elliottwood

115-119 Goldhurst Terrace
London

# Structural Engineering Report and Subterranean Construction Method Statement

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## Document Control

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## Contents



## Appendices

## Non-Technical Summary

The attached report and Basement Impact Assessment (BIA) conclude that the excavation and construction associated with the proposed four storey building with single storey basement at 115-119 Goldhurst Terrace will pose no significant threat to the structural stability of the adjoining properties or surrounding ground.

From the Basement Impact Assessment completed by Site Analytical Services, it can be concluded that the proposed basement will not cause a significant change to the ground water flow regime in the vicinity of the site.

Site Analytical Services also completed a Site Investigation which indicated that the area has a 1.5m layer of made ground overlying London Clay. The results indicated that some minor contamination was present within the made ground. To this end, the contractor will need to carry out further testing in order to determine the most appropriate method of disposal.

A ground movement assessment was carried out by Applied Geotechnical Engineering Limited and it was concluded that given good workmanship, the proposed basement can be constructed without imposing more than “very slight” damage to the adjoining properties. This conclusion assumes a high standard of workmanship and adequate propping of the basement excavation.

To this end, Elliott Wood will have an on-going role during the works on site to monitor that the works are being carried out generally in accordance with our design and specification. This role will typically involve weekly site visits at the beginning of the project and fortnightly thereafter.

## 1.0 Introduction

1.1 Elliott Wood Partnership Ltd is a firm of consulting structural and civil engineers approximately 120 strong operating from their head office in south west London. Residential developments of all scales have been central to the workload of the practice with many in the Greater London area. In particular Elliott Wood have been producing designs for basements to both existing and new buildings. To date this numbers approximately 500 sites many of which have been in the Borough of Camden. Our general understanding of the development of London, its geology and unique features together with direct experience on many sites puts us in a strong position to advise clients on works to their buildings and in particular the design and construction of their basement.

1.2 Elliott Wood were appointed by the building’s owner to advise on the structural implications of the proposed demolition of the existing building and construction of a new four storey building with single-storey basement on the site of 115-119 Goldhurst Terrace, London, NW6 3HR. The following report has been prepared to ensure that the neighbouring properties are safeguarded during the works. This report follows the guidance given in the Camden Planning Guidance on Basements and Lightwells CPG4. This assessment has been prepared in accordance with the guidance given in CPG4 and the relevant Development Policies. The Basement Impact Assessment has been produced by persons holding the required qualifications relevant to each stage.

1.3 The Contractor will provide a detailed method statement including all temporary works before the works can commence on site. The Contractor is to accept full responsibility for the stability and structural integrity of the works during the Contract and provide temporary support as necessary. The Contractor shall also prevent overloading of any completed or partially completed elements.

1.4 This statement focuses on the proposed subterranean works as opposed to the superstructure works and should be read in conjunction with all relevant architects and specialists supporting documents, some of which appear in the appendices of this document.

1.5 A site investigation has been completed at the property by Site Analytical Surveys, and comprised of one rotary percussive borehole (extending down to 20.0m below ground level), two window samples (extending to 5.0m below ground level) and eleven hand dug trial pit excavations (extending down to 1.5m below ground level). The investigations showed a 1.5m thick layer of made ground, overlying London Clay. Groundwater was not encountered during the investigations, but surface water runoff was subsequently found in the made ground during the ongoing monitoring of the standpipes.

## 2.0 Existing Site

2.1 The site is accessed by Goldhurst Terrace to the west, and is bordered by neighbouring buildings/gardens to the north, south and east.

2.2 The site is approximately rectangular in shape, measuring 32m long by 18m wide. It currently contains Maryon House; a four storey building constructed in the 1960’s which comprises a number of maisonettes.

2.3 The surrounding area consists nearly exclusively of terraced housing. The exception to this is the garage building to the east of the site.

2.4 Evidence from historical maps suggests that the housing along Goldhurst Terrace was constructed in the early 1890’s, with the garage to the east of the site developed around the 1930’s. The site itself suffered extensive bomb damage during WWII, leading to the demolition of the original Victorian buildings on the site.

2.5 No.’s 115-119 were rebuilt in the 1960’s. The rest of the road appears to have changed little since the original development.

2.6 The topographical survey shows that there is a slope of less than 1 degree across the length of the site, with the ground level falling by 0.5m between the back of the site, and the front along Goldhurst Terrace.

2.7 None of the buildings on the site, or within the surrounding area are listed; however the site does fall within the South Hampstead conservation area.

2.8 The site is not located within a flood plain; however through consultation with Thames Water, it has become apparent that the area is at risk from surface water flooding due to the surcharging of the public sewers. This has been considered carefully in the design of the basement. A Flood Risk Assessment has been completed for the development and has been submitted as support for planning.

2.9 The boreholes and trial pits revealed ground conditions that are consistent with the geological records and known history of the area and comprised of made ground up to 1.50m in thickness resting on deposits of the

London Clay Formation. The made ground extended down to a depth of 1.10m in BH1, to 1.20m below ground level in WS1 and WS2, and to 1.50m in TP2. The material generally comprised of a surface layer of grass overlying sandy clay with fragments of brick and concrete rubble. The London Clay Formation was encountered below the made ground and consisted of firm followed by stiff becoming very stiff silty clay with occasional gypsum crystals. These deposits extended down to the full depth of investigation of 20.00m below ground level in the Borehole.

2.10 Following drilling operations a groundwater monitoring piezometer was installed in the borehole to approximately 8.00m depth, and both window samples to approximately 5.00m depth. Groundwater was not subsequently encountered within the monitoring standpipe within Borehole 1, but was encountered at respective depths of 1.04mbgl (38.24mOD) and 1.05mbgl (38.12mOD) within the standpipes in WS1 and WS2 after a period of approximately six weeks. This is likely to be surface water run-off perched on top of the London Clay Formation.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (March and April 2016) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

2.11 Laboratory testing indicated some contamination within the made ground; most of the soil samples analysed were classified as inert waste, however some were classified as stable non-reactive hazardous waste. The contractor will need to carry out further testing in order to determine the most appropriate method of disposal; however it should be noted that the made ground comprises only a small proportion of the total spoil and that the majority will be formed from virgin London Clay. The testing also highlighted slightly elevated levels of lead and some hydrocarbons and this will need to be considered in relation to the health of the end users. This will be carefully considered during the development of the proposals, and any risk associated with the finding will be designed out as far as possible.

2.12 There are two trees to the front of the site; one oak tree within the northern site boundary, and one lime tree just outside the southern boundary. The presence of these trees has been carefully considered when developing the footprint of the proposed basement and in determining the appropriate method of construction. Underpinning will be used to construct the basement wall to the front of the site in lieu of piles. This method uses hand excavation to minimise disruption to roots, and also only requires that the excavation depth is down to the formation level of the basement raft.

2.13 The results of the desk study can be summarised as follows;

- Evidence from historical maps suggests that the housing along Goldhurst Terrace was constructed in the early 1890's, with the garage to the east of the site developed in around the 1930's. The site itself suffered extensive bomb damage during WWII, and consequently no.'s 115-119 were demolished and rebuilt in the 1960's. The rest of the road appears to have changed little since the original development.
- The site is underlain by the London Clay Formation (as indicated by the 1:50000 Geological Survey of Great Britain [England and Wales, Sheet 256, "North London", Solid and Drift Edition])
- Three borehole logs exist within 500m of 115-119 Goldhurst Terrace and the closest of the three (110m south of the site - BGS Ref: TQ285E/276) recorded made ground down to a depth of 0.5m with overlying soft clay to a depth of 1.5m, before London Clay formation to the base of the borehole at 7.6m depth)
- Environment Agency Flood Maps indicate that the site is located within Flood Zone 1. A Flood Risk Assessment is however required in this instance, as the site is located within a Local Flood Risk Zone, as identified by the Local Authority.
- Thames Water sewer records show that the offsite sewer network is combined (sewers carry both foul and surface water flows). No adopted sewers are shown to pass beneath the site

## 3.0 Proposed Works

3.1 The current proposals consist of the demolition of the existing four storey building, and the construction of a new four storey building with a one storey basement on a slightly larger footprint.

3.2 The new basement will extend approximately 4.0m below ground level. The Party Walls with no.'s 113 and 121 Goldhurst Terrace will be underpinned through the construction of a mass concrete footing with a reinforced concrete wall above. The footing and walls will be installed in a hit and miss sequence of maximum 1m sections and will be designed to cantilever from the new basement raft. To the west, the new basement walls will be formed through the installation of reinforced concrete pins, cast in a 1m wide underpinning sequence. The east wall will be formed through the installation of minipiles to form a contiguous piled retaining wall. An RC lining wall will be cast in front of the piles to the internal face of the basement box and will be designed to resist hydrostatic water pressures.

3.3 The ground floor and basement slab will be constructed in RC and will prop the retaining walls to resist lateral forces applied to the underpins. Local to lightwells where the ground floor slab is not present an RC beam strip will be installed to prop the top of the walls.

3.4 The basement slab will be designed as a raft foundation that will support the downward vertical loads from the superstructure above and resist any uplift forces from hydrostatic pressure and heave.

3.5 Temporary horizontal propping will be required to prop the underpinning sections until the RC ground floor slab has been cast and cured.

3.6 Refer to the Subterranean Construction Method Statement in section 10.0 and drawings in Appendix A for more information regarding the proposed works.

3.7 The construction of the new superstructure is beyond the scope of this document but is assumed to be comprised of an RC frame.

## 4.0 Proposed Below Ground Drainage & SUDS Assessment

4.1 Refer to separate Below Ground Drainage / SUDS Assessment report for details.

## 5.0 Basement Waterproofing

5.1 The proposed basement will be designed to achieve a Grade 3 level of waterproofing protection as outlined in BS 8102:2009.

5.2 The reinforced concrete retaining walls and raft slab will be cast with waterproof concrete additive to form the primary barrier to water ingress. Water bars will be installed at construction joints as well as joints between underpins. These concrete elements will be designed to limit crack width to be compatible with the requirements of the concrete additive. An internal cavity drain system will also be installed to provide a secondary barrier against possible water ingress.

## 6.0 Party Wall Matters

6.1 The proposed works development falls within the scope of the Party Walls Act 1996. Procedures under the Act will be dealt with in full by the Employer's Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the provisions of the Act and agree Party Wall Awards in the event of disputes. The Contractor will be required to provide the Party Wall Surveyor with appropriate drawings, method statements and other relevant information covering the works that are notable under the Act. The resolution of matters under the Act and provisions of the Party Wall Awards will protect the interests of all owners.

6.2 The designs for 115-119 Goldhurst Terrace will be developed so as not to preclude or inhibit similar, or indeed any, works on the adjoining properties. This will be verified by the Surveyors as part of the process under the Act.

## 7.0 Hydrogeological Statement Summary

7.1 A Basement Impact Assessment has been prepared by Site Analytical Services to demonstrate that the proposed works should not have an adverse effect on the adjoining properties or the groundwater.

7.2 During the site investigation works, ground water was not discovered within the boreholes or trial pits and the soils remained essentially dry throughout.

7.3 Following drilling operations, a groundwater monitoring piezometer was installed in the borehole to approximately 8.00m depth, and both window samples to approximately 5.00m depth. Groundwater was not subsequently encountered within the monitoring standpipe within Borehole 1, but was encountered at respective depths of 1.04mbgl (38.24mOD) and 1.05mbgl (38.12mOD) within the standpipes in WS1 and WS2 after a period of approximately six weeks.

7.4 It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (March and April 2016) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

7.5 As the underlying ground was established as impermeable clay, the encountered seepages and water observed during monitoring are likely to be due to a localised permeable soil layer in the location of the borehole and/or surface water infiltration as opposed to the actual ground water. For further information regarding the hydrogeology at the site, please refer to SAS's Basement Impact Assessment. Although significant groundwater inflows are not likely due to the impermeable clay soil, the contractor should make allowances for suitable dewatering methods (e.g. sump pumping) due to any seepages through more permeable layers, or surface water run-off over the top of the clays.

