RWA London
Civil & Structural Engineers

39 Fitzjohn's Avenue
London NW3 5JY

Planning Application
Basement Impact Assessment

Rev E

03rd May 2018

SUMMARY

In accordance with London Borough of Camden Development Policy DP27 – Basements and Lightwells, and the recent LB Camden guidance document entitled "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development", an impact assessment for the proposed basement construction on this site is being undertaken for this project.

This report covers the initial desk study, screening process, site investigation and assessment of the impact of the basement.

The findings and opinions conveyed and summarised in this report are based on information obtained from a variety of sources as referenced within the report.

This report has been prepared by Conor O'Boyle and Kevin Tilney of RWA London LLP.

TABLE OF CONTENTS

APPENDICES

APPENDIX 1 – CH + MRP ARCHITECTURAL DRAWINGS:

3169_001 LOCATION SITE PLAN
3169_002 EXISTING SITE PLAN
3169_50 PROPOSED SITE PLAN
3169_51 PROPOSED GARDEN LEVEL PLAN
3169_52 PROPOSED LOWER GROUND FLOOR PLAN
3169_53 PROPOSED RAISED GROUND FLOOR PLAN
3169_54 PROPOSED FIRST FLOOR PLAN
3169_55 PROPOSED SECOND FLOOR PLAN
3169_56 PROPOSED THIRD FLOOR PLAN
3169_57 PROPOSED ROOF PLAN

APPENDIX 2 – RWA LONDON STRUCTURAL SCHEME DRAWINGS

3686 – 26 - Level -02 Basement Plan
3686 – 27 – Level -01 Lower ground plan
3686 – 28 – Level 00 Ground plan
3686 – 29 – Level 01 1st Floor Plan
3686 – 30 – Level 02 2nd Floor Plan
3686 – 31 – Level 03 3rd Floor Plan
3686 – 32 – Foundation Plan

APPENDIX 3 – RWA LONON PROPOSED BASEMENT CONSTRUCTION SEQUENCE DRAWINGS

3686 – 19 Phased Basement Construction sheet 1
3686 – 20 Phased Basement Construction sheet 2

APPENDIX 4 – NETWORK RAIL RECORD INFORMATION

WB 30455 (EN15138) Belsize (fast) tunnel No. 1
WB 30455 (EN15138) Belsize (slow) tunnel No. 2
WB 30455 (EN15138) Location map including tunnel alignment

REFERENCE DOCUMENTS

Documents prepared by RWA London and other parties have been presented as part of the planning application for 39 Fitzjohn's Avenue. These documents, to be read in conjunction with this report, are shown in the list below:

Jomas Associates Limited, "Desk Study, Ground Investigation & Basement Impact Assessment Report for 39 Fitzjohn's Avenue, London NW3 5SY P1135J1199

1 INTRODUCTION

1.1 Introduction

RWA London was appointed by 39 FITZJOHNS AVENUE LIMITED to provide the necessary pre-planning information required to support the main application from CH+MRP ARCHITECTS The objective of this study was to produce an impact assessment for the proposed basement construction on this site in accordance with the requirements of the London Borough of Camden. Their requirements are set out within their Development Policy DP27 – Basements and Lightwells, and the recent LB Camden guidance document entitled "Camden geological, hydrogeological and hydrological study – Guidance for subterranean development".

This report covers the initial desk study, screening process, site investigation and assessment of the impact of the basement.

1.2 Scope

This report presents RWA London's interpretation of the reports by Jomas Associates Ltd (JAL) detailing desk study findings, site investigation findings and impact assessment statements.

The extent of the proposed basement installation is set out in the Architect's drawings listed above, and summarised in Section 2.3. The recommendations set out in this report are limited to the above-mentioned development scheme.

2 THE SITE

2.1 Site Location

The site is referred to as 39 Fitzjohn Avenue and is located in Finchley, north London. It is bounded by Fitzjohn avenue to the east, Nutley terrace to the south and Maresfield gardens to the west.

It is approximately centred at National Grid reference 526509, 184997.

The site is trapezoidal in shape and measures approximately 67m x 56m.

The site presently contains Victorian semi-detached house facing Fitzjohn avenue extending over ground, 1st, and 2nd floors. There is a partial lower ground floor in the south of the building which occupies approximately 50% of the Victorian building footprint.
The adjoining building to the north of the Victorian building was a later addition first shown on the 1951 survey. This building will be refurbished wit a partial rear extension. It does not currently have a basement or lower ground floor plan. **Only above ground remodelling is proposed and as such this building is not included in the basement impact study**

The existing Victorian building has an approximate level of 74.52m OD at the Lower Ground floor level, and 77.1m OD at raised ground level bounded by:

- An entrance drive and front garden at approximately 7.3m OD
- A rear garden at approximately 75.3m OD
- The adjoining 1951 more modern residential property to the north.

A site location plan is presented as Appendix 1.

2.2 Historical Mapping Information

The historical development of the site and its surrounding areas was evaluated following the review of a number of Ordnance Survey historic maps, procured from GroundSure, and provided in Appendix 3 of JAL BIA report P1135j1199.

Site History Overview	A review of historical maps indicates that in 1866 the site comprised undeveloped land with a pond in the north-east corner. By the map dated 1894, this pond in no longer shown and a building is shown in the south-east corner. An air shaft is shown in the north-west corner of the site by the map dated 1915. This indicated the presence of a railway tunnel beneath the site. Few changes occur to the site until the map dated 1951 when the building on site is shown to have been extended and the tunnel below site is identified as the 'Belsize New Tunnel'. A tennis court is also shown in the north of the site. Few changes then occur to the site until the present day. Historically, the surrounding area has consisted largely of residential use. Several small ponds are shown to have been infilled by the late 1800's. The remaining land uses of concern involve the railway tunnels running from east to west.

For information regarding the historical mapping of the area surrounding the site, refer to the above-mentioned appendix.

2.3 Proposed Development

The proposal is to rebuild and extend the existing Victorian property behind a retained façade along Fitzjohn avenue and Nutley terrace. The new building will be constructed over lower ground, ground 1st 2nd and 3rd floor. A basement will be constructed under rear 3rd of the building footprint. The basement will extend approximately 5m below existing ground levels.
The adjoining 1951 building will be subject to internal re-configuration and a ground level extension. The link between this building and the Victorian building will be demolished.
As there is no proposed basement works to the 1951 building this BIA is only concerned with the Victorian building to the south of the site.

The foot print of the new Victorian building occupies the site of the existing building and hard standing terrace to the rear. The existing building and hardstanding is 790m2 and the proposed building and hardstanding is 1124 m2
It is proposed that the new basement and building foundations will be constructed as a reinforced concrete raft in the London clay.

Appendix 1 shows Architect's planning Drawings
Appendix 2 shows the Structural scheme
Appendix 3 shows the Basement Construction Scheme

3 GROUND CONDITIONS

3.1 Published Geological Data

Summarising the information presented in the JAL BIA report P1135j1199, information provided by

Site Setting	The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site. Deposits of the London Clay Formation are identified as 'Unproductive' strata. A review of the EnviroInsight Report indicates that there are no Environment Agency Zone 2 or Zone 3 flood zones within 500m of the site. The nearest abstraction is reported 740m south of site. There are no detailed river entries within 500m of the site; nor surface water features reported within 250m of the site.

The following are brief findings extracted from the JAL BIA report Pp1135j1199 Section 4 and Appendix 2, which relate to factors that may have a potential impact upon the engineering of the proposed development.

Potential Hazard	Site Check Hazard Rating	Details	Further Actions Required?
Shrink Swell	Moderate	Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.	Yes
Landslides	Very Low	Slope instability problems are unlikely to be present. No special actions are required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.	No
Ground Dissolution Soluble rocks	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks.	No
Compressible deposits	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.	No
Collapsible rock	Very Low	Deposits with the potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required.	No
Running sand	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required and increased construction costs or increased financial risks are unlikely due to potential problems.	No
Coal mining	No	There are no coal mining areas identified within 1000m of the site boundary.	No
Non-coal mining	Yes	Air shaft located on site – associated with rail tunnel under site.	No
Brine affected areas	No		No

4 HYDROGEOLOGY & HYDROLOGY

The following sections have been extracted from JAL BIA report P1135J1199 Section 5.

4.1 Hydrogeology and Flood Risk

- In accordance with the NPPF Guidance, below is a review of flood risks posed to and from the development and recommendations for appropriate design mitigation where necessary. Specific areas considered are based on the requirements laid out in the "Camden Guidance and Subterranean Development (CPG4)"

- As required by CPG4 reference has been made to the London Borough of Camden's document "Camden geological, hydrogeological and hydrological study: Guidance for subterranean development" (Arup November 2010). This document used information from the BGS, EA and other sources to provide small scale plans showing the whole of the borough of Camden. The used sources regularly update their information and as the information obtained by Jomas is site specific it is considered that this data is both more current and more relevant. Generally, this information confirms that indicated in the Arup report.

The proposed basement does not extend into a sensitive groundwater body; there is unlikely to be a risk posed to or from the development to groundwater based on following industry standard basement construction techniques.

No groundwater flows will be impeded by the basement.

4.2 Hydrology and Flood Risk

The table below summarises the review of the flood risks posed to and from the development. Refer JAL BIA report P1135J1199 (section 5) for full details regarding the investigation.

Flood Sources	Site Status	Comment on flood risk posed to / from the development
Fluvial / Tidal	Site is not within 250m of an Environment Agency Zone 2 or zone 3 floodplain. Risk of flooding from rivers and the sea (RoFRaS) rating very low.	Proposed development consists of alterations to an existing property, as well as the construction of a new property. The proposed new build will increase the total impermeable surface area by approx. 140%– SUDS may be required.
Groundwater	The BGS does not consider the area to be susceptible to groundwater flooding.	The proposed development should not increase the potential risk of groundwater flooding. Basement will be fully waterproofed as appropriate to industry standard.
Artificial Sources	The closest identified lake is within Hampstead Heath located approximately 1000m from site. No artificial sources of groundwater/ surface water within 250m.	Low Risk
Surface Water / Sewer Flooding	The site is not within 250m of any surface water features. Condition, depth and location of surrounding infrastructure uncertain.	Proposed construction of new building will increase impermeable areas – SUDS required. Development on existing building will utilise existing connection to sewers, gravity drainage and non-return valves. Lower ground floor and basement foul drainage will be protected by a pumped loop allowing for 24-hour storage Development unlikely to significantly increase the peak flow/ volume of discharge from the site: Low Risk SUDS may be required.
Climate Change	Included in the flood modelling extents. Site not within climate change flood extent area.	Development will not significantly increase the peak flow and volume of discharge from the site. Low risk posed to and from the development

Hydrogeology

- The baseline hydrogeology of the site is based on available hydrogeological mapping, including the BGS online mapping, and generic information obtained from the Groundsure Report.

- The available data indicates that the geology of the area consists of London Clay Formation. It is unlikely that significant quantities of shallow groundwater are present beneath the site. This has been verified by the subsequent site investigation.

- It should also be noted that there are 2no. National Rail tunnels in close proximity to the site. Pumping of these tunnels to prevent flooding should have lowered the groundwater table on the site.

5 UNDERGROUND STRUCTURES

5.1 Basements

From a walkover of the site and its surrounds, it appears the majority of properties in the vicinity of 39 Fitzjohn Avenue do not have basements.
A planning search indicates that a Sunken house was developed at 43 Fitzjohn Avenue in 2012. This modest basement/lower ground floor can have no effect on our proposals The surrounding area is uphill south to north and many of the surrounding properties have a partial lower ground floor to accommodate the change of level. This site and surrounding area is not heavily developed and the adjoining building to the north does not have a Basement or lower ground floor.

5.2 London Underground Tunnels

The Groundsure report indicated the existence of 2 Network Rail tunnels close to the site.

The tunnels are shown on the historic maps as running East/West. One tunnel is located just north of the Victorian building and the other is located under Nutley terrace. Correspondence with network rail (ref EN15128) (appendix 5) indicates that the tunnels are at approximately 53.5m AOD and our development is generally at 75m AOD providing 21.5m. The chosen foundations are ground bearing raft foundations.
The new building basement works on the site of the Victorian building will have no bearing on the tunnels.

6 SCREENING EXERCISE

Screening is the process of determining whether or not there are areas of concern which require a BIA for a particular project

6.1 Surface Flow and Flooding

The screening assessment for Surface Flow and Flooding was undertaken by JAL and presented in report P1135J1199. The findings are summarised in the table below:

Query	Y/N/ Unknown	Comment
Surface Flow and Flooding		
Is the site within the catchment of any ponds?	No	No evidence of any current ponds or surface water features on historical or current OS maps.
As part of the site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially different from the existing route?	No	The proposed development involves the construction of a new dwelling with basement. Impermeable areas are likely to increase and SUDS will be required.
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	There are no nearby surface water features.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	No surface waters in the area to be impacted.
Is the site in an area known to be at risk from surface water flooding, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	No nearby surface water features and not within an EA flood zone.

6.2 Groundwater Flow

The screening assessment for Subterranean (Groundwater) Flow was undertaken by JAL and presented in report P1135J1199. The findings are summarised in the table below:

Query	Y/N/ Unknown	Comment
Subterranean (Groundwater) Flow)		
Is the site located directly above an aquifer?	No	The site is directly underlain by unproductive strata.
Will the proposed basement extend below the surface of the water table?	No	No groundwater anticipated within the London clay Formation underlying the site. This has been verified by the subsequent Site investigation
Is the site within 100m of a watercourse, well (disused or used) or a potential spring line?	No	No nearby subterranean water features.
Is the site within the catchment of any pond?	No	No nearby surface water features.
Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	Possibly No	The proposed development involves the construction of a new dwelling with basement. Impermeable areas are likely to increase by 140%and SUDS may be required.
As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	There is no reason to believe that more water than at present will be discharged to the ground.
Is the lowest point of the proposed excavation (allowing of any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line?	No	No nearby water features.

