SuDS Drainage Report

Site 1 Ardwick Road
London
NW2 2BX

Client Green Structural Engineers
Date 11th May 2015
Our Ref CDL/5217A

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REPORT CONTENTS

TABLES

1.0 INTRODUCTION

1.1. Purpose of This Report

The purpose of this report is to assess the potential for disposing of surface water from proposed development at 1 Ardwick Road London NW2 2BX (the Site) through a sustainable drainage system (SuDS).

It is a preliminary SuDS assessment and complies with the principles of SuDS presented in the Draft National Standards for Sustainable Drainage Systems (DEFRA, 2011) and the London Plan supplementary planning policy guidance (Mayor of London, 2014). A surface water drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The drainage potential has been used to suggest initial design considerations for a potential soakaway. Drainage on the Site has been assessed by considering the following key constraints:

1. Topography of the Site
2. Local water features and the hydrological context
3. Underlying geology, soil types and permeability
4. Layout and geometry of the proposed development

1.2. What are SuDS

A sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS can also significantly improve the quality of water leaving the Site and can enhance the amenity and biodiversity that a site has to offer.

There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. When considering these options the destination of the run off should be considered using the order of preference outlined DEFRA's Draft National Standards for SuDS (2011) and in the London Plan supplementary guidance (2014):

1. Discharge to the ground
2. Discharge to a surface water body
3. Discharge to a surface water sewer
4. Discharge to a local highway drain
5. Discharge to a combined sewer

Guidance suggests that where possible there should be no discharge to surface water or sewer that results from the first 5 mm of rainfall.

A glossary of the terms used in SuDS schemes is provided in Appendix 1.

2.0 THE PROPOSED DEVELOPMENT

2.1 Proposed development

It is proposed to refurbish and extend an existing residential building (the Site) by developing the present basement into lower ground floor accommodation, adding a small extension to the south and excavating ground to create lightwells for the new lower ground area. The southern, single-storey extension is proposed to be covered by a green roof. A summary of the current and proposed status of the Site is presented in Table 2.1.

Table 2.1 Summary of the existing and proposed development

	Existing	Proposed
Development	3-storey semi-detached house with basement garage and utility room	Extended 4-storey semi-detached house.
Land cover	Residential dwelling and surrounding garden	Residential dwelling and surrounding garden
Site area	502 m^2	502 m^2
Roof area	190 m^2	235 m^2 (Increase of 45 m^2)
Impermeable positively drained areas	14 m^2	0

2.2 Site Information

Basic information relating to the Site is outlined in the following table:

Site name	1 Ardwick Road, London
National Grid Reference	TQ 2510 8587
Nearest postcode	NW2 2BX
Approximate site area	502 m^2
Approximate Elevation	90 m AOD
General setting	Residential
Landform	Hampstead Heath rises to 134 m AOD in the north east but the Site is near the crest of a low hill which forms a local topographic high. The land slopes away to the south and south west and is separated from higher ground to the north east by a shallow valley
Proximity to local highway	Nearby roads will be drained to sewer. This Site is not in proximity to local highway filtration trenches.

Sewer network	Sewered, but not confirmed if separate or combined. Probably via combined sewer to Beckton via Middle Level No 2 interceptor sewer. The Site is not in a critical drainage area.
Proximity to nature conservation areas	There are no nature conservation areas in the immediate vicinity of the Site.

Additional information relating to the current and proposed development can be found in the site plans in Appendix 2.

2.3 Geology, hydrogeology and hydrology of the Site

The main geological, hydrogeological and hydrological characteristics of the Site are summarised in Table 2.2. The underlying bedrock is predominately clay but with local fine sand bands, particularly in the lower strata where this site is located. The local soils are mapped as imperfectly draining but the site is close to a boundary with well-drained soils. A site test would be required to properly assess the ability of the ground to absorb infiltration.

The site is not in a groundwater source protection zone nor subject to dissolution risk so there are no impediments to infiltration if found to be technically feasible.

The Site is in an area of low fluvial flood risk and no other sources of flooding have been identified.

Table 2.2 Geology, hydrogeology and hydrology.

Characteristics	**Description**
Geology *Sources:* *BGS (2015)* *Cranfield Soil and Agrifood Institute (2015)*	Bedrock: The site is underlain by the Claygate Member of the London Clay formation, comprising Clay, Silt And Sand. Superficial deposits: There are no superficial deposits indicated on the BGS geology map underlying or in the vicinity of the Site. Soils: Freely draining slightly acid loamy soils with unimpeded drainage, but very close to mapped slowly permeable and seasonally wet soils, with impeded drainage. A site survey would be required to determine the local soil characteristics. Made Ground: Readily available geological data does not provide indication of Made Ground at the Site. However, made ground has been identified immediately next to the property (Chelmer, 2015). Contaminated land: The Site is located in an urban area and we are not aware of any historical industrial land use. Further investigation would be required to confirm this. The client has not provided information to suggest the potential for contamination at the Site from past land uses. Ground stability: Dissolution, sand liquefaction and landslides could be enhanced by SuDS infiltration and lead to unstable ground. Dissolution risk is low since the Site does not appear to be directly underlain by chalk or other soluble rocks. Sand liquefaction risk is low since the Site is not located on unconsolidated superficial sand deposits. Landslide risk is low since there are no records of landslides close to the Site according to BGS.
Hydrogeology	Aquifers:

Characteristics	Description
Sources: EA (2014) *BGS (2014)*	Source Protection Zone (SPZ): The Site is not located within a Source Protection Zone. Source Protection Zones have been defined by the Environment Agency around major public water supplies with the intent to show the risk of contamination from any activities that might cause pollution in the area. Three zones are defined: SPZ 1 is the Inner Zone (highest risk); SPZ 2 is the Outer Zone (average risk); SPZ 3 is the Total Catchment (least risk). Groundwater Levels (GWLs): Site Investigations (Chelmer, 2015) have indicated no groundwater visible to 6.0 m BGL. A borehole at 378 Finchley Road (approximately 200 m north of the Site at TQ 25120,86140) recorded groundwater at 2.03 m below ground level. Groundwater levels below the Site will dictate whether infiltration SuDS will be feasible. A minimum of 1 m separation between the base of the soakaway and the winter water table is recommended (CIRIA, 2007).
Hydrology *Source: Ordnance Survey (2014)* *Environment Agency (2014)*	Rainfall: Standard Annual Average Rainfall is 650 mm and M5 2day rainfall is 50 mm. Mean Annual Flood: is 0.2l/s, estimated from IH124 Surface water drainage network: There are no mapped surface watercourses in the vicinity Fluvial flood risk: There are no mapped areas susceptible to river and tidal flooding in the vicinity and the Site appears to be in a low flood risk zone (Flood Zone 1). Surface water flood risk: The site is not mapped as being susceptible to surface water flooding, and to be expected from its position on locally high ground. Runoff generated at the Site may pose a risk to downstream receptors if the runoff is not managed. Other flood risk: there are no other identified sources of flood risk in the area.

3.0 SITE RUN OFF

3.1 Source Control

Source control SuDS limit the volume and rate of runoff at the source, ie the impermeable surface giving rise to runoff. Source control measures include green roofs, rain gardens and disconnecting roof downpipes from drainage systems.

There is some scope for source control at the Site. It is proposed to create a green roof for the single storey extension to the South, and this will reduce runoff volume, prevent runoff from many small rainfall events and increase local biodiversity.

Other options include not providing positive drainage for paths, patios and surrounding hardstanding areas, replacing these with permeable materials, creating a raingarden in the garden area to the south of the property and disconnecting some rainwater downpipes from the drainage network, where suitable ground is appropriate to directly receive small volumes of runoff.

3.2 External runoff destinations

Possible receptors for run-off generated onsite have been assessed in line with the prioritisation set onsite out in the Draft National Standards (Defra, 2011) and the London Plan (2014). Table 3.1 summarises the possible destination of run-off generation.

Table 3.1 Potential discharge routes

Run-off Destination	Assessment
Discharge to the ground	Infiltration might be feasible but capacity limited due to relatively low impermeability soils. However, the Site is close to soils which have a much higher rate of infiltration and a site soakage test is required to fully establish the rate at which water can be infiltrated. The groundwater table is likely to be sufficiently low to enable a soakaway to properly function.
Discharge to surface water body	Not feasible - there are no nearby surface waters available for discharge.
Discharge to surface water sewer	It is not thought likely that a surface water sewer is available, but this should be confirmed with Thames Water.
Discharge to Local Highway drain	This is unlikely to be acceptable where other options are viable, but in any case is likely to drain to a combined sewer in this area.
Discharge to Combined sewer	It is probable that the property is currently drained to combined sewer. Continued discharge is likely to be acceptable, but any increase would be resisted. Discharge would have to be controlled and onsite attenuation would be required.

4.0 POTENTIAL SUSTAINABLE DRAINAGE OPTIONS

The aim of the SuDS solution at the Site is to provide for the increase in impermeable area without increasing direct runoff to the drainage system and, if possible, reduce the current rates and volumes of discharge from the existing site.

4.1 Source Control and Infiltration

The most desirable solution is source control and infiltration of runoff. The property is close to the Site boundary on the eastern side (adjacent to Fortune Green Road) and there is an adjoining property on the western side, so there are no feasible infiltration options in those two directions.

To the north of the property is a small garden area, though much of this is to be occupied by a lightwell for the lower ground floor windows, and a garden area to the south. Although it may be possible to infiltrate incident water to the north, this area is too restricted to site a soakaway, which would have to be at least 5 metres beyond the building to comply with Building Regulations.

The garden area to the south of the property is thus the only part of the site where infiltration may be possible. Infiltration may be possible in this garden area, though soakage tests will be required to assess the ability of this area to infiltrate water. The underlying geology suggests it is possible that the capacity for infiltration will be limited but this may be managed by provision of storage and ensuring the inflow of water to a soakaway is matches the infiltration capacity.