7.6 Arup's Subterranean Development Scoping Study (para 5.1), June 2008, notes that the impact of subterranean development on groundwater flows is negligible as groundwater flows will find an alternative route if blocked by a subterranean structure.

## 8.0 Monitoring During Excavation and Construction

8.1 The Contractor shall provide tri-axial monitoring to all structures and infrastructure adjacent to the basement excavation at the time of excavation and construction.

8.2 The Contractor is to ensure the monitoring locations are free from all obstructions prior to the monitoring surveyor's visit to allow readings to be taken and shall provide a report to show full tri-axial movements data for each monitoring point, with comparisons made against base reading and previous reading.

8.3 Monitoring proposals/requirements will be confirmed with the Contractor and adjoining Owner's Surveyor prior to works but are assumed to be in line with the principles outlined below:

*8.3.1 Monitoring completed as follows:*

1) 2No. readings (one week apart) prior to any works being started to establish a base reading.
2) On a weekly basis during the excavation and construction of the basement until all underpins have been completed; and 3No. consecutive readings show no significant movement.
3) Fortnightly until all major structural works are completed and temporary works removed; and 3No. consecutive readings show no significant movement.
4) On a monthly basis thereafter for a 3 month period following completion of the notifiable works, unless otherwise agreed with the adjoining Owner's surveyor.

*8.3.2 Cumulative movement of survey points must not exceed:*

a. *Settlement*
   Code amber trigger values: ± 5mm
   Code red trigger values: ± 10mm
b. *Lateral displacement*
   Code amber trigger values: ± 4mm
   Code red trigger values: ± 8mm

*8.3.3 Movement approaching critical values:*

*Code amber trigger value:*

All interested parties, including the Adjoining Owner's Surveyor and his Engineer should be informed. The contractor will consider the cause of the movement, and submit plans to limit movement thereafter. Further actions immediately agreed between the Party Wall Surveyors.

*Code red trigger value:*

All interested parties including Adjoining Owner's Surveyor and Engineer will be informed immediately. Works will stop in the affected area immediately, and if required actions will be taken to make the works safe. Actions to limit movement thereafter to be proposed by the Contractor for comment and any required remedial works shall be completed as soon as possible.

## 9.0 Noise, Vibration and Dust

9.1 As far as practically possible, the contractor is to adopt methods that ensure that construction impacts such as noise, vibration and dust are kept to acceptable levels for the duration of the works.

9.2 The works for both the demolition of the existing building and the construction of the proposed basement will extend across the majority of the site. Those most likely to be affected are No. 113 Goldhurst Terrace to the north of the site and No. 121 to the south.

9.3 Below we have described the mitigation measures that are proposed to keep noise, dust and vibration to acceptable levels:

### *9.3.1 Demolition of the existing building*

All demolition work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise. The contractor will need to utilise non-percussive breaking techniques where practical.

To the north, the property shares a Party Wall with No. 113, and so there is a risk that noise and vibration produced during the demolition works will be transferred via connections to the neighbouring building. The contractor should ensure that where any slab isse adjacent to the boundary, the concrete slab should be diamond saw cut first along the boundary to isolate the slab from any adjoining structures.

The property is currently lightly attached to No. 121 to the south with a stair core and store, and so there will be less of an issue with noise and vibration transference.

Dust suppression equipment should be used during the demolition process to ensure that any airborne dust is kept to a minimum.

### *9.3.2 Underpinning works*

The underpin shafts will be excavated using hand tools. At the base of the underpin shaft it may be found that compressed air tools are required due to the compaction of the ground. Care should be taken in selecting a suitable air compressor that keeps noise to a minimum. The air compressor should be located within the site and behind a hoarding to minimise noise transfer to the adjoining properties.

In order to minimise dust, skips covered or completely enclosed to ensure that dust cannot escape.

### *9.3.3 Piling works*

The contiguous piled wall will be formed using a continuous flight auger rig – this is a non- percussive technique and therefore produces significantly less noise and vibration than the alternative driven piles.

### *9.3.4 Bulk excavation*

Due to the size of the basement it is likely that some mechanical plant will be required to complete the bulk excavation. The contractor should ensure that any mechanical plant is switched off when not in use and is subject to regular maintenance checks and servicing.

### *9.3.5 Construction of the concrete slabs and walls*

The contractor should ensure that any concrete pours are completed within the permitted hours for noise generating works. The contractor should allow for a contingency period to ensure that concrete pours can be completed within these hours regardless of unforeseen circumstances such as batching plant delays and traffic congestion.

The fabrication and cutting of steelwork for the reinforced concrete walls and underpins shall take place off site. If any rebar needs to be trimmed on site this should be completed using hydraulic or pneumatic tools instead of angle grinders.

### *9.3.6 Dust Control*

In order to reduce the amount of dust generated from the site, the contractor should ensure that any cutting, grinding and sawing should be completed off site where possible. Any equipment used on site should be fitted with dust suppression or a dust collection facility.

The contractor will be responsible for ensuring good practice with regards to dust and should adopt regular sweeping, cleaning and washing down of the hoardings and scaffolding to ensure that the site is kept within good order. The contractor selected will be a member of the Considerate Contractors Scheme. Contact details of the contractor who will be responsible for containing dust and emissions within the site will be displayed on the site boundary so that the local residents can contact the contractor to raise any concerns regarding noise and dust.

Cement, fine aggregates, sand and other fine powders should be sealed after use and any stockpiles of sand or dust-generating materials should be covered.

## 10.0 Subterranean Construction Method Statement

### 10.1 Construction generally

It is assumed that the above measures and assumed sequence of works are taken into account in the eventual design and construction of the proposed works.

Detailed method statements and calculations for the enabling and temporary works will need to be prepared by the Contractor for comment by all relevant parties including Party Wall Surveyors and their Engineers. Elliott Wood Partnership will need to ensure that adequate supervision and monitoring is provided throughout the works particularly during the excavation and demolition stages.
To this end, Elliott Wood will have an on-going role during the works on site to monitor that the works are being carried out generally in accordance with our design and specification. This role will typically involve weekly site visits at the beginning of the project and fortnightly thereafter. A written site report will be provided to the design team, Contractor and Party Wall Surveyor.

Access onto the site will be from Goldhurst Terrace and must be coordinated in a sensible manner to minimise disruption to the adjoining residents; and provide a safe working environment.

### 10.2 Assumed sequence of construction (Refer to sequence drawings in Appendix A). Please note that the likely timeframes given below are indicative only and this will need to be confirmed by the contractor once they have been appointed.

*Stage 1: Site set-up (approximately 2 weeks)*

- Erect a fully enclosed painted plywood site hoarding to the boundary, this should not impact on the neighbouring properties.
- All below ground services should be identified prior to excavation and isolated as necessary.
- The principles for the removal of spoil shall be agreed. Given the size of the site, it is likely that machinery will be used to move the spoil from the excavation to a holding skip located in the roadway in front of the site. Grab lorries will be used to remove material from the skip.
- Protection methods to be agree and installed for the trees to be retained to the front of the site.
- Monitoring points should be installed to all neighbouring structures and infrastructure and a base reading should be taken prior to and construction works starting on site. Refer to Section 8.0 for a more detailed discussion with regards to monitoring.

*Stage 2: Internal soft-strip and demolition (approximately 6 weeks)*

- Complete soft strip of internal finishes within the building
- Carefully demolish the exiting main building down to ground floor level in a staged sequence (TBC by the contractor) and then break out the existing ground floor slab and foundations. If the foundations extend below the level of the Party Wall footings, then the foundations will be broken down to the base of the Party Wall level, and the final part will need to be removed sequentially prior to the installation of the individual underpins.

*Stage 3: Install piles and underpins (approximately 6 weeks)*

- Form piling mat at approximate existing ground floor level.
- Complete contiguous piling from ground floor level along the eastern edge of the proposed basement footprint. These piles will resist the lateral pressures in both the temporary and permanent cases.
- Carry out reduced level excavations to the level of the Party Wall footing along the northern and southern boundaries and commence underpinning to Party Wall structures in an agreed "hit and miss" sequence. No underpin is to be greater than 1m width.
- The installation of the mass concrete footing will be carried out first, before the reinforced concrete walls are installed above. Both of these component will be installed in an underpin sequence. The reinforced concrete walls are anticipated to extend to a depth of around 3m below the level of the existing footings and so it is envisaged that they can be formed in a single stage. The walls will be cast with starter bars exposed at the base so that the basement raft can be tied in during stage 6.
- Dig trial underpins for inspection by Elliott Wood Partnership to check the ground conditions are as expected from the site investigation report. The Contractor is to check the grounds ability to 'stand up' whilst the individual pin is completed. If necessary install localised trench sheeting and props to maintain stability of the ground.
- Commence installation of the first stage of the RC retaining walls along the western perimeter of the basement. These L shaped underpins will be cast in a in a "hit and miss" sequence. The depth of the proposed basement is 4.0m bgl and so it is envisaged that the underpinning along this perimeter will have to be completed in two stages. These underpins will be excavated using hand tools to prevent excessive damage to the tree roots to the front of the site.
- All pits excavated should be backfilled before commencing works to adjacent pins.
- Shoring should be provided to all unsupported faces of excavations formed during underpinning works.

*Stage 4: Cast capping beam and install high level props (approximately 1 week)*

- Excavate local trench to the top of the piles along the eastern perimeter and to the underpins along the western perimeter, propping off the adjacent earth bund, to allow the RC capping beam to be formed.
- Commence first stage excavation and install waling beams and high level props to underpins and contiguous piles.

*Stage 5: Install Temporary Works & Excavate down to Formation Level (approximately 2 weeks)*

- Install the second stage of the underpins to the front wall of the basement.
- Commence second stage excavation down to formation level. Excavation to be carried out in sections, and low level props sequentially installed.
- Although significant groundwater inflows are not likely due to the impermeable clay soil, the Contractor should make allowance for suitable dewatering methods (e.g. sump pumping) due to any seepages through more permeable layers and from surface water run-off.

*Stage 6: Cast Basement Raft & Columns (approximately 2 weeks)*

- Cast a layer of blinding across the site.
- Cast the R.C basement raft with kicker sections for basement columns. The basement slab will be doweled in to the RC retaining wall to the front of the site, and tied in to the reinforcement at the base of the walls below the party wall foundations.
- Remove second stage temporary horizontal props once the raft slab has gained sufficient strength to prop the mass concrete underpins at their toes.
- Cast R.C columns and liner wall up to the underside of the proposed ground floor slab. The RC walls will be cast around the high level horizontal props where required.

*Stage 7: Cast Ground Floor Slab (approximately 1 weeks)*

- Cast ground floor RC slab. The ground floor slab will be dowelled in to the top of the RC retaining walls along the east and west faces of the building, and will extend to the masonry walls of the adjacent building to the north and south, in order to act as a prop.

*Stage 8: Remove Temporary Works (approximately 2 weeks)*

- Once the ground floor slab has cured, it will provide the permanent prop to both the top of the concrete underpins and pile cap to the east and west of the building, and to the bottom of the neighboring Party Walls to the north and south. Therefore any temporary horizontal props can be removed.
- With the basement structure complete up to ground floor, the superstructure works can commence.