6.3 Slope Stability

The screening assessment for Slope Stability was undertaken by JAL and presented in report P1135J1199. The findings are summarised in the table below:

Query	Y/N/ Unknown	Comment
Slope Stability		
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	No	No
Will the proposed re-profiling of landscaping change slopes at the property to more than 7 degrees?	No	No
Does the developments' neighbouring land include railway cuttings and the like, with a slope greater than 7 degrees?	No	Surrounding land is mostly residential in nature.
Is a clay stratum the shallowest stratum at the site?	Unknown	Unknown but highly likely as the site is reportedly directly underlain by the London Clay Formation.
Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	YES	Refer to the Arboriculturalist report included in the planning application
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	Unknown	Whilst it is not known if there is a history of seasonal shrink swell, given that the site is reported to be directly underlain by London Clays (noted to be a moderate risk from shrink-swell clays) and the trees on the site it is likely.

Is the site within an area of previously worked ground?	No	Although a tunnel passes beneath the site, the ground in this area does not appear to have been worked other than regarding the existing residential development.
Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The basement will extend into unproductive strata.
Is the site within 50m of ponds?	No	No natural ponds are identified.
Is the site within 5m of a pedestrian 'right of way'?	Yes	The site faces onto a pavement and road. (Fitzjohn's Avenue, Nutley Terrace and Marsefield Gardens).
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Unknown	It is likely that the basement foundations will increase the differential depth of foundations relative to neighbouring properties however this is dependent on the type of foundations used at the neighbouring properties and this is currently unknown. In addition, due to the distance to neighbouring building, the new basement foundations are likely to have minimal effect on neighbouring property.
Is the site over (or within the exclusion of) any tunnels e.g. railway lines?	No	The Belsize and Belsize New Tunnels pass in an east to west direction to the north and south of the site. The Belsize Tunnel is also present. See the attached red line drawing.

7 SCOPING EXERCISE

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

- The potential impacts of each of the matters highlighted in Table 6.1 above are discussed in further detail below together with the requirements for further investigations. Detailed assessment of the potential impacts are recommendations are provided where possible.

- These issues include proposed changes to hard standing, the possibility of Made Ground and/or gravel immediately beneath the site, the shrink/swell nature of any clays at the surface.

To address the issues identified in the screening phase, a determination of the basement impact on groundwater conditions and adjacent structures is to be carried out. To this end, the following procedure will be followed:

1. Conduct ground investigation
2. Determine geotechnical properties of soils underlying the site
3. Determine groundwater conditions present at time of investigation
4. Monitor groundwater levels for a period of time and report changes in levels

Items 1-4 have been carried out and results are presented in detail in JAL BIA report P1135J1199 Sections 8 to 13, and Appendices 6 to 8. A summary of the results of the site investigation, as well as engineering recommendations relating to construction of the basement, is presented in the subsequent sections.

8 39 FITZJOHN AVEUNE SITE INVESTIGATION

The following sections have been extracted from JAL GROUND INVESTIGATION AND BIA report P1135J1199.

8.1 Scope of Ground Investigation

The intrusive investigation was undertaken on 16th October 2017, and comprised the following:

- 5No window sample boreholes drilled up to 5.00m bgl
- 3No combined gas and groundwater monitoring wells
- In-situ geotechnical testing
- Laboratory chemical and geotechnical testing

The work was undertaken in accordance with BS5930 'Code of Practice for Site Investigation' and BS10175 'Investigation of Potentially Contaminated Sites'.

8.2 Investigation Results

Detailed results of the site investigation are summarised from JAL BIA report P1135J1199 Section 4.

- **Ground Conditions**

Soil

Ground conditions were logged in accordance with the requirements of BS5930:2015. Detailed exploratory hole logs are provided in Appendix 6. The ground conditions encountered are summarised in Table 8.1 below, based on the strata observed during the investigation.
Ground conditions were logged in accordance with the requirements of BS5930:2015. The ground conditions encountered are summarised in, based on the strata observed during the investigation.

Stratum & Description	Encountered from (m BGL)	Base of Strata (m BGL)	Thickness Range (m)
Grass over silty sandy gravelly clay. Gravel consists of flint and brick fragments. (MADE GROUND)	GL	0.45-1.25	0.45-1.25
Brown to dark grey medium strength locally sandy CLAY with occasional rootlets.	0.45-1.25	>5.00	3.75->4.55

- **Site Hydrogeology**

No groundwater was encountered in any of the monitoring wells during drilling. All wells were reported to be dry during return monitoring with the exception of WS5 on the final visit which recorded water at a depth of 3.85mbgl. It is considered most likely that this water level represents surface water ingress rather than the natural ground water level; however this cannot be determined definitively from the data available.

Groundwater was encountered in window sampler hole WS1 during the course of the investigation at 7m BGL. The table below summarises the groundwater conditions encountered during the investigation.

DURING DRILLING			
Exploratory Hole ID	**Depth Encountered (m BGL)**	**Depth After 20mins (m BGL)**	**Stratum**
BH1	-	-	-
WS1	7.0	Not recorded	Sandy Gravelly CLAY
POST DRILLING / RETURN MONITORING			
Exploratory Hole ID	**Depth Encountered (m BGL)**	**Depth After 20mins (m BGL)**	**Stratum**
BH1	0.98 – 1.05	8.12	Sand and Gravel
WS1	1.4 – 1.45	7.06	Sand and Gravel

Groundwater encountered within WS1 at 7m BGL during drilling is considered to represent water accumulated within sandy pockets/lenses within the London Clay. The water will be limited in volume and is expected to be very slow to recharge.

During the post drilling monitoring groundwater was recorded at shallower depths and is considered to represent the groundwater within the sand and gravel superficial deposits of the Lynch Hill Gravel.

8.3 Geotechnical Engineering Recommendations

The following sections have been extracted from JAL BIA report P1135J1199 Section 13.

8.3.1 Foundations

- Preliminary structural design indicates that significant concrete retaining walls will be required to for the lower ground floor perimeter. Further deeper walls will be required to for the basement.

- The walls will be designed as propped retaining walls where they occur at the building perimeter and as cantilever walls at lightwells.

- It is considered likely that an excavation circa 3.5m deep would be required to form the lower ground floor. A partial lower ground floor exists at this depth within the existing building.

- In view of the results obtained to date, it is considered that conventional foundations, constructed at a depth of 3.5mbgl within the underlying clay may be designed with an allowable bearing pressure of 100kPa.

- It is understood from the proposed drawings that a deeper basement is proposed at the rear third of the building. A raft foundation may be a suitable founding option, with an approximate allowable bearing capacity of 115kPa at 5mbgl. The proposed basement is 5.4m below ground level at the rear of the building

- The above assumes that the Basement will not lie below the natural groundwater table. Although significant groundwater is not anticipated within the London Clay, and the first monitoring visit reported wells to be dry, water has been reported in the wells on subsequent visits. It is unclear whether this is the natural water level, or rainfall/surface water ingress.

- On completion of the detailed foundation design. Bearing pressures and sliding of retaining walls will be reviewed against the information contained in the site investigation.

- In view of the foundation / cantilever retaining wall being formed within the high volume change potential London Clay heave precautions should be incorporated. These are likely to incorporate a void or void former that will result in a void of 35mm.

- Void formers consist of materials that collapse to form a void into which the clay can swell. The void dimension is the 'remaining void' after collapse. The thickness of the void former should be in accordance with the manufacturer's recommendations

- The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer. Once structural loads have been fully determined a full design check in accordance with BS EN 1997 should be undertaken to confirm suitability of foundation choice.

8.3.2 Retaining Walls

- Final structural design of the building has not been completed, however It is assumed that a propped and un propped cantilever retaining walls will be used to form the basement

- Normally sliding failure is a significant part of any retaining wall design and will form part of the design check. However, the significant mass of the building and raft foundation will prevent sliding

  Assuming that the retaining wall will be supporting cohesive materials, it is considered that a phi of 0° should be taken as the clays will be in their undrained state.

- Given the high-volume change potential of the underlying/retained clays it is recommended that the walls should incorporate heave precautions. These should consist of 35mm void or the equivalent thickness of compressible material adjacent to the wall.

- Basement walls formed under existing Victorian building or retained facades will be formed in an underpinned sequence

The above comments are indicative only based on limited ground investigation data. Foundations will be designed by a suitably qualified Engineer. Once structural loads have been fully determined a full design check in accordance with BS EN 1997 will be undertaken to confirm suitability of foundation choice.

8.3.3 Concrete in Ground

Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.

In accordance with BRE Special Digest 1, in a data set where there are more than 10 results available, assessment should be undertaken against the average of the highest 20% of values. Where there are less than 10 results in a data set the highest value is taken.

The below table summarises the analysis of the aggressive nature of the ground for each of the stratum encountered within the ground investigation.

Stratum	No. Samples	pH Range	WS Sulphate (ave 20% / highest)	Design Sulphate Class	ACEC Class
Made Ground	1	7.9	90	DS-1	AC-1
Gravelly SAND	1	8.1	70	DS-1	AC-1

London CLAY	2	7.6 – 8.1	250	DS-1	AC-1s

8.3.4 Ground Floor Slabs

Formations of the structures will be inspected by a competent Chartered Engineer. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete. The formation should be blinded if left exposed for more than a few hours or if inclement weather is experienced.

Following excavation of the basement the floor slab will be founded upon London Clay strata. It is expected that a small amount of heave will occur due to the removal of the overlying ground and the slab construction should be design to accommodate this.

8.3.5 Excavations

Excavations will be required at the site for services and construction works. These are anticipated to remain stable for the short term only.

It is recommended that the stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported or battered back to a safe angle.

In addition, the basement excavation will be located beneath a retained facade and adjoining building. The progression of the basement excavation will need to consider the potential impact to existing structures both on and off site and provide adequate and appropriate support. Significant façade retention, underpinning and temporary earth retention will be required.

8.3.6 Groundwater Control

During the investigation groundwater was not observed although the sand within BH1 was reported to be wet.

During return monitoring groundwater levels were recorded between 0.98m and 1.45m below ground level.

Subject to seasonal variations, any groundwater encountered during site works should be readily dealt with by conventional pumping from a sump.

9 BASEMENT IMPACT ASSESSMENT

The following sections have been extracted from JAL BIA report P1135J1199 Section 8.
impact adversely on the stability of the surrounding ground and any associated services and structures.

9.1 Proposed Changes to Areas of External Hardstanding

9.1.1 The proposed development on the site of the existing Victorian building involves the construction of a new multi-unit residential dwelling with a basement. Impermeable areas will increase and SUDS may be required.
The increase in drained area goes for 790m2 to 1124m2

9.2 Past Flooding

9.2.1 Planning Policy Statement PPS25 "Development and Flood Risk" seeks to protect development from flooding as well as preventing flooding. PPS25 states that developers are responsible for providing a flood risk assessment:

- demonstrating whether any proposed development is likely to be affected by current or future flooding from any source;
- satisfying the local planning authority that the development is safe and where possible reduces flood risk overall;
- demonstrating whether the development will increase flood risk elsewhere;
- demonstrating measures proposed to deal with these effects and risks.

9.2.2 The site is not in an area which has been knowingly affected by flooding in the past, nor is it located within 250m of a known area of flood risk.

9.3 Geological Impact

9.3.1 The published geological maps indicate that the site is directly underlain by solid deposits of the London Clay Formation.

9.3.2 At the depths that the basement would be constructed, the London Clay Formation is unlikely to be prone to seasonal shrinkage and swelling that arises due to changing water content in the soil.

9.3.3 It is recommended that heave precautions are incorporated into the retaining wall details.

9.3.4 It is also recommended that a suspended floor slab is utilised. Dependant on the final design a ground bearing may be used for the basement but it would need to be formed on a suitable thickness of engineered granular materials.
Preliminary consideration of the building loads and ground conditions suggest a ground bearing raft will be employed. The design will consider ground heave.

9.4 Hydrology and Hydrogeology Impact

9.4.1 Based on all the information available at the time of writing, the risk of flooding from groundwater is considered to be low. The proposed basement is unlikely to have a detectable impact on the local groundwater regime.

9.4.2 Appropriate water proofing measures should be included within the whole of the proposed basement wall/floor design as a precaution.

9.4.3 The proposed dwelling will lie outside of flood risk zones and is therefore assessed as being at a very low probability of fluvial flooding.

9.4.4 There are no surface water features on or in the immediate vicinity of the site. It is therefore not anticipated that the site will make any impact upon the hydrology of the area.

9.4.5 The information available suggests that the site lies in an area that is not at risk of surface water flooding. Flooding via this source is therefore considered to be low.

9.4.6 The proposed basement construction will create an increase of impermeable area in the post development scenario. Depending of Volumes some retention may be required.

9.4.7 No risk of flooding to the site from artificial sources has been identified.

9.5 Impacts of Basement on Adjacent Properties and Pavement

9.5.1 The proposed basement excavation will be within 5m of a public pavement. It is also within 5m of neighbouring properties.

9.5.2 Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground, any associated services and structures.

9.5.3 It is recommended that the site is supported by suitably designed temporary support with a ground bearing basement box construction. This will ensure that the adjacent land is adequately supported in the temporary and permanent construction.

9.5.4 Careful and regular monitoring of the structure will need to be undertaken during the construction phase to ensure that vertical movements do not adversely affect the adjoining property, public highway or retained facades. If necessary the works may have to be carried out in stages with the above structure suitably propped and supported.

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

- Establishment of the likely ground movements arising from the temporary and permanent works and the mitigation of excessive movements;
- Assessment of the impact on any adjacent structures (including adjacent properties and the adjacent pavement with potential services);
- Determination of the most appropriate methods of construction of the proposed basements;
- Undertake pre-condition surveys of adjacent structures;
- Monitor any movements and pre-existing cracks during construction;
- Establishment of contingencies to deal with adverse performance;
- Ensuring quality of workmanship by competent persons.