According to the guidance in BRE Digest 365 a soakaway design must be able to discharge 50% of the run-off generated during a storm event within 24 hours in readiness for subsequent storm flow. This is the basic threshold criteria for a soakaway design and the internal surface area of the proposed soakaway design options should be calculated on this basis by taking into account the soil infiltration rate for the Site.

Consideration could also be given to incorporating a storage tank between the drained areas and the soakaway to enable water re-use within the garden area, and a raingarden (an open, planted infiltration area) could also be incorporated to increase the infiltration area and provide a pleasing feature.

4.2 Drainage of Roof Areas

The roof area is to be increased from 190 m^2 to 235 m^2, an increase of 45 m^2. Of this increase most (42.75 m^2) will be a flat roof extension on the southern side of the building, which will feature a green roof.

The green roof will absorb small rainfall events without causing runoff and reduce both the volume and rate of runoff from larger ones, as well as providing habitat enhancements. Depending on the design of the green roof it could absorb a two-year return period rainfall without discharge (CIRIA, 2007) and attenuate and retard larger ones. The outlet from the roof could be directed towards the adjacent garden area to the south of the building, where further reduction in runoff could be achieved through storage and infiltration.

Most of the increase in roof area could thus be accommodated without generating more runoff into the drainage system.

In addition, it may be possible to drain some of the existing roof area into an infiltration system in the southern garden. The gutter runs and downpipe positions are not known in sufficient detail to establish whether this is a feasible proposition.

The remaining extra roof area (approximately 2.25 m^2) results from bay windows to be constructed over existing flat window reveals. It should be possible to divert at least an equivalent area of existing roof to the proposed soakaway system in the southern garden area, and possibly more.

The proposed development could therefore be constructed without increasing runoff to the drainage system and there is potential for a reduction over that which currently occurs. The size of any potential reduction in roof drainage is subject to infiltration tests and detailed soakaway design.

4.3 Drainage of Service Areas

The property is currently serviced by paved areas and a short driveway (of approximately 14 m^2) leading to a garage. There is a narrow concrete path along the eastern side of the property, running alongside a flower bed and crazy paving to the north. It is assumed both these are drained to surrounding garden areas and are not positively drained. The driveway slopes down to the garage and is likely to be positively drainage: it is assumed this goes to the surface water drainage system.

The proposed property will feature courtyard gardens on the east and an entrance and lightwell on the northern side. These areas should be surfaced with permeable materials (gravel, permeable block paving or similar) so that no positive drainage will be required. These areas will be below the level of the adjacent roads. If required, after detailed design, extra storage could be provided under the permeable surfacing, in the form of graded angular gravel or plastic geocellular systems, to avoid surface ponding in very heavy rainfall events, and the surfaces could be sloped slightly away from the property to ensure any temporary standing water does not lie against the building walls.

Care should be taken to restore the permeability of the ground surface under these surface finishes after the building work has been completed, to counteract any compaction of underlying soils.

South of the property will be the garden where, as described above, infiltration will be feasible. There are no paved service areas proposed in this area.

All the proposed service areas can therefore be drained by infiltration, providing a small improvement (ie reduction in drained area) over the current arrangements.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The property at 1 Ardwick Road, London NW2 is being refurbished and extended, resulting in an increase in impermeable area.

1. The garden area to the south of the property could be used to provide a soakaway. The capacity of this may be limited, and requires confirmation with on-site soakage tests.
2. Nearly all the proposed extra roofed area will comprise a green roof. Any overflow from this area can go to the proposed soakaway. A rainwater harvesting store and/or a raingarden could also be employed prior to the soakaway.
3. Some of the existing roof (area to be confirmed after soakage tests) could also be led to the soakaway for disposal. The remaining roof area will go to surface water sewer, as at present.
4. The surrounding service areas should be permeable. Careful design of the lightwell areas may indicate the need for storage to avoid ponding of rainwater in heavy rain events.
5. The above measures will ensure runoff from the site is less than that which currently occurs, despite an increase in building footprint. The size of the reduction in runoff to the drainage system can only be quantified after on-site soakage tests have been conducted in the garden area.

5.2 Recommendations

1. Site infiltration tests to BRE 365 should be undertaken in the garden area to the south of the property to assess the capacity for a soakaway. The above outline SuDS scheme should then be firmed up at a detailed design stage and implemented.
2. Detailed design of the soakaway is required to establish the size of reduction in roof runoff from the site that can be achieved.
3. The infiltration capacity of the lightwell areas should be managed during, and improved after, construction work to ensure soil permeability. Detailed design of the surfacing in the lightwell areas may be required to ensure standing water does not occur adjacent to the building in heavy rainfall events.

6.0 REFERENCES

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APPENDICES

APPENDIX 1

Glossary of SuDS Terms (from CIRIA guidance)

Attenuation	Reduction of peak flow and increased duration of a flow event.
Combined sewer	A sewer designed to carry foul sewage and surface water in the same pipe
Detention basin	A vegetated depression, normally is dry except after storm events, constructed to store water temporarily to attenuate flows. May allow infiltration of water to the ground.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
FEH	*Flood Estimation Handbook*, produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology)
Filter drain or trench	A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water, but may also be designed to permit infiltration.
First flush	The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants, and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution
Flood plain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions (see Environment Agency's *Policy and practice for the protection of flood plains* for a fuller definition).
Greenfield runoff	This is the surface water runoff regime from a site before development, or the existing site conditions for brownfield redevelopment sites.
Impermeable surface	An artificial non- porous surface that generates a surface water runoff after rainfall.

