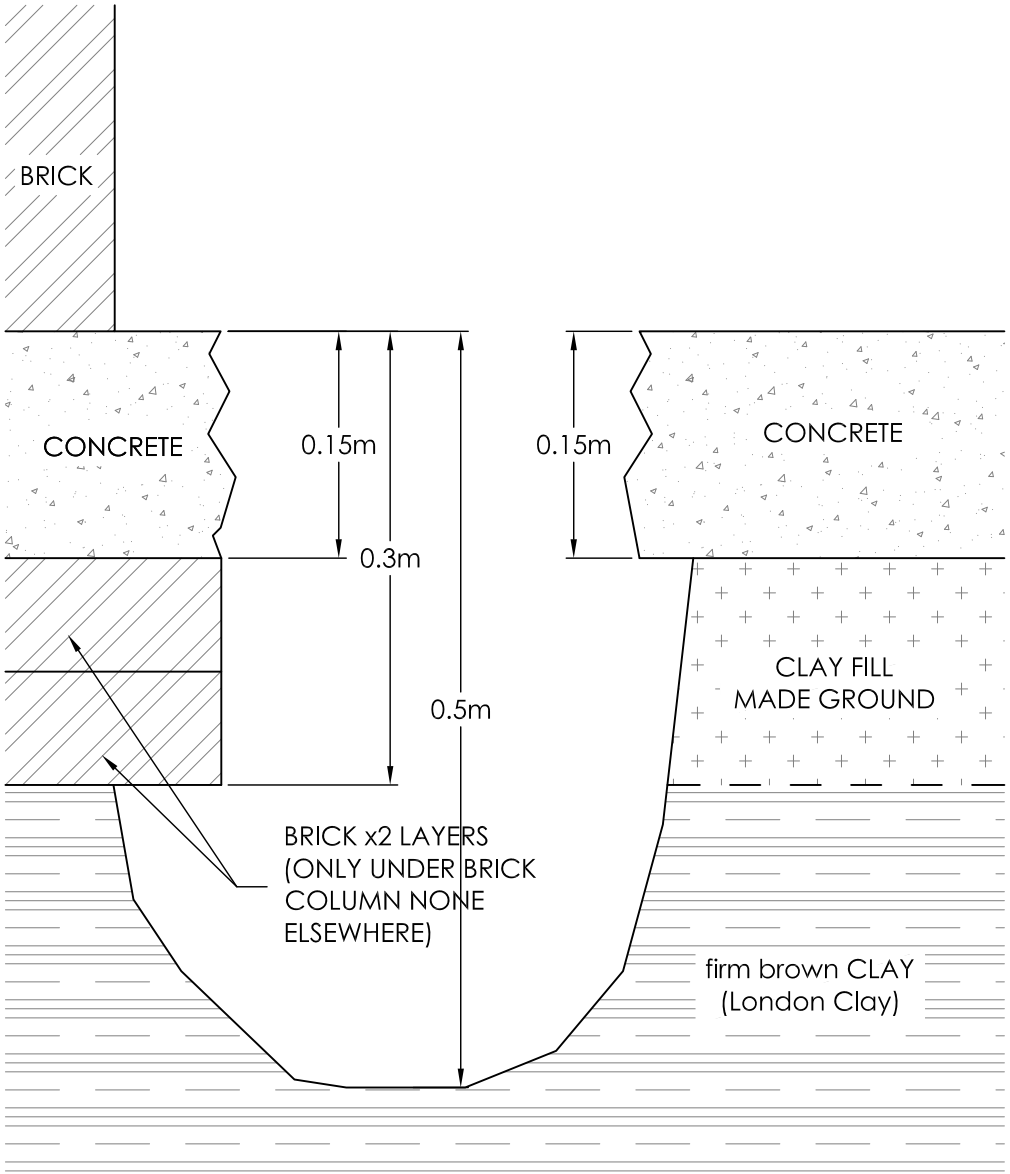


NOTE: NO FOUNDATION ON PARTY WALL

TRIAL PIT 2 (OLD STORE)

