

WE ARE SYMMETRYS

BASEMENT IMPACT ASSESSMENT

THE CORNERWAYS, MUSWELL HILL
LONDON, N10 3DD

22120-SYM-XX-XX-RP-S-0001



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P1	Draft	19/01/2023	EW/SR	AB
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1.0 Introduction

- 1.1 Symmetrys Limited have been engaged by Wolff Architects to carry out a Basement Impact Assessment for the proposed three-storey dwelling with single storey basement at The Cornerways, Muswell Hill, London.
- 1.2 Symmetrys drawings and this report form part of the Architect's planning application. These documents are not intended for, and should not be relied upon by any third party for any other purpose. Symmetrys drawings are based on the existing and proposed drawings provided by Wolff Architects.
- 1.3 Symmetrys Limited have carried out a preliminary design of the proposed basement. The resulting structural drawings can be found in Appendix A.

2.0 Authors

- 2.1 The Basement Impact Assessment has been authored by Ethan Watkins Meng (Hons), Structural Engineer at Symmetrys.
- 2.2 The report has been reviewed by Anna Beckett (CEng MStructE), Associate Director at Symmetrys.
- 2.3 The SuDs strategy was authored by Stefany Rojas (BEng) Civil Engineer at Symmetrys, and reviewed by Rachel Field (MSc BEng) Associate at Symmetrys.

3.0 Sources of Information

- 3.1 The following reference documents have been used as guidance in compiling this report;
- "Local requirements for information to be submitted with planning applications", Haringey, July 2021;
 - Development management DPD, including Policy DM18, Haringey, July 2017;
 - Haringey Council Strategic Floor Risk Assessment, February 2015;
 - British Geological Survey (BGS) Geology of Britain Viewer;
 - WW2 Bomb Census Bomb Site Map;
 - Rail Map Online Historic Railway, Railroad & Canals Map;
 - The Lost Rivers of London (Barton, N.L, 1982);
 - Guidelines of safe and efficient basement construction directly under or near to existing structures, Association of Specialist Underpinning Contractors (ASUC), 2013.

4.0 Existing Site

- 4.1 The site is located on the junction between Cranley Gardens and Ellington Road in the London Borough of Haringey.
- 4.2 The site is currently occupied by a two-storey 1930s detached property in its northern part and garden and storage/parking in its southern part.
- 4.3 There is one neighbouring building located to the West of the proposed development, No. 12 Cranley Gardens, which comprises a two-storey residential property.



Figure 1 – Site Location Plan (Google Maps)

5.0 Desktop Study

- 5.1 Ground Conditions
- 5.1.1 According to the British Geological Survey (BGS) 'Geology of Britain' digital map, the site is located directly over the London Clay Formation.
- 5.1.2 Historical site investigation information available on the British Geological Survey website shows a number of investigations have been undertaken within the vicinity of the site. Borehole logs from a selection of these reports, including TQ28NE200 approximately 500m West and TQ28NE261 approximately 400m North East, indicate made ground overlying soils interpreted as the London Clay Formation.
- 5.2 Bomb Damage
- 5.2.1 According to the WW2 Bomb Census Bomb Site Map (figure 2), there are records of explosive bombs in the vicinity of The Cornerways, thus caution must be exercised during the ground works.

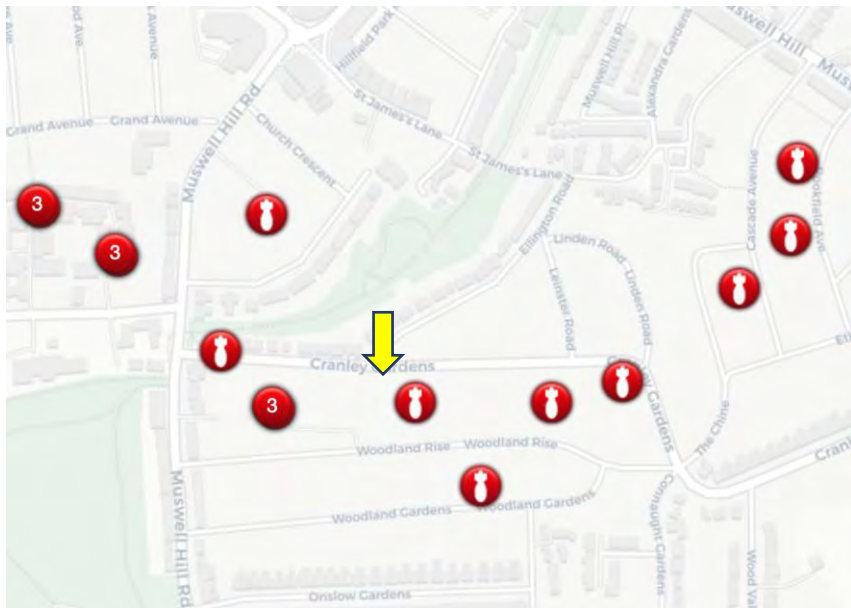


Figure 2 – WW2 Bomb Census Bomb Sight Map

5.3 Hydrology and Flood Risk

- 5.3.1 The Cranfield Soil and AgriFood Institute (CSAI), incorporating the National Soil Resources Institute (NSRI,) at Cranfield University maintains soil reports and maps for England and Wales. The Soilsapes dataset map, shown in Figure 4, indicates that soils in the area are 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils'. These soils are identified as having 'impeded' drainage which means that soils have a tight, compact deep subsoil that impedes downward water movement; after heavy rainfall, particularly during the winter, the subsoil becomes waterlogged.

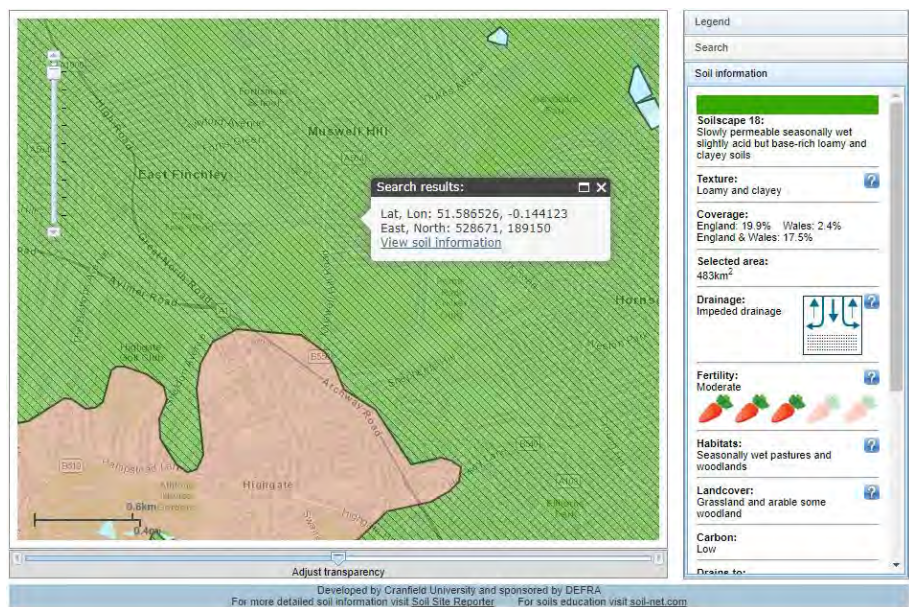


Figure 3 – Soilsapes Map (Cranfield University, 2022)

- 5.3.2 The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. In Flood Zone 1 ("Low Probability"), there is a less than 1 in 1000 chance of river and sea flooding occurring each year. A copy of the EA flood map is reproduced in Figure 4, below.

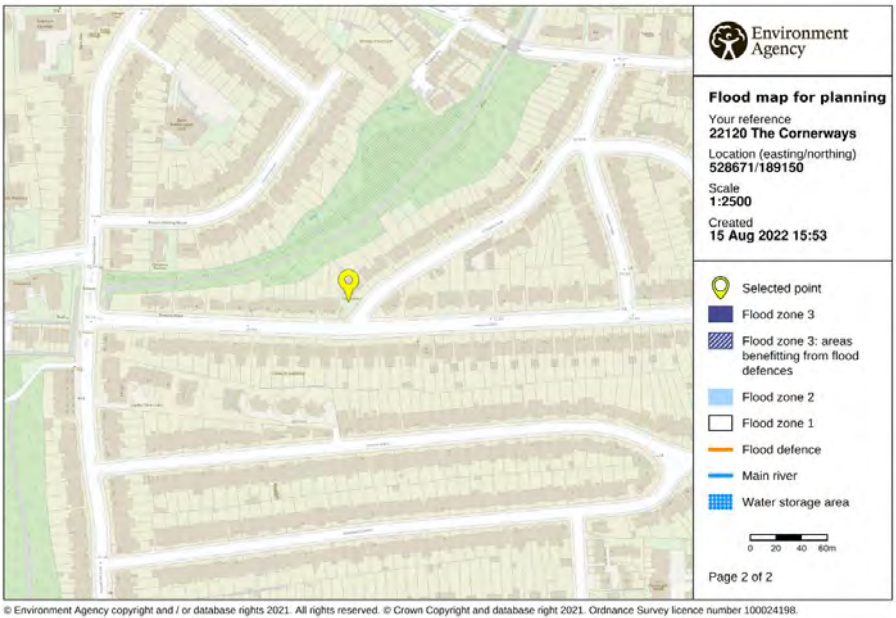


Figure 4 – Environment Agency Flood Map for Planning (EA, 2022)

- 5.3.3 Haringey Council's Strategic Flood Risk Assessment (JBA Consulting, 2015) contains 'Figure 6-8 National Reservoir Inundation Maps' showing that the site is not within the vicinity of a Main River.
- 5.3.4 Based on Haringey Council's Local Flood Risk Management Strategy (LFRMS) *Increase Potential for Elevated Groundwater* map, the site is not at a greater risk of groundwater flooding.
- 5.3.5 The site lies within a Critical Drainage Area as defined by Haringey Council, therefore, flooding from sewers should be carefully considered.
- 5.3.6 Haringey Council's Strategic Flood Risk Assessment (JBA Consulting, 2015) shows the site is not within an area of reservoir flooding.
- 5.3.7 Due to the complex nature of flooding within Critical Drainage Areas, further assessment of flooding should be considered as design progresses.
- 5.4 Overground and Underground Railway Infrastructure
- 5.4.1 Figure 5 shows the location of the proposed development relative to historic and existing railway network routes. The closest railway infrastructure is the disused Alexandra Palace branch of the Northern line, which is located approximately 70m North West of the site.
- 5.4.2 The proposed development is unlikely to have any impact to existing overground or underground network rail systems.

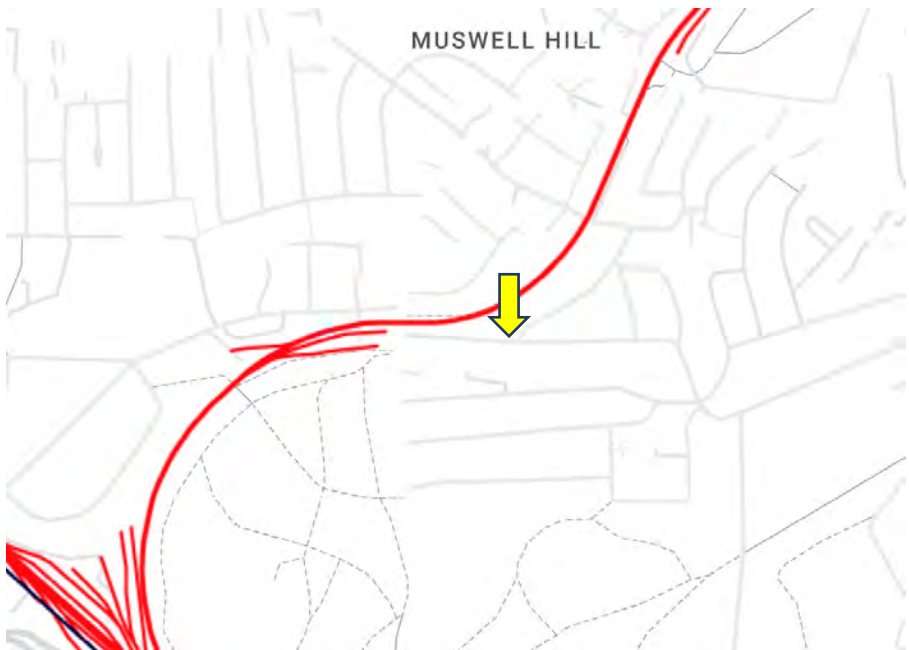


Figure 5 – Historic and Existing Rail Networks London

- 5.5Underground utilities
- 5.5.1CAT scanning, safe digging practises (as contained in HSE publications), and other appropriate investigative techniques should be carried out during construction works.

6.0Ground Investigation

- 6.1A site-specific ground investigation has been undertaken by specialist geotechnical engineers MiniSoils Ltd. Their geotechnical report is provided in appendix C.
- 6.2The site investigation included excavation of one borehole to a maximum depth of 6.0m bgl.
- 6.3The ground condition findings from the borehole investigation are summarised in Table 1 below.

Table 1: Ground conditions

Borehole	Depth	Description
Borehole (BH01)	GL to 0.30m	MADE GROUND comprising 30mm of tarmac on 150mm concrete slab on soft brown clay with occasional gravel of flint and brick fragments.
	0.30m to 1.5m	Soft brown CLAY.
	1.5m to 3.0m	Firm brown CLAY.
	3.0m to 6.0m	Stiff brown CLAY.

- 6.4Groundwater was not encountered during the ground investigation works. However, the appointed contractor should allow for dewatering measures should perched water be encountered during excavation and construction.

7.0Design Proposal

- 7.1The proposed basement will be formed using a contiguous pile wall at the perimeter and a 300mm thick reinforced concrete suspended slab at basement level. Due to the sloping nature of the site, the pile walls will span double-storey from basement to first floor at the North of the building, and single-storey from basement to ground floor to the East and West. The basement walls will be propped in the permanent case by reinforced concrete floors slabs at ground and first floor levels.
- 7.2The basement garden will be enclosed by a contiguous pile wall along Ellington Road, and a reinforced concrete cantilever retaining wall along the boundary of No. 12 Cranley Gardens. The cantilever wall will be constructed in a hit and miss sequence in maximum lengths of 1.0m, and will be propped by a contiguous pile wall at its base. The contiguous pile wall along Ellington Road, which will be un-propped at the top, will cantilever a single-storey from basement to ground floor level and will be subject to a surcharge load from the adjacent highway.
- 7.3All new retaining structure shall have adequate strength to resist anticipated lateral soil forces, water pressures and surcharge loading.

8.0Temporary Works

- 8.1The proposed temporary works sequence for the basement is provided in Appendix A.
- 8.2The proposed methodology is for design development purposes only and for the purposes of this planning application. The appointed contractor will be responsible for all temporary supports and for the stability of the structure during the works.
- 8.3To ensure that the retained engineer’s intent is correctly interpreted by the contractor, they will be required to submit all temporary works proposals for review a minimum of 7 working days prior to commencing works. The contractor should also submit a dewatering strategy to ensure a strategy is agreed should water be encountered.

9.0Construction Method Statement

- 9.1A preliminary sequence of works is provided within the structural drawings in Appendix A (to be confirmed by the contractor).

10.0Ground Stability and Stability of Neighbouring Structures

- 10.1Due to the robust engineering principles and construction methods applied, the extent of movement is limited in accordance with British and European codes. We can confirm that the proposed structural design and method of construction of the basement have been developed with a view to ensuring structural safety and that if constructed in accordance with this document, the works will be able to be completed without any adverse impact on the structural stability of the neighbouring properties, other adjacent structure, adjoining land and gardens or the adjoining Public Highway.
- 10.2The reinforced concrete structure will be designed to accommodate surcharges from the neighbouring properties, Public Highway and ground pressures. The structure will have adequate stiffness to ensure that the lateral deflections do not exceed the appropriate limits recommended by British Standards Codes of Practice in order to ensure that potential ground movements be kept to acceptable limits. Appointed contractors will also be advised to carry out movement monitoring as part of the basement construction.
- 10.3The structure will be designed to withstand any uplift due to hydrostatic pressures as well as being designed to transfer vertical loads into the ground safely.

11.0Drainage and SuDS

- 11.1The Outline Drainage Strategy sketches are appended to Appendix D. The outline drainage strategy assumes there is no existing connections to the public foul and surface water sewers.
- 11.2The drainage strategy is subject to findings of a CCTV drainage survey.

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| 11.3 | National and Local Policy Guidance |
| 11.3.1 | <p>This drainage strategy is prepared to demonstrate compliance with the regional and local planning policy (NPPF), Planning Policy Guidance (PPG) and other statutory requirements as far as reasonably practical. In addition, the following documents have been consulted:</p> <ul style="list-style-type: none"> • National Planning Policy Framework (August 2022) • The London Plan (2021) • Haringey's Local Plan • Haringey Council's Strategic Flood Risk Assessment (JBA Consulting, 2015) |
| 11.3.2 | <p>As of May 2022, the applicable climate change allowance is defined by specific Management Catchment for the 1 in 30 ($\geq 3.3\%$ AEP) and 1 in 100 (< 3.3 to 1% AEP) year event. As the proposed development will be used within a residential capacity, the lifespan of the development and requirements for climate change should allow up to the 2070s scenario for the 1% annual exceedance rainfall event. The Site lies within the London Management Catchment and therefore the 40% climate change allowances is applicable.</p> |
| 11.3.3 | <p>The Development Management DPD Policy DM25 Sustainable Drainage Systems states:</p> <p><i>A All proposals for new development must seek to manage surface water as close to its source as possible in line with the London Plan drainage hierarchy.</i></p> <p><i>B The Council will require Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design, having regard to the following requirements:</i></p> <p><i>a All major development proposals will be required to reduce surface water flows to a greenfield run-off rate for a 1 in 100 year critical storm event;</i></p> <p><i>b All minor development proposals should aim to achieve a greenfield run-off rate and, at a minimum, achieve a 50 per cent reduction on existing site run-off rates;</i></p> <p><i>c All other development should seek to achieve a greenfield run-off rate and include at least one 'at source' SuDS measure resulting in a net improvement in water quantity or quality discharging to a sewer; and</i></p> <p><i>d For all development where a greenfield runoff rate cannot be achieved justification must be provided to demonstrate that the run-off rate has been reduced as much as possible.</i></p> <p><i>C Where Sustainable Drainage Systems are implemented they will be expected to:</i></p> <p><i>a Meet the requirements set out in the Council's relevant local standards and guidance, or national standards where agreed;</i></p> <p><i>b Incorporate measures identified in the Surface Water Management Plan;</i></p> <p><i>c Be designed to maximise biodiversity and local amenity benefits, and where appropriate, ensure that SuDS techniques provide for clean and safe water at the surface;</i></p> <p><i>d Improve water quality; and</i></p> <p><i>e Function effectively over the lifespan of the development.</i></p> <p><i>D Where SuDS cannot be implemented due to site constraints (such as land contamination or space limitations) robust justification must be provided along with proposed alternative sustainable approaches to surface water management.</i></p> |
| 11.3.4 | <p>The Development Management DPD Policy DM26 Managing and Reducing Flood Risk states:</p> <p><i>A All proposals for new development within a Critical Drainage Area (CDA) will be required to incorporate measures to reduce the overall level of flood risk in the CDA.</i></p> |

B Proposals for new development within Local Flood Risk Zones must include a statement describing how flood risk issues have been addressed. The Council may require a further site-specific Flood Risk Assessment to assess risk, particularly from surface water flooding.

- | | |
|--------|---|
| 11.4 | Greenfield Runoff Rates |
| 11.4.1 | The pre-development greenfield runoff rate for Site was estimated using the UK SUDS online tool. The full report is contained in Appendix F and summarised below: |

Table 2: Greenfield Runoff Rates

Pre-Development	Rainfall Events			
	Q1	QBAR	Q30	Q100
Greenfield Runoff Rates (l/s)	0.39	0.46	1.06	1.47

- | | |
|--------|---|
| 11.5 | Existing Surface Water Flow Rates |
| 11.5.1 | Existing flow rates have been calculated following The Modified Rational Method as developed by The Wallingford Procedure, using the formula below: |

$$Q_p = 2.78 \text{ C} \times i \times A$$

Qp – Design event peak rate of runoff (l/s) ; A – Contributing catchment area (ha); i – average rainfall intensity during the time of concentration (mm/hr) ; C – Non-dimensional runoff coefficient which is dependent on the catchment characteristics

- 11.5.2 Intensities have been calculated in accordance with the Wallingford Procedure based on the following site-specific values:

$$M5-60 \text{ (mm)} = 21.00$$

Ratio $R = 0.44$

- 11.5.3 The average rainfall intensities were obtained from MicroDrainage and are summarised in Table 3, below.

Table 3: Average Rainfall Intensities

Average Rainfall Intensity (mm/hr)			
Storm duration	Q1	Q30	Q100
15 min	33.632	82.613	107.525
1 hour	13.524	32.372	42.578
6 hours	3.671	8.081	10.474

- 11.5.4 For the total site area of 0.0168 ha, the following flowrates have been calculated:

Table 4: Existing Surface Water Flow Rates

Existing Flowrate (l/s)			
Storm duration	Q1	Q30	Q100
15 min	1.57	3.86	5.02
1 hour	0.63	1.51	1.99
6 hours	0.17	0.38	0.49

11.6 SuDS Hierarchy

11.6.1 A SuDS Assessment has been carried out using the guidance set out in The London Plan (2021) published by Greater London Authority and The SuDS Manual (2015) published by CIRIA. SuDS techniques were assessed as possible surface water disposal methods and priority was given to SuDS which provide multi-functional benefits in line with the drainage hierarchy. Table 5, below, presents the drainage hierarchy taken from Policy SI 13 Sustainable drainage of The London Plan. The feasibility of incorporating different SuDS into the development proposals is outlined.

Table 5: SuDS Hierarchy Assessment

Method	Feasibility	Explanation
Rainwater as a resource (e.g., rainwater harvesting)	✓	Runoff can be collected from roofs and other impermeable areas, stored, treated (where required) and then used as a supply of water.
Rainwater infiltration to ground at or close to the source	✗/✓	In accordance with the Haringey SFRA, Figure 5-7 <i>Runoff Zones informed by Bedrock Geology and Superficial Deposits</i> (Reproduced in Appendix J) classifies the site area as Runoff Zone 1. Zone 1 are areas where the bedrock is of 'London Clay' and there are no superficial deposits. These are areas of poor infiltration and high runoff. Haringey Council's SWMP <i>Infiltration SUDS Suitability Map</i> indicates this is potentially unsuitable. Site specific infiltration testing is recommended to assess feasibility,
Rainwater attenuation in green infrastructure for gradual release	✓	Runoff can be attenuated from roofs and other impermeable areas, stored, treated (where required) and then gradually released.
Rainwater discharge direct to a watercourse	✗	There is no watercourse in the close enough vicinity to the site to make discharge to a watercourse a feasible option.
Rainwater attenuation above ground (including blue/green roofs)	✓	Runoff can be attenuated from roofs and other impermeable areas, stored and then gradually released.
Rainwater attenuation below ground	✓	Runoff can be attenuated, stored and then gradually released.
Controlled rainwater discharge to a surface water sewer	✓	Runoff can be attenuated from roofs and other impermeable areas, stored, treated (where required) and then gradually released into the public surface water sewer.
Controlled rainwater discharge to a combined sewer	✗	There is no combined sewer within the vicinity of the site.

11.7 Surface Water Drainage and SuDS Strategy

11.8 Based on the SuDS feasibility assessment, the surface water strategy involves the use of green roofs, permeable paving, bioretention systems in the form of planters and below ground attenuation.

11.8.1 The surface water strategy is to match greenfield flow rates.

11.8.2 Surface water is to collect to a below ground attenuation tank; a permavoid sub-base (95% porosity) replacement attenuation system. The below ground attenuation tank is to connect to the outfall flow control chamber then discharge via gravity via a

new proposed connection to the Thames Water surface water sewer underneath Ellington Road, subject to Thames Water S106 approval.

11.8.3 The surface water system has been modelled in MicroDrainage and the maximum outflow achieved for the 1 in 100 year storm plus 40% climate change allowance is 0.9 l/s. The full MicroDrainage calculations are available in Appendix G.

11.8.4 The Pre-planning enquiry: Confirmation of sufficient capacity by Thames Water, contained in Appendix E, confirms capacity for the proposal.