Permeability	A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium, for example grain size, porosity and pore shape.
Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
Sewerage undertaker	This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal including surface water from roofs and yards of premises.
Soakaway	A subsurface structure into which surface water is conveyed to allow infiltration into the ground.
Treatment	Improving the quality of water by physical, chemical and/or biological means.

APPENDIX 2

Proposed Development Plans (Supplied by Client)

7852 **1 Ardwick Road**

SITE LOCATION PLAN

MDC
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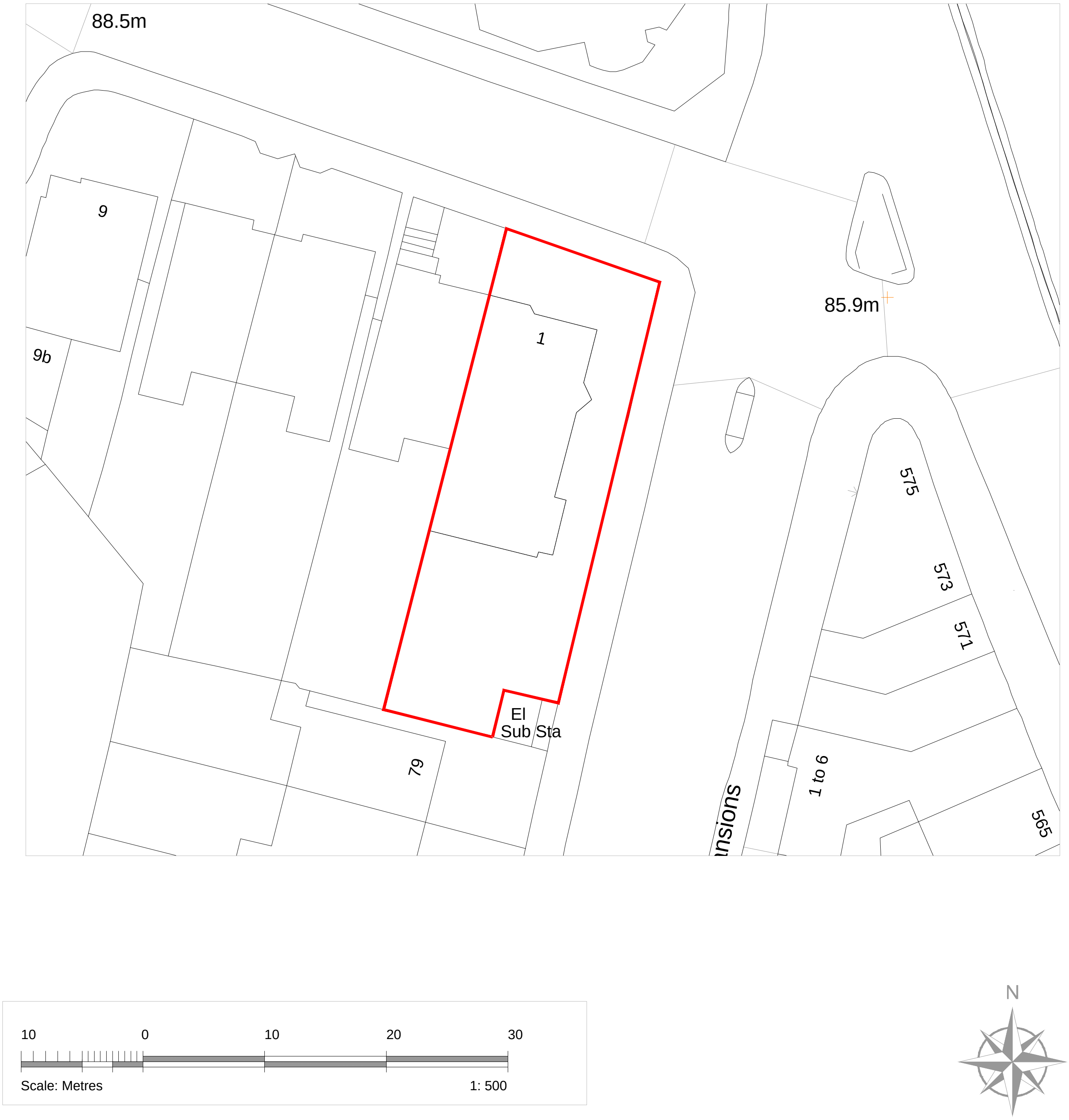