9.5.6 In addition given the sites location close to but not over Network Rail assets (see below) discussions should be held with them regarding any unlikely impacts this may have on the tunnels.

9.5.7 A ground movement assessment can be carried out if required.

9.6 Tunnels

9.6.1 It is known that the Belsize New Tunnel passes directly under the adjoining building to the north of the site in an east to west direction. It is also known that the Belsize Tunnel is also present 4m south of the site under Nutley terrace, running parallel to the Belsize New Tunnel.

9.6.2 At the current time only indicative details regarding the tunnel i.e. approximate depth and diameter and approximate location are known. These were provided by network rail on indicative drawings showing the construction of the tunnel along a length close to the site. The tunnels were Formed by conventional tunnelling techniques and not cut and cover. This limits the effects of the tunnels on the ground above.
The network rail tunnel sections are shown in appendix 4

9.6.3 Considering a zone of influence of 45 deg from the plan location of the tunnels, our site although not over the tunnels would be within the influence zone. However, with almost 20m cover to the crown of the tunnel and traditional rather than piled foundations the proposed development will have a negligible effect on the tunnels.

10 PROPOSED BASEMENT CONSTRUCTION METHODOLOGY

10.3 Construction Sequence Methodology

The proposed sequence of construction has been outlined in Appendix 3.

10.4 Structural Stability Principles

The initial works to the site consist of underpinning the foundations to the adjoining building and retained facades. These will be taken down to formation level for the new lower ground floor or basement. Façade retention frames will be erected externally to the east and south elevations. The adjoining building to the north is assumed self-supporting and not in need of temporary support during demolition. This will be verified on site prior to demolition.

With underpinning and façade retention in place, demolition of the existing building can commence down to the existing ground floor/lower ground floor level.

Thrust block foundations will be excavated and cast remote from building boundaries.
These will be used as foundations for the props to the trench sheeting which will be used to support excavations.
The basement level to the rear 1/3rd is approximate 5m below existing ground. From the site investigation ground water should not be present during excavation. The wailers and props used to support the trench sheeting will be adjusted as the excavation proceeds.

The lower level basement to the rear will be constructed as a concrete box with external and internal waterproofing. Claymaster or similar will be used behind the wall to limit movement from lateral clay heave.

The retaining walls necessary for the lower ground floor are predominately light well walls external the building footprint. These will be designed and constructed as unpropped cantilevered retaining walls. Sliding of the wall base can be prevented by the main building foundations. Underpinning to the building façade wall will be excavated to below the retaining wall foundations.

Throughout the Underpinning, demolition, excavation and construction phases movement of the building and surrounding structures will be monitored using reflective targets. The frequency of the readings will increase and decrease depending of the risk level associated with the activity.
The new framed building will be connected to the retained structures with vertical slide connector to allow for differential movement.

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11 ASSESSMENT OF ADVERSE EFFECTS

The impact assessment concluded that the construction of the basement is unlikely to impact upon the hydrogeology and hydrology of the site, and does not pose a flooding risk from any source.
The Clay heave associate London clay will be allowed for behind retaining walls with the use of a suitable clay master product. The lower basement will be checked for the effects of heave and the basement reinforced raft will be designed to resist any ground heave.

The impact assessment identified lateral ground movements associated with the excavation of the basement as a potential adverse effect of the basement construction. To control this and mitigate any damage associated with the basement excavation, a method of construction was recommended.

The proposed construction methodology is outlined in Appendix 3 RWA London Proposed Basement Construction Sequence as well as previously in Section 10.2. It should be noted that this conforms to the recommendations outlined by JAL in BIA report P1135J1199. Furthermore, temporary propping shall be provided to laterally support existing structures, which shall be design by the Temporary Works Contractor and reviewed by RWA London. The temporary works, correctly design and installed, should limit damage to cosmetic cracking, corresponding to a Burland Scale category of 0 to 1.

12 AREAS OF FURTHER INVESTIGATION

The following list is a summary of the information requiring investigation subsequent to the completion of the Basement Impact Assessment:

- Main contractor to undertake pre-condition survey of adjacent structures
- Main contractor to investigate methods for monitoring the movement of adjacent structures during construction, as well as any pre-existing cracks detected as part of the pre-condition survey
- Temporary works contractor to design works to mitigate the lateral ground movements

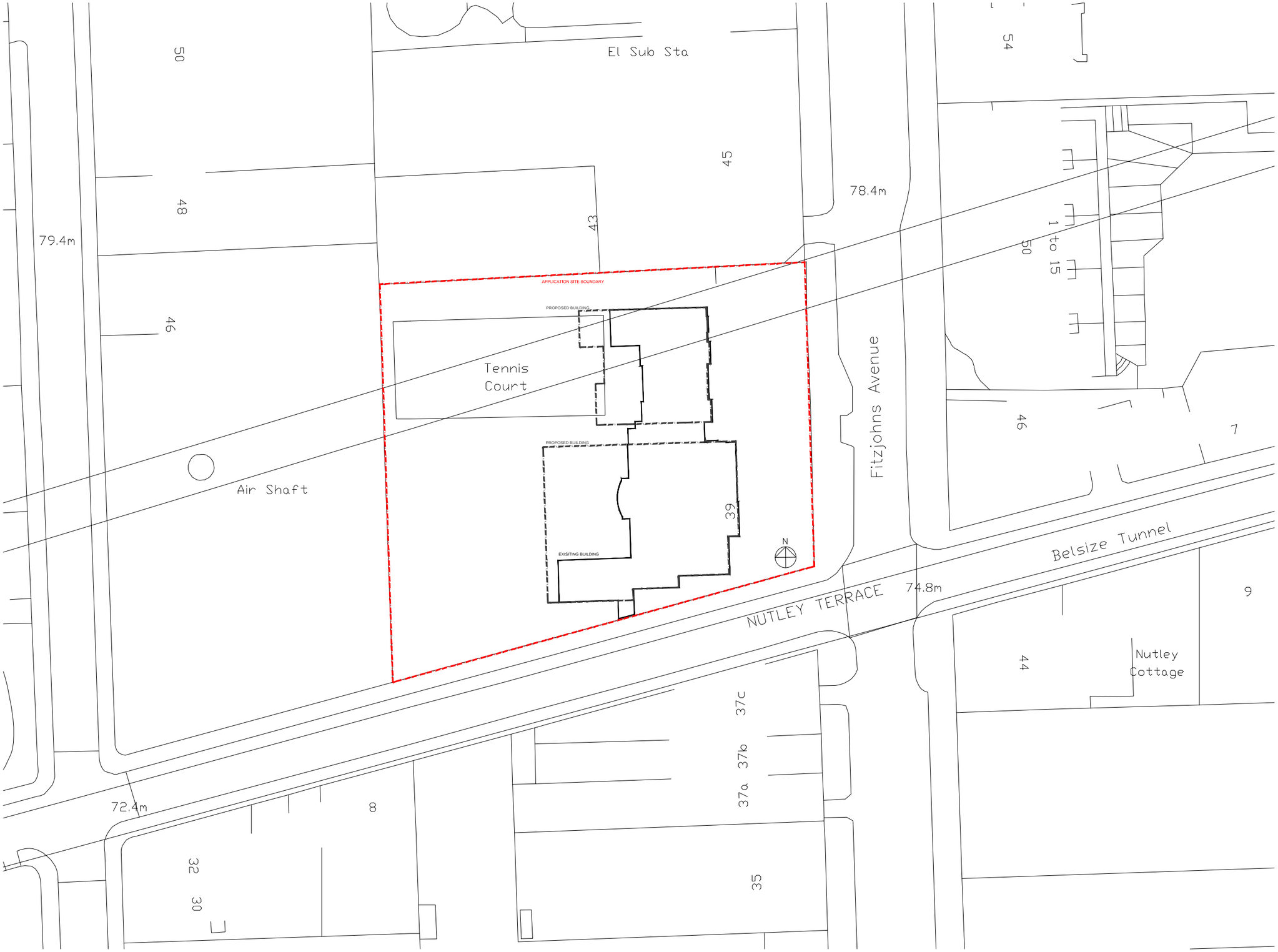
All works designed by contractors to be reviewed by RWA prior to implementation.

During the course of the desktop study and site investigation, information was obtained such that a Ground Movement Assessment can be undertaken. Because of the methods proposed to construct the basement, ground movements should be limited to localised heaving within the footprint of the basement, and deflection of the retaining walls which will be controlled by temporary propping and appropriate design limits in the permanent case.
Due to the localised and controlled nature of the ground movements, a Ground Movement Assessment has not been undertaken. However; if during the audit process it is decided that a Ground Movement Assessment is necessary, it can be undertaken.

13 CONCLUSION

An assessment of the impact of the proposed basement construction has been carried out and indicates that there will be no geological, hydrological or hydrogeological impact as a result of its construction. Lateral ground movements as a result of excavation of the basement shall be mitigated through the use of temporary propping and the implementation of the recommended construction methodology outlined within the impact assessment.

APPENDIX 1 – CH + MRP Architectural drawings



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PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Location site Plan

CH+MRP ARCHITECTS
41-42 FOLEY STREET, LONDON W1W 7TS
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www.ch-architects.com / www.mrpartnership.co.uk

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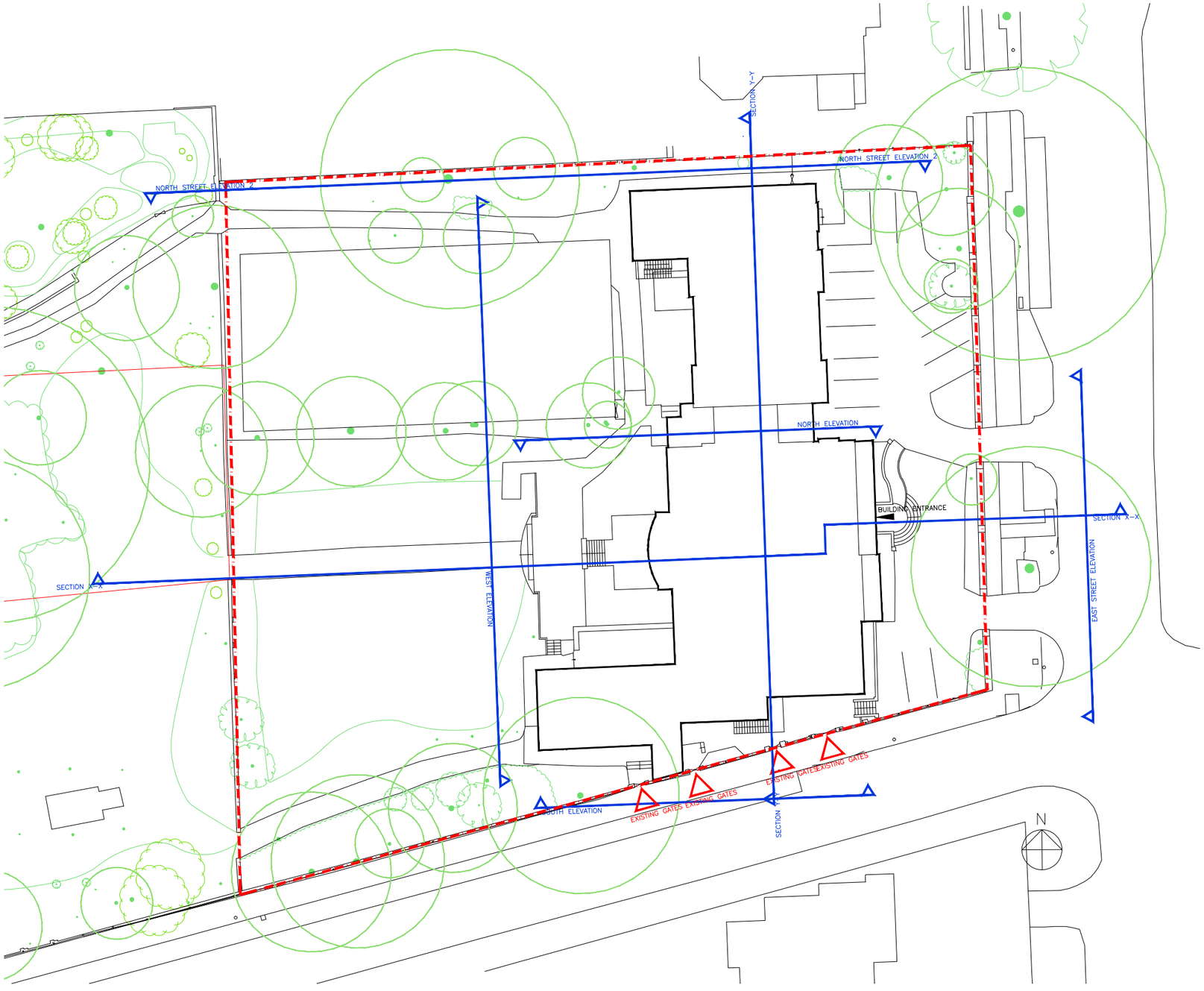

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PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Existing
Site Plan

