Basement Impact Assessment

Site | 13-15 Johns Mews
London
WC1N 2PA

Client | JM13 Ltd
Date | July 2017
Our Ref | BIA/9149

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Foreword

This report has been prepared in accordance with the scope and terms agreed with the Client, and the resources available, using all reasonable professional skill and care. The report is for the exclusive use of the Client and shall not be relied upon by any third party without explicit written agreement from Chelmer Site Investigations Laboratories Ltd.

This report is specific to the proposed site use or development, as appropriate, and as described in the report. Chelmer Site Investigations Laboratories Ltd. accept no liability for any use of the report or its contents for any purpose other than the development or proposed site use described herein.

This assessment has involved consideration, using normal professional skill and care, of the findings of ground investigation data obtained from the Client and other sources. Ground investigations involve sampling a very small proportion of the ground of interest as a result of which it is inevitable that variations in ground conditions, including groundwater, will remain unrecorded around and between the exploratory hole locations; groundwater levels/pressures will also vary seasonally and with other man-induced influences; no liability can be accepted for any adverse consequences of such variations.

This report must be read in its entirety in order to obtain a full understanding of our recommendations and conclusions.

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1.0 INTRODUCTION

1.1 This report presents the outcome of a Basement Impact Assessment (BIA) for the proposed development of 13-15 John's Mews, London WC1N 2PA. The local planning authority is the London Borough of Camden.

1.2 Chelmer Site Investigation Laboratories Ltd (Chelmer) was instructed in May 2017 by Shaun Counihan to complete this report. The report has been prepared by Joel Slater BEng, and reviewed by Dr Martin Preene BEng PhD CEng FICE CGeol FGS CSci CEnv C.WEM FCIWEM. Dr Preene is a UK Registered Ground Engineering Adviser with 30 years' experience of geotechnical engineering.

1.3 This report presents a BIA that is compliant with Camden Borough CPG4 planning document (July 2015). As required by the CPG4, screening flow charts covering the three main issues (surface flow and flooding, land stability and groundwater flow) have been provided in Appendix A.

1.4 The BIA aims to identify any detrimental impacts the proposed basement may have to the local area or neighbouring properties through its potential impacts to surface water, groundwater and ground movement. This has been performed by using the Stage 1 Screening assessment set out in CPG4 and completing the screening flow charts in Appendix A. Where Stage 1 identifies potential impacts these have been addressed in Appendix A, which refers to the relevant Conceptual Site Model sections in this report. The third stage of the BIA includes a site investigation and desk study; these are detailed in Section 3.0. The Conceptual Site Model, Section 4.0, evaluates the implications of the proposed development (Stage 4). Finally, a Ground Movement and Damage Category Assessment has been undertaken that identifies potential impacts to neighbouring properties (Stage 4).

1.5 The site comprises 13-15 John's Mews, London WC1N 2PA and is located at approximate Ordnance Survey grid reference (OSNGR) 530795E, 182060N. The site comprises two storey former mews houses which are currently configured as a single unit combining a garage, workshop and offices. At the rear of the building there is a single-storey section, beyond which are the gardens to No.'s 23 and 24 John Street. The site fronts directly onto the public footpath of John's Mews

1.6 It is to our understanding that the proposed development involves a roof extension, redevelopment of the single storey section to the rear and excavation of a basement level. Existing and proposed plans are presented in Appendix B.

1.7 A site inspection (walk-over survey) was undertaken on 19th August 2014 as part of the previous BIA by Chelmer, photos from which are presented in Appendix C. Desk study data have been collected from various sources including borehole/well logs from the vicinity of the site from the British Geological Survey (BGS) (Appendix D) and geological data, environmental data and historic maps from GroundSure which are presented in Appendix E. Relevant information from the desk study and site inspection is presented in Sections 2.0 and 3.0.

1.8 Ground investigations were undertaken by Chelmer (2014, 2015, 2016) between May and August 2014 and in August 2015; the findings are summarised in Section 3.0. The Factual Reports from the ground investigations are presented in Appendix F.

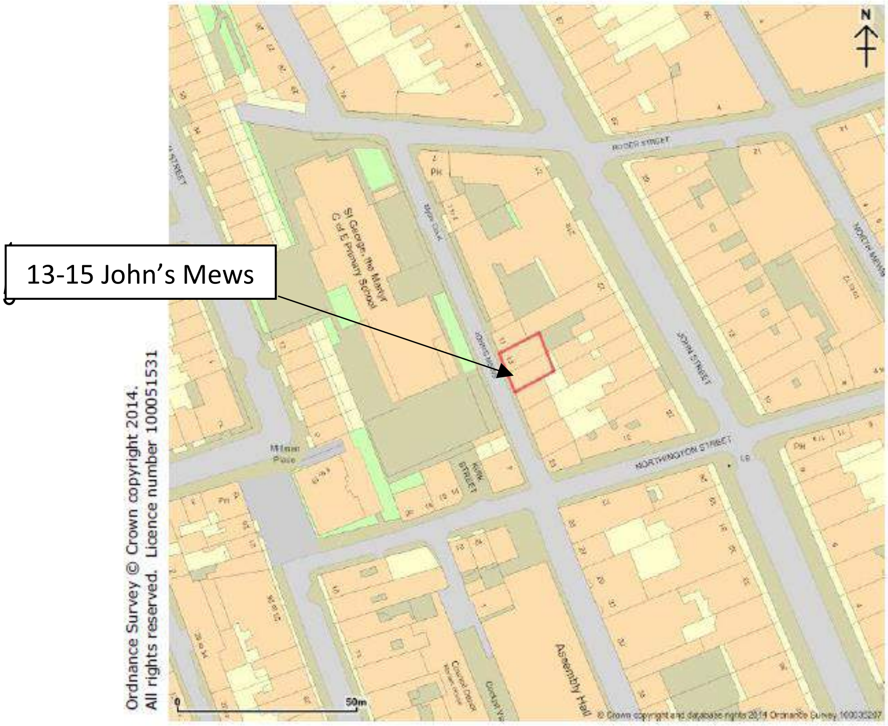
1.9 The following site-specific documents in relation to the proposed basement have been considered:

Barrett Mahony Structural Engineers

Drawing L14771-01-P2 (Proposed Lower Ground Floor Plan)
Drawing L14771-02-P2 (Existing and Proposed Ground Floor Plans)
Drawing L14771-03-P2 (Existing and Proposed First Floor Plans)
Drawing L14771-04-P2 (Existing and Proposed Second Floor Plans)
Drawing L14771-05-P2 (Proposed Roof Plan)
Drawing L14771-10-P2 (Full Height Sections A and B)
Drawing L14771-11-P2 (Sections Sheet 1)
Drawing L14771-12-P2 (Sections Sheet 2).

2.0 PROPERTY AND AREA DETAILS

2.1 The property is located in the centre of John's Mews, and is approximately 560 m northwest of Chancery Lane London Overground station. The site occupies an area of approximately



0 m^2 and is centred on approximate Ordnance Survey National Grid Reference 530795E, 182060N.

Figure 1. Site Location Plan (Extract from 1:1,250 OS map)

2.2 The site comprises 13-15 John's Mews, London WC1N 2PA two storey former mews houses which are currently configured as a single unit combining a garage, workshop and offices. At the rear of the building there is a single-storey section, beyond which are the gardens to No.'s 23 and 24 John Street that are approximately 1m higher than the floor level in No.'s 13/15. The property shares a party wall with No. 11 John's Mews (No. 11) to the north and No. 17 John's Mews (No. 17) to the south.

2.3 A site inspection (walk-over survey) was undertaken on 19th August 2014 as part of a previous BIA by Chelmer, photos from which are presented in Appendix C. Evidence of damp was visible in some of the walls, especially the 15/17 party wall. There was some broadly vertical cracking in the rear wall and a horizontal crack over No.13's garage door. Diagonal cracking in the front wall of No.11 suggested relative settlement of the 11/13 party wall.

2.4 The proposed development involves a roof extension, redevelopment of the single storey section to the rear and excavation of a basement level. Existing and proposed plans are presented in Appendix B.

2.5 As detailed by Barrett Mahony the proposed basement floor level is anticipated to be founded approximately 3.9 m below existing ground level (bgl) assuming a 0.4 m thick concrete slab. The proposed basement is therefore founded approximately 4.9 m below the back gardens to No.'s 23 and 24 John Street. Localised drainage sumps will extend below the basement slab, but for the purposes of assessing impacts, the dominant factor will be the basement excavation to slab level, and the slab level is used for the impact assessments in this report.

2.6 A search has been made of planning applications on the London Borough of Camden website in order to obtain details of any other basements which have been constructed, or are planned, in the vicinity of the site. This search identified a single planning application relating to a modern basement within the vicinity of the site linking No.'s 21 & 27 John Street (Camden planning application no. 2017/1959/P). Existing plans from 2017/1959/P indicate a lower ground floor extending beneath the five-storey building. No further relevant planning applications were found that related to basements within the vicinity of the proposed development.

3.0 PHYSICAL SETTING

3.1 Site History and Age of the Property

3.1.1 Historic maps (presented in the Groundsure Report in Appendix E) indicate that these buildings pre-date the first available map from 1875. By 1894 the single-storey rear section to No. 15 had been built in the rear part of No. 24 John Street's garden; the single-storey section behind No. 13 did not appear on the OS maps till 1953. Small mews-style houses formerly occupied the west side of John's Mews, fronting onto Robert Street; that area was re-developed for the primary school by 1973. The site to the north of No.11 was formerly occupied by a Baptist Chapel and annex, sometimes labelled "Sun. School"; an aerial photograph from 1947 shows the chapel still standing but the 1951/52 OS map shows the site vacant and the School as a ruin. The site had been redeveloped with what appears to be the current building (see Photo 2, Appendix C) by 1962.

3.2 Topography

3.2.1 The two-storey building is located near the centre of John's Mews. The BGS Onshore GeoIndex indicates that the site is at approximately 22.4 mOD with a shallow valley approximately 100 m to the east-northeast where a 20 mOD contour loops round to Roger Street and the 15 mOD contour approximately 225 m to the northeast, creating a slope of less than 2°. The surrounding area fluctuates between similar levels and consists of similar shallow gradient changes for over 1 km in all directions.

3.2.2 The Groundsure Report (Appendix E) identifies a disused railway oriented north-east to south-west passing 22 m north of the site. A BIA report for a nearby property (No.21 John's Mews) suggests this may be a Royal Mail tunnel. There was limited confidence about the position of this tunnel so enquiries should be made to determine whether it is relevant to the proposed basement at No's 13/15.

3.3 Hydrological Setting (Rivers and Watercourses)

3.3.1 The site lies approximately 1.3 km to the north of the River Thames. The nearest surface water feature, identified in the Groundsure Report, is a culvert approximately 340 m east of the site. The BGS Onshore GeoIndex identifies the nearest well as being located approximately 230 m to the east of the property and is 10.8 m deep but stated as not being within an aquifer. A water well to a depth of 67.7 m within the Chalk Group aquifer is recorded approximately 270 m southeast of the site.

3.3.2 The book 'The Lost Rivers of London' (Barton, 1992) identifies tributaries of the lost River Fleet running through the vicinity of the site. A map of the tributaries of the Thames and showing the approximate location of No.13-15 John's Mews is presented in Figure 2 and the location of the Fleet relative to No. 13-15 is presented in Figure 3. It is believed that the shallow valley to the east-northeast (see Section 3.2.1) was the likely location of the west-east orientated tributary. This tributary may run in a culvert or, more likely, flow in the Victorian sewer beneath Roger Street, as displayed in Figure 4 below. The current location of the north-south tributary is less clear as Barton's map does not show all the roads. However, it is possible that it flows/flowed through the abandoned sewer which formerly ran to the west of John's Mews, as displayed in Figure 4.

3.3.3 Hydrological data have also been obtained from the Groundsure Report (see Appendix E), which indicates:

- There are no surface water abstraction licences within 1500 m of the site.
- There are no flood defences, no area benefitting from flood defences, and no flood storage areas within 250m of the site.

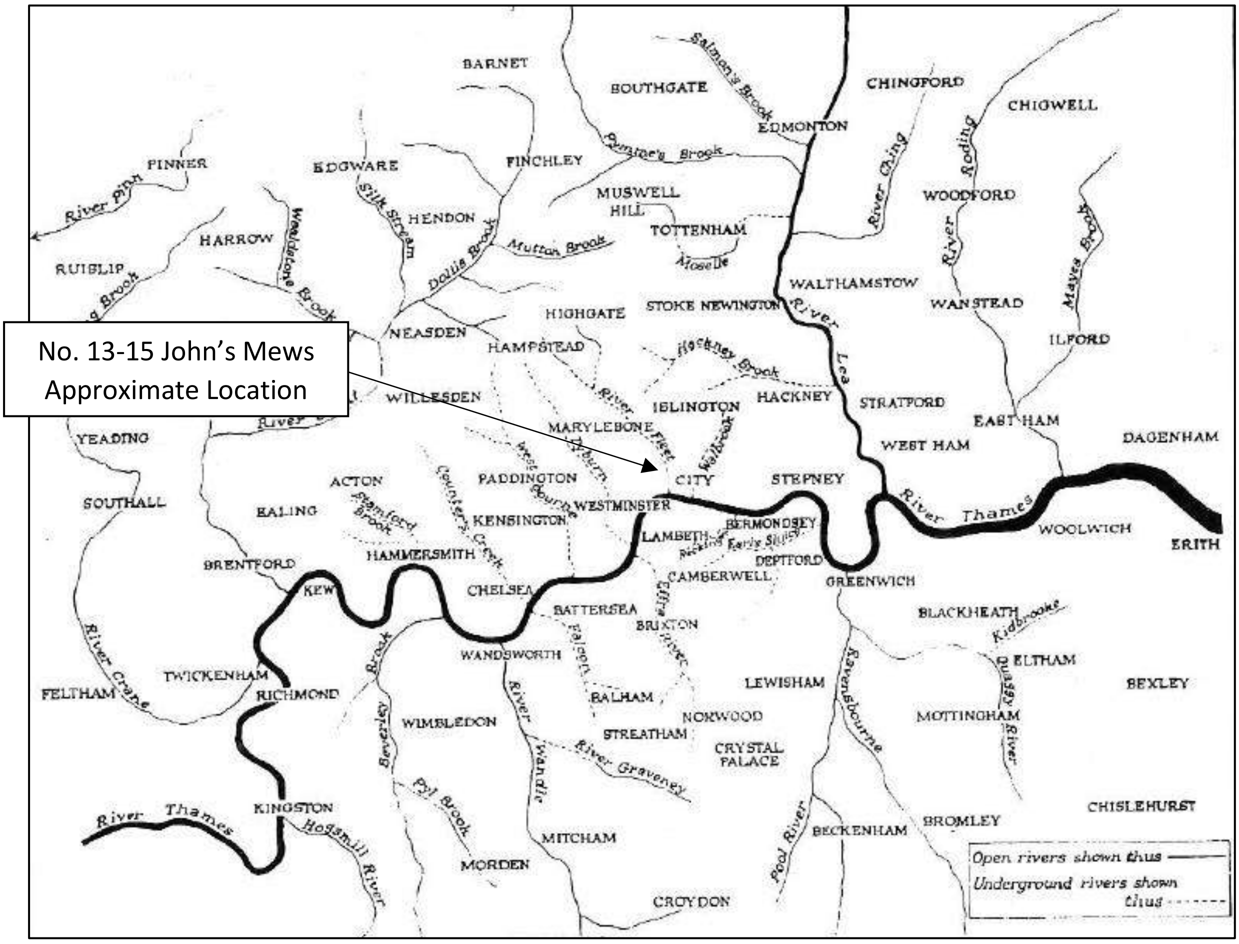


Figure 2. Tributaries of the Thames from Kingston to Erith identified in 'The Lost Rivers of London' (Barton, 1992)

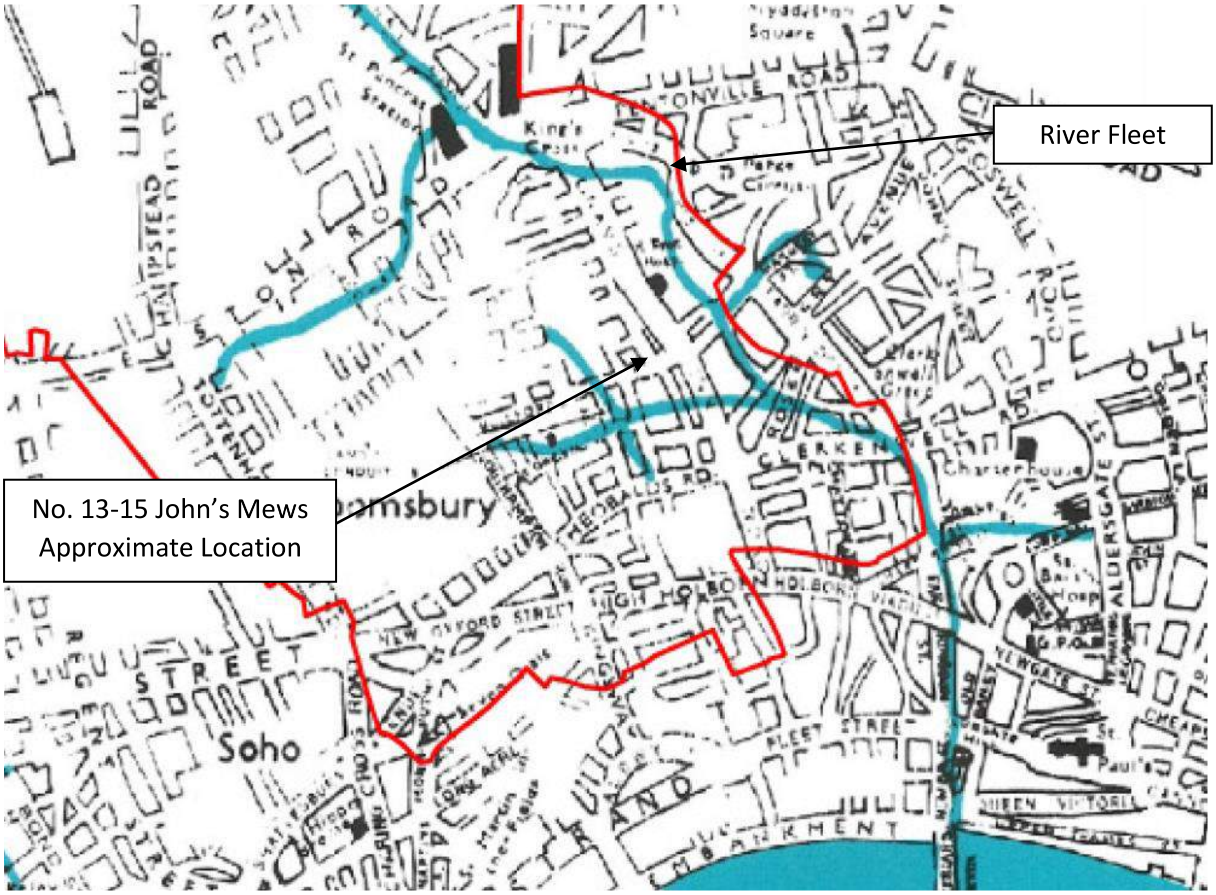


Figure 3. Location of River Fleet relative to 13-15 John's Mews (Camden Geological, Hydrogeological and Hydrological Study, Arup (2010))

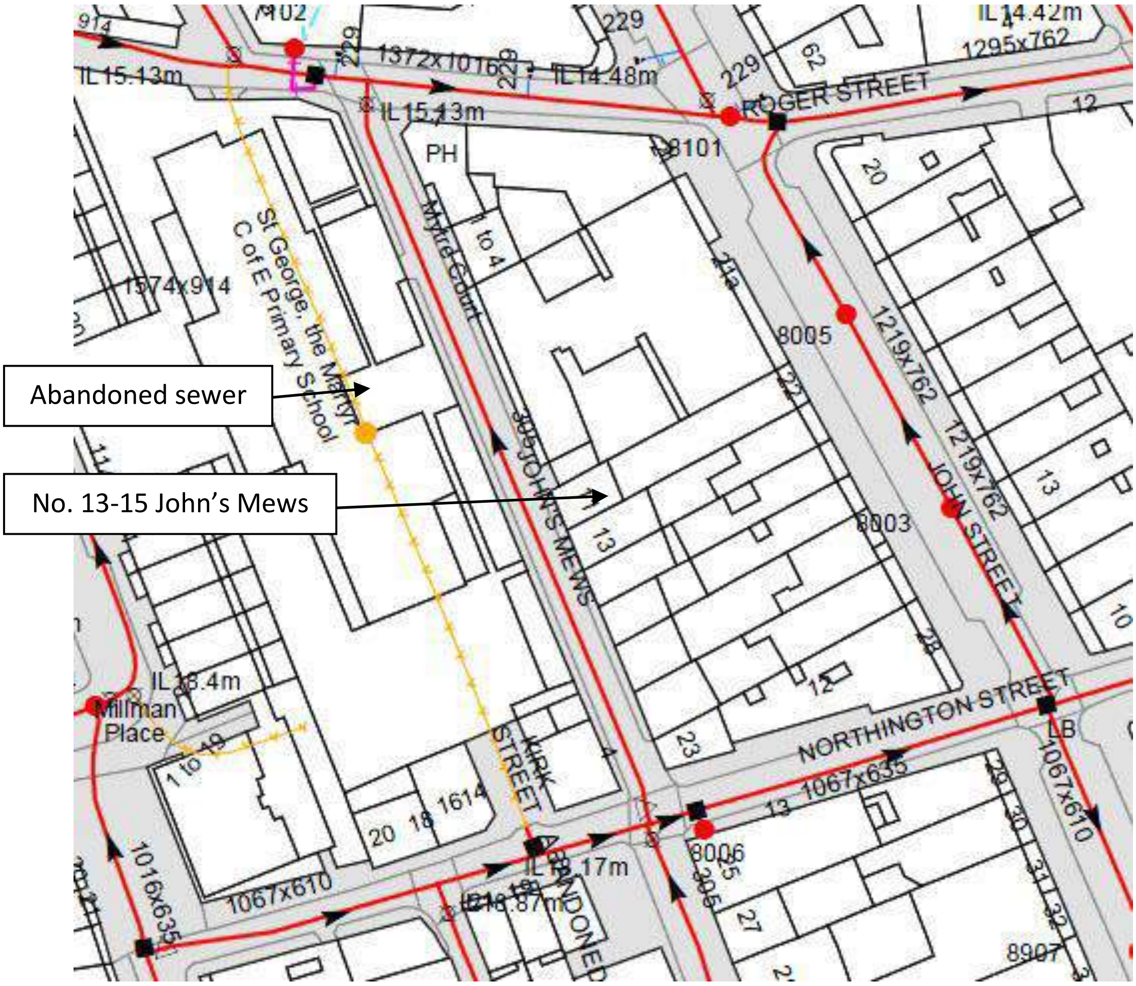


Figure 4. Extract from Thames Water sewer plan

3.4 Flood Risk

3.4.1 The Environment Agency (EA) website shows that the property lies within flood risk Zone 1 which is defined as areas where flooding from rivers and the sea is very unlikely, with less than a 0.1 per cent (1 in 1000) chance of such flooding occurring each year.

3.4.2 The Gov.uk website also identifies the area as being at a low risk of surface water flooding. The flood risk from surface water is presented in Figure 5 below; the property itself is entirely within the area identified as being at very low risk with the low risk running along John's Mews carriageway.

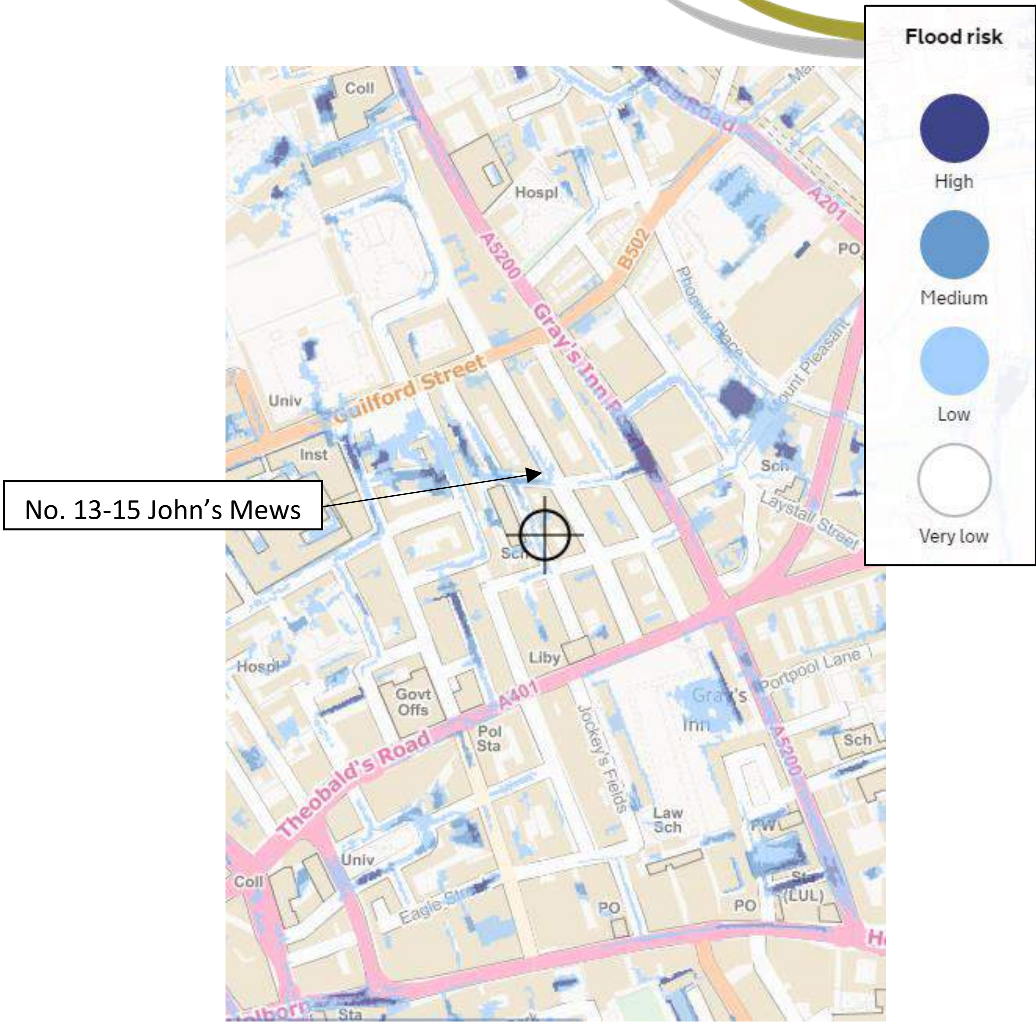


Figure 5. Flood Risk from Surface Water (Contains public sector information licensed under the Open Government Licence v3.0)

3.4.3 Figure 15 'Surface Water Flood Risk Potential' from the Camden Geological, Hydrogeological and Hydrological Study (GHHS) by Arup (2010) does not show any historic flooding on John's Mews in either the 1975 or 2002 floods. Figure 6 below shows the extent of surface water flooding across most of the borough in both the 1975 and 2002 flood events and the potential at risk of surface water flooding.

Figure 6. Surface Water Flood Risk Potential (Camden Geological, Hydrogeological and Hydrological Study, Arup (2010))

3.4.4 Figure 5a of the London Borough of Camden Strategic Flood Risk Assessment (SFRA) by URS (2014) shows that the site is not in an area affected by internal sewer flooding and Figure 5b shows the site is not within an area affected by external sewer flooding.

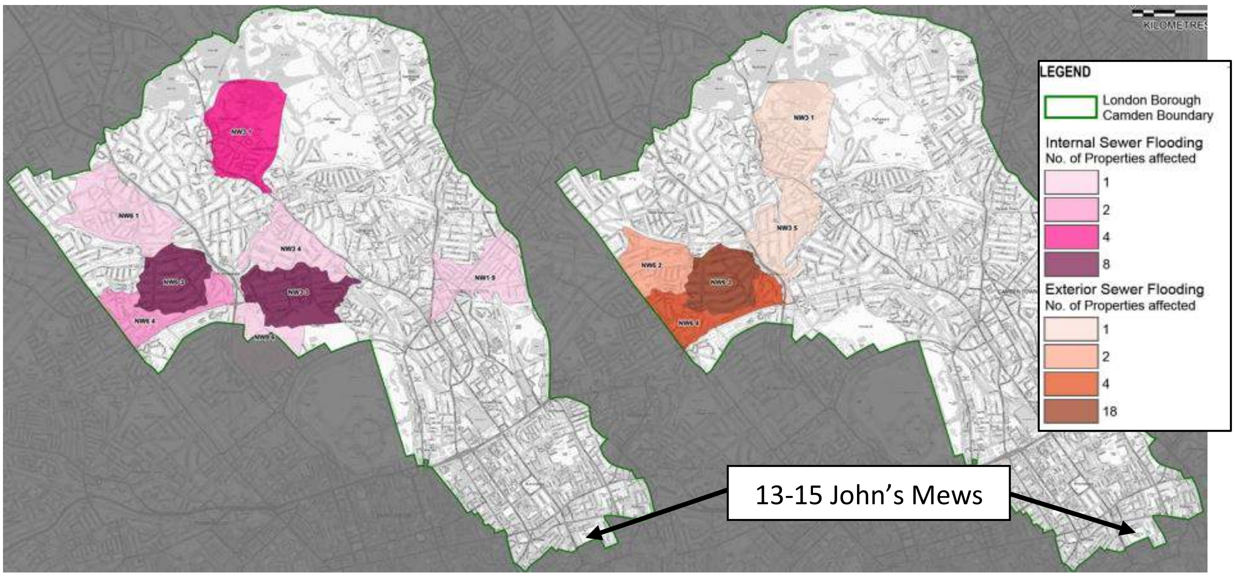
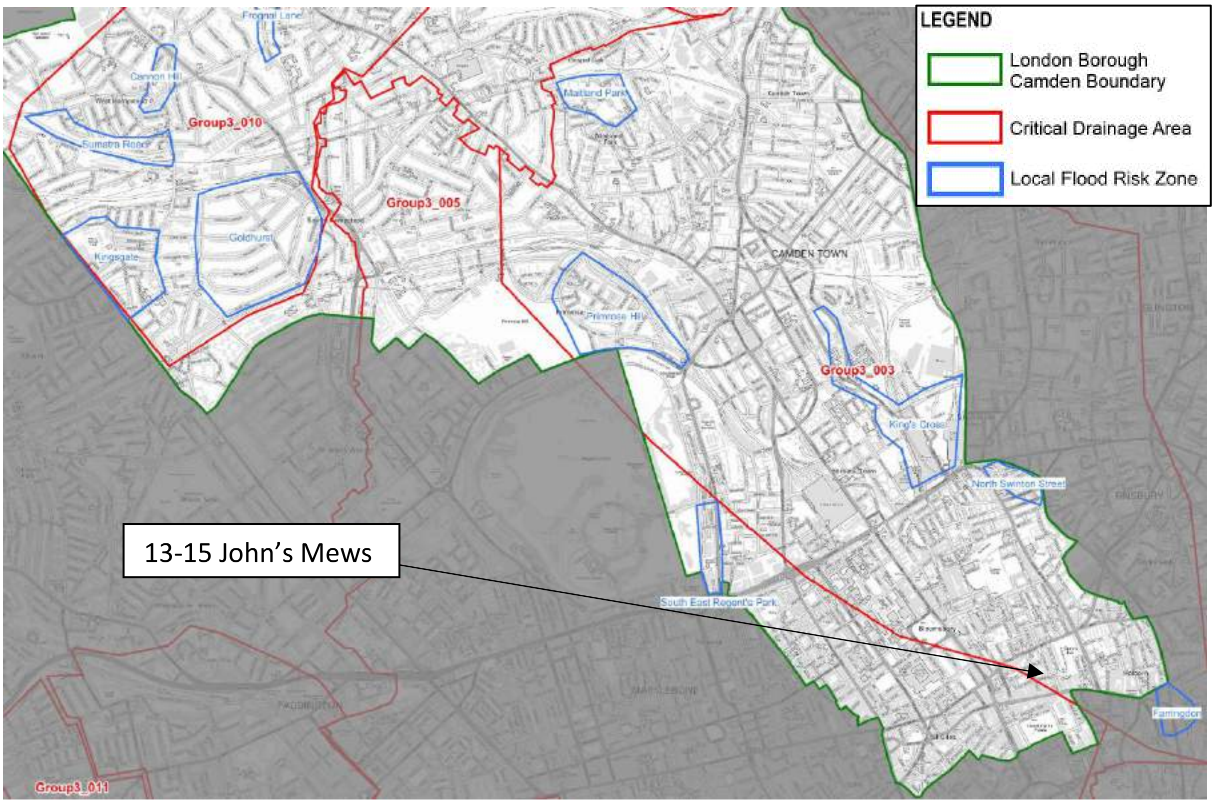


Figure 7. Extracts from Figures 5a and 5b of the SFRA (URS, 2014)



3.4.5 Figure 6 of the SFRA shows that the site is in Critical Drainage Area Group3_003 but not within a Local Flood Risk Zone. An extract of that Figure 6 is displayed in Figure 8 below.

