elliottwood

50 Avenue Road

London, NW8 6HS

Structural Engineering Report and Subterranean Construction Method Statement

Job number: 213136

Revision: P3

Status: Preliminary

Date: July 2014

Document Control

issue no.	01	remarks:	Issued for Planning				
revision:	P3	prepared by:	Sarah Wadley Engineer MEng (Hons)	checked by:	Gary Povey Senior Associate BSc CEng MIStructE	approved by:	Gary Povey Senior Associate BSc CEng MIStructE
date:	July 2014	signature:		signature:		signature:	

Contents

Appendices

Non-Technical Summary

If the above measures and sequence of works are taken into account in the eventual design and construction of the proposed works and are properly undertaken by suitability qualified contractor, these works will pose no significant threat to the structural stability of the adjoining properties, the remaining house and surrounding grounds.

The attached reports state that the proposed basement will have no significant adverse effect on the local hydrogeology. They also state that both ground water and surface water will not be affected or will cause significant adverse effects to the surrounding properties.

To this end, EWP 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 LLP (EWP) is a firm of consulting structural engineers approximately 100 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 EWP 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. It should be noted that EWP were responsible for the design of the basements at 40 Avenue Road which was successfully completed in 2012.

1.2 EWP were appointed by the building's owner to advise on the structural implications of the proposed construction of a new two-storey basement on the site of 50 Avenue Road. The following report has been prepared to ensure that the property and 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, DP23 and DP27. The Basement Impact Assessment has been carried out, 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. He shall also prevent overloading of any completed or partially completed elements.

1.4 This statement should be read in conjunction with the following documents:

- EWP drawings 213136 – refer to Appendix A
- KSR architects drawings – refer to Architect's report
- Water Environment Ltd.'s Flood Risk Assessment (August 2013) – refer to Appendix F
- Site Analytical Services Ltd.'s Basement Impact Assessment (August 2013) – refer to Appendix C
- Site Analytical Services Ltd.'s Phase 1 Preliminary Risk Assessment (August 2013) – refer to Appendix D
- Site Analytical Services Ltd.'s Report on Ground Investigation (August 2013) – refer to Appendix E
- Site Analytical Services Ltd. damage risk assessment (at the end of Basement Impact Assessment) – refer to Appendix C

2.0 Description of Existing Building and Site Conditions

2.1 No. 50 Avenue Road is a three storey detached house located on the Northern side of Avenue Road. The existing building is assumed to be a load bearing masonry structure supporting timber joist floors and beams at each level. Stability is provided by cellular action of the masonry walls and diaphragm action of the timber floors at each level. We have assumed that the ground floor is a ground bearing reinforced concrete slab.The building is not listed.

2.2 Avenue Road is a 'secondary area' street in risk of surface water flooding (as listed by Camden Planning Guidance CPG 4). Therefore a flood risk assessment has been completed by Water Environment and can be found in Appendix F.

2.3 A site investigation consisting of two boreholes has been carried out by Site Analytical Services Ltd in June/July 2013, which indicates that the underlying ground is London Clay overlaid by up to 1.5m of made ground. This is in line with geological records for this area. Groundwater was not encountered during the boring operations but was found to have stabilised at a depth of 3.49m below ground level in the monitoring standpipe installed in Borehole 1 after a period of approximately seven to eight weeks. Sample testing indicated the soil underlying clay to be of high swelling and shrinkage potential. Refer to Site Analytical Services Ltd.'s Report on Ground Investigation in Appendix E.

2.4 The Report on Ground Investigation also highlighted that levels of carbon dioxide had been monitored in the soil in line with characteristic situation 2 as outlined in CIRIA report C665. Table 8.5 of CIRIA report C665 states levels of carbon dioxide of this amplitude are low risk and are typical of made ground layers. The basement structure will be designed with appropriate membranes to ensure no ingress of exterior gases (or water).

2.6 There are a number of mature trees both in the garden of number 50 and in adjacent gardens and public footpaths. The proximity of the existing and new trees will need to be considered in the final design of the basement and its foundations.

2.7 The results of our desk study can be summarised as follows;

- The building appears to be in the vicinity of the historic river Tyburn (reference Lost Rivers of London, Nicholas Barton – refer to Appendix B).

- The site is not located within the flood plain as shown on the latest Environment Agency Flood Maps (reference; www.environment-agency.gov.uk).
- The site is located within Source Protection Zone 2 as shown on the latest Environment Agency Groundwater source maps (reference; www.environment-agency.gov.uk).
- The site is not in the vicinity of any London Underground Ltd infrastructure (refer to confirmation letter in Appendix F).
- There is record of historical minor blast bomb damage to the property (reference, The LCC London Bomb Damage Maps 1939-1945, LTS, map 37).

3.0 Observations

3.1 There are trees located around the periphery of the existing building. A tree survey and report has been conducted by project Arboriculturalist, Landmark Trees, in July 2013. The proposed works fall within root protection zones for some trees. For further information regarding existing and proposed trees refer to the Architect's report.

4.0 Proposed Alterations

4.1 The proposed works involve the construction of a new two storey basement beneath the footprint of the existing house and into the back garden.

4.2 The existing front and side walls will be retained but the majority of the internal walls are to be demolished and the new walls constructed. It is also intended that all existing floor structures are to be retained.

4.3 The majority of the basement will extend approximately 7m below ground level with a portion extending approximately 10m below ground level to form the pool area.

4.4 The rear garden basement perimeter will be formed using contiguous piles to enable the safe excavation of the basement. It will be required to resist lateral forces from soil and surcharge loads in the temporary and permanent state. A reinforced concrete box formed inside the pile line will provide additional lateral resistance against any hydrostatic forces and support the vertical loads of the basement slabs. The lining wall will be cast with waterproof concrete to form the primary barrier to water ingress. A cavity drain system will provide a secondary barrier.

4.5 The slabs and load bearing walls within the rear garden basement will be formed with reinforced concrete. The founding slab will be a suspended slab spanning over a compressible void former, and will be designed to resist any residual uplift forces from heave, due to the release of the overburden and hydrostatic pressures.

4.6 The rear garden basement works will follow a 'top-down' approach whereby the ground floor slab can be cast, supported by the perimeter and temporary internal piles, prior to the excavation of the basement. The ground floor slab will contain sufficient voids for access, excavation and ventilation.

4.7 The existing house walls will be underpinned to allow excavation to the basement under the house. This underpinning will be permanent where it can be kept and temporary where it is only needed at enabling works for excavation. An explanation of the proposed works is contained on the drawings attached.

5.0 Proposed Below Ground Drainage

5.1 It is proposed that the existing connection to the public sewer is retained and re-used. This will be subject to location and condition, which will be confirmed by a CCTV survey prior to works.