11.9 Foul Drainage Strategy

11.9.1 Foul drainage points located in the lower ground floor are to be pumped to ground floor.

11.9.2 Foul drainage points located at ground floor and above are to flow to an access chamber and ultimately discharge via gravity to the Thames Water foul sewer underneath Ellington Road.

11.9.3 A new foul connection is proposed and subject to S106 approval.

11.9.4 The Pre-planning enquiry: Confirmation of sufficient capacity by Thames Water, contained in Appendix H, confirms capacity for the proposal.

12.0 Party Wall Matters

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

12.2 Monitoring

It is proposed that the structural stability of the adjacent properties is safeguarded by a system of movement monitoring. The Contractor shall monitor the position and movements of the elevations of the retained façade and adjacent properties around the perimeter of the proposed excavation. The monitoring shall be undertaken by a specialist survey company. The monitoring system will have at least the following characteristics:

- (1)

The retained façade and existing façades of the neighbouring properties as well as the flank wall of the neighbouring building will be monitored near ground level and at roof level, at intervals not exceeding 3m centres.
- (2)

Monitoring points (targets) shall be firmly attached, to allow 3D position measurement, for the duration of the work, to a continuous and uninterrupted accuracy of +/- 1mm. A suitable remote reference base/datum unaffected by the works will be adopted, one located at least 50m from the site.
- (3)

Points/targets shall be measured for 3D positioning on, at not less than the following intervals:

- (a)

Before any works commence (base reading).
- (b)

Weekly during the period of basement excavation/construction.
- (c)

Fortnightly until permanent structure is in place
- (d)

Monthly during the course of the remainder of the works.
- (e)

Six months after the completion of all construction works.

(4) All measurements shall be plotted graphically, to clearly indicate the fluctuation of movement with time. The survey company shall submit the monitoring results to the Engineer (Symmetrys Ltd) and to the Adjoining Owners Party Wall Surveyors/Engineer within 24 hour of measurement, graphically and numerically.

(5) The following trigger levels for movement are proposed for agreement. In the event of a trigger value being reached the Contractor will immediately stop any work that might cause further movement, assess the situation and propose alternative methods for proceeding, with definitive further movement limits for those later steps.

(6) Trigger movement limits are proposed as follows:

Existing Buildings: Horizontal/Vertical Movement	
Amber +/-5mm	All parties notified
Red +/-10mm	Works Reviewed

13.0

Sustainability

- 13.1
- As the basement construction will involve significant amounts of concrete, cement replacement alternatives should be considered. Cement replacements can used to replace up to 40% of the cement in concrete mix. These replacements are typically waste products from the energy production industry such as PFA (pulverised fuel ash) and GBFS (granulated blast furnace slag). By adopting them waste products from the energy production industry are recycled and not sent to landfill sites. Furthermore, this also reduces the amount of cement that needs to be mined. Concrete should be bought from a local supplier to further reduce the carbon footprint of transport.
- 13.2
- There is a significant amount of reinforced concrete on the project for which steel reinforcement bars will be required. By specifying reinforcement from a UK supplier, it ensures that the rebar is made from 100% recycled steel. Any structural steelwork should be sourced from a British manufacturer to ensure that rolled sections are made from at least 60% recycled steel. Sourcing the steel from a local supplier will further reduce the transport carbon footprint.

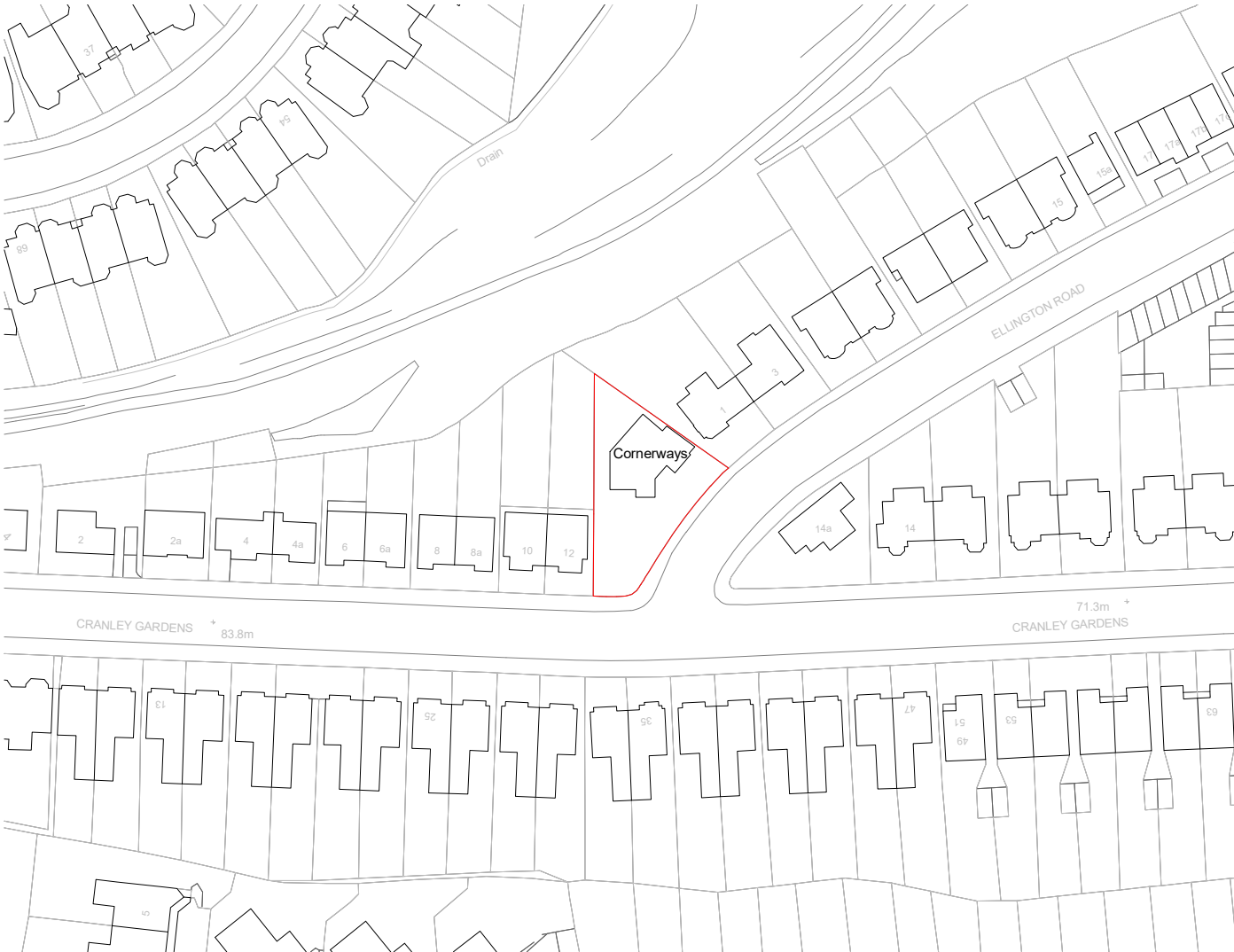
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Summary

- 14.1
- It is essential that a thorough review of all temporary works, contractors' method statements and calculations for these works is undertaken by a suitable qualified structural engineer prior to works starting. The permanent works will also be submitted to Building Control and the necessary Party Wall Surveyors for approval prior to the works commencing on site.
- 14.2
- The proposed basement has been designed with robust structural principles and methods of construction that are widely used and known. This will ensure the integrity of neighbouring structures and roadways are not compromised during its construction.

APPENDIX A

STAGE 2 DRAWINGS



P1	Planning Issue	25/01/23
Rev	Description	Date



WOLFF ARCHITECTS

16 lambton place
notting hill
london w11 2sh
t 02072293125
f 02072293257
e info@wolffarchitects.co.uk

status:

Planning

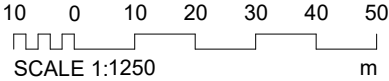
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Cornerways, Muswell Hill, N10
3DD, London

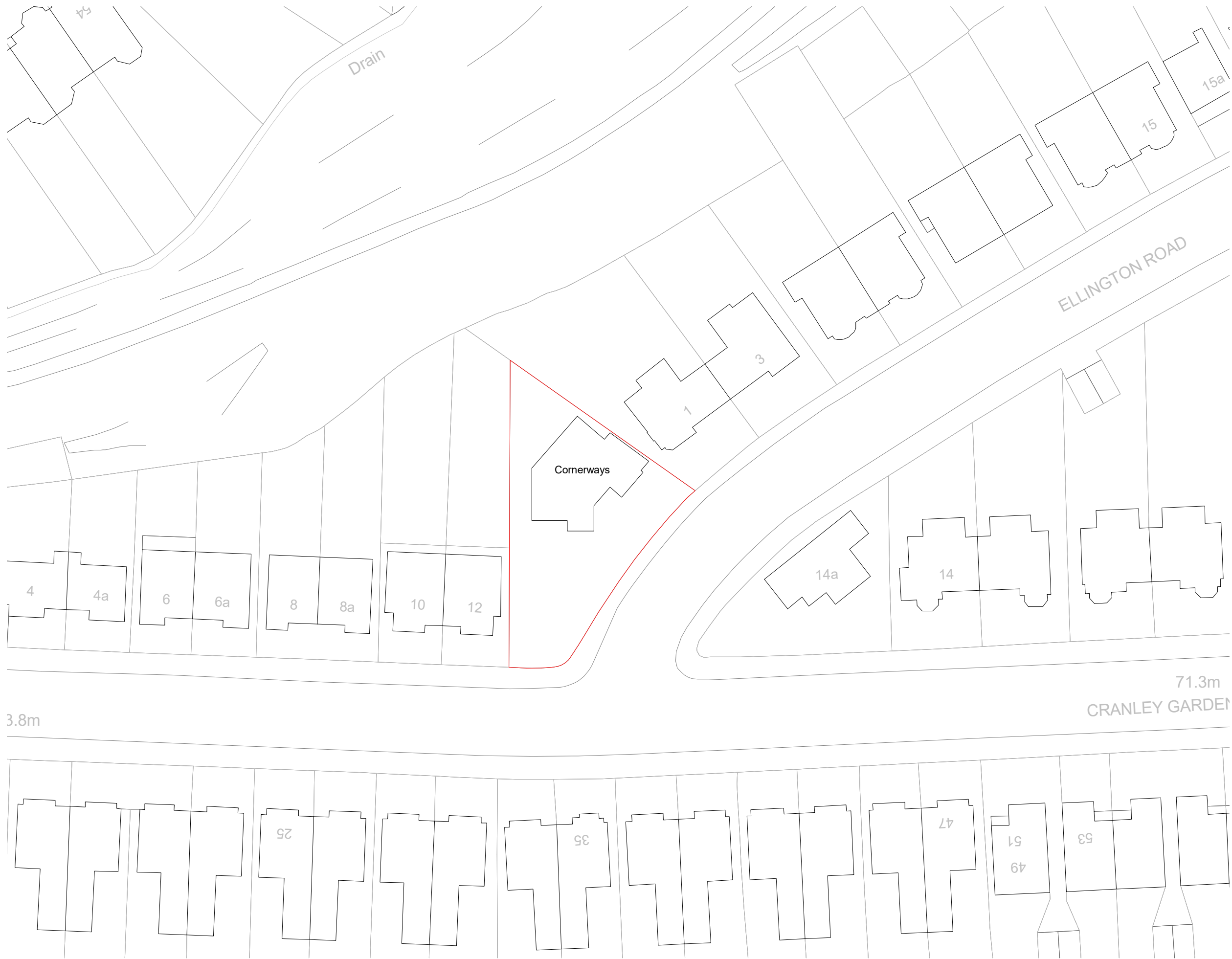
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date: 23/11/2022	scale: As indicated
dwg no: 2236-PL-0001	rev no: P1

site location plan

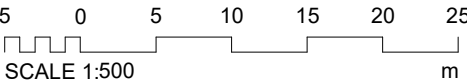
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block plan

1 : 500



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notting hill
london w11 2sh
t 02072293125
f 02072293257
e info@wolffarchitects.co.uk

status:

Planning

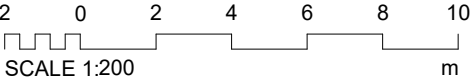
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Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Block Plan

date:	23/11/2022	scale:	As indicated
dwg no:	2236-PL-0002	rev no:	P1



existing site plan

1 : 200



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notting hill
london w11 2sh
t 02072293125
f 02072293257
e info@wolffarchitects.co.uk

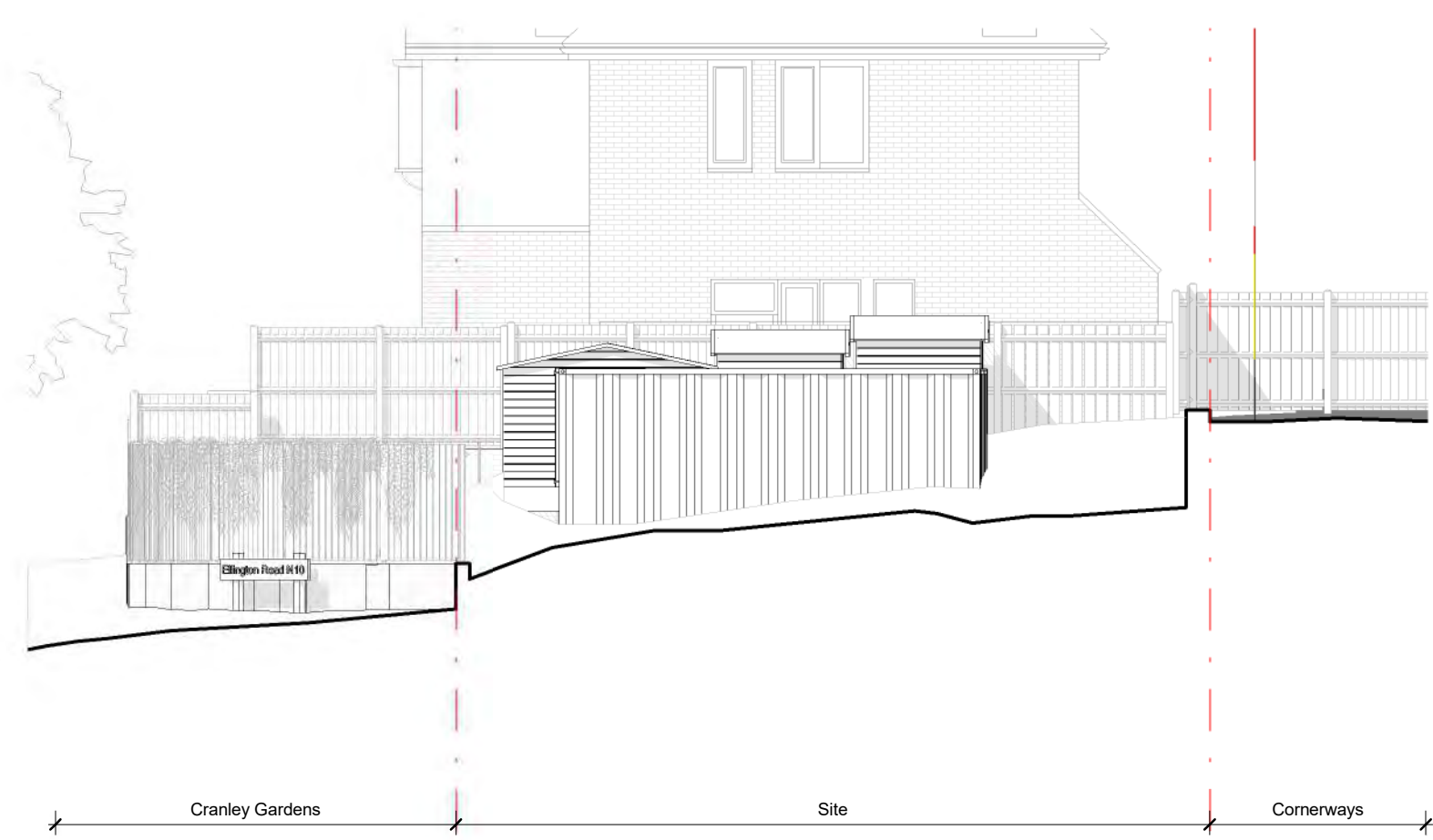
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Planning

project:	Cornerways Cornerways, Muswell Hill, N10 3DD, London
drawing title:	Existing Site Plan

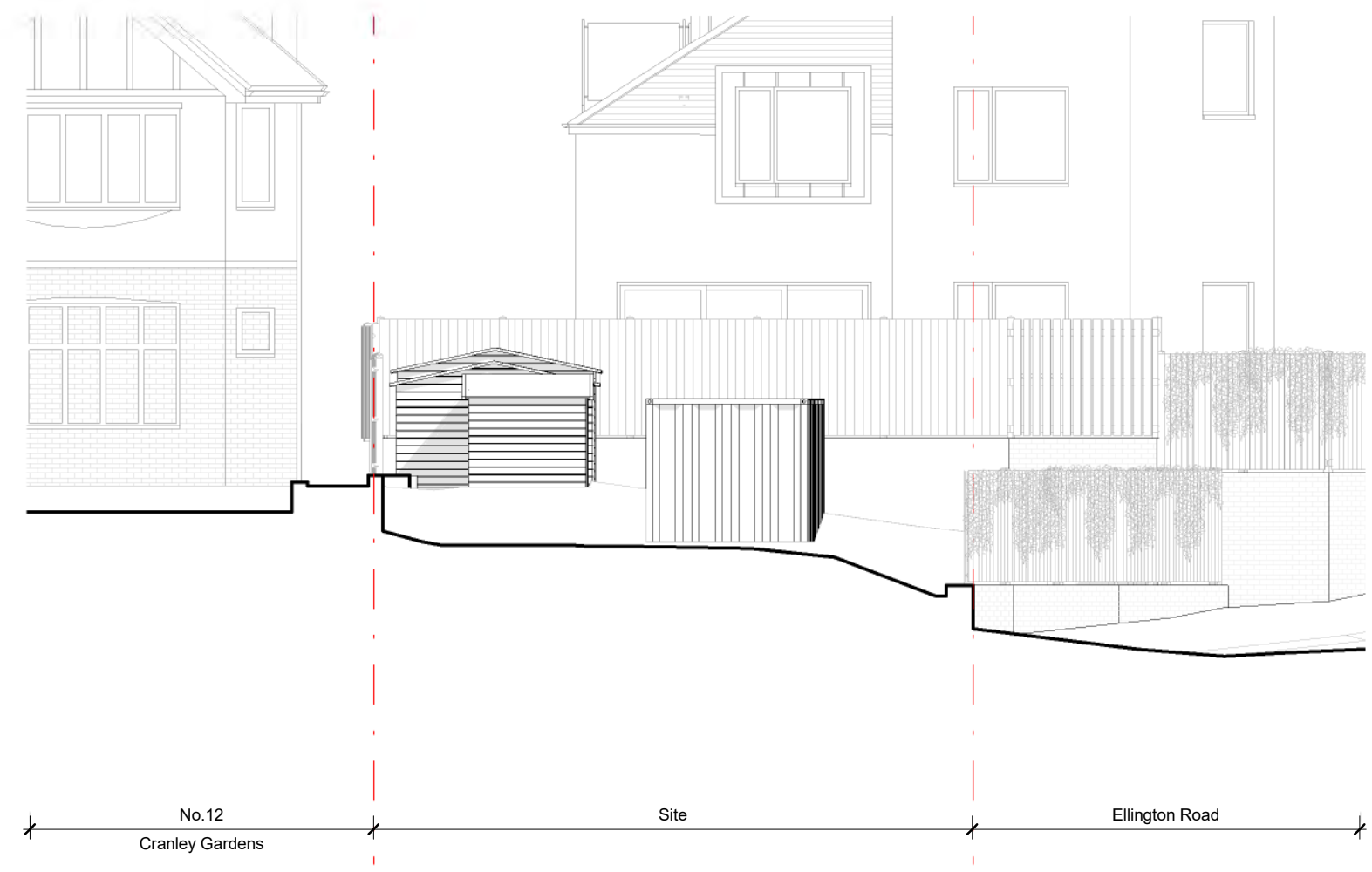
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existing eastern elevation

1 : 100



existing southern elevation

1 : 100



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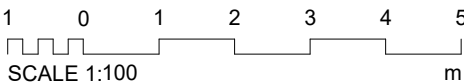
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project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

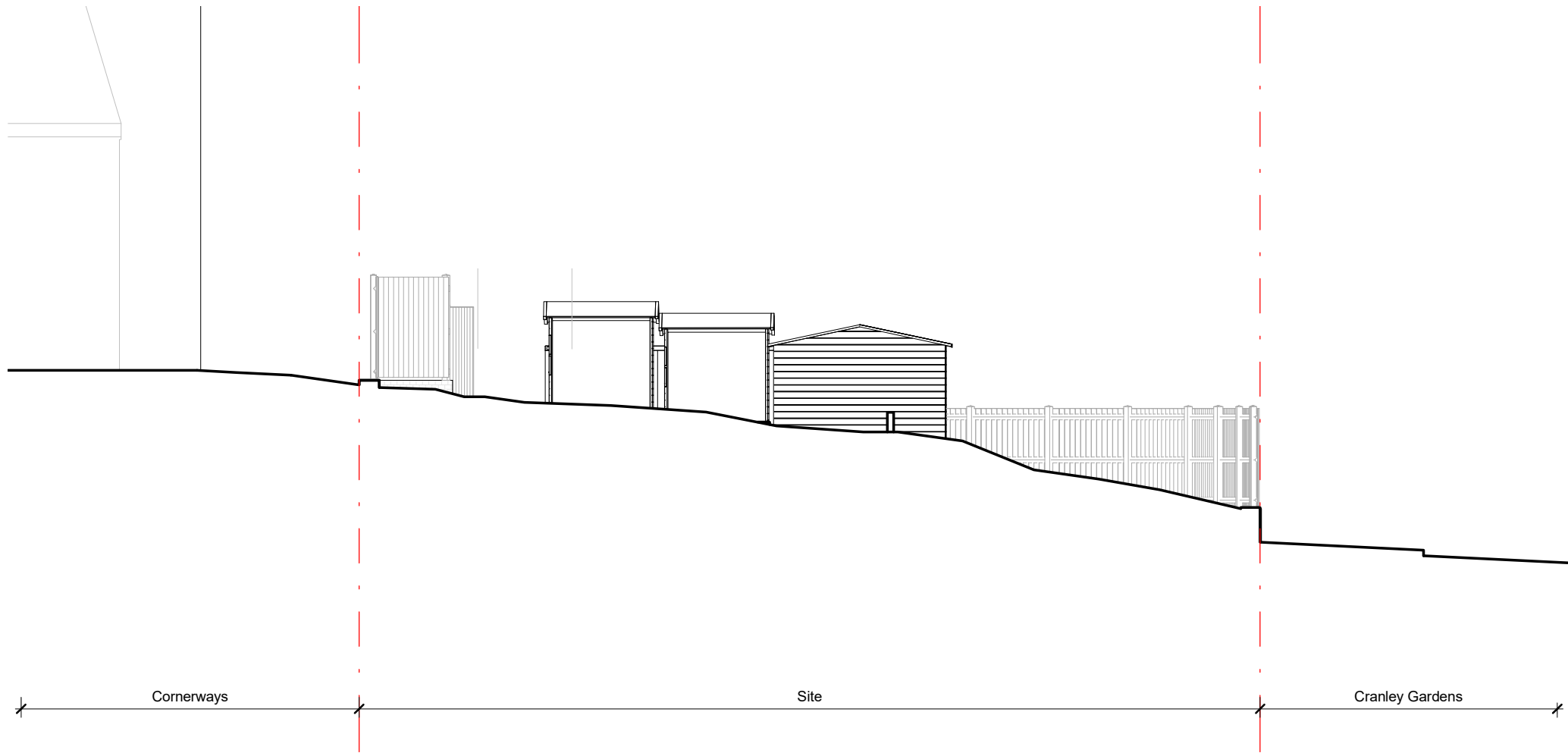
drawing title:
Existing Elevations

date: **23/11/2022** | scale: **As indicated**

dwg no: **2236-PL-0110** | rev no: **P1**

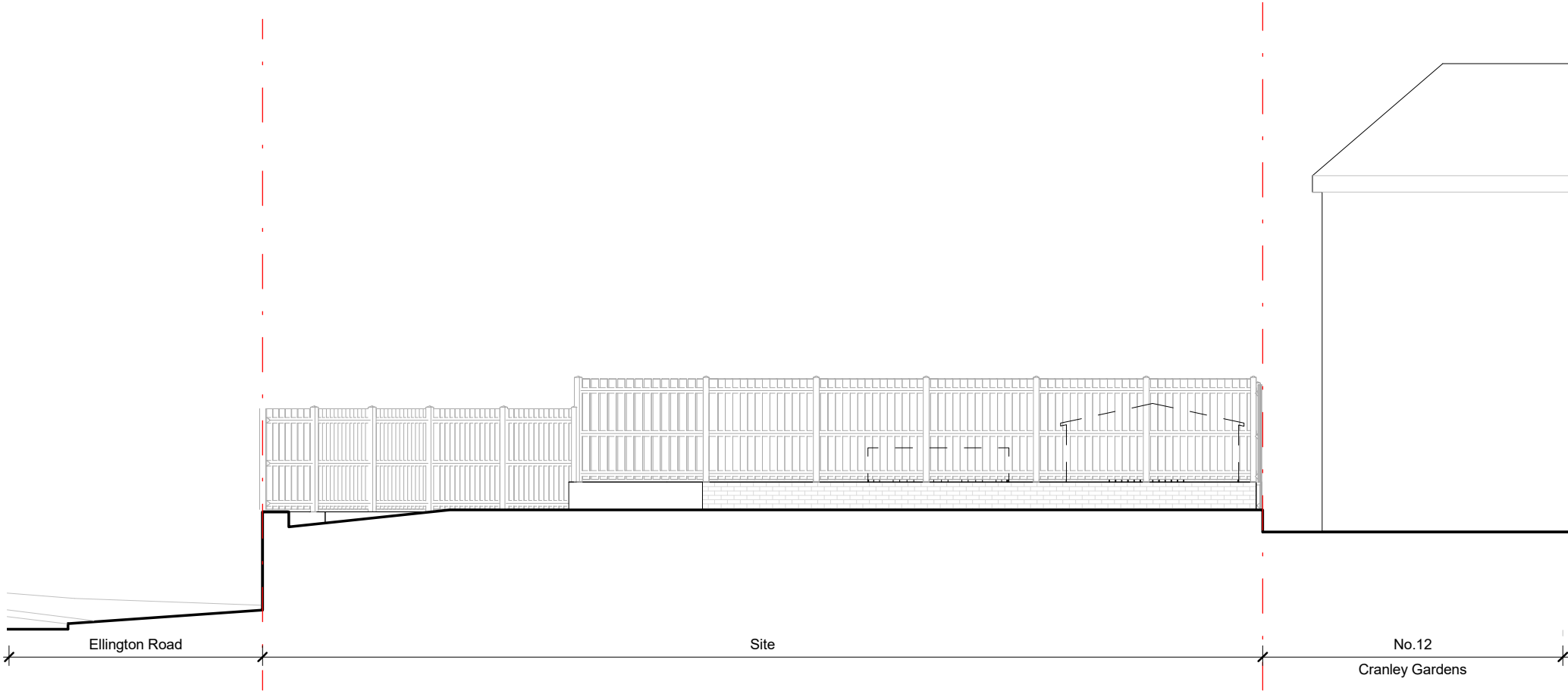


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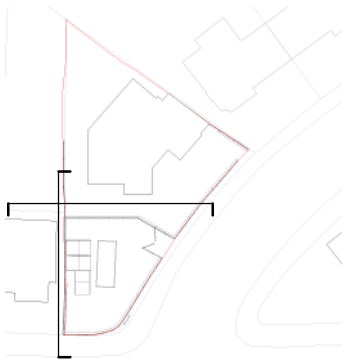
existing western elevation