## 11.0 Conclusions

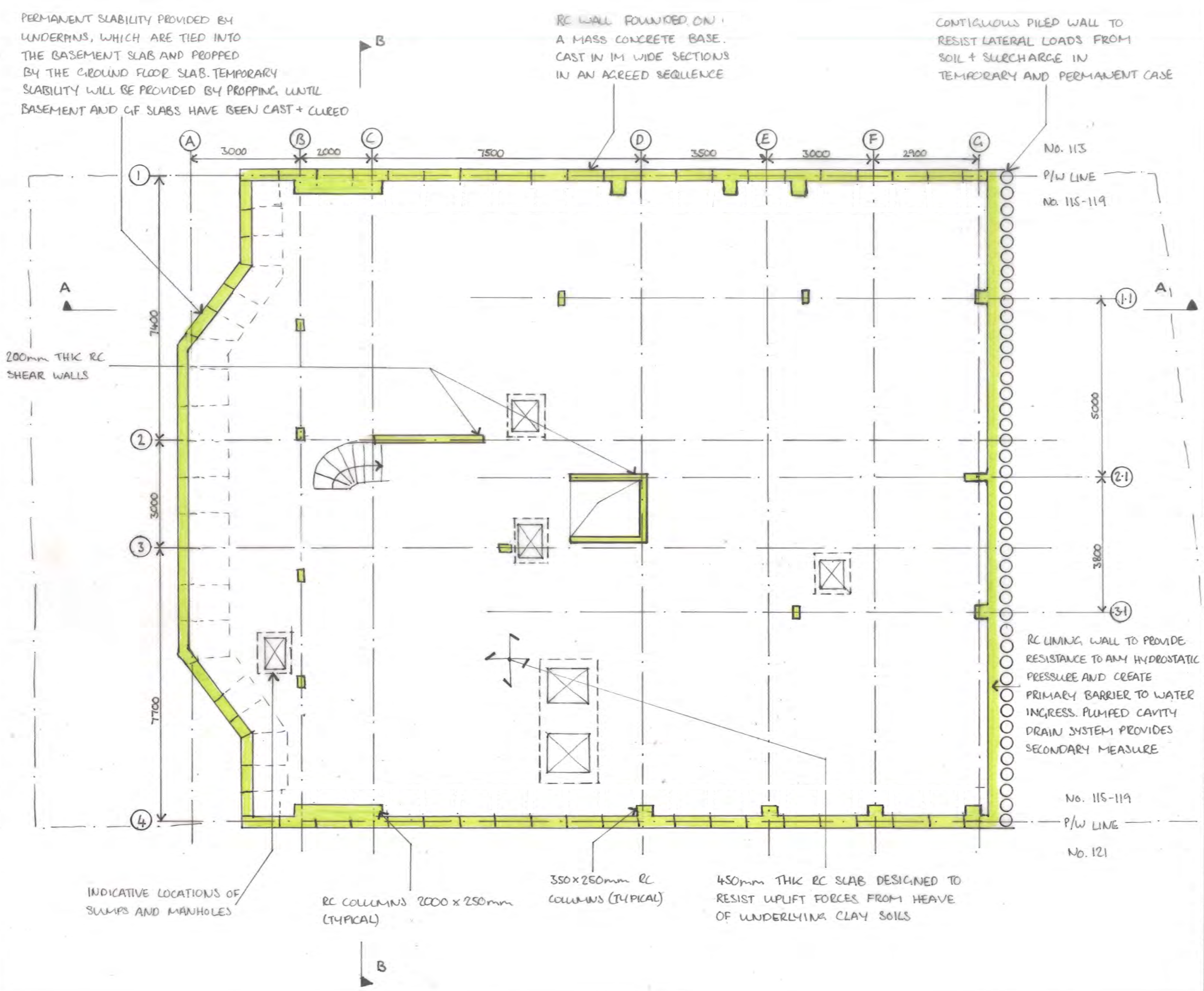
11.1 It is intended that the above measures and sequence of works are considered for the eventual design and construction of the proposed works.

11.2 Detailed method statements and calculations for the enabling and temporary works will need to be prepared by the Contractor for comment by all relevant parties including Party Wall Surveyors and their advising Engineers. Elliott Wood Partnership will need to ensure that adequate supervision and monitoring is provided throughout the works particularly during the excavation and demolition stages. A specification and indication of monitoring requirements is given in Section 8.0.

11.3 A ground movement assessment report has been completed by Applied Geotechnical Engineering Limited which concludes that given good workmanship, the proposed basement can be constructed without imposing more than “very slight” damage to the adjoining properties. This conclusion assumes a high standard of workmanship and adequate propping of the basement excavation.

11.4 To this end, Elliott Wood will have an on-going role during the works on site to monitor that the works are being carried out generally in accordance with our design and specification. This role will typically involve weekly site visits at the beginning of the project and fortnightly thereafter. A written site report will be provided to the design team, Contractor and Party Wall Surveyor.

# Appendix A: Proposed Structure Drawings




This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

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| P2 | 21/09 | JM | GW | NOTES UPDATED |
| P1 | 09/06 | JM | JG | PRELIMINARY |

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job title
115 - 119 GOLDHURST TERRACE

drawing title
PROPOSED BASEMENT PLAN

| scale(s) | date | drawn |
|---|---|---|
| 1:100 | June '16 | JLM |

drawing status
PRELIMINARY

| job no | drawing no | revision |
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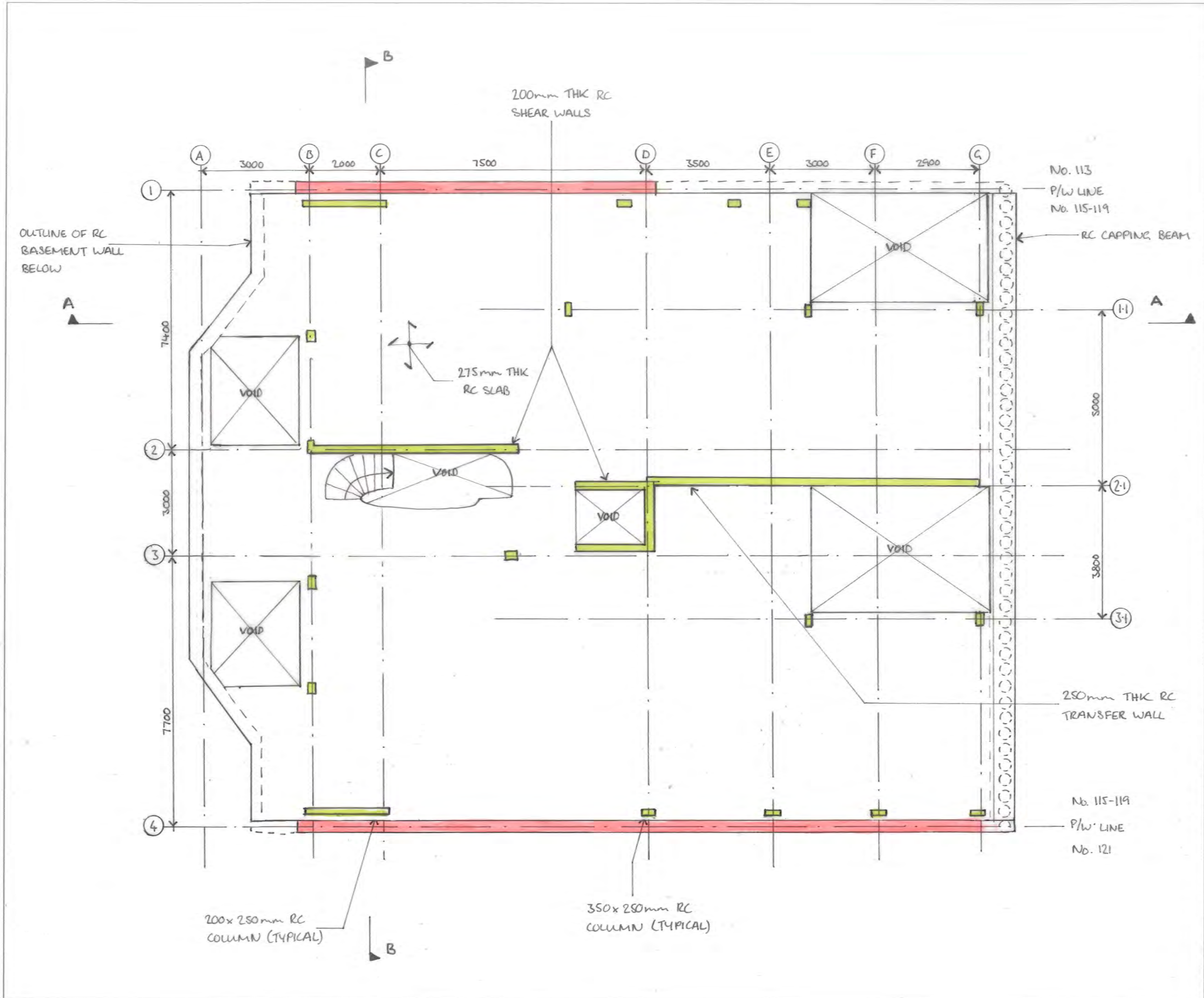
| 2150657 | S0900 | P2 |

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job title
115-119 GOLDHURST TERRACE

drawing title
PROPOSED GROUND FLOOR PLAN

| scale(s) | date | drawn |
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| 1:100 | June '16 | JLM |

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PRELIMINARY

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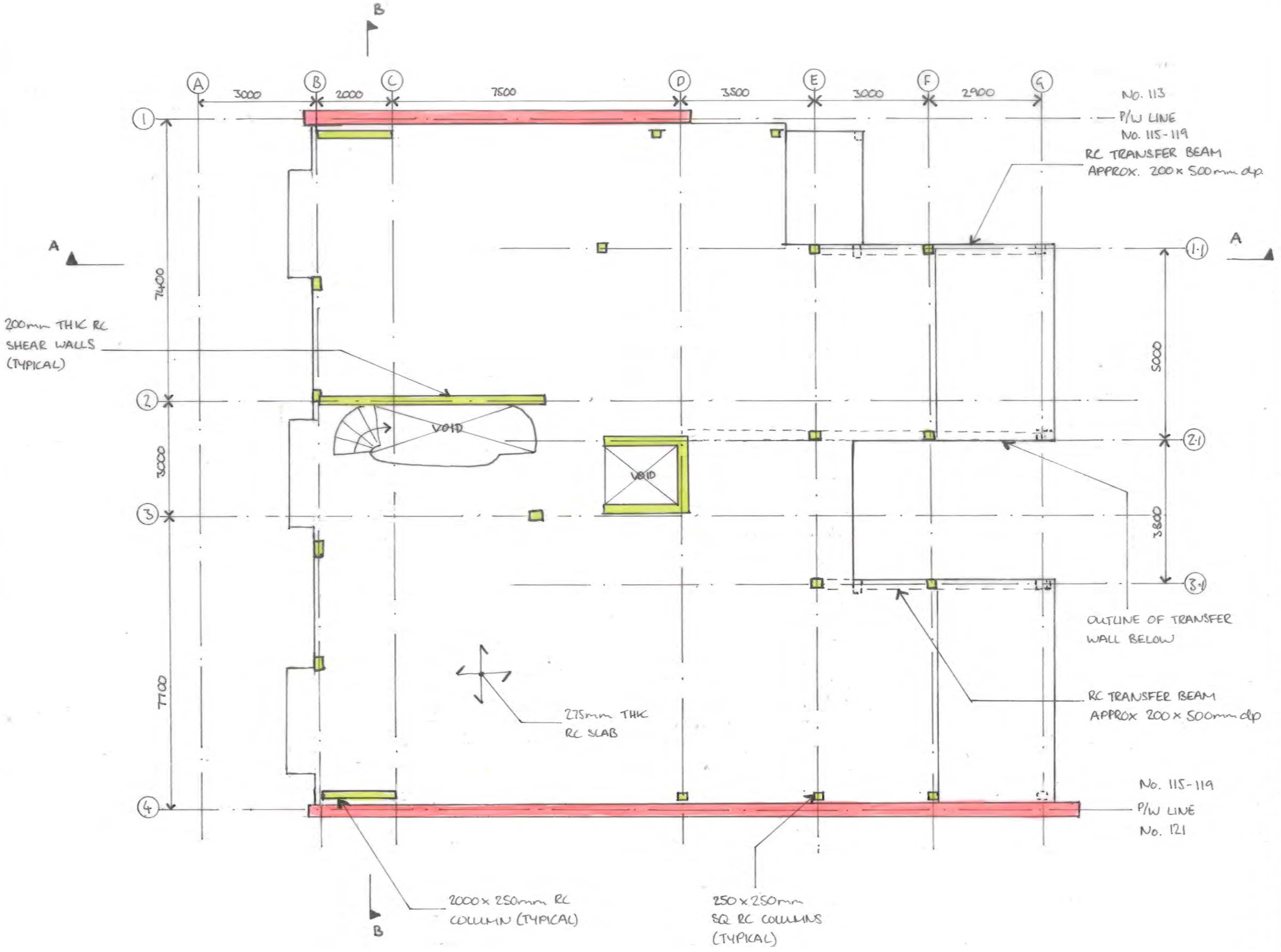
| 2150657 | S1000 | P1 |