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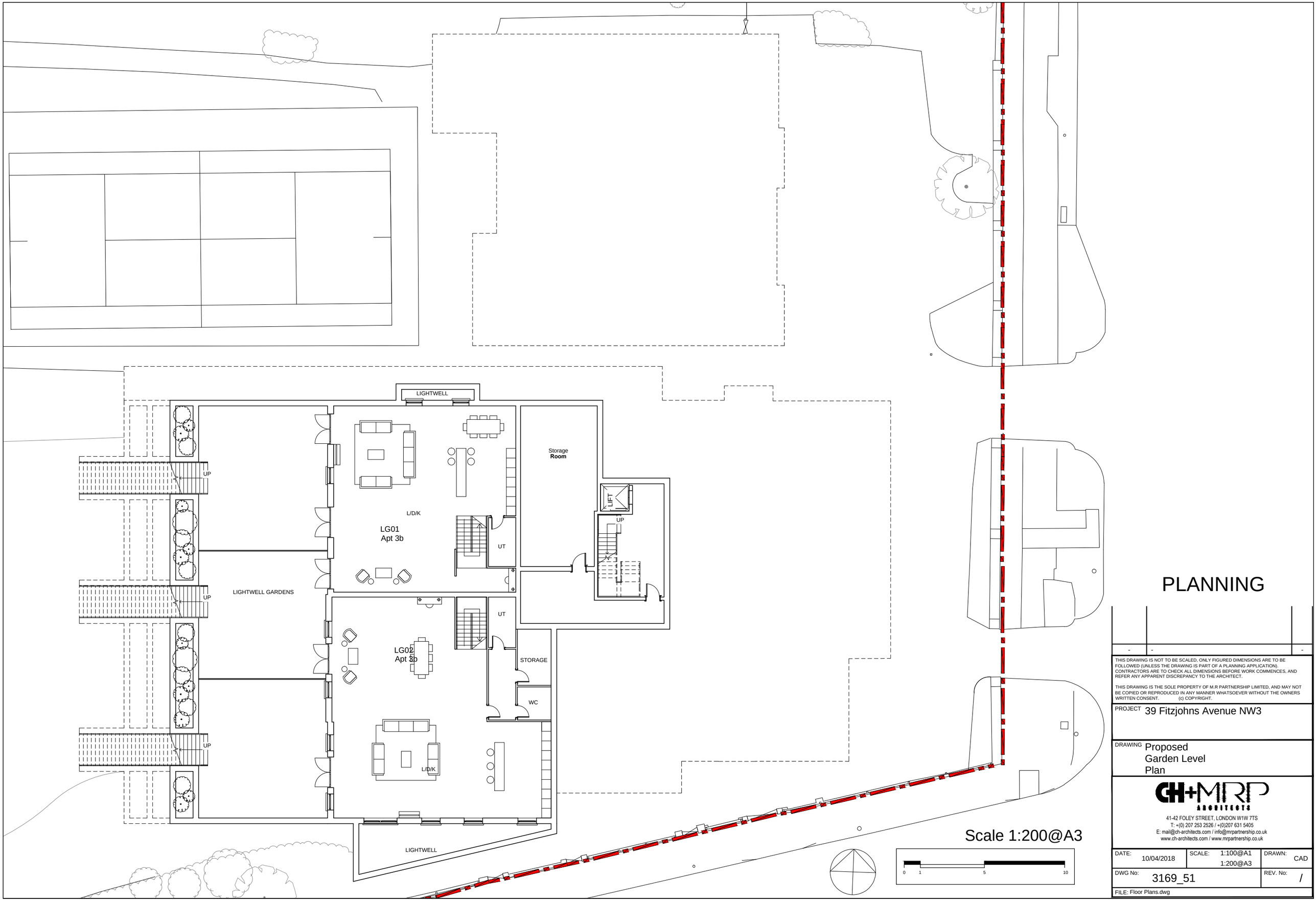

PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Garden Level Plan

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41-42 FOLEY STREET, LONDON W1W 7TS
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DATE:	SCALE:	DRAWN:
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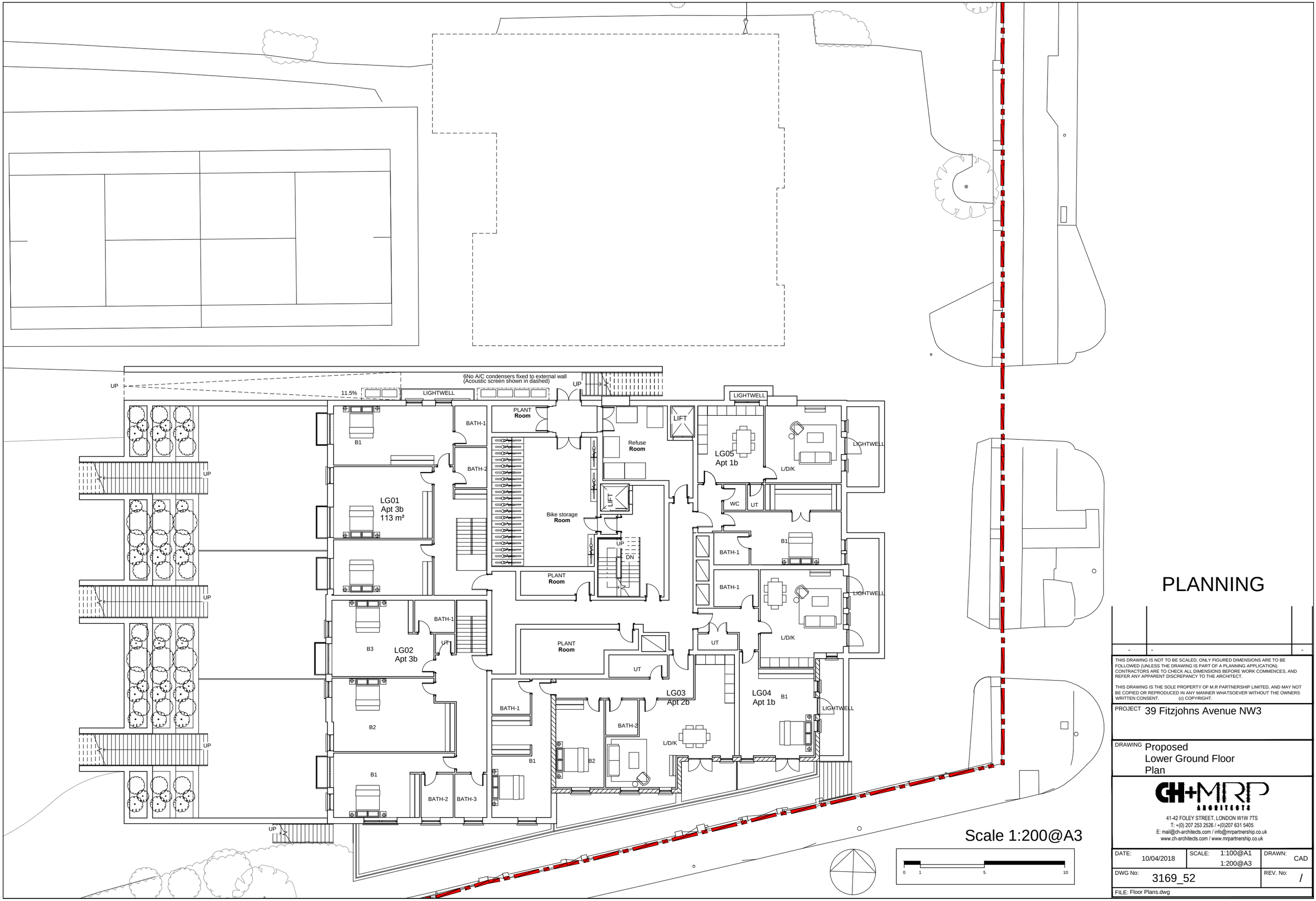

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Lower Ground Floor Plan

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PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Raised Ground Floor Plan

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed First Floor Plan

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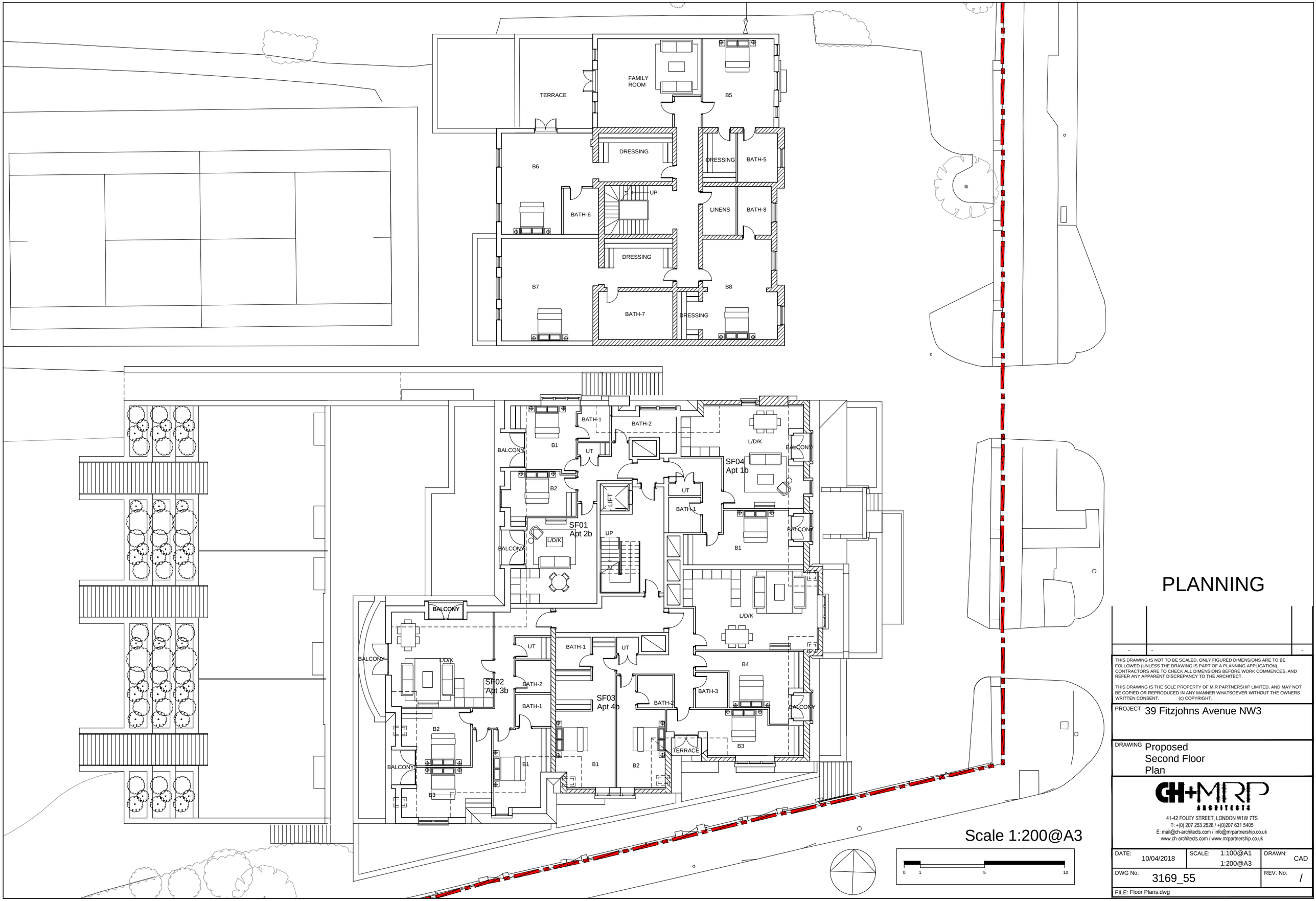

PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Second Floor Plan

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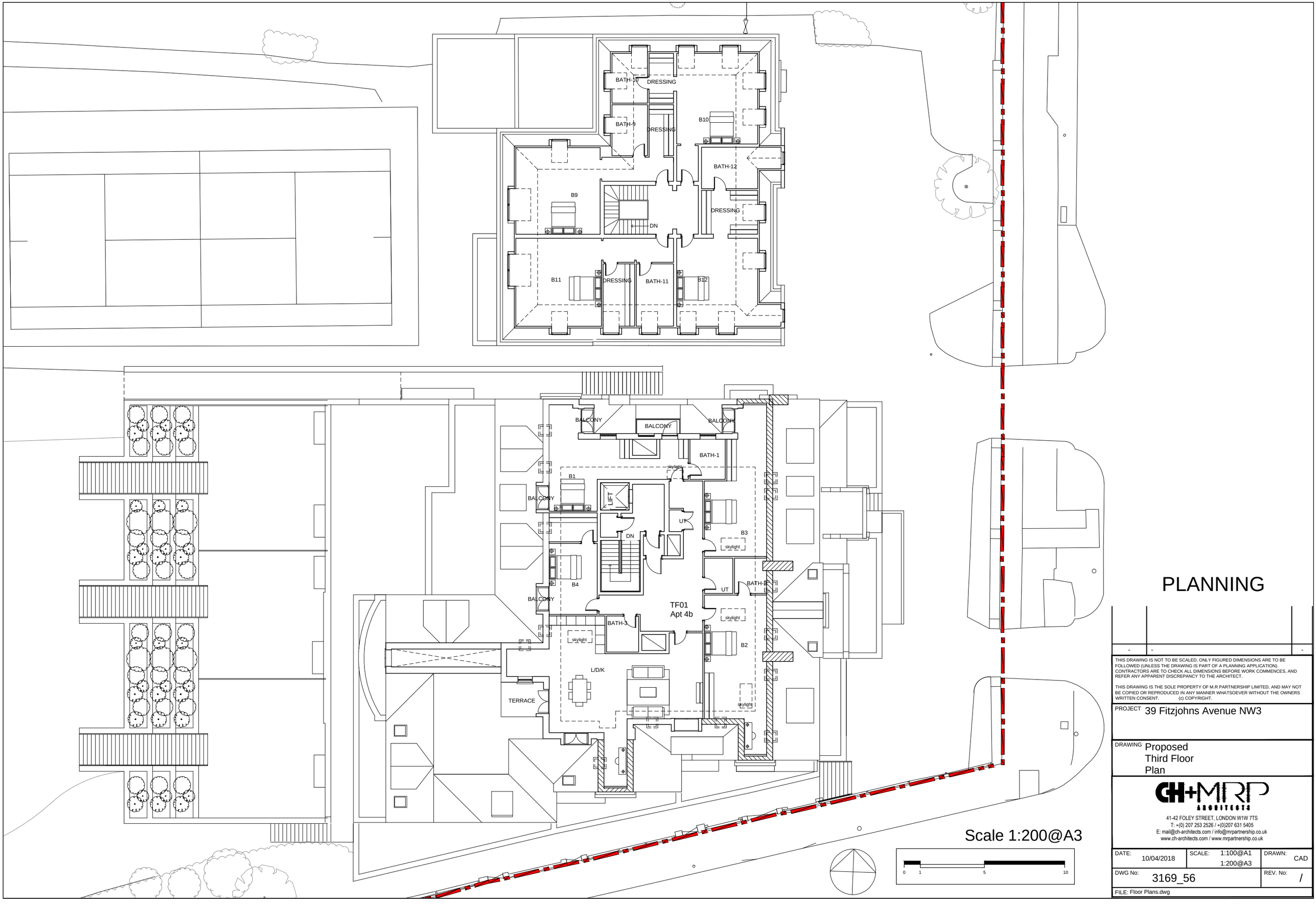