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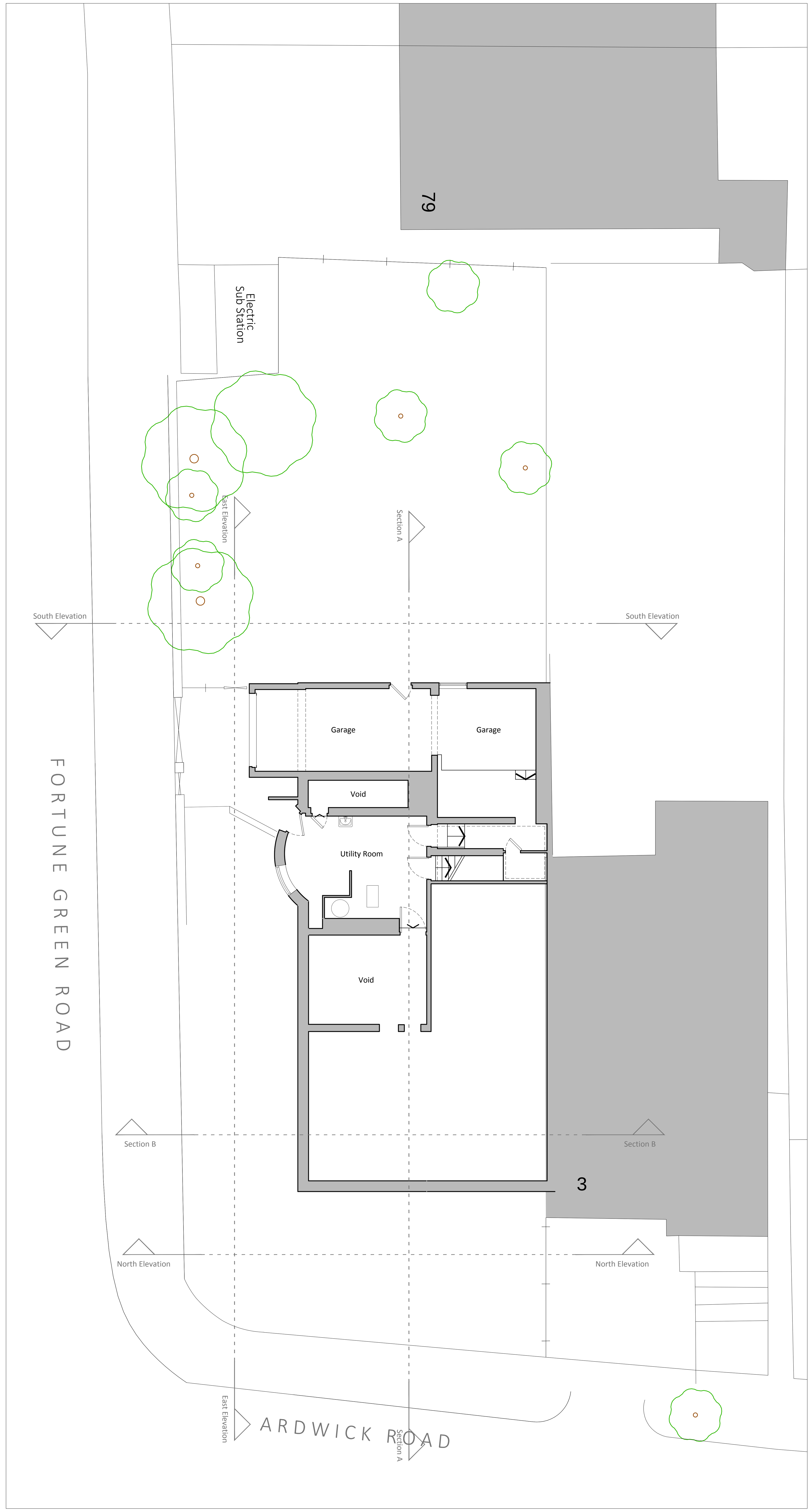