Figure 8. Extract from Figures 6 of the SFRA (URS, 2014)

3.5 <u>Geological Setting (Ground Conditions)</u>

3.5.1 Mapping by the British Geological Survey (BGS) indicates that the site is underlain by the London Clay Formation, with overlying Lynch Hill Gravel Member superficial deposits recorded. The BGS geological plan showing the site is presented in Figure 9 below. The BGS indicates the same bedrock geology is encountered for over a 1 km radius from the site with only a small area of the Lambeth Group indicated to outcrop approximately 240 m to the north-northeast. The Lynch Hill Gravel Member extends a significant distance to the west; the Hackney Gravel Member superficial deposits are encountered approximately 100 m to the east of the site.

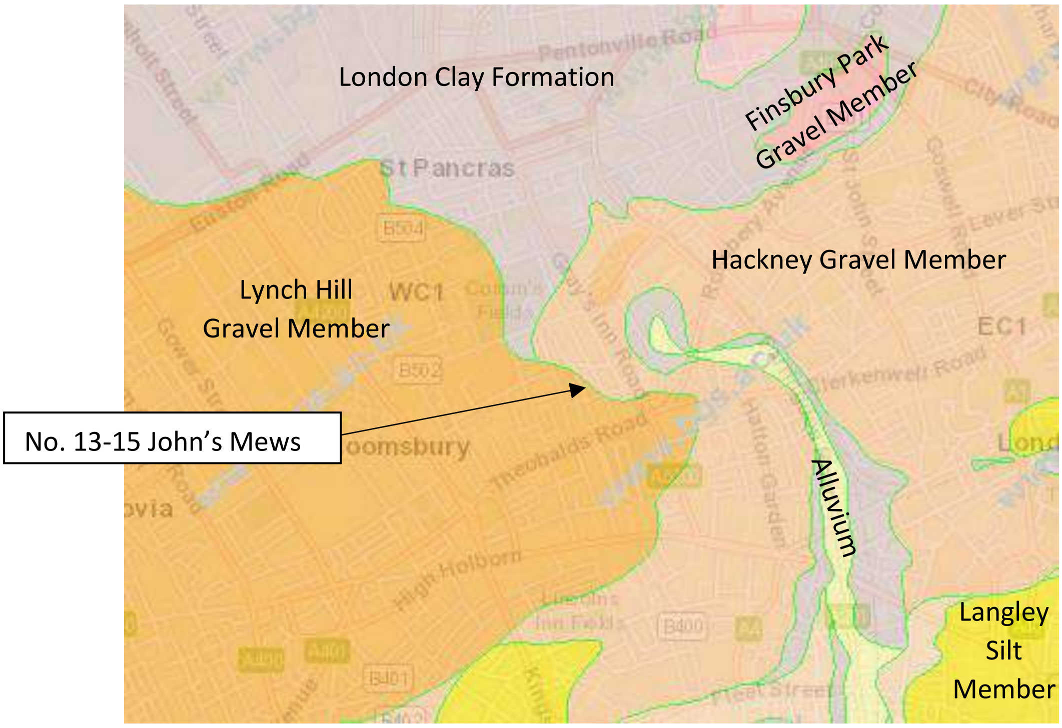


Figure 9. Site BGS Geological Plan (Contains British Geological Survey materials © NERC 2016. Base mapping is provided by ESRI)

3.5.2 The London Clay Formation consists of mainly dark blue-grey to brown-grey clay containing variable amounts of fine-grained sand and silt. The London Clay Formation generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes and is commonly intensely fissured. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

3.5.3 When exposed to the weathering process the upper regions of the London Clay Formation oxidise to brown in colour. It usually contains selenite crystals, often grouped in bands or layers, which are thought to have originated from the decomposition of shell fragments. London Clay contains clay minerals in the form of illite, kaolinite and smectite. The presence of smectite renders the London Clay Formation particularly susceptible to changes in moisture content and is prone to shrinkage and swelling (settlement and heave) caused by alternate wetting and drying near the surface.

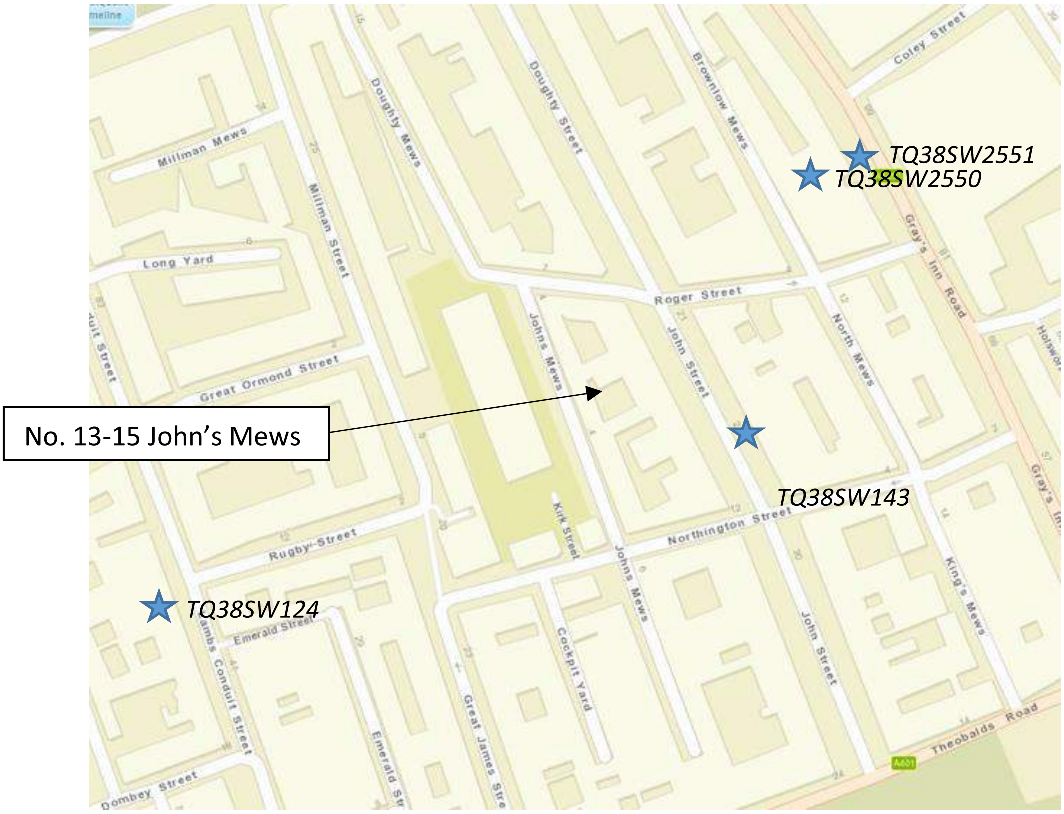
3.5.4 The Lynch Hill Gravel Member is a sand and gravel, with local lenses of silt, clay or peat from the parent material, the Maidenhead Formation. The Lynch Hill Gravel Member can be described as being coarse to fine subangular gravel with coarse to fine brown sand. The Wolstonian age gravel rests unconformably on the bedrock geology and with an average thickness of 7m with a range typically 1-12m. It is geographically limited to the Thames Valley and associated tributaries. The Lynch Hill Gravel Member was previously known as the Lynch Hill Gravel Formation.

3.5.5 A search of the BGS borehole database was undertaken for information on previous ground investigations and any wells in the vicinity of the site, the approximate locations of which are presented on the location plan in Figure 10 below. The borehole logs are presented in Appendix D.

3.5.6 Four BGS boreholes were reviewed, with the deepest borehole extending to 32.9 m bgl. Made Ground depths range from 0.9 to 5.5 m bgl. Sand and Gravel was encountered beneath the Made Ground in boreholes TQ38SW124 and TQ38SW143 to depths of 2.7 m bgl in TQ38SW124 and to the maximum recorded borehole depth of 6.4 m bgl in TQ38SW143. TQ38SW124 then encountered clay or silty clay to approximately 30.6 m bgl where it became sandy clay to the maximum recorded borehole depth of 32.9 m bgl. TQ38SW2550 and TQSW382551 encountered clay immediately beneath the Made Ground, the clay was predominantly recorded as silty clay with some pockets and partings of sand to their maximum recorded depths of 30.0 m bgl and 15.0 m bgl respectively.

3.5.7 Groundwater levels recorded in the boreholes are detailed in Section 3.6.3.

Figure 10. BGS Borehole Locations (Contains British Geological Survey materials © NERC 2016. Base



mapping is provided by ESRI)

3.5.8 The ground investigations completed by Chelmer (2014 and 2015) comprised one successful continuous flight auger (cfa) borehole (BH1B in 2014) to 10.0 m bgl, one 'cut-down' cable percussive borehole (BH5 in 2015) to 12.0 m bgl and nine hand excavated trial pits (TP1 – TP4 in 2014 and TP2, TP3 and TP5-TP7 in 2015) to examine the current properties foundations. The ground investigation indicated that the 'Reworked' Ground and Alluvium was present beneath Made Ground at a depth of 3.0 m bgl. The Lynch Hill Gravel Member was then encountered from 4.0 to 5.7 m bgl and consisted of slightly silty, variably sandy GRAVEL. The London Clay Formation was recorded from 5.7 m bgl in BH5, this consisted of firm, slightly sandy CLAY to 7.0 m bgl then stiff, silty CLAY to the maximum drilling depth of 12.0 m bgl. The London Clay Formation was encountered immediately beneath the Made Ground in BH1B, at 5.95 m bgl, and consisted of stiff, silty CLAY until the maximum drilling depth of 10.0 m bgl. Table 1 below presents a summary of the ground conditions encountered and the borehole and trial pit records are presented within the Factual Report in Appendix F.

Table 1: Summary of Ground Conditions Encountered

Depth to top of stratum (m bgl)	Depth to base of stratum (m bgl)	Description
0.00	0.08	Concrete
0.00/0.08	3.50/3.90	Made Ground/Reworked Ground (predominantly gravelly silty clay in BH1B; slightly clayey, silty gravelly fine sand in BH5)
3.50	4.00	Alluvium: firm brown/grey gravelly silty CLAY (BH5)
4.00	5.70/5.90	Lynch Hill Gravel Member: dense and medium dense brown silty very sandy fine to coarse GRAVEL (BH5)
5.70/5.90	7.00/7.50	Weathered London Clay: firm to stiff brown/grey slightly sandy silty CLAY with selenite crystals, mica and partings of silt and fine sand
7.00/7.50	10.00+/12.00+	London Clay: stiff grey slightly sandy silty CLAY with selenite crystals, mica and partings of silt and fine sand

3.6 Hydrogeological Setting (Groundwater)

3.6.1 The Groundsure Report (see Appendix E) indicates that the superficial deposits (Lynch Hill Gravel Member) at the site are classified as being a 'Secondary A' aquifer and the London Clay Formation bedrock deposits are classified as being an 'Unproductive' aquifer. 'Secondary A' aquifers are defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.'*

3.6.2 Additional hydrogeological data obtained from the Groundsure Report, includes:

- There are no groundwater abstraction licences are within 500 m of the site.
- No Source Protection Zones (SPZs) have been identified within 500 m of the site.
- There are is a BGS groundwater flooding susceptibility areas within 50 m of the site relating to superficial deposits flooding where there is potential for groundwater flooding at surface.

3.6.3 Groundwater information recovered from the BGS boreholes near the site (Figure 10) are detailed in Table 2 below.

Table 2: Summary of Groundwater Records from BGS Boreholes		
Location	**Date**	**Groundwater Standing Level (m bgl)**
TQ38SW124	March 1950	4.6 – Percolated behind casing from sand & gravel 16.0 – Entered from soft clay at that level
TQ38SW143	1908	No Data
TQ38SW2550	September 1989	None Recorded
TQ38SW2551	September 1989	6.4

3.6.4 A groundwater 'seepage' was observed within borehole BH1B at a depth of 5.9 m bgl. Standing groundwater was observed within borehole BH1B at a depth of 9.5 m bgl. A groundwater strike was observed at a depth of 4.5 m bgl in BH5 which rose to 4.2 m bgl; however, the borehole was dry on completion due to the water being sealed out when the casing reached 6.0 m bgl. Monitoring standpipes were installed to 8.0 m bgl and 12.0 m bgl in BH1B and BH5 respectively. On the return gas/groundwater monitoring visits, between July 2014 and May 2017, to the installations fitted within borehole BH1B and BH5 groundwater levels were recorded between 2.9 m bgl and 3.8 m bgl.

3.6.5 Figure 4e of the SFRA (URS, 2014) indicates that the site is approximately 50 to 100 m from an area with increased susceptibility to elevated groundwater, which is defined as an area 'where there is increased potential for groundwater levels to rise within 2m of the ground surface following periods of higher than average recharge'. Additionally, the nearest Environment Agency groundwater flood incident occurred approximately 550 m southwest of the site (see Figure 11 below).

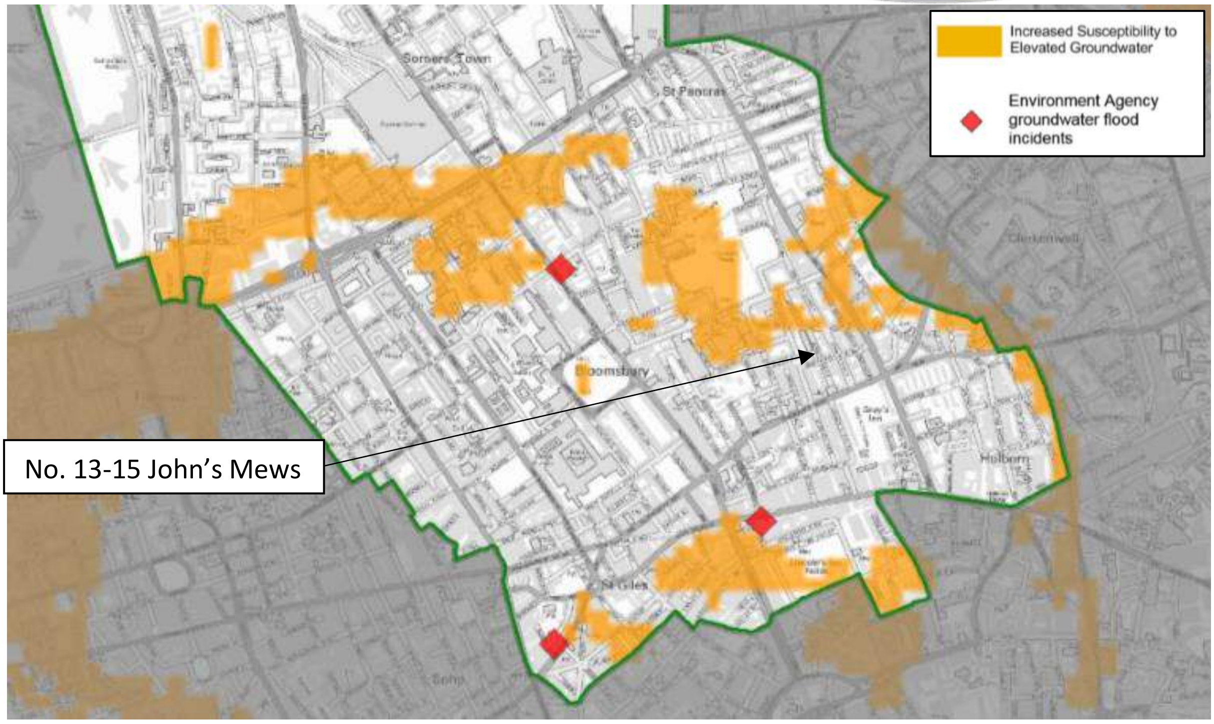


Figure 11. Extract from Increased Susceptibility to Elevated Groundwater (London Borough of Camden Strategic Flood Risk Assessment (SFRA) by URS (2014))

4.0 CONCEPTUAL SITE MODEL

4.1 Basis of Conceptual Site Model

4.1.1 The Conceptual Site Model has been built using desk study evidence together with the ground investigation findings, as outlined in Section 3 of this report. The ground investigations were completed in August 2015 (Appendix F).

4.1.2 The Impact Assessments contained in the sections below are based on the Screening Assessment in Appendix A and any concerns identified in Sections 2.0 and 3.0.

4.1.3 The Conceptual Site Model can be summarised as:

- The proposed basement excavation is to approximately 3.9 m bgl.
- The surrounding land slopes at less than 2°.
- The nearest surface water feature identified is 340 m east of the site and the nearest well is approximately 230 m to the east.
- The site is an area where flooding from rivers and seas is reported as very unlikely, and the flood risk from surface water is reported to be low.
- Ground conditions comprise, varying of depths of Made Ground (both clay dominated and sand dominated to maximum 5.9 m thick), with reworked ground and alluvium present in BH5 between 3.0 to 4.0 m bgl overlying the Lynch Hill Gravel Member to 5.7 m bgl. The London Clay Formation was encountered at 5.7 m bgl beneath the Lynch Hill Gravel Member in BH5 and at 5.9 m bgl beneath the Made Ground in BH1B. The London Clay Formation was present to the base of the maximum borehole depth of 12.0 m bgl.
- The site is located above a 'Secondary A' aquifer, formed by the Lynch Hill Gravel Member and an 'Unproductive' stratum formed by the clay of the London Clay Formation.
- Groundwater was not encountered above 2.9 m bgl during the return monitoring visits.

4.14 The Groundsure Report (Appendix E) identifies a disused railway oriented north-east to south-west passing 22 m north of the site, this is possibly a Royal Mail tunnel. Further enquiries must be made to determine whether it is relevant to the proposed basement at No's 13/15.

4.2 Groundwater Flow Impact Assessment

4.2.1 The site is located above an 'Secondary A' aquifer formed by the Lynch Hill Gravel Member and an 'Unproductive' stratum formed by the clay of the London Clay Formation. Groundwater was observed during the drilling process of the ground investigations performed by Chelmer (2014 and 2015), where BH1B & BH5 were drilled to 10.0 & 12.0 m depths and monitoring standpipes installed to 8.0 & 12.0 m bgl respectively. Seven return monitoring visits were completed between July 2014 and May 2017 and groundwater levels were recorded between 2.9 m bgl and 3.8 m bgl.

4.2.2 The permeability of the strata encountered at the site is expected to vary. The permeability within the London Clay Formation at the site is expected to be very low due to the high clay content. The permeability of the Made Ground depends on the nature of the material, interconnectivity of the permeable soils, the degree of clay infilling in the voids and the extent of any other permeable materials which remain presently undetected. Some flow through the sand and gravels of the Lynch Hill Gravel Member should be expected; however, the low groundwater strike and slow subsequent rise recorded in BH5 would indicate a permeability on the low end of the expected range. The low topographical relief in the area is also expected to contribute towards minimal groundwater flow. This hydrogeological regime (ie: groundwater levels and pressures) will be affected by long-term climatic variations as well as seasonal fluctuations and other man-induced influences, all of which must be taken into account when selecting a design water level for the permanent works. No frequent, long term, multi-seasonal groundwater monitoring data are available so a conservative approach will be needed, as required by current geotechnical design standards.

4.2.3 The proposed basement level will be founded partly within the Made Ground and partly in the dense sandy gravel of the Lynch Hill Gravel Member, and possibly partly in the alluvial clays. The monitoring performed in the on-site boreholes (BH1B & BH5) indicated groundwater level (2.9 mbgl) was up to 1.0 m above the founding level of the proposed basement (3.9 mbgl). Permeable strata (Lynch Hill Gravel Member) is indicated to be below the underpins and to be present for approximately 2.0 m below the founding level of the basement. Therefore, it is considered unlikely that the basement would cause any significant adverse impact on groundwater flows as groundwater will be able to divert beneath the basement structure. The piles supporting the slabs are sufficiently widely spaced that they are unlikely to restrict groundwater flow.

4.2.4 The basement will be excavated below groundwater level and groundwater control will be required during the basement construction works. The soils above formation level are dominated by Made Ground and are likely to be of variable permeability; groundwater seepages and inflows should be expected. In clay-dominated Made Ground sump pumping may be appropriate. However, more granular dominated Made Ground may have a higher permeability, and alternative measures, such as wellpointing may be required. Specialist dewatering contractors should be consulted if significant groundwater inflows are encountered.

4.3 Surface Water Impact Assessment

4.3.1 The site is in an area where flooding from rivers and seas is defined as very unlikely and the flood risk from surface water is low. This combined with no record of historic flooding on John's Mews in either the 1975 or 2002 floods can lead to the conclusion that conventional measures of managing surface water run-off should be sufficient to minimise any potential hydrological impacts.

4.3.2 The proposed basement footprint will be entirely beneath the existing building, as shown on Barrett Mahony Drawings in Appendix B. Therefore the basement would not result in an increase in impermeable surfacing and run-off will remain unchanged.

4.3.3 Due to the very low risk of surface water flooding then conventional measures of managing surface water run-off should be sufficient; such as up-stands to protect lightwells and a ground level difference at external doorways. Non-return valves and/or pumped above ground loop systems should be fitted on the drains serving the basement and the enclosed courtyards, in order to ensure that water from the combined/foul sewer system cannot enter the basement or flood the courtyards when the public sewers are operating under surcharge.

4.4 Ground Stability Impact Assessment

4.4.1 The site is located on a relatively flat area with a slope gradient of less than 2°, therefore slope stability will be highly unlikely to cause any problems with the proposed basement.

4.4.2 Neighbouring properties could be affected by the excavation and construction of the proposed basement. This issue is addressed in the Damage Category Assessment section (Section 6.0) of this report.

4.4.3 The Groundsure Report (Appendix E) states there is a moderate hazard for natural subsidence at the property location.

4.4.4 A high quality of workmanship and use of best practice methods of temporary support are therefore crucial to the satisfactory control of ground movements alongside basement excavations. All cracks in load-bearing walls which have weakened their structural integrity should be fully repaired in accordance with recommendations from the appointed structural engineer before excavations for the underpinning works begin.

4.4.5 Under UK standard practice, the contractor is responsible for designing and implementing the temporary works, so it is considered essential that the contractor employed for these works should have completed similar schemes successfully. For this reason, careful pre-selection of the contractors who will be invited to tender for these works is recommended. Full details of the temporary works should be provided in the contractor's method statements.

4.4.6 Soil parameters of the strata encountered were detailed in the Chelmer (2016) Geo-Environmental Interpretative Report, GENV/4507 Rev.3, dated June 2016.

4.4.7 The Chelmer (2016) Geo-Environmental Interpretative Report addresses contamination issues, and that report should be noted by the contractors. However, it is appropriate to note here that its paragraph 6.71 states that 'Due to the elevated concentrations identified, any excavated material at this site may pose a 'moderate' hazard to ground workers as far as Health and Safety is concerned. We would therefore recommend that standard Health and Safety precautions be taken with regard to ground workers at this site. These should include PPE equipment such as gloves, overalls etc. to prevent dermal contact with the soils. Washing facilities should be made available on-site to reduce extended contact with site soils. During the construction phase, dust suppression measures may be required to minimise potential inhalation of dust by neighbours or ground workers.'

5.0 GROUND MOVEMENT ANALYSIS

5.1 Basement Geometry and Stresses

5.1.1 Analyses of vertical ground movements (heave or settlement) arising from changes in vertical stresses caused by excavation of the basement have been undertaken using proprietary software (Oasys PDISP™). The analysis is based on Boussinesq's theory of analysis for calculating stresses and strains in soils due to vertically applied loads; the predicted ground movements are derived by integration of vertical strains derived from Boussinesq's equations. These preliminary analyses have not modelled the horizontal forces on the retaining walls, and so have simplified the stress regime significantly. In addition, consistent with Boussinesq theory, the soils are assumed to comprise semi-infinite isotropically homogeneous elastic medium.

5.1.2 The layout of the basement used within the analysis is based on Drawing L14771-01-P2 provided by Barrett Mahony, and is presented in Figure 12 below. The proposed basement is approximately 13.5 m long by 11.0 m wide with excavation generally extending to a depth of approximately 3.9 m bgl. The basement is understood to be constructed by reinforced concrete underpins with the basement slab supported on pile foundations.

5.1.3 The excavation depths for the basement have been modelled using Drawings L14771-11-P2 and L14771-12-P2 to estimate the gross pressure reductions (unloading) across the development. Figure 13 below illustrates the layout of all load zones, positive and negative (unloading), used to model the proposed basement in PDISP. These include the excavation and loads on the underpinned walls and piled foundations, the self-weight of walls, and construction of the concrete slab and excavation of central area from existing ground level.

5.1.4 The table in Appendix G presents the net changes in vertical pressure for each load zone for the four major stages in the sequence of stress changes which will result from excavation and construction of the basement (see 5.3.1 below for details). All the pressures used in PDISP analysis have been calculated from loads and information provided by Barrett Mahony.