5.2 It is proposed that all drainage from the ground floor and above is drained via gravity. The proposed basement level will be lower than the level of the existing public sewer connection as such the foul effluent generated at basement level will need to be pumped to the main private drainage system. This will prevent any flooding from the public sewer in case of backup.

5.3 The basic waterproofing strategy is informed by the proposed use of the basement and the existing ground conditions. Ground water is unlikely to be encountered but as the basement forms a habitable space, it has been considered in the design and waterproofing of the basement. It is proposed that the reinforced concrete basement walls and slab are constructed from waterproof concrete and will act as the primary barrier to possible water ingress. An internal drained cavity system will be installed to complete the system creating a Category 3 Basement as defined in Table 2 of BS 8102.

5.4 The cavity drain system will include a cavity drain sump to collect any water which will then be pumped to the main private drainage system.

5.5 It is proposed that SuDS are incorporated within the scheme, to reduce the surface water run-off from the site. The current proposals include both an extensive green and brown roof on the new extension and garden shed respectively. The site investigation has confirmed that the underlying subsoils consist of impermeable clay, therefore infiltration into the ground via soakaways will not be feasible. As noted in the Flood Risk Assessment, the development will marginally increase the surface water run-off from the site, as the total hard standing area is increasing slightly. To limit the run-off from the site to that of the existing situation, an attenuation tank has been proposed within the front area of the property. The exact details of this attenuation tank, including size and flow control device will be confirmed as part of the detailed design phase, although it is likely that the tank will be constructed from cellular storage crates. We note that it has been suggested that the surface water run-off is restricted to Greenfield rates if possible – unfortunately due to the small size of the site, this will not be practical and will potentially increase the risk of the site flooding, due to a very small flow restrictor.

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 50 Avenue Road 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 Groundwater was not encountered during the boring operations carried out by Site Analytical Services Ltd in June/July 2013 but was found to have stabilised at a depth of 3.49m below ground level in the monitoring standpipe installed in Borehole 1 after a period of approximately seven to eight weeks. This is likely to be surface water from recent thunderstorms perched locally on impermeable layers, rather than ground water.

7.2 A Basement Impact Assessment has been prepared by Site Analytical Services Ltd to show that the proposed works should not have an adverse effect on the adjoining properties or the groundwater. Refer to the report in Appendix C.

7.3 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.

7.4 A Flood Risk Assessment and Surface Water Report have been produced by Water Environment Ltd to demonstrate that the proposed works should not have an adverse effect on the adjoining properties or increase the risk of flooding in the area, refer to Appendix F.

7.5 A Burland Category report and Damage Risk Assessment has been prepared by SAS which is included in Appendix C. It confirms that the works proposed will not have any greater effect on neighbouring properties or ground than 'very slight'.

8.0 Subterranean Construction Method Statement

8.1 Construction generally

All demolitions and excavations will need to be undertaken in a carefully controlled sequence. In our structural design we have assumed the following Subterranean Construction Method Statement. The Contractor will however have to provide a detailed method statement including all temporary works design before the works commence on site. These proposals will be issued to EWP and the design team for comments prior to commencement of the works on site.

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

The undertaking of such subterranean projects is specialist work and EWP will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project.

8.2 Noise & vibration

The Contractor shall undertake the works in such a way as to minimise noise, dust and vibration when working close to adjoining buildings in order to protect the amenities of the nearby occupiers.

The breaking out of existing structure shall be carried out by saw cutting where possible to minimise vibration to the adjacent properties and associated construction noise. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise.

8.3 Construction Method Statement

Refer to drawings attached for sequence of construction.

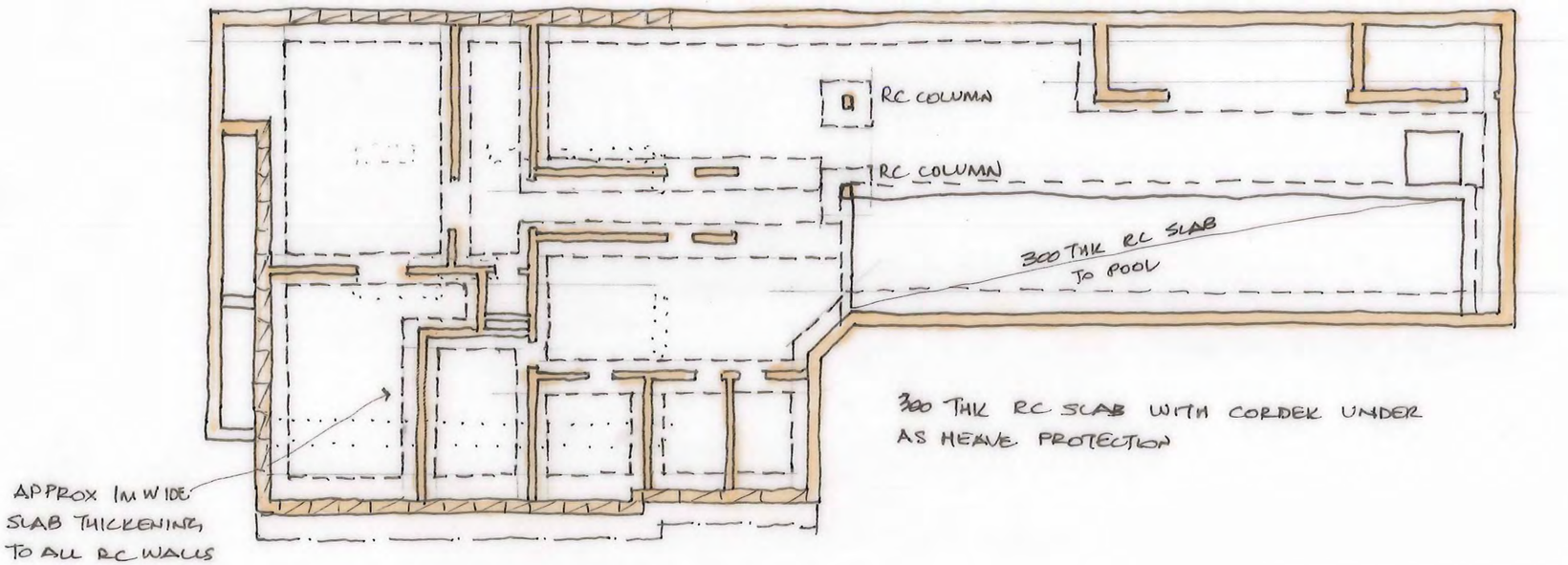
APPENDICES

A Proposed Structural Layouts and Sequence of Construction Drawings

KEY

NEW RC WALLS

NEW RC U/PINNING



300 THK RC SLAB WITH CORDEK UNDER AS HEAVE PROTECTION

RC LINING WALLS TO BE CONSTRUCTED IN WATERPROOF CONCRETE. CAVITY DRAIN SYSTEM TO INSIDE FACE TO PROVIDE TWO MEANS OF DEFENCE AGAINST WATER INGRESS.