1 : 100



existing northern elevation

1 : 100



P1	Planning Issue	25/01/23
Rev	Description	Date



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notting hill
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f 02072293257
e info@wolffarchitects.co.uk

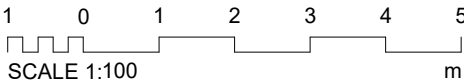
status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

drawing title:
Existing Elevations

date: 23/11/2022	scale: As indicated
dwg no: 2236-PL-0111	rev no: P1



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existing street elevation - Ellington Road

1 : 200



existing street elevation - Cranley Gardens

1 : 200



P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Existing Street Elevations

date: **11/21/21** | scale: **As indicated**

dwg no: **2236-PL-0112** | rev no: **P1**

1 0 1 2 3 4 5
SCALE 1:100 m

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existing section A-A

1 : 100



existing section B-B

1 : 100



P1	Planning Issue	25/01/23
Rev	Description	Date



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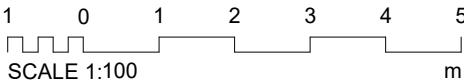
16 lambton place
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f 02072293257
e info@wolffarchitects.co.uk

status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Existing Sections

date: 23/11/2022	scale: As indicated
dwg no: 2236-PL-0120	rev no: P1



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Outline of approved application - HGY/2018/2596

- ① Sandstone paving for patio area
- ② Permeable paving
- ③ Scattered sandstone pavers
- ④ Paving
- ⑤ Potted planting
- ⑥ Hanging planting
- ⑦ Secture timber bin and cycle store
- ⑧ Stepped planter
- ⑨ Sedum roof

P1	Planning Issue	25/01/23
Rev	Description	Date



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e info@wolffarchitects.co.uk

status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

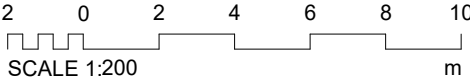
drawing title:
Proposed Site Plan

date: **23/11/2022** | scale: **As indicated**

dwg no: **2236-PL-0199** | rev no: **P1**

proposed site plan

1 : 200



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Outline of approved application - HGY/2018/2596



P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

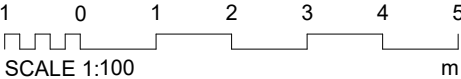
Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Proposed Lower Ground Floor

date: 23/11/2022	scale: As indicated
dwg no: 2236-PL-0200	rev no: P1

proposed lower ground floor

1 : 100



12 Cranley
Gardens

Cornerways

Ellington Road

Cranley Gardens

B/ PL-0220

A/ PL-0220

Utility

Kitchen

Dining Area

Living Room

patio

Garden

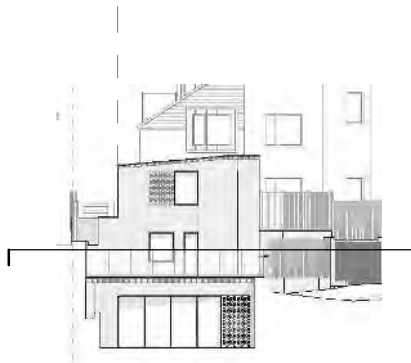
skylights above

skylights above

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Outline of approved application - HG/2018/2596



P1	Planning Issue	25/01/23
Rev	Description	Date



WOLFF ARCHITECTS

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e info@wolffarchitects.co.uk

status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:

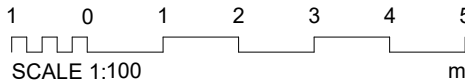
Proposed Ground Floor

date: **23/11/2022** scale: **As indicated**

dwg no: **2236-PL-0201** rev no: **P1**

proposed ground floor

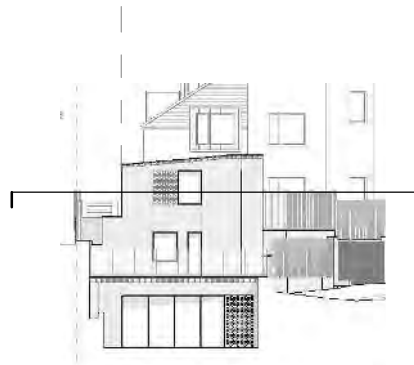
Cranley Gardens



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Outline of approved application - HGY/2018/2596



P1	Planning Issue	25/01/23
Rev	Description	Date



WOLFF ARCHITECTS

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e info@wolffarchitects.co.uk

status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

drawing title:
Proposed First Floor

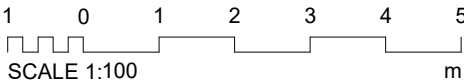
date: **23/11/2022** scale: **As indicated**

dwg no: **2236-PL-0202** rev no: **P1**

proposed first floor

Cranley Gardens

1 : 100



Ellington Road

Cornerways

B/ PL-0220

A/ PL-0220

Hall

En-Suite

Dressing

Master
Bedroom

12 Cranley
Gardens

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Outline of approved application - HGY/2018/2596



P1	Planning Issue	25/01/23
Rev	Description	Date



WOLFF ARCHITECTS

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e info@wolffarchitects.co.uk

status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

drawing title:
Proposed Roof Plan

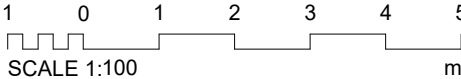
date: **23/11/2022** | scale: **As indicated**

dwg no: **2236-PL-0203** | rev no: **P1**

proposed roof plan

Cranley Gardens

1 : 100





 Minimum 30 minute fire resistant wall construction

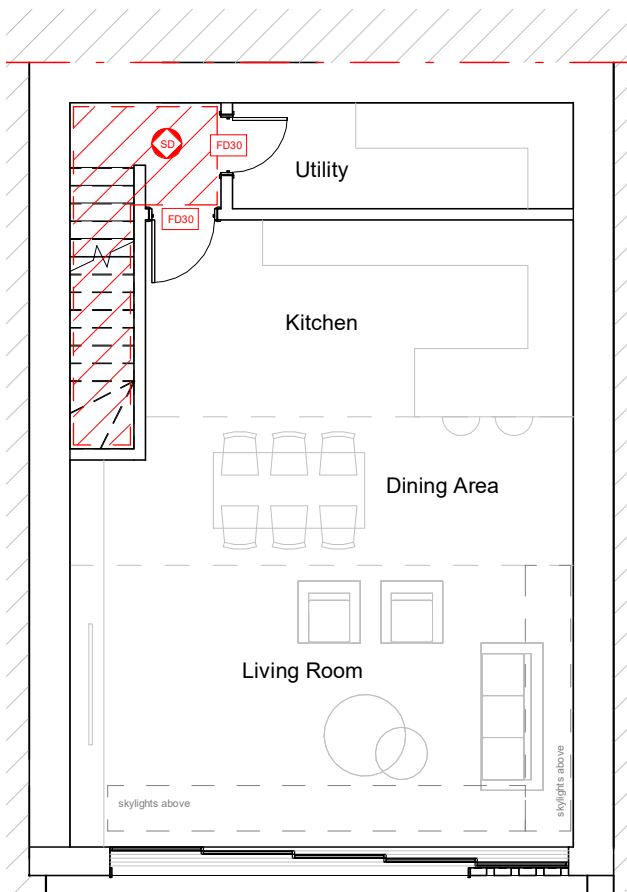
 Escape door

 Fire Door, minimum 30minute fire resistance to be achieved

 Smoke Detector linked to specialist fire detection system

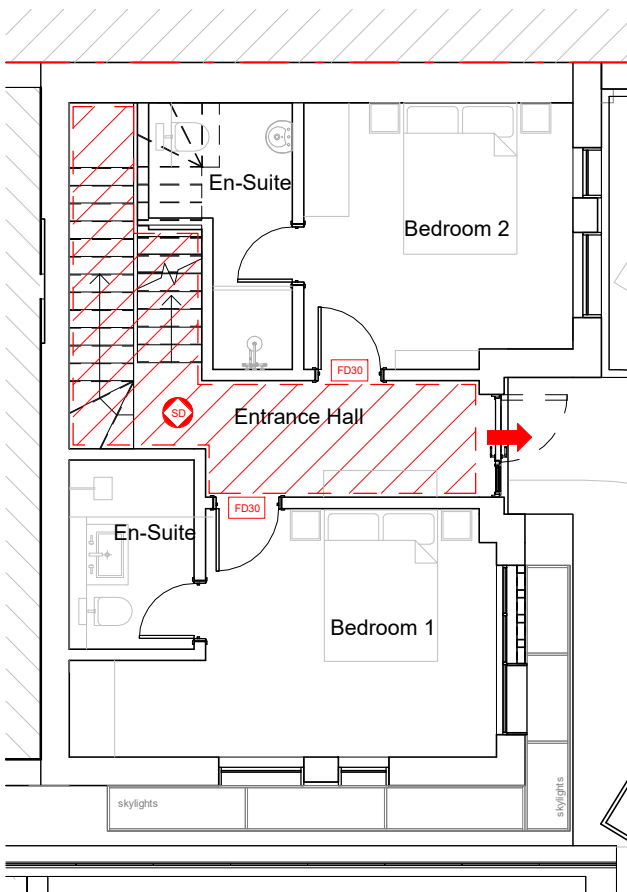
Notes:

- Provide fire dampers / collars as required between all compartment walls (denoted with red line on fire strategy drawings) to maintain 1/2 hour fire seperation
- fire alarm and detection system, to specialists design, to be linked with specialist building management system and specialist equipment
- Internal Fire Spread; Circulation spaces and garages to have wall and ceiling linings that meet Nation Class 1, as defined by BS 476 "Fire tests on building materials and structures
- All steels are to be treated with intumescent steel paint to thermally insulate them in a fire for a period of 30 minutes.



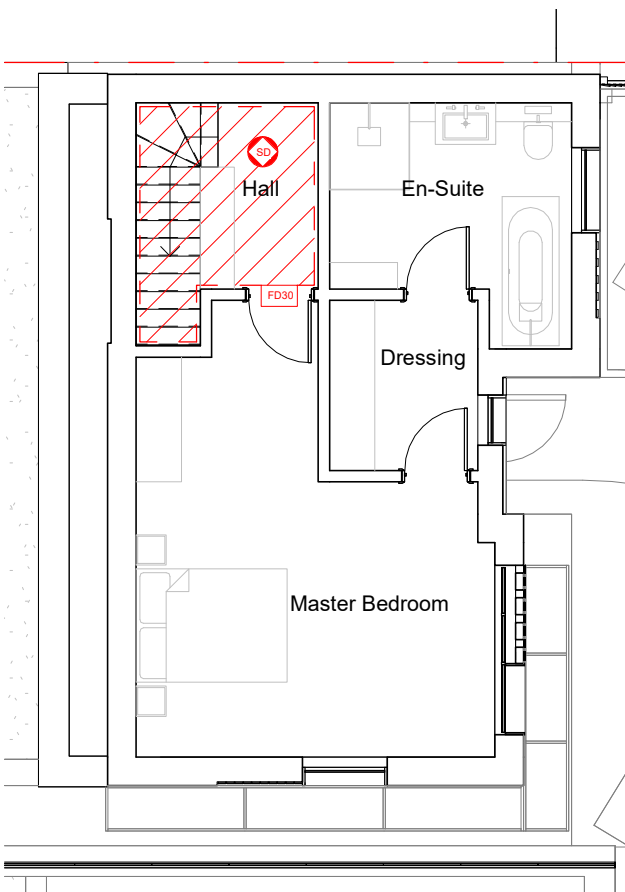
proposed lower ground Floor

1 : 100



proposed ground floor

1 : 100



proposed first floor

1 : 100

Rev	Description	Date
P1	Planning Issue	25/01/23



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status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

drawing title:
Fire Strategy plans

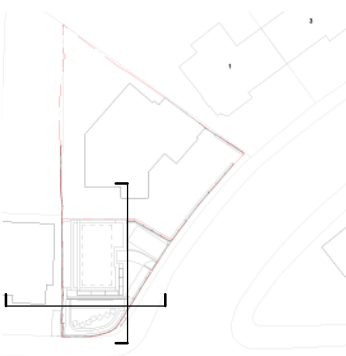
date: **25/01/23** scale: **As indicated**

dwg no: **2236-PL-207** rev no: **P1**

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SCALE 1:100 m

Outline of approved application - HGY/2018/2596

- 1 Pale rustic brickwork
- 2 'Hit and miss' protruding brickwork
- 3 'Hit and miss' penetrations
- 4 Powdercoated aluminium windows
- 5 Powdercoated aluminium sliding door system
- 6 Recessed brickwork
- 7 Brick header/stretcher course
- 8 Closeboard timber fence on dwarf garden wall
- 9 Powder coated steel car gate system and pedestrian access door
- 10 Vertical greening on 'hit and miss' timber fence



P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

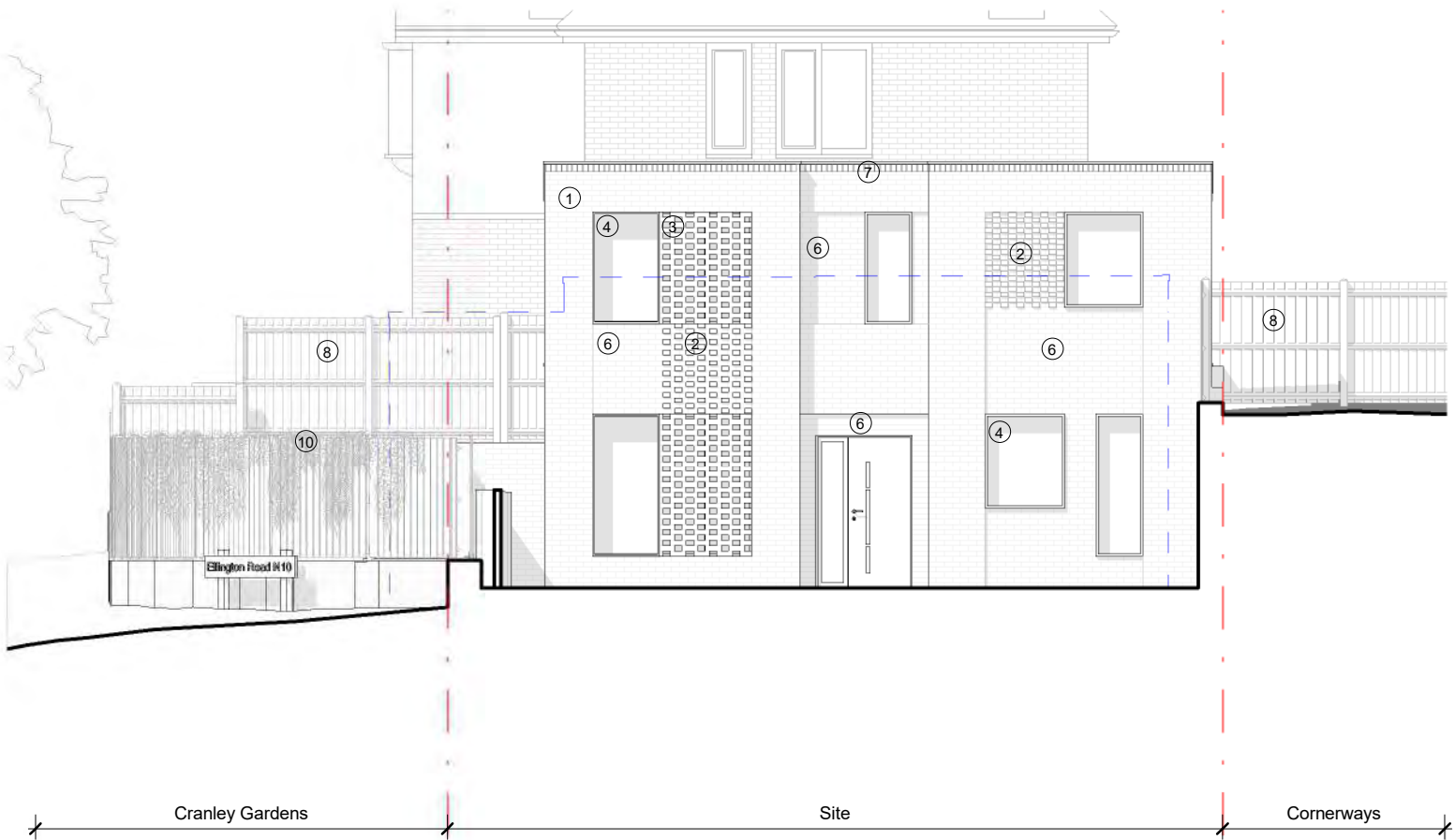
drawing title:
Proposed Elevations

date: **23/11/2022** scale: **As indicated**

dwg no: **2236-PL-0210** rev no: **P1**

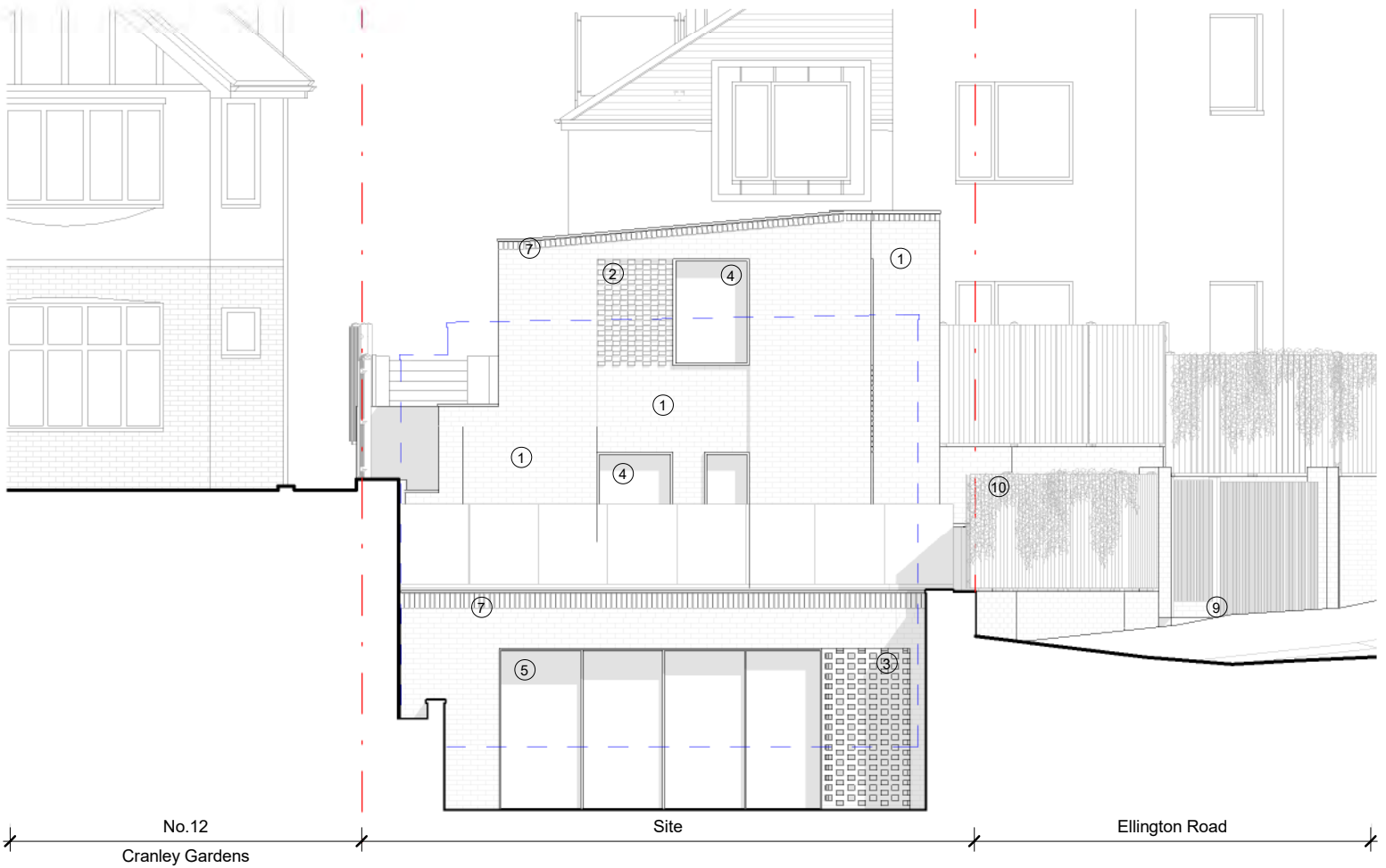
proposed eastern elevation

1 : 100



proposed southern elevation

1 : 100



1 0 1 2 3 4 5
SCALE 1:100 m

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Outline of approved application - HGY/2018/2596

- 1 Pale rustic brickwork
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- 3 'Hit and miss' penetrations
- 4 Powdercoated aluminium windows
- 5 Powdercoated aluminium sliding door system
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P1	Planning Issue	25/01/23
Rev	Description	Date