SCALE 1:5

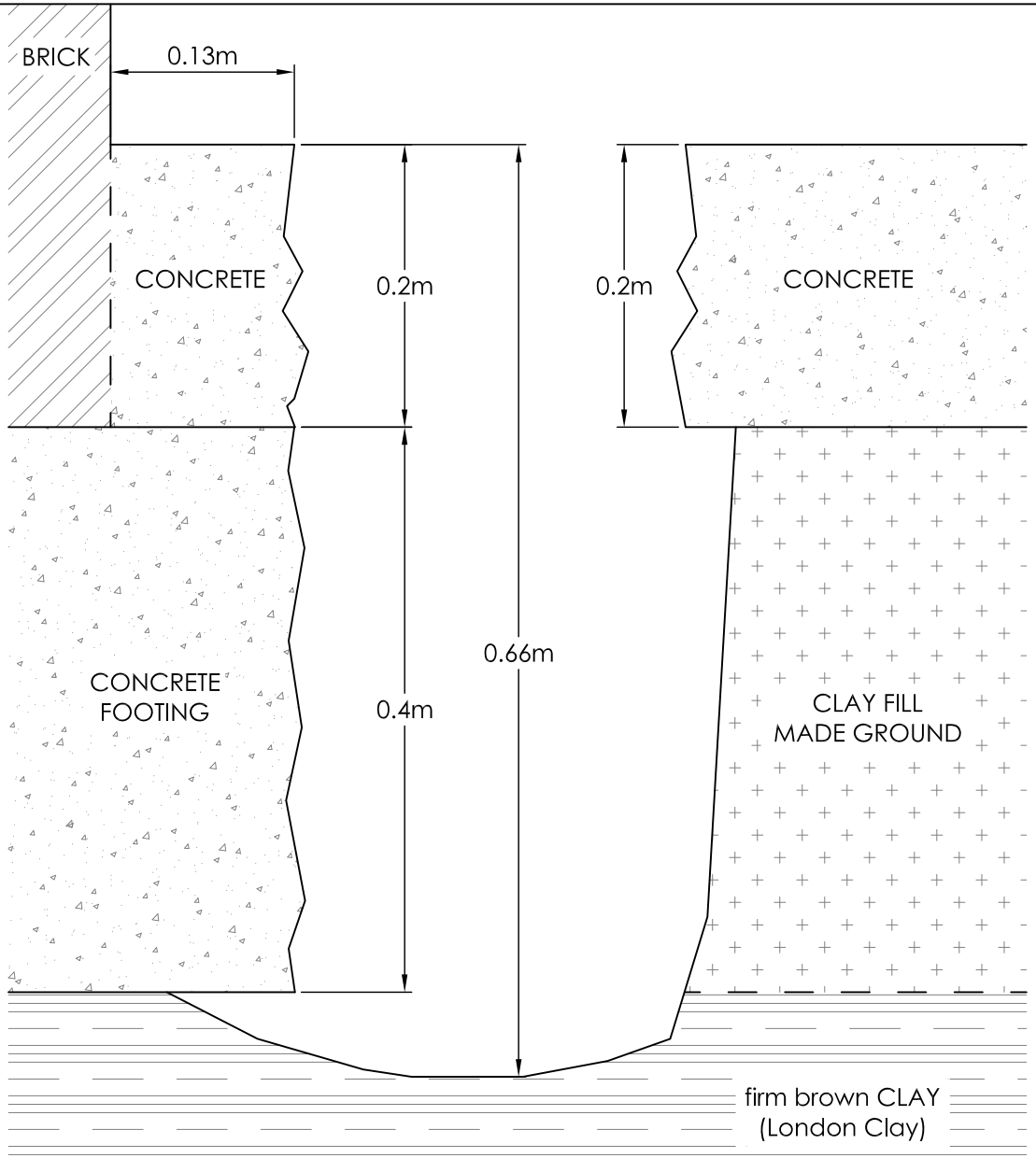
PLATE 1: EXCAVATION



TRIAL PIT 3 (COURTYARD)

SCALE 1:5

PLATE 1: EXCAVATION



TRIAL PIT 4 (CUPBOARD)

SCALE 1:5

PLATE 1: EXCAVATION

APPENDICES

APPENDIX B GEOTECHNICAL LABORATORY RESULTS

TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	LMB Geosolutions Ltd	Client Reference:	N/A
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-23123
		Date Sampled:	18/07/2016
		Date Received:	19/07/2016
Contact:	Philip Lewis	Date Tested:	22/07/2016
Site Name:	Albert St, London	Sampled By:	PIL
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
603914	Not Given	BH1	1	Not Given	D	Yellowish brown slightly gravelly CLAY	31
603915	Not Given	BH1	2	Not Given	D	Yellowish brown CLAY	29
603916	Not Given	BH1	3	Not Given	D	Yellowish brown CLAY	30
603917	Not Given	BH1	4	Not Given	D	Yellowish brown CLAY with thin laminae of grey clay and gypsum crystals	30
603918	Not Given	BH1	5	Not Given	D	Yellowish brown CLAY with thin laminae of grey clay	32