THIS DRAWING TO BE READ IN CONJUNCTION WITH CONSTRUCTION METHOD STATEMENT (ENABLING WORKS PILES NOT SHOWN)

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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title

PROPOSED BASEMENT 2 PERMANENT PLAN

scale(s)	date	drawn
N1:200	4.6.14	CP

drawing status

PLANNING

elliottwood

Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title

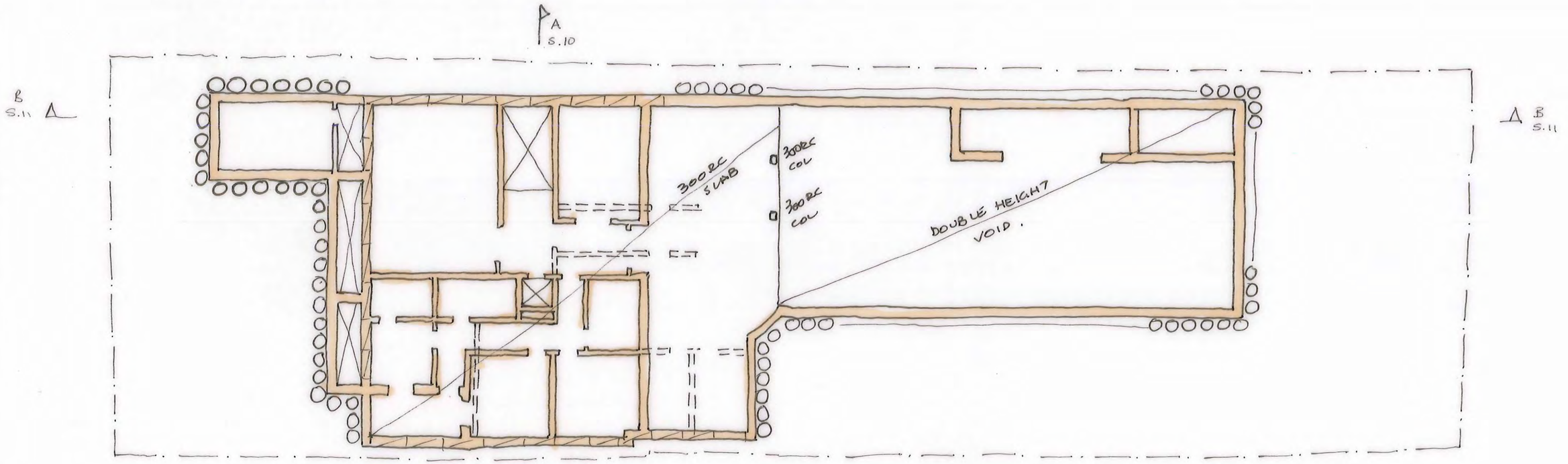
50 AVENUE ROAD

job no	drawing no	revision
213136	S.01	P1

KEY

NEW RC WALLS

NEW U/PINNING



THIS DRAWING TO BE READ IN CONJUNCTION WITH CONSTRUCTION METHOD STATEMENT.
TEMPORARY LATERAL PROPPING NOT SHOWN FOR CLARITY.

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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED BASEMENT & GROUND FLOOR

scale(s)	date	drawn
N1:200	4.6.14	GP

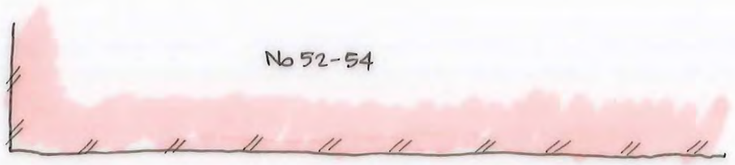
drawing status
PLANNING

elliottwood

Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD

job no	drawing no	revision
213136	S.02	P1



250 THICK RC LINING WALL TO PILES

B SK.11

No 52-54

BOUNDARY LINE

AVENUE ROAD

CAR STACKER VOID

TEMPORARY ACCESS FOR EXCAVATION FROM BELOW GRND FLOOR SLAB VIA PERMANENT VOIDS IN SLAB

300 RC SLAB

500 RC SLAB

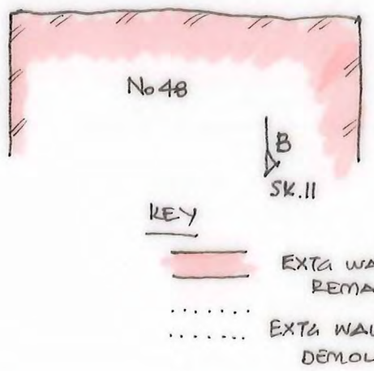
COLUMNS UNDER

500 THICK RC SLAB SUPPORTED ON RC LINING WALLS BELOW

450ø CONTIGUOUS PILES TO PERIMETER OF DOUBLE STOREY BASEMENT AS ENABLING WORKS (NOT SHOWN FOR CLARITY)

No 48

SURCHARGE LOAD FROM NEIGHBOURING STRUCTURES TO BE CONSIDERED IN DESIGN OF U/P's.



REFER TO SEQUENCE DRAWINGS FOR EXISTING WALLS TO REMAIN AND THOSE TO BE DEMOLISHED. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH CONSTRUCTION METHOD STATEMENT.

PILES TO RESIST LATERAL FORCES FROM SURCHARGE LOADS AND SOIL PRESSURE IN TEMP. AND PERM CASE

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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED GROUND FLOOR