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Third Floor Plan

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CHIMNEY

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CHIMNEY

CHIMNEY

CHIMNEY

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0 1 5 10

PLANNING

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PROJECT 39 Fitzjohns Avenue NW3

DRAWING Proposed Roof Level Plan

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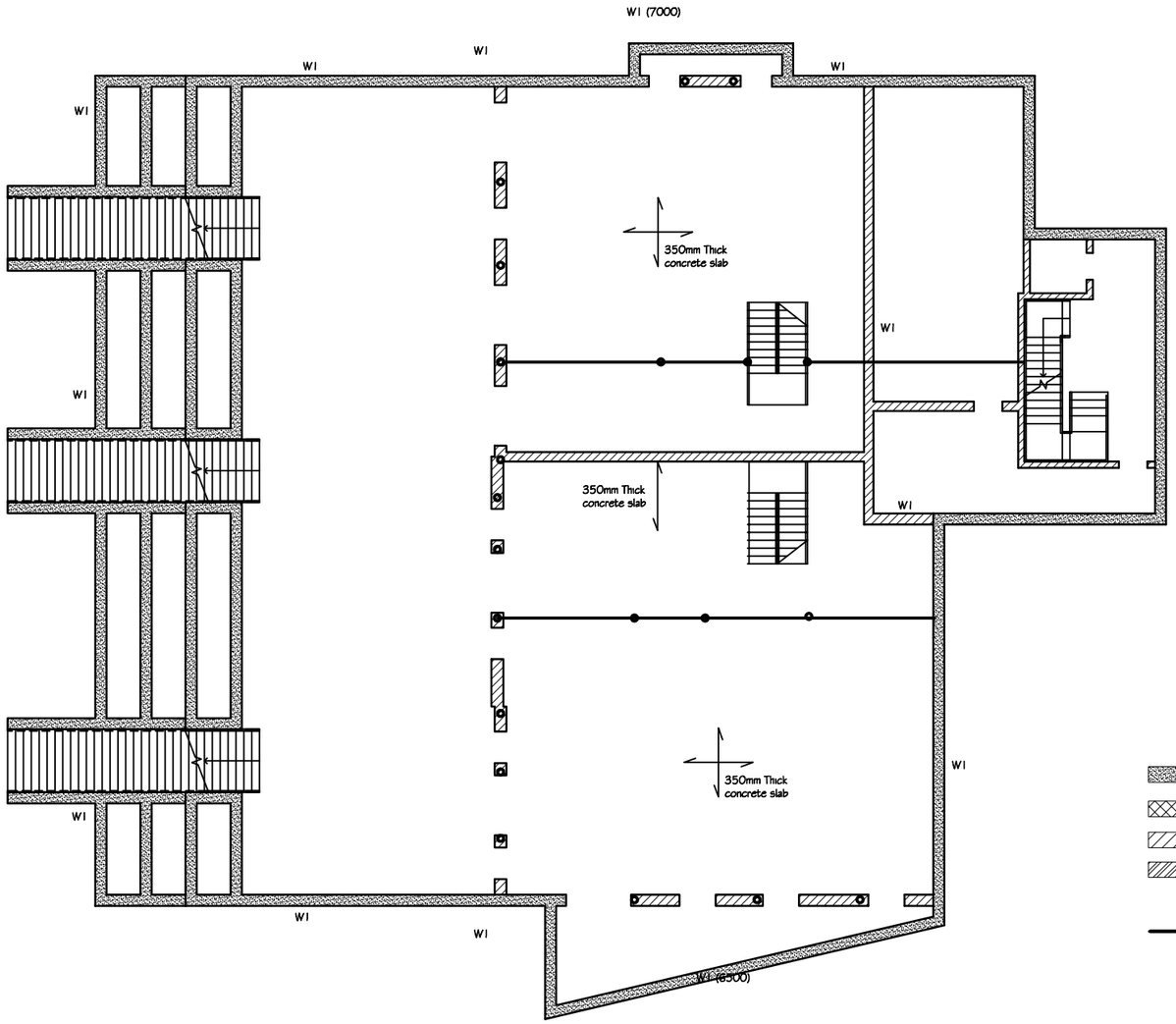
APPENDIX 2 – RWA Structural scheme



Level -02 (FFL -7.00)
Basement
Scale 1:100

NOTES

1. This drawing to be read in conjunction with all relevant Architects, Engineers an specialists drawings, details and specifications.
2. Do not scale from this drawing
3. All dimensions in millimeters
4. Scale 1:100 unless noted otherwise
5. For general notes refer to drg No. 3686-0--

Key

- W1 = 450mm Thick R.C Retaining wall (Maximum retained height = 7000mm)
- W2 = 300mm Thick R.C (Retaining) wall under pin to formation @ -3.5m.
- W3 = 200mm Thick concrete wall.
- Retained masonry wall.
- Indicative steel column position.
- Indicative steel beam position.
- Raft base 450mm.

Rev	Date	
A	17-04-2018	Updated to suit new Architect Layout
-	14-02-2018	Information Issue

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General Arrangement
Level -02 Garden Level Plan

3686 26 A

NOTES

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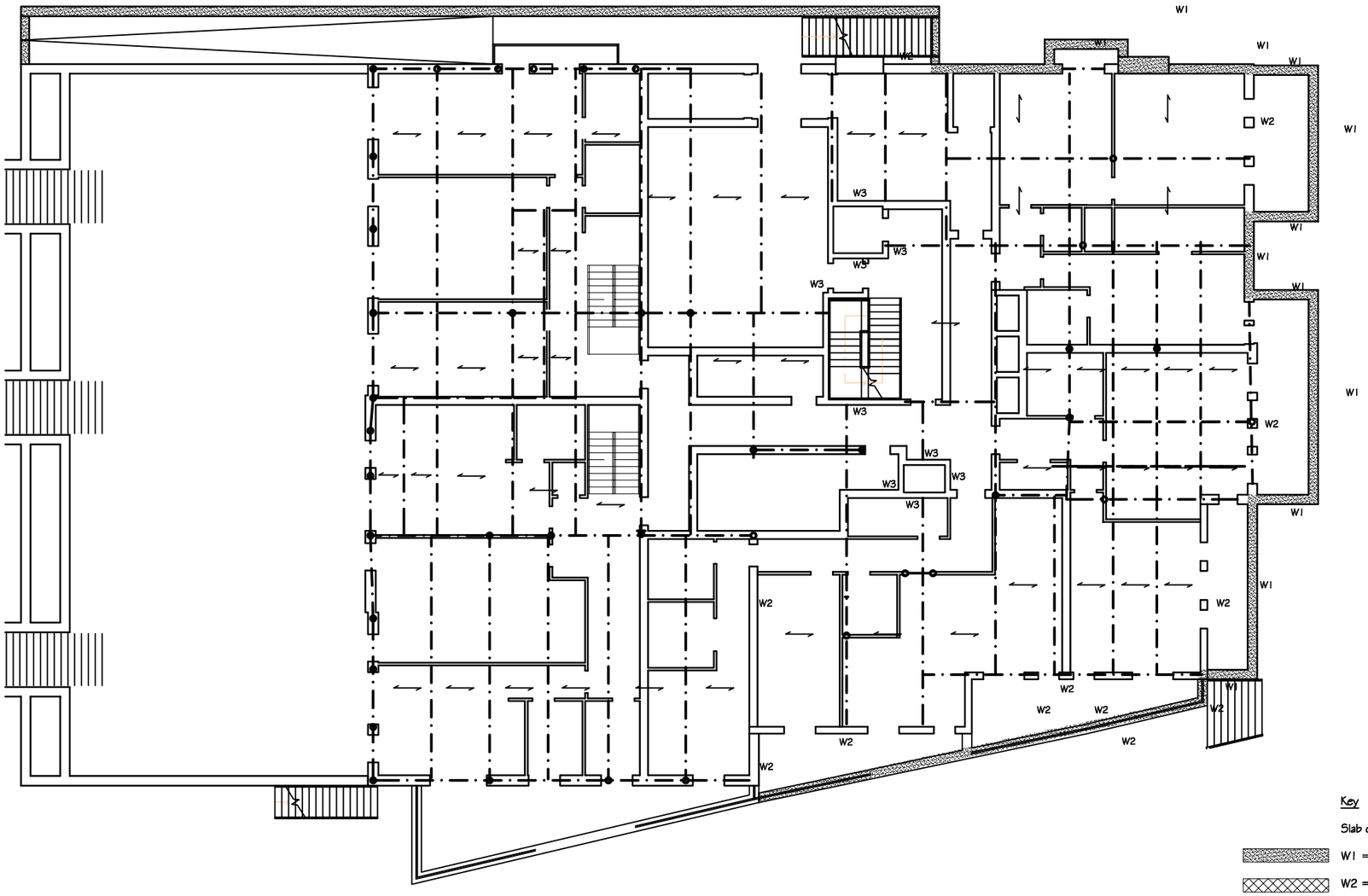
3. All dimensions in millimeters
4. Scale 1:100 unless noted otherwise
5. For general notes refer to drg No. 3630-012



Level -01 (FFL -3.50)
Scale 1:100

Key

Slab over =350mm Thick concrete slab.

W1 = 450mm Thick R.C Retaining wall (Maximum retained height = 7000mm)

W2 = 300mm Thick R.C (Retaining) wall under pin to formation @ -3.5m.

W3 = 200mm Thick concrete wall.

Retained masonry wall.

Indicative steel column position.

Indicative steel beam position.

Comfloor concrete slab span.

Structural under (Not shown)
Either as detailed on drg No
3686-26 or R.C Raft slab.

Rev	Date	
A	17-04-2018	Updated to suit new Architect Layout
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General Arrangement
Level -01 Lower Ground Floor Plan

3686 27 A

NOTES

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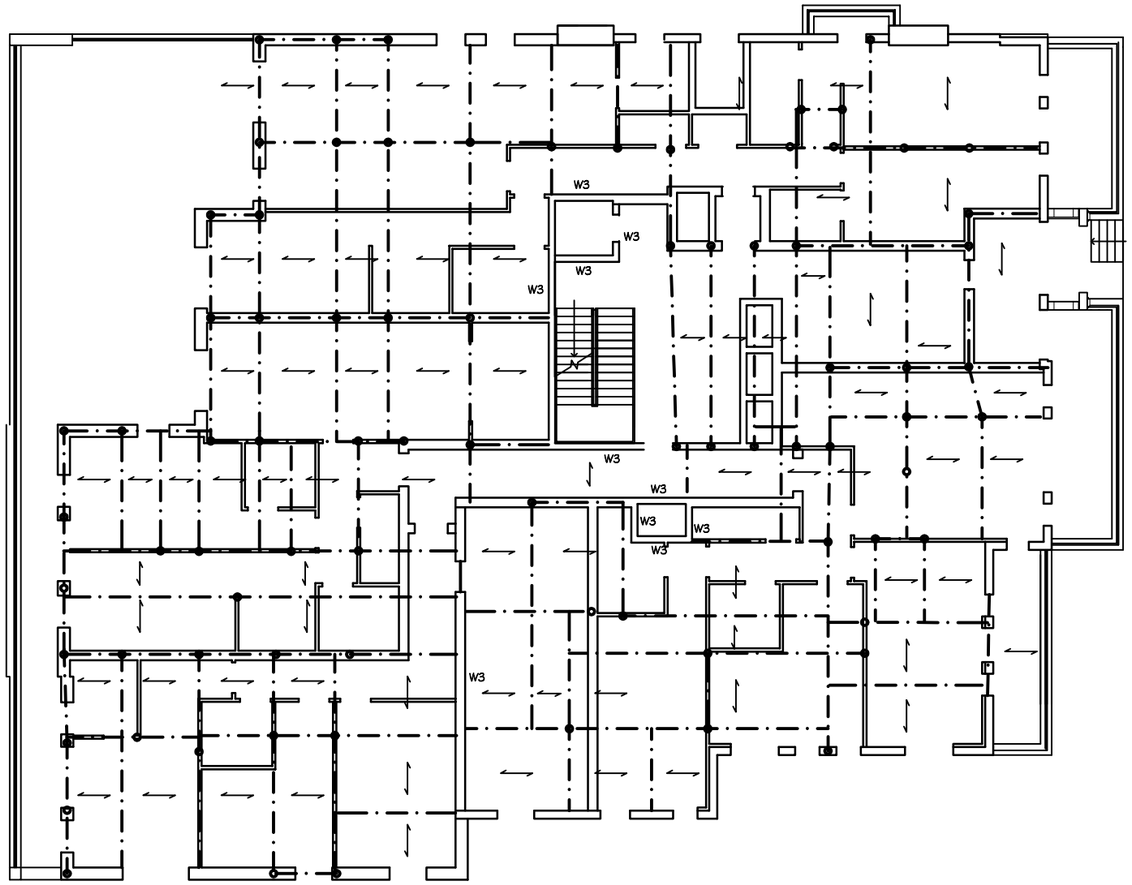
5. For general notes refer to drg No. 3630-012



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W1 = 450mm Thick R.C Retaining wall (Maximum retained height = 7000mm)

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W3 = 200mm Thick concrete wall.

Retained masonry wall.

Indicative steel column position.