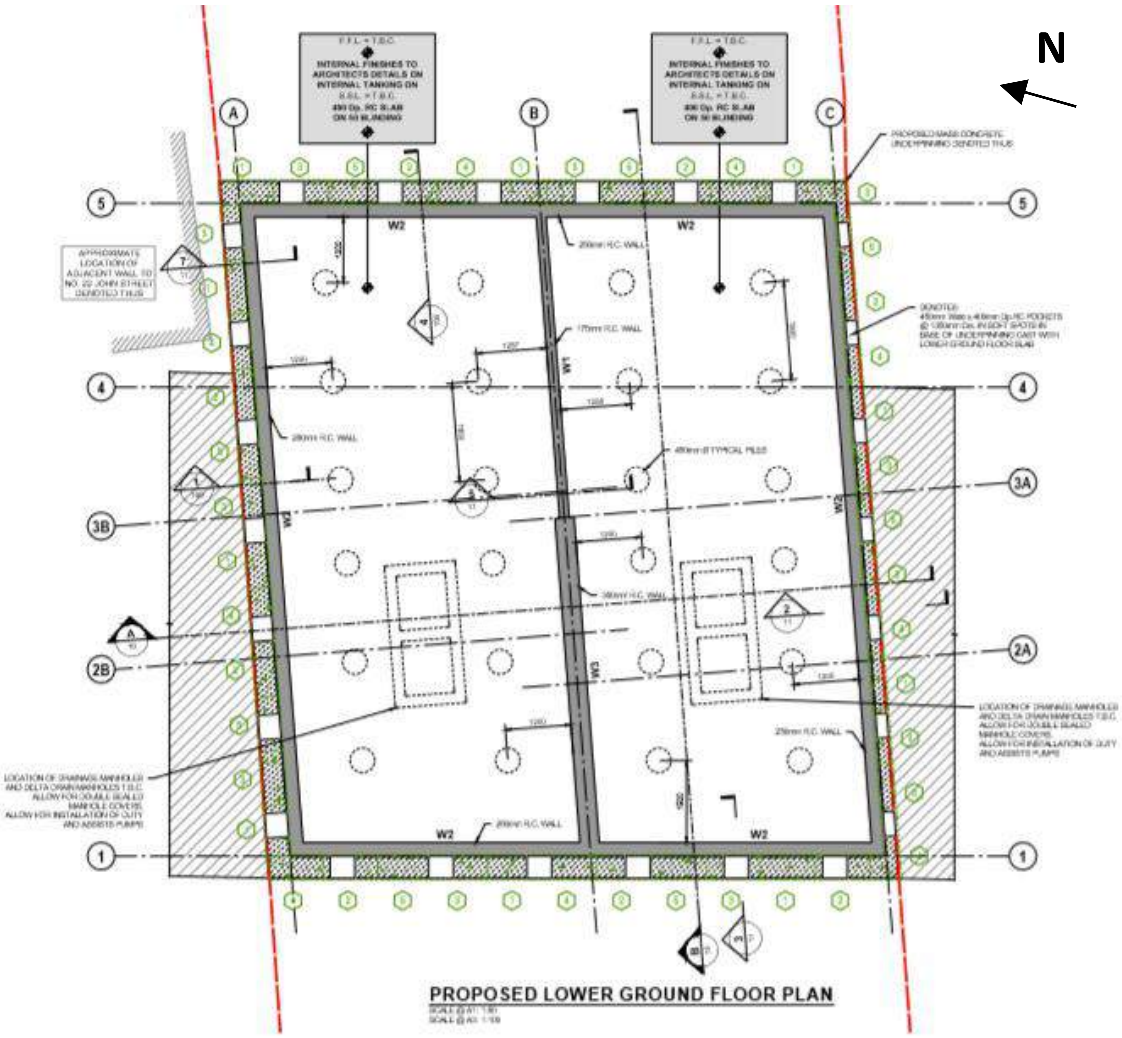


Figure 12. Layout of the proposed basement (Drawing L14771-01-P2)

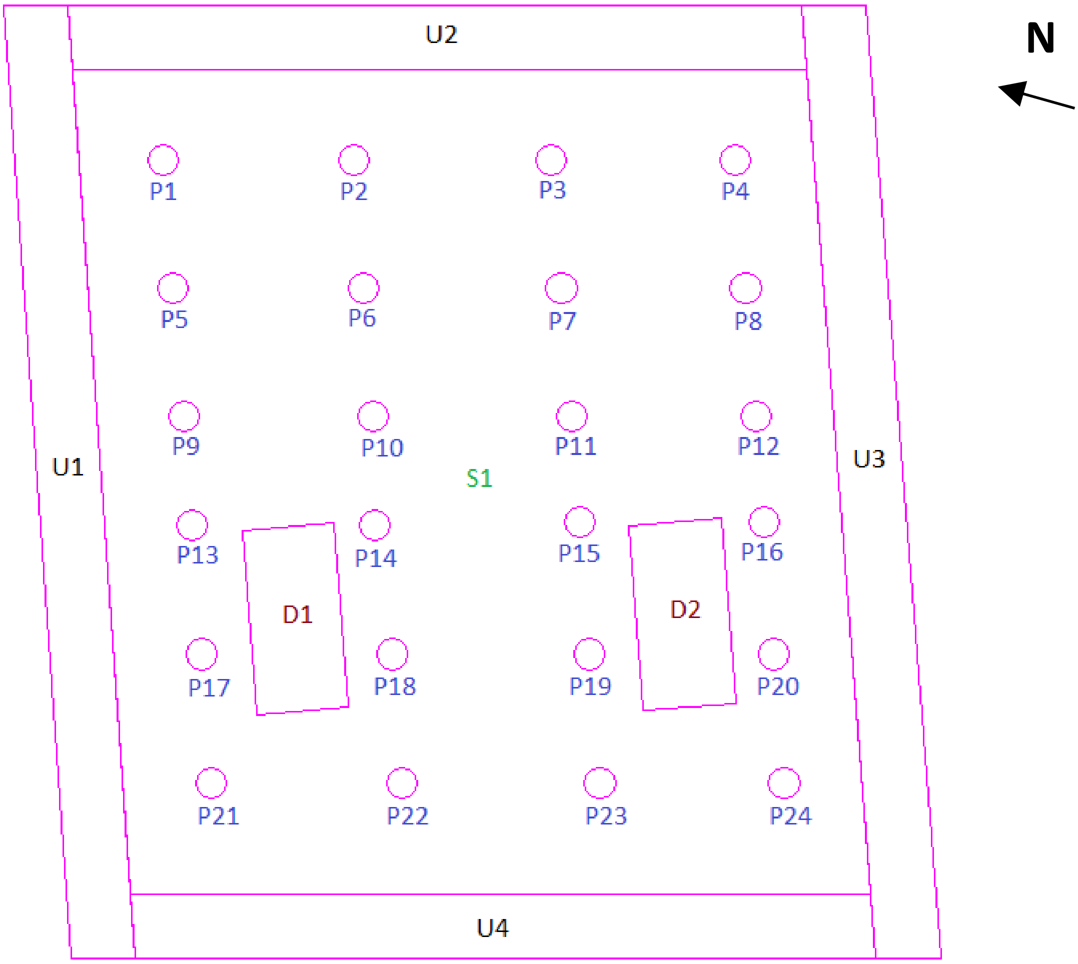


Figure 13. Detail of geometry introduced to PDISP
[U = Underpin loads, P = Pile foundations, D = Bulk excavation and slab loads of drainage manholes, Slab = Bulk excavation and slab loads]

5.2 Ground Conditions

The short-term and long-term geotechnical properties used in the analysis are summarised in Table 3 below. These were based on the Chelmer (2014 and 2015) ground investigation, and on data from previous Chelmer projects in similar ground conditions. BH5 encountered less Made Ground, extending to only 3.0m below ground level (bgl) though this Made Ground was loose to very loose and included voids (one SPT gave a zero blowcount). Soft, apparently re-worked, alluvial-type clays were recorded beneath the Made Ground, to a depth of 3.5m. While, at the location of BH5, all the very weak Made Ground and soft clay will be removed by the excavations (such that the basement will be founded on apparently in-situ River Terrace Deposits), it is possible that similar materials will extend to greater depth elsewhere.

Table 3 - Soil parameters for PDISP analyses			
Strata	**Depth** *(m bgl)*	**Short-term, undrained Young's Modulus,** E_u *(MPa)*	**Long-term, drained Young's Modulus,** *E'* *(MPa)*
Made Ground	3.9 – 5.9	35.0	20.0
London Clay Formation	5.9 27.5	40.0 120.0	25.0 70.0
Drained Young's Modulus, E' = 2 * N value London Clay Formation: Undrained shear strength, C_u assumed = 80 kPa at 5.9 m bgl Undrained Young's Modulus, E_u = 500 * C_u Hence profile of Eu = 40 + 3.75z Drained Young's Modulus, E' = 0.6 Eu Where z = depth below top of the London Clay Formation.			

5.3 PDISP Analysis:

5.3.1 Three dimensional analyses of vertical displacements have been undertaken using PDISP software and the basement geometry, loads/stresses and ground conditions outlined above in order to assess the potential magnitudes of ground movements (heave or settlement) which may result from the vertical stress changes caused by excavation of the basement. PDISP analyses have been carried out as follows:

- Stage 1 – Construction of underpins and installation of internal piles – Short-term (undrained) condition
- Stage 2 – Bulk excavation of central area to basement formation level – Short-term (undrained) conditions
- Stage 3 – Construction of the basement slab – Short-term (undrained) conditions
- Stage 4 – Construction of the basement slab – Long-term (drained) conditions

5.3.2 The results of the analyses for Stages 1, 2, 3 and 4 are presented as contour plots on Figures 14 to 17.

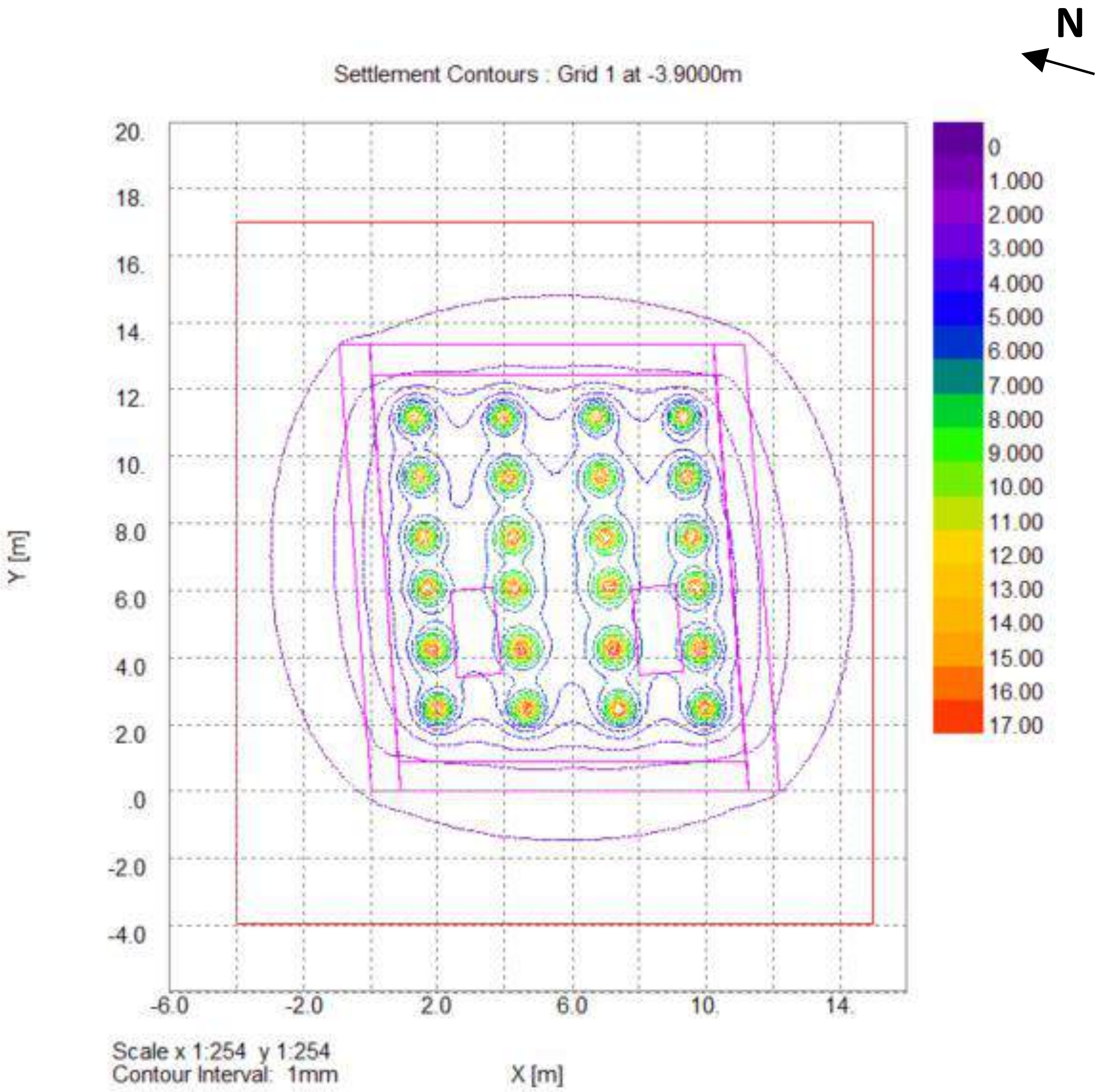


Figure 14. Stage 1 – Construction of underpins and installation of internal piles – Short-term (undrained) condition (1.0 mm settlement contours)

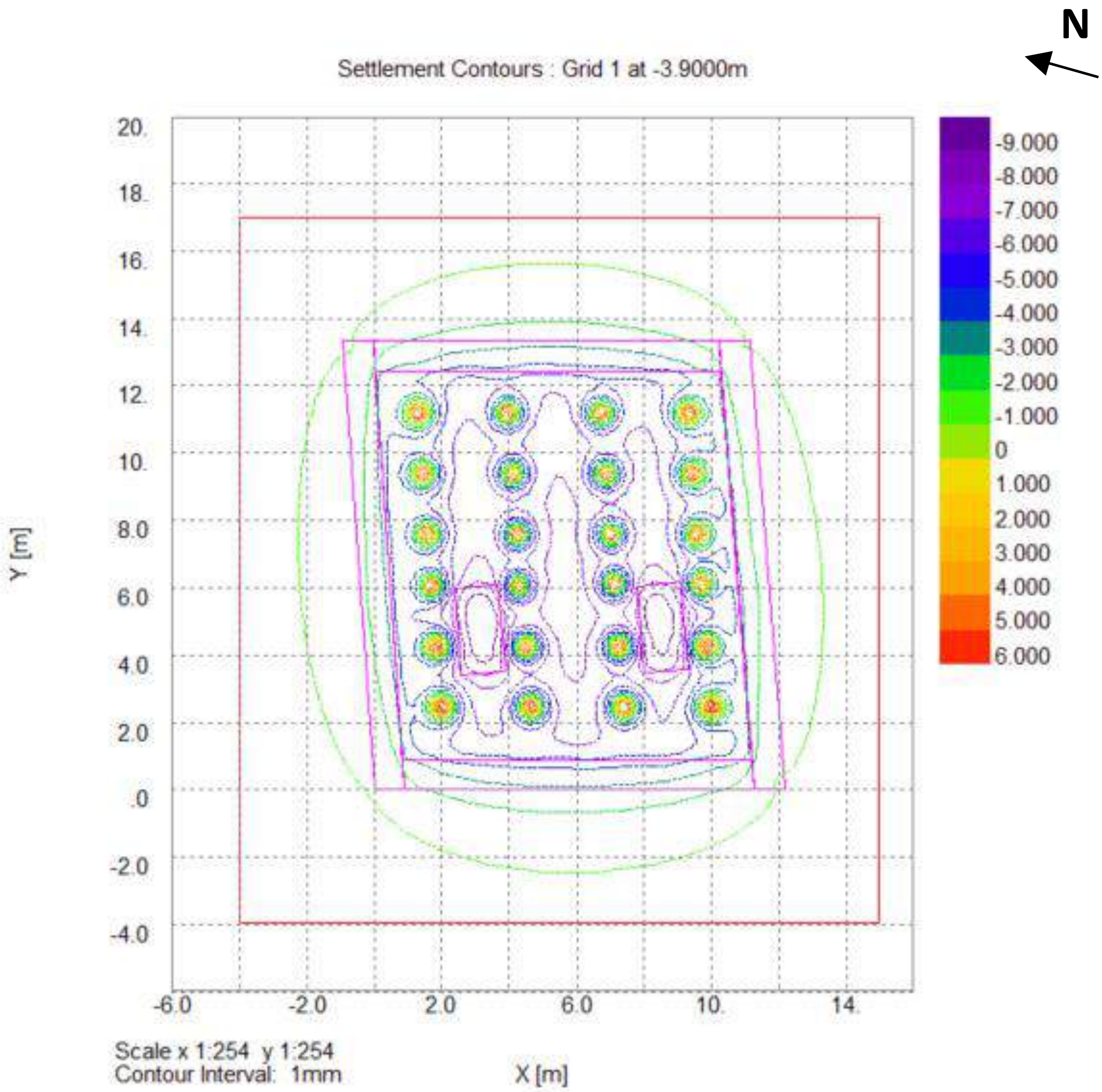


Figure 15. Stage 2 – Bulk excavation of central area to basement formation level – Short-term (undrained) conditions (1.0mm settlement contours)

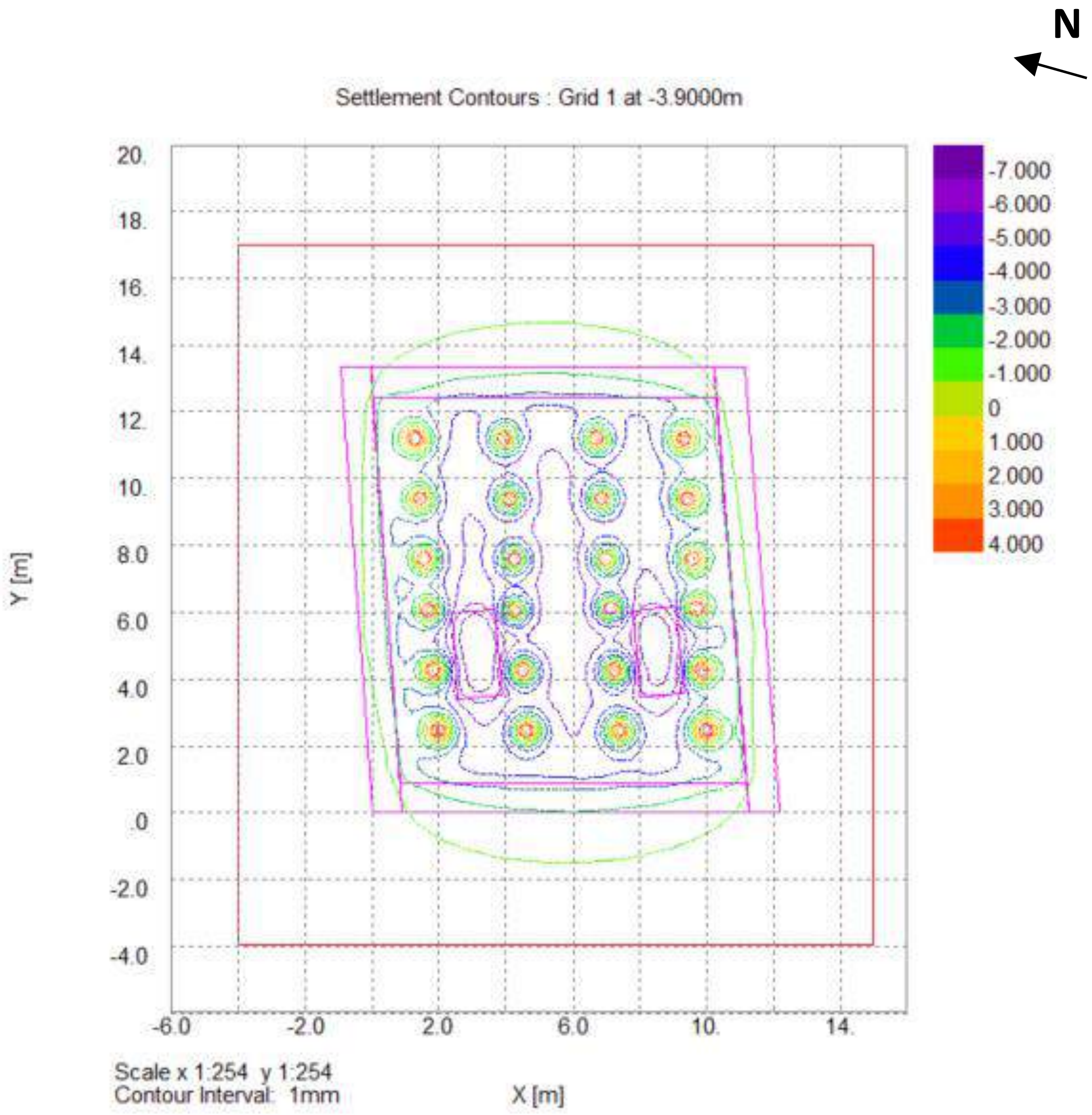


Figure 16. Stage 3 – Construction of the basement slab – Short-term (undrained) conditions (1.0mm settlement contours)

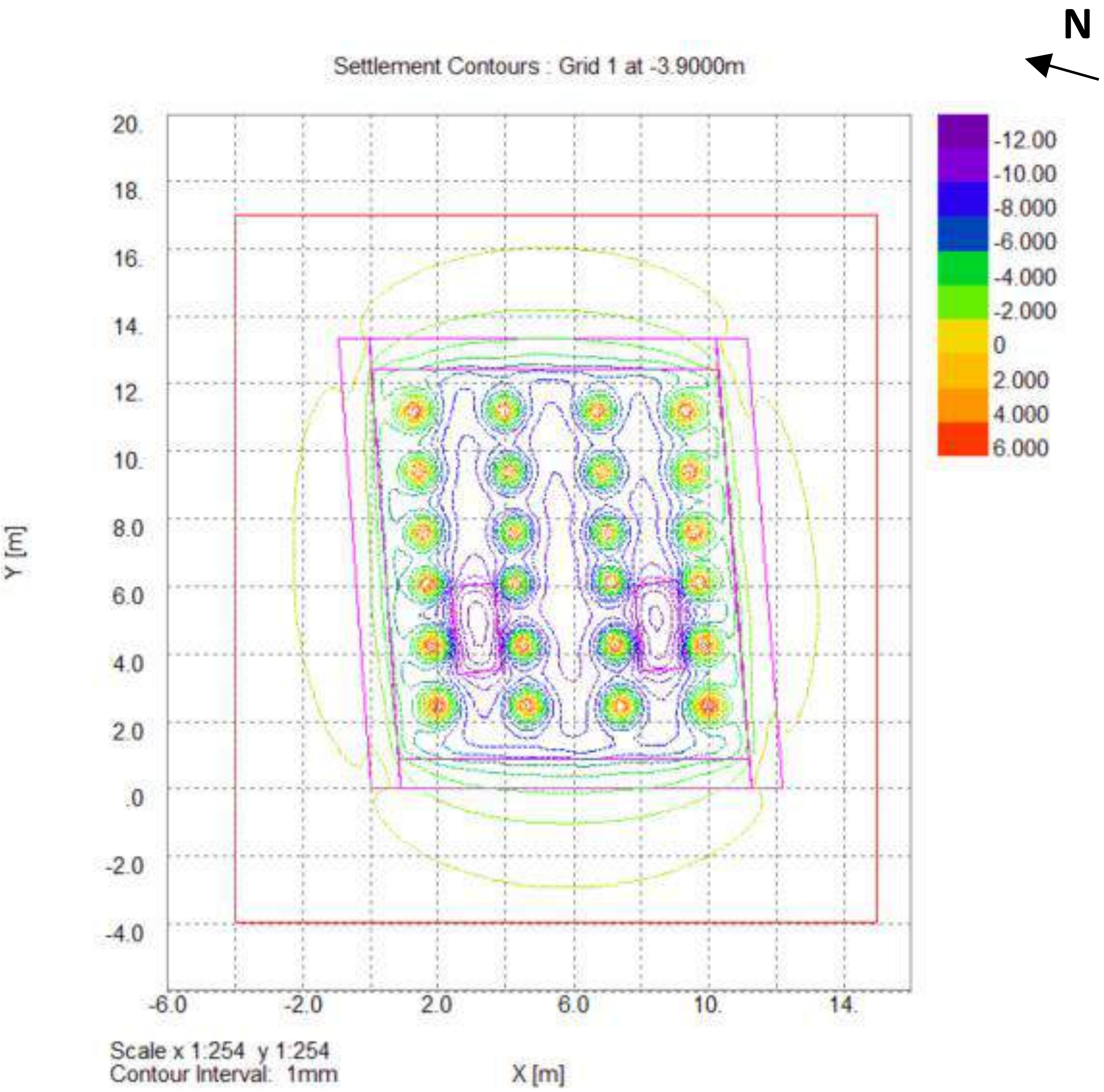


Figure 17. Construction of the basement slab – Long term (drained) conditions (1.0mm settlement contours)

5.4 Heave/Settlement Analysis

5.4.1 Excavation of the basement and construction of the underpins will cause immediate elastic heave/settlements in response to the stress changes. However, as the basement will be founded on granular soils the immediate effects are likely to be relatively small. The basement slab will need to be designed to enable it to accommodate the swelling displacements/pressures developed underneath it.

5.4.2 The ranges of predicted short-term and long-term movements for each of the main sections of the proposed basement are presented in Table 4 below. These analyses indicated that the perimeter basement walls are predicted to undergo movements ranging from 3 mm heave to 3 mm settlement. The basement slab are is predicted to undergo displacements ranging from 3 mm to 10 mm heave. The piled foundations are predicted to undergo settlements of up 17 mm settlement. All values are approximate owing to the simplification of the stress regime and include only displacements caused by stress changes in the ground beneath the basement.

Table 4: Summary of Predicted Ground Movements from PDISP

Location / Building Element	***Stage 1 (short term)***	***Stage 2 (short term)***	***Stage 3 (short term)***	***Stage 4 (long term)***
Northern perimeter of basement	1.0 – 3.0 mm Settlement	1.0 – 2.0 mm Heave	0.0 – 1.0 mm Heave	1.0 – 2.0 mm Heave
Eastern perimeter of basement	1.0 – 2.0 mm Settlement	1.0 – 3.0 mm Heave	0.0 – 2.0 mm Heave	1.0 – 3.0 mm Heave
Southern perimeter of basement	1.0 – 3.0 mm Settlement	1.0 – 2.0 mm Heave	0.0 – 1.0 mm Heave	1.0 – 2.0 mm Heave
Western perimeter of basement	1.0 – 2.0 mm Settlement	1.0 – 3.0 mm Heave	0.0 – 2.0 mm Heave	1.0 – 3.0 mm Heave
Basement slab	-	3.0 – 7.0 mm Heave	2.0 – 6.0 mm Heave	2.0 – 10.0 mm Heave
Drainage manholes	-	6.0 – 10.0 mm Heave	4.0 – 8.0 mm Heave	8.0 – 13.0 mm Heave
Piled foundations	5.0 – 17.0 mm Settlement	3.0 mm Heave to 6.0 mm Settlement	2.0 mm Heave to 4.0 mm Settlement	4.0 mm Heave to 7.0 mm Settlement

5.4.3 All the short-term elastic displacements would have occurred before the basement slab is cast, so only the post-construction incremental heave/settlements (the difference from Stages 3, short-term, to 4, long-term) are relevant to the slab design. However, if the construction involves a progressive transfer of loads from the temporary works to the permanent structure additional elastic movements after the slab has been cast would be expected. So the differential displacements experienced by the slab after it has cured will be larger than the difference between the displacements at Stages 3 & 4, and possibly in the order of up to 10 mm.

6.0 DAMAGE CATEGORY ASSESSMENT

6.1 When underpinning it is inevitable that the ground will be un-supported or only partially supported for a short period during excavation of each pin, even when support is installed sequentially as the excavation progresses. This means that the behaviour of the ground will depend on the quality of workmanship and suitability of the methods used, so rigorous calculations of predicted ground movements are not practical. However, provided that the temporary support follows best practice, then extensive past experience has shown that the bulk movements of the ground alongside underpins for a single storey basement (of nominal depth 3.5 m) should not exceed 5 mm horizontally. This figure should be adjusted pro-rata for notably shallower or deeper basements.

6.2 In order to relate these predicted ground movements to possible damage which adjacent properties might suffer, it is necessary to consider the strains and the angular distortion (as a deflection ratio) which they might generate using the method proposed by Burland (2001, in CIRIA Special Publication 200, which developed earlier work by himself and others).

6.3 The uniform founding level for the proposed basement means that the potentially critical locations will be determined by the displacements predicted by the PDISP analyses and the geometries of the adjacent buildings. For these damage category assessments we are interested in the ground movements at the foundation level of the neighbouring buildings, so it is the depth of the proposed excavation below foundation level of the neighbouring properties that must be considered.

6.4 As identified in Section 2.6 the only neighbouring property identified to have a basement or lower ground floor is the one linking No. 21 John's Mews & 27 John Street. There is no evidence that No.'s 11 and 17 John's Mews have basements beneath them. Therefore, considering their proximity to proposed basement and the locations of the heave and settlement predicted by the PDISP analyses these structures are considered to be the worst-case scenarios for potential damage. The approximate geometries are presented in Figure 18 below.

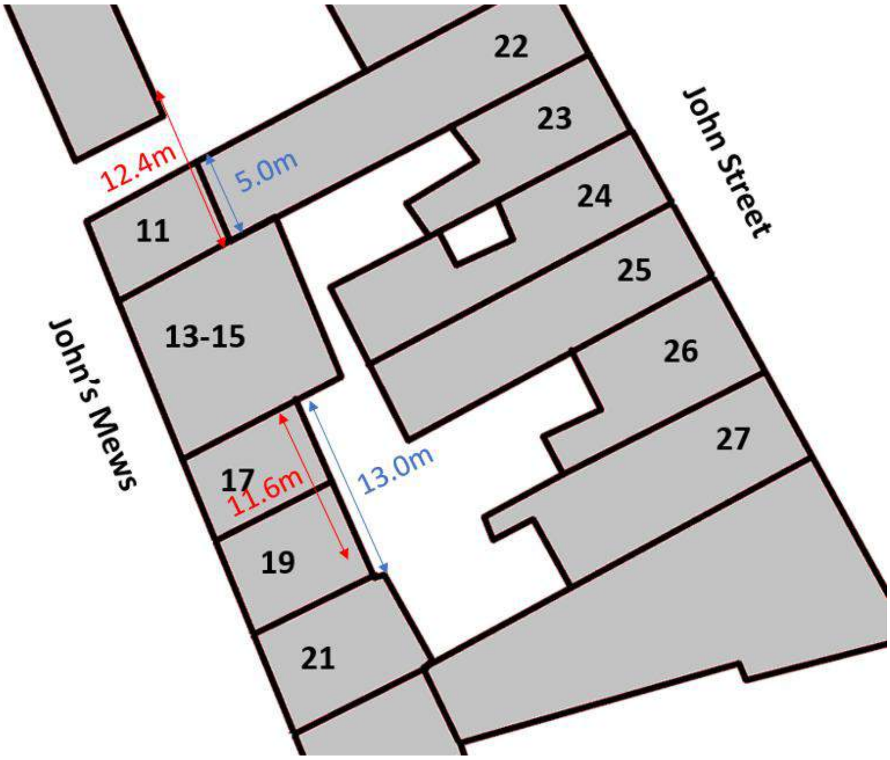


Figure 18. Approximate widths and distances of adjacent structures (Not to Scale)

6.5 The lateral extent of ground movements caused by relaxation of the ground alongside the basement excavation depends in part on whether the excavated soils are granular (mainly sands and gravels) or cohesive (clay). The ground investigation indicated that the Made Ground is variable, but included granular elements. In this assessment it is assumed that granular soils are predominantly present to the founding depth of the proposed basement. Therefore, published data for ground movements associated with the construction of retaining walls in granular soils have been used for the damage category assessments.

6.6 The damage category assessments undertaken consider the following:

- ground movements arising from the vertical stress changes, as assessed by the PDISP analyses;
- ground movements alongside the proposed underpins and retaining walls caused by relaxation of the ground in response to the excavations.

Some ground movement is inevitable when basements are constructed. Ground movements associated with the construction of retaining walls in sand have been shown to extend to a distance up to 2 times the depth of the excavation, as detailed in Figure 2.12 of CIRIA C580 (Gaba et al, 2003). CIRIA C580 does not give specific guidance on the lateral extent of horizontal movement due to excavation, therefore horizontal movements extending four times the depth of excavation (based on industry experience) have been used in this assessment.

6.7 The maximum ground surface settlements alongside a supported excavation in sand are typically 0.3% of the excavated depth, as defined in Figure 2.12 of CIRIA C580. Therefore, for a 3.9 m excavation below the property (see Section 5.1.2) the total settlement immediately alongside the proposed basement due to excavation of the soil would be 11.7 mm.

No. 11 John's Mews:

6.8 The greatest displacements predicted by PDISP where the proposed basement adjoins No. 11 are along the rear wall. Therefore, the rear wall of No. 11 is assumed to be the worst case scenario.