scale(s)	date	drawn
N1:100	JUNE 14	GP

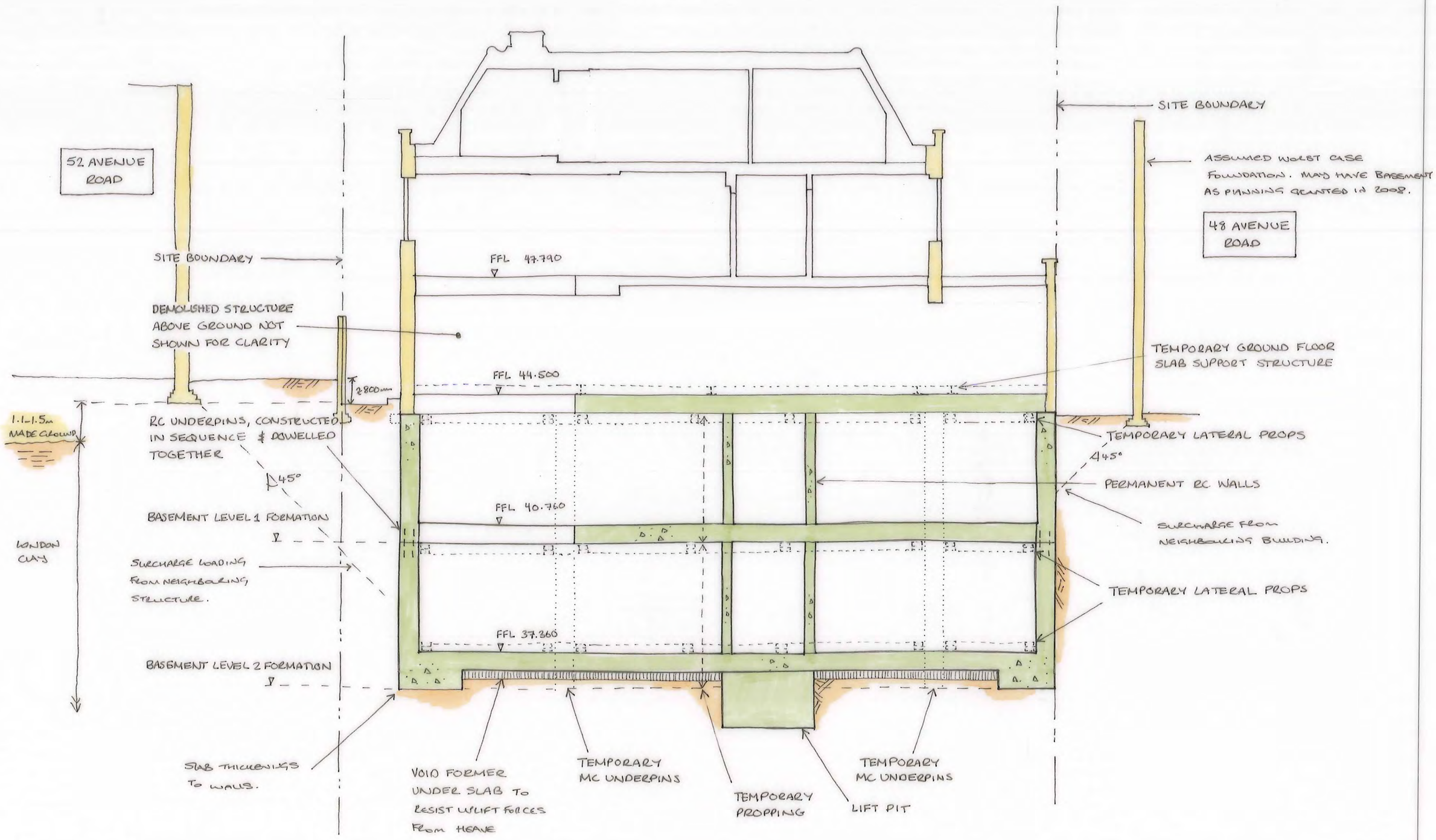
drawing status
PRELIMINARY

elliottwood

Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD

job no	drawing no	revision
213136	S.03	P1



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

Do not scale from this drawing.

DRAWING TO BE READ IN CONJUNCTION WITH PLAN & SECTION SEQUENCE OF WORKS DRAWINGS

rev	date	by	chk	description

drawing title
PROPOSED SECTION A-A

scale(s)	date	drawn
1:100@A3	MAY '14	MO

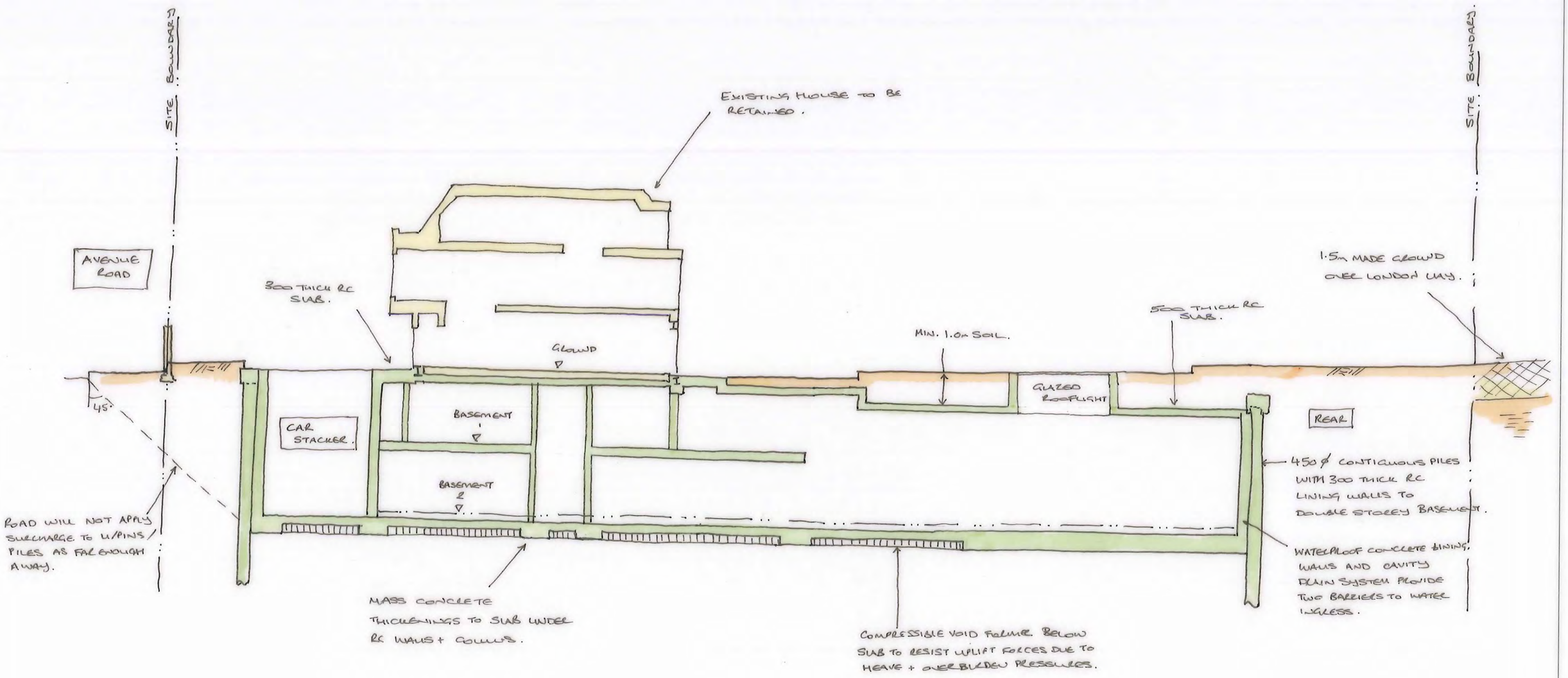
drawing status
PRELIMINARY

elliottwood
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD
LONDON
NW8 6HS

job no	drawing no	revision
213136	S.10	P1

ALL UNDERPINS + WALLS TO BE FULLY PROPPED DURING CONSTRUCTION UNTIL SLABS HAVE BEEN CAST + CURED.