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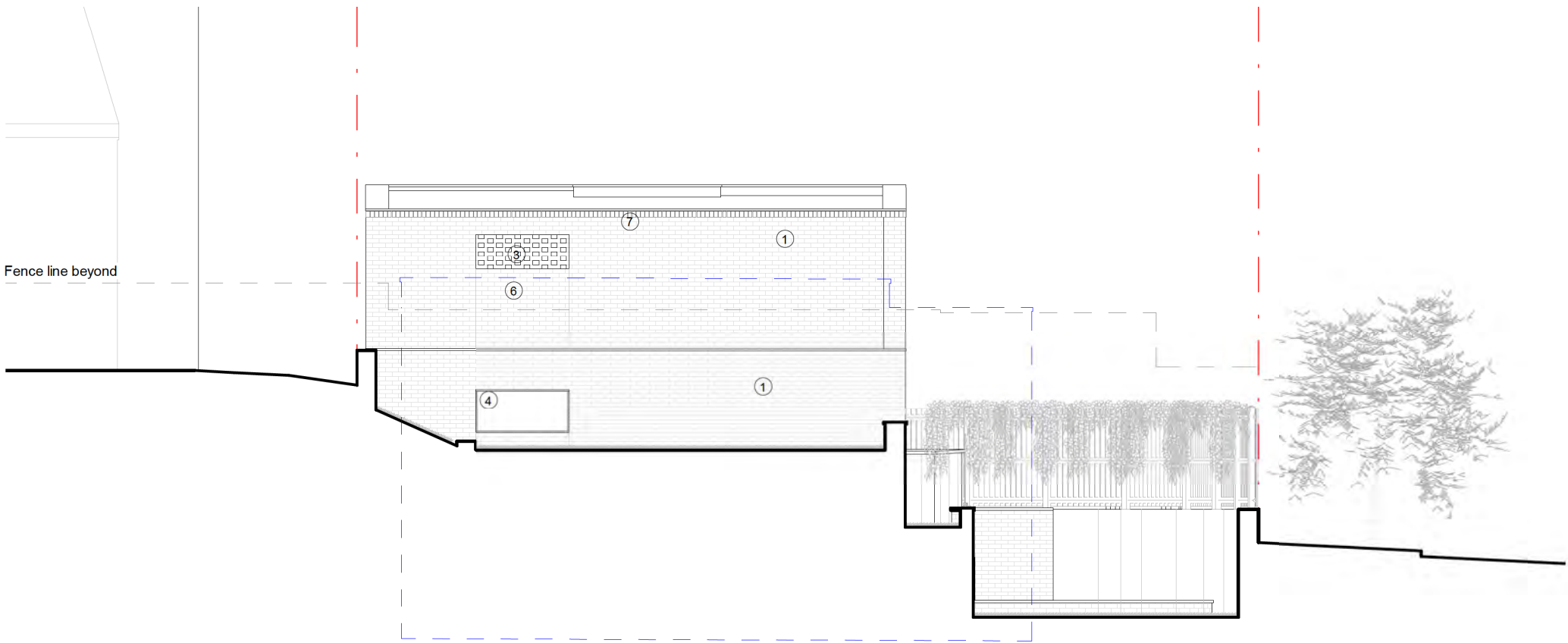
status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Proposed Elevations

date: **23/11/2022** scale: **As indicated**

dwg no: **2236-PL-0211** rev no: **P1**



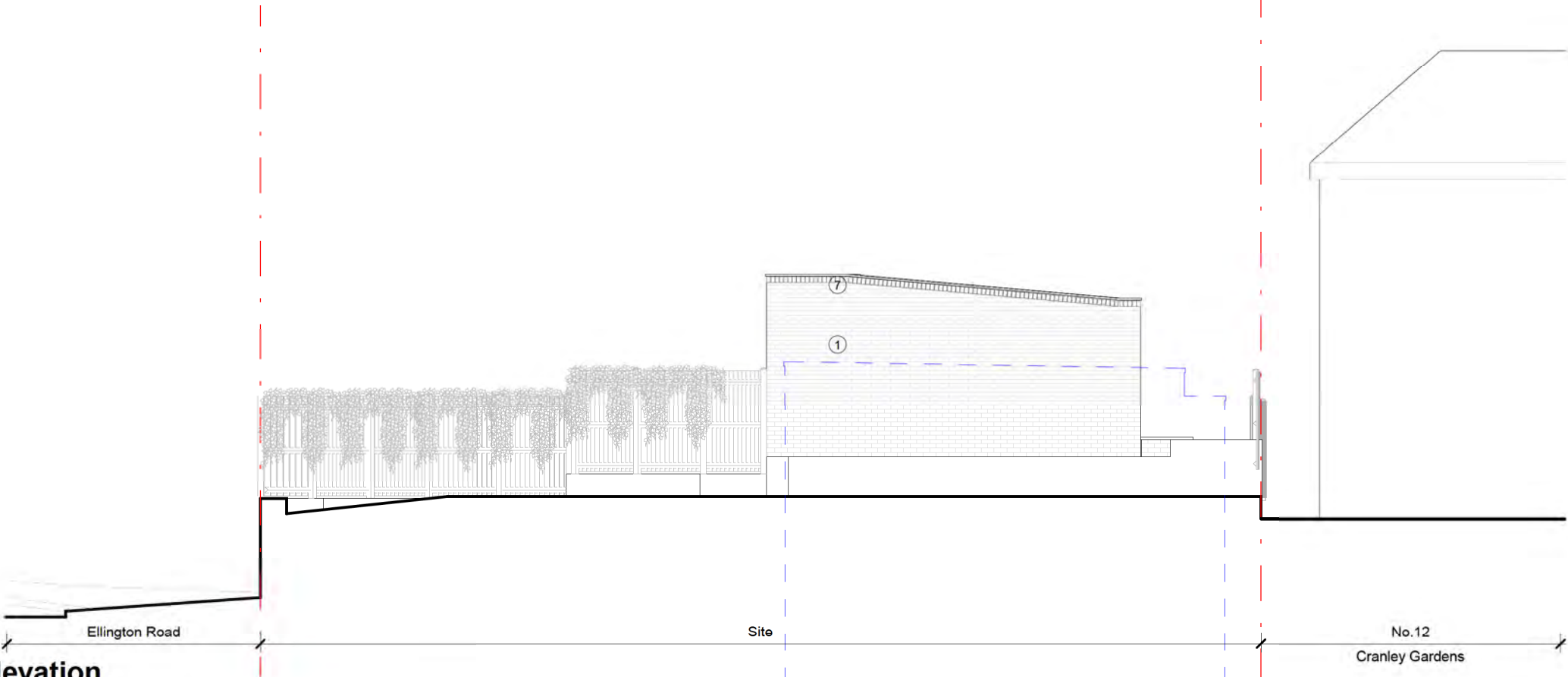
Cornerways

Site

Cranley Gardens

proposed western elevation

1 : 100



Ellington Road

Site

No.12

Cranley Gardens

porposed northern elevation

1 : 100

1 0 1 2 3 4 5
SCALE 1:100 m



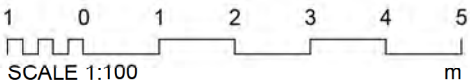
proposed street elevation - Ellington Road

1 : 200



proposed street elevation - Cranley Gardens

1 : 200



Rev	Description	Date
P1	Planning Issue	25/01/23



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status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Proposed Street Elevations

date:	23/11/2022	scale:	As indicated
dwg no:	2236-PL-0212	rev no:	P1

Outline of approved application - HGY2018/2596

- 1 Pale rustic brickwork
- 2 'Hit and miss' protruding brickwork
- 3 'Hit and miss' penetrations
- 4 Powdercoated aluminium windows
- 5 Powdercoated aluminium sliding door system
- 6 Recessed brickwork
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P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

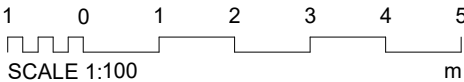
Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London
drawing title:
Proposed Front Elevation

date:	23/11/2022	scale:	As indicated
dwg no:	2236-PL-0213	rev no:	P1

proposed eastern elevation

1 : 50



Outline of approved application - HGY/2018/2596

- 1 Pale rustic brickwork
- 2 'Hit and miss' protruding brickwork
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- 4 Powdercoated aluminium windows
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P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

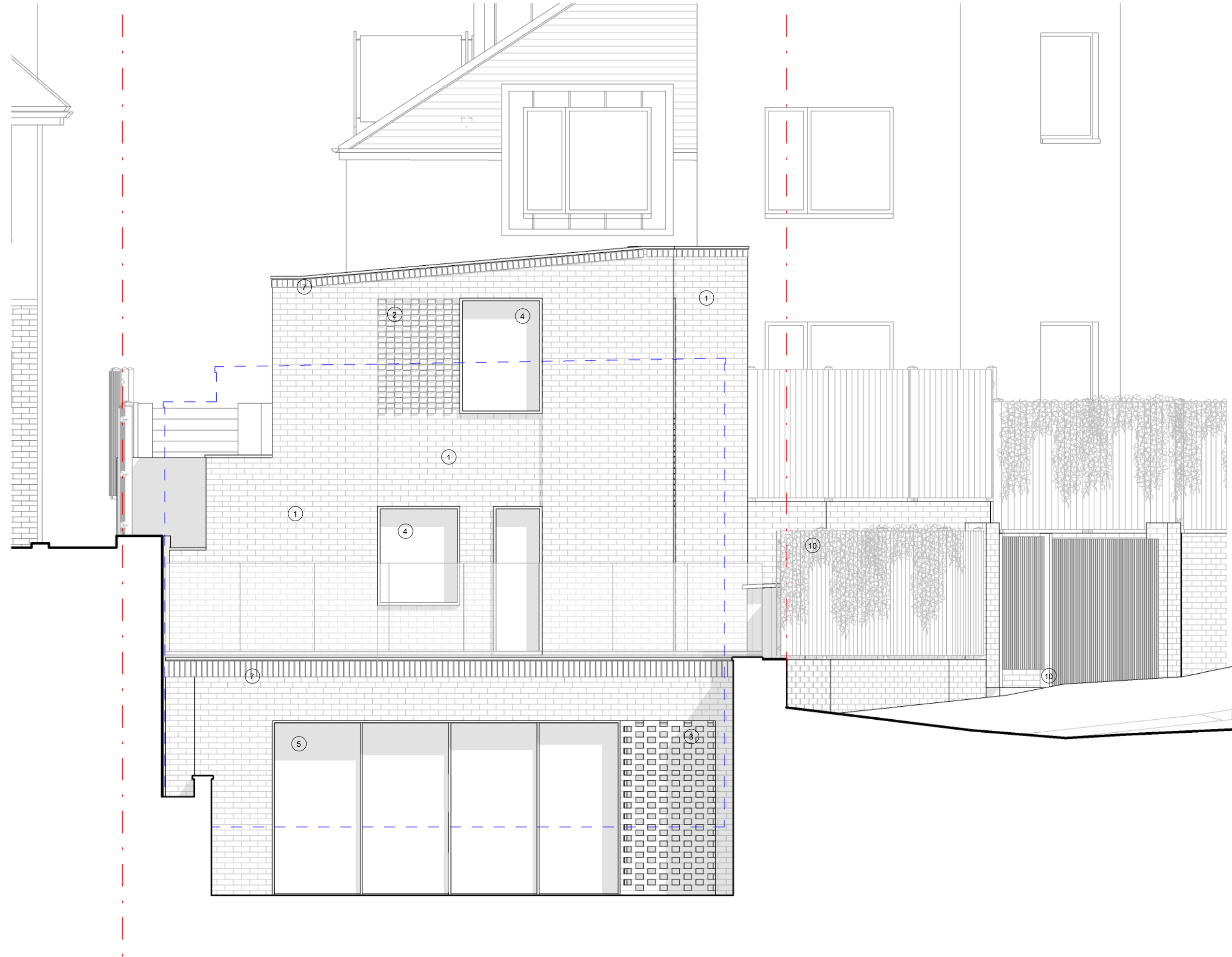
Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

drawing title:
Proposed Side Elevation

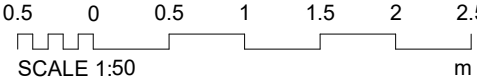
date: 23/11/2022 scale: As indicated

dwg no: 2236-PL-0214 rev no: P1



proposed southern elevation

1 : 50



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Outline of approved application - HGY/2018/2596

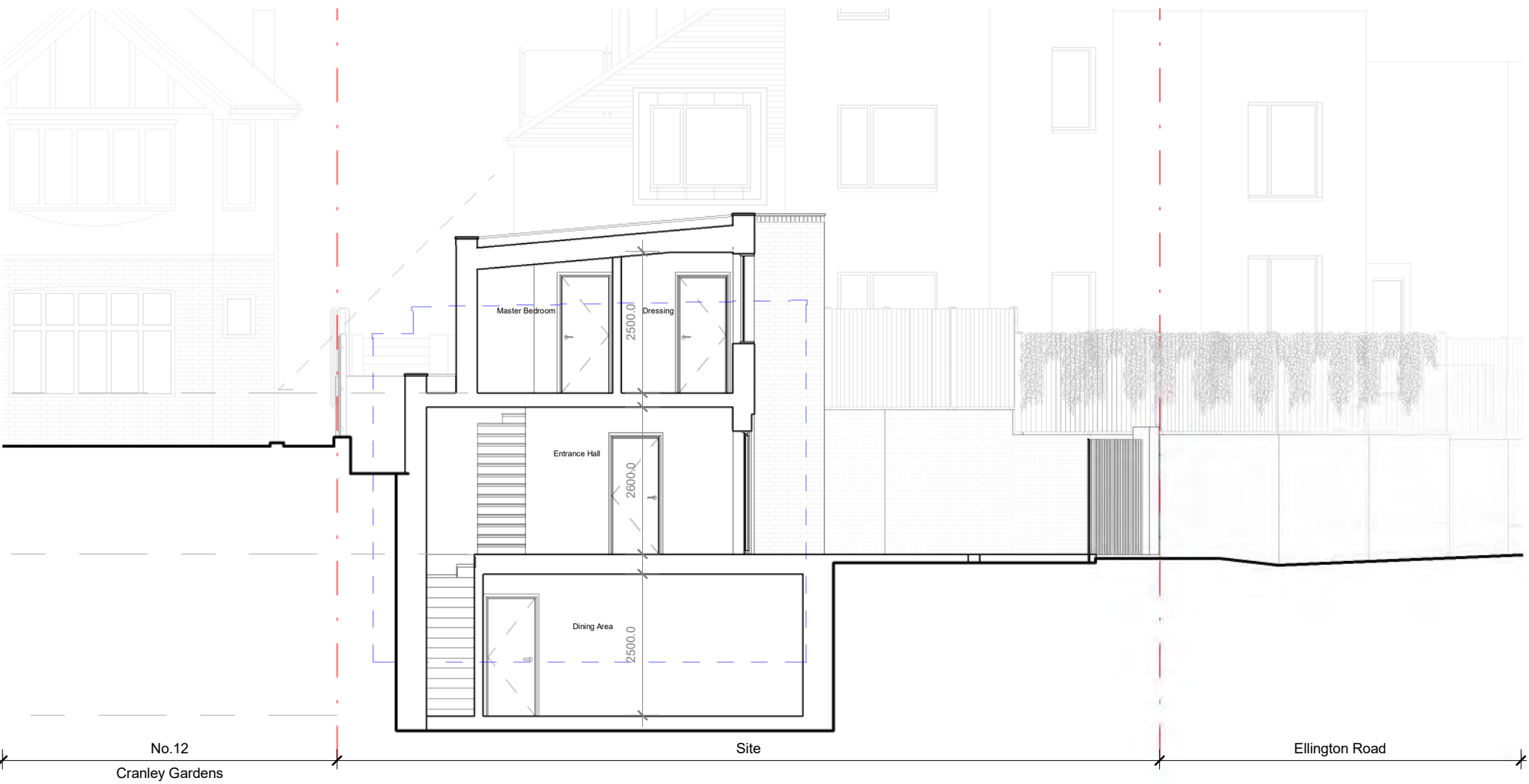
First Floor
2850.0

Ground Floor
0.0

Lower Ground Floor
-2850.0

proposed section A-A

1 : 100



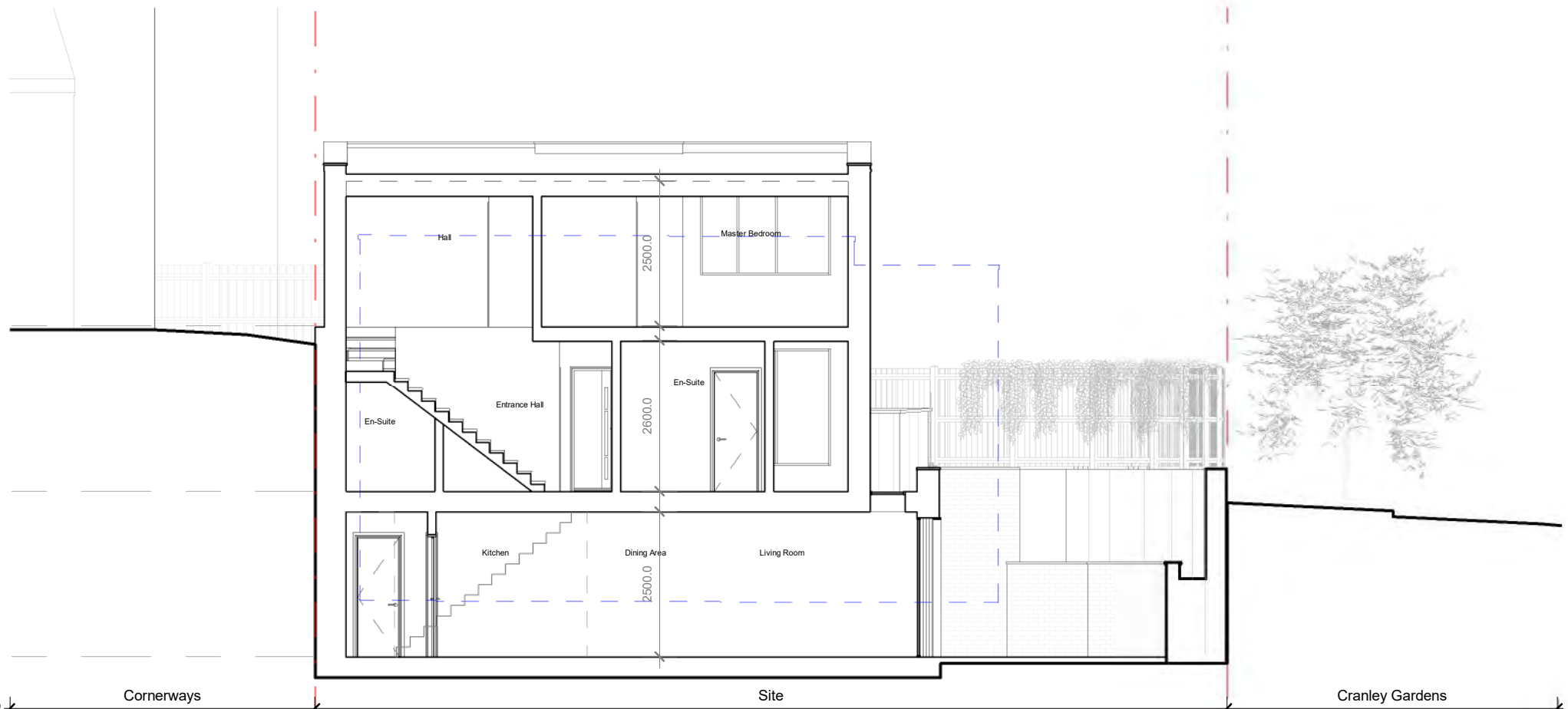
First Floor
2850.0

Ground Floor
0.0

Lower Ground Floor
-2850.0

proposed section B-B

1 : 100



P1	Planning Issue	25/01/23
Rev	Description	Date



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status:

Planning

project:
Cornerways
Cornerways, Muswell Hill, N10
3DD, London

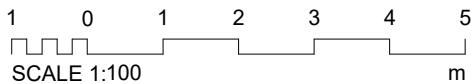
drawing title:
Proposed Sections

date:
23/11/2022

scale:
As indicated

dwg no:
2236-PL-0220

rev no:
P1



The contractor shall be responsible for the design, installation and sequencing of all temporary works and must ensure that the stability of the structure is not compromised during the works

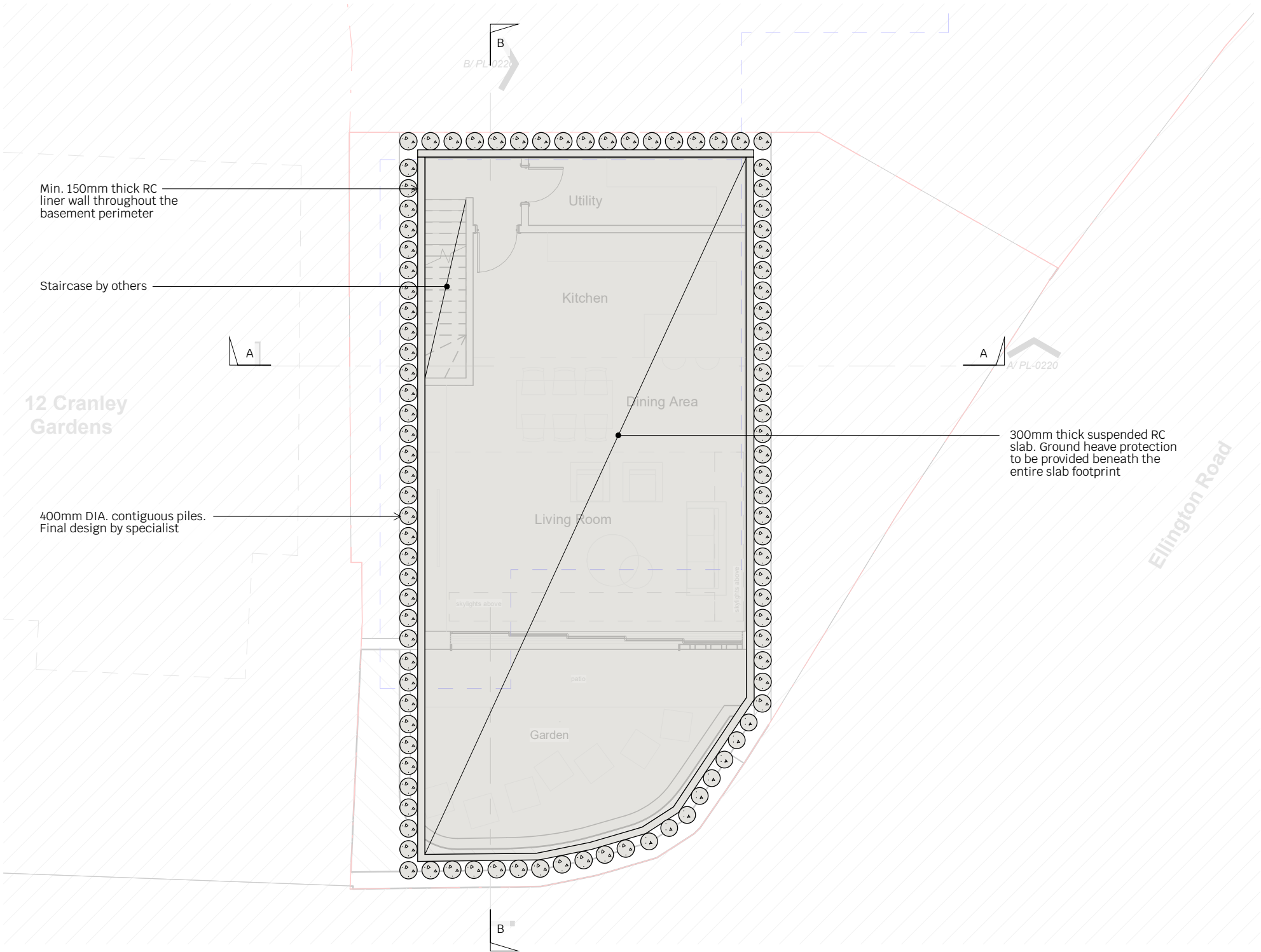
All structural elements sizes have been calculated on a preliminary basis to provide an indicative scheme and will be reviewed and developed further at a later stage

Refer to Architect's drawings for all setting out details, insulation, ventilation and waterproofing details

Do not scale from this drawing

Contractor/specialist design elements:

- 1. All temporary works
- 2. All tanking details



Lower Ground Floor Plan

(Background taken from Wolff Architects drawing No. 22236-PL-0200)

Drawing Status - Preliminary



The contractor shall be responsible for the design, installation and sequencing of all temporary works and must ensure that the stability of the structure is not compromised during the works