6.9 The relevant geometries are as follows:

Depth of foundations = 0.8 m (identified in TP2B)
Depth of excavation = 3.9 – 0.8 = 3.1 m
Zone of influence (horizontal disp't) = 3.1 x 4 = 12.4 m
Zone of influence (settlement) = 3.1 x 2 = 6.2 m

Width (L) of structure = 5.0 m (estimated)
Height (H) of structure = 5.8 m (estimated) + 0.8 m (footing depth) = 6.6 m
Hence L/H = 0.9

6.10 The predicted 5 mm maximum horizontal displacement (see Section 6.1), reduces pro-rata to 4.4 mm due to the depth of excavation. Thus, the horizontal strain beneath the rear wall would, theoretically, be in the order of $\varepsilon h = 3.55 \times 10^{-4}$ (0.036%).

6.11 The maximum settlement produced by the PDISP analysis beneath the location where the rear wall of the adjoining No. 11 meets the proposed development was in Stage 1 where approximately 2.2 mm settlement was predicted. This must be added to the settlement profile presented in Figure 2.11(b) of CIRIA Report C580 for the low stiffness ground support scenario, as CIRIA C580 does not provide a curve for moderate support stiffness systems.

6.12 The total predicted settlement (due to excavation) of 11.7 mm (see Section 6.7) is reduced to 9.3 mm when the assumed depth to the adjoining buildings footings are taken into account. The total combined settlement of 11.5 mm, 9.3 mm predicted by the CIRIA methods plus the 2.2 mm predicted by PDISP, is detailed as the point immediately alongside the proposed basement (0 m) in Figure 19 below. Figure 19 presents the settlement curve from the basement wall to the maximum distance of affected ground, 6.2 m (see Section 6.9).

6.13 The deflection along the rear wall of the adjoining building is calculated as the difference between the tangent of the relevant width of the affected walls (5.0 m) and the total predicted ground surface movements curve (from Figure 2.11(b) of CIRIA C580). For the low stiffness ground support case (appropriate to the underpinning method), settlement is convex and gives a maximum vertical deflection, Δ = 2.4 mm as displayed in Figure 19 below, which represents a deflection ratio $\Delta/L = 4.80 \times 10^{-4}$ (0.048%).

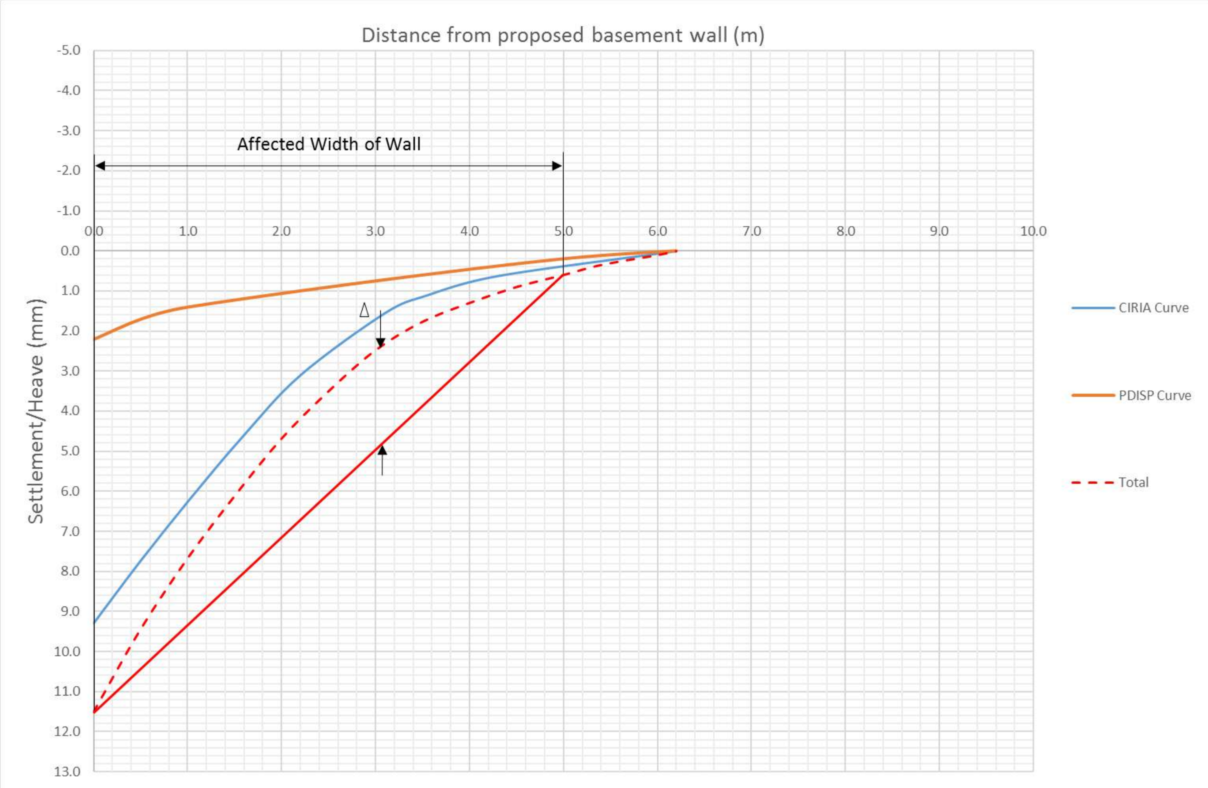


Figure 19. Combined displacements for No. 11's rear wall due to excavation of proposed basement

6.14 Using the damage category ratings and graphs given in CIRIA SP200, for L/H = 1.0 (a conservative value for the L/H of 0.9 defined in Section 6.8), these deformations represent a damage category of 'very slight' (Burland Category 1), as illustrated in Figure 20 below.

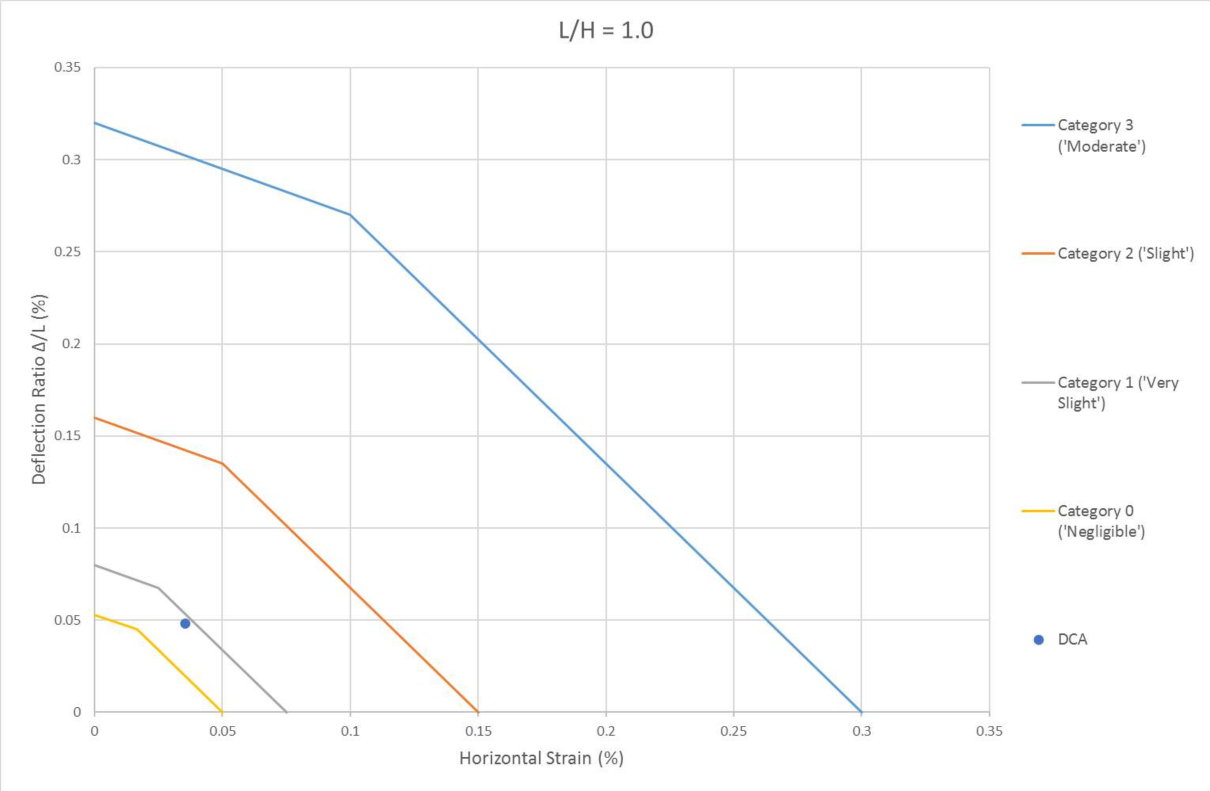


Figure 20: Damage category assessment for No. 11's rear wall

No.'s 17 and 19 John's Mews

6.15 The greatest displacements predicted by PDISP where the proposed basement adjoins No. 17 are again along the rear wall. Therefore, the rear wall of No. 17 and 19 is assumed to be the worst-case scenario.

6.16 The relevant geometries are as follows:

Depth of foundations = 1.0 m (identified in TP7)
Depth of excavation = 3.9 – 1.0 = 2.9 m
Zone of influence (horizontal disp't) = 2.9 x 4 = 11.6 m
Zone of influence (settlement) = 2.9 x 2 = 5.8 m

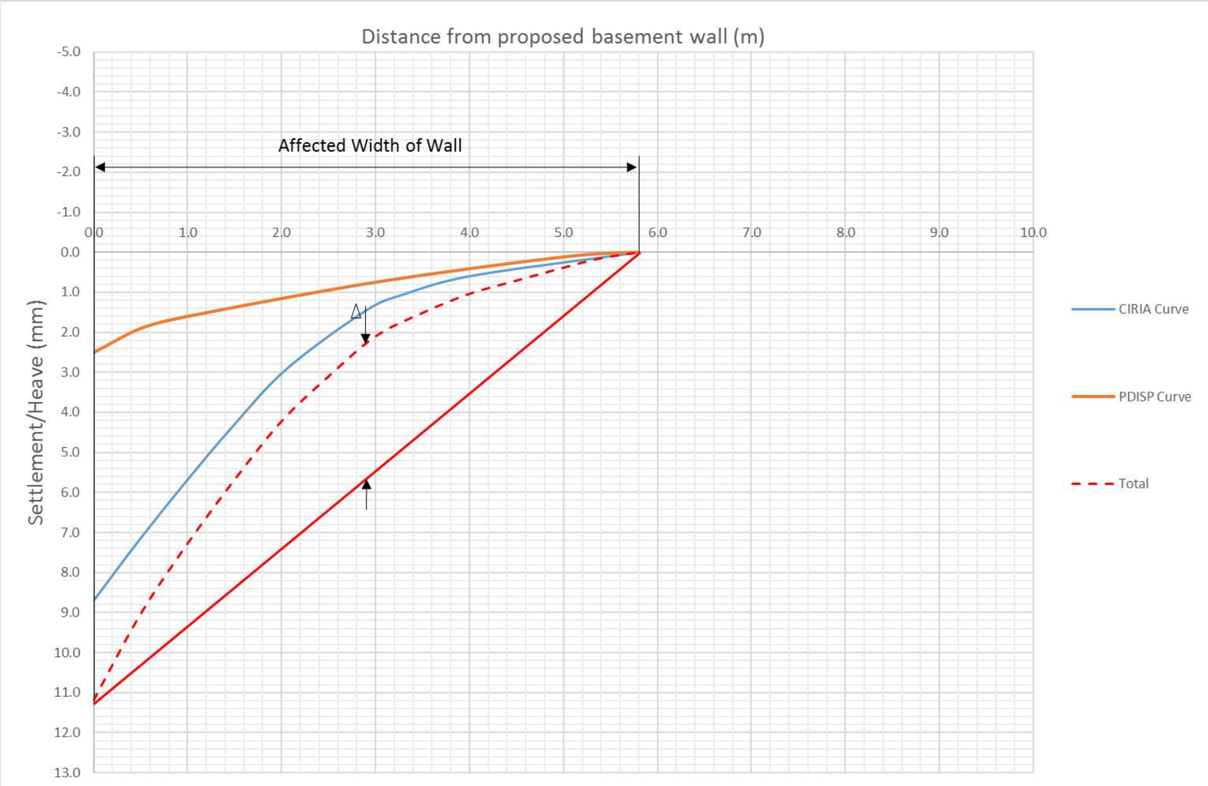
Width of structure = 13.0 m (estimated) therefore,
Affected width (L) due to settlement = 5.8 m
Height (H) of structure = 5.8 m (estimated) + 1.0 m (footing depth) = 6.8 m
Hence L/H = 0.9

6.17 The predicted 5 mm maximum horizontal displacement (see Section 6.1), reduces pro-rata to 4.1 mm due to the depth of excavation. Thus, the horizontal strain beneath the rear wall would, theoretically, be in the order of $\varepsilon h = 3.53 \times 10^{-4}$ (0.035%).

6.18 The maximum settlement produced by the PDISP analysis beneath the location where the rear wall of the adjoining No. 17 meets the proposed development was in Stage 1 where approximately 2.5 mm settlement was predicted. This must be added to the settlement profile presented in Figure 2.11(b) of CIRIA Report C580 for the low stiffness ground support scenario, as CIRIA C580 does not provide a curve for moderate support stiffness systems.

6.19 The total predicted settlement (due to excavation) of 11.7 mm (see Section 6.7) is reduced to 8.7 mm when the assumed depth to the adjoining buildings footings are taken into account. The total combined settlement of 11.2 mm, 8.7 mm predicted by the CIRIA methods plus the 2.5 mm predicted by PDISP, is detailed as the point immediately alongside the proposed basement (0 m) in Figure 21 below. Figure 21 presents the settlement curve from the basement wall to the maximum distance of affected ground, 5.8 m (see Section 6.16).

6.20 The deflection along the rear wall of the adjoining buildings is calculated as the difference between the tangent of the relevant width of the affected walls (5.8 m) and the total predicted ground surface movements curve (from Figure 2.11(b) of CIRIA C580). For the low stiffness ground support case (appropriate to the underpinning method), settlement is convex and gives a maximum vertical deflection, Δ = 3.4 mm as displayed in Figure 21 below, which



represents a deflection ratio Δ/L = 5.86 x 10^{-4} (0.059%).

Figure 21. Combined displacements for No. 17's and 19's rear wall due to excavation of proposed basement

6.21 Using the damage category ratings and graphs given in CIRIA SP200, for L/H = 1.0 (a conservative value for the L/H of 0.9 defined in Section 6.16), these deformations represent a damage category of 'slight' (Burland Category 2), just above the boundary of 'very slight', as illustrated in Figure 22 below.

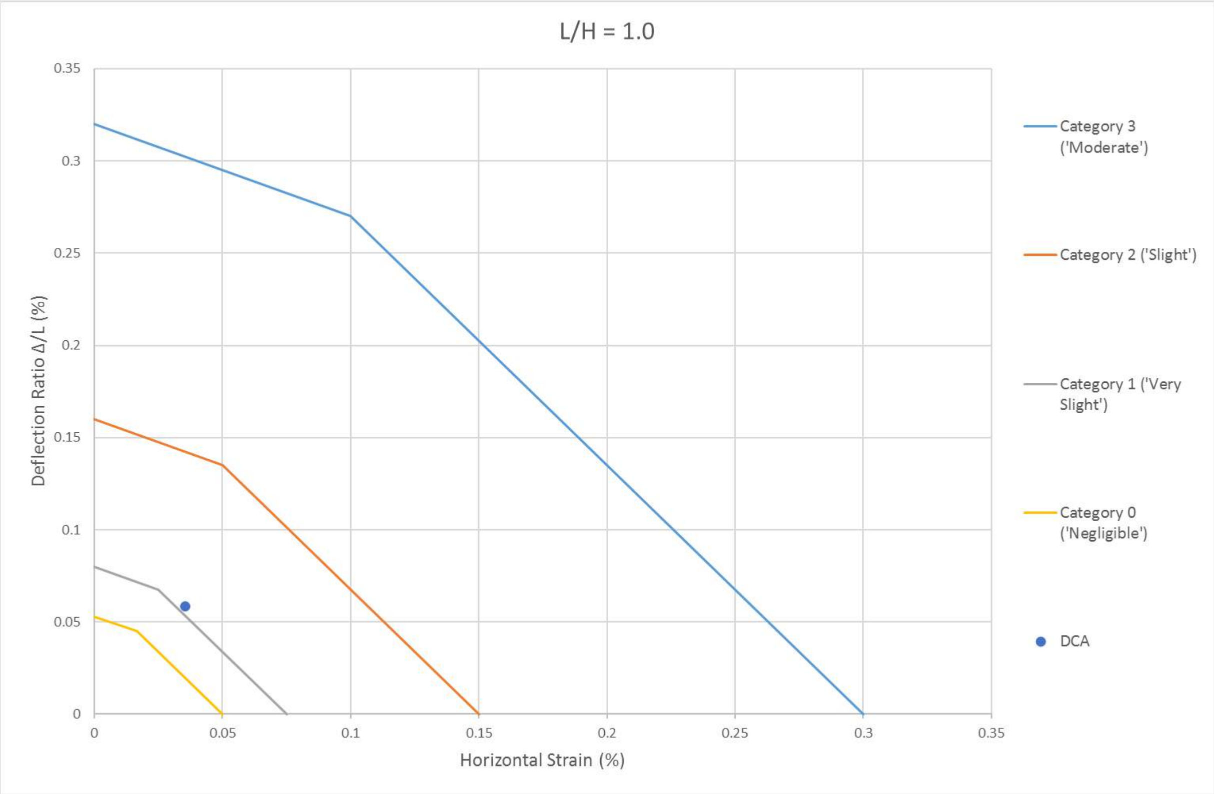


Figure 22: Damage category assessment for No. 17's and 19's rear wall

6.22 Due to the geometry and distance of other neighbouring structures from the proposed basement development it is assumed the development will have a lower potential to cause damage to them than both of those assessed above. Therefore, other structures have not been assessed in detail, and the damage category assessment to all other surrounding developments is assumed to be Category 1 'very slight' or lower.

6.23 Under UK standard practice the contractor (and/or their designer) is responsible for designing and implementing the temporary works. Use of best practice construction methods will be essential to ensure that the ground movements are kept in line with the above predictions. Pre-construction condition surveys of neighbouring properties are also recommended and a system of monitoring adjoining and adjacent structures should be established before the works start.

7.0 CONCLUSIONS AND NON-TECHNICAL SUMMARY

7.1 This Non-Technical Summary includes only the principal aspects and primary findings of this assessment; the whole report should be read to obtain a full understanding of the matters considered.

Stage 1: Screening

7.2 The screening exercise in accordance with CPG4 has identified the issues which need to be taken forward to Stage 2 (Scoping). Details of screening questions and responses are given in Appendix A of this report.

Stage 2: Scoping

7.3 An initial conceptual ground model was developed at scoping stage and can be summarised as:

- The proposed basement excavation is to approximately 3.9 m bgl.
- The surrounding land slopes at less than 2°.
- The nearest surface water feature identified is 340 m east of the site and the nearest well is approximately 230 m to the east.
- The site is an area where flooding from rivers and seas is reported as very unlikely, and the flood risk from surface water is reported to be low.
- The site is located above a 'Secondary A' aquifer, formed by the Lynch Hill Gravel Member and an 'Unproductive' stratum formed by the clay of the London Clay Formation.
- A disused railway oriented north-east to south-west is indicated to pass 22 m north of the site, this is possibly a Royal Mail tunnel.

7.4 The scoping exercise has reviewed the potential impacts for each of the items carried forward from Stage 1 screening and has identified the following actions to be undertaken:

- A ground investigation is required (which has already been undertaken), followed by relevant impact assessments (presented herein).
- Appropriate design and implementation of temporary groundwater control measures.
- Appropriate design and adequate implementation of temporary and permanent support to excavations, including use of best practice underpinning methods.

Stage 3: Site Investigation

7.5 Two ground investigations completed by Chelmer (2014 and 2015) comprised two boreholes to a maximum depth of 12.0 m bgl and nine hand excavated trial pits to examine the current properties' foundations. The ground investigation indicated that the 'Reworked' Ground and Alluvium was present beneath Made Ground at a depth of 3.0 m bgl. The Lynch Hill Gravel Member was then encountered from 4.0 to 5.7 m bgl and consisted of slightly silty, variably sandy GRAVEL. The London Clay Formation was recorded to the maximum drilling depth of 12.0 m bgl.

7.6 A groundwater 'seepage' was observed within borehole BH1B at a depth of 5.9 m bgl. Standing groundwater was observed within borehole BH1B at a depth of 9.5 m bgl. A groundwater strike was observed at a depth of 4.5 m bgl in BH5 which rose to 4.2 m bgl; however, the borehole was dry on completion due to the water being sealed out when the casing reached 6.0 m bgl. Monitoring standpipes were installed to 8.0 m bgl and 12.0 m bgl in BH1B and BH5 respectively. On return gas/groundwater monitoring visits, between July 2014 and May 2017, to the installations fitted within borehole BH1B and BH5 groundwater levels were recorded between 2.9 m bgl and 3.8 m bgl.

7.7 The site investigation confirmed the conceptual site model, and further identified that a significant thickness of Made Ground was present over the Lynch Hill Gravel Member.

7.8 The Chelmer (2016) Geo-Environmental Interpretative Report addresses contamination issues, and that report should be noted by the contractors. However, it is appropriate to note here that its paragraph 6.71 states that 'Due to the elevated concentrations identified, any excavated material at this site may pose a 'moderate' hazard to ground workers as far as Health and Safety is concerned. We would therefore recommend that standard Health and Safety precautions be taken with regard to ground workers at this site. These should include PPE equipment such as gloves, overalls etc. to prevent dermal contact with the soils. Washing facilities should be made available on-site to reduce extended contact with site soils. During the construction phase, dust suppression measures may be required to minimise potential inhalation of dust by neighbours or ground workers.'

Stage 4: Impact Assessment

7.9 The site is in an area where flooding from rivers and seas is defined as very unlikely and the flood risk from surface water is low. This combined with no record of historic flooding near John's Mews in either the 1975 or 2002 floods can lead to the conclusion that conventional measures of managing surface water run-off should be sufficient to minimise any potential hydrological impacts.

7.10 The site is located above a 'Secondary A' aquifer formed by the Lynch Hill Gravel Member. Groundwater was observed as high as 2.9 m bgl on one of the return monitoring visits. Permeable strata (Lynch Hill Gravel Member) is indicated to be below the underpins and to be present for approximately 2.0 m below the founding level of the basement. Therefore, it is considered unlikely that the basement would cause any significant adverse impact on groundwater flows as groundwater will be able to divert beneath the basement structure. The piles supporting the slabs are sufficiently widely spaced that they are unlikely to restrict groundwater flow.

7.11 The basement will be excavated below groundwater level and groundwater control will be required during the basement construction works. The soils above formation level are dominated by Made Ground and are likely to be of variable permeability; groundwater seepages and inflows should be expected. In clay-dominated Made Ground sump pumping may be appropriate. However, more granular dominated Made Ground may have a higher permeability, and alternative measures, such as wellpointing may be required. Specialist dewatering contractors should be consulted if significant groundwater inflows are encountered.

7.12 The standpipes installed on site should be maintained so that further groundwater level monitoring readings can be taken during the detailed design and prior to the start of construction.

7.13 The Groundsure Report (Appendix E) identifies a disused railway oriented north-east to south-west passing 22 m north of the site, this is possibly a Royal Mail tunnel. Further enquiries should be made to determine whether it is relevant to the proposed basement at No's 13/15.

7.14 The site is located on a relatively flat area with a slope gradient of less than 2°, therefore slope stability will be highly unlikely to cause any problems with the proposed basement.

7.15 Contour plots of displacement in response to the changes in vertical pressure caused by the excavation and construction of the proposed basement are presented in Figures 14 – 17.

7.16 A Damage Category Assessment (DCA) was undertaken for the worst case scenarios in the adjacent structures, based on the maximum displacements predicted by the PDISP analyses, combined with the ground movements alongside the basement in response to the lateral stress releases, as predicted by CIRIA C580.

7.17 In the assessed cases, the rear wall of No.'s 17 and 19 John's Mews, fell within Burland Category 2 'slight', just above the 'very slight boundary' (as given in CIRIA SP200, Table 3.1) and the rear wall of No. 11 John's Mews fell within Category 1 'very slight'. The damage category results have been plotted graphically in Figures 20 and 22.

7.18 No further damage category assessments have been carried out as the assessed cases are considered the worst-case scenarios and therefore all other structures will be classified as Category 1 'very slight' or lower.

7.19 Use of best practice construction methods will be essential to ensure that the ground movements are kept in line with the above predictions. Pre-construction condition surveys of neighbouring properties are also recommended and a system of monitoring adjoining and adjacent structures should be established before the works start.

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End of report

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a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of Chelmer Site Investigation Laboratories Limited (CSI) to act as a consultant.
b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, CSI has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
e) CSI acknowledges that it is being retained, in part, because of its knowledge and experience with respect to environmental matters. CSI will consider and analyse all information provided to it in the context of our knowledge and experience and all other relevant information known to us. To the extent that the information provided to us is not inconsistent or incompatible therewith, CSI shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of such information.
f) The content of this report represents the professional opinion of experienced environmental consultants. CSI does not provide specialist legal advice and the advice of lawyers may be required.
g) In the Summary and Recommendations sections of this report, CSI has set out our key findings and provided a summary and overview of our advice, opinions and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by CSI and therefore any advice, opinions or recommendations set out in the Executive Summary, Summary and Recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data, which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
i) There may be special conditions appertaining to the site, which have not been taken into account in the report. The assessment may be subject to amendment in light of additional information becoming available.
j) Where any data supplied by the client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by CSI for inaccuracies within the data supplied by other parties.
k) Whilst the report may express an opinion on possible ground conditions between or beyond trial pit or borehole locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy thereof.
l) Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. Groundwater conditions may vary due to seasonal or other effects.
m) This report is prepared and written in the context of the agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a reinterpretation of the report in whole or part after its original submission.
n) The copyright in the written materials shall remain the property of the CSI but with a royalty-free perpetual license to the client deemed to be granted on payment in full to CSI by the client of the outstanding amounts.
o) These terms apply in addition to the CSI Standard Terms of Engagement (or in addition to another written contract which may be in place instead thereof) unless specifically agreed in writing. (In the event of a conflict between these terms and the said Standard Terms of Engagement the said Standard Terms of Engagement shall prevail). In the absence of such a written contract the Standard Terms of Engagement will apply.
p) This report is issued on the condition that CSI will under no circumstances be liable for any loss arising directly or indirectly from subsequent information arising but not presented or discussed within the current Report.
q) In addition CSI will not be liable for any loss whatsoever arising directly or indirectly from any opinion within this report

APPENDIX A

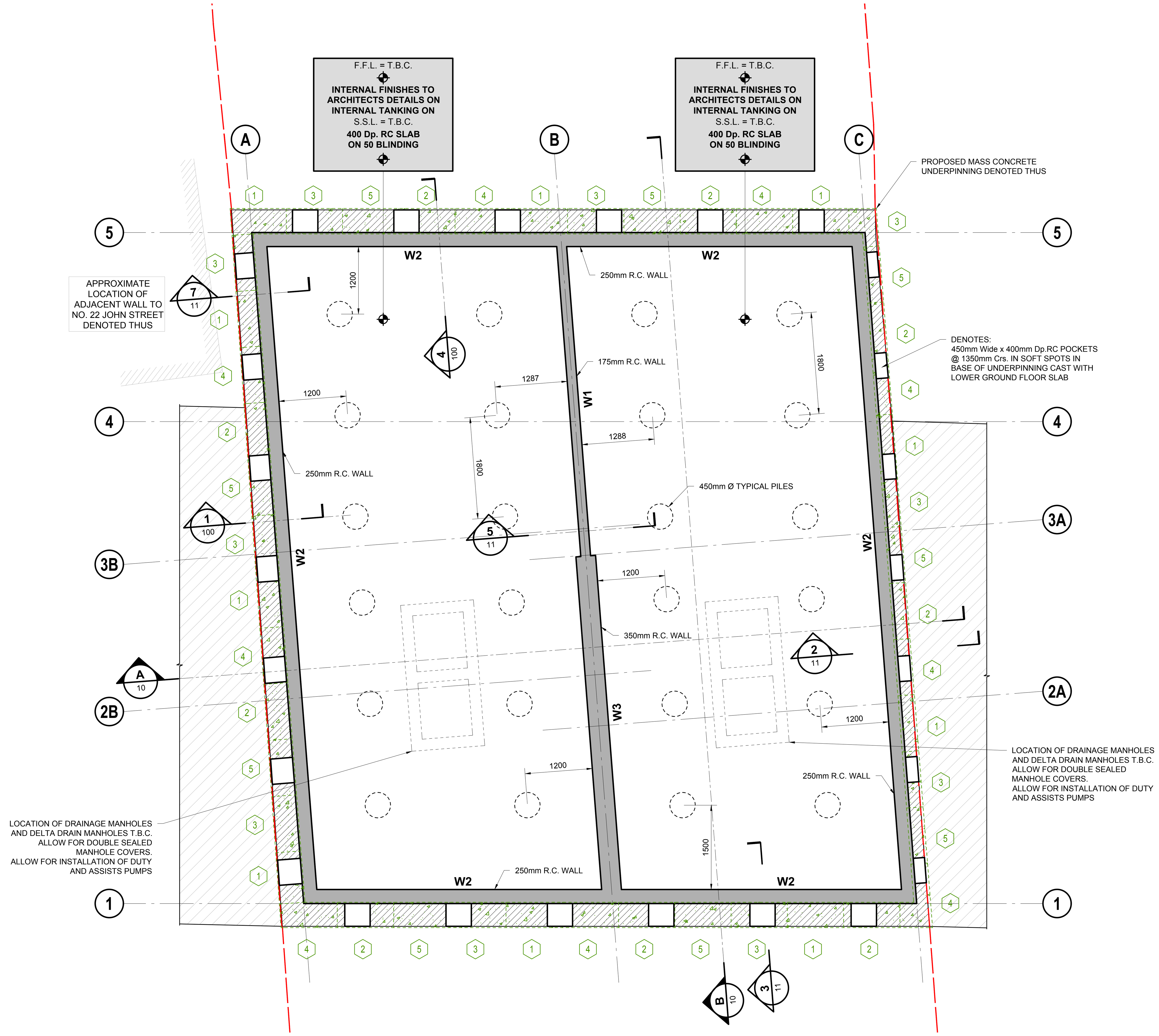
SCREENING ASSESSMENT

Subterranean (groundwater) flow screening chart	
1. a) Is the site located directly above an aquifer?	Yes. The site is located above the 'Secondary A' aquifer of the Lynch Hill Gravel Member. However, there is no planned increase in hard surfacing so infiltration into the aquifer is not anticipated to be affected (see Section 4.2 and 4.3)
b) Will the proposed basement extend beneath the water table surface?	Yes. Groundwater monitoring has shown the groundwater level to be as high as 1 m above the proposed founding level. However, there is anticipated to be limited groundwater flow due to the low topographic relief and any flow present should be able to continue beneath the basement through the permeable strata (see Section 4.2).
2. Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No. There are no surface water features within 250 m of the site and nearby former minor tributaries to the Fleet are believed to be culverted (see Sections 3.3 and 4.1)
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No. The site is over 4 km from Hampstead Heath.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No. The site has no external area.
5. As part of the site drainage, will more surface water (e.g. rainfall and runoff) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No. Roof/surface water will continue to be discharged to the mains drainage system.
6. Is the lowest point of the proposed excavation (allowing for 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. There are no surface water features within 250 m of the site.