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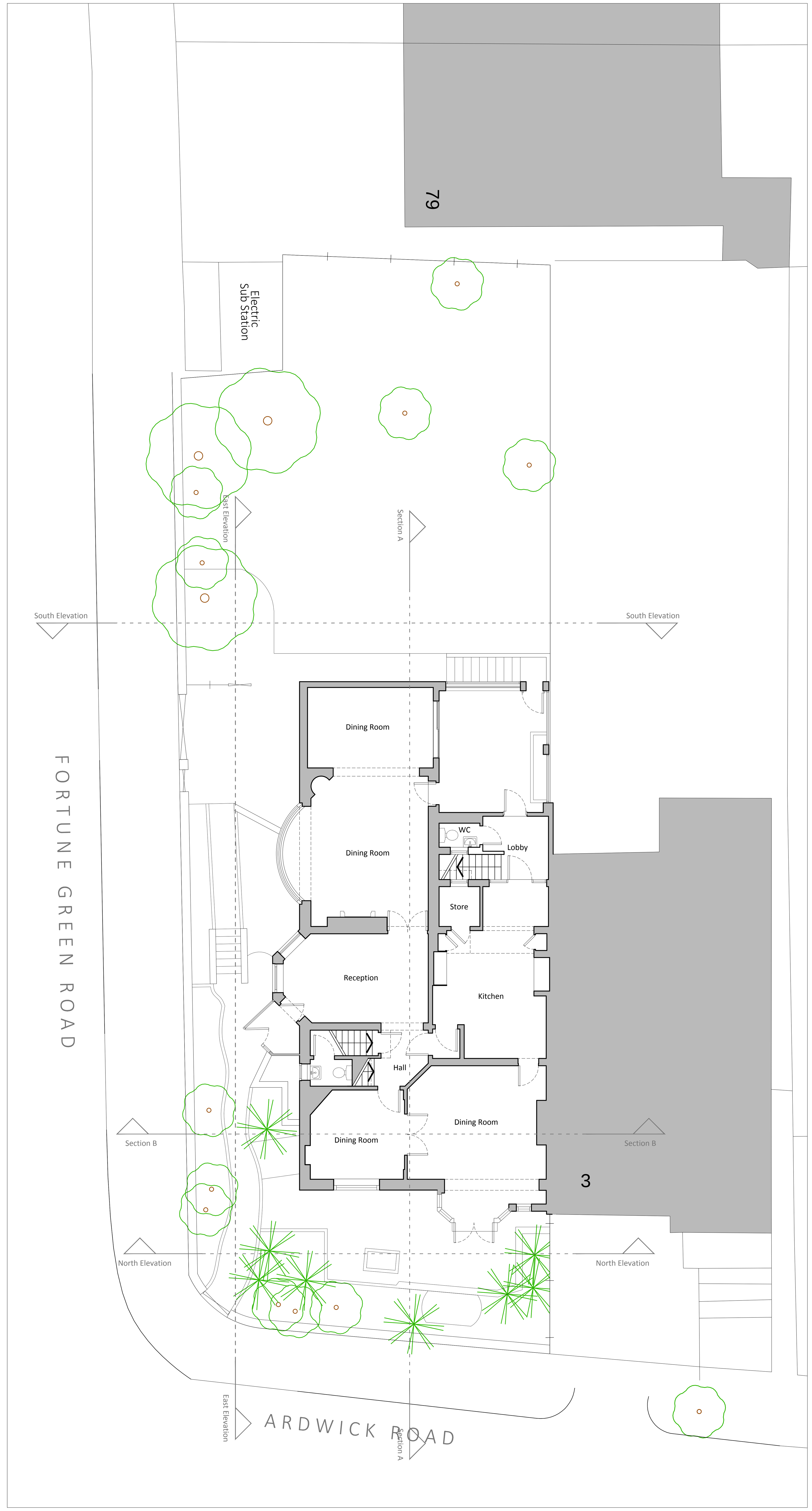

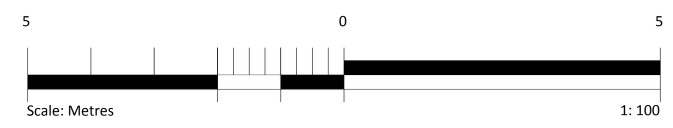

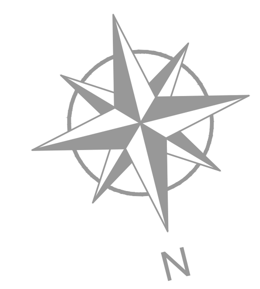

rev

project

1 Ardwick Road
London
NW2 2BX

client

drawing

EXISTING
Lower Ground and Ground Floor Plans

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7852 / 11

MDC METROPOLITAN DEVELOPMENT CONSULTANCY

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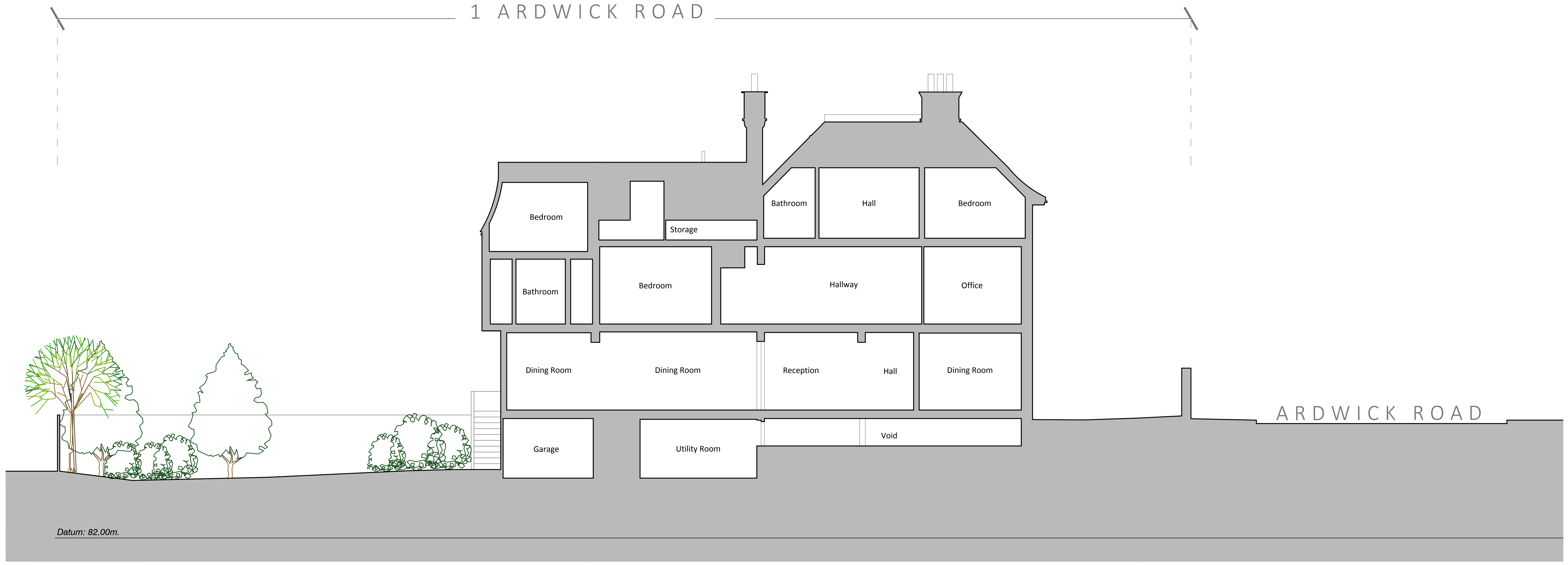