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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED LONG SECTION B-B

scale(s)	date	drawn
1:200@A3	04.06.14	SW.

drawing status
PRELIMINARY.

elliottwood

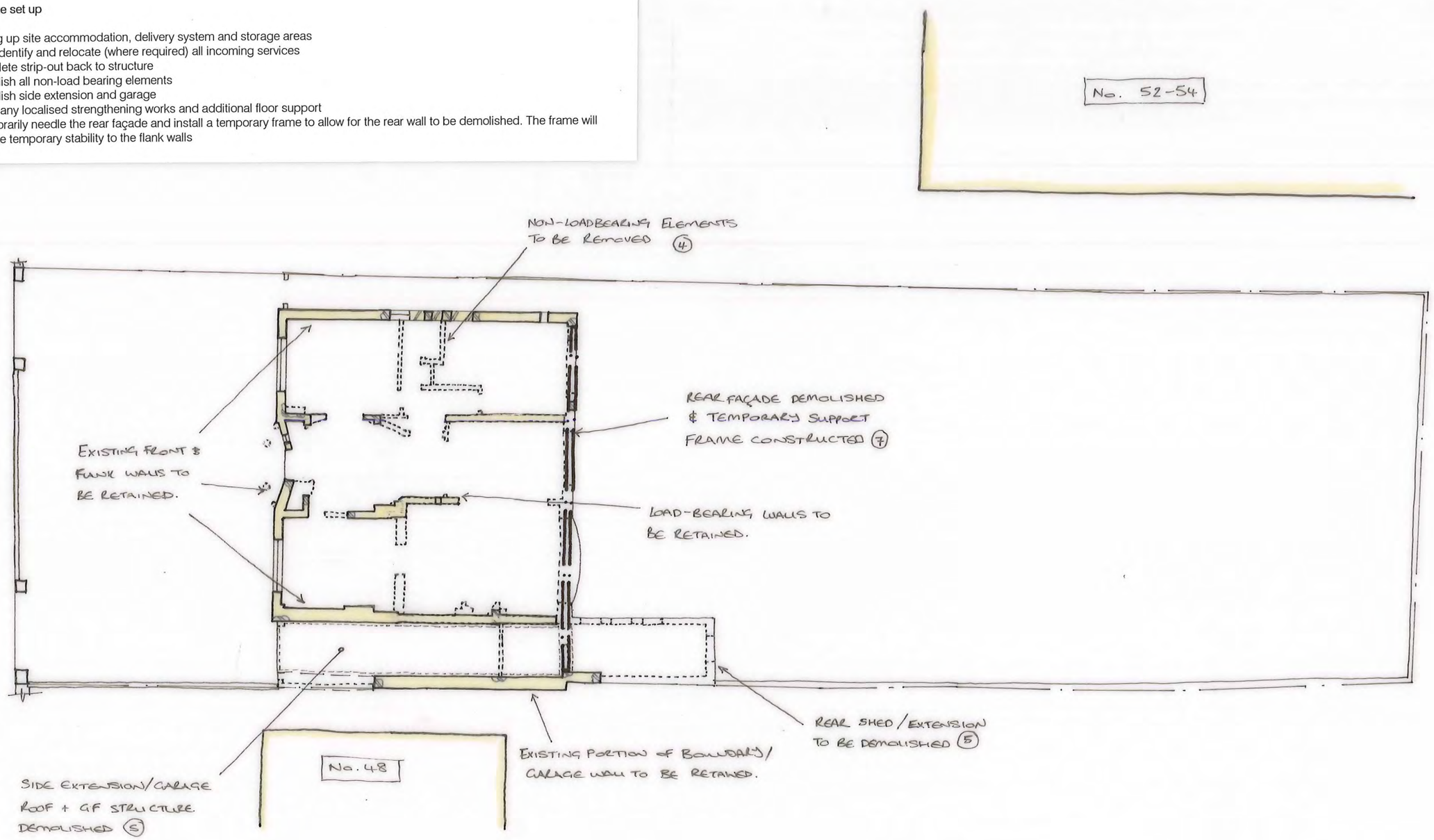
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD, NW8 6HS

job no	drawing no	revision
213136	S.11	P1

Stage 1 – Site set up

1. Setting up site accommodation, delivery system and storage areas
2. Find, identify and relocate (where required) all incoming services
3. Complete strip-out back to structure
4. Demolish all non-load bearing elements
5. Demolish side extension and garage
6. Install any localised strengthening works and additional floor support
7. Temporarily needle the rear façade and install a temporary frame to allow for the rear wall to be demolished. The frame will provide temporary stability to the flank walls



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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED SEQUENCE OF WORKS - PLANS (1)

scale(s) 1:200@A3 | date APR '14 | drawn MR

drawing status
PRELIMINARY

elliottwood

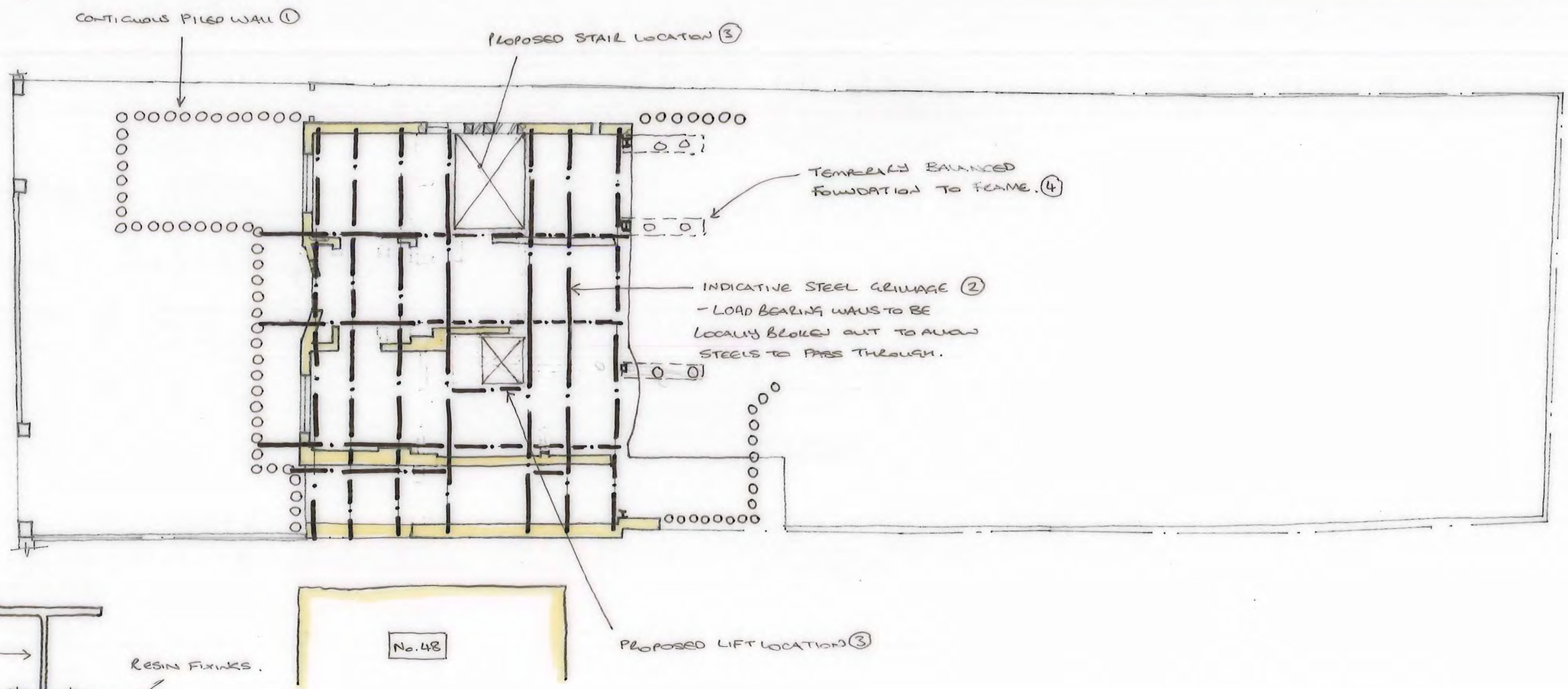
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