Indicative steel beam position.

Comfloor concrete slab span.

Structural under (Not shown)
Either as detailed on drg No
3686-26 or R.C Raft slab.

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General Arrangement
Level 00 Raised Ground Floor Plan

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NOTES

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3. All dimensions in millimeters
4. Scale 1:100 unless noted otherwise
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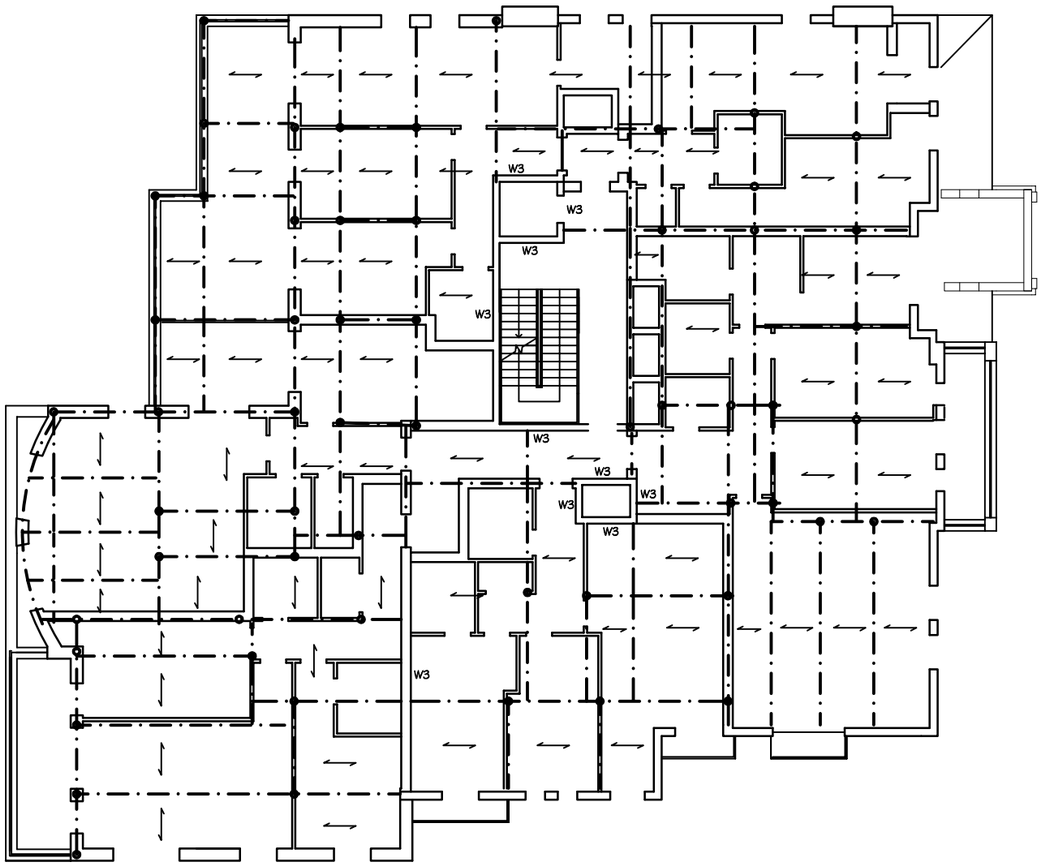

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W2 = 300mm Thick R.C (Retaining) wall under pin to formation @ -3.5m.

W3 = 200mm Thick concrete wall.

Retained masonry wall.

Indicative steel column position.

Indicative steel beam position.

Comfloor concrete slab span.

Structural under (Not shown)
Either as detailed on drg No 3686-26 or R.C Raft slab.

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General Arrangement
Level +01 Plan

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NOTES

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2. Do not scale from this drawing
3. All dimensions in millimeters
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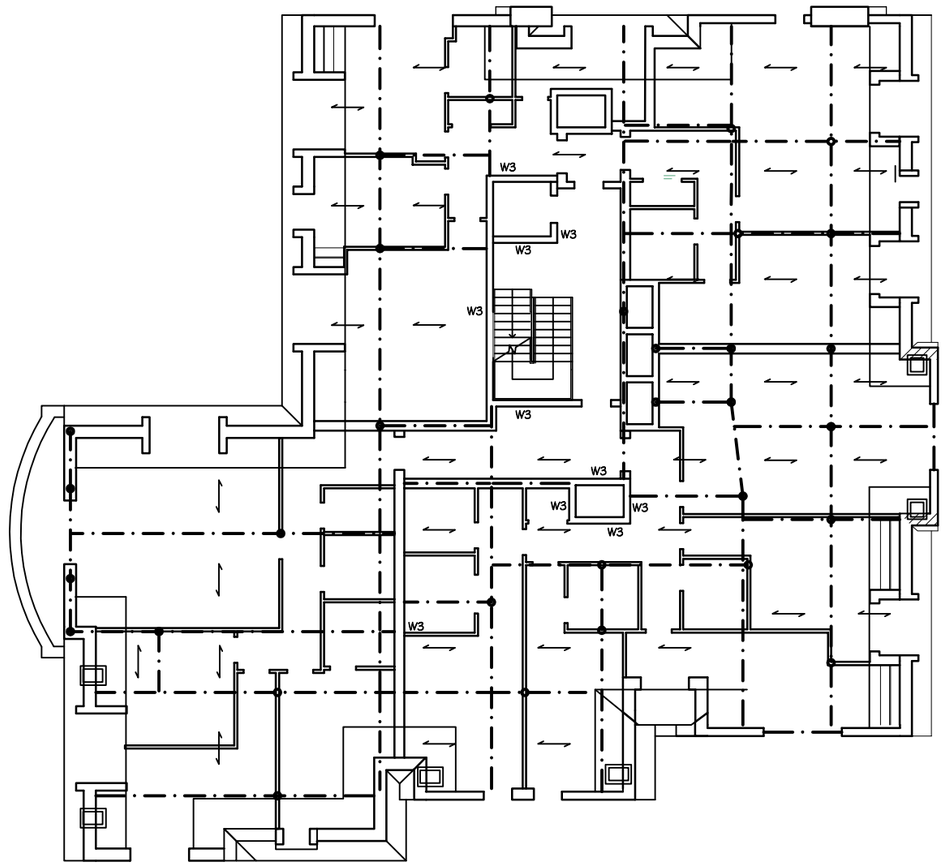

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W1 = 450mm Thick R.C Retaining wall (Maximum retained height = 7000mm)

W2 = 300mm Thick R.C (Retaining) wall under pin to formation @ -3.5m.

W3 = 200mm Thick concrete wall.

Retained masonry wall.

Indicative steel column position.

Indicative steel beam position.

Comfloor concrete slab span.

Structural under (Not shown)
Either as detailed on drg No
3686-26 or R.C Raft slab.

Rev	Date	
A	17-04-2018	Updated to suit new Architect Layout
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General Arrangement
Level +02 Plan

3686 30 A

NOTES

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2. Do not scale from this drawing
3. All dimensions in millimeters
4. Scale 1:100 unless noted otherwise
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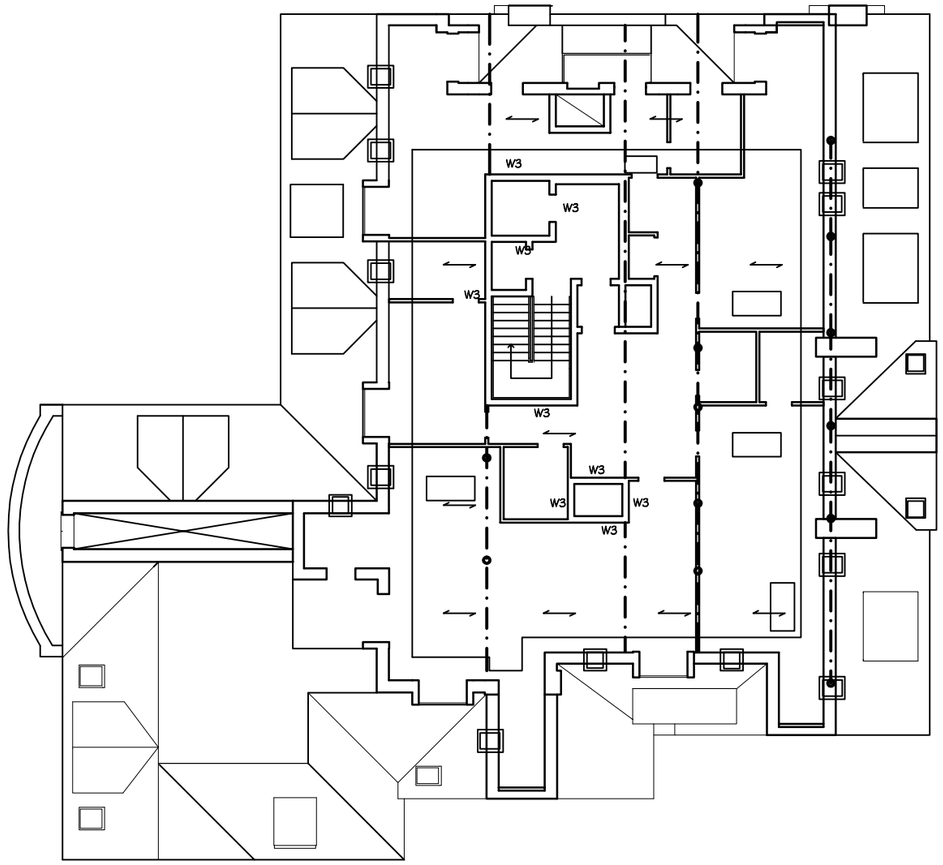

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W3 = 200mm Thick concrete wall.

Retained masonry wall.

Indicative steel column position.

Indicative steel beam position.

Comfloor concrete slab span.

Structural under (Not shown)
Either as detailed on drg No
3686-26 or R.C Raft slab.

Rev	Date	
A	17-04-2018	Updated to suit new Architect Layout
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General Arrangement
Level +03 Plan

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NOTES

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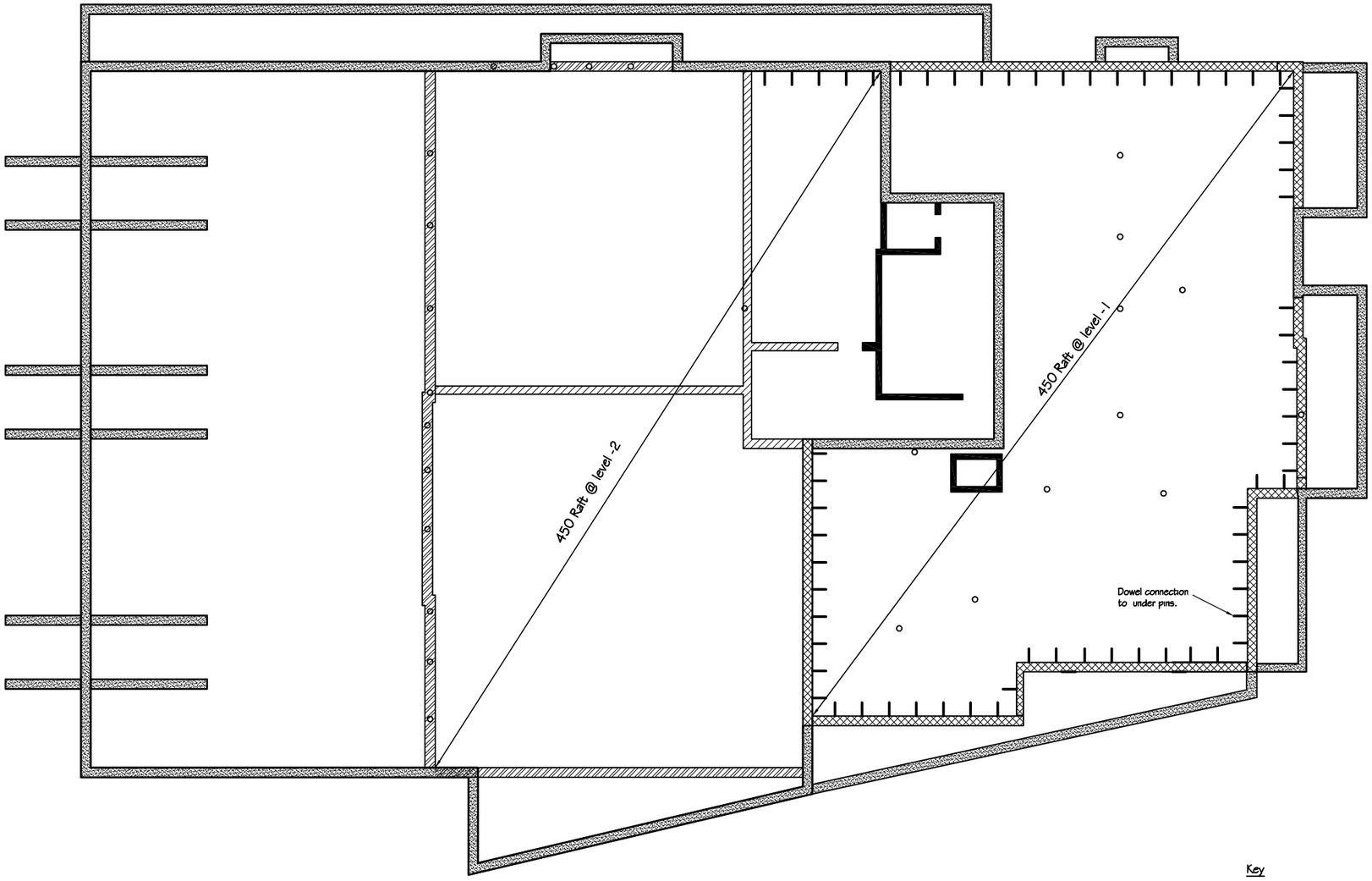
2. Do not scale from this drawing
3. All dimensions in millimeters
4. Scale 1:100 unless noted otherwise
5. For general notes refer to drg No. 3686-0--



Foundation Plan
Scale 1:100

Key

- 450mm Thick R.C Retaining wall
- 300mm Thick R.C (Retaining) wall under pin
- 200mm Thick concrete wall.
- Retained masonry wall.
- Indicative steel column position.