Slope stability screening chart	
1. Does the existing site include slopes, natural or manmade, greater than 7 degrees? (approx. 1 in 8)	No. The site is level and fully developed.

2. Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7 degrees? (approx. 1 in 8)	No. No major re-profiling is indicated.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees? (approx. 1 in 8)	No. The surrounding area is relatively flat (see Section 3.2).
4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees? (approx. 1 in 8)	No. The surrounding area is relatively flat (see Section 3.2).
5. Is the London Clay the shallowest strata at the site?	No. The Lynch Hill Gravel Member is the shallowest natural strata (see Section 3.5)
6. Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?	No. There are no trees on site.
7. Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at site?	No. Structural cracking observed during the site visit is believed to be due to differential settlement of foundations within Made Ground.
8. Is the site within 100 m of a watercourse or a potential spring line?	No. There are no surface water features within 250 m of the site.
9. Is the site within an area of previously worked ground?	Yes. The ground investigation found deep Made Ground and Reworked Ground. Backfilled workings may present less stable ground for excavations. Appropriate design required of both permanent basement walls and temporary support to excavations.
10. 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?	Yes. The site is located above the 'Secondary A' aquifer of the Lynch Hill Gravel Member. Appropriate design of groundwater control required.
11. Is the site within 50 m of the Hampstead Heath Ponds	No. The site is over 4 km from Hampstead Heath.
12. Is the site within 5 m of a highway or pedestrian right of way?	Yes. Ensure adequate temporary and permanent support by use of best practice underpinning methods.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes. Neighbouring properties do not currently have basement levels and are likely to be set on shallow foundations. A Damage Category Assessment has been carried to assess the potential damage to neighbouring properties (see Section 6.0).
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	Unlikely. The Groundsure report indicates an abandoned or dismantled railway line within 50 m to the north of the site. Enquiries should be made to identify the exact location of any tunnels or railways in the vicinity.

Surface flow and flooding screening chart	
1. Is the site within the catchment of the pond chains on Hampstead Heath?	No. The site is over 4 km from Hampstead Heath.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No. Roof/surface water will continue to be discharged to the mains drainage system.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No. The basement will be beneath the existing building.
4. Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?	No. No run-off is received by adjacent properties. Nearby historic watercourses have been culverted.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No. There will be no significant change in types of surface generating run-off. None of the surface run-off from this property reaches a nearby watercourse.
6. Is the site in an area identified to have surface water flood risk 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. The site is not near an area that flooded during the 1975 or 2002 floods and is indicated to be of low risk (see Section 4.3).



PROPOSED LOWER GROUND FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100

PRELIMINARY

NOTES

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- NEW NON-LOADBEARING WALL
- LOADBEARING TIMBER STUD WALL
- EXISTING MASONRY WALL
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- B1 — CONCRETE BEAM
- C1 — CONCRETE COLUMN
- EX. J — DENOTES EXISTING JOISTS SPAN DIRECTION
- Jx — DENOTES NEW JOISTS SPAN DIRECTION

SCHEDULE OF CONCRETE MEMBERS

CONCRETE WALLS

REF.	SIZE	COMMENT
W1	175mm THK. R.C. WALL	-
W2	250mm THK. R.C. WALL	-
W3	350mm THK. R.C. WALL	-

CONCRETE WALLS

REF.	SIZE	COMMENT
B1	300 Wide x 500mm Dp. R.C. BEAM	-

CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

STEEL COLUMNS

REF.	SIZE	COMMENT
SC1	152 UC 23kg.	-

STEEL BEAMS

REF.	SIZE	COMMENT
SB1	203 UC 46kg.	-
SB2	203 UC 60kg.	-
SB3	152 UC 23kg.	-
SB4	200 x 100 RHS 5.0	WITH 225 x 10mm THK. BOTTOM PLATE
SB5	203 UC 60kg.	CRANKED BEAM

SCHEDULE OF TIMBER MEMBERS

TIMBER JOISTS

REF.	SIZE	COMMENT
J1	47 x 220 C24 TIMBER JOISTS @ 400mm Crs.	-
J2	47 x 170 C24 TIMBER JOISTS @ 400mm Crs.	-

ISSUE	DATE	DESCRIPTION	DRN/ORIG	P.E./P.D.
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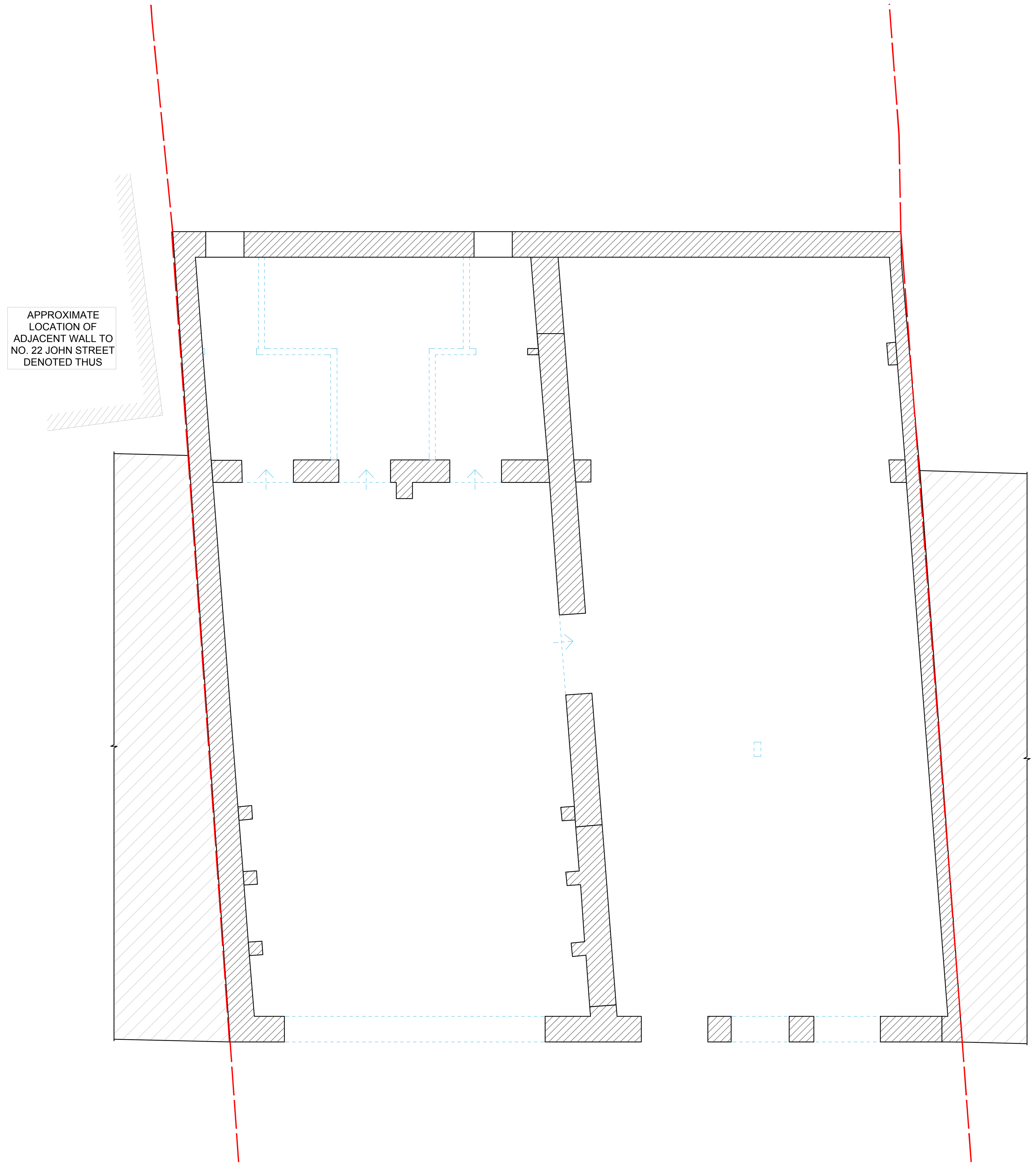
CLIENT
JM13 Ltd.

PROJECT TITLE
No. 13-15 JOHN'S MEWS, LONDON, WC1N 2PA

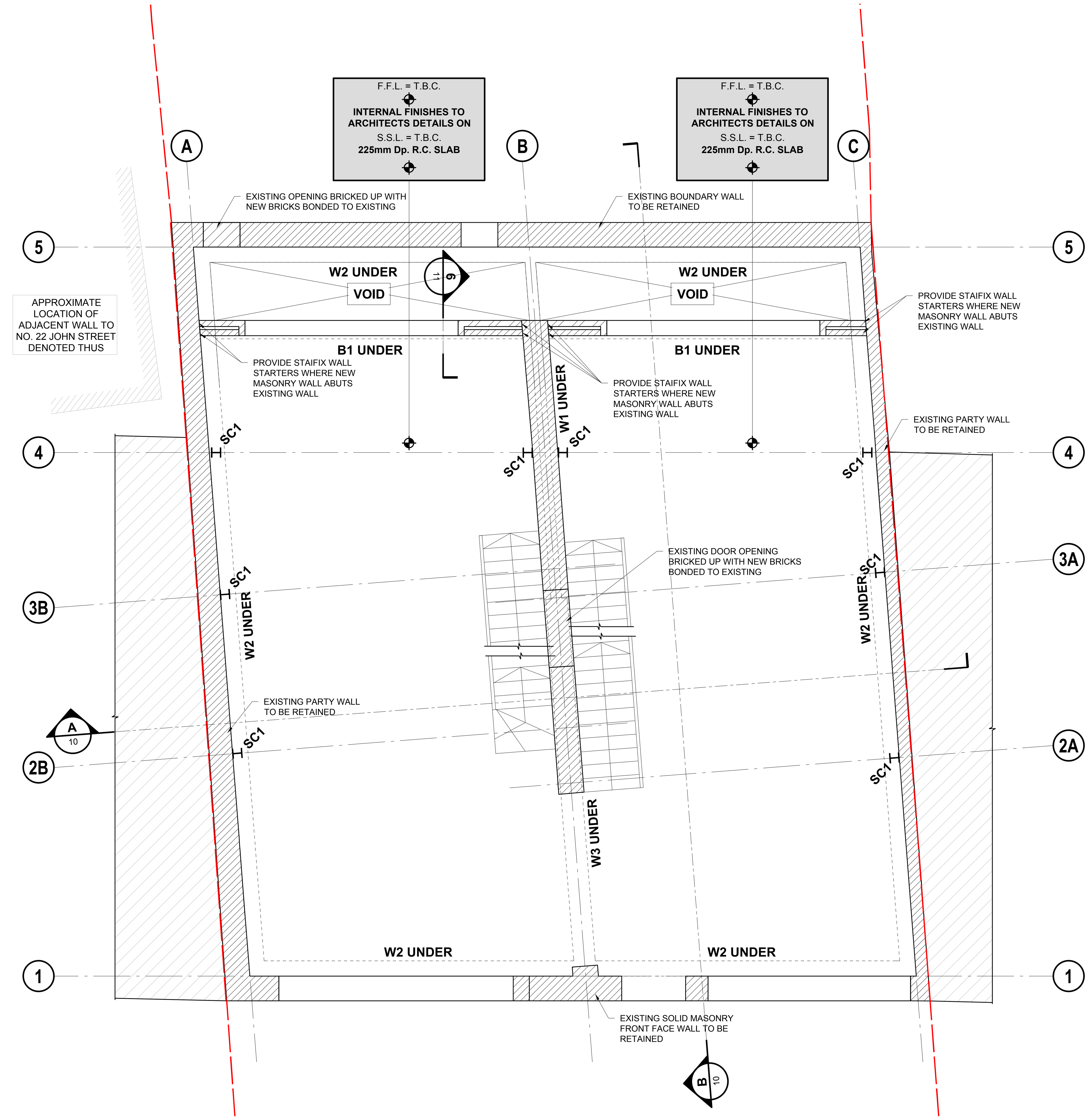
DRAWING TITLE
PROPOSED LOWER GROUND FLOOR PLAN

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	01	P2



EXISTING GROUND FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100



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SCALE @ A1: 1:50
SCALE @ A3: 1:100

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CONCRETE WALLS

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CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

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STEEL BEAMS

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SB4	200 x 100 RHS 5.0	WITH 225 x 10mm THK. BOTTOM PLATE
SB5	203 UC 60kg.	CRANKED BEAM

SCHEDULE OF TIMBER MEMBERS

TIMBER JOISTS

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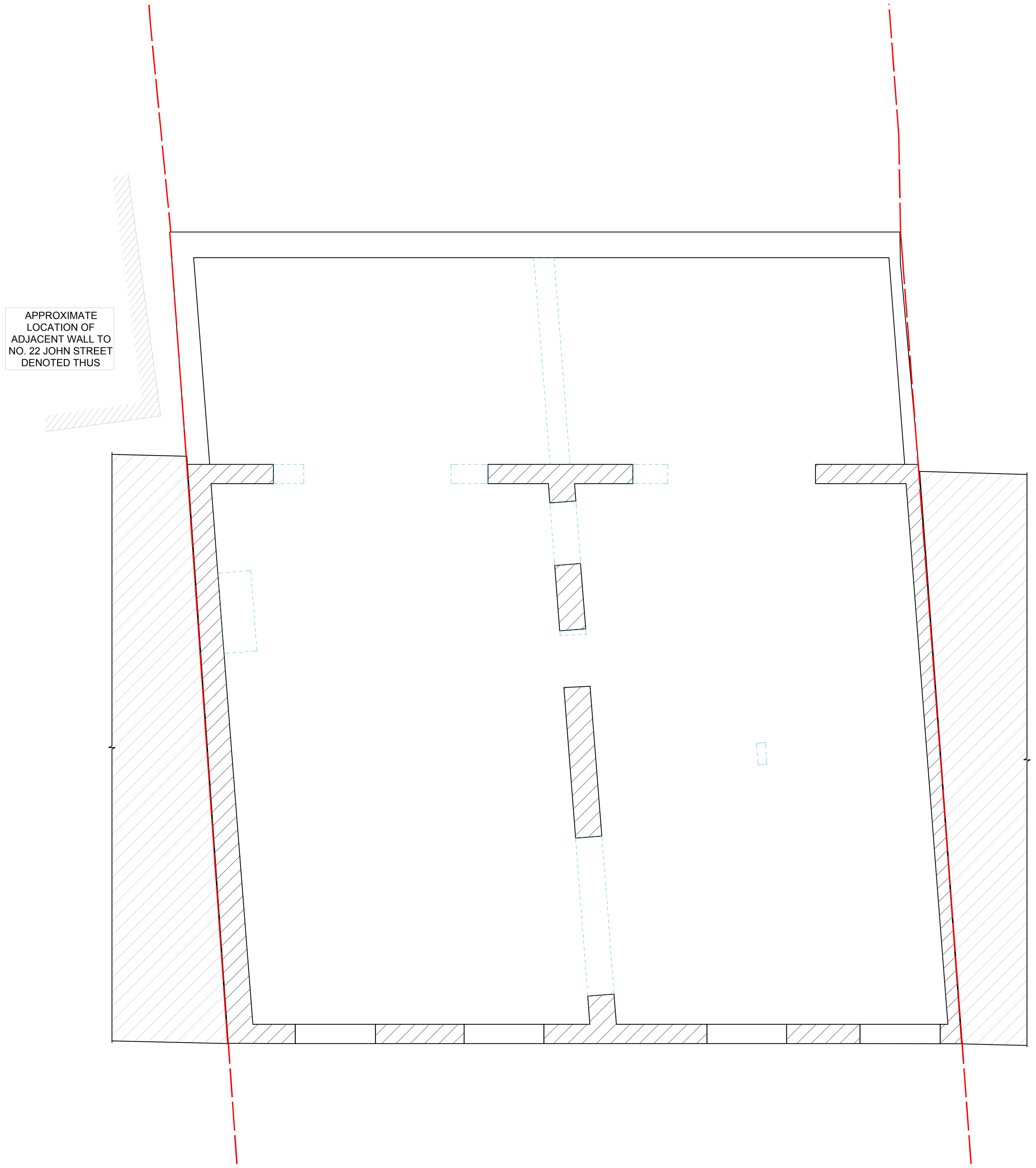
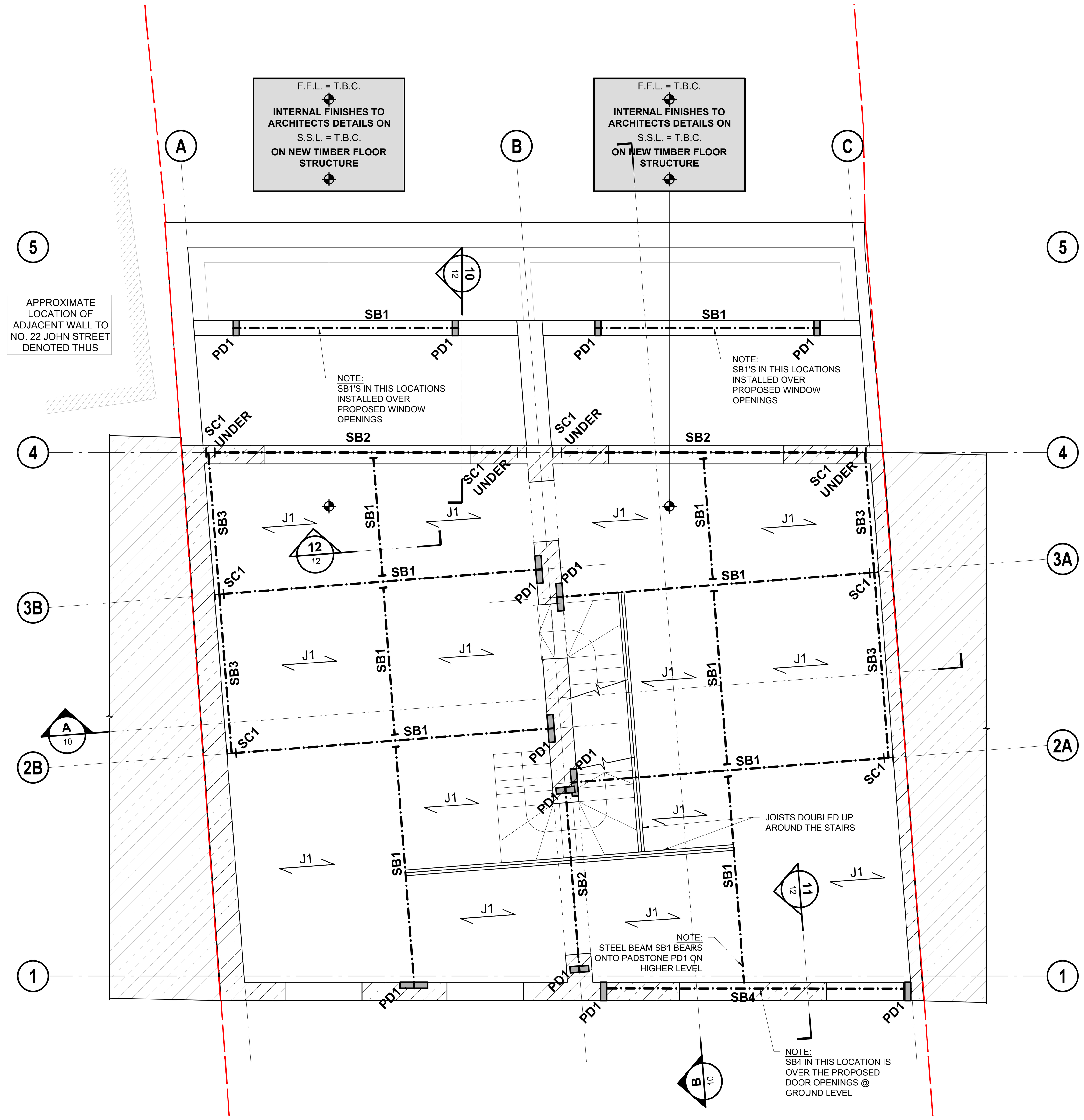
DRAWING TITLE
EXISTING AND PROPOSED GROUND FLOOR PLANS

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	02	P2



EXISTING FIRST FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100



PROPOSED FIRST FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100

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CONCRETE WALLS

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CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

STEEL COLUMNS

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STEEL BEAMS

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DRAWING TITLE
EXISTING AND PROPOSED FIRST FLOOR PLANS

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
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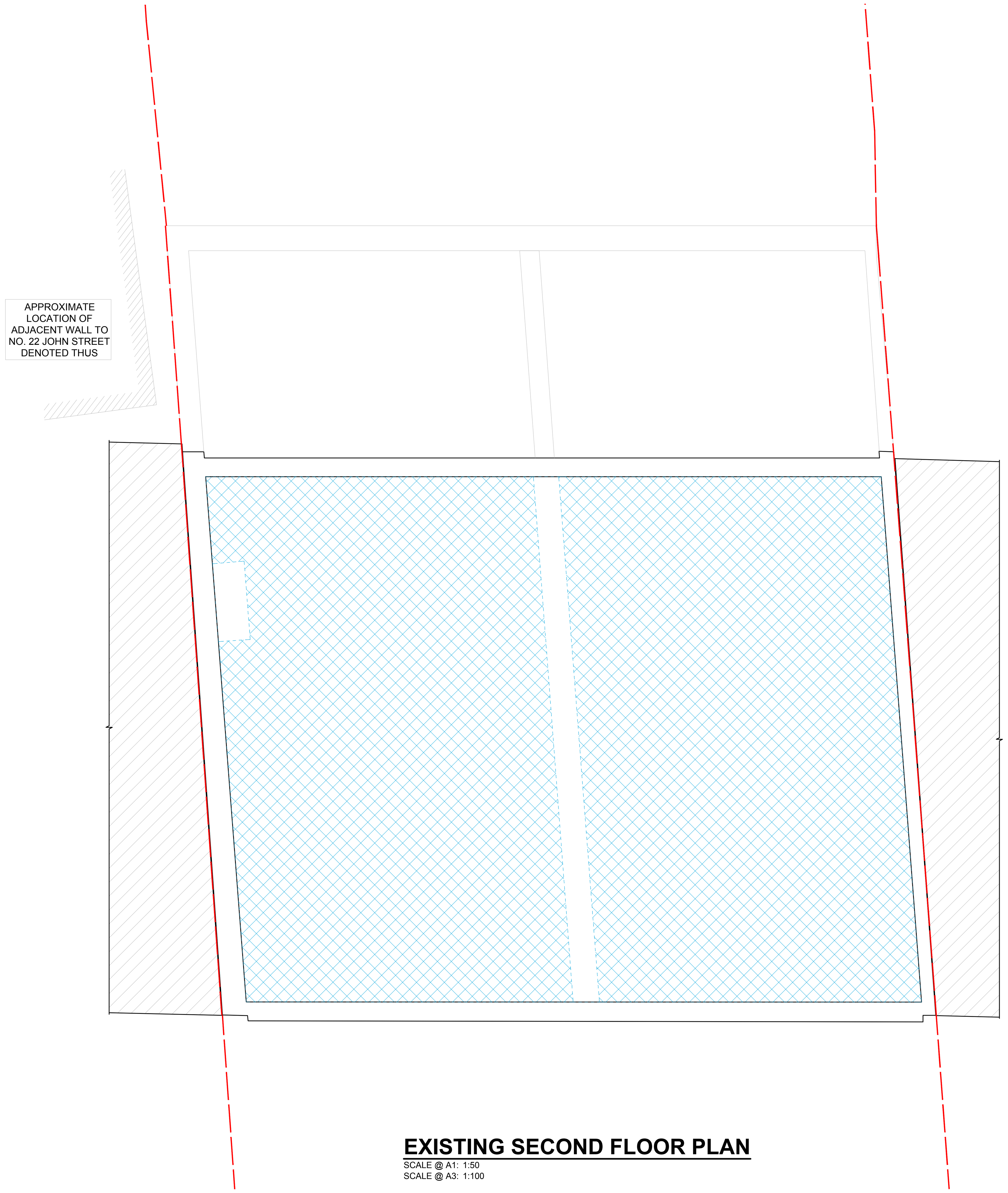
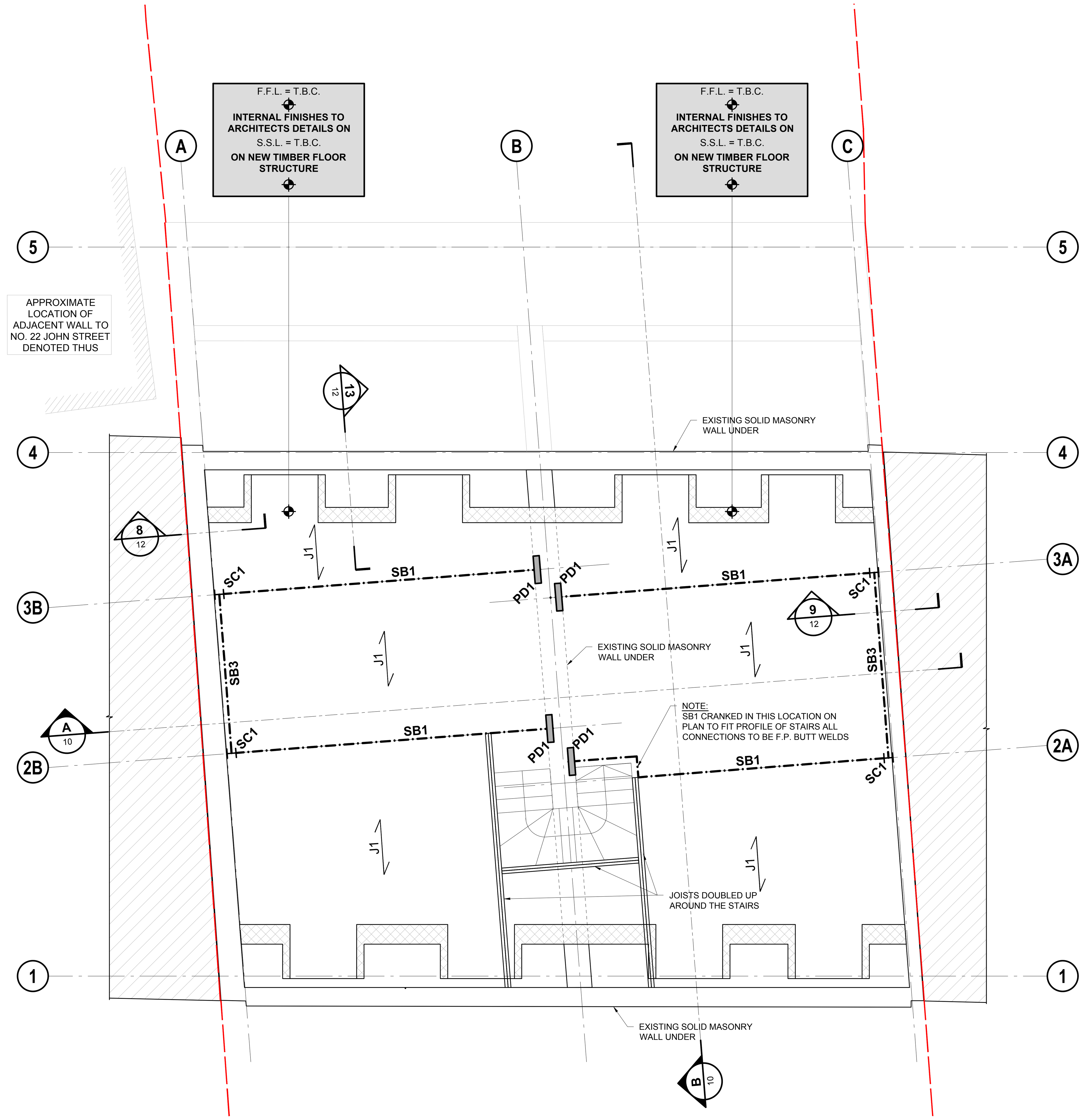


EXISTING SECOND FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100



PROPOSED SECOND FLOOR PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100

SCHEDULE OF CONCRETE MEMBERS

CONCRETE WALLS

REF.	SIZE	COMMENT
W1	175mm THK. R.C. WALL	-
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CONCRETE WALLS

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CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

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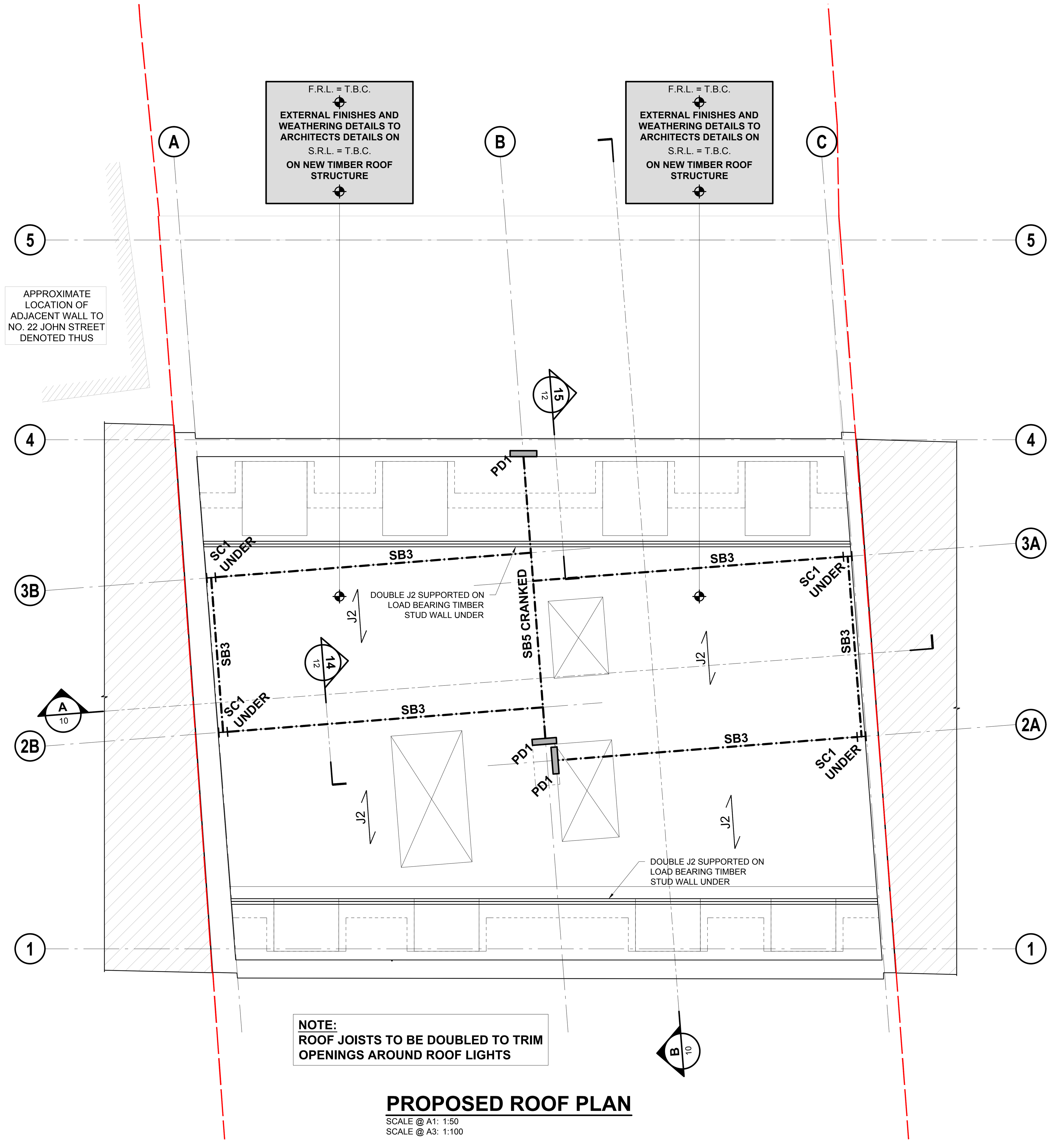
DRAWING TITLE
EXISTING AND PROPOSED SECOND FLOOR PLANS

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	04	P2



NOTE:
ROOF JOISTS TO BE DOUBLED TO TRIM OPENINGS AROUND ROOF LIGHTS

PROPOSED ROOF PLAN

SCALE @ A1: 1:50
SCALE @ A3: 1:100

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W3	350mm THK. R.C. WALL	-

CONCRETE WALLS

REF.	SIZE	COMMENT
B1	300 Wide x 500mm Dp. R.C. BEAM	-

CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

STEEL COLUMNS

REF.	SIZE	COMMENT
SC1	152 UC 23kg.	-

STEEL BEAMS

REF.	SIZE	COMMENT
SB1	203 UC 46kg.	-
SB2	203 UC 60kg.	-
SB3	152 UC 23kg.	-
SB4	200 x 100 RHS 5.0	WITH 225 x 10mm THK. BOTTOM PLATE
SB5	203 UC 60kg.	CRANKED BEAM

SCHEDULE OF TIMBER MEMBERS

TIMBER JOISTS

REF.	SIZE	COMMENT
J1	47 x 220 C24 TIMBER JOISTS @ 400mm Crs.	-
J2	47 x 170 C24 TIMBER JOISTS @ 400mm Crs.	-

ISSUE	DATE	DESCRIPTION	DRN. / ORIG.	P.E. / P.D.
P2	25.05.17	RE-ISSUED FOR COMMENT	M.A. / P.P.	O.C. / V.B.
P1	19.05.17	ISSUED FOR COMMENT	M.A. / P.P.	O.C. / V.B.