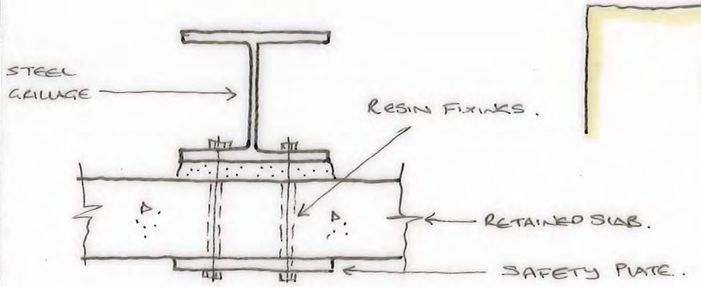
job title
50 AVENUE ROAD LONDON NW8 6HS

job no	drawing no	revision
213136	S. 20	P1

Stage 2 – Contiguous piling and steel grillage installed

1. First install the contiguous piled wall to areas providing access for the basement works i.e. front of the house and adjacent to the property at the rear. Then complete the contiguous piled wall around the perimeter of the rear garden basement and sacrifial piles needed to temporarily support the rear frame. Access for the piling rig will be via a side access either side of the house. A limited width rig will be used.
2. In order to retain the existing ground floor slab a steel grillage will be installed as temporary support directly above the existing slab. The grillage will be fixed to the slab using steel threaded rod and resin mortar.
3. Locally break out the slab in the stair and lift locations. This will provide access and ventilation for the basement excavation.
4. Install temporary support to the rear frame





TYPICAL GRILLAGE DETAIL

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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED SEQUENCE OF WORKS - PLANS (2)

scale(s) 1:200@A3 | date APR '14 | drawn MR

drawing status
PRELIMINARY

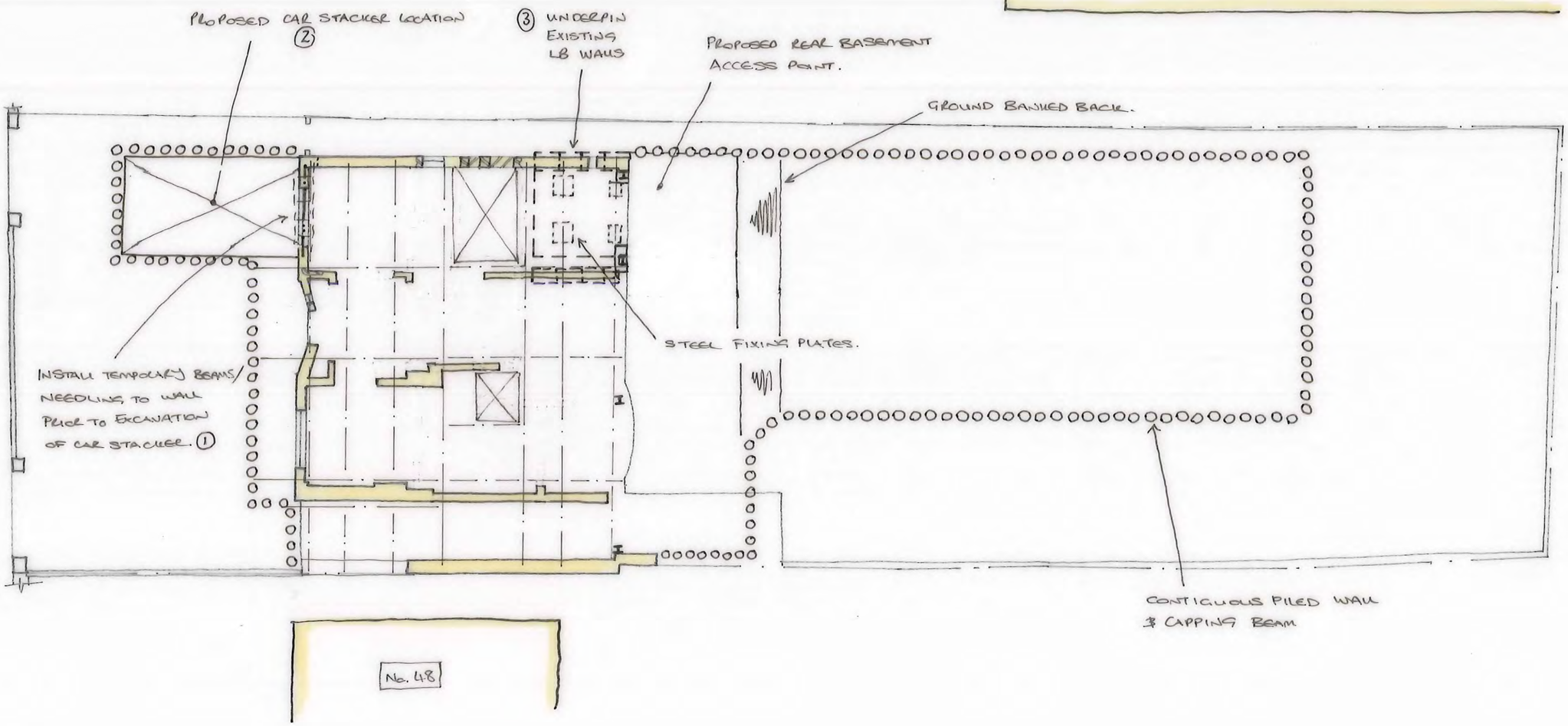
elliottwood
Elliott Wood Partnership LLP. 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD LONDON NW8 6HS

job no	drawing no	revision
213136	S.21	P1

Stage 3 – First stage underpinning

1. Install temporary needles under the front wall adjacent to the proposed car stacker and install new beam.
2. Locally excavate in the car stacker location and at the rear of the house to provide access to the underpinning works. Install lateral propping to the piles as required.
3. Complete first stage sequential underpinning works from the rear of the property and car stacker tunnelling through. Underpinning is to be completed sequentially one pin at a time to basement level 1 formation level. Fix steel plates to the projecting steel threaded rods as the excavation under the existing ground floor slab progress. The rods can then be trimmed and covered with safety caps.