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 02/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

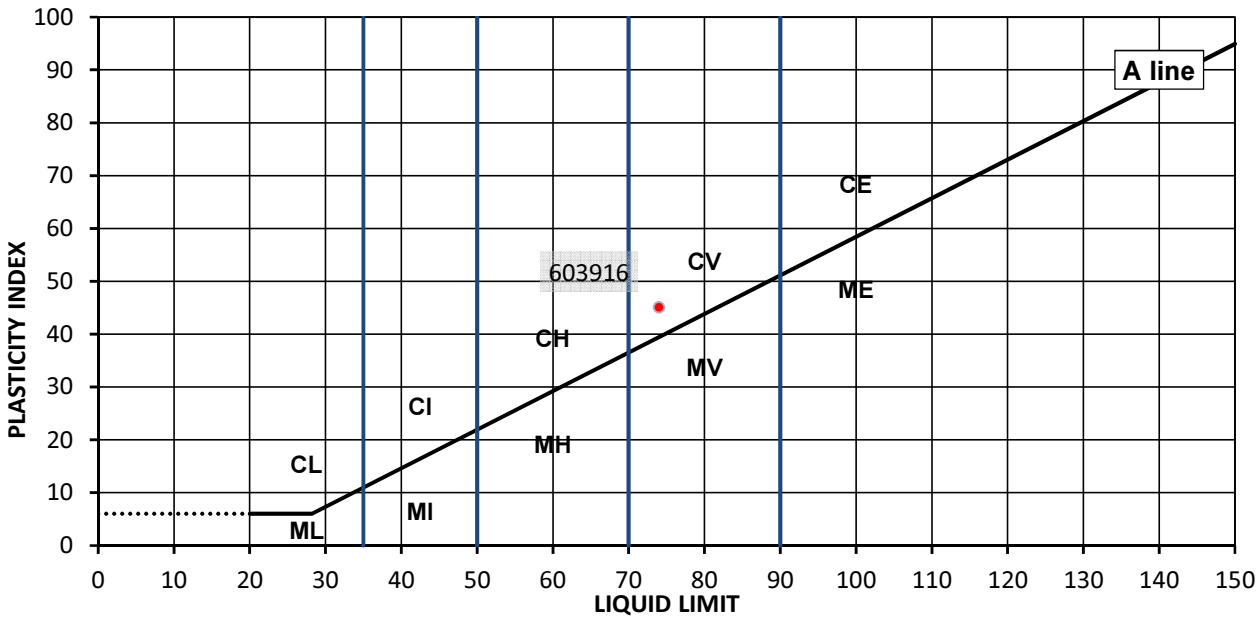
Client:	LMB Geosolutions Ltd	Client Reference:	
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-23123
		Date Sampled:	18/07/2016
		Date Received:	19/07/2016
Contact:	Philip Lewis	Date Tested:	22/07/2016
Site Name:	Albert St, London	Sampled By:	PIL
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 603916
Sample Reference: Not Given

Description:	Yellowish brown CLAY	Sample Type:	D
Location:	BH1	Depth Top [m]:	3
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	74	29	45	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 02/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