ISSUE STATUS
☒ PRELIMINARY (P1, P2, P3 etc.,) ☐ PLANNING (PL1, PL2, PL3 etc.,)
☐ TENDER (T1,T2, T3 etc.,) ☐ CONSTRUCTION (0, 1, 2 etc.,)

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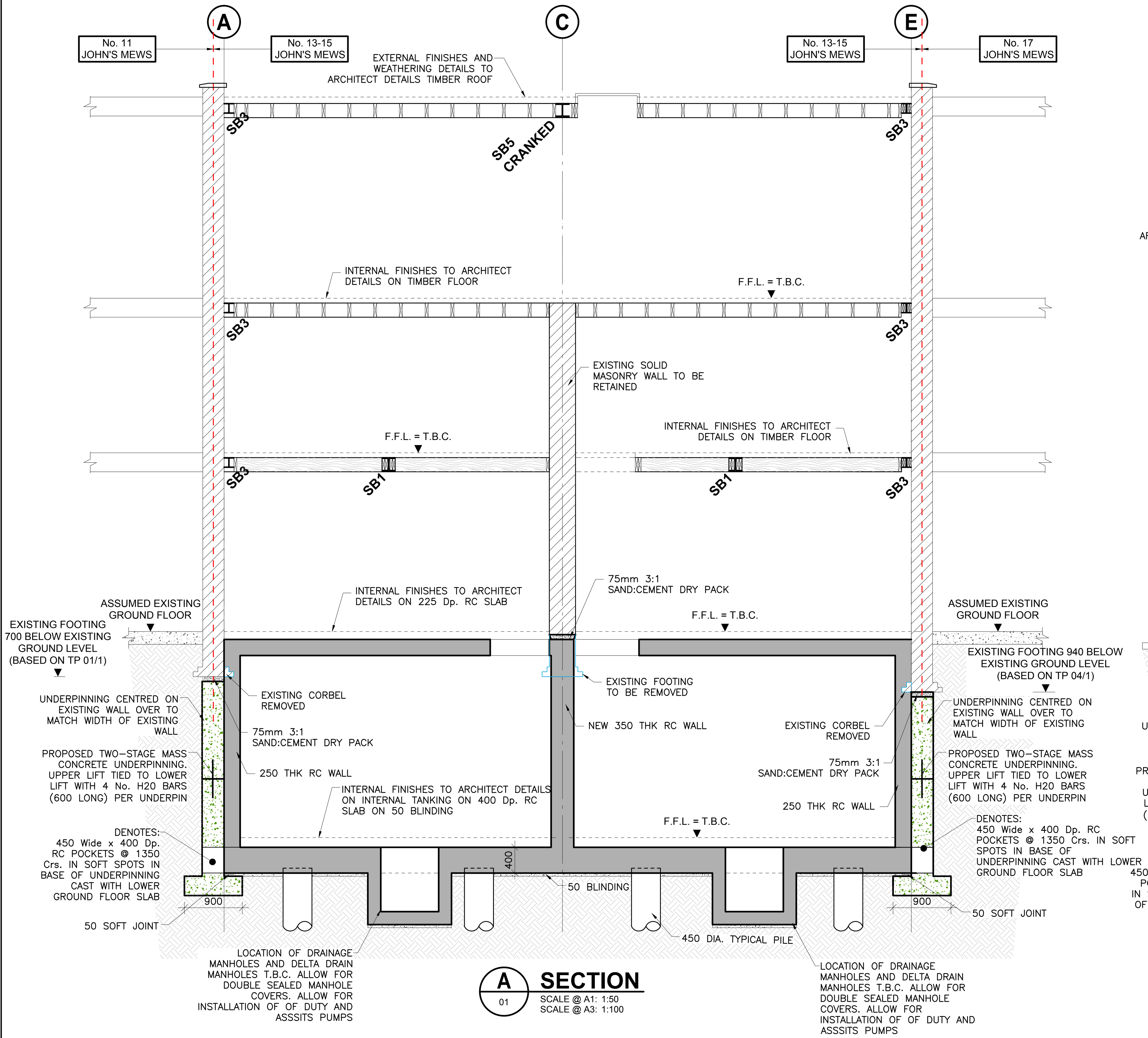
barrett mahony

CLIENT
JM13 Ltd.

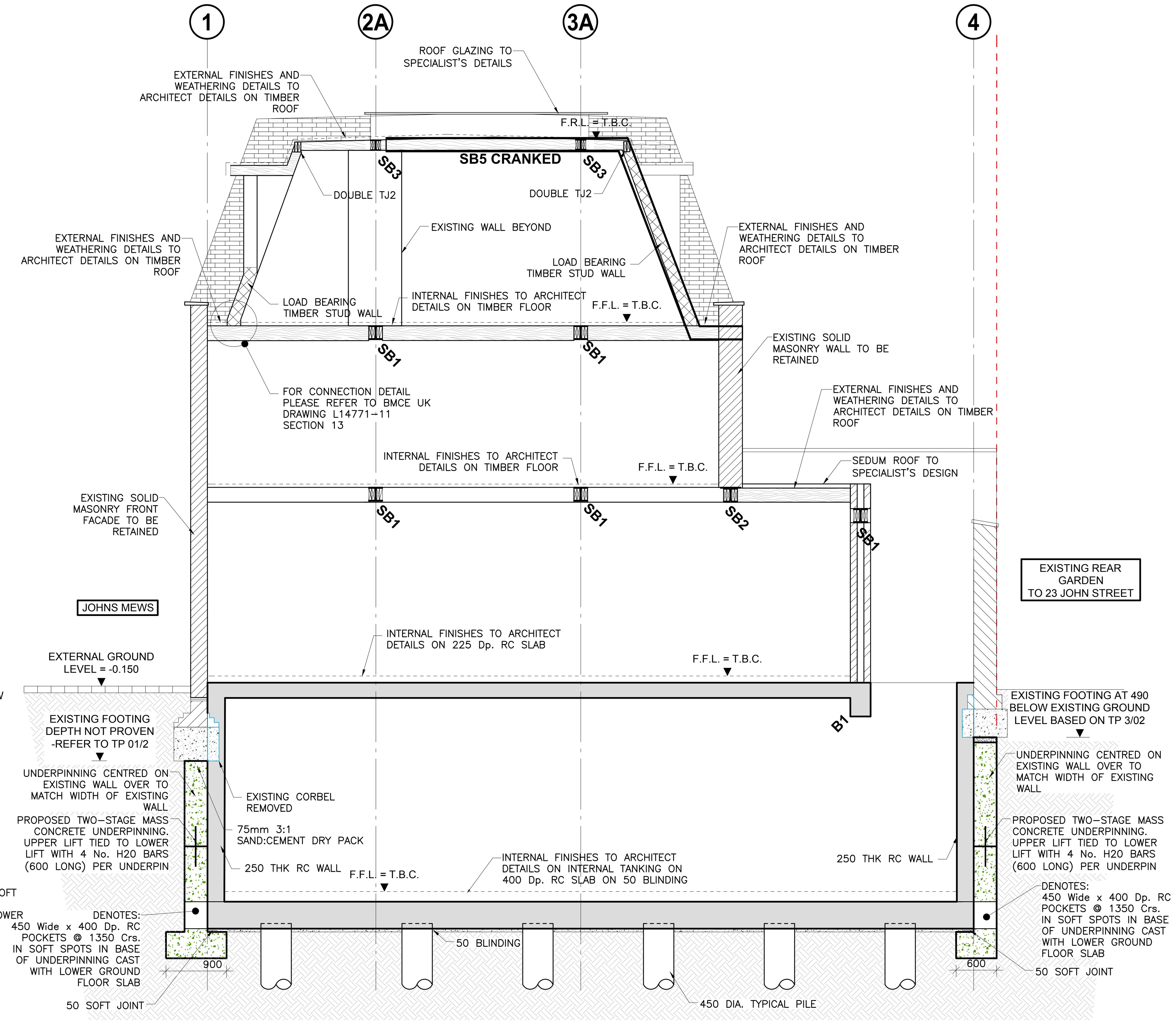
PROJECT TITLE
No. 13-15 JOHN'S MEWS, LONDON, WC1N 2PA

DRAWING TITLE
PROPOSED ROOF PLAN

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	05	P2



A SECTION 01
SCALE @ A1: 1:50
SCALE @ A3: 1:100



B SECTION 01
SCALE @ A1: 1:50
SCALE @ A3: 1:100

PRELIMINARY

NOTES

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SCHEDULE OF CONCRETE MEMBERS

CONCRETE WALLS

REF.	SIZE	COMMENT
W1	175mm THK. R.C. WALL	-
W2	250mm THK. R.C. WALL	-
W3	350mm THK. R.C. WALL	-

CONCRETE WALLS

REF.	SIZE	COMMENT
B1	300 Wide x 500mm Dp. R.C. BEAM	-

CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

STEEL COLUMNS

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REF.	SIZE	COMMENT
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SCHEDULE OF TIMBER MEMBERS

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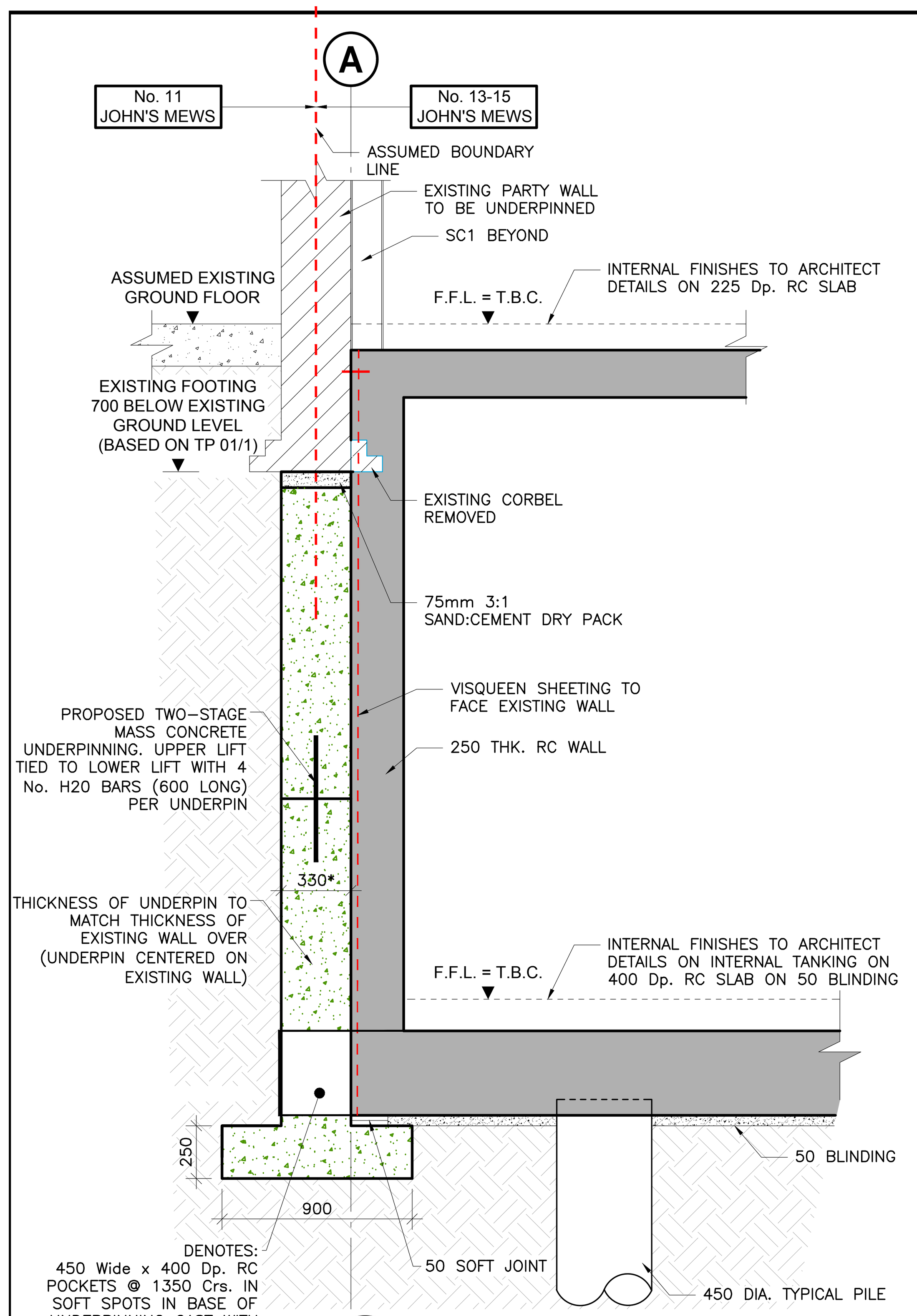
CLIENT
JM13 Ltd.

PROJECT TITLE
No. 13-15 JOHN'S MEWS, LONDON, WC1N 2PA

DRAWING TITLE
FULL HEIGHT SECTIONS A AND B

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	10	P2



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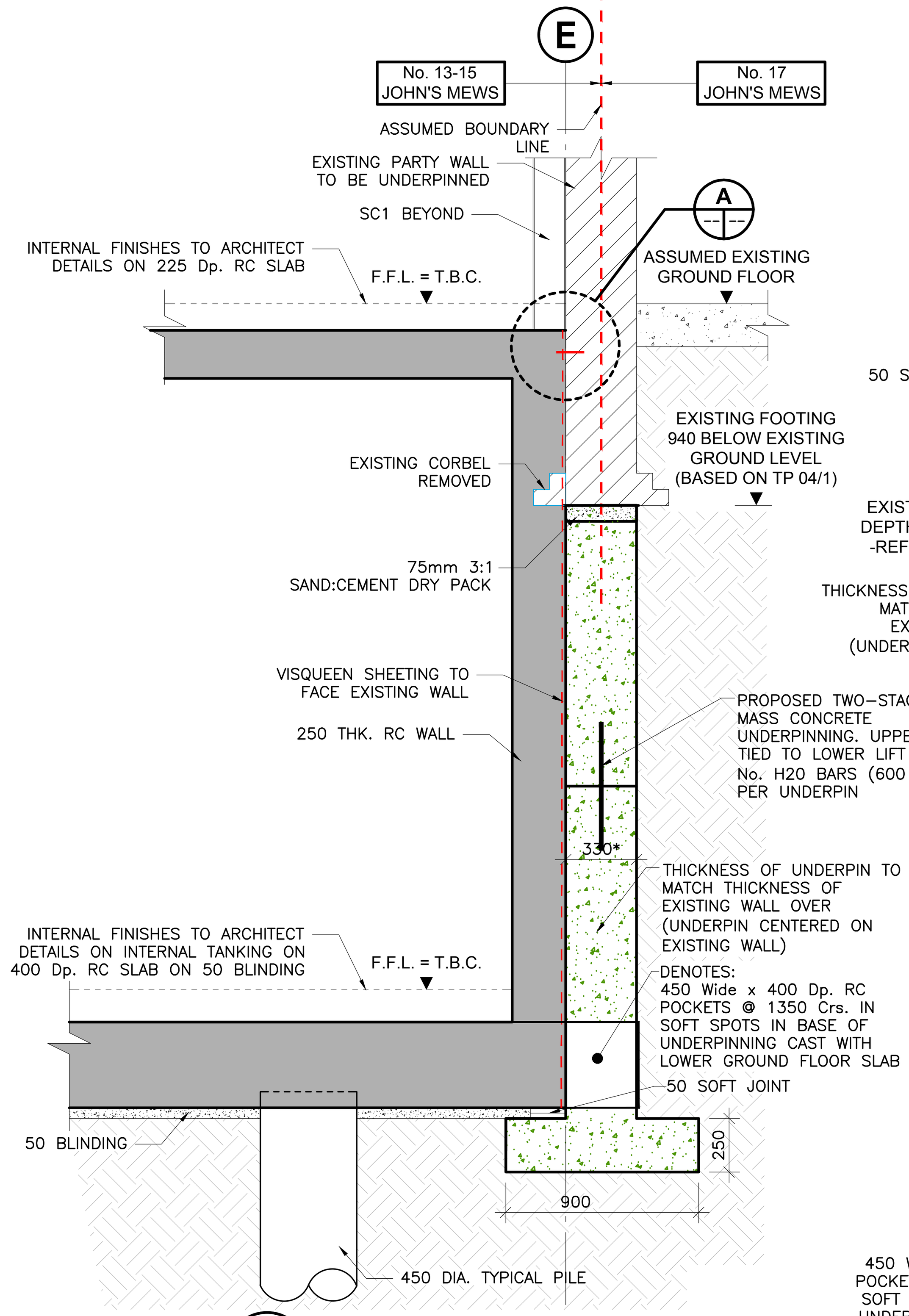

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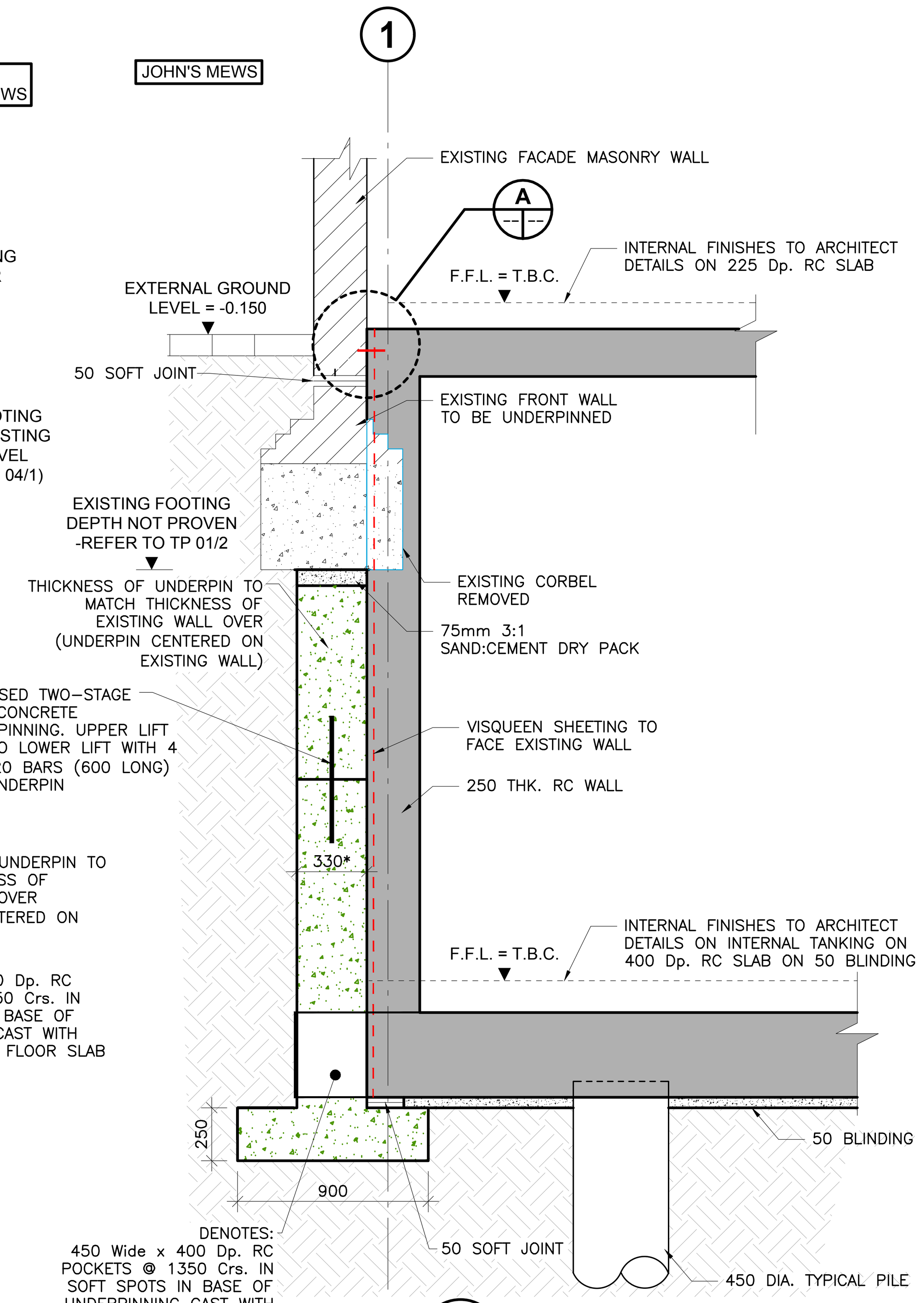

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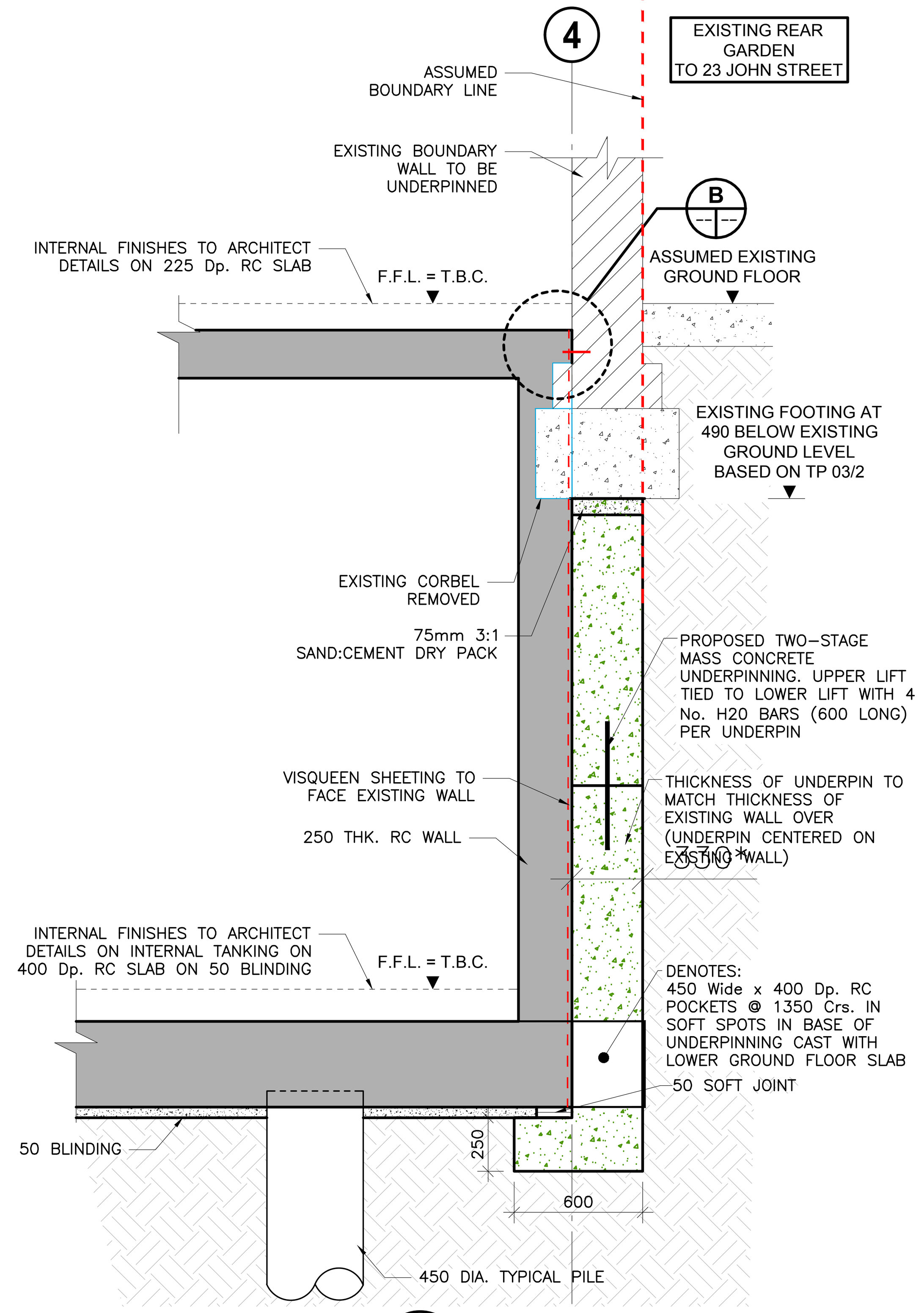
SCALE @ A3: 1:50



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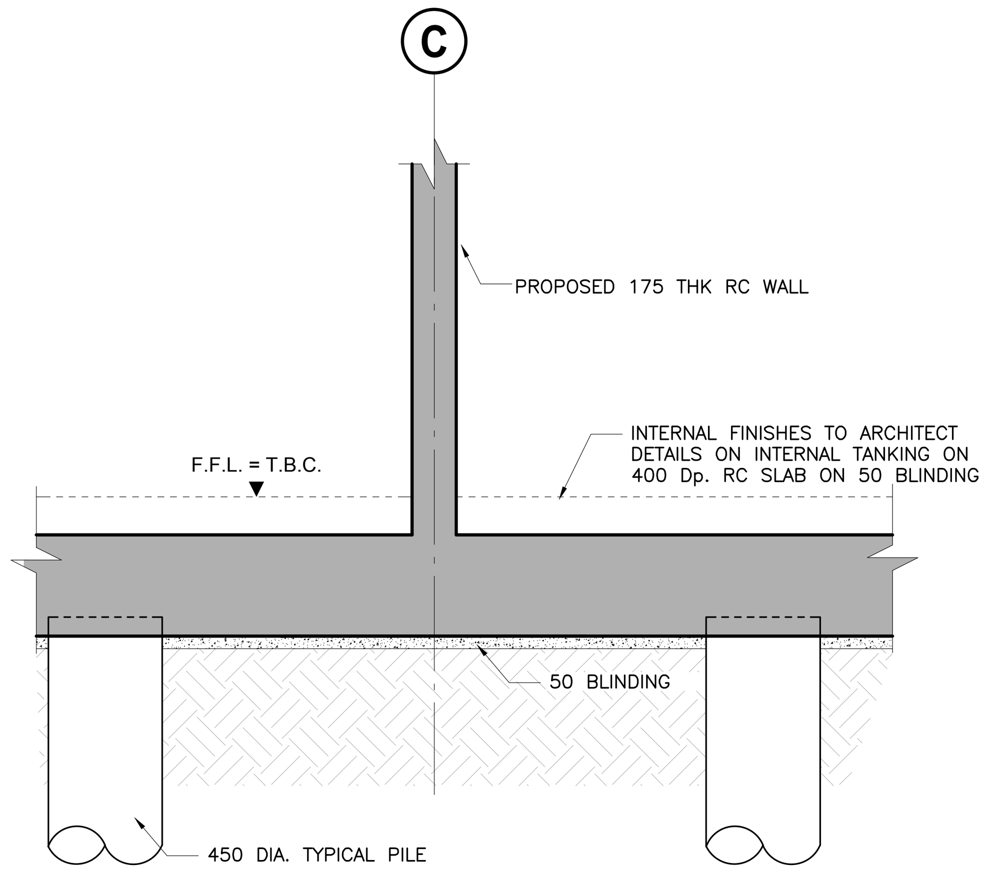
SCALE @ A3: 1:50