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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title: PROPOSED SEQUENCE OF WORKS - PLANS (3)

scale(s)	date	drawn
1:200@A3	APR '14	MR

drawing status: PRELIMINARY

elliottwood

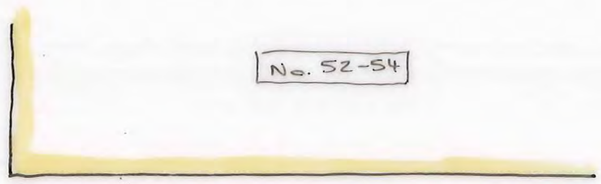
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

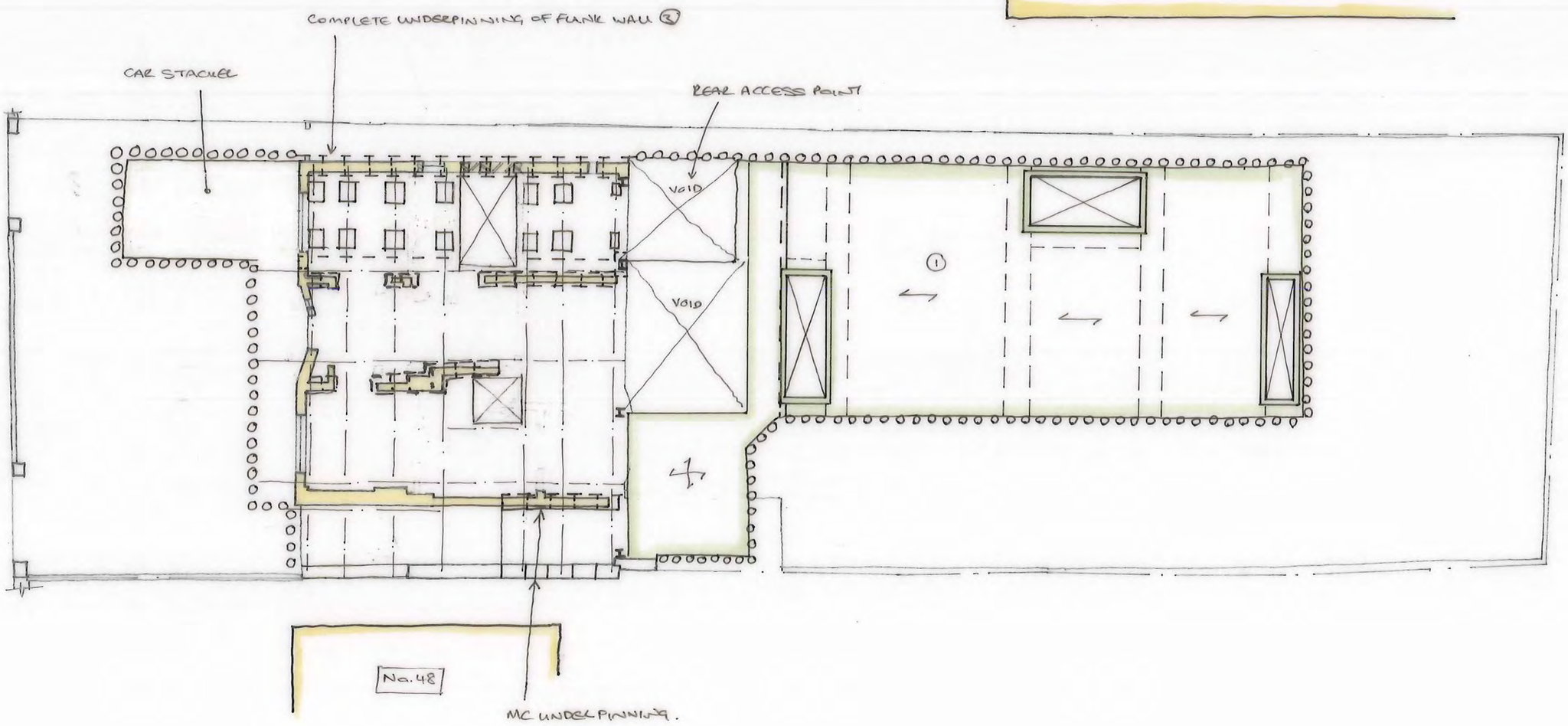
job title: 50 AVENUE ROAD LONDON NW8 6HS

job no	drawing no	revision
213136	S.22	P1

Stage 4 – Underpinning and cast basement roof slab

1. Excavate the rear garden to formation level of the basement roof slab. Tie the reinforcement and cast the roof slab and associated beams leaving voids in the slab for lightwells.
2. Start underpinning beneath the boundary wall with No. 48 and flank wall of house in sequential underpins. Install steel plates to underside of slab as excavation progress.
3. Underpin remaining internal walls once excavation reaches these walls
4. Underpin existing front wall.





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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED SEQUENCE OF WORKS - PLANS (4)