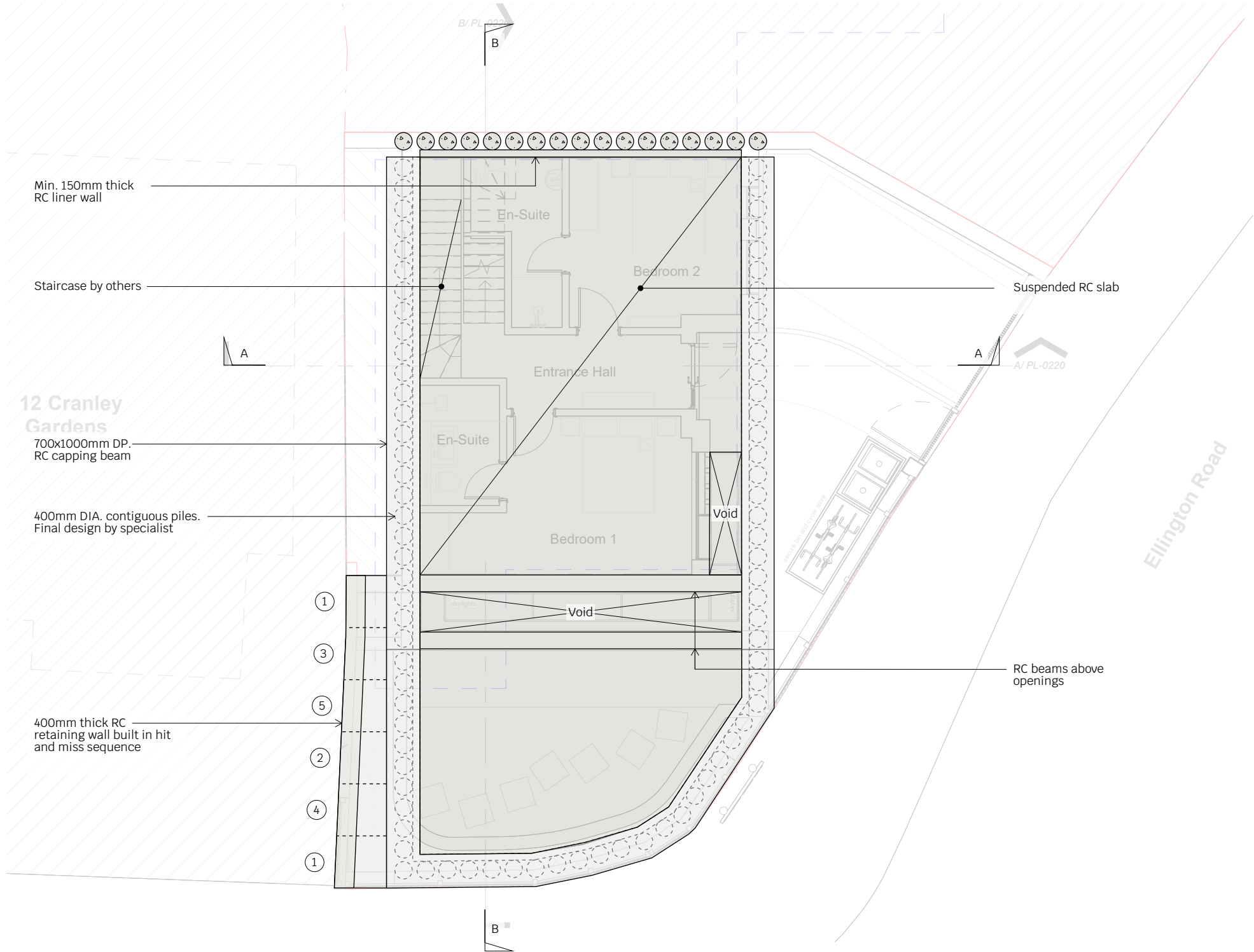
All structural elements sizes have been calculated on a preliminary basis to provide an indicative scheme and will be reviewed and developed further at a later stage

Refer to Architect's drawings for all setting out details, insulation, ventilation and waterproofing details

Do not scale from this drawing

Contractor/specialist design elements:

1. All temporary works
2. All tanking details



Ground Floor Plan

(Background taken from Wolff Architects drawing No. 22236-PL-0201)

Drawing Status - Preliminary



The contractor shall be responsible for the design, installation and sequencing of all temporary works and must ensure that the stability of the structure is not compromised during the works

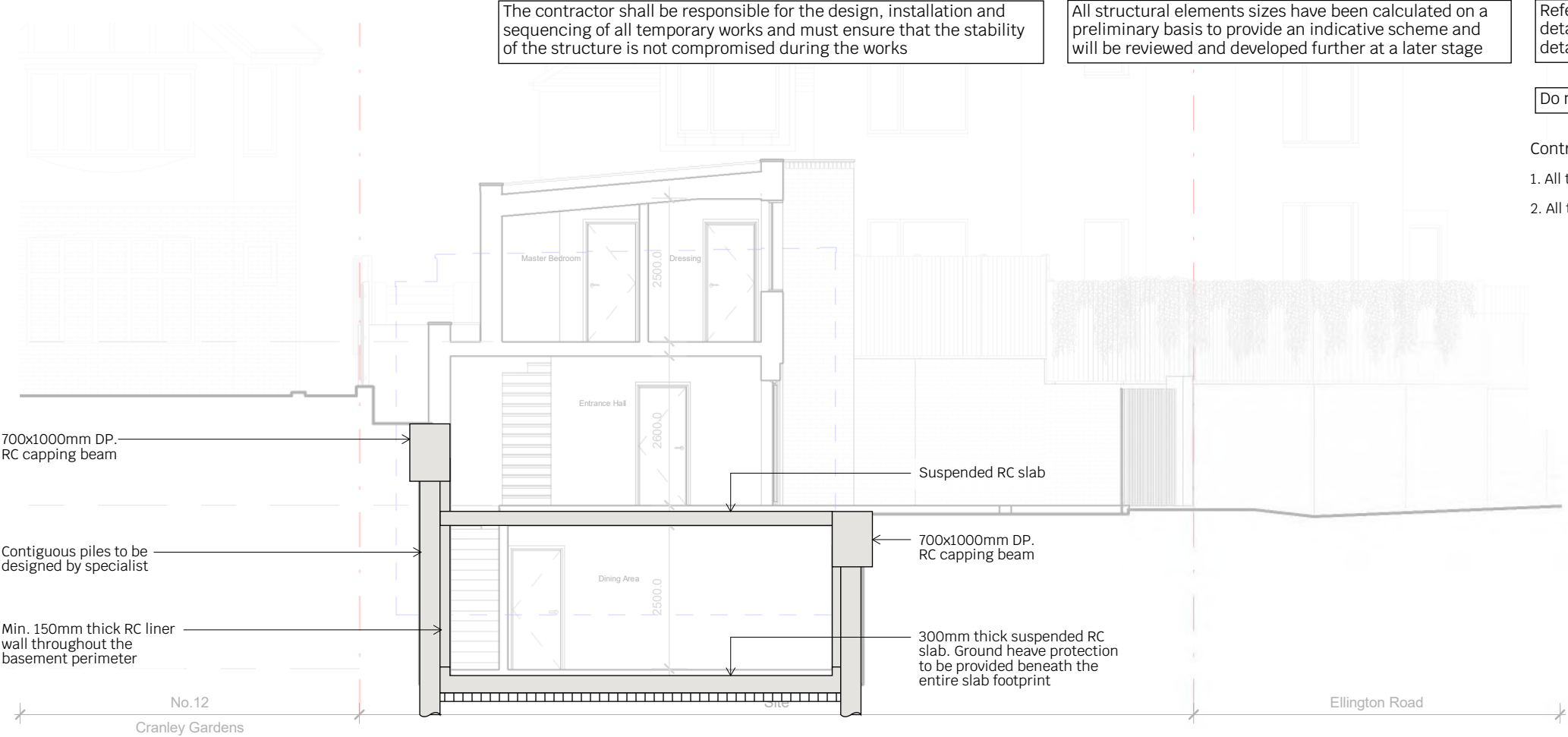
All structural elements sizes have been calculated on a preliminary basis to provide an indicative scheme and will be reviewed and developed further at a later stage

Refer to Architect's drawings for all setting out details, insulation, ventilation and waterproofing details

Do not scale from this drawing

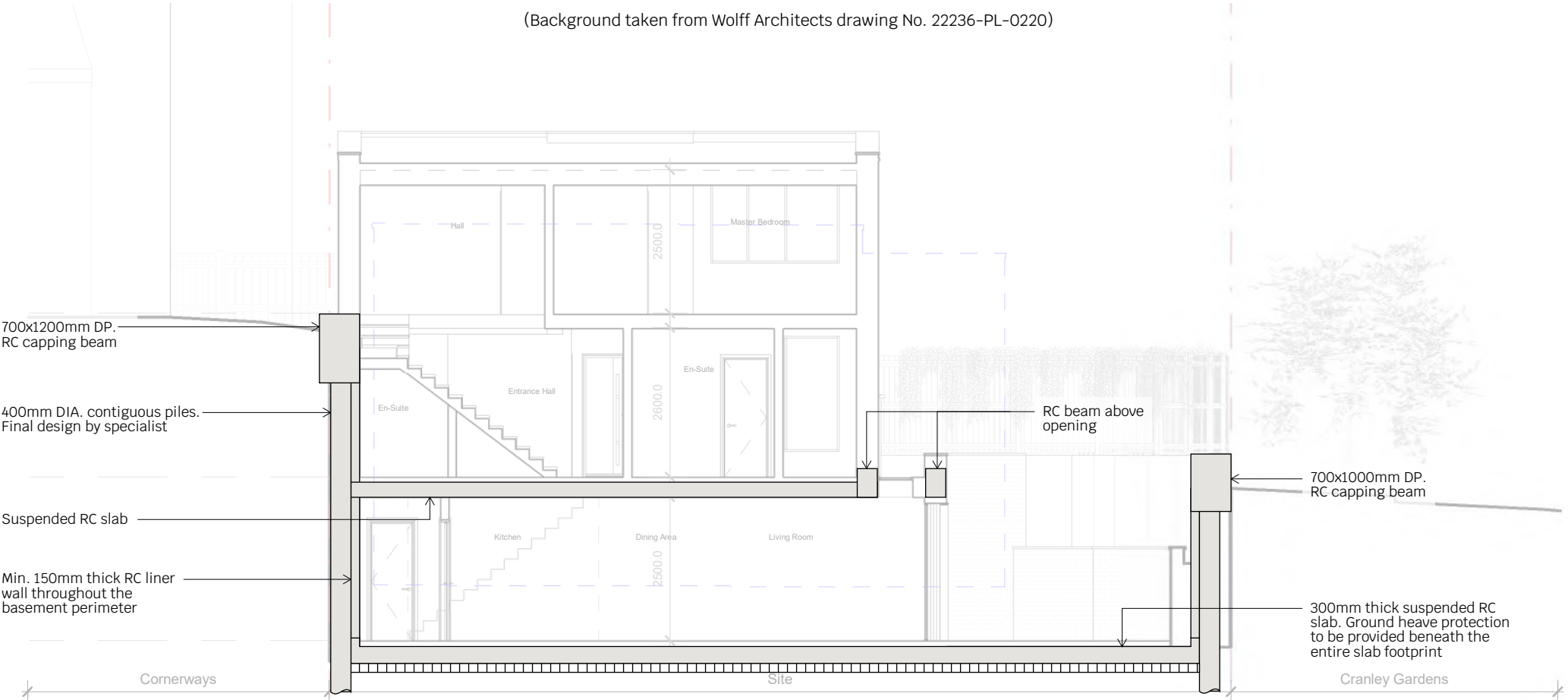
Contractor/specialist design elements:

1. All temporary works
2. All tanking details



Section A-A

(Background taken from Wolff Architects drawing No. 22236-PL-0220)



Section B-B

(Background taken from Wolff Architects drawing No. 22236-PL-0220)

Drawing Status - Preliminary



The contractor shall be responsible for the design, installation and sequencing of all temporary works and must ensure that the stability of the structure is not compromised during the works

All structural elements sizes have been calculated on a preliminary basis to provide an indicative scheme and will be reviewed and developed further at a later stage

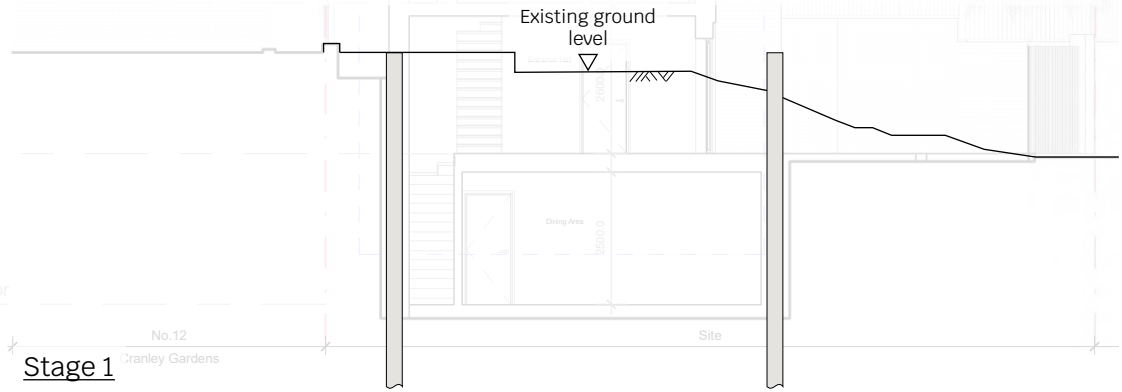
Refer to Architect's drawings for all setting out details, insulation, ventilation and waterproofing details

Do not scale from this drawing

Contractor/specialist design elements:

1. All temporary works
2. All tanking details

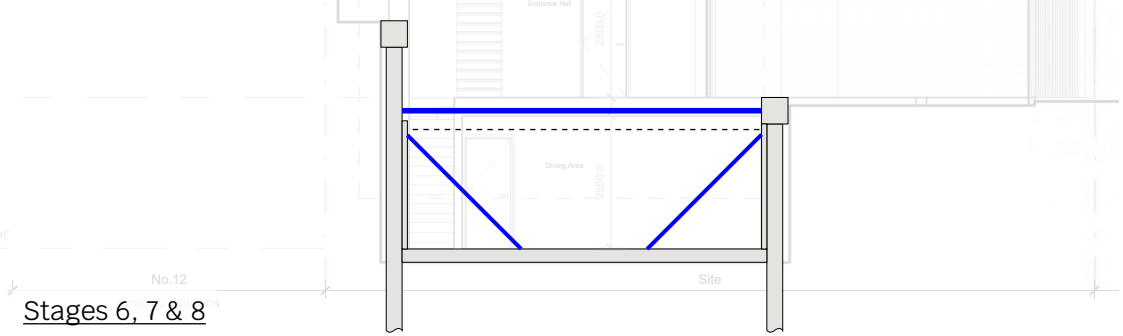
1. Install piles



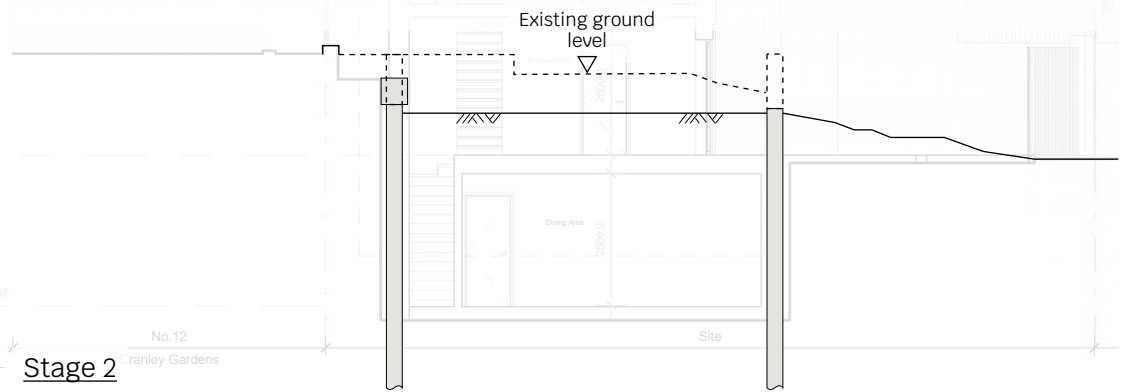
6. Excavate to underside of basement level and install basement slab

7. Install liner walls

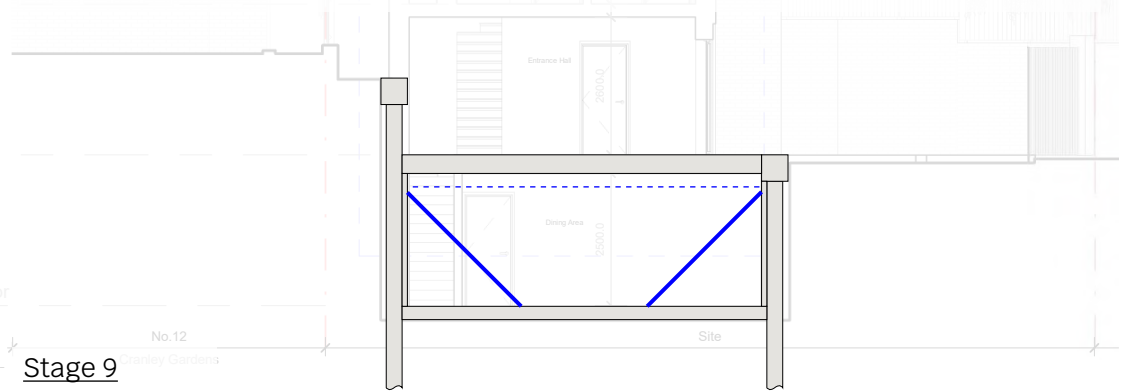
8. Install raking props



2. Install higher level pile caps to western elevation



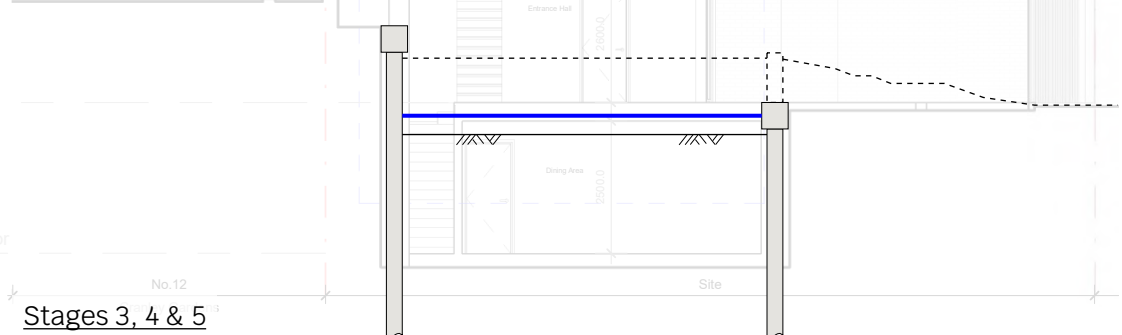
9. Install ground floor slab



3. Excavate to below lower level pile cap and cut down piles

4. Install lower level pile caps to eastern elevation

5. Install temporary steel propping



10. Complete installation of RC liner wall



Drawing Status - Preliminary



22120-SYM-XX-XX-SK-S-0002 - Rev P1
Temporary Works Installation Sequence
The Cornerways, Muswell Hill
London, N10 3DD
EW
19/01/2023

APPENDIX B

STRUCTURAL CALCULATIONS

WE ARE SYMMETRYS

STRUCTURAL CALCULATION PACKAGE (BIA)

THE CORNERWAYS, MUSWELL HILL
LONDON N10 3DD

REF: 22120-SYM-XX-XX-CAL-S-0001





REVISION HISTORY

Revision	Description	Date	By	Checked
P1	Draft	19/01/2023	EW	AB
A	First Issue	03/03/2023	EW	AB



1.0 Introduction

- 1.1 Symmetrys were instructed by Wolff Architects to undertake the structural design in support of the planning application for a proposed three-storey dwelling with single storey basement at The Cornerways, Muswell Hill, London.
- 1.2 The structural design works shall consist of the following:
- Substructure design of a single-storey basement

2.0 Design Codes

- 2.1 The following design codes were used to carry out the design:
- BS EN 1990 – Basis of Structural design;
 - BS EN 1991 – Actions on Structure;
 - BS EN 1992 – Design of Concrete Structures;
 - BS EN 1993 – Design of steel structures;
 - BS EN 1997 – Geotechnical design.

3.0 Ground conditions

- 3.1 A site-specific ground investigation has been carried out by specialist geotechnical engineers MiniSoils Ltd., confirming Made Ground to a depth of 0.3m overlaying London Clay.

4.0 Substructure design

- 4.1 The proposed basement will be formed using a contiguous pile wall at the perimeter and a 300mm thick reinforced concrete suspended slab at basement level. Due to the sloping nature of the site, the pile walls will span double-storey from basement to first floor at the North of the building, and single-storey from basement to ground floor to the East and West. The basement walls will be propped in the permanent case by reinforced concrete floors slabs at ground and first floor levels.
- 4.2 The basement garden will be enclosed by a contiguous pile wall along Ellington Road, and a reinforced concrete cantilever retaining wall along the boundary of No. 12 Cranley Gardens. The cantilever wall will be constructed in a hit and miss sequence in maximum lengths of 1.0m, and will be propped by a contiguous pile wall at its base. The contiguous pile wall along Ellington Road will cantilever a single-storey from basement to ground floor level.
- 4.3 All pile walls have been sized on a preliminary basis for design development purposes only. The pile walls are assumed to extend below ground a minimum of x2 the retaining soil height. The final pile design will be undertaken by a specialist.



5.0 Loadings

Item	DL (kPa)	LL (kPa)
No. 12 Cranley Gardens Pitched Roof		
Tiles (plain clay)	0.75	
Battens & felt	0.10	
Rafters	0.15	
Total dead load on slope (slope angle = 45)	1.40	
Ceiling joists & insulation	0.10	
Plasterboard	0.10	
Services	0.20	
Total dead load on plan	1.80	
1.0 Roof snow		0.60
No. 12 Cranley Gardens External Masonry Wall		
330mm thick	6.30	
Plaster (2 sides)	0.30	2.0
	6.60	
3.0 The Cornerways Lower Ground Floor Level		
4.0 Finishes	2.0	
5.0 300mm RC slab	7.5	
6.0 Imposed load		1.5
7.0 Total	8.5	1.5
8.0 Reinforced concrete	25*	9.0
10.0 Note: * = KN/m3		



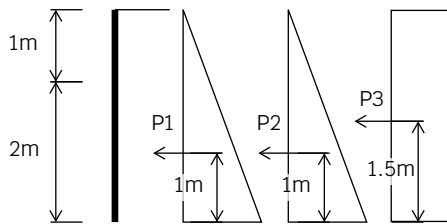
Job No.	Sheet No.	Revision
22120	01	A
Date	Made By	Checked By
JAN 23	EW	AB

Job Title The Cornerways, Muswell Hill, London N10 3DD

Section Contiguous Pile Wall Preliminary Sizing

The basement and garden will be enclosed by a contiguous pile wall. Loading and support conditions vary between elevations. Therefore, piles have been sized according to the two most onerous cases; (1) Un-propped wall adjacent to the highway, (2) Un-propped wall at the base of the cantilever retaining wall along No. 12 Cranley Gardens.