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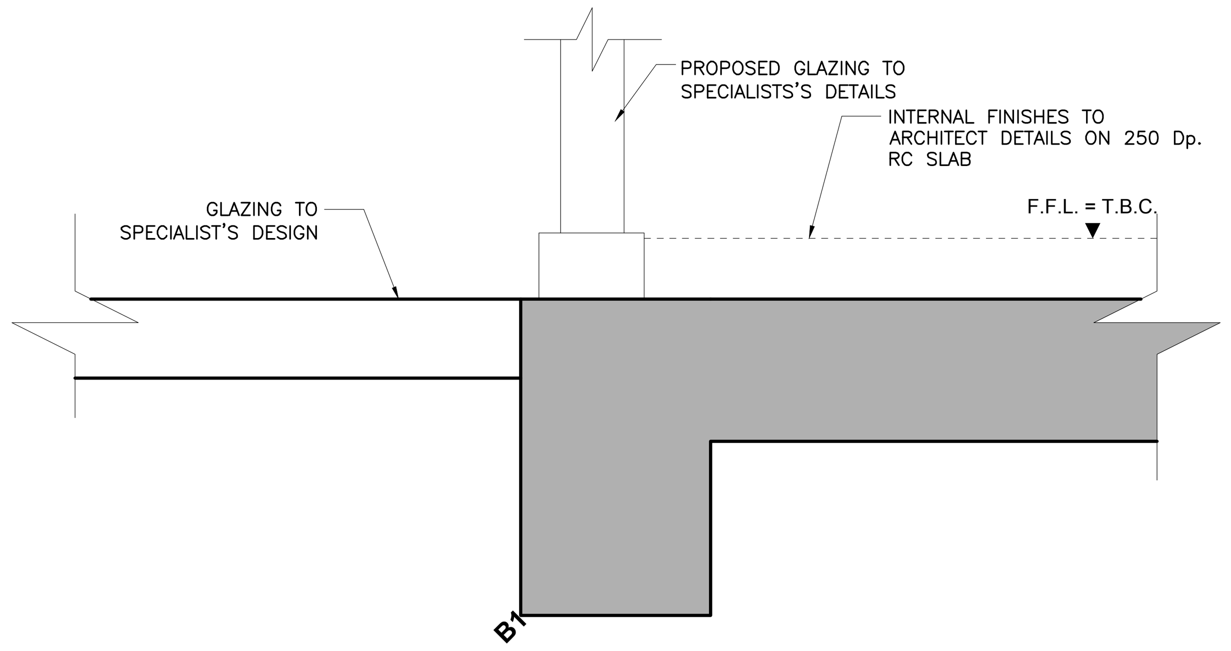

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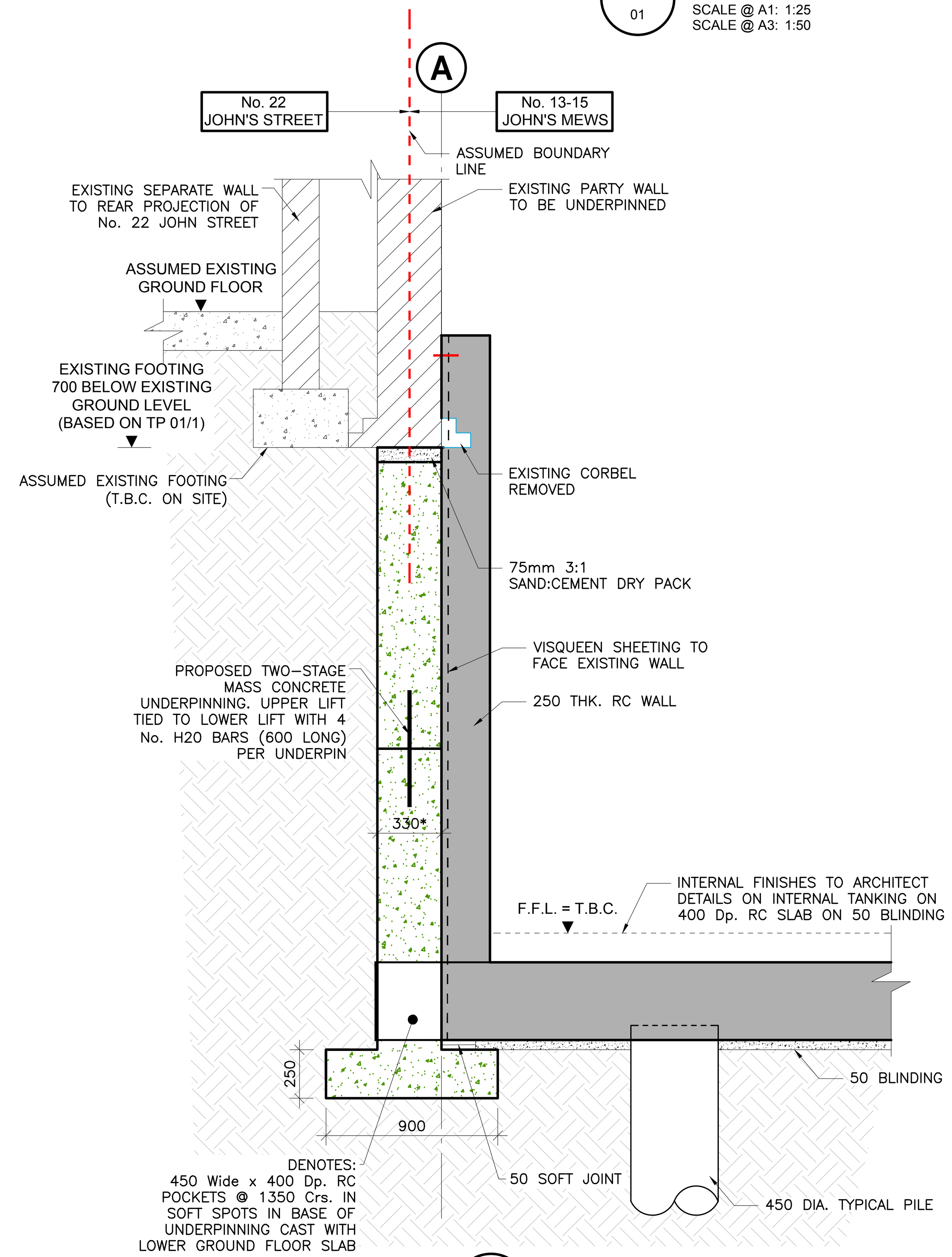
SCALE @ A3: 1:20



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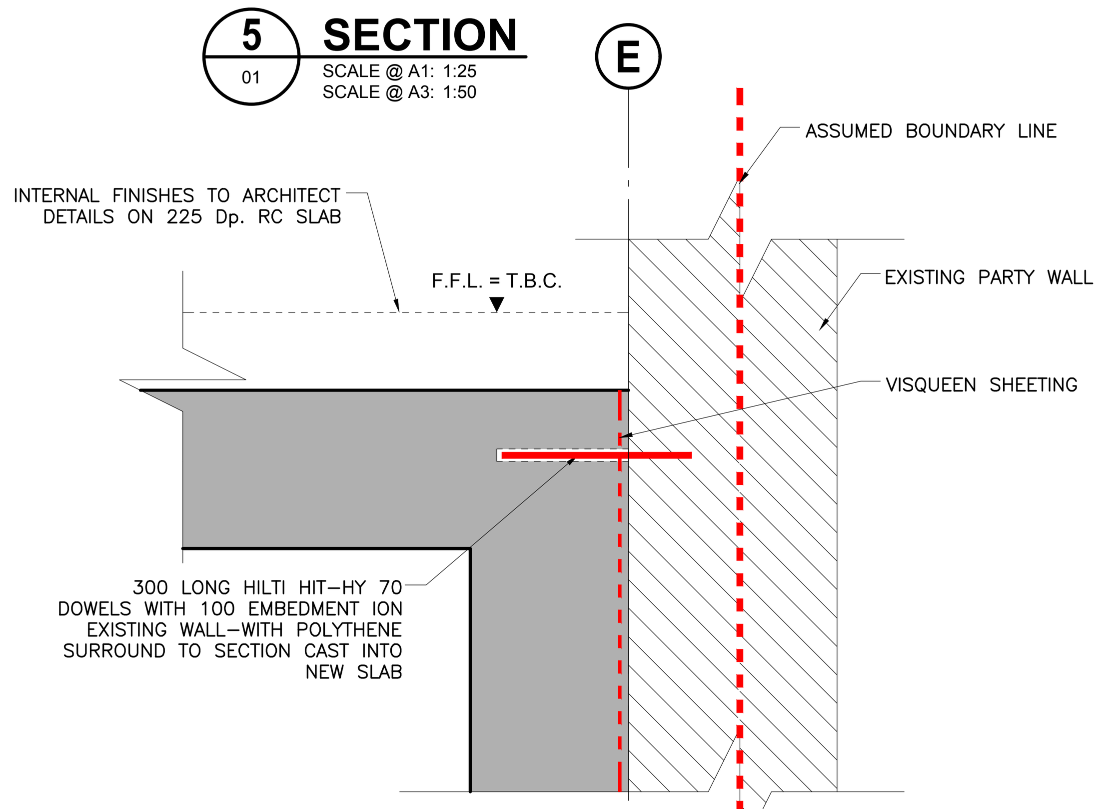
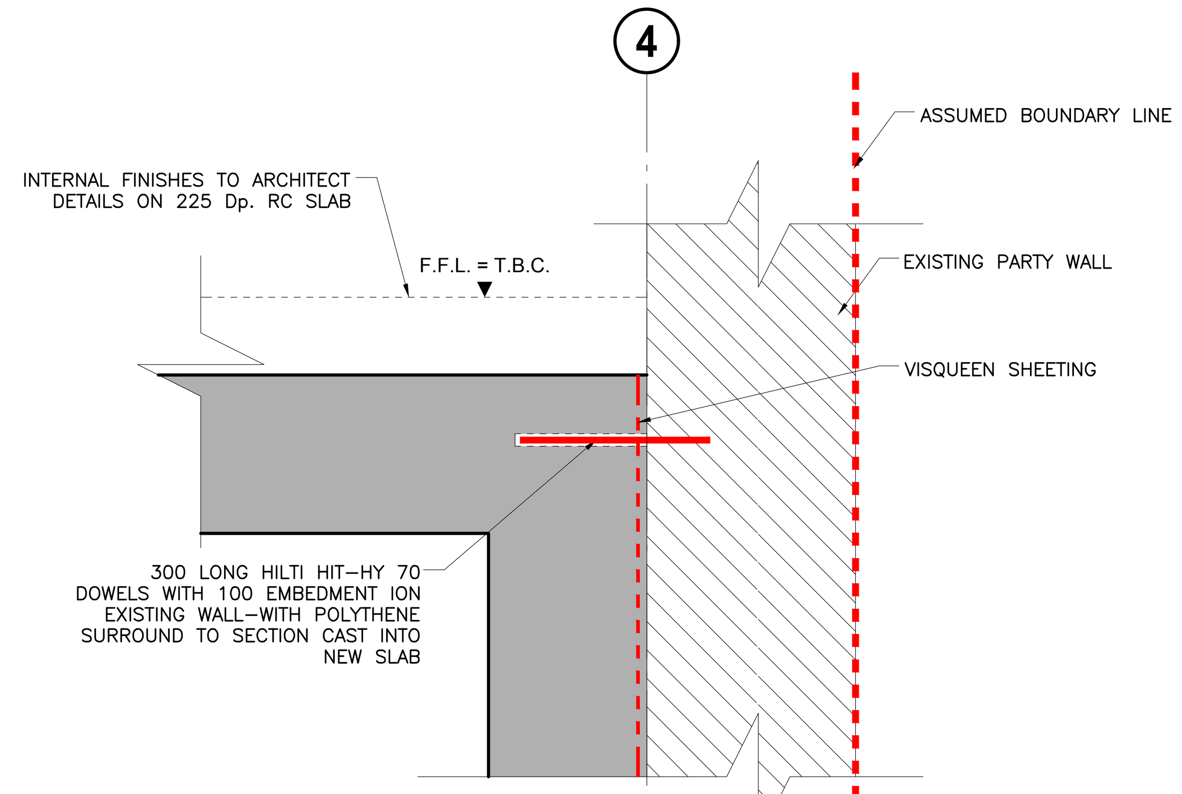


A DETAIL
SCALE:- 1:10 @ A1
& 1:20 @ A3



B DETAIL
SCALE:- 1:10 @ A1
& 1:20 @ A3

PRELIMINARY

NOTES

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W3	350mm THK. R.C. WALL	-

CONCRETE WALLS

REF.	SIZE	COMMENT
B1	300 Wide x 500mm Dp. R.C. BEAM	-

CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

STEEL COLUMNS

REF.	SIZE	COMMENT
SC1	152 UC 23kg.	-

STEEL BEAMS

REF.	SIZE	COMMENT
SB1	203 UC 46kg.	-
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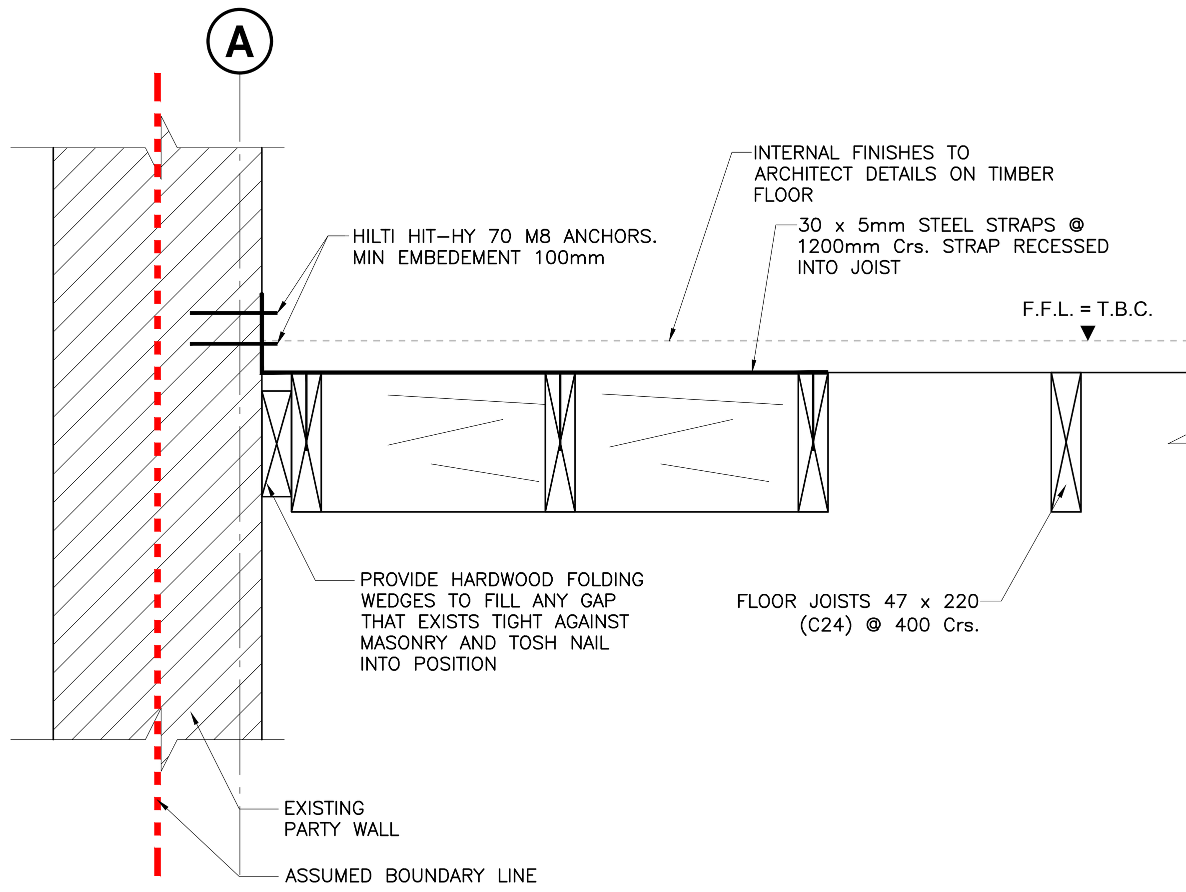
CLIENT
JM13 Ltd.

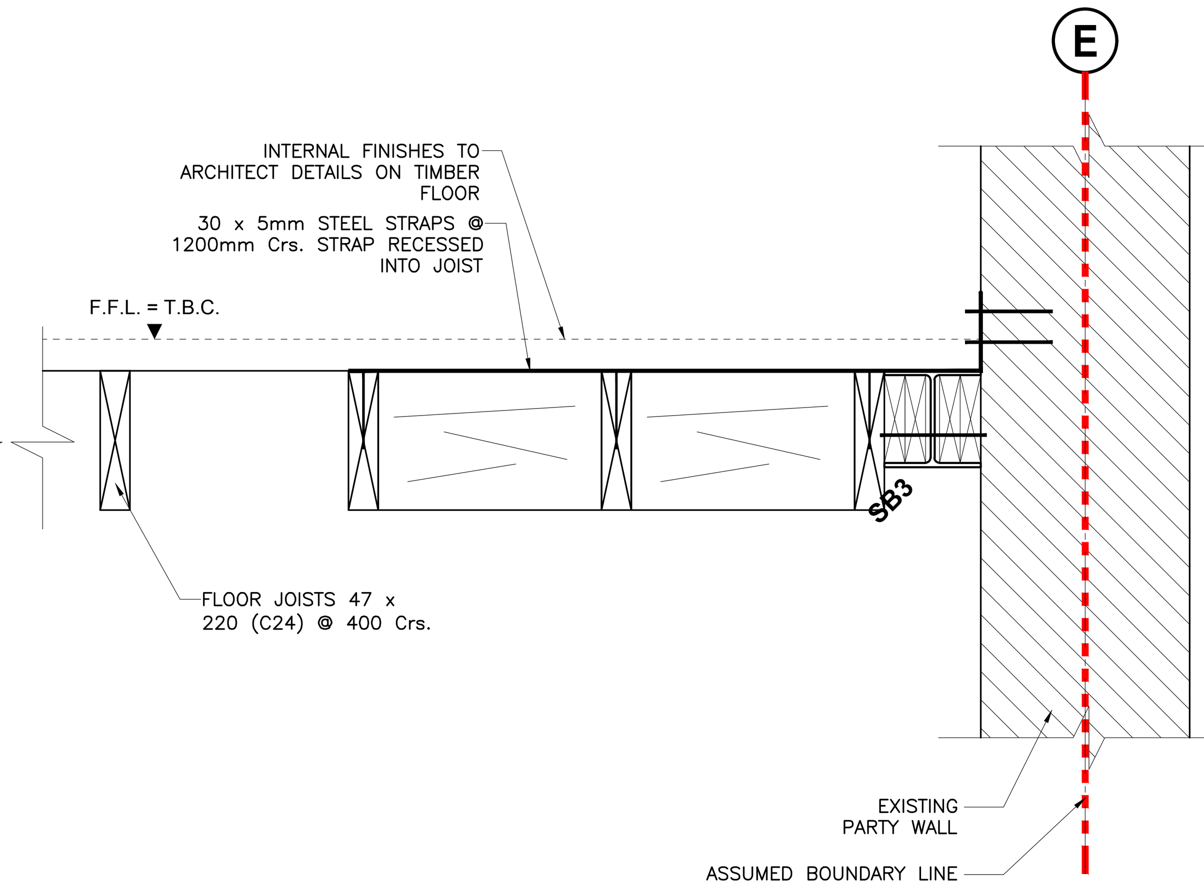
PROJECT TITLE
No. 13-15 JOHN'S MEWS, LONDON, WC1N 2PA

DRAWING TITLE
SECTIONS SHEET 1

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	11	P2



8 **SECTION** 04
SCALE @ A1: 1:10
SCALE @ A3: 1:20



9 **SECTION** 04
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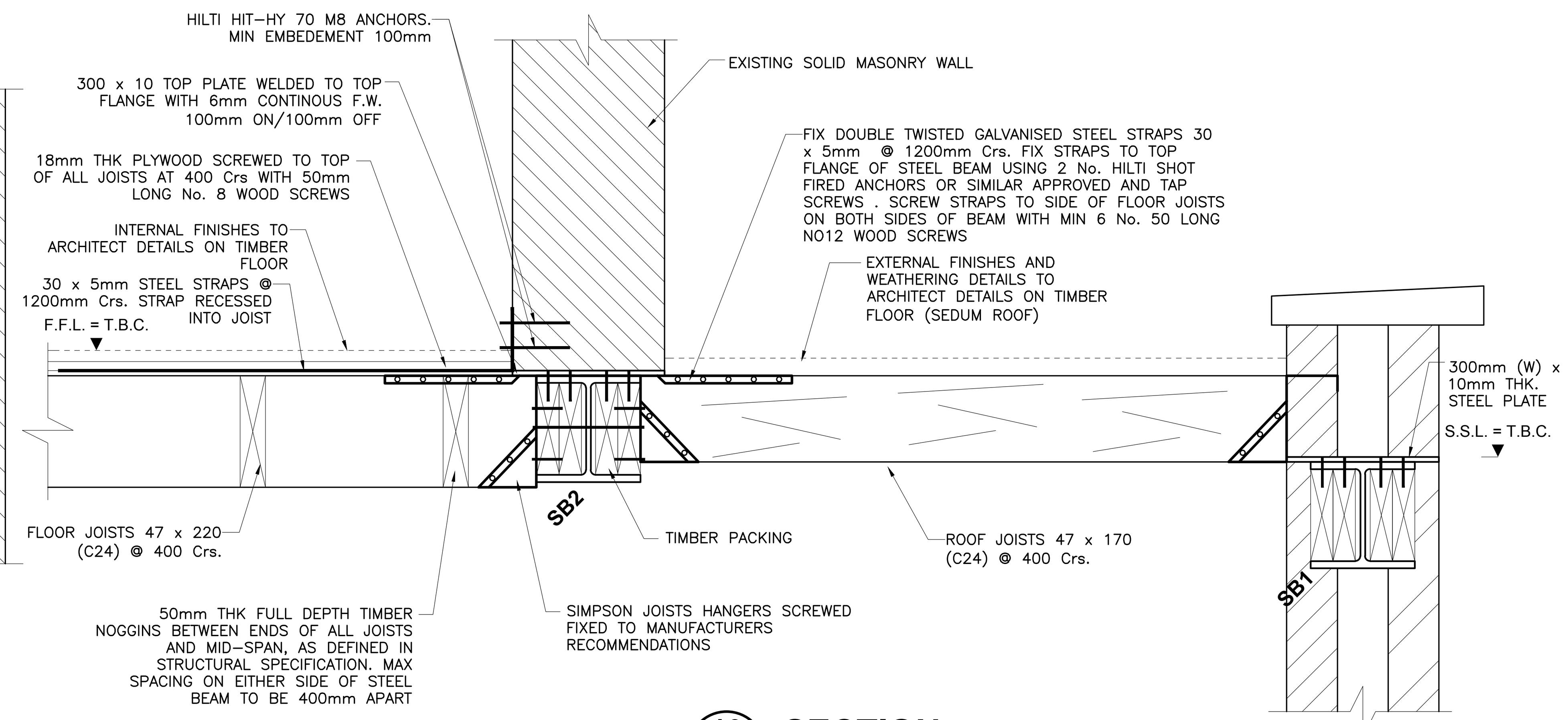
SCALE @ A3: 1:20



10 **SECTION** 03
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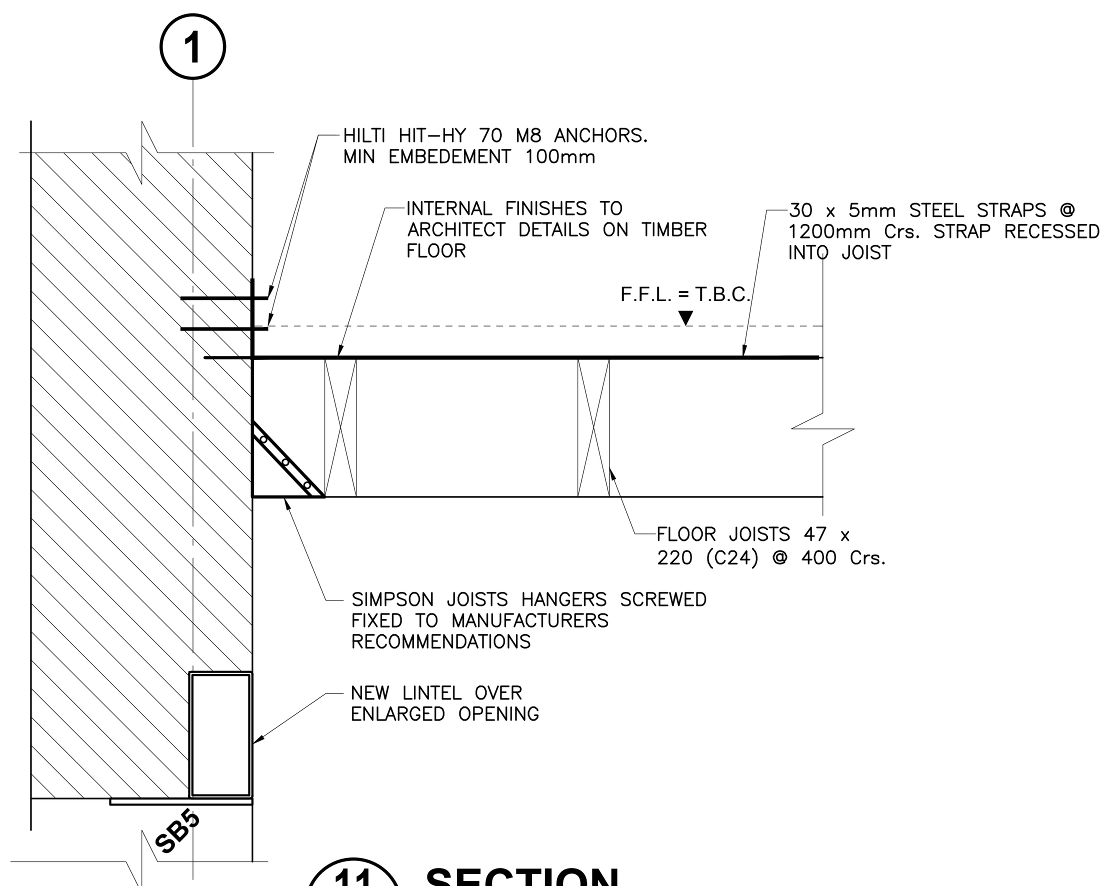
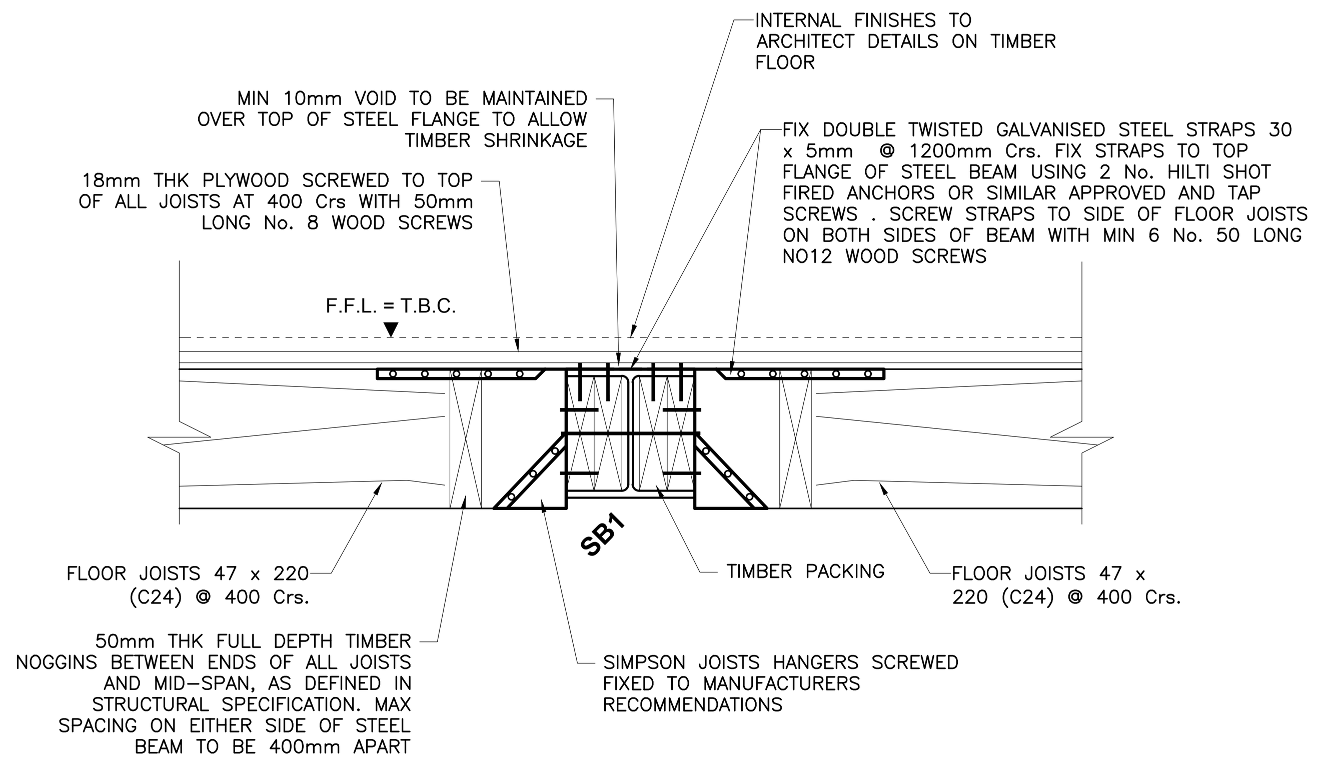
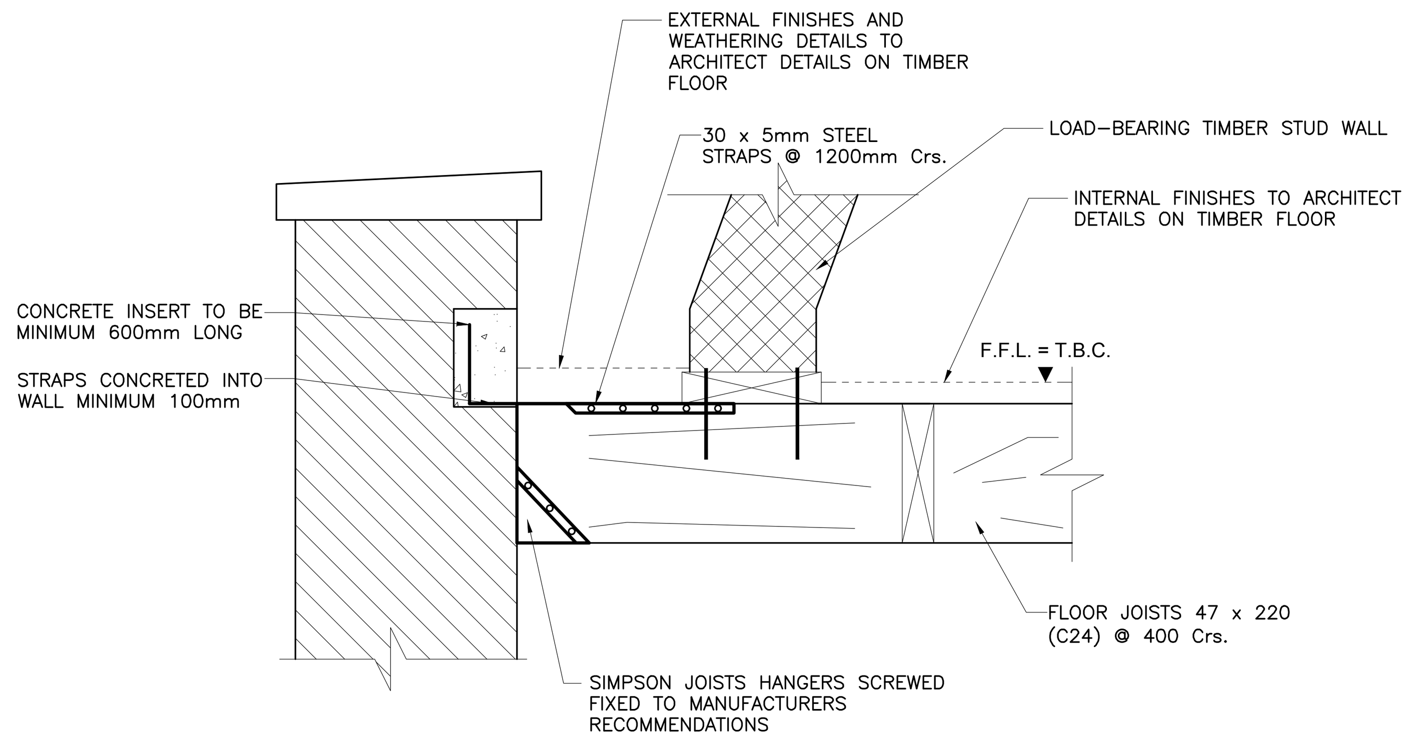
SCALE @ A3: 1:20