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job title
115-119 GOLDHURST TERRACE

drawing title
PROPOSED FIRST FLOOR PLAN

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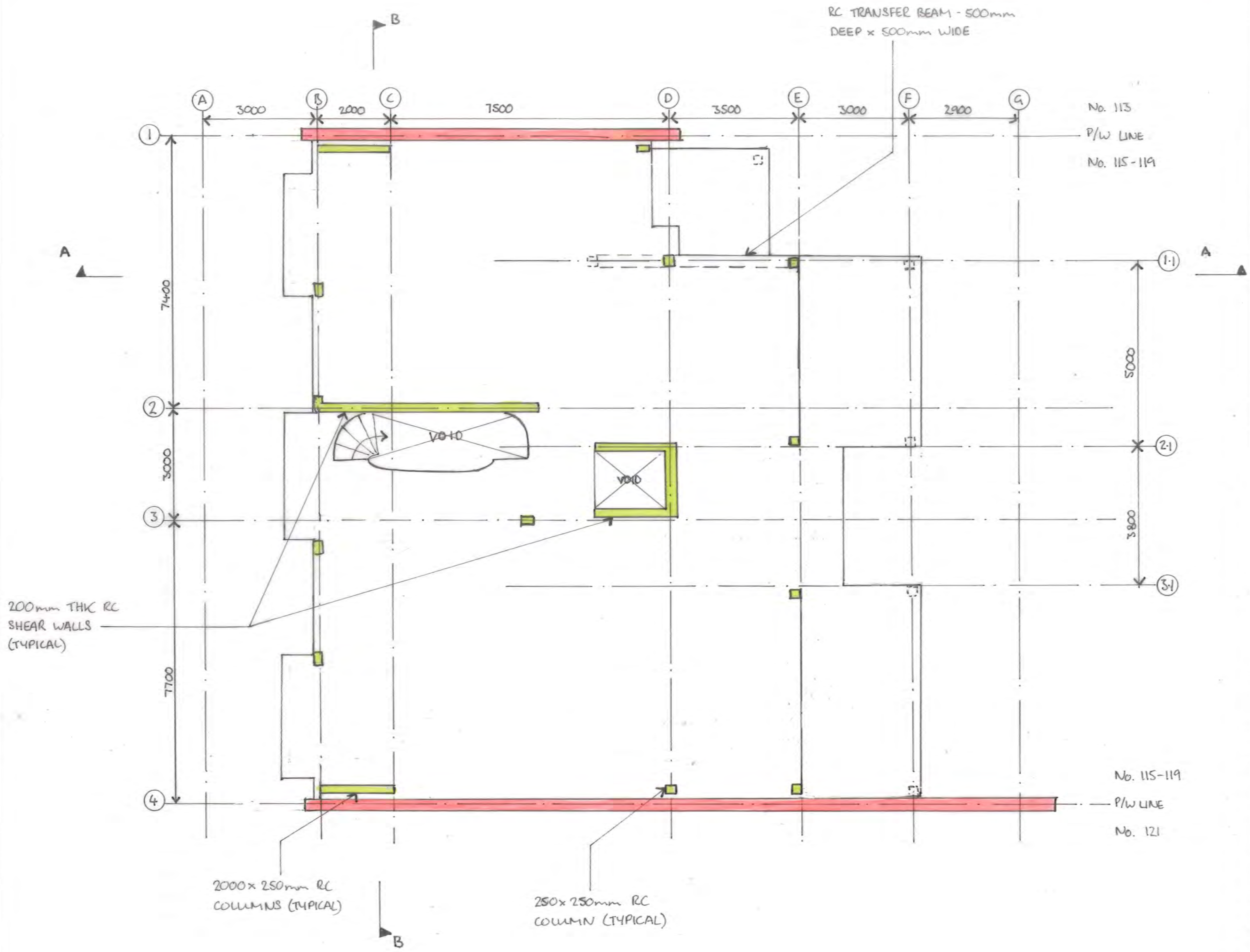


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| rev | date | by | chk | description |
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| P1 | 09/06 | JLM | JK | PRELIMINARY |

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job title: 115-119 GOLDHURST TERRACE

drawing title: PROPOSED SECOND FLOOR PLAN

| scale(s) | date | drawn |
|---|---|---|
| 1:100 | June'16 | JLM |

drawing status: PRELIMINARY

| job no | drawing no | revision |
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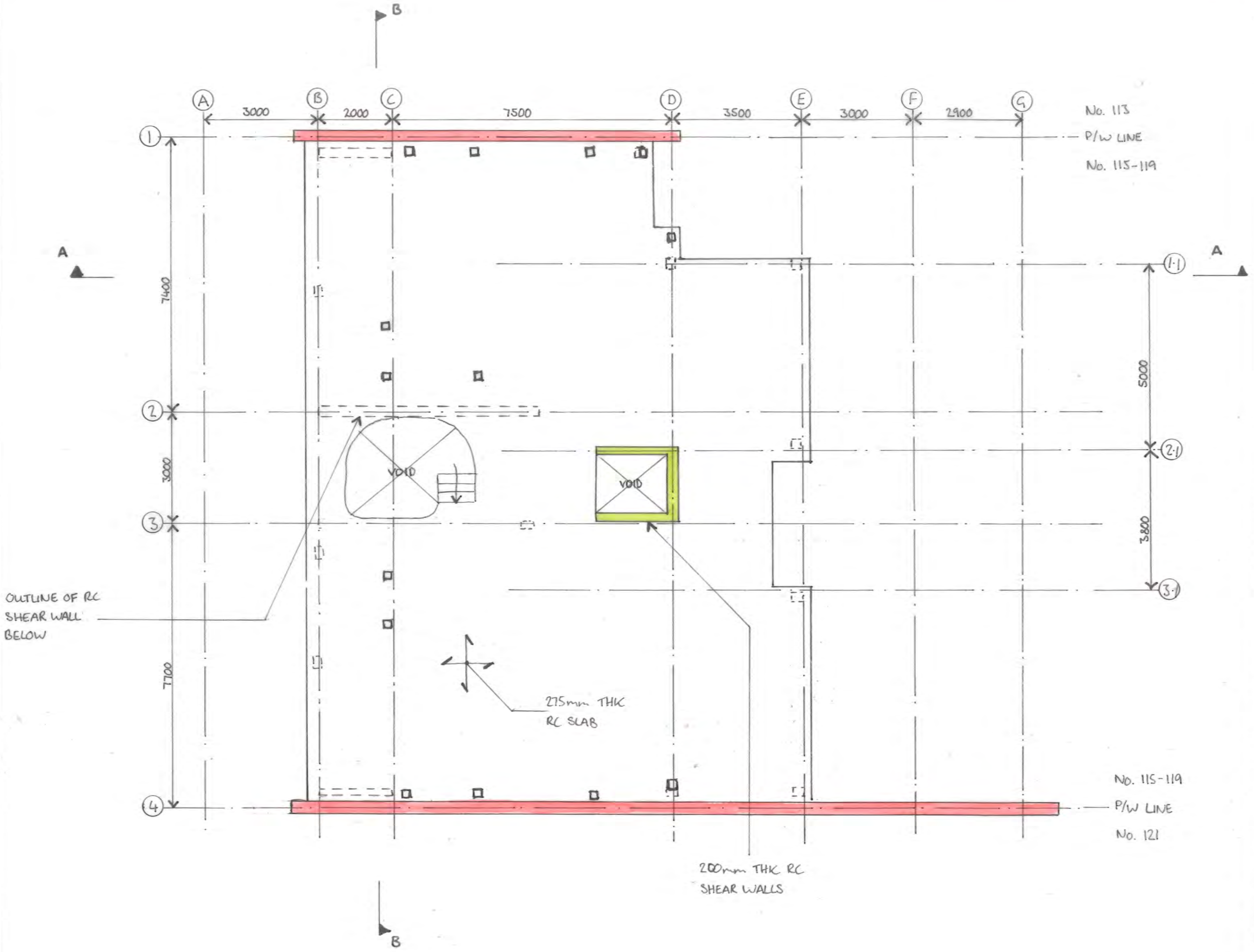


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| P1 | 07/06 | JM | JG | PRELIMINARY |

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drawing title
PROPOSED THIRD FLOOR PLAN

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|---|---|---|
| 1:100 | June '16 | JLM |

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PRELIMINARY

| job no | drawing no | revision |
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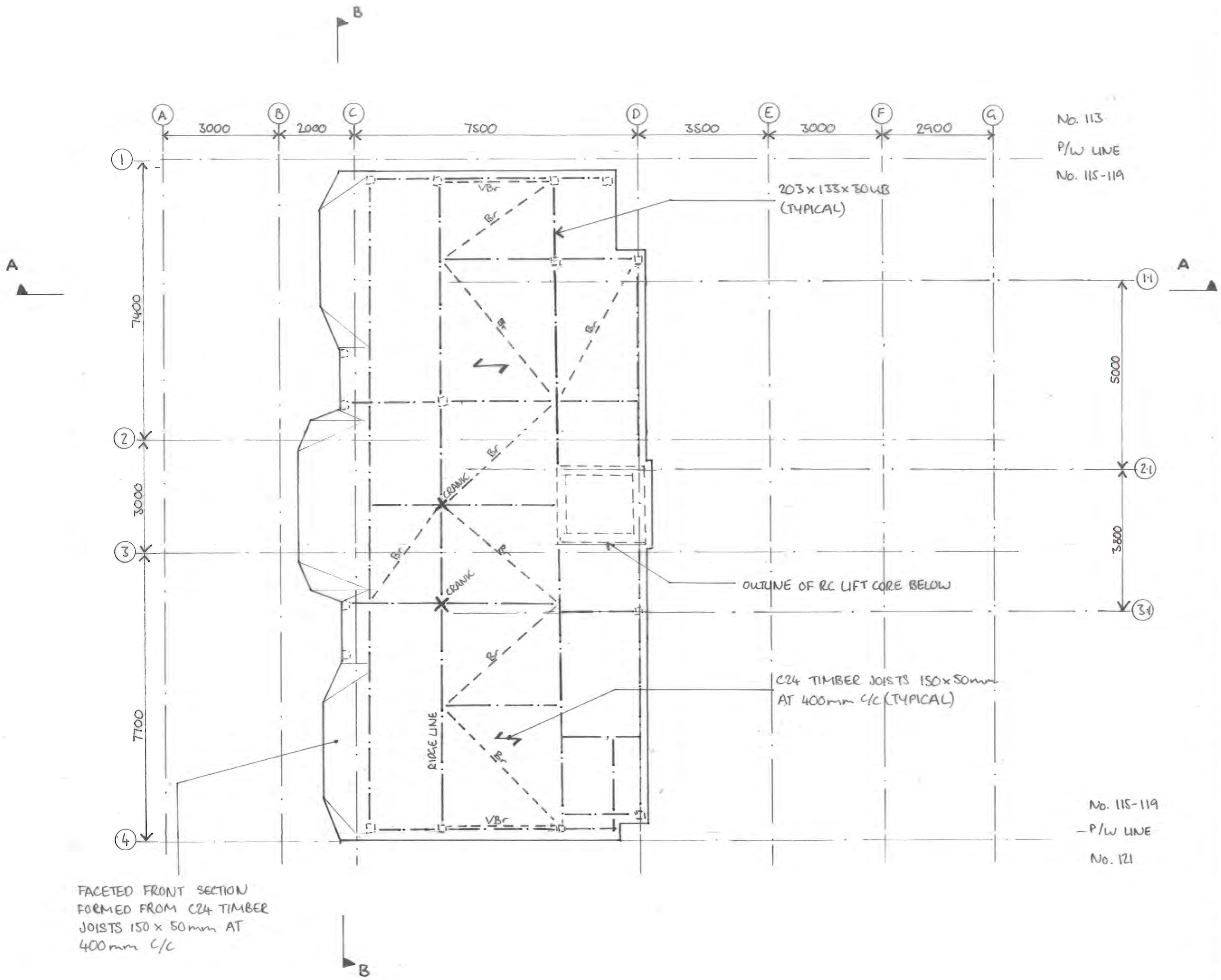
| 2150657 | S1300 | P1 |