(1) Un-propped wall adjacent to the highway



$$\gamma = 18 \text{ kN/m}^3$$

$$\phi' = 24^\circ$$

$$K_a = 1 - \sin 24 / 1 + \sin 24 = 0.42$$

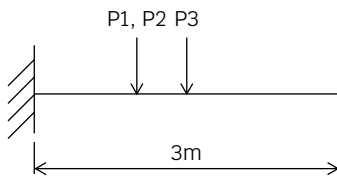
$$\text{Surcharge} = 10 \text{ kN/m}^2$$

$$P1 = 18 \text{ kN/m}^3 \times 0.42 \times 3\text{m} \times 3\text{m} \times 1/2 = 43 \text{ kN/m}$$

$$P2 = 9.81 \text{ kN/m}^3 \times 3\text{m} \times 3\text{m} \times 1/2 = 44.1 \text{ kN/m}$$

$$P3 = 10 \text{ kN/m}^2 \times 0.42 \times 3\text{m} = 12.6 \text{ kN/m}$$

Analyse wall as fixed cantilever:



$$M = 43 \text{ kN/m} \times 1\text{m} \times 1.35 + 44.1 \text{ kN/m} \times 1\text{m} \times 1.5 + 12.6 \text{ kN/m} \times 1.5\text{m} \times 1.5 = 152.6 \text{ kNm / m}$$

$$\text{Piles @ 400mm cts, } M \text{ per pile} = 152.6 \text{ kNm / m} \times 0.4 \text{ m} = 61.0 \text{ kNm}$$

Check 400mm DIA. RC pile in bending:

$$d = 400\text{mm} - 75\text{mm} - 16\text{mm}/2 = 317 \text{ mm}$$

$$k = M / bd^2f_{ck} = 61 \times 10^6 / 400 \times 317^2 \times 30 = 0.050$$

$$z = d [0.5 + (0.25 - k/1.134)^{0.5}] = 317 [0.5 + (0.25 - 0.050/1.134)^{0.5}] = 302.3 \text{ mm} > 0.95 d, \text{ therefore } z = 299.3 \text{ mm}$$

$$A_{s, \text{req}} = M / 0.87f_y z = 61 \times 10^6 / 0.87 \times 500 \times 299.3 = 468.5 \text{ mm}^2$$

Considering contribution of 4No. H16 bars, $A_{s, \text{prov}} = 804 \text{ mm}^2 > 468.5 \text{ mm}^2$, therefore wall OK.

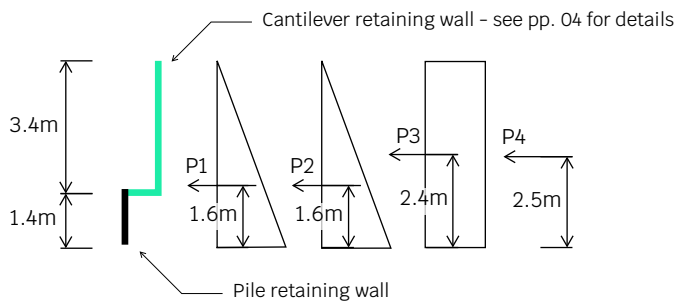


Job No.	Sheet No.	Revision
22120	02	A
Date	Made By	Checked By
JAN 23	EW	AB

Job Title The Cornerways, Muswell Hill, London N10 3DD

Section Contiguous Pile Wall Preliminary Sizing

(2) Un-propped wall at the base of the cantilever retaining wall along No. 12 Cranley Gardens.



$$\gamma = 18 \text{ kN/m}^3$$

$$\phi' = 24^\circ$$

$$K_a = 1 - \sin 24 / 1 + \sin 24 = 0.42$$

$$\text{Surcharge} = 2.5 \text{ kN/m}^2$$

$$P1 = 18 \text{ kN/m}^3 \times 0.42 \times 4.8\text{m} \times 4.8\text{m} \times 1/2 = 87.1 \text{ kN/m}$$

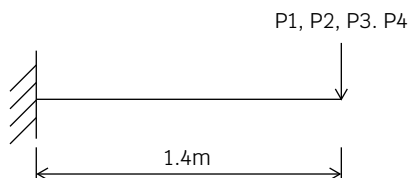
$$P2 = 9.81 \text{ kN/m}^3 \times 4.8\text{m} \times 4.8\text{m} \times 1/2 = 113.0 \text{ kN/m}$$

$$P3 = 2.5 \text{ kN/m}^2 \times 0.42 \times 4.8\text{m} = 5.0 \text{ kN/m}$$

$$P4 = 28.3 \text{ DL}, 0.8 \text{ LL kN/m (lateral force from the neighbouring building foundations - see pp 03 for details)}$$

Analyse wall as fixed cantilever:

Note the resultant forces P1, P2, P3 and P4 are each located above the top of the pile wall, however conservatively size wall with all forces applied at its cantilever end



$$M = 87.1 \text{ kN/m} \times 1.4\text{m} \times 1.35 + 113 \text{ kN/m} \times 1.4\text{m} \times 1.5 + 5.0 \text{ kN/m} \times 1.4\text{m} \times 1.5 + 28.3 \text{ kN/m} \times 1.4\text{m} \times 1.35 + 0.8 \text{ kN/m} \times 1.4\text{m} \times 1.5 = 467.6 \text{ kNm/m}$$

$$\text{Piles @ 400mm cts, } M \text{ per pile} = 467.6 \text{ kNm} / \text{m} \times 0.4 \text{ m} = 187.0 \text{ kNm}$$

Check 400mm DIA. RC pile in bending:

$$d = 400\text{mm} - 75\text{mm} - 25\text{mm}/2 = 312.5 \text{ mm}$$

$$k = M / bd^2f_{ck} = 187 \times 10^6 / 400 \times 312.5^2 \times 30 = 0.160$$

$$z = d [0.5 + (0.25 - k/1.134)^{0.5}] = 312.5 [0.5 + (0.25 - 0.160/1.134)^{0.5}] = 259.4 \text{ mm} < 0.95 d$$

$$A_{s,req} = M / 0.87f_y z = 187.0 \times 10^6 / 0.87 \times 500 \times 259.4 = 1657.2 \text{ mm}^2$$

Considering contribution of 4No. H25 bars, $A_{s,prov} = 1963 \text{ mm}^2 > 1657 \text{ mm}^2$, therefore wall OK.



Job Title	The Cornerways, Muswell Hill, London N10 3DD	Job No.	Sheet No.	Revision
		22120	03	A
Section	Cantilever Retaining Wall Preliminary Sizing	Date	Made By	Checked By
		JAN 23	EW	AB

Along the boundary of No. 12 Cranley gardens the basement garden will be enclosed by a reinforced concrete cantilever retaining wall. In the permanent case the wall will be propped by a contiguous pile wall at its base and will be subject to lateral earth pressures and an equivalent lateral force from the neighbouring building foundations.

(1) Calculate lateral force on wall from No. 12 Cranley Gardens according to CIRIA Guidance on Embedded Retaining Wall Design:

A **line** load of magnitude Q_L (kN per metre run of the wall) may be considered to exert an additional lateral force on the wall of P_n per metre run, given by:

$$P_n = Q_L \cdot \sqrt{K_a} \quad (4.13)$$

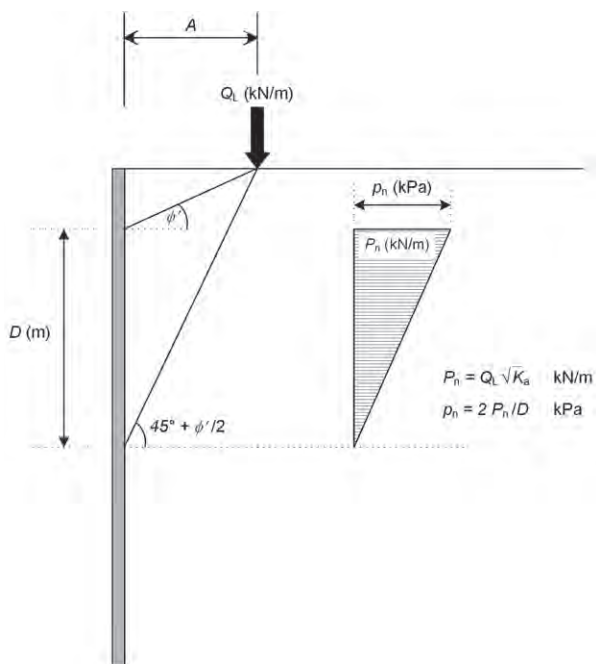


Figure 4.7 Pressure diagram for a line load (after Williams and Waite, 1993)

Load taken down from No. 12 Cranley Gardens:

Pitched roof = $4.4\text{m} \times 1/2 \times (1.8, 0.6) \text{ kN/m}^2 = 4.0 \text{ DL}, 1.3 \text{ LL kN/m}$

Masonry wall 330mm = $6.0\text{m} \times 6.6 \text{ kN/m}^2 = 39.6 \text{ DL kN/m}$

Total = 43.6 DL, 1.3 LL kN/m

Line load from No. 12 Cranley Gardens $Q_L = 43.6 \text{ DL}, 1.3 \text{ LL kN/m}$

Lateral force on retaining wall $P_n = Q_L \times \sqrt{K_a}$

$P_n = (43.6, 1.3) \text{ kN/m} \times \sqrt{0.42} = \mathbf{28.3 \text{ DL}, 0.8 \text{ LL kN}}$

$K_a = 1 - \sin 24 / 1 + \sin 24 = 0.42$

See sketch on following page for location of equivalent lateral force from the neighbouring property foundations according to figure 4.7.

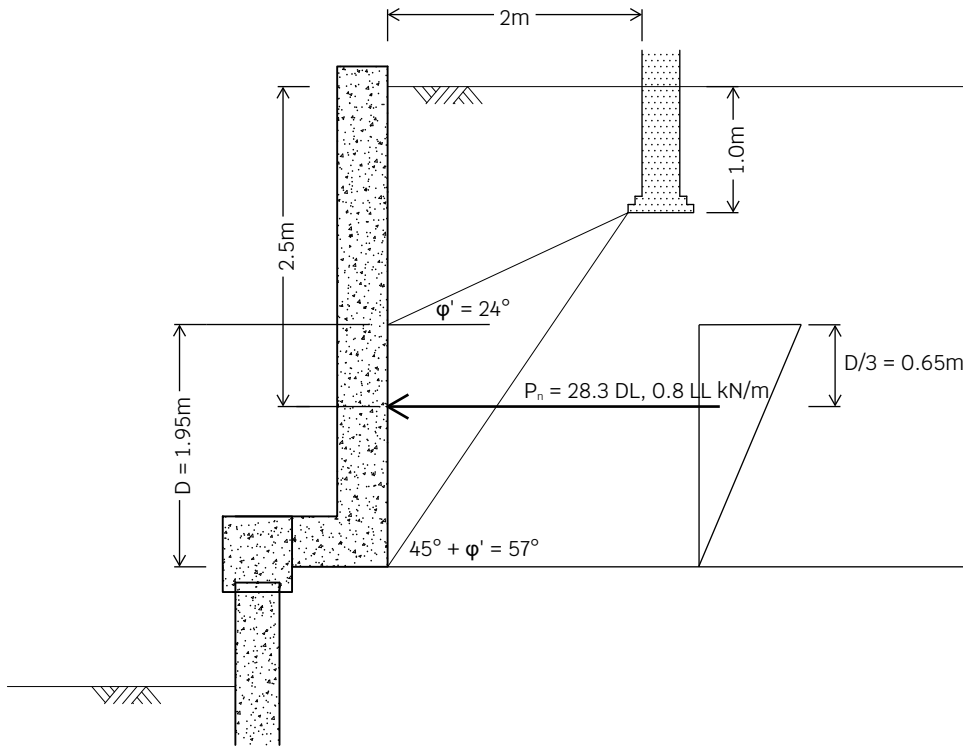


Job No.	Sheet No.	Revision
22120	04	A
Date	Made By	Checked By
JAN 23	EW	AB

Job Title The Cornerways, Muswell Hill, London N10 3DD

Section Cantilever Retaining Wall Preliminary Sizing

Position of equivalent lateral force from the neighbouring building foundations:



(2) Check retaining wall is adequate in bending to support lateral earth pressures and equivalent lateral force from the neighbouring property foundations - According to Tedds Analysis & design (see following pages) 400mm THK retaining wall OK.

Project The Cornerways, Muswell Hill, London N10 3DD				Job no. 22120	
Calcs for Cantilever Retaining Wall Design				Start page no./Revision 05	
Calcs by EW	Calcs date 18/01/2023	Checked by AB	Checked date 18/01/2023	Approved by AB	Approved date 18/01/2023

RETAINING WALL ANALYSIS

In accordance with EN1997-1:2004 incorporating Corrigendum dated February 2009 and the UK National Annex incorporating Corrigendum No.1

Tedds calculation version 2.9.14

Retaining wall details

Stem type	Cantilever
Stem height	$h_{\text{stem}} = 3600 \text{ mm}$
Stem thickness	$t_{\text{stem}} = 400 \text{ mm}$
Angle to rear face of stem	$\alpha = 90 \text{ deg}$
Stem density	$\gamma_{\text{stem}} = 25 \text{ kN/m}^3$
Toe length	$l_{\text{toe}} = 3600 \text{ mm}$
Base thickness	$t_{\text{base}} = 400 \text{ mm}$
Base density	$\gamma_{\text{base}} = 25 \text{ kN/m}^3$
Height of retained soil	$h_{\text{ret}} = 3600 \text{ mm}$
Angle of soil surface	$\beta = 0 \text{ deg}$
Depth of cover	$d_{\text{cover}} = 0 \text{ mm}$
Height of water	$h_{\text{water}} = 2600 \text{ mm}$
Water density	$\gamma_w = 9.8 \text{ kN/m}^3$

Retained soil properties

Soil type	Stiff clay
Moist density	$\gamma_{\text{mr}} = 19 \text{ kN/m}^3$
Saturated density	$\gamma_{\text{sr}} = 19 \text{ kN/m}^3$
Characteristic effective shear resistance angle	$\phi'_{r,k} = 18 \text{ deg}$
Characteristic wall friction angle	$\delta_{r,k} = 9 \text{ deg}$

Base soil properties

Soil type	Stiff clay
Soil density	$\gamma_b = 19 \text{ kN/m}^3$
Characteristic effective shear resistance angle	$\phi'_{b,k} = 18 \text{ deg}$
Characteristic wall friction angle	$\delta_{b,k} = 9 \text{ deg}$
Characteristic base friction angle	$\delta_{bb,k} = 12 \text{ deg}$
Presumed bearing capacity	$P_{\text{bearing}} = 100 \text{ kN/m}^2$

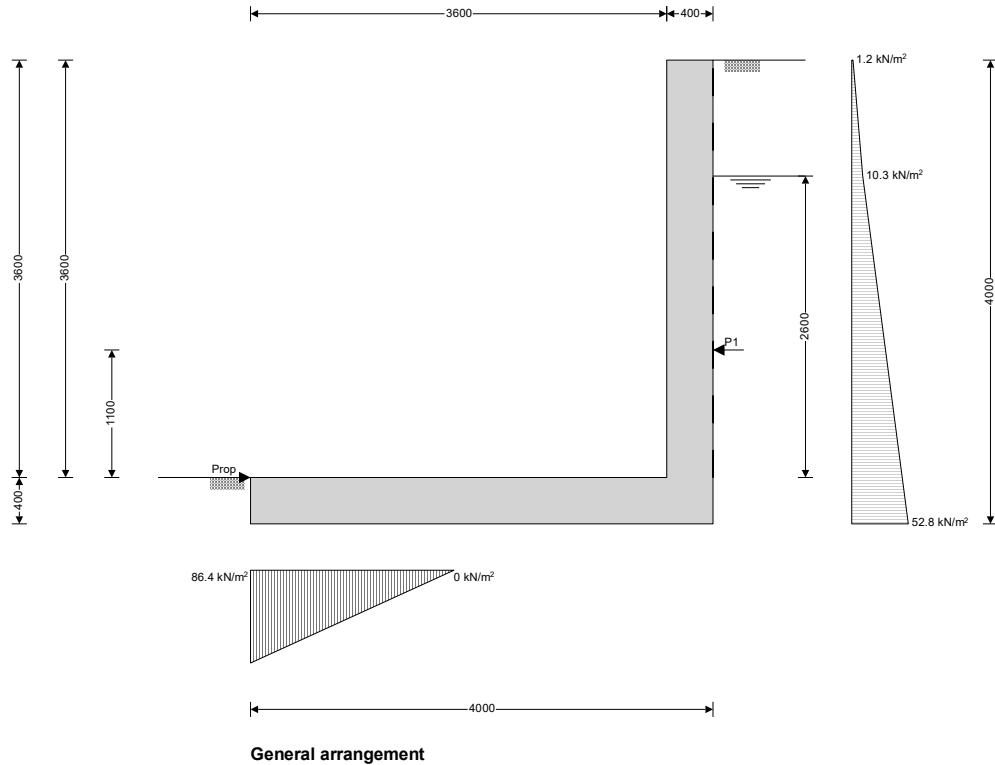
Loading details

Variable surcharge load	Surcharge _Q = 2.5 kN/m ²
Horizontal line load at 1100 mm	$P_{G1} = 28.3 \text{ kN/m}$
	$P_{Q1} = 0.3 \text{ kN/m}$

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Calcs for Cantilever Retaining Wall Design				Start page no./Revision 06	
Calcs by EW	Calcs date 18/01/2023	Checked by AB	Checked date 18/01/2023	Approved by AB	Approved date 18/01/2023

The retaining wall geometry will be as per the sketch provided on pp 04.

Note this calculation is to check the retaining wall in bending only, therefore, the base geometry and bearing check can be ignored.



Calculate retaining wall geometry

- Base length
- Saturated soil height
- Moist soil height
- Length of surcharge load
 - Distance to vertical component
- Effective height of wall
 - Distance to horizontal component
- Area of wall stem
 - Distance to vertical component
- Area of wall base
 - Distance to vertical component

$$\begin{aligned}
 l_{\text{base}} &= l_{\text{toe}} + t_{\text{stem}} = \mathbf{4000 \text{ mm}} \\
 h_{\text{sat}} &= h_{\text{water}} + d_{\text{cover}} = \mathbf{2600 \text{ mm}} \\
 h_{\text{moist}} &= h_{\text{ret}} - h_{\text{water}} = \mathbf{1000 \text{ mm}} \\
 l_{\text{sur}} &= l_{\text{heel}} = \mathbf{0 \text{ mm}} \\
 x_{\text{sur}_v} &= l_{\text{base}} - l_{\text{heel}} / 2 = \mathbf{4000 \text{ mm}} \\
 h_{\text{eff}} &= h_{\text{base}} + d_{\text{cover}} + h_{\text{ret}} = \mathbf{4000 \text{ mm}} \\
 x_{\text{sur}_h} &= h_{\text{eff}} / 2 = \mathbf{2000 \text{ mm}} \\
 A_{\text{stem}} &= h_{\text{stem}} \times t_{\text{stem}} = \mathbf{1.44 \text{ m}^2} \\
 x_{\text{stem}} &= l_{\text{toe}} + t_{\text{stem}} / 2 = \mathbf{3800 \text{ mm}} \\
 A_{\text{base}} &= l_{\text{base}} \times t_{\text{base}} = \mathbf{1.6 \text{ m}^2} \\
 x_{\text{base}} &= l_{\text{base}} / 2 = \mathbf{2000 \text{ mm}}
 \end{aligned}$$

Using Coulomb theory

- Active pressure coefficient
- Passive pressure coefficient

$$\begin{aligned}
 K_A &= \sin(\alpha + \phi'_{r,k})^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta_{r,k}) \times [1 + \sqrt{[\sin(\phi'_{r,k} + \delta_{r,k}) \times \sin(\phi'_{r,k} - \beta) / (\sin(\alpha - \delta_{r,k}) \times \sin(\alpha + \beta))]}]^2) = \mathbf{0.483} \\
 K_P &= \sin(90 - \phi'_{b,k})^2 / (\sin(90 + \delta_{b,k}) \times [1 - \sqrt{[\sin(\phi'_{b,k} + \delta_{b,k}) \times \sin(\phi'_{b,k}) / (\sin(90 + \delta_{b,k}))]}]^2) = \mathbf{2.359}
 \end{aligned}$$

Bearing pressure check

Vertical forces on wall

$$\begin{aligned}
 F_{\text{stem}} &= A_{\text{stem}} \times \gamma_{\text{stem}} = \mathbf{36 \text{ kN/m}} \\
 F_{\text{base}} &= A_{\text{base}} \times \gamma_{\text{base}} = \mathbf{40 \text{ kN/m}}
 \end{aligned}$$

Project The Cornerways, Muswell Hill, London N10 3DD				Job no. 22120	
Calcs for Cantilever Retaining Wall Design				Start page no./Revision 07	
Calcs by EW	Calcs date 18/01/2023	Checked by AB	Checked date 18/01/2023	Approved by AB	Approved date 18/01/2023

Total	$F_{total_v} = F_{stem} + F_{base} + F_{water_v} = \mathbf{76 \text{ kN/m}}$
Horizontal forces on wall	
Surcharge load	$F_{sur_h} = K_A \times \cos(\delta_{r,k}) \times \text{Surcharge}_Q \times h_{eff} = \mathbf{4.8 \text{ kN/m}}$
Line loads	$F_{P_h} = P_{G1} + P_{Q1} = \mathbf{28.6 \text{ kN/m}}$
Saturated retained soil	$F_{sat_h} = K_A \times \cos(\delta_{r,k}) \times (\gamma_{sr} - \gamma_w) \times (h_{sat} + h_{base})^2 / 2 = \mathbf{19.7 \text{ kN/m}}$
Water	$F_{water_h} = \gamma_w \times (h_{water} + d_{cover} + h_{base})^2 / 2 = \mathbf{44.1 \text{ kN/m}}$
Moist retained soil	$F_{moist_h} = K_A \times \cos(\delta_{r,k}) \times \gamma_{mr} \times ((h_{eff} - h_{sat} - h_{base})^2 / 2 + (h_{eff} - h_{sat} - h_{base}) \times (h_{sat} + h_{base})) = \mathbf{31.7 \text{ kN/m}}$
Base soil	$F_{pass_h} = -K_P \times \cos(\delta_{b,k}) \times \gamma_b \times (d_{cover} + h_{base})^2 / 2 = \mathbf{-3.5 \text{ kN/m}}$
Total	$F_{total_h} = F_{sur_h} + F_{P_h} + F_{sat_h} + F_{water_h} + F_{moist_h} + F_{pass_h} = \mathbf{125.4 \text{ kN/m}}$
Moments on wall	
Wall stem	$M_{stem} = F_{stem} \times X_{stem} = \mathbf{136.8 \text{ kNm/m}}$
Wall base	$M_{base} = F_{base} \times X_{base} = \mathbf{80 \text{ kNm/m}}$
Surcharge load	$M_{sur} = -F_{sur_h} \times X_{sur_h} = \mathbf{-9.5 \text{ kNm/m}}$
Line loads	$M_P = -(P_{G1} + P_{Q1}) \times (p_1 + t_{base}) = \mathbf{-42.9 \text{ kNm/m}}$
Saturated retained soil	$M_{sat} = -F_{sat_h} \times X_{sat_h} = \mathbf{-19.7 \text{ kNm/m}}$
Water	$M_{water} = -F_{water_h} \times X_{water_h} = \mathbf{-44.1 \text{ kNm/m}}$
Moist retained soil	$M_{moist} = -F_{moist_h} \times X_{moist_h} = \mathbf{-55.9 \text{ kNm/m}}$
Total	$M_{total} = M_{stem} + M_{base} + M_{sur} + M_P + M_{sat} + M_{water} + M_{moist} = \mathbf{44.6 \text{ kNm/m}}$
Check bearing pressure	
Propping force	$F_{prop_base} = F_{total_h} = \mathbf{125.4 \text{ kN/m}}$
Distance to reaction	$\bar{x} = M_{total} / F_{total_v} = \mathbf{587 \text{ mm}}$
Eccentricity of reaction	$e = \bar{x} - l_{base} / 2 = \mathbf{-1413 \text{ mm}}$
Loaded length of base	$l_{load} = 3 \times \bar{x} = \mathbf{1760 \text{ mm}}$
Bearing pressure at toe	$q_{toe} = 2 \times F_{total_v} / l_{load} = \mathbf{86.4 \text{ kN/m}^2}$
Bearing pressure at heel	$q_{heel} = \mathbf{0 \text{ kN/m}^2}$
Factor of safety	$FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) = \mathbf{1.158}$

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

In accordance with EN1992-1-1:2004 incorporating Corrigendum dated January 2008 and the UK National Annex incorporating National Amendment No.1

Tedds calculation version 2.9.14

Concrete details - Table 3.1 - Strength and deformation characteristics for concrete