11 **SECTION** 03
SCALE @ A1: 1:10
SCALE @ A3: 1:20



12 **SECTION** 03
SCALE @ A1: 1:10
SCALE @ A3: 1:20



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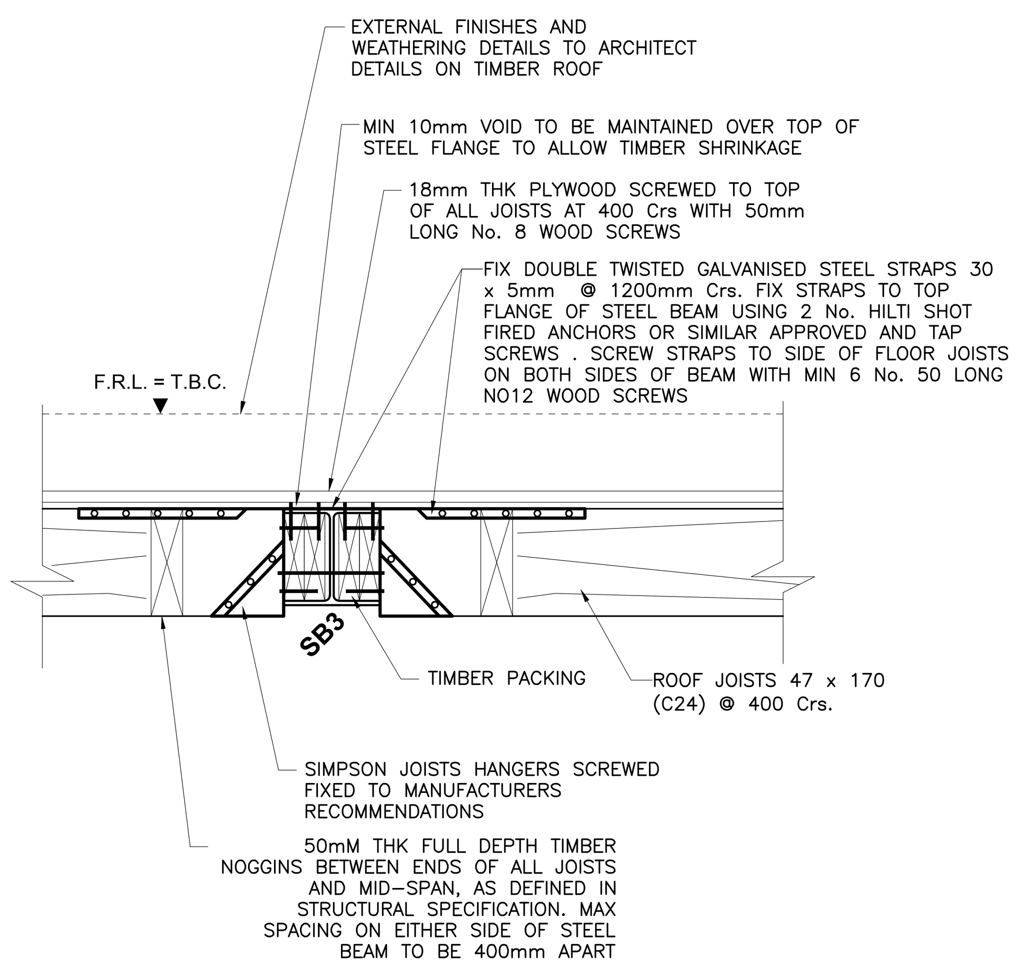
SCALE @ A1: 1:10
SCALE @ A3: 1:20



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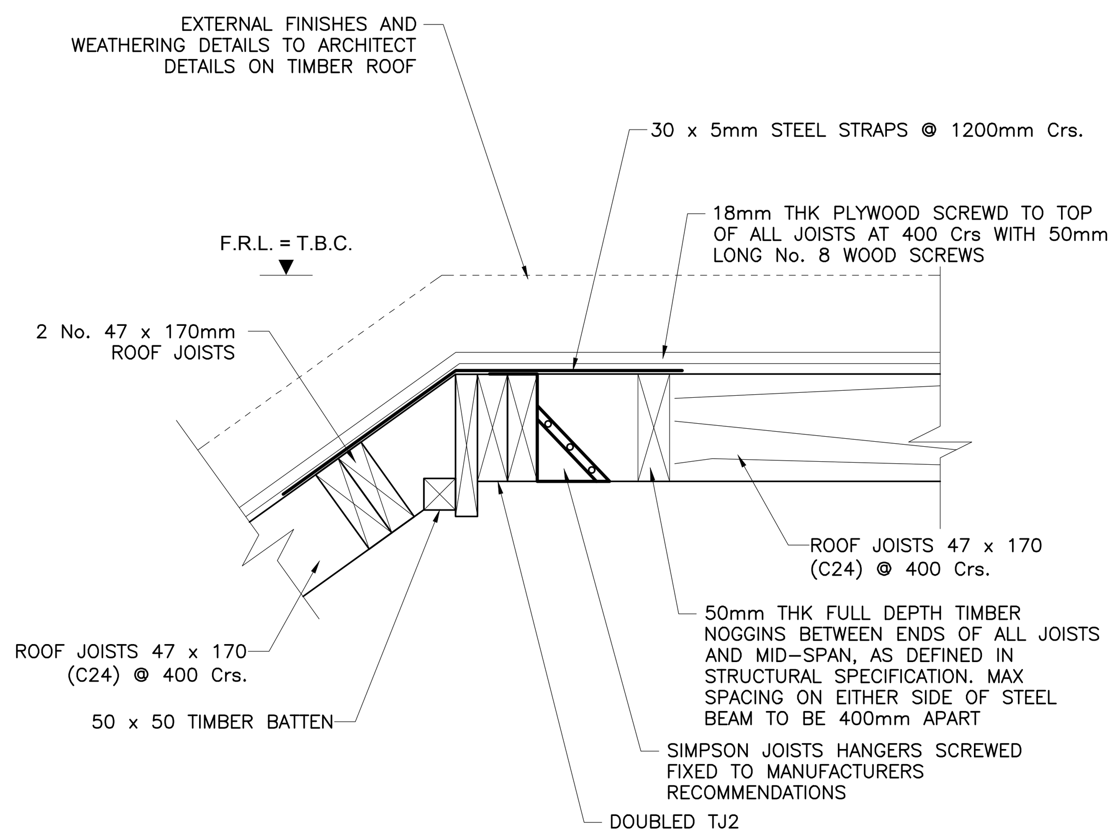
SCALE @ A1: 1:10
SCALE @ A3: 1:20



15 **SECTION** 05
SCALE @ A1: 1:10
SCALE @ A3: 1:20

PRELIMINARY

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B1	300 Wide x 500mm Dp. R.C. BEAM	-

CONCRETE PADSTONES

REF.	SIZE	COMMENT
PD1	450mm Long x 100mm Wide x 225mm Dp.	-

SCHEDULE OF STEEL MEMBERS

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REF.	SIZE	COMMENT
SC1	152 UC 23kg.	-

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REF.	SIZE	COMMENT
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CLIENT
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PROJECT TITLE
No. 13-15 JOHN'S MEWS, LONDON, WC1N 2PA

DRAWING TITLE
SECTIONS SHEET 2

SCALE @ A1	JOB NO.	DRAWING NO.	ISSUE
AS NOTED	L14771	12	P2

Chelmer
Consultancy Services
'Groundbreaking Services'

APPENDIX C

Chelmer Consultancy Services 'Groundbreaking Services'

Photo 1: Front elevations of terrace looking south (uphill)

Photo 2: Front elevations of terrace looking north (downhill)

Photo 3: No.11 (on right) and adjoining commercial property.
Note lightwell to lower ground floor (behind railings) and steep ramp down from vehicle access.

Photo 4: Threshold to No.15.

APPENDIX D

TQ/38SW/124 ~~3058 8208~~ 1

GROUND LEVEL: 63·5 AOD. (Newlyn)
NOMINAL B.H. DIA.: 8" Casing to 40'-0"
DATE OF BORING: 10/3/50 to 18/3/50 (Lamb's Conduit St.)

BOREHOLE No. 10

GROUNDWATER LEVEL	GROUNDWATER DATE	SAMPLE DEPTH	DEPTH	R.L.	DESCRIPTION OF STRATA
			3'-0"	+60·5	Fill (Bricks, ashes etc)
		5'-0"	9'-0"	+54·5	Medium sand & gravel
			10'-0"	+53·5	Soft dark brown clay
15'-0"	14/3/50	10'-0", 15'-0", 20'-0", 25'-0", 30'-0", 35'-0", 40'-0", 45'-0", 50'-0"	52'-6"	+11·0	Stiff grey - blue silty fissured clay getting sandy with depth
52'-6"	15/3/50	53'-0"	54'-0"	+9·5	Soft dark grey silty clay
		55'-0"	57'-0"	+6·5	Stiff dark grey silty clay
		58'-0", 61'-0", 64'-0", 66'-0", 68'-0", 73'-0", 75'-0", 80'-0"	80'-0"	-16·5	Stiff grey, brown & red mottled fissured clay. Cont'd.

REMARKS: Water at 15'-0" appeared to have percolated behind the casing from the sand & gravel above. Water at 52'-6" appeared to enter from the soft clay at that level. This was later sealed off by B.H. Casing.

SAMPLES: ▮ Undisturbed ● Disturbed

SCALE: 1/8" to 1'-0"

G.P.O. LONDON. TQ 38 SW 124

SITE INVESTIGATION FOR PROPOSED TUNNEL.

SOILS No. S/380

DRWG. No. S/R/674

GEORGE WIMPEY & CO. LTD., CENTRAL LABORATORY, SOUTHALL.

TQ/38SW/124 ~~3058 8208~~ 2

GROUND LEVEL: 63·5 A.O.D. (Newlyn)
NOMINAL B.H. DIA.: 8" Casing to 40'-0"
DATE OF BORING: 10/3/50 to 18/3/50 (Lamb's Conduit St.)

BOREHOLE No. 10 Contd.

GROUNDWATER LEVEL	GROUNDWATER DATE	SAMPLE DEPTH	B.H.	DEPTH 80'-0"	R.L.		DESCRIPTION OF STRATA
							Stiff grey, brown & red mottled fissured clay
				83'-0"	-19·5		
		83'-6"	●				Stiff dark grey fissured clay
				86'-0"	-22·5		
		87'-0"	●				Stiff light blue clay
				88'-0"	-24·5		
							Stiff grey & brown mottled silty clay
		92'-0"	●	92'-0"	-28·5		
		97'-0"	●				Stiff grey & brown mottled fissured clay
		98'-6"	●				
				100'-6"	-37·0		
		101'-0"	●				Stiff grey sandy clay
				103'-0"	-39·5		
		104'-0"	●				Stiff green, grey & brown mottled silty sandy clay. Traces of gravel at 108'-0"
		108'-0"	●	108'-0"	-44·5		

REMARKS:
Boring 8" dia. from GL. to 108 ft.

SAMPLES
▮ Undisturbed
● Disturbed

SCALE: 1/8" to 1'-0"

G.P.O. LONDON.

SITE INVESTIGATION FOR PROPOSED TUNNEL.

SOILS No. S/380

DRWG. No. S/R/674

GEORGE WIMPEY & CO. LTD., CENTRAL LABORATORY, SOUTHALL.

BGS REGISTRATION No.TQ 38 SW - 143

BRITISH GEOLOGICAL SURVEY

SHEET :- 1 of 1

BOREHOLE LOG

NAME OF BOREHOLE :- JOHN STREET

O.D. LEVEL:- 69 ft

TOWN OR VILLAGE :- HOLBORN

COUNTY:-

NGR :- 3085 8204

DATE :- 1908

FOR WHOM MADE :-

PURPOSE :-

MADE BY :-

INFORMATION FROM :-

ADDITIONAL NOTES

DATA

DESCRIPTION OF STRATA	THICKNESS (m)		DEPTH(m)	
Road to Basement	(11ft)	3.35	(11ft)	3.35
Made ground & loam	(7ft)	2.13	(18ft)	5.48
Loamey sand & gravel	(3ft)	0.91	(21ft)	6.39

Base of drift at below +48' OD

Transposed by :- KCS

TQ38SW 2550

Contract: GRAYS INN ROAD

Client: Taylor Woodrow Developments Ltd

Borehole No. 1
Sheet No. 1 Of 3.
Depth 0 to 10 metres.

Equipment and Methods
Light cable percussion boring 150mm diameter

Orientation : Vertical

Ground Level : (m.O.D.)

Coordinates :

Job Number : S39\644

Location :

Dates : 11/9/89
12/9/89

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description
				B 100	0.00		MADE GROUND (concrete)
					(0.70)		
					0.70		MADE GROUND (brown silty sandy clay, gravel and brick)
			S 6	J 101			
				B 102			
					(2.30)		
			S 9	J 103			
				B 104			
			S 2	J 105	3.00		Soft to firm orange brown silty CLAY with occasional rounded gravel
				U 106			
					(1.50)		
				J 107			
				J 108			
				U 109	4.50		Soft to firm orange brown silty sandy CLAY with occasional thin bands of sand
		Vertical Worm tubes? infilled with tufa 4.60m to 5.00m.		J 110			
				J 111	(1.70)		
				U 112			
11/9				J 113			
				J 114	6.20		Firm to stiff fissured brown and grey CLAY with small pockets and partings of orange brown fine sand and silt (London Clay)
				U 115			
					(0.80)		
				J 116			
				J 117	7.00		Firm to stiff becoming stiff fissured dark brownish grey silty CLAY with numerous small pockets and partings of fine sand and silt (London Clay)
				U 118			
				J 119			
				J 120			
				U 121			
					(7.00)		
				J 122			
				J 123			
				U 124			
				J 125			
					10.00		Continued

Continued

Operator
GW

General Remarks:

Appendix
1

Scale
10m/sheet

Sheet No.
1

TQ38SW 2550

Contract: GRAYS INN ROAD Client: Taylor Woodrow Developments Ltd	Borehole No. 1 Sheet No. 2 Of 3. Depth 10 to 20 metres.
Equipment and Methods: Light cable percussion boring 150mm diameter Orientation : Vertical	Ground Level : (m.O.D.) Coordinates :
Job Number : S39\644 Location : Dates : 11/9/89 12/9/89	

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description
				J 126	10.00		
		Pockets and partings of fine sand and silt lens frequent below 10.00m		U 127			Firm to stiff becoming stiff fissured dark brownish grey silty CLAY with numerous small pockets and partings of fine sand and silt (London Clay)
				J 128			
				J 129			
				U 130	(7.00)		
				J 131			
				J 132			
				U 133			
				J 134	14.00		
				J 135	(0.80)		Stiff fissured dark brownish grey silty CLAY with numerous small pockets and partings of fine sand and silt
					14.80		
				U 136			Very stiff fissured becoming finely fissured brown and grey mottled silty CLAY
				J 137			
				J 138			
				U 139			
				J 140			
				J 141	(7.70)		
				U 142			
				J 143			
				J 144			
		Becomes hard below 19.00m		U 145			
				J 146	20.00		
							Continued

Operator GW	General Remarks:	Appendix 1
Scale 10m/sheet		Sheet No. 2

TQ 38 SW 2550

Contract: GRAYS INN ROAD

Client: Taylor Woodrow Developments Ltd

Borehole No. 1
Sheet No. 3 Of 3.
Depth 20 to 30 metres.

Equipment and Methods
Light cable percussion boring 150mm diameter

Orientation : Vertical

Ground Level : (m.O.D.)

Coordinates :

Job Number : S39\644

Location :

Dates : 11/9/89 12/9/89

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
11/9		Becomes grey from 21.50m		J 147, U 148, J 150, J 151	20.00 – 22.50 (7.70)		Very stiff fissured becoming finely fissured brown and grey mottled silty CLAY	
				U 152, J 153, J 154	22.50 – 24.00 (1.50)		Very stiff grey silty CLAY partings of fine sand and silt some layers of carbonised plant remains, bands of shells towards base.	
				U 155, J 156	24.00 – 24.50 (0.50)		Very stiff to hard fissured grey CLAY with scattered rounded gravel	
				J 157, U 158, J 159	24.50 – 25.90 (1.40)		Hard fissured yellow brown and grey mottled slightly sandy very silty CLAY	
				J 160, U 161, J 162	25.90 – 28.00 (2.10)		Hard yellow brown and grey mottled sandy CLAY becomes sandier with depth with bands of dense clayey SAND	
				J 163, U 164, J 165	28.00 – 29.30 (1.30)		Hard fissured reddish brown and grey mottled silty CLAY with small partings of medium sand	
12/9				J 166, U 167, J 168	29.30 – 30.00 (0.70)		Hard fissured dark grey and brown mottled silty sandy CLAY with medium to fine rounded gravel	
					30.00		End of Borehole	

General Remarks:

Operator GW

Scale 10m/sheet

Appendix 1

Sheet No. 3

TQ38SW 2551

Contract: Grays Inn Road
Client: Taylor Woodrow Developments Ltd

Borehole No. 2
Sheet No. 1 Of 2.
Depth 0 to 10 metres.

Equipment and Methods
Light Cable Percussion Boring
150mm Diameter

Orientation : Vertical

Ground Level : (m.O.D.)
Coordinates :

Job Number : S39/644
Location :
Dates : 21/9/89

Daily Prog	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description
					0.00		
					0.25 (0.25)		MADE GROUND (concrete)
			C 4	B 169	1.80 (1.55)		MADE GROUND (black silty clayey sand, bricks and ash)
			C 16 C 6	B 170 B 171	3.55 (1.75)		MADE GROUND (concrete, ash, stone, and brown silty clay with ash brick and chalk traces)
				J 172 U 173 J 174	5.10 (1.55)		MADE GROUND (Soft black very sandy silty CLAY with fine gravel, traces of ash, brick and clay smoking pipes)
				J 175 U 176	5.85 (0.75)		Soft to firm olive brown and grey silty very sandy CLAY
	▽ 23/9		C 10	J 177 U* 178 B 179	6.65 (0.80)		Soft to firm olive brown and grey silty CLAY with occasional fine to medium gravel
21/9				J 180 U 181	7.80 (1.15)		Firm brown fissured silty CLAY with numerous small pockets and partings of orange brown fine sand and silt (London Clay)
21/9		Water level observation tubing installed to 8.0m		J 182 J 183 U 184 J 185	9.40 (1.60)		Stiff grey fissured very silty CLAY
					10.00 (5.60)		Stiff grey fissured very silty CLAY
							Continued

Operator
MC

General Remarks:

Scale
10m/sheet

Appendix
1

Sheet No.

TQ 38 SW 2551

Contract: Grays Inn Road

Client: Taylor Woodrow Developments Ltd

Borehole No. 2
Sheet No. 2 Of 2.
Depth 10 to 20 metres.

Equipment and Methods -
Light Cable Percussion Boring
150mm Diameter

Orientation . Vertical

Ground Level : (m.O.D.)

Coordinates :

Job Number : S39/644

Location :

Dates : 21/9/89

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
				U 186	10.00		Stiff grey fissured very silty CLAY	
				J 187				
				U 188				
				J 189				
					(5.60)			
				U 190				
				J 191				
				U 192				
22/9				J 193	15.00		End of Borehole	

Operator
MC

General Remarks:

Appendix
1

Scale
10m/sheet

Sheet No.
5

APPENDIX E

Gabriel GeoConsulting Ltd

Highfield House, Rolvenden Road,
Benenden, TN17 4EH

GroundSure Reference:	HMD-1661662
Your Reference:	GGC15321
Report Date	12 Sep 2014
Report Delivery Method:	Email - pdf

GroundSure EnviroInsight

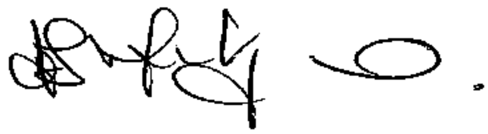
Address: 13-15,JOHNS MEWS,LONDON, WC1N 2PA

Dear Sir/ Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure Enviroinsight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above GroundSure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

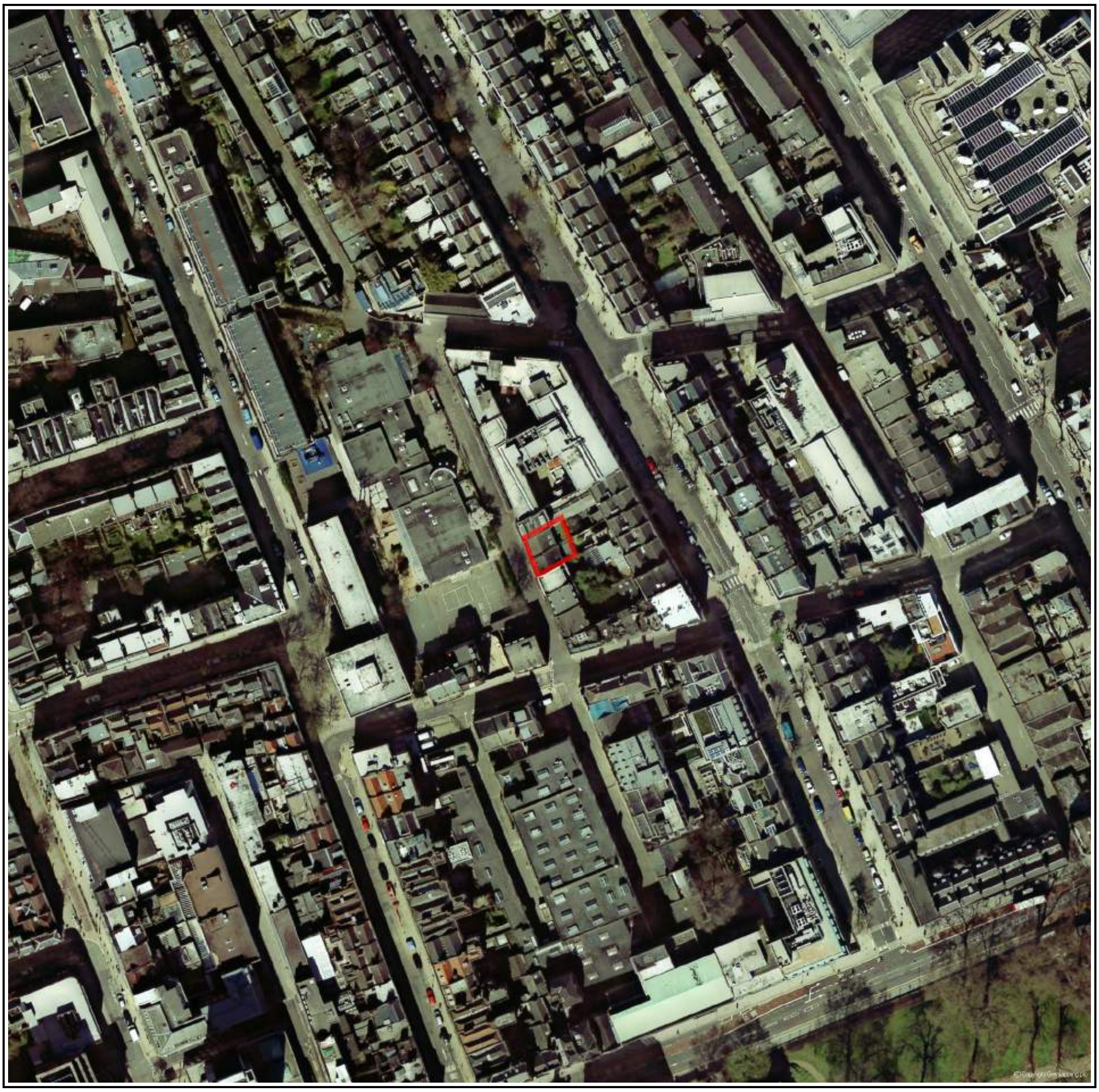
Enc.
GroundSure EnviroInsight

GroundSure EnviroInsight

Address:	13-15,JOHNS MEWS,LONDON, WC1N 2PA
Date:	12 Sep 2014
Reference:	HMD-1661662
Client:	Gabriel GeoConsulting Ltd

NW N NE

W



E

SW S SE

Aerial Photograph Capture date:	20-Apr-2013
Grid Reference:	530793,182058
Site Size:	0.01ha

Contents Page

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
1.1.1 Records of historic IPC Authorisations	0	0	0	0
1.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0
1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0
1.1.5 Records of List 1 Dangerous Substances Inventory sites	0	0	1	0
1.1.6 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
1.1.7 Records of Part A(2) and Part B Activities and Enforcements	0	0	3	4
1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	34
1.1.9 Records of Licensed Discharge Consents	0	0	0	0
1.1.10 Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0
1.2 Records of COMAH and NIHHS sites	0	0	0	0
1.3 Environment Agency Recorded Pollution Incidents				
1.3.1 National Incidents Recording System, List 2	0	0	0	1
1.3.2 National Incidents Recording System, List 1	0	0	0	0
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 2: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-5000
2.1 Landfill Sites						
2.1.1 Environment Agency Registered Landfill Sites	0	0	0	0	0	Not searched
2.1.2 Environment Agency Historic Landfill Sites	0	0	0	0	2	0
2.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
2.1.4 GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
2.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
2.2.2 Environment Agency Licensed Waste Sites	0	0	0	0	0	1

Section 3: Current Land Use

	On-site	0-50m	51-250	251-500
3.1 Current Industrial Sites Data	0	3	38	Not searched
3.2 Records of Petrol and Fuel Sites	0	0	0	0
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0

Section 4: Geology

4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 5: Hydrogeology and Hydrology

	0-500m
5.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes
5.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
5.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	13	70
5.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	4
5.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	3	40
5.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
5.7 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	1	0	0	0	Not searched	Not searched

	On-site	0-50m	51-250	251-500	501-1000	1000-1500
5.8 Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	No
5.9 Detailed River Network entries within 500m of the site	0	0	0	2	Not searched	Not searched
5.10 Surface water features within 250m of the study site	No	No	No	Not searched	Not searched	Not searched

Section 6: Flooding

6.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	No
6.2 Are there any Environment Agency Zone 3 floodplains within 250m of the study site?	No
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate

Section 7: Designated Environmentally Sensitive Sites

Section 7: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
7.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.5 Records of Ramsar sites	0	0	0	0	0	0
7.6 Records of Ancient Woodlands	0	0	0	0	0	0
7.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	2
7.8 Records of World Heritage Sites	0	0	0	0	0	0
7.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
7.11 Records of National Parks	0	0	0	0	0	0
7.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0

Section 8: Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Moderate
8.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Moderate
8.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
8.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
8.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
8.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
8.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Very Low

Section 9: Mining

9.1 Are there any coal mining areas within 75m of the study site?	No
9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?	Negligible
9.3 Are there any brine affected areas within 75m of the study site?	No