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job title
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drawing title
PROPOSED ROOF PLAN

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| 1:100 | June '16 | JLM |

drawing status
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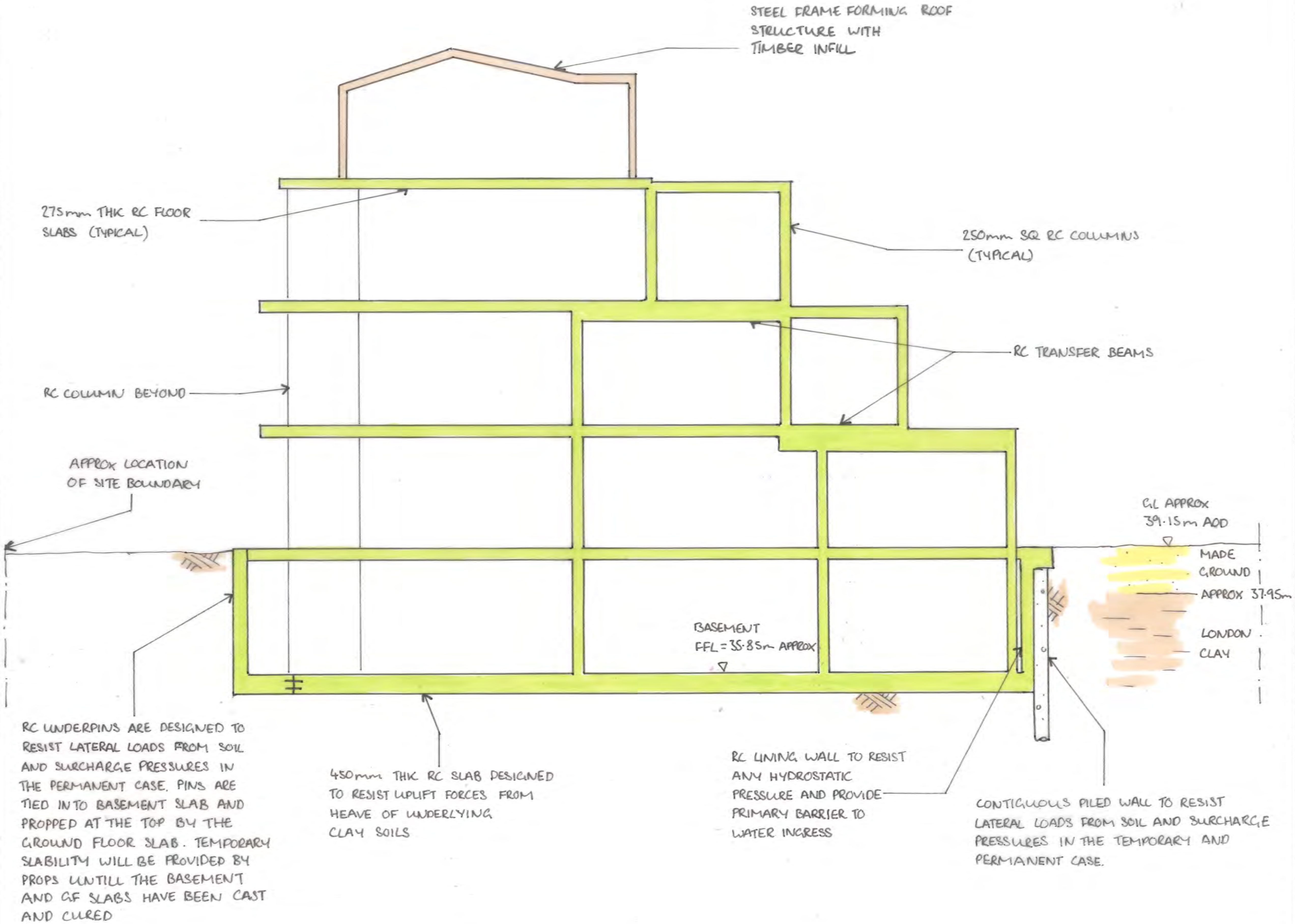


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| P1 | 09/06 | JH | JC | PRELIMINARY |

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job title
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drawing title
SECTION A-A

| scale(s) | date | drawn |
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| 1:100 | June '16 | JLM |

drawing status
PRELIMINARY

| job no | drawing no | revision |
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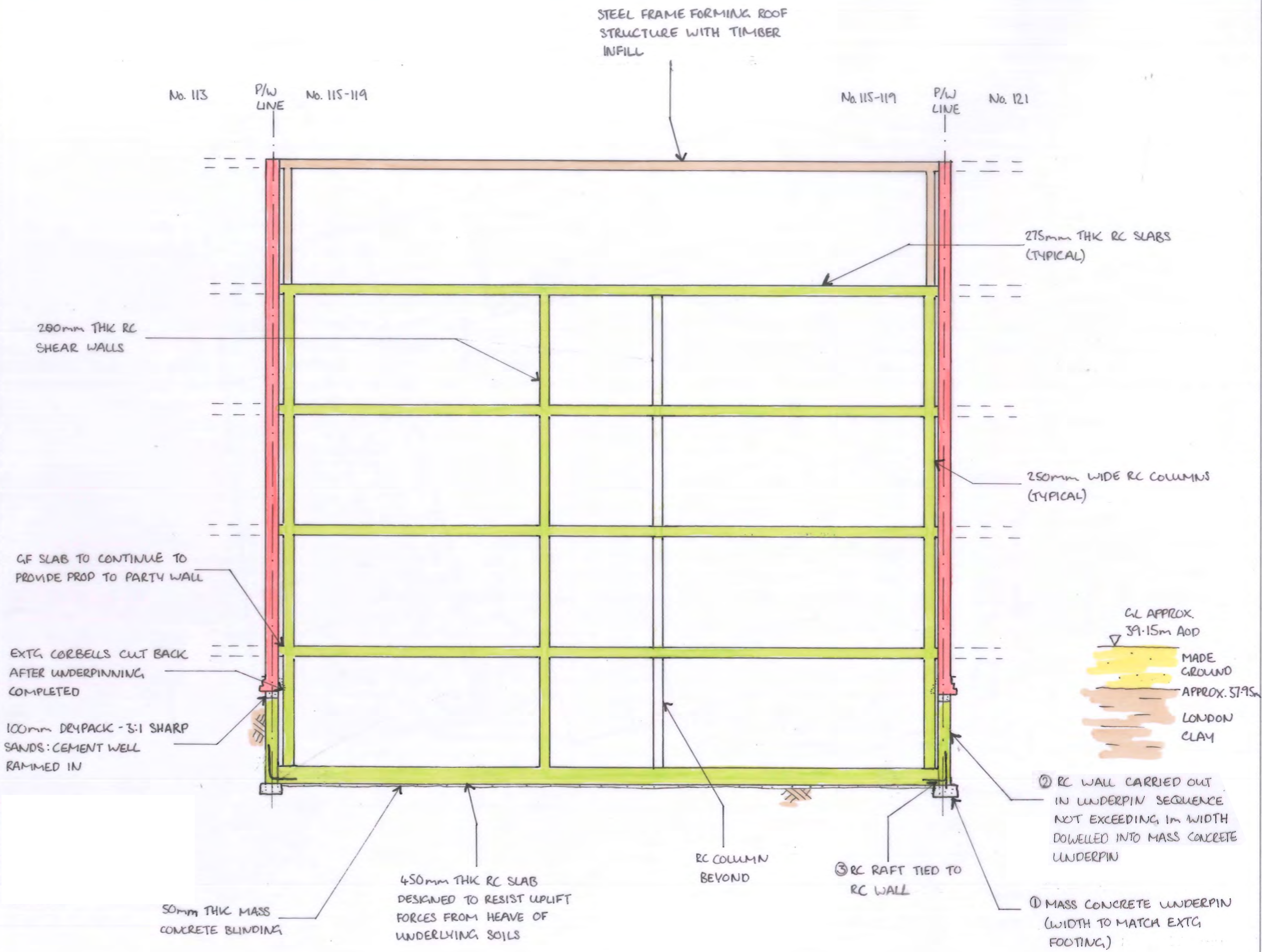
| 2150657 | SK/12 | P1 |

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| P2 | 21/09 | JM | CW | NOTES UPDATED |
| P1 | 09/09 | JM | SG | PRELIMINARY |

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drawing title: SECTION B-B

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drawing status: PRELIMINARY

job no: 2150657 | drawing no: SK/13 | revision: P2

# Appendix B: Proposed Construction Sequence Drawings

**Stage 1: Site set-up**

- Erect a fully enclosed painted plywood site hoarding to the boundary, this should not impact on the neighbouring properties.

- All below ground services should be identified prior to excavation and isolated as necessary.

- The principles for the removal of spoil shall be agreed. Given the size of the site, it is likely that machinery will be used to move the spoil from the excavation to a holding skip located in the roadway in front of the site. Grab lorries will be used to remove material from the skip.

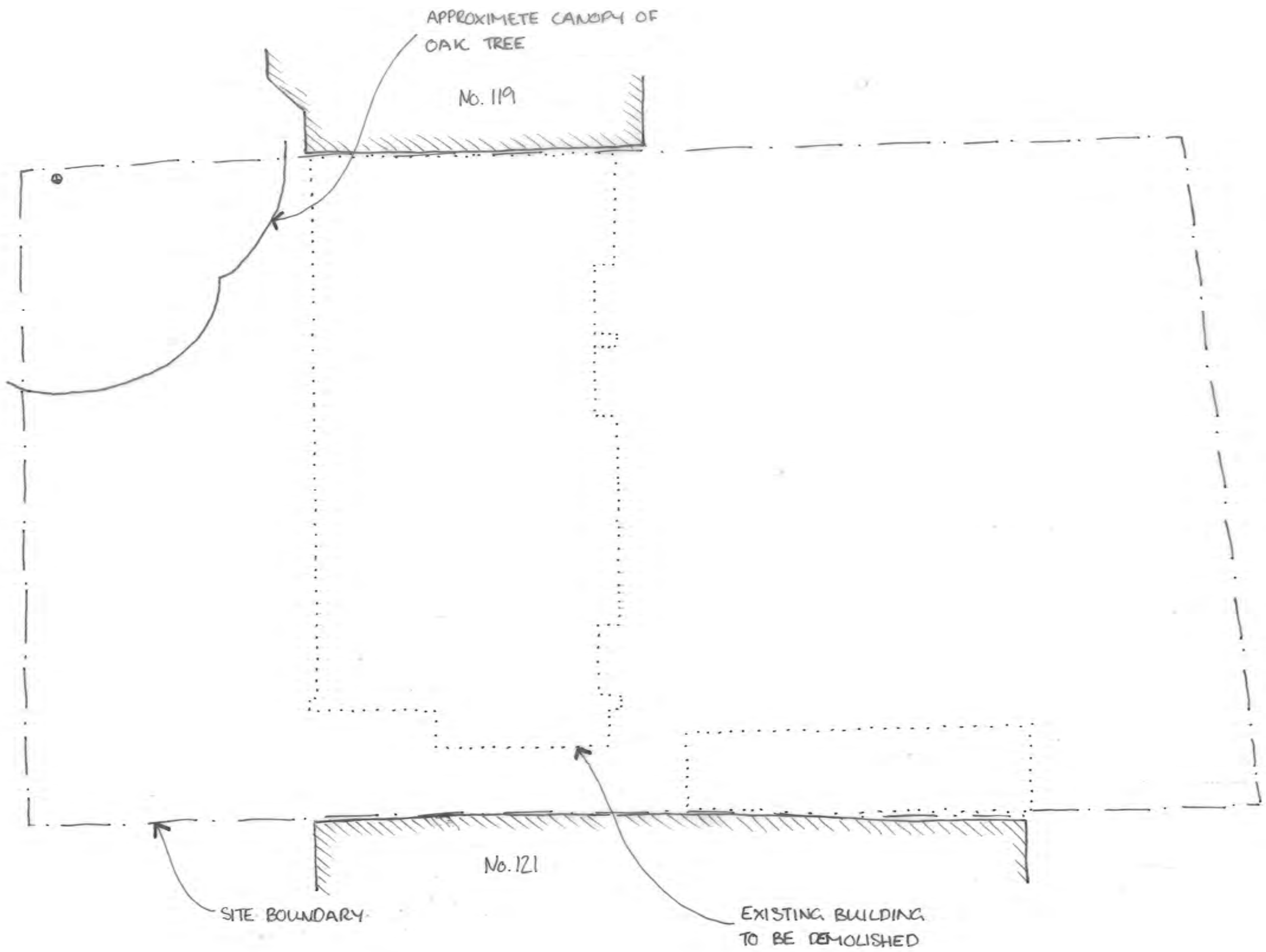
- Protection methods to be agree and installed for the trees to be retained to the front of the site.