scale(s) 1:200@A3 | date APR '14 | drawn MR

drawing status
PRELIMINARY

elliottwood

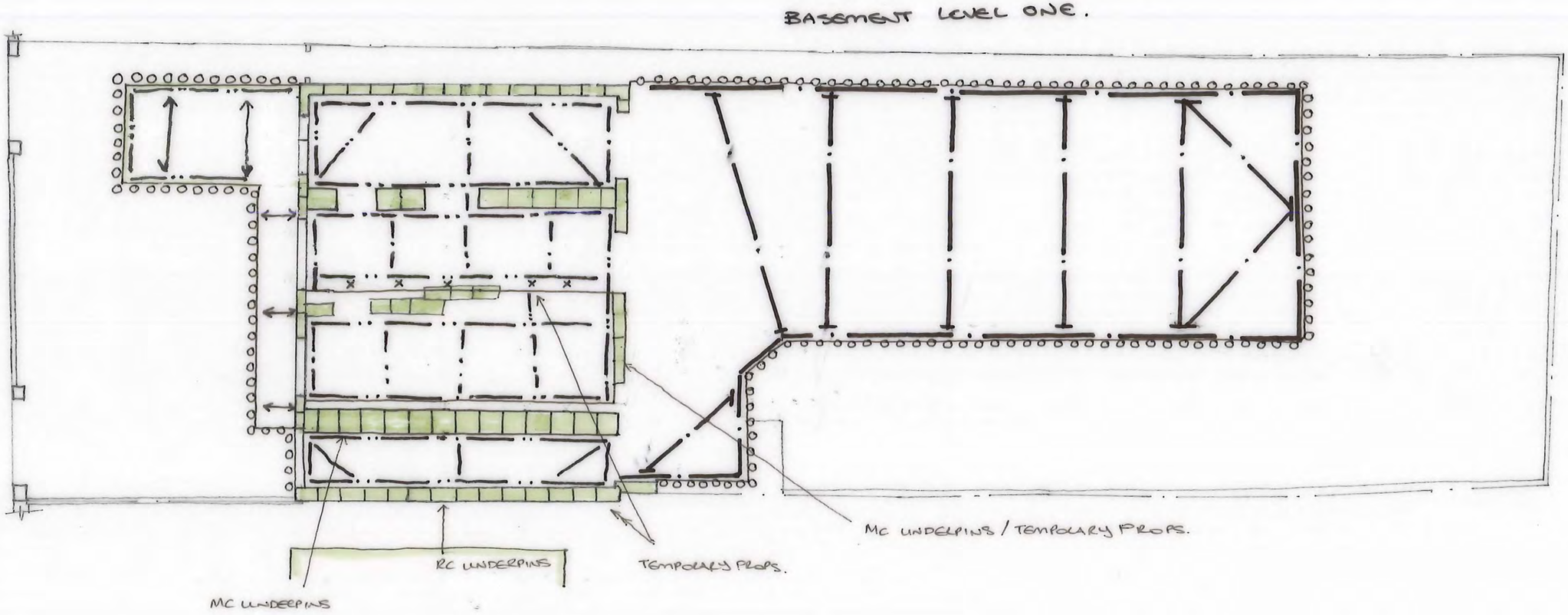
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD
LONDON NW8 6HS

job no	drawing no	revision
213136	S.23	P1

Stage 5 – Reduced level dig to basement level 1

1. Excavate the rear garden basement down to formation level 1. Install temporary lateral propping to support the contiguous piled wall
2. At the end of stage 5 all underpinning works and lateral propping to both piled walls and underpins will be complete and installed.



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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED SEQUENCE OF WORKS - PLANS (5)

scale(s)	date	drawn
1:200@A3	APR '14	MR

drawing status
PRELIMINARY

elliottwood

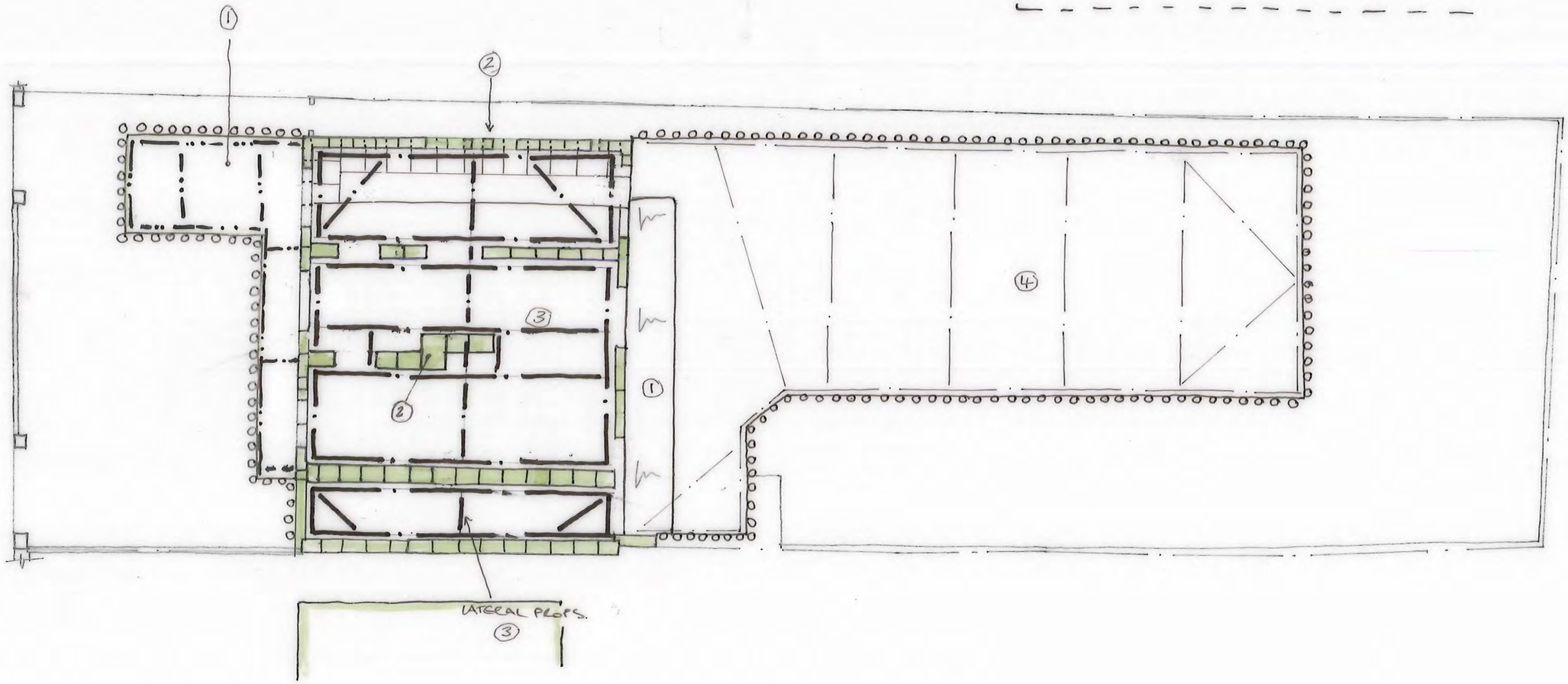
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD
LONDON NW8 6HS

job no	drawing no	revision
213136	S.24	P1

Stage 6 – Second stage underpinning

1. Complete excavation to the car stacker and rear access points down to basement level 2 installing temporary propping as required. This will allow access for the second stage underpinning.
2. Start stage two underpinning down to basement level 2. Underpinning will progress in a sequential manner starting from the rear access points and the car stacker.
3. Install lateral props at an appropriate level to allow unimpeded installation of basement level 1 floor later in the sequence.



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

Do not scale from this drawing.

rev	date	by	chk	description

drawing title
PROPOSED SEQUENCE OF WORKS - PLANS (6)

scale(s) 1:200@A3 | date APR '14 | drawn MR

drawing status
PRELIMINARY

elliottwood

Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0066 info@elliottwood.co.uk

job title
50 AVENUE ROAD
LONDON NW8 6HS

job no	drawing no	revision
213136	S. 25	P1