Appendix D

Resilience and Flood Risk

1A Glastonbury Street, London
Flood Risk Assessment

15/03/2016

Final version 2.0

RAB: 946B

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Revision history

Version	Date	Amendments	Issued to
Draft v1 0	23/10/2014		Frances A Bennett
Final v1.0	06/11/2014		Frances A Bennett
Final v2.0	15/03/2016		

Quality control

Action	Signature	Date
Prepared	Andrew McHugh BSc (Hons) MCIWEM	20/10/2014
Checked	Dr Alexandros Tsavdaris	23/10/2014;15/03/2016
Approved	Ray Pickering DipCE CEng MCIWEM C.WEM MCGI MEPS	23/10/2014

Disclaimer

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Contents

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1.0 Introduction

RAB Consultants has prepared this Flood Risk Assessment (FRA) in support of a planning proposal for a residential development at 1A Glastonbury Street, London, NW6 1QJ.

The National Planning Policy Framework requires a Flood Risk Assessment to be carried out to ensure flood risk to the proposed development is considered as well as the impact the development will have elsewhere on people and property.

The 2011 Surface Water Management Plan (SWMP) of the London Borough of Camden identifies the development site as being within a Critical Drainage Area (CDA). CDA's are areas of significant flood risk, characterised by the amount of surface runoff that drains into the area, the topography and hydraulic conditions of the pathway and the receptors (people, properties and infrastructure) that may be affected by surface water flooding. This FRA has been prepared in accordance with the Environment Agency's Flood Risk Assessment (FRA) Guidance Note 1 (Development Greater Than 1 Hectare (ha) in Flood Zone 1, and Critical Drainage areas less than 1ha).

2.0 Site location

The proposed development site is 1A Glastonbury Street, London, NW6 1QJ (National Grid Reference: TQ 24941 85027). The area for development is on the southern side of Glastonbury Street and opposite Beckford Primary School (see Figure 1 below).

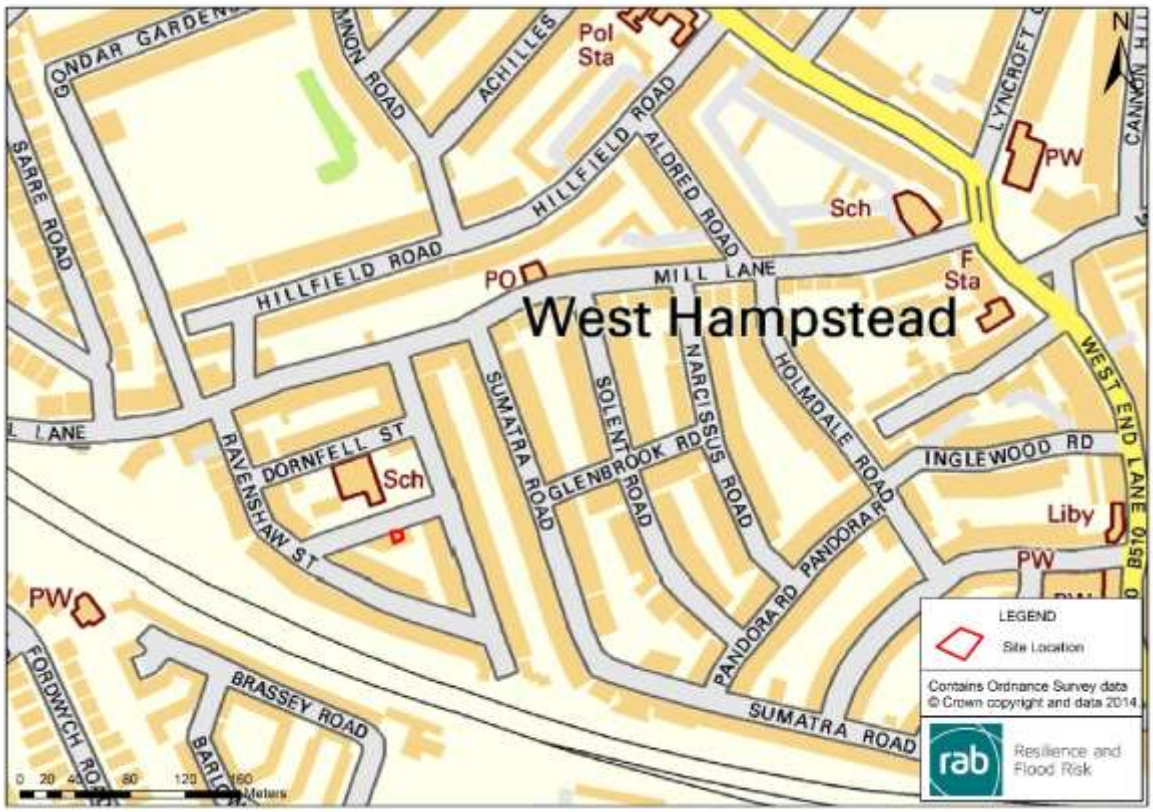

Figure 1 – Site Location

3.0 Existing site and development proposal

The site is approximately 60m^2 and currently consists of a car garage. To the east and west of the building are residential dwellings with access to the building from Glastonbury Street to the north. Approximately 50% of the garage appears to be drained via a formal guttering and downpipe system which appears to discharge into Glastonbury Street. 50% of the building appears to have no formal drainage system and the sloped nature of the building rooftop suggests rainwater will flow off the building to the south. Photographs of the site are provided in Figure 2 below.

Figure 2 – Existing building on development site

The planning proposal is to demolish the existing building on site and replace it with a new dwelling. The dwelling incorporates living accommodation, bathroom, and kitchen in the basement with living space and bedroom on the ground floor and bedroom with en-suite bathroom on the 1st floor. There will be no change to the impermeable area as a result of the proposed development (see development plans in Appendix A).