- Monitoring points should be installed to all neighbouring structures and infrastructure and a base reading should be taken prior to and construction works starting on site. Refer to Section 8.0 for a more detailed discussion with regards to monitoring.

**Stage 2: Internal soft-strip and demolition**

- Complete soft strip of internal finishes within the building

- Carefully demolish the exiting main building down to ground floor level in a staged sequence (TBC by the contractor) and then break out the existing ground floor slab and foundations.
If the foundations extend below the level of the party wall footings, then the foundations will be broken down to the base of the party wall level, and the final part will need to be removed sequentially prior to the installation of the individual underpins.

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| P2 | 21/09 | JM | GLW | NOTES UPDATED |
| P1 | 09/06 | JLM | GLW | PRELIMINARY |

drawing title: ASSUMED CONSTRUCTION SEQUENCE - STAGE 1 + 2

scale(s): NTS | date: June '16 | drawn: JLM

drawing status: PRELIMINARY

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job no: 2150657 | drawing no: TW-01 | revision: P2

**Stage 3: Install piles and underpins**

- Form piling mat at approximate existing ground floor level.

- Complete contiguous piling from ground floor level along the eastern edge of the proposed basement footprint. These piles will resist the lateral pressures in both the temporary and permanent cases.

- Carry out reduced level excavations to the level of the Party Wall footing along the northern and southern boundaries and commence underpinning to Party Wall structures in an agreed "hit and miss" sequence. No underpin is to be greater than 1m width.

- The installation of the mass concrete footing will be carried out first, before the reinforced concrete walls are installed above. Both of these component will be installed in an underpin sequence. The reinforced concrete walls are anticipated to extend to a depth of around 3m below the level of the existing footings and so it is envisaged that they can be formed in a single stage. The walls will be cast with starter bars exposed at the base so that the basement raft can be tied in during stage 6.

- Dig trial underpins for inspection by Elliott Wood Partnership to check the ground conditions are as expected from the site investigation report. The Contractor is to check the grounds ability to 'stand up' whilst the individual pin is completed. If necessary install localised trench sheeting and props to maintain stability of the ground.

- Commence installation of the first stage of the RC retaining walls along the western perimeter of the basement. These L shaped underpins will be cast in a in a "hit and miss" sequence. The depth of the proposed basement is 4.0m bgl and so it is envisaged that the underpinning along this perimeter will have to be completed in two stages. These underpins will be excavated using hand tools to prevent excessive damage to the tree roots to the front of the site.

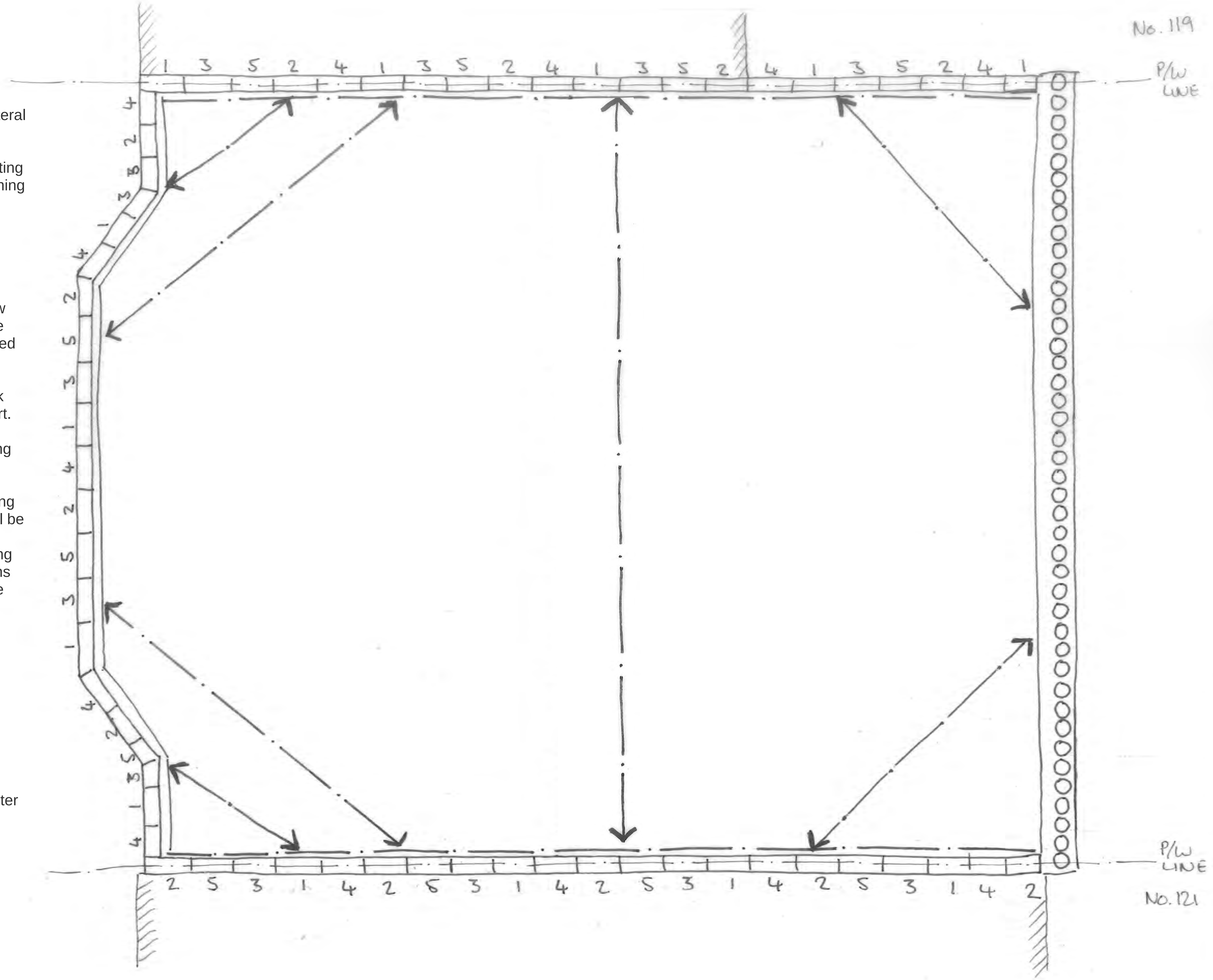
- All pits excavated should be backfilled before commencing works to adjacent pins.

- Shoring should be provided to all unsupported faces of excavations formed during underpinning works.

**Stage 4: Cast capping beam and install high level props**

- Excavate local trench to the top of the piles along the eastern perimeter and to the underpins along the western perimeter, propping off the adjacent earth bund, to allow the RC capping beam to be formed.

- Commence first stage excavation and install waling beams and high level props to underpins and contiguous piles.

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| P2 | 21/09 | JM | CLW | NOTES UPDATED |
| P1 | 09/06 | JM | JC | PRELIMINARY |

drawing title: ASSUMED CONSTRUCTION SEQUENCE - STAGE 3+4

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drawing status: PRELIMINARY

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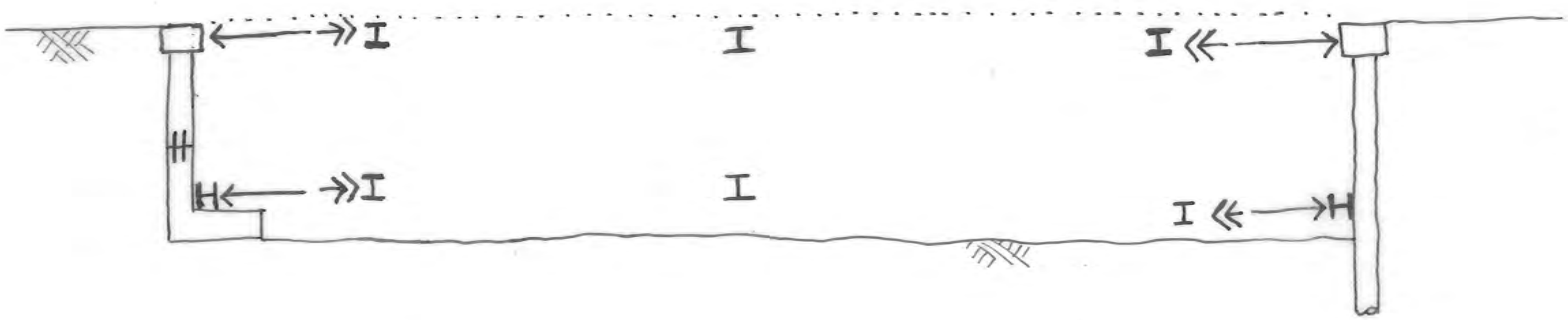
**Stage 5: Install Temporary Works & Excavate down to Formation Level**

- Install the second stage of the underpins to the front wall of the basement.

- Commence second stage excavation down to formation level. Excavation to be carried out in sections, and low level props sequentially installed.

- Although significant groundwater inflows are not likely due to the impermeable clay soil, the contractor should make allowance for suitable dewatering methods (e.g. sump pumping) due to any seepages through more permeable layers and surface water run-off





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| P1 | 09/06 | JM | JC | PRELIMINARY |

drawing title: ASSUMED CONSTRUCTION SEQUENCE - STAGE 5

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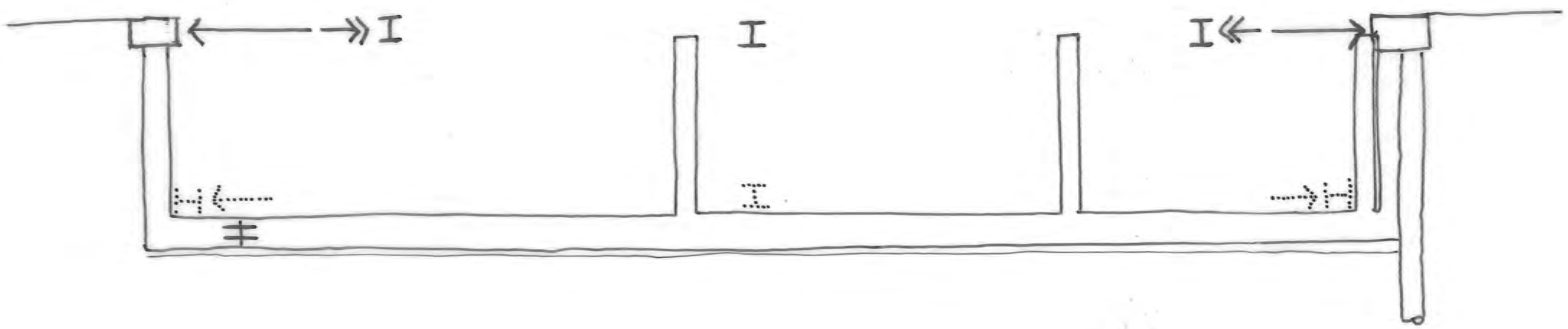
**Stage 6: Cast Basement Raft & Columns**

- Cast a layer of blinding across the site.

- Cast the R.C basement raft with kicker sections for basement columns. The basement slab will be doweled in to the RC retaining wall to the front of the site, and tied in to the reinforcement at the base of the walls below the party wall foundations.

- Remove second stage temporary horizontal props once the raft slab has gained sufficient strength to prop the mass concrete underpins at their toes.