Rev	Date	
A	17-04-2018	Updated to suit new Architect Layout
-	14-02-2018	Information Issue

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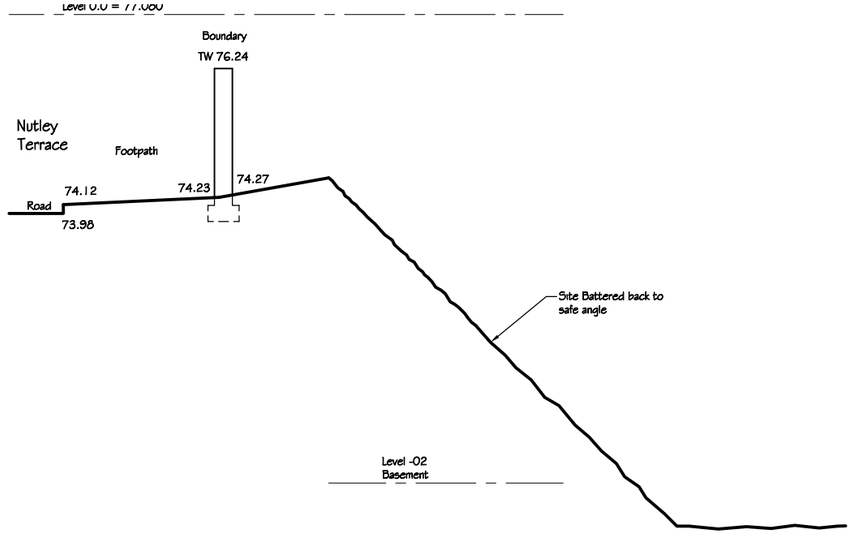
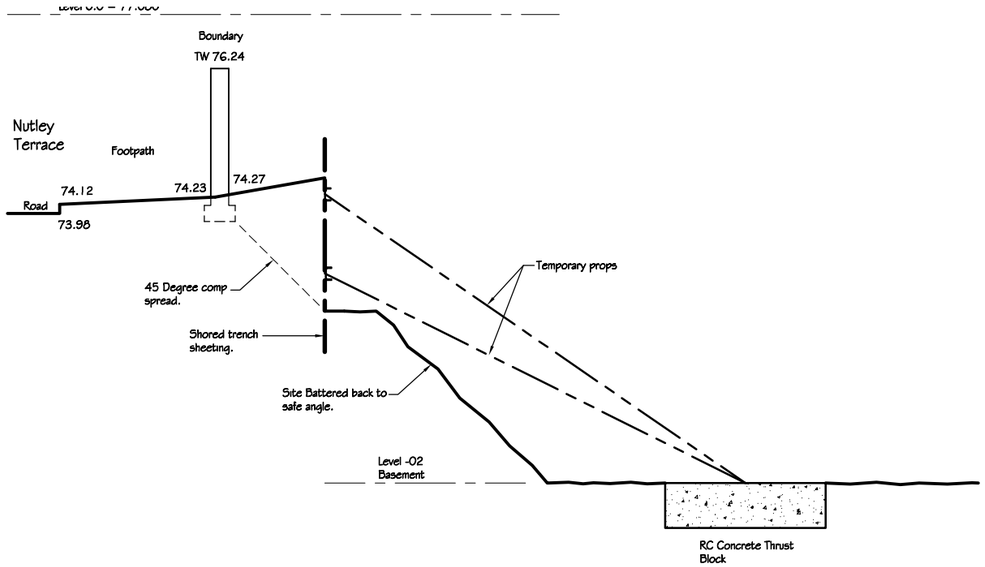
General Arrangement
Foundation Plan

3686 32 A

APPENDIX 3 – RWA LONDON PROPOSED BASEMENT CONSTRUCTION SEQUENCE DRAWINGS



Basement Construction Phase 1

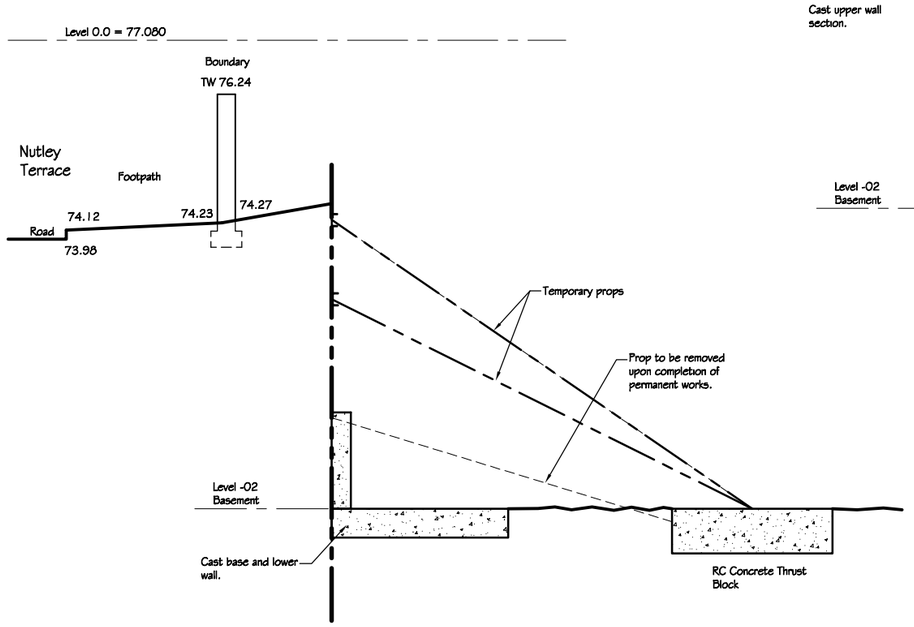


Basement Construction Phase 2

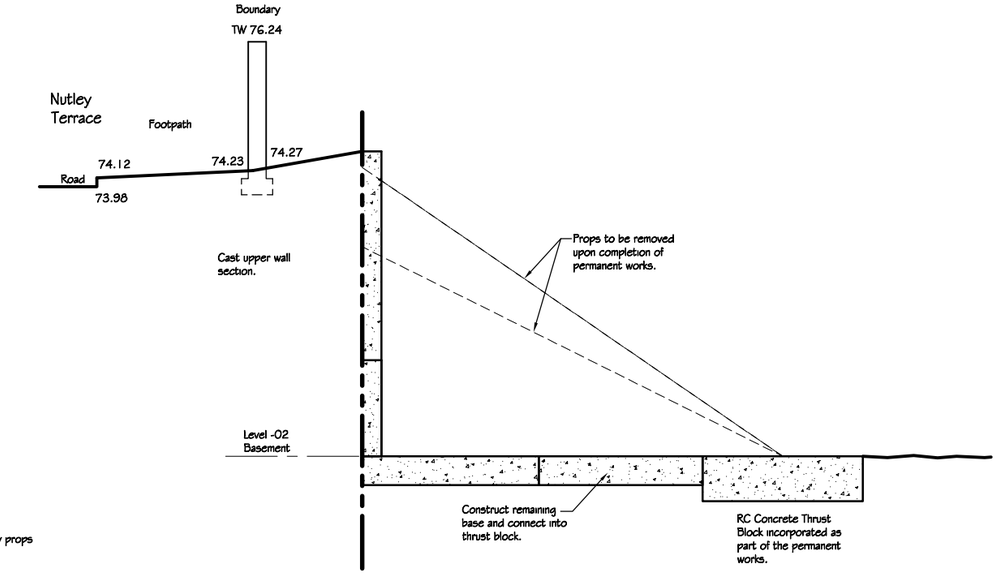
NOTES

1. This drawing to be read in conjunction with all relevant Architects, Engineers an specialists drawings, details and specifications.
2. Do not scale from this drawing
3. All dimensions in millimeters
4. Scale 1:50 unless noted otherwise

Basement Construction Phase 3



Basement Construction Phase 4



Basement Construction Phase 5

Rev	Date	
-	14-02-2018	Information Issue

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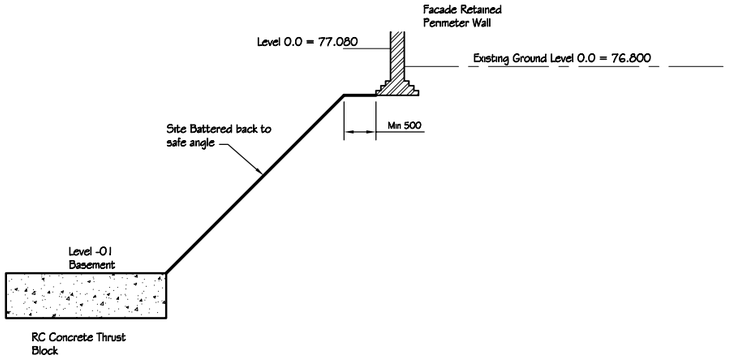
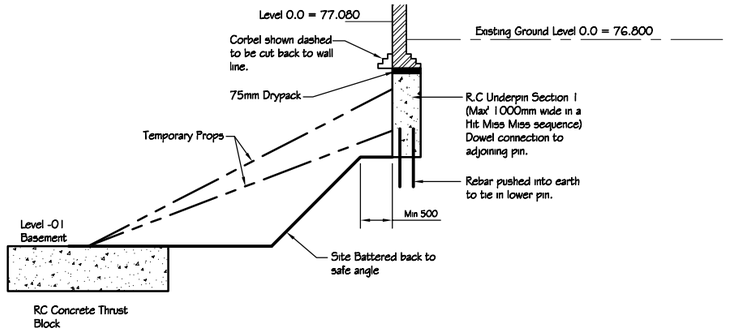
Phase Basemen Construction
Sheet 1

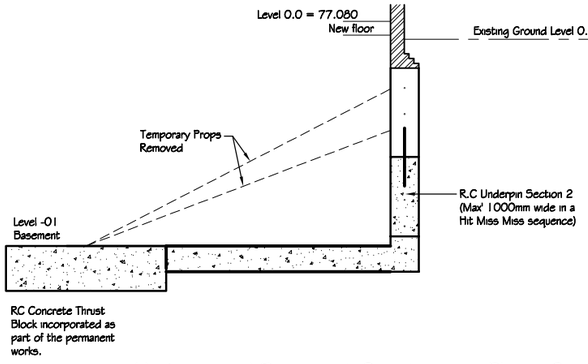
3686 19 -



Underpinned Basement Construction Phase 1



Underpinned Basement Construction Phase 2



Underpinned Basement Construction Phase 3

NOTES

1. This drawing to be read in conjunction with all relevant Architects, Engineers an specialists drawings, details and specifications.
2. Do not scale from this drawing
3. All dimensions in millimeters
4. Scale 1:50 unless noted otherwise

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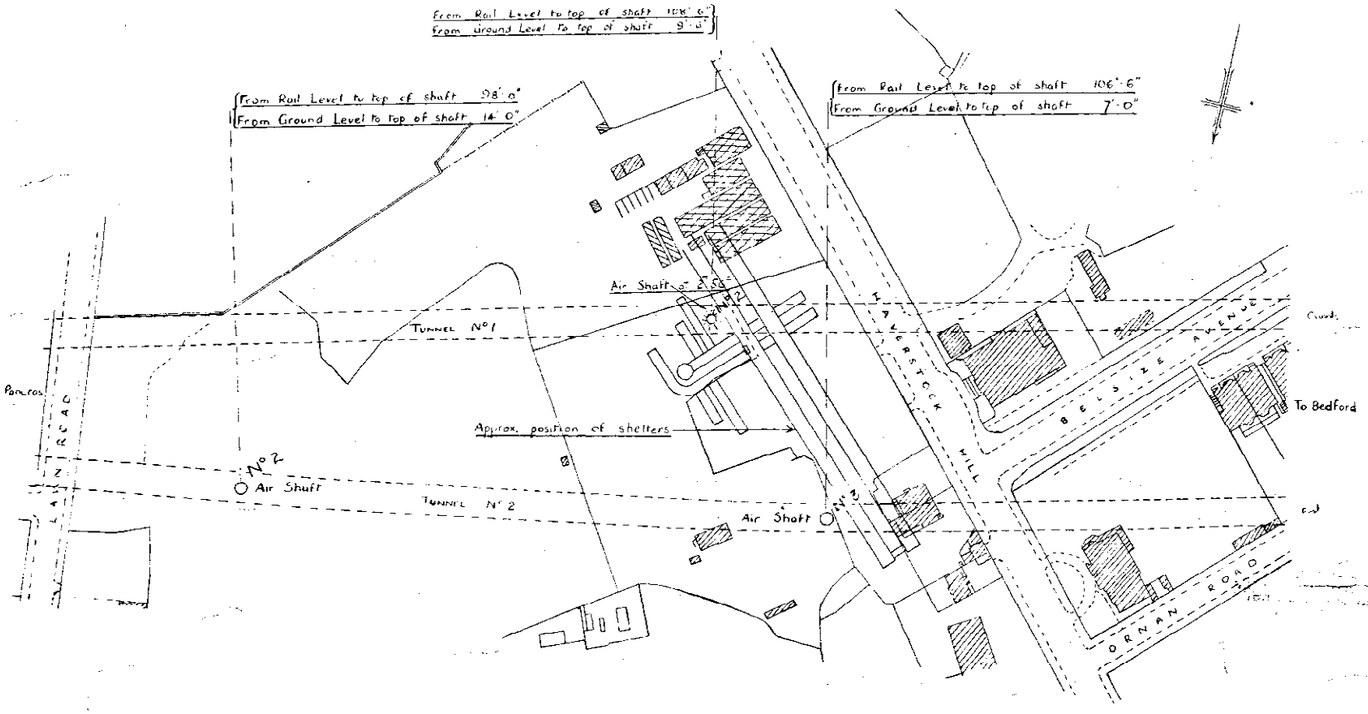
Sheet 2