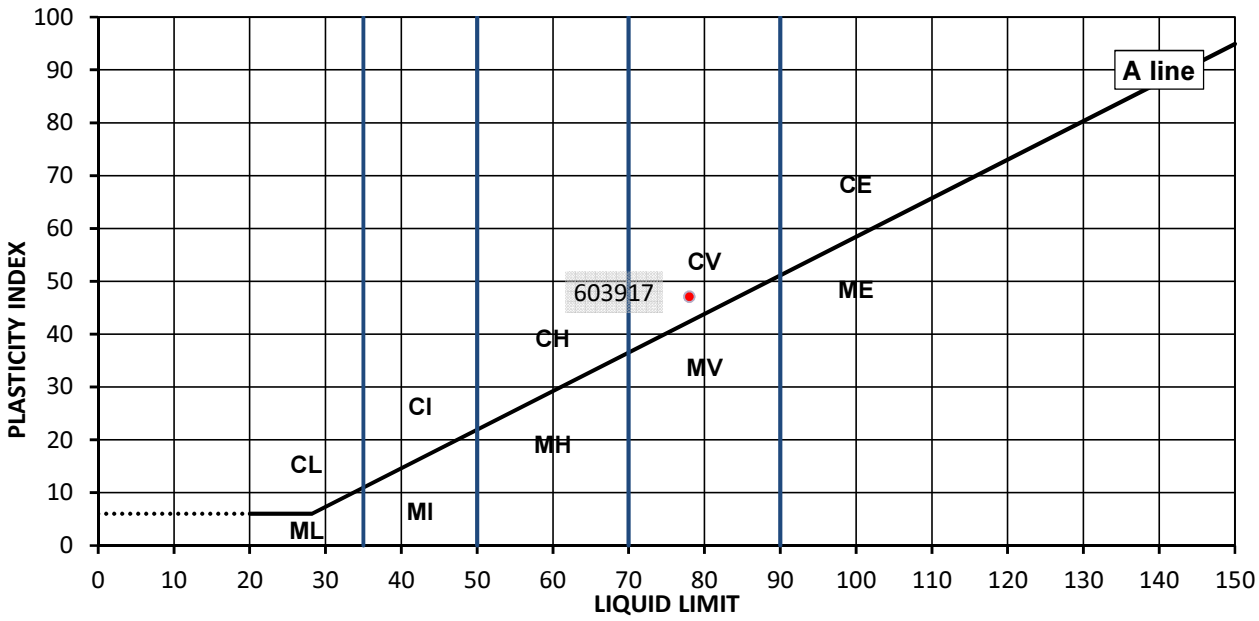
Client:	LMB Geosolutions Ltd	Client Reference:	
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-23123
		Date Sampled:	18/07/2016
		Date Received:	19/07/2016
Contact:	Philip Lewis	Date Tested:	22/07/2016
Site Name:	Albert St, London	Sampled By:	PIL
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 603917
Sample Reference: Not Given

Description: Yellowish brown CLAY with thin laminae of grey clay and gypsum crystals
Sample Type: D
Location: BH1
Depth Top [m]: 4
Sample Preparation: Tested in natural condition
Depth Base [m]: Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	78	31	47	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical section
Date Reported: 02/08/2016

Signed:

Terry Stafford
Geotechnical Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

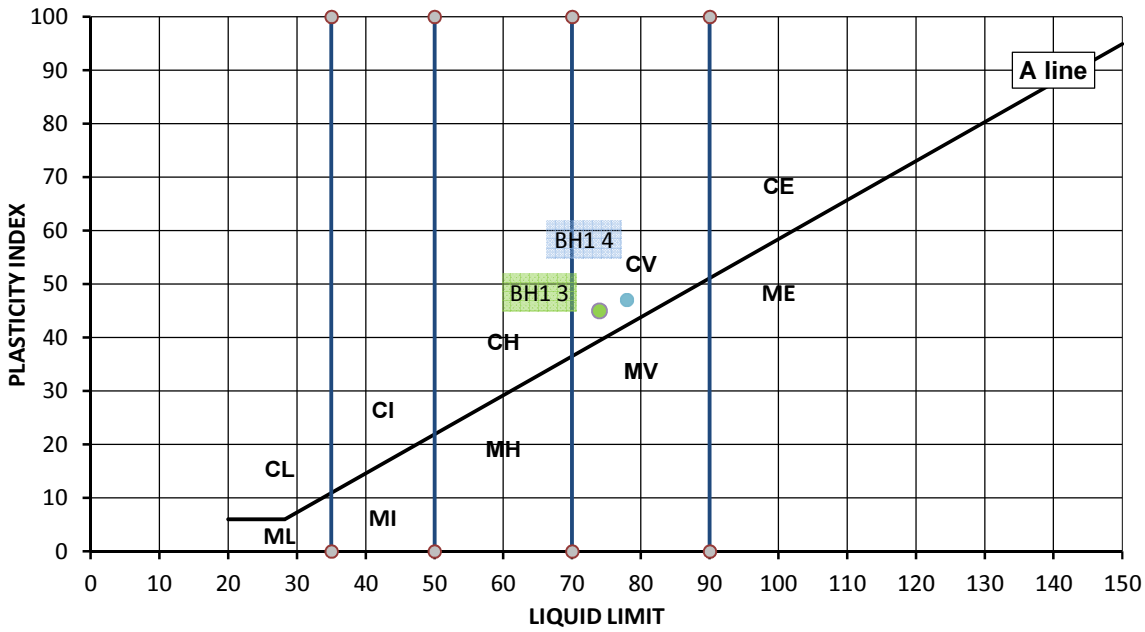
4041

Tested in Accordance with BS1377-2: 1990: Clauses 4.4 & 5: One Point Method

Client:	LMB Geosolutions Ltd	Client Reference:	N/A
Client Address:	28 Dresden Road London N19 3BD	Job Number:	16-23123
		Date Sampled:	18/07/2016
		Date Received:	19/07/2016
Contact:	Philip Lewis	Date Tested:	22/07/2016
Site Name:	Albert St, London	Sampled By:	PIL
Site Address:	Not Given		