- Cast R.C columns and liner wall up to the underside of the proposed ground floor slab. The RC walls will be cast around the high level horizontal props where required.



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| P2 | 21/09 | JM | CLW | NOTES UPDATED |
| P1 | 09/06 | JM | JG | PRELIMINARY |

drawing title: ASSUMED CONSTRUCTION SEQUENCE - STAGE 6

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|---|---|---|
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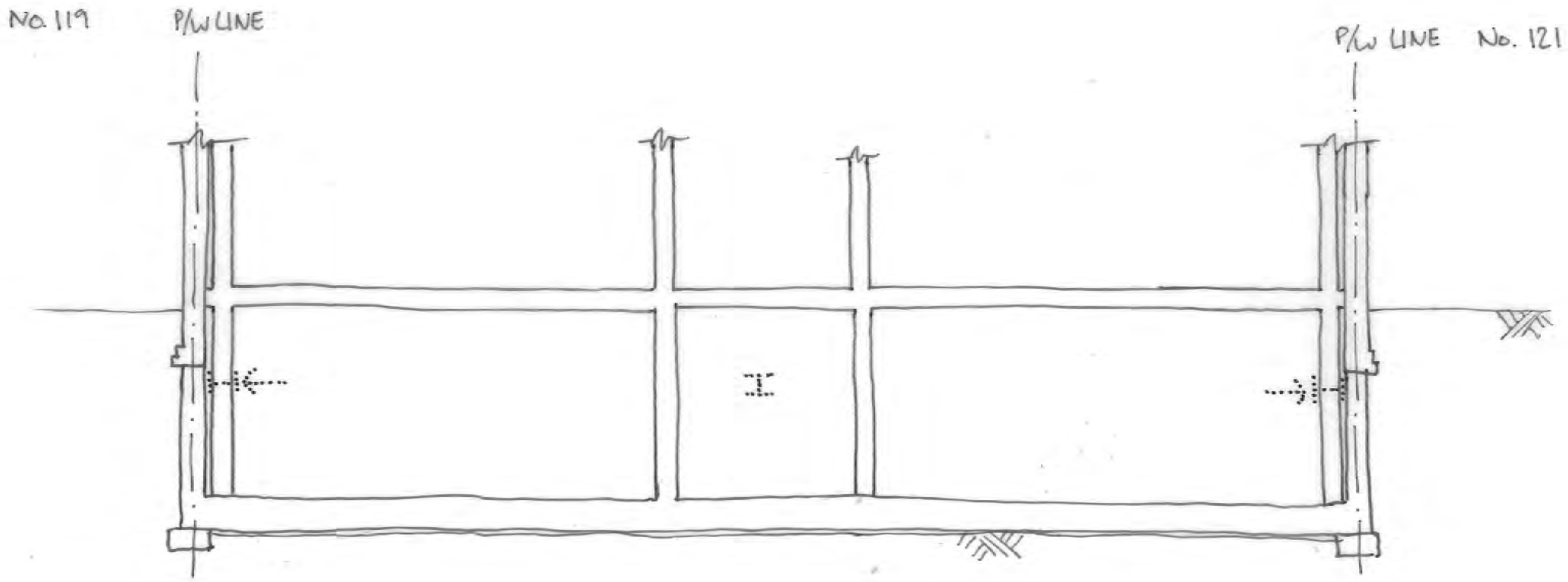
**Stage 7: Cast Ground Floor Slab**

- Cast ground floor RC slab. The ground floor slab will be dowelled in to the top of the RC retaining walls along the east and west faces of the building, and will extend to the masonry walls of the adjacent building to the north and south, in order to act as a prop.

**Stage 8: Remove Temporary Works**

- Once the ground floor slab has cured, it will provide the permanent prop to both the top of the concrete underpins to the east and west of the building, and to the bottom of the neighboring party walls to the east and west. Therefore any temporary horizontal props can be removed.

- With the basement structure complete up to ground floor, the superstructure works can commence.

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| P1 | 09/06 | JLM | SG | PRELIMINARY |

drawing title: ASSUMED CONSTRUCTION SEQUENCE - STAGE 7+8

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job no: 2150657 | drawing no: TW-05 | revision: P1

# Appendix C: Structural Calculations

## Basement calculations

- Soil parameters from SAS report:

| | Depth | $\gamma_b$ | $\phi'$ |
|---|---|---|---|
| Made ground | 0 – 1.2 | 20 | 28 |
| London clay | 1.2 – | 20 | 24 |

- soil properties:

$$K_a = \frac{1 - \sin \phi'}{1 + \sin \phi'} = \frac{1 - \sin(24)}{1 + \sin(24)} = 0.42$$

$$K_p = \frac{1 + \sin \phi'}{1 - \sin \phi'} = \frac{1 + \sin(24)}{1 - \sin(24)} = 2.37$$

$$K_o = 1 - \sin \phi' = 1 - \sin(24) = 0.59$$

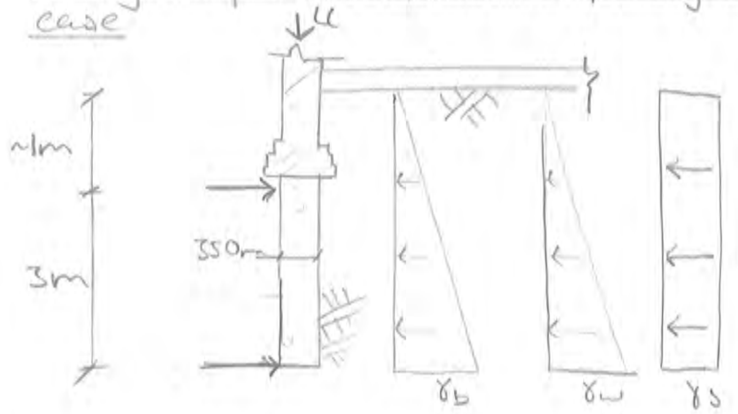
- during the groundwater monitoring, ground water was found at a depth of 1m in WS1 and WS2. Because of this, and because of the clay soil, ground water will be assumed to act at ground level

- surcharge load is assumed to be 10KN/m² in the temporary and permanent case, for the area to the front and back of the site. For the underpins to party walls, the surcharge load is assumed to be 5KN/m²





## Design of underpins to party walls - in temporary case




propped at the base and at the underside of the existing foundation

At a depth of 4m,

soil: $d(\gamma_b - \gamma_w)K_o = 4(20-10)0.59 = 23.6$ KN/m²

$23.6 \times 4 \times 0.5 = 47.2$ KN - acts at 2/3 h   $47.2 \times 1.35 = 63.7$ KN at ULS

water: $d\,\gamma_w = 10 \times 4 = 40$ KN/m²

$40 \times 4 \times 0.5 = 80$ KN - acts at 2/3 h   $80 \times 1.2 = 96$ KN at ULS

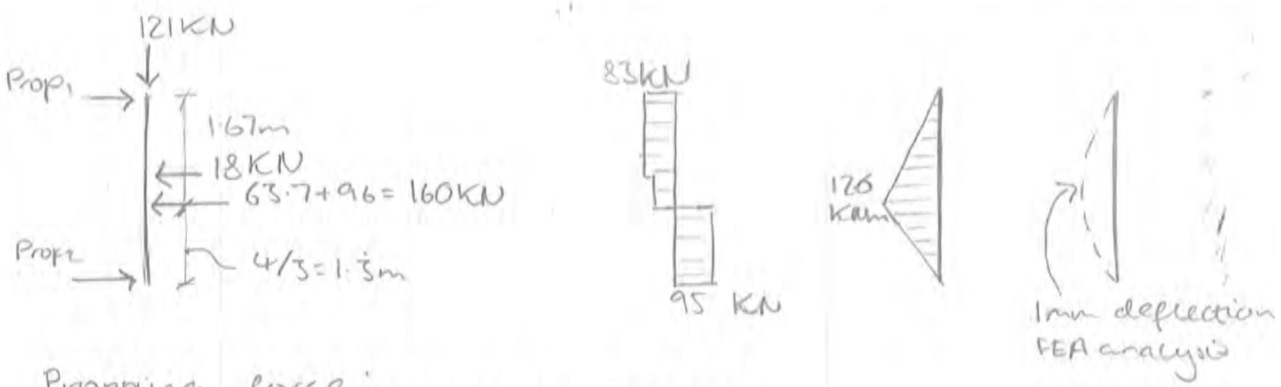
Surcharge: $5 \times K_o \times 1.5 \times 4 = 17.7$ KN at ULS - acts at 1/2 4m

Party wall loading

DL: wall = 12.8m height × 0.33m width × 19KN/m³ = 80KN/m
floors = 1m width × 1.0KN/m² × 2 floors = 3KN/m
roof = 1m width × 0.6 KN/m² × 1 = 0.6 KN/m

LL: floors = 1m width × 2.5KN/m² × 2 floors = 5KN/m
roof = 1m width × 0.6 KN/m² × 1 = 0.6

SLS = 83.6 + 5.6 = 89.2 KN/m
ULS = 1.35(83.6) + 1.5(5.6) = 121.3 KN/m




Propping force:

Prop 2 = (160 × 1.67) + (18 × 1) / 3 = 95 KN

Prop 1 = 178 − 95 = 83 KN

Moments in underpin

1.33m × 95 KN = 126 KNm

Design of structure:

Assume: • 350mm thk
• $d = 350 - 50 - 12 - 12/2 = 282$ mm
• $f_{ck} = 30$ N/mm²

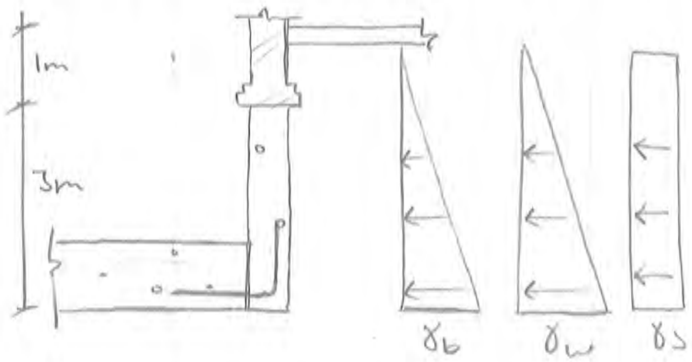
$K = (126\times10^6)/(1000\times 282^2 \times 30) = 0.053 < 0.168$

$z = d(0.5 + 0.5\sqrt{1-3.53K}) = 0.95 \rightarrow z = 268$ mm

$A_{s,req} = (126\times10^6)/(0.87\times268\times500) = 1080$ mm²

↳ use H12 @ 100 (1131 mm²) − inner face

Design of underpins to party walls in permanent case

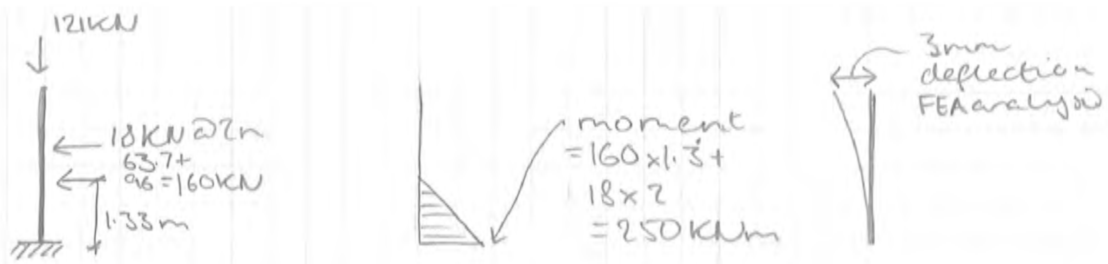



Loads = to temporary case

Prop removed, but pin is tied into basement raft → fixed support at base








Design of structure:

Assume: • 350mm thick
• $d = 350 - 50 - 16 - 16/2 = 276$ mm
• $f_{ck} = 30$ N/mm²