Concrete strength class	C32/40
Characteristic compressive cylinder strength	$f_{ck} = \mathbf{32 \text{ N/mm}^2}$
Characteristic compressive cube strength	$f_{ck,cube} = \mathbf{40 \text{ N/mm}^2}$
Mean value of compressive cylinder strength	$f_{cm} = f_{ck} + 8 \text{ N/mm}^2 = \mathbf{40 \text{ N/mm}^2}$
Mean value of axial tensile strength	$f_{ctm} = 0.3 \text{ N/mm}^2 \times (f_{ck} / 1 \text{ N/mm}^2)^{2/3} = \mathbf{3.0 \text{ N/mm}^2}$
5% fractile of axial tensile strength	$f_{ctk,0.05} = 0.7 \times f_{ctm} = \mathbf{2.1 \text{ N/mm}^2}$
Secant modulus of elasticity of concrete	$E_{cm} = 22 \text{ kN/mm}^2 \times (f_{cm} / 10 \text{ N/mm}^2)^{0.3} = \mathbf{33346 \text{ N/mm}^2}$
Partial factor for concrete - Table 2.1N	$\gamma_C = \mathbf{1.50}$
Compressive strength coefficient - cl.3.1.6(1)	$\alpha_{cc} = \mathbf{0.85}$
Design compressive concrete strength - exp.3.15	$f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_C = \mathbf{18.1 \text{ N/mm}^2}$
Maximum aggregate size	$h_{agg} = \mathbf{20 \text{ mm}}$

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Calcs for Cantilever Retaining Wall Design				Start page no./Revision 08	
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Ultimate strain - Table 3.1

$$\epsilon_{cu2} = \mathbf{0.0035}$$

Shortening strain - Table 3.1

$$\epsilon_{cu3} = \mathbf{0.0035}$$

Effective compression zone height factor

$$\lambda = \mathbf{0.80}$$

Effective strength factor

$$\eta = \mathbf{1.00}$$

Bending coefficient k_1

$$K_1 = \mathbf{0.40}$$

Bending coefficient k_2

$$K_2 = 1.00 \times (0.6 + 0.0014/\epsilon_{cu2}) = \mathbf{1.00}$$

Bending coefficient k_3

$$K_3 = \mathbf{0.40}$$

Bending coefficient k_4

$$K_4 = 1.00 \times (0.6 + 0.0014/\epsilon_{cu2}) = \mathbf{1.00}$$

Reinforcement details

Characteristic yield strength of reinforcement

$$f_{yk} = \mathbf{500 \text{ N/mm}^2}$$

Modulus of elasticity of reinforcement

$$E_s = \mathbf{200000 \text{ N/mm}^2}$$

Partial factor for reinforcing steel - Table 2.1N

$$\gamma_s = \mathbf{1.15}$$

Design yield strength of reinforcement

$$f_{yd} = f_{yk} / \gamma_s = \mathbf{435 \text{ N/mm}^2}$$

Cover to reinforcement

Front face of stem

$$c_{sf} = \mathbf{40 \text{ mm}}$$

Rear face of stem

$$c_{sr} = \mathbf{50 \text{ mm}}$$

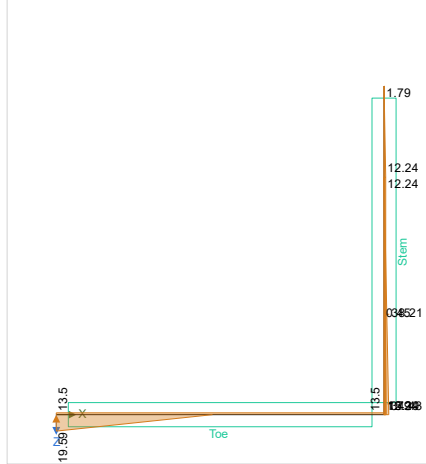
Top face of base

$$c_{bt} = \mathbf{40 \text{ mm}}$$

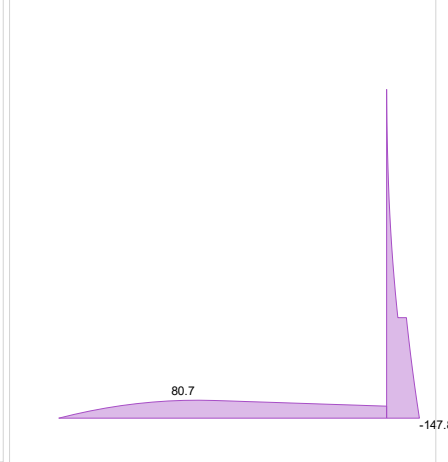
Bottom face of base

$$c_{bb} = \mathbf{75 \text{ mm}}$$

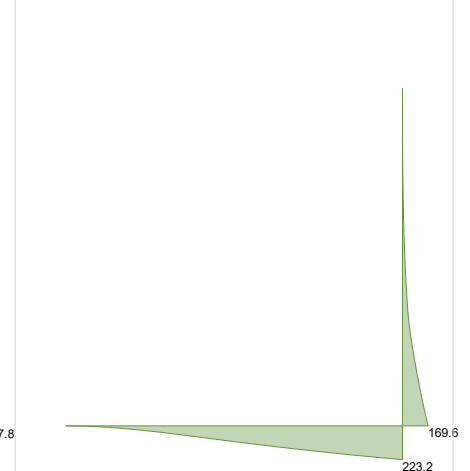
Loading details - Combination No.1 - kN/m²



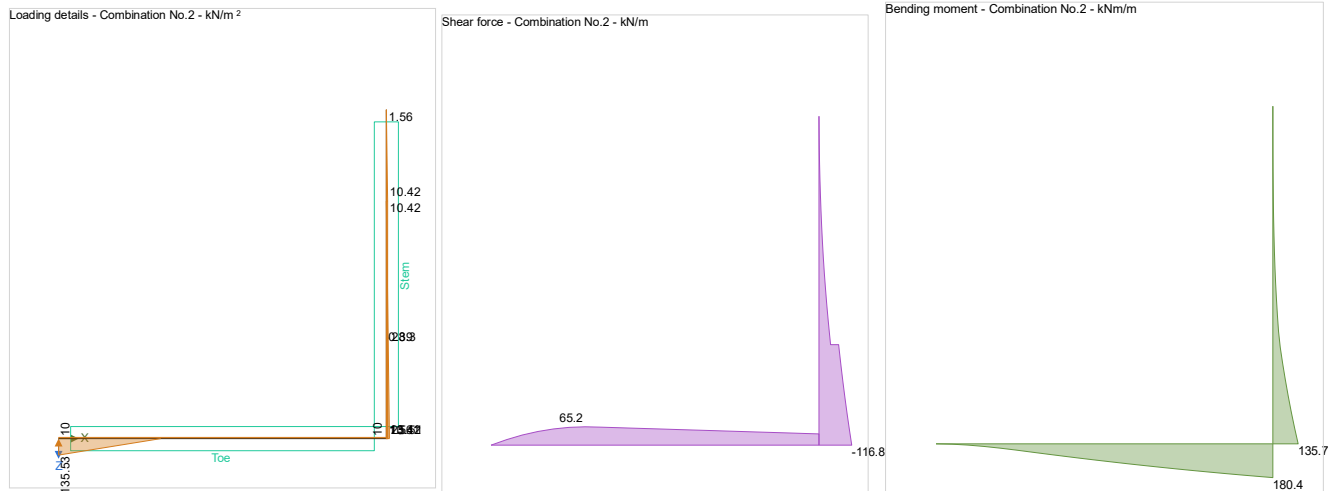
Shear force - Combination No.1 - kN/m



Bending moment - Combination No.1 - kNm/m



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Check stem design at base of stem

Depth of section

$h = 400 \text{ mm}$

Rectangular section in flexure - Section 6.1

Design bending moment combination 1

$M = 169.6 \text{ kNm/m}$

Depth to tension reinforcement

$d = h - c_{sr} - \phi_{sr} / 2 = 342 \text{ mm}$

$K = M / (d^2 \times f_{ck}) = 0.045$

$K' = (2 \times \eta \times \alpha_{cc} / \gamma_c) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times K_2))$

$K' = 0.207$

$K' > K$ - No compression reinforcement is required

Lever arm

$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_c))^{0.5}, 0.95) \times d = 325 \text{ mm}$

Depth of neutral axis

$x = 2.5 \times (d - z) = 43 \text{ mm}$

Area of tension reinforcement required

$A_{sr.req} = M / (f_{yd} \times z) = 1200 \text{ mm}^2/\text{m}$

Tension reinforcement provided

16 dia.bars @ 100 c/c

Area of tension reinforcement provided

$A_{sr.prov} = \pi \times \phi_{sr}^2 / (4 \times s_{sr}) = 2011 \text{ mm}^2/\text{m}$

Minimum area of reinforcement - exp.9.1N

$A_{sr.min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d = 538 \text{ mm}^2/\text{m}$

Maximum area of reinforcement - cl.9.2.1.1(3)

$A_{sr.max} = 0.04 \times h = 16000 \text{ mm}^2/\text{m}$

$\max(A_{sr.req}, A_{sr.min}) / A_{sr.prov} = 0.597$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Library item: Rectangular single output

Deflection control - Section 7.4

Reference reinforcement ratio

$\rho_0 = \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} / 1000 = 0.006$

Required tension reinforcement ratio

$\rho = A_{sr.req} / d = 0.004$

Required compression reinforcement ratio

$\rho' = A_{sr.2.req} / d_2 = 0.000$

Structural system factor - Table 7.4N

$K_b = 0.4$

Reinforcement factor - exp.7.17

$K_s = \min(500 \text{ N/mm}^2 / (f_{yk} \times A_{sr.req} / A_{sr.prov}), 1.5) = 1.5$

Limiting span to depth ratio - exp.7.16.a

$\min(K_s \times K_b \times [11 + 1.5 \times \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} \times \rho_0 / \rho + 3.2 \times \sqrt{(f_{ck} / 1 \text{ N/mm}^2)} \times (\rho_0 / \rho - 1)^{3/2}], 40 \times K_b) = 16$

Actual span to depth ratio

$h_{stem} / d = 10.5$

PASS - Span to depth ratio is less than deflection control limit

Rectangular section in shear - Section 6.2

Design shear force

$V = 147.8 \text{ kN/m}$

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Longitudinal reinforcement ratio

$$C_{Rd,c} = 0.18 / \gamma_C = \mathbf{0.120}$$

$$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) = \mathbf{1.765}$$

$$\rho_l = \min(A_{sr,prov} / d, 0.02) = \mathbf{0.006}$$

$$V_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = \mathbf{0.464 \text{ N/mm}^2}$$

Design shear resistance - exp.6.2a & 6.2b

$$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, V_{min}) \times d$$

$$V_{Rd,c} = \mathbf{192.6 \text{ kN/m}}$$

$$V / V_{Rd,c} = \mathbf{0.767}$$

PASS - Design shear resistance exceeds design shear force

Horizontal reinforcement parallel to face of stem - Section 9.6

Minimum area of reinforcement – cl.9.6.3(1)

$$A_{sx,req} = \max(0.25 \times A_{sr,prov}, 0.001 \times t_{stem}) = \mathbf{503 \text{ mm}^2/\text{m}}$$

Maximum spacing of reinforcement – cl.9.6.3(2)

$$s_{sx,max} = \mathbf{400 \text{ mm}}$$

Transverse reinforcement provided

$$12 \text{ dia.bars @ } 200 \text{ c/c}$$

Area of transverse reinforcement provided

$$A_{sx,prov} = \pi \times \phi_{sx}^2 / (4 \times s_{sx}) = \mathbf{565 \text{ mm}^2/\text{m}}$$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Check base design at toe

Depth of section

$$h = \mathbf{400 \text{ mm}}$$

Rectangular section in flexure - Section 6.1

Design bending moment combination 1

$$M = \mathbf{223.2 \text{ kNm/m}}$$

Depth to tension reinforcement

$$d = h - C_{bb} - \phi_{bb} / 2 = \mathbf{317 \text{ mm}}$$

$$K = M / (d^2 \times f_{ck}) = \mathbf{0.069}$$

$$K' = (2 \times \eta \times \alpha_{cc} / \gamma_C) \times (1 - \lambda \times (\delta - K_1) / (2 \times K_2)) \times (\lambda \times (\delta - K_1) / (2 \times K_2))$$

$$K' = \mathbf{0.207}$$

K' > K - No compression reinforcement is required

Lever arm

$$z = \min(0.5 + 0.5 \times (1 - 2 \times K / (\eta \times \alpha_{cc} / \gamma_C))^{0.5}, 0.95) \times d = \mathbf{296 \text{ mm}}$$

Depth of neutral axis

$$x = 2.5 \times (d - z) = \mathbf{52 \text{ mm}}$$

Area of tension reinforcement required

$$A_{bb,req} = M / (f_{yd} \times z) = \mathbf{1733 \text{ mm}^2/\text{m}}$$

Tension reinforcement provided

$$16 \text{ dia.bars @ } 100 \text{ c/c}$$

Area of tension reinforcement provided

$$A_{bb,prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb}) = \mathbf{2011 \text{ mm}^2/\text{m}}$$

Minimum area of reinforcement - exp.9.1N

$$A_{bb,min} = \max(0.26 \times f_{ctm} / f_{yk}, 0.0013) \times d = \mathbf{498 \text{ mm}^2/\text{m}}$$

Maximum area of reinforcement - cl.9.2.1.1(3)

$$A_{bb,max} = 0.04 \times h = \mathbf{16000 \text{ mm}^2/\text{m}}$$

$$\max(A_{bb,req}, A_{bb,min}) / A_{bb,prov} = \mathbf{0.862}$$

PASS - Area of reinforcement provided is greater than area of reinforcement required

Library item: Rectangular single output

Rectangular section in shear - Section 6.2

Design shear force

$$V = \mathbf{80.7 \text{ kN/m}}$$

$$C_{Rd,c} = 0.18 / \gamma_C = \mathbf{0.120}$$

$$k = \min(1 + \sqrt{(200 \text{ mm} / d)}, 2) = \mathbf{1.794}$$

Longitudinal reinforcement ratio

$$\rho_l = \min(A_{bb,prov} / d, 0.02) = \mathbf{0.006}$$

$$V_{min} = 0.035 \text{ N}^{1/2}/\text{mm} \times k^{3/2} \times f_{ck}^{0.5} = \mathbf{0.476 \text{ N/mm}^2}$$

Design shear resistance - exp.6.2a & 6.2b

$$V_{Rd,c} = \max(C_{Rd,c} \times k \times (100 \text{ N}^2/\text{mm}^4 \times \rho_l \times f_{ck})^{1/3}, V_{min}) \times d$$

$$V_{Rd,c} = \mathbf{186.2 \text{ kN/m}}$$

$$V / V_{Rd,c} = \mathbf{0.434}$$

PASS - Design shear resistance exceeds design shear force

Secondary transverse reinforcement to base - Section 9.3

Minimum area of reinforcement – cl.9.3.1.1(2)

$$A_{bx,req} = 0.2 \times A_{bb,prov} = \mathbf{402 \text{ mm}^2/\text{m}}$$

Maximum spacing of reinforcement – cl.9.3.1.1(3)

$$s_{bx,max} = \mathbf{450 \text{ mm}}$$

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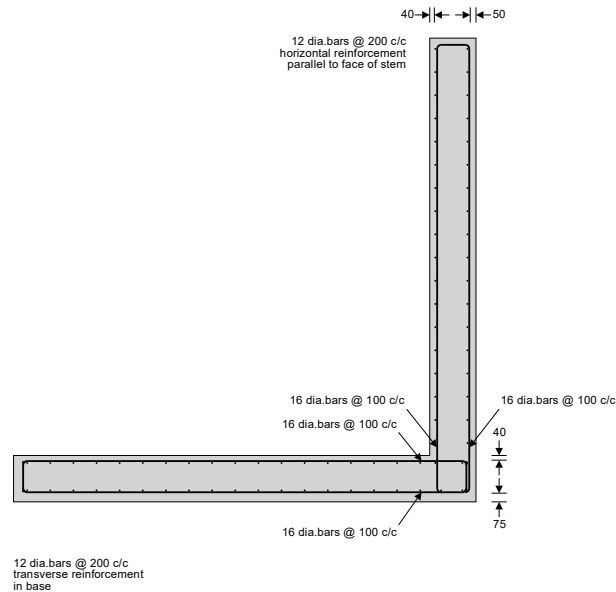
Transverse reinforcement provided

12 dia.bars @ 200 c/c

Area of transverse reinforcement provided

$A_{bx,prov} = \pi \times \phi_{bx}^2 / (4 \times s_{bx}) = 565 \text{ mm}^2/\text{m}$

PASS - Area of reinforcement provided is greater than area of reinforcement required



Reinforcement details

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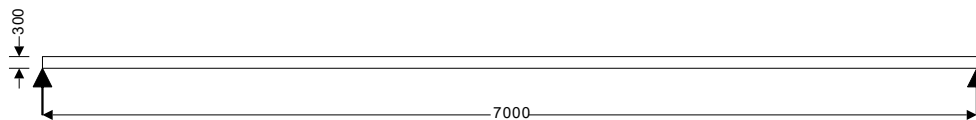
RC SLAB DESIGN

In accordance with EN1992-1-1:2004 incorporating corrigendum January 2008 and the UK national annex

Tedds calculation version 1.0.21

Design summary

Description	Unit	Provided	Required	Utilisation	Result
Support 1					
Span 1					
Tension reinf.	mm ² /m	1340	858	0.640	PASS
Tension bar spacing	mm	150	300	0.500	PASS
Allow. span-to-depth ratio		28.93	40.00	0.723	PASS
Support 2					
Cover					
Min cover bottom	mm	50	26	0.520	PASS



Slab definition

Slab reference name
Overall slab depth
Number of spans
First support
Last support

Basement Slab
h = 300 mm
N_{spans} = 1
Simple
Simple

Slab Analysis:

DL = 8.5 kN/m², LL = 1.5 kN/m² l = 7.0m
w = 14 kN/m (ULS)
M = wl² / 8 = 85.8 kNm
V = wl / 2 = 49 kN

Nominal cover to bottom reinforcement

C_{nom_b} = **50 mm**

Loading

Ratio of quasi-permanent to ultimate load

r_q = **0.300**

Concrete properties

Concrete strength class
Characteristic cylinder strength
Partial factor (Table 2.1N)
Compressive strength factor (cl. 3.1.6)
Design compressive strength (cl. 3.1.6)
Mean axial tensile strength (Table 3.1)
Maximum aggregate size

C30/37
f_{ck} = **30 N/mm²**
γ_C = **1.50**
α_{cc} = **0.85**
f_{cd} = **17.0 N/mm²**
f_{ctm} = 0.30 N/mm² × (f_{ck} / 1 N/mm²)^{2/3} = **2.9 N/mm²**
d_g = **20 mm**

Reinforcement properties

Characteristic yield strength
Partial factor (Table 2.1N)
Design yield strength (fig. 3.8)

f_{yk} = **500 N/mm²**
γ_S = **1.15**
f_{yd} = f_{yk} / γ_S = **434.8 N/mm²**

Concrete cover to reinforcement

Nominal cover to bottom reinforcement
Fire resistance period to bottom of slab
Axis distance to bottom reinf (Table 5.8)
Max bar diameter in bottom
Min. btm cover requirement with regard to bond

C_{nom_b} = **50 mm**
R_{btm} = **60 min**
a_{fi_b} = **20 mm**
φ_{max_b} = **16 mm**
C_{min,b_b} = φ_{max_b} = **16 mm**

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Reinforcement fabrication
Cover allowance for deviation
Min. required nominal cover to bottom reinf

Not subject to QA system

$$\Delta C_{dev} = 10 \text{ mm}$$

$$C_{nom_b_min} = \max(a_{fi_b} - \phi_{max_b} / 2, C_{min_b_b} + \Delta C_{dev}) = 26.0 \text{ mm}$$

PASS - There is sufficient cover to the bottom reinforcement

Bending design checks

Redistribution ratio

$$\delta = 1.0$$

Limiting value of K

$$K' = 0.598 \times \delta - 0.18 \times \delta^2 - 0.21 = 0.208$$

Reinforcement design at midspan of span 1 (cl.6.1)

Length of span 1

$$l_1 = 7000 \text{ mm}$$

Design bending moment

$$M_{p1} = 85.8 \text{ kNm/m}$$

Reinforcement provided

16 mm dia. bars at 150 mm centres

Area provided

$$A_{sp1} = 1340 \text{ mm}^2/\text{m}$$

Effective depth to tension reinforcement

$$d_{p1} = h - C_{nom_b} - \phi_{p1} / 2 = 242.0 \text{ mm}$$

K factor

$$K = M_{p1} / (b \times d_{p1}^2 \times f_{ck}) = 0.049$$

K < K' - Compression reinforcement is not required

Lever arm

$$z = \min(0.95 \times d_{p1}, d_{p1} / 2 \times (1 + \sqrt{1 - 3.53 \times K}))$$

$$z = 229.9 \text{ mm}$$

Area of reinforcement required for bending

$$A_{sp1_m} = M_{p1} / (f_{yd} \times z) = 858 \text{ mm}^2/\text{m}$$

Minimum area required

$$A_{sp1_min} = \max(0.26 \times (f_{ctm}/f_{yk}), 0.0013) \times b \times d_{p1} = 364 \text{ mm}^2/\text{m}$$

Area of reinforcement required

$$A_{sp1_req} = \max(A_{sp1_m}, A_{sp1_min}) = 858 \text{ mm}^2/\text{m}$$

PASS - Area of tension reinforcement provided is adequate (0.640)

Check reinforcement spacing

Reinforcement service stress

$$\sigma_s = (f_{yk} / \gamma_s) \times \min((A_{sp1_m}/A_{sp1}), 1.0) \times r_q = 83.5 \text{ N/mm}^2$$

Maximum allowable spacing (Table 7.3N)

$$s_{max_p1} = 300 \text{ mm}$$

Actual bar spacing

$$s_{p1} = 150 \text{ mm}$$

PASS - The reinforcement spacing is acceptable

Shear design checks

Shear resistance constant (cl. 6.2.2)

$$C_{Rd,c} = 0.18 \text{ N/mm}^2 / \gamma_c = 0.12 \text{ N/mm}^2$$

Shear capacity check at support 1

Shear force

$$V_1 = 49.0 \text{ kN/m}$$

Reinforcement provided

16 mm dia. bars at 150 mm centres

Area provided

$$A_{sd1} = 1340 \text{ mm}^2/\text{m}$$

Effective depth

$$d_{d1} = h - C_{nom_b} - \phi_{d1} / 2 = 242.0 \text{ mm}$$

Effective depth factor (cl. 6.2.2)

$$k = \min(2.0, 1 + (200 \text{ mm} / d_{d1})^{0.5}) = 1.909$$

Reinforcement ratio

$$\rho_l = \min(0.02, A_{sd1} / (b \times d_{d1})) = 0.0055$$

Minimum shear resistance (Exp. 6.3N)

$$V_{Rd,c_min} = 0.035 \text{ N/mm}^2 \times k^{1.5} \times (f_{ck} / 1 \text{ N/mm}^2)^{0.5} \times b \times d_{d1}$$

$$V_{Rd,c_min} = 122.4 \text{ kN/m}$$

Shear resistance (Exp. 6.2a)

$$V_{Rd,c1} = \max(V_{Rd,c_min}, C_{Rd,c} \times k \times (100 \times \rho_l \times (f_{ck} / 1 \text{ N/mm}^2))^{0.333} \times b \times d_{d1})$$

$$V_{Rd,c1} = 141.3 \text{ kN/m}$$

PASS - Shear capacity is adequate (0.347)

Shear capacity check at support 2

Shear force

$$V_2 = 49.0 \text{ kN/m}$$

Reinforcement provided

16 mm dia. bars at 150 mm centres

Area provided

$$A_{sd2} = 1340 \text{ mm}^2/\text{m}$$

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Effective depth	$d_{d2} = h - c_{nom_b} - \phi_{d2} / 2 = \mathbf{242.0 \text{ mm}}$
Effective depth factor (cl. 6.2.2)	$k = \min(2.0, 1 + (200 \text{ mm} / d_{d2})^{0.5}) = \mathbf{1.909}$
Reinforcement ratio	$\rho_l = \min(0.02, A_{sd2} / (b \times d_{d2})) = \mathbf{0.0055}$
Minimum shear resistance (Exp. 6.3N)	$V_{Rd,c_min} = 0.035 \text{ N/mm}^2 \times k^{1.5} \times (f_{ck} / 1 \text{ N/mm}^2)^{0.5} \times b \times d_{d2}$ $V_{Rd,c_min} = \mathbf{122.4 \text{ kN/m}}$
Shear resistance (Exp. 6.2a)	$V_{Rd,c2} = \max(V_{Rd,c_min}, C_{Rd,c} \times k \times (100 \times \rho_l \times (f_{ck} / 1 \text{ N/mm}^2))^{0.333} \times b \times d_{d2})$ $V_{Rd,c2} = \mathbf{141.3 \text{ kN/m}}$
PASS - Shear capacity is adequate (0.347)	

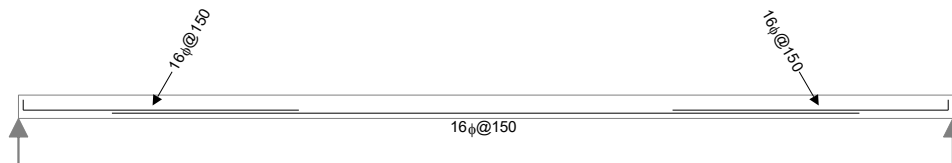
Deflection checks

Basic span-to-depth ratio deflection check span 1 (cl. 7.4.2)

Reference reinforcement ratio	$\rho_0 = (f_{ck} / 1 \text{ N/mm}^2)^{0.5} / 1000 = \mathbf{0.0055}$
Required tension reinforcement ratio	$\rho = \max(0.0035, A_{sp1_m} / (b \times d_{p1})) = \mathbf{0.0035}$
Required compression reinforcement ratio	$\rho' = A_{scp1_req} / (b \times d_{p1}) = \mathbf{0.0000}$
Structural system factor (Table 7.4N)	$K_\delta = \mathbf{1.0}$
Basic span-to-depth ratio limit (Exp. 7.16a)	$ratio_{lim1_bas} = K_\delta \times [11 + 1.5 \times (f_{ck} / 1 \text{ N/mm}^2)^{0.5} \times \rho_0 / \rho + 3.2 \times (f_{ck} / 1 \text{ N/mm}^2)^{0.5} \times (\rho_0 / \rho - 1)^{1.5}]$ $ratio_{lim1_bas} = \mathbf{30.72}$
Modified span-to-depth ratio limit	$ratio_{lim1} = \min(40 \times K_\delta, \min(1.5, (500 \text{ N/mm}^2 / f_{yk}) \times (A_{sp1} / A_{sp1_m})) \times ratio_{lim1_bas}) = \mathbf{40.00}$
Actual span-to-depth ratio	$ratio_{act1} = l_1 / d_{p1} = \mathbf{28.93}$
PASS - Span-to-depth ratio is acceptable (0.723)	

Reinforcement sketch

The following sketch is indicative only. Note that additional reinforcement may be required in accordance with clauses 9.2.1.2, 9.2.1.4 and 9.2.1.5 of EN 1992-1-1:2004 to meet detailing rules.