TEST RESULTS

Location	Depth [m]	As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
BH1	3	30	74	29	45	100
BH1	4	30	78	31	47	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Comments:

Approved: Mirosława Pytlik
PL Head of Geotechnical section

Signed: Terry Stafford
Geotechnical Manager

Date Reported: 02/08/2016

for and on behalf of i2 Analytical Ltd

APPENDICES

APPENDIX C CHEMICAL LABORATORY TESTING RESULTS

Philip Lewis
LMB Geosolutions Ltd
28 Dresden Road
London
N19 3BD

e: philip@lmbgeosolutions.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 16-23119

Project / Site name:	Albert St, London	**Samples received on:**	19/07/2016
Your job number:		**Samples instructed on:**	19/07/2016
Your order number:		**Analysis completed by:**	27/07/2016
Report Issue Number:	1	**Report issued on:**	27/07/2016
Samples Analysed:	3 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 16-23119

Project / Site name: Albert St, London

Lab Sample Number				603901	603902	603903		
Sample Reference				BH1	BH1	BH1		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.60	1.00	3.00		
Date Sampled				18/07/2016	18/07/2016	18/07/2016		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	18	19	17		
Total mass of sample received	kg	0.001	NONE	1.1	0.43	0.45		
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-		
General Inorganics								
pH	pH Units	N/A	MCERTS	-	8.1	8.3		
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.026	0.13		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	-		
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Fluorene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Anthracene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Pyrene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	-		
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	-	-		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	-		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	-	-		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	-	-		
Boron (water soluble)	mg/kg	0.2	MCERTS	1.7	-	-		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	-	-		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	41	-	-		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	36	-	-		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	130	-	-		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	-	-		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	-	-		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	60	-	-		

Analytical Report Number : 16-23119

Project / Site name: Albert St, London

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
603901	BH1	None Supplied	0.60	Brown clay and loam with gravel and brick.
603902	BH1	None Supplied	1.00	Light brown clay.
603903	BH1	None Supplied	3.00	Brown clay.

Analytical Report Number : 16-23119

Project / Site name: Albert St, London

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Philip Lewis
LMB Geosolutions Ltd
28 Dresden Road
London
N19 3BD

e: philip@lmbgeosolutions.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 16-23121

Project / Site name:	Albert St, London	**Samples received on:**	19/07/2016
Your job number:		**Samples instructed on:**	19/07/2016
Your order number:		**Analysis completed by:**	28/07/2016
Report Issue Number:	1	**Report issued on:**	28/07/2016
Samples Analysed:	1 10:1 WAC sample		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

i2 Analytical
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**16-23121**						
					Client:	**LMBGEOSOL**	
Location	**Albert St, London**						
Lab Reference (Sample Number)	603908 / 603909				**Landfill Waste Acceptance Criteria**		
					Limits		
Sampling Date	18/07/2016				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH1						
Depth (m)	0.60						
Solid Waste Analysis							
TOC (%)**	0.7				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg)	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	8.3				--	>6	--
Acid Neutralisation Capacity (mol / kg)	5.5				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:01	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0065			0.0556	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0056			0.048	0.5	10	70
Copper *	0.0057			0.049	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0220			0.189	0.5	10	30
Nickel *	0.0053			0.046	0.4	10	40
Lead *	0.0082			0.070	0.5	10	50
Antimony *	0.0020			0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0084			0.072	4	50	200
Chloride *	0.16			< 1.5	800	4000	25000
Fluoride	0.87			7.5	10	150	500
Sulphate *	1.9			16	1000	20000	50000
TDS	60			510	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	2.89			24.8	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.1						
Dry Matter (%)	82						
Moisture (%)	18						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and I2 cannot be held responsible for any discrepencies with current legislation

*= UKAS accredited (liquid eluate analysis only)
** = MCERTS accrediited

Analytical Report Number : 16-23121

Project / Site name: Albert St, London

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
603908	BH1	None Supplied	0.60	Brown clay and loam with gravel and brick.