$K = (250\times10^6)/(1000\times 276^2 \times 30) = 0.109 < 0.168$

$z = d(0.5 + 0.5\sqrt{1-3.53K}) = 0.89 \rightarrow z = 246$ mm

$A_{s,req} = (250\times10^6)/(0.87\times246\times500) = 2340$ mm²

↳ use H25 @ 200 (2454mm) − outer face + bottom of raft

Project name:
Goldhurst Terrace

| Project number: | Sheet: | Revision: |
|---|---|---|
| 2150657 | 05 | P1 |
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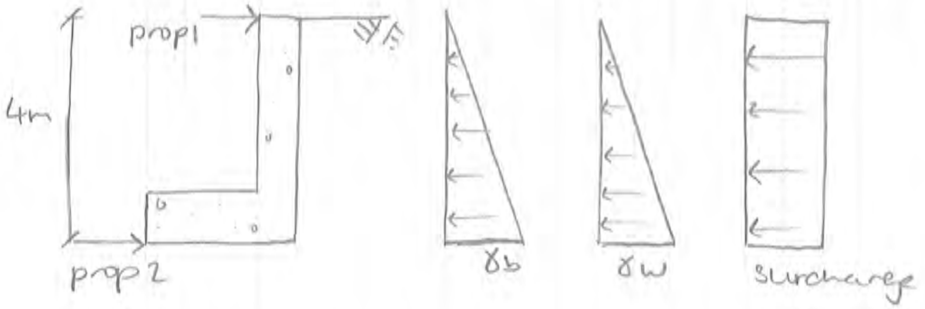
## Design of underpins to front of site - temporary case




propped at the base and at the top during temporary case

At a depth of 4m:

• Soil: $(\gamma_b - \gamma_w) K_0 d = (20-10) 0.59 \times 4 = 23.6\,kN/m^2$

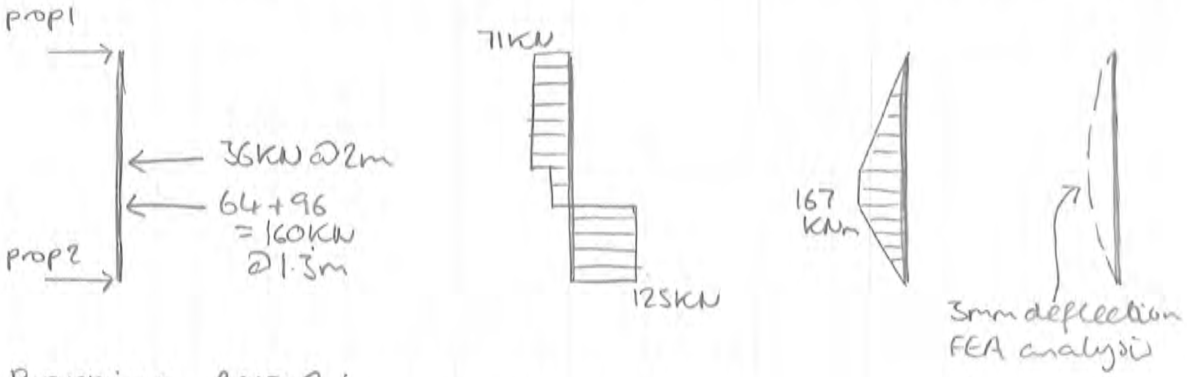
$23.6 \times 4 \times 0.5 = 47.2\,kN$, acts at 1/3h, $47.2 \times 1.35 = 64\,kN$ at ULS

• water: $\gamma_w d = 10 \times 4 = 40\,kN/m^2$

$40 \times 4 \times 0.5 = 80\,kN$, acts at 1/3h, $80 \times 1.2 = 96\,kN$ at ULS

• surcharge: $\gamma_s K_0 = 10 \times 0.59 = 5.9\,kN/m^2$

$4 \times 5.9 = 24\,kN$, acts at h/2, $24 \times 1.5 = 36\,kN$ at ULS




Propping force:
prop 1 = $(36 \times 2) + (160 \times 1.\dot{3}) / 4 = 71\,kN$
prop 2 = $(160 + 36) - 71 = 125\,kN$

Max moment in underpin:
$125\,kN \times 1.\dot{3} = 167\,kNm$




Project name:
Goldhurst Terrace


| Project number: | Sheet: | Revision: |
|---|---|---|
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## Design of structure:

Assume: • 300mm thk
• $d = 300 - 50 - 16 - 16/2 = 226\,mm$
• $f_{ck} = 30\,N/mm^2$

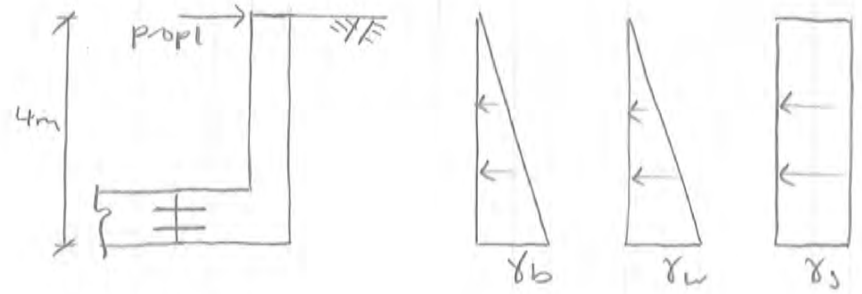
$K = (167 \times 10^6) / (1000 \times 226^2 \times 30) = 0.109 < 0.168$

$z = d(0.5 + 0.5\sqrt{1 - 3.53K}) = 0.89 \rightarrow z = 202\,mm$

$A_{s,req} = (167 \times 10^6) / (0.87 \times 202 \times 500) = 1900\,mm^2$

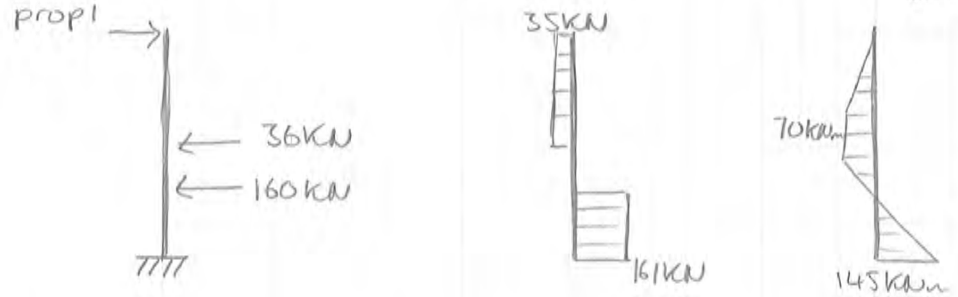
Use H16 @ 100 ($2011\,mm^2$) to inside face

## Design of underpins to front of site in permanent case




fixed at base as tied into raft slab and propped at top by GF slab

Loads as in temp case




shear forces and bending moments have been calculated using Tedds

Design of structure:

Assume:
- 300mm thk
- $d = 300 - 50 - 16 - 16/2 = 226\,mm$
- $f_{ck} = 30\ N/mm^2$

$K = (145 \times 10^6)/(1000 \times 226^2 \times 30) = 0.095 < 0.168$

$z = d(0.5 + 0.5\sqrt{1 - 3.53K}) = 0.908 \rightarrow z = 205\,mm$

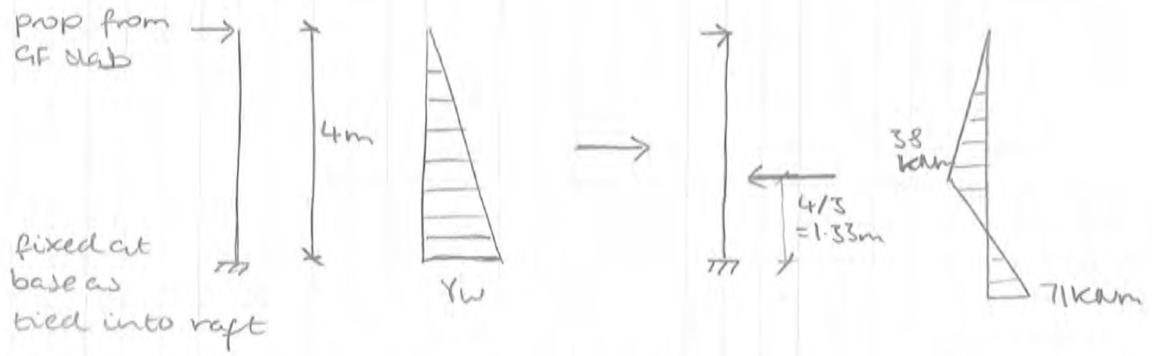
$A_{s,req}\ (145 \times 10^6)/(0.87 \times 205 \times 500) = 1626\,mm^2$

Use H16 @ 100 ($2011\,mm^2$) to outside face and base of raft.





Design of liner wall to resist hydrostatic pressures




at 4m depth; $\gamma_w \times 4m = 40\,kN/m^2$, $40 \times 1.2 = 48\,kN/m^2$ ULS

total force $= 4 \times 48/2 = 96\,kN$, acts at $4m/3 = 1.33m$

Lining wall structure:

Assume: 250mm thk
$d = 250 - 50 - 16 - 12/2 = 178\,mm$
$f_{ck} = 30\ N/mm^2$

$K = (71 \times 10^6)/(1000 \times 182^2 \times 30) = 0.075 < 0.168$

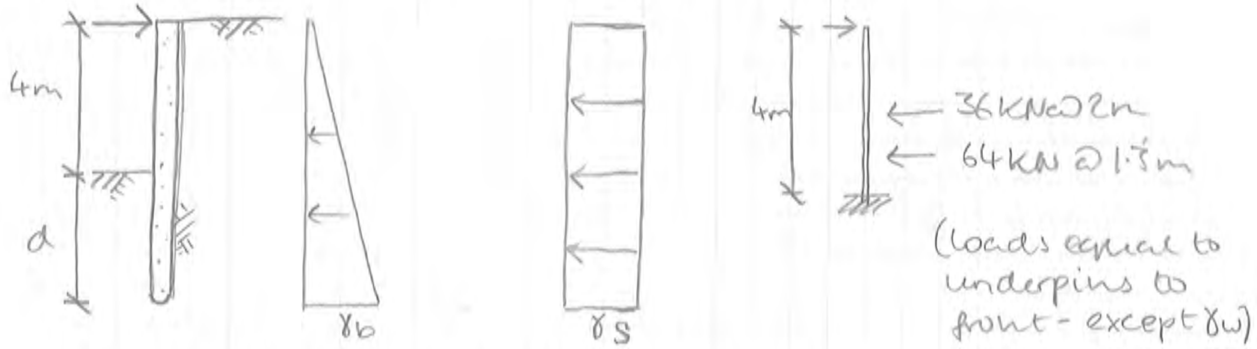
$z/d = 0.5(1 + \sqrt{1 - 3.53K}) = 0.93 \rightarrow z = 165\,mm$

$A_{s,req} = (71 \times 10^6)/(0.87 \times 170 \times 500) = 987\,mm^2$

→ use H16 at 200 c/c $= 1005\,mm^2$ in outside face

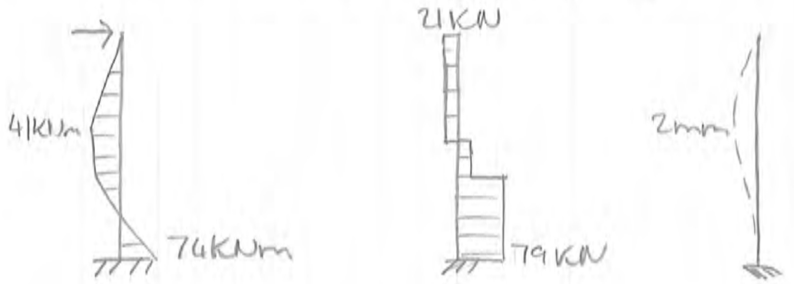
## Contiguous piled wall to West of site

- detailed design will be by specialist contractor




- assume 350mm dia piles, and 500mm c/c,
  Load per pile = γs 18kN
  γb 32kN

- vertical loads are negligible




values of moments, shear force, deflection based on FEA results

- from column design chart for d/h = 0.8

$A_{s,req}$ = 577mm² → use 6 No H16 = 1206mm²

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