SECTION A-A

SECTION B-B

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project

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London
NW2 2BX

client

drawing

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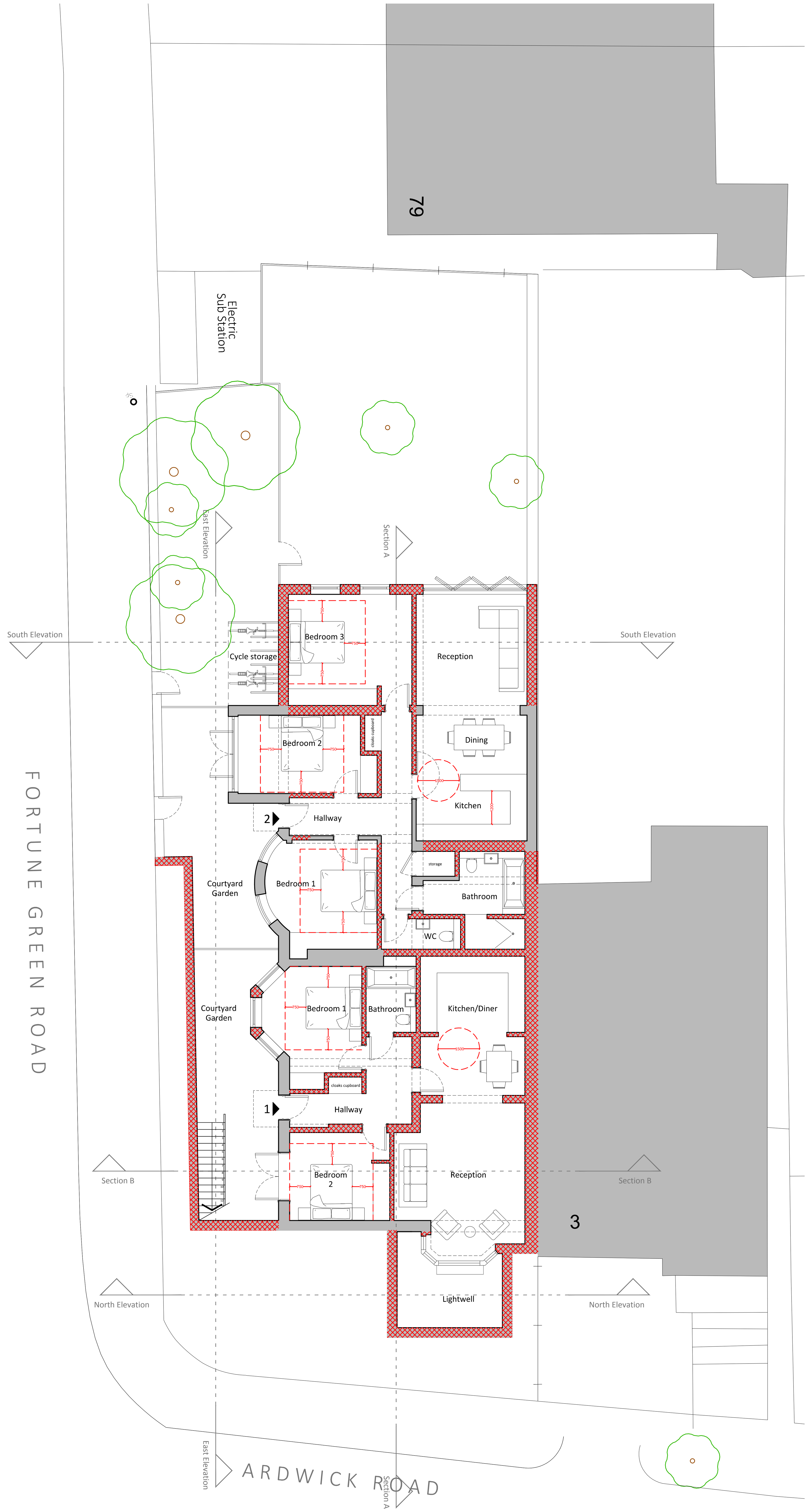
LOWER GROUND FLOOR