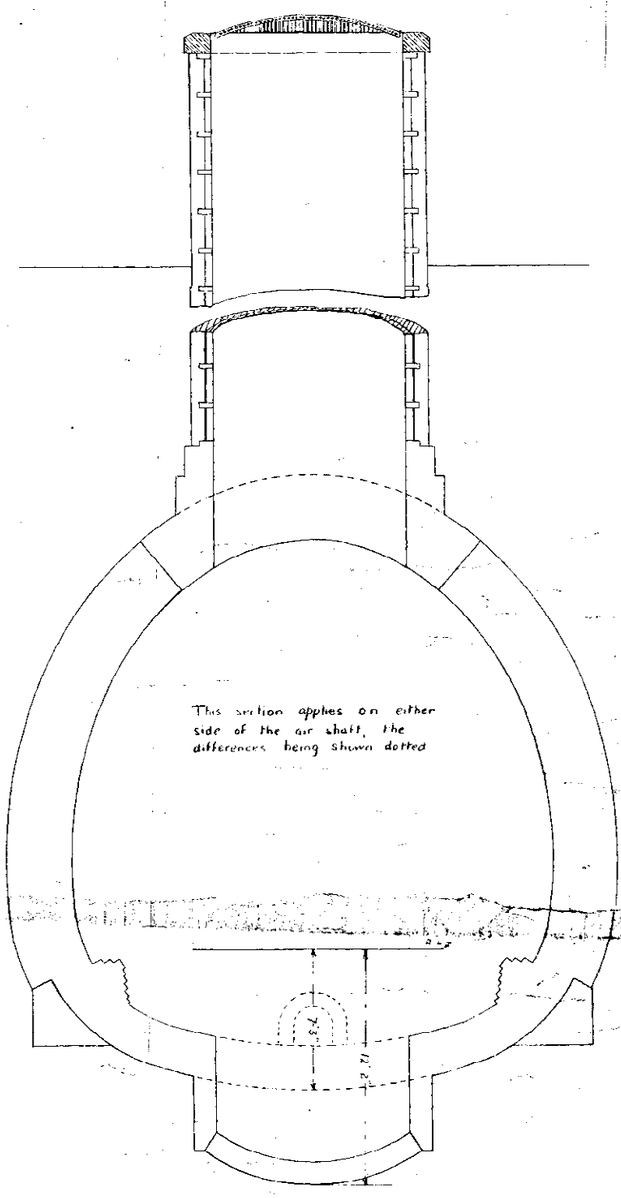
3686 20 -

APPENDIX 4 – NETWORK RAIL RECORD INFORMATION

L.M.& S.R. — Belsize Tunnel No 1



Scale — 88 Feet to an Inch



— Section of Shaft No 2 — (Tunnel No 1)

Scale — 4 Feet to an Inch

London District Engineer's Office
London.
Plan No. 142/61
Date

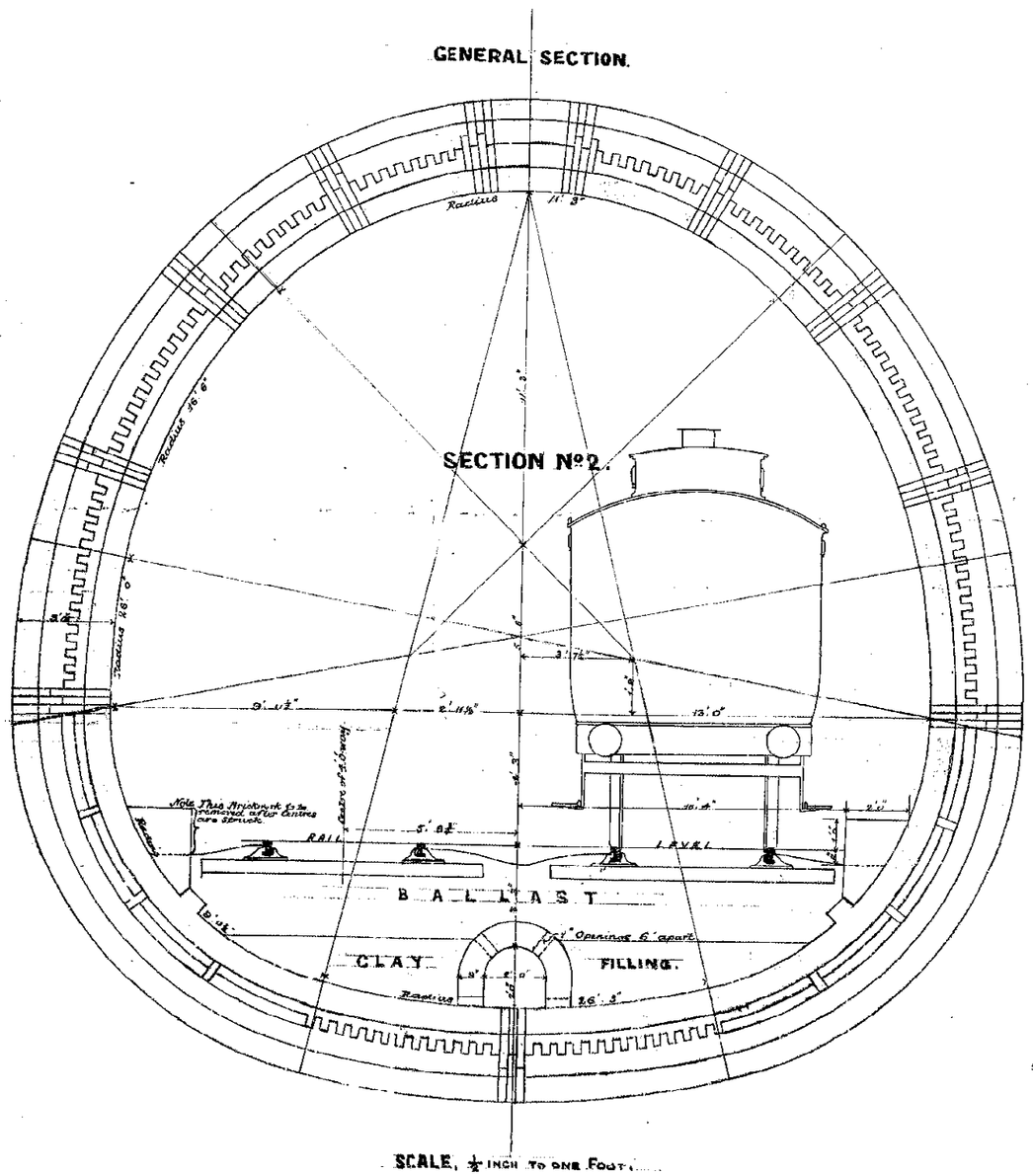
BOOK 1t

M. Ry BELSIZE SECOND TUNNEL.

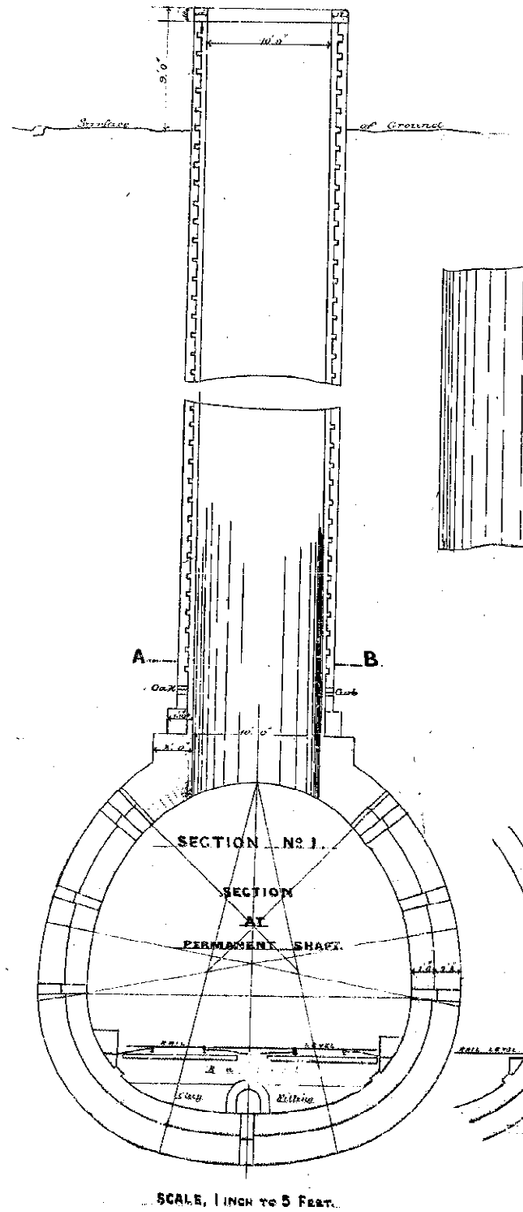
3056023

Passenger Channel — Bridge No. 29.

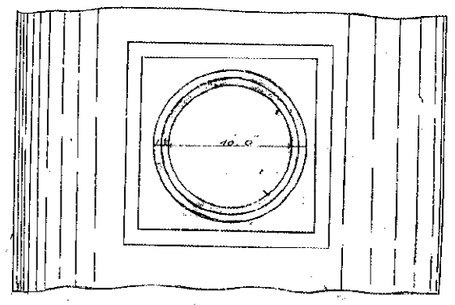
GENERAL SECTION.

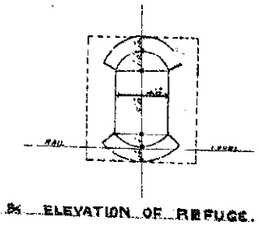


SCALE, ½ INCH TO ONE FOOT.



SECTION ON LINE A.B.





SECTION & ELEVATION OF REFUGE.

SCALE, 1 INCH TO 5 FEET.

Derby May 25 1898

BOC 109

ASPRO

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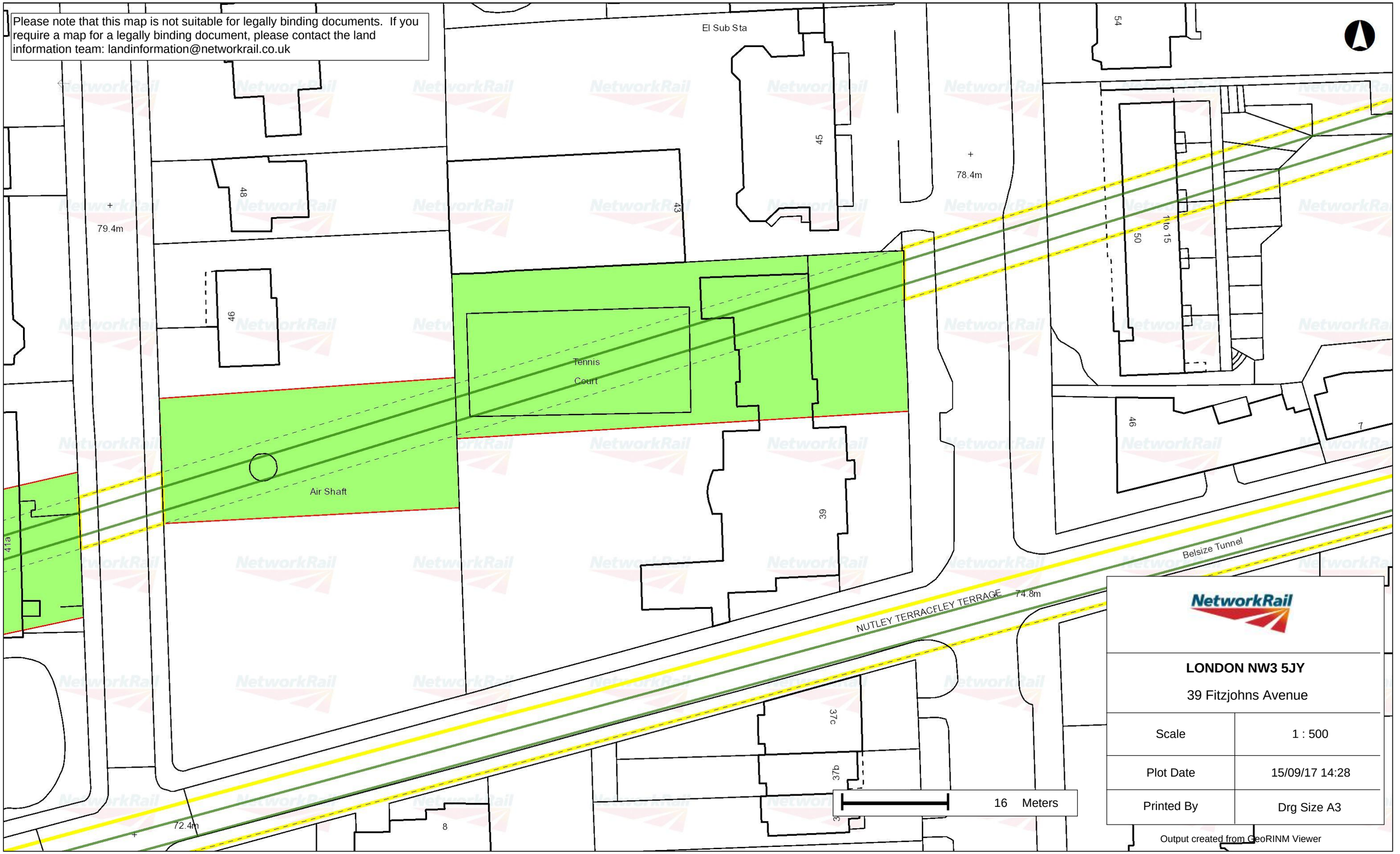

LONDON NW3 5JY

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Scale	1 : 500
Plot Date	15/09/17 14:28
Printed By	Drg Size A3

Output created from GeoRINM Viewer