Analytical Report Number : 16-23121

Project / Site name: Albert St, London

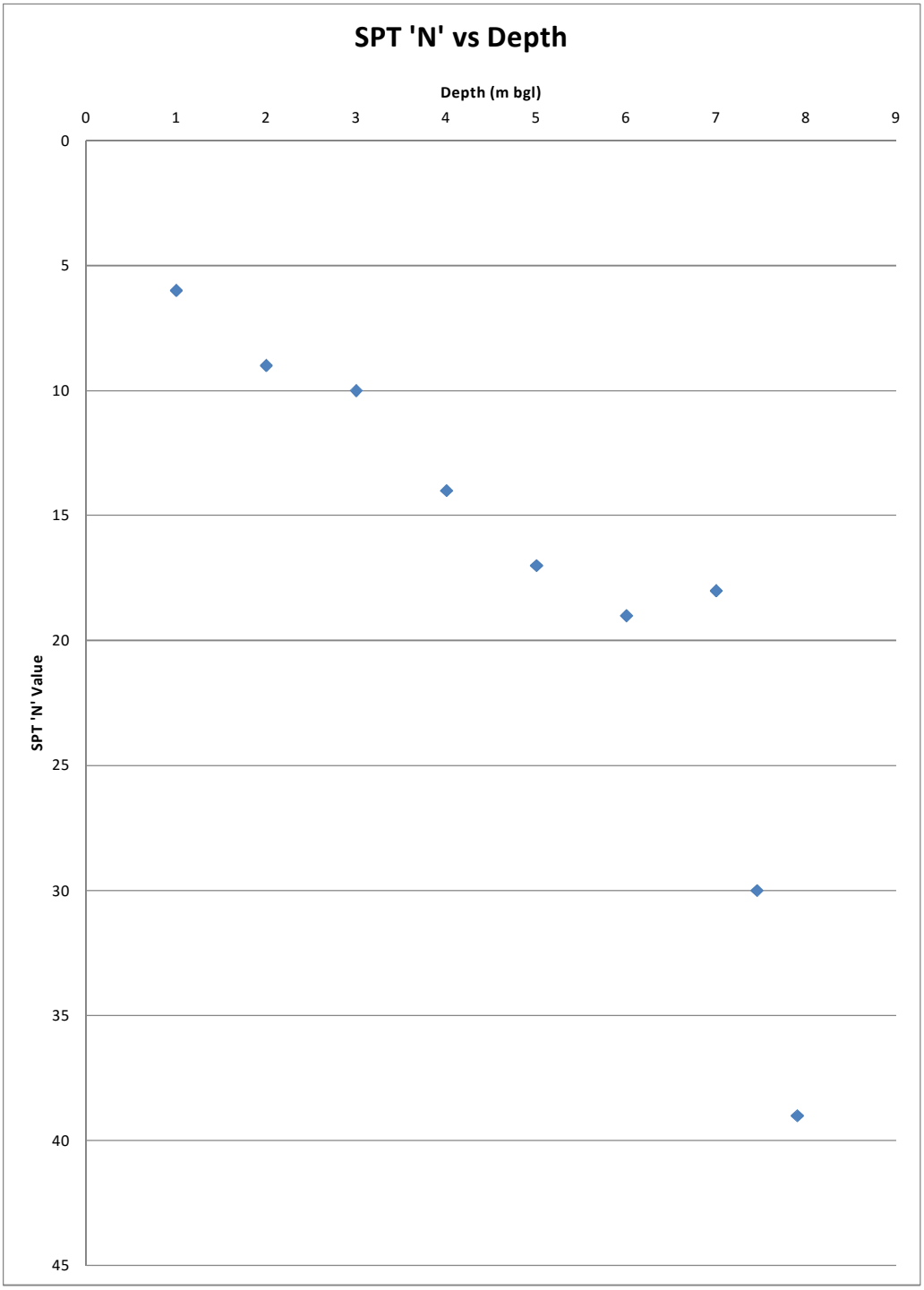
Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-UK	W	NONE
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	D	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-UK	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDICES

APPENDIX D PLOT OF SPT ‘N’ VLAUE VS DEPTH



LMB GEOSOLUTIONS LTD

SPT N DEPTH PLOT

Project: 47 Albert Street, London NW1
Client: Mr Neil & Mrs Angela Moran
Logged By: PIL

Depth	SPT N BH1		Geol
	1	6	MG
	2	9	LC
	3	10	LC
	4	14	LC
	5	17	LC
	6	19	LC
	7	18	LC
	7.45	30	LC
	7.9	39	LC