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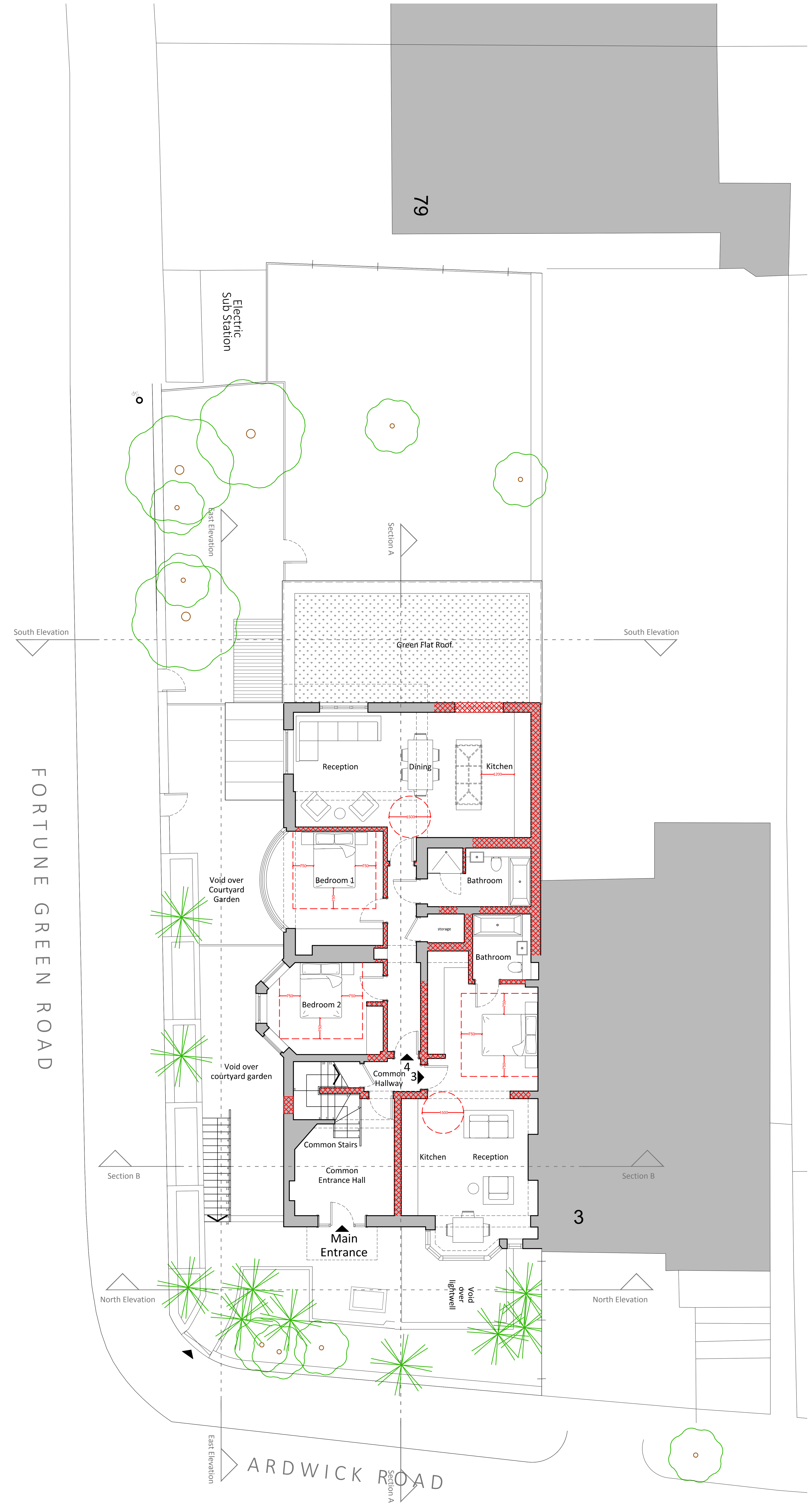

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New walls

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B	Hatch added to new walls	
A	Layout re-design	

project

1 Ardwick Road
London
NW2 2BX

client

drawing

PROPOSED
Lower Ground and Ground Floor Plans

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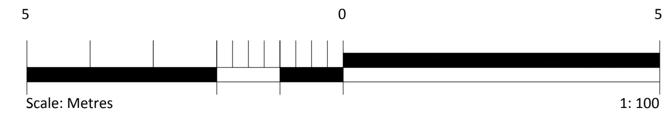
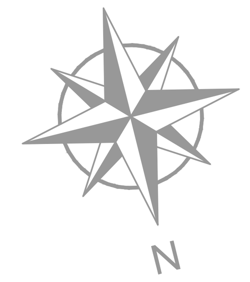
SECTION A-A

SECTION B-B





rev A Layout re-design

project

1 Ardwick Road
London
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client

drawing

PROPOSED
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7852 / 25 A

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