CONTINUE THE CONVERSATION

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APPENDIX C

GEOTECHNICAL REPORT

MINI • SOIL • SURVEYS



Minisoils Ltd 6, Ridgeway Road, Timperley, Cheshire, WA15 7EY

0161 980 0044

BASIC REPORT
ON
GROUND INVESTIGATION
AT
CORNERWAYS,
ELLINGTON ROAD, LONDON, N10 3DD.

MSS REF: LON 02175/ MIN 1680/C

DATE: 20/04/2018

CORNERWAYS,
ELLINGTON ROAD, LONDON, N10 3DD.

1.0 INTRODUCTION

This report has been commissioned by Fairbrook Projects Ltd who is seeking a basic ground investigation and report regarding the build of a single storey extension with a sub-floor basement to the Southern part of the site.

2.0 SCOPE

The report is based solely on the findings from 1No borehole, the Driller's site report and laboratory tests on retrieved samples.

Details of the borehole and a key plan showing its approximate locations are appended together with the results of the laboratory tests.

Responsibility cannot be accepted for changes in strata away from or below the borehole. It is also assumed that all other aspects relating to foundations such as contamination from previous use, drainage, mining, underground services, slope stability etc (except where specifically referred to in this report) have been, or will be, investigated by others and will not prove detrimental to the recommendations given herein.

This is a basic ground investigation and report and must not be construed to be a full site investigation.

3.0 FINDINGS

3.1 Borehole

The borehole revealed approximately 0.3m of MADE GROUND overlying CLAY.

The MADE GROUND comprised 30mm of tarmac on 150mm concrete slab overlying soft brown clay with occasional gravel of flint and brick fragments.

At 0.3m, soft brown CLAY becoming firm from 1.5m and then stiff from 3.0m continued to be sampled to 6.0m below ground level. At 6.0m, the borehole was converted to probing using a Super Heavy Dynamic Probe (SHDP) equipment to BS1377 to 9.0m below ground level.

Probing indicates that the ground material steadily becomes more resistant with depth. The borehole was terminated at 9.0m below ground level after 22 standard blows were required for the final 100mm penetration.

Based upon the online geology map information at this location, the ground to the depth of the borehole is almost certainly to be London clay.

No water was encountered, and no standing water recorded twenty minutes after completion of borehole.

3.2 Driller's Report.

The Driller confirms that the site is located at Cornerways, Ellington Road, London.

The site area significantly slopes down from the North towards the South where there are some trees and shrubs within close proximity of the site.

There is nothing in the report to raise concerns about the overall stability of the site or possible sources of contamination of the subsoil.

3.3 Laboratory Tests.

5No samples of the clay was taken from the borehole and tested for plasticity indices and moisture content.

Borehole	Sample Depth	Moisture Content %	Plasticity Index %	Passing .425mm %	Liquid Limit %
BH1	1.6 – 2.2m	37	41	100	70
BH1	2.2 – 2.8m	35	49	100	81
BH1	2.8 – 3.4m	34	51	100	84
BH1	4.0 – 4.6m	34	50	100	83
BH1	4.6 – 5.2m	35	45	100	76

The results indicate that the clay is of HIGH volume change potential as defined in NHBC Chapter 4.2 Building Near Trees. The clay is significantly desiccated to depth.

4.0 DISCUSSION AND RECOMMENDATIONS.

The proposed building is to include a basement which would appear that its formation level would be approximately 4.5m below the ground level at the location of where the borehole was drilled. The clay at this depth is stiff brown clay capable of supporting a safe ground bearing pressure of 175kN/m². However, the clay is of High Volume Change Potential and is significantly desiccated at this depth and below to at least 5.2m below ground level.

The location of where the proposed building is to be constructed is close by to the corner of the highway on two of its adjacent sides. The surrounding street level is approximately 1.0m – 1.5m lower than the general sloping site levels. With the amount of shrubs and trees throughout this site area, it would be expected that the London clay is desiccated to its upper levels. Since the clay is desiccated to depth, caution in the design of the basement foundations and retaining walls must be made when designing the structure to allow for clay heave if the clay regains moisture.

The Basement Impact Statement has already pre-empted the proven ground conditions and has identified the potential risk for natural swelling of the clay following the excavation and clay heave to its proposed base and surrounding walls. The design parameters to be designed by the engineer are not known to the writer and are therefore beyond the brief of this investigation.

It is understood that the site development area is to be piled with contiguous retaining piles to provide a safe excavation area. Probing of the ground material between 6.0m to 9.0m below the driller's borehole site level indicates that stiff clay is expected to be present and it is reasonable to expect that stiff clay would be found beyond the end of the borehole that could provide sufficient anchorage for the retaining piles. However without factual information beyond the depth of the borehole, this is unproven.

It is proposed to plant new trees and shrubs to the South and East of the proposed building. No information is available as to the species of these trees.

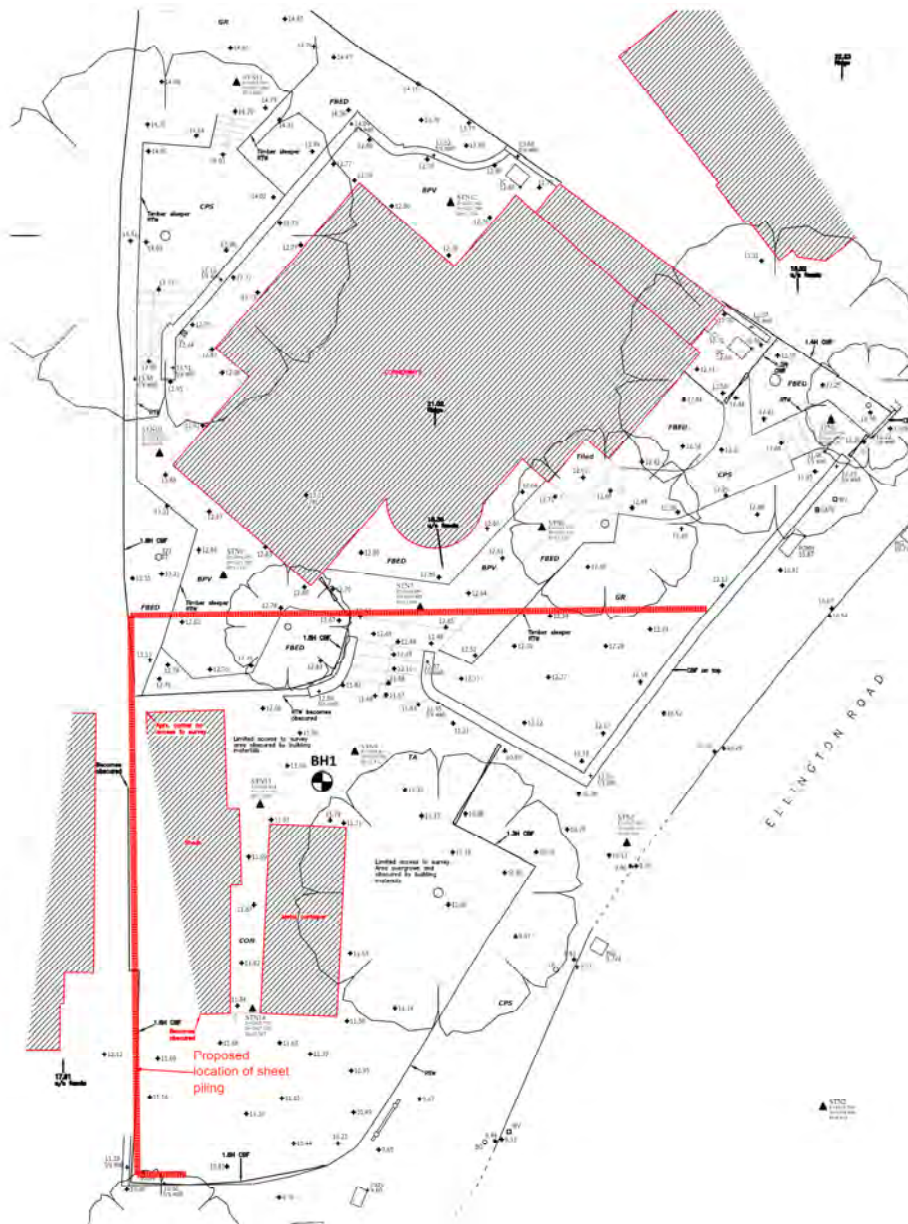
It is recommended that the designer should make reference to the NHBC Chapter 4.2 Building Near Trees as these new trees will be within influential distance of the structure's new foundations based upon the clay being of a High VCP and the trees mature water demand.

If, during construction, the ground conditions vary noticeably from those described in this report, Mini Soil Surveys (London) Ltd are to be informed immediately.

**MiniSoils Ltd.
6 Ridgeway Road
Timperley
WA15 7EY**

Date: 20/04/2018

Tel: 01622 675 755
Fax: 01622 675 755



JOB No: LON02175 SITE: CORNRWAYS, ELLINGTON ROAD, LONDON, N10 3DD

Not to Scale: Diagrammatic only. All dimensions are in metres unless otherwise noted. BH = Borehole TP = Trial Pit



Mini Soil Surveys (London) Ltd, 96 South Park Road, Maidstone, Kent, ME15 7AW

Job Number: LON02175

Borehole No: 1 of 1

Site: Cornerways, Ellington Road, London, N10 3DD

Crew: G&D

Tel: 01622 675755

Fax: 01622 675755

Date Drilled: 27/03/2018

Description	Depth	Leg	Test Depth	Type	Value
30mm tarmac on 150mm concrete slab overlying soft brown clay with occasional gravel of flint and brick fragments MADE GROUND			0.10	DS	
Soft brown CLAY becoming firm from 1.5m	0.3		1.00	DS	
			1.20	SPT	N=5
			1.60	DS	
			1.80	SPT	N=11
			2.20	DS	
			2.40	SPT	N=14
			2.80	DS	
Stiff brown CLAY	3.0		3.00	SPT	N=15
			3.40	DS	
			3.60	SPT	N=14
			4.00	DS	
			4.20	SPT	N=18
			4.60	DS	
			4.80	SPT	N=17
			5.20	DS	
			5.40	SPT	N=21
Super Heavy Dynamic Probing to BS1377, see attached sheet for results	6.0				
End of Hole	9.0				

SPT @ 1.2m 1,1/1,1,1,2 SPT @ 1.8m 2,2/2,3,3,3 SPT @ 2.4m 3,2/3,3,4,4
 SPT @ 3.0m 4,4/4,3,4,4 SPT @ 3.6m 3,2/3,4,3,4 SPT @ 4.2m 4,4/4,4,5,5
 SPT @ 4.8m 4,4/4,4,5,4 SPT @ 5.4m 5,5/5,5,5,6
 Disturbed samples taken from 0.1-0.6m, 1.0-1.6m, 1.6-2.2m, 2.2-2.8m,
 2.8-3.4m, 3.4-4.0m, 4.0-4.6m, 4.6-5.2m and 5.2-5.8m
 No water encountered during drilling and on completion of the borehole



DYNAMIC CONE PENETROMETER TEST

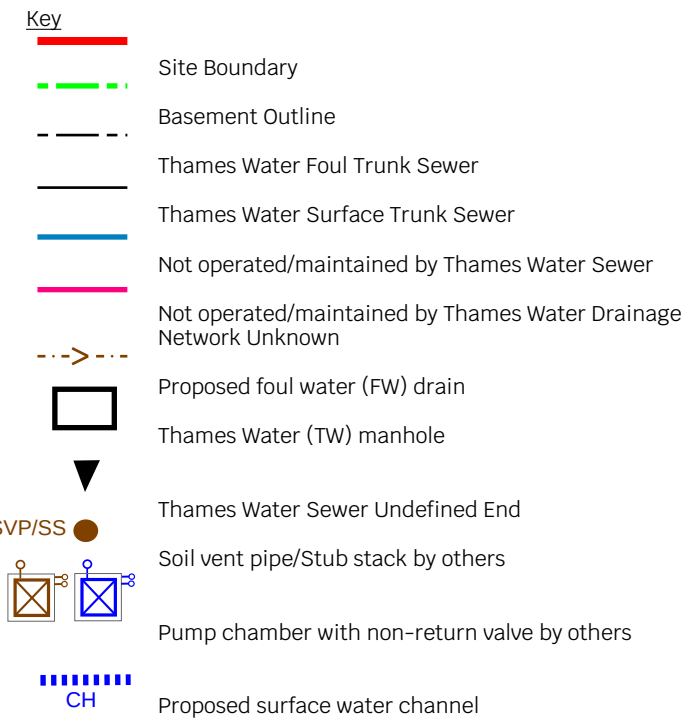
MSS	London	Weight: 65 kg	
		Fall: 760mm	
Job No.	LON02175	Diameter: 50mm cone end	
SITE:	Cornerways, Ellington Road, London, N10 3DD	CREW:	G&D
Probe No.	1 of BH1	Date:	27/03/2018

Depth	Blows					Comments
0.5 - 1.0						
1.0 - 1.5						
1.5 - 2.0						
2.0 - 2.5						
2.5 - 3.0						
3.0 - 3.5						
3.5 - 4.0						
4.0 - 4.5						
4.5 - 5.0						
5.0 - 5.5						
5.5 - 6.0						
6.0 - 6.5	7	7	8	8	9	
6.5 - 7.0	9	10	10	10	10	
7.0 - 7.5	11	11	11	12	12	
7.5 - 8.0	13	12	13	14	14	
8.0 - 8.5	15	15	16	17	17	
8.5 - 9.0	18	18	20	20	22	
9.0 - 9.5						
9.5 - 10.0						
10.0 - 10.5						
10.5 - 11.0						
11.0 - 11.5						
11.5 - 12.0						
12.0 - 12.5						

Bottom: 9.0m

APPENDIX D

DRAINAGE STRATEGY SKETCHES



1. This sketch is based on the architectural layout, drawing no 2236-PL-0200 by Wolff Architects, dated 23/11/2022, received by Symmetrys on 01/02/2023.
2. This sketch is subject to planning approval and is pending a CCTV survey.
3. A Build Over Agreement with Thames Water is required.
4. Thames Water confirmation of sufficient capacity was obtained but design is pending S106 approval.
5. Levels quoted in metres Ordnance Newlyn Datum.
6. Subject to detailed design.

1. Above ground drainage points shown indicatively and to be confirmed by MEP.
2. Drainage points to be collected via gravity then pumped to ground floor.
3. Pump emergency storage to be designed by Specialist.
4. Waterproofing to be designed by Specialist.



22120-SYM-XX-XX-SK-C-0002-REV P2
Outline Drainage Strategy - Lower
Ground Floor
The Cornerways, N10 3DD
By: SR/YP
02/02/2023
1:100 @ A3

APPENDIX E

THAMES WATER PRE-PLANNING ENQUIRY

LETTER



Miss Stefany Rojas

Symmetrys Ltd
6 The Courtyard,
Lynton Road,
Hornsey,
N8 8SL



12 October 2022

Pre-planning enquiry: Confirmation of sufficient capacity

Site: The Cornerways, Ellington Road, Muswell Hill, London, N10 3DD

Dear Stefany,

Thank you for providing information on your development.

Drainage Strategy

Proposed site: Housing (1 unit).

Proposed foul water discharge by gravity into manhole TQ28896103.

Proposed surface water discharge at 0.9 l/s for all storm events up to and including 1:100yr+40%CC into manhole TQ28896104.

We have completed the assessment of the foul water flows and surface water flows based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in our network to serve foul flows from your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.



The disposal hierarchy being:

1. rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. rainwater infiltration to ground at or close to source
3. rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. rainwater discharge direct to a watercourse (unless not appropriate)
5. controlled rainwater discharge to a surface water sewer or drain
6. controlled rainwater discharge to a combined sewer

Where connection to the public sewerage network is still required to manage surface water flows, we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to 0.9 l/s, then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

What happens next?

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you have any further questions, please contact me on 07747647155.

Kind Regards,

Zaid Kazi

Developer Services – Project Engineer, Major Projects

zaid.kazi@thameswater.co.uk

Get advice on making your sewer connection correctly at connectright.org.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB

Find us online at developers.thameswater.co.uk

APPENDIX F

GREENFIELD RATES CALCULATION

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Stefany Rojas

Site name: 22120 The Cornerways

Site location: Ellington Road, Muswell Hill, London, N10 3PD

This is an estimation of greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude: 51.58645° N

Longitude: 0.14413° W

Reference: 2149864685

Date: Aug 18 2022 16:50

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

Default Edited

SOIL type: 4 4

HOST class: N/A N/A

SPR/SPRHOST: 0.47 0.47

Hydrological characteristics

Default Edited

SAAR (mm): 671 671

Hydrological region: 6 6

Growth curve factor 1 year: 0.85 0.85

Growth curve factor 30 years: 2.3 2.3

Growth curve factor 100 years: 3.19 3.19

Growth curve factor 200 years: 3.74 3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default Edited

Q_{BAR} (l/s): 0.46 0.46

1 in 1 year (l/s): 0.39 0.39

1 in 30 years (l/s): 1.06 1.06

1 in 100 year (l/s): 1.47 1.47

1 in 200 years (l/s): 1.72 1.72

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX G

MICRODRAINAGE CALCULATIONS

Symmetrys Limited		Page 1
Unit 6, The Courtyard Lynton Road, Crouch End London, N8 8SL	22120 The Cornerways Muswell Hill, N10 3DD Planning	
Date 30/08/2022	Designed by SR	
File 22120 The Cornerways Re...	Checked by YP	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.437	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	1.000	0.100	10.0	0.010	2.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	1.000	0.100	10.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	2.01	9.570	0.010	0.0	0.0	0.0	2.46	19.3	1.4
1.001	50.00	2.01	9.470	0.010	0.0	0.0	0.0	2.46	19.3	1.4

Symmetrys Limited		Page 2
Unit 6, The Courtyard Lynton Road, Crouch End London, N8 8SL	22120 The Cornerways Muswell Hill, N10 3DD Planning	
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Innovyze	Network 2020.1.3	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.010	0.010	0.010

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	30
Ratio R	0.437		

Symmetrys Limited		Page 3
Unit 6, The Courtyard Lynton Road, Crouch End London, N8 8SL	22120 The Cornerways Muswell Hill, N10 3DD Planning	
Date 30/08/2022	Designed by SR	
File 22120 The Cornerways Re...	Checked by YP	
Innovyze	Network 2020.1.3	
Online Controls for Storm Orifice Manhole: 2, DS/PN: 1.001, Volume (m³): 0.6 Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 9.470		
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Symmetrys Limited		Page 4																								
Unit 6, The Courtyard Lynton Road, Crouch End London, N8 8SL	22120 The Cornerways Muswell Hill, N10 3DD Planning																									
Date 30/08/2022	Designed by SR																									
File 22120 The Cornerways Re...	Checked by YP																									
Innovyze	Network 2020.1.3																									
Storage Structures for Storm Porous Car Park Manhole: 1, DS/PN: 1.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>2.1</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>4.2</td></tr><tr><td>Max Percolation (l/s)</td><td>2.5</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.95</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>9.570</td><td>Membrane Depth (mm)</td><td>130</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	2.1	Membrane Percolation (mm/hr)	1000	Length (m)	4.2	Max Percolation (l/s)	2.5	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.95	Evaporation (mm/day)	3	Invert Level (m)	9.570	Membrane Depth (mm)	130
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	2.1																							
Membrane Percolation (mm/hr)	1000	Length (m)	4.2																							
Max Percolation (l/s)	2.5	Slope (1:X)	0.0																							
Safety Factor	2.0	Depression Storage (mm)	5																							
Porosity	0.95	Evaporation (mm/day)	3																							
Invert Level (m)	9.570	Membrane Depth (mm)	130																							
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Date 30/08/2022	Designed by SR	
File 22120 The Cornerways Re...	Checked by YP	
Innovyze	Network 2020.1.3	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 21.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 60, 360
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

			Water Surcharged Flooded					
PN	US/MH Name	Event	US/CL (m)	Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)
1.000	1	15 minute 1 year Winter I+0%	10.000	9.605	-0.065	0.000	0.14	
1.001	2	15 minute 1 year Winter I+0%	10.000	9.605	0.035	0.000	0.06	

			Half Drain Pipe			
PN	US/MH Name	Maximum Vol (m ³)	Discharge Vol (m ³)	Time (mins)	Pipe Flow (l/s)	Status
1.000	1	0.296	0.661	10	1.3	OK
1.001	2	0.148	0.659		0.5	SURCHARGED

Symmetrys Limited				Page 7			
Unit 6, The Courtyard Lynton Road, Crouch End London, N8 8SL			22120 The Cornerways Muswell Hill, N10 3DD Planning				
Date 30/08/2022			Designed by SR				
File 22120 The Cornerways Re...			Checked by YP				
Innovyze			Network 2020.1.3				
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>							
Simulation Criteria							
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000							
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000							
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800							
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000							
Foul Sewage per hectare (l/s) 0.000							
Number of Input Hydrographs 0 Number of Storage Structures 1							
Number of Online Controls 1 Number of Time/Area Diagrams 0							
Number of Offline Controls 0 Number of Real Time Controls 0							
Synthetic Rainfall Details							
Rainfall Model FSR Ratio R 0.439							
Region England and Wales Cv (Summer) 0.750							
M5-60 (mm) 21.000 Cv (Winter) 0.840							
Margin for Flood Risk Warning (mm) 300.0							
Analysis Timestep 2.5 Second Increment (Extended)							
DTS Status OFF							
DVD Status ON							
Inertia Status ON							
Profile(s) Summer and Winter							
Duration(s) (mins) 15, 60, 360							
Return Period(s) (years) 1, 30, 100							
Climate Change (%) 0, 0, 40							
Water Surcharged Flooded							
PN	US/MH Name	Event	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.
1.000	1	60 minute 100 year Winter I+40%	10.000	9.859	0.189	0.000	0.12
1.001	2	60 minute 100 year Winter I+40%	10.000	9.858	0.288	0.000	0.10
Half Drain Pipe							
PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Time (mins)	Pipe Flow (l/s)	Status
1.000	1		2.445	4.669	43	1.0	FLOOD RISK
1.001	2		0.435	4.521		0.9	FLOOD RISK
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OR EMAIL US AT [INFO@SYMMETRYS.COM](mailto:info@symmetrys.com)**

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