4.0 Flood risk

4.1 River (fluvial)

River flooding may occur when a watercourse (river, stream or natural watercourse) is at its maximum capacity and the water overtops or breaches the riverbanks. River flooding is closely linked to periods of heavy rain and waterlogged catchments.

The proposed development is located within Flood Zone 1 in accordance with the Environment Agency's Flood Map for Planning (Rivers and Sea). Flood Zone 1 is land assessed as having less than a 1 in 1,000 year (0.1% annual probability (a.p)) chance of flooding in any given year.

The North London Strategic Flood Risk Assessment (SFRA) (2008) confirms the London Borough of Camden has no major fluvial watercourses within its borough boundaries. There are three ordinary watercourses which flow through the borough of Camden at the following locations:

- Parliament Hill (3km north east of Glastonbury Road)
- Regents Canal (2km to the south of Glastonbury Road)
- Hampstead Heath (2.5km to the east of Glastonbury Road)

None of the above watercourses pose a flood risk to West Hampstead therefore the site has low risk of fluvial flooding.

4.2 Tidal flooding – River Thames

The proposed development site is shown to be within the Environment Agency Flood Zone 1; land assessed as having less than a 0.1% a.p of flooding, therefore not at risk of tidal flooding.

4.3 Surface water flooding

When the infiltration capacity of land or the drainage capacity of a local sewer network is exceeded, excess rainwater flows overland; this water will collect in topographic depressions and at obstructions, and can inundate development downslope. The severity of the rainfall event, the degree of saturation of the soil before the event, the permeability of soils and geology, hill slope steepness and the intensity of land use all contribute to and affect the severity of overland flow.

The Environment Agency most recent flood map for surface water published in December 2013 is freely available online at their website and can be used to see the approximate areas that would experience surface water flooding from a variety of rainfall return periods. The risk is categorised based on annual probability of occurrence. The different risk categories are displayed below in Table 4.

Environment Agency Surface Water Risk Category	Surface water flooding annual probability of occurrence
Very Low	Less than 0.1% (1 in 1000 years)
Low	Between 1% and 0.1% (1 in 100 years and 1 in 1000 years)
Medium	Between 1% and 3.3% (1 in 100 years and 1 in 30 years)
High	Greater than 3.3% (1 in 30 years)

Table 4 - Environment Agency Surface Water Risk Categories

The map identifies the development site itself is at 'very low' flood risk (See Figure 3 below). Ravenshaw Street, located to the west of Glastonbury Street, is classed as 'medium' risk. Ravenshaw Street slopes away sharply from north to south and is expected to be an overland flow route during intense rainfall events.

There is a lack of any historical surface water flood records at the site to support the Environment Agency categorisation of a very low risk of flooding from this source.

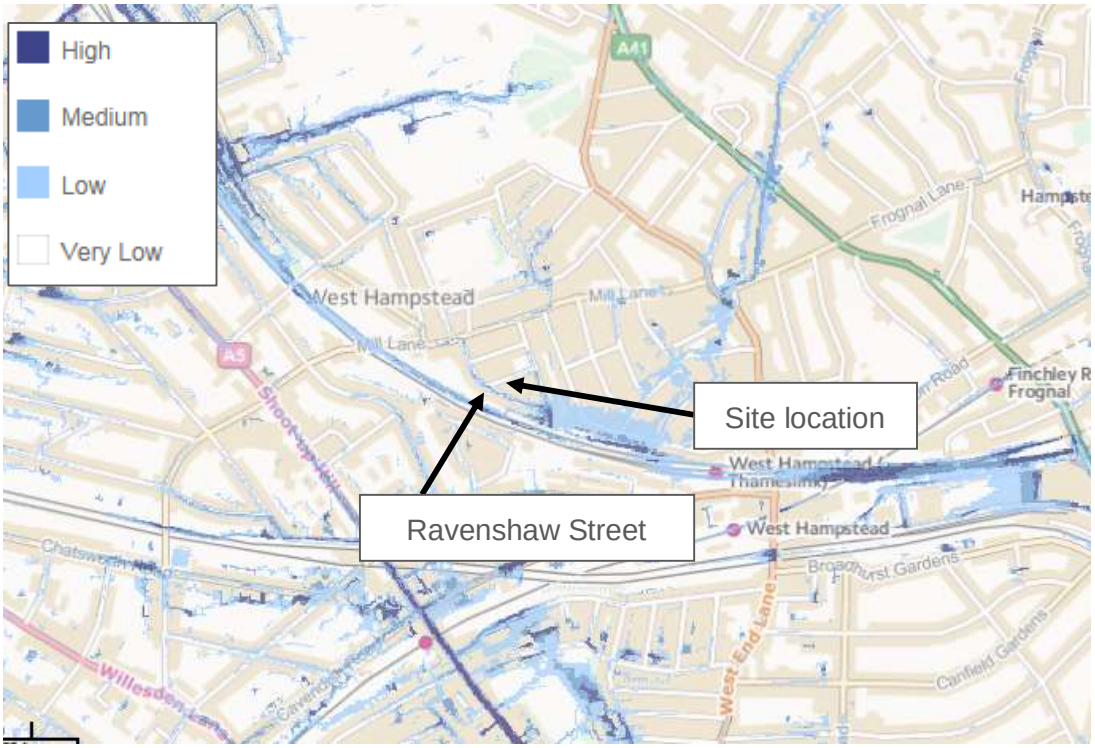

Figure 3 – Environment Agency's Risk of Flooding from Surface Water map

4.4 Drainage and sewage infrastructure flooding

Sewer flooding occurs when the capacity of the underground sewer system is exceeded, which in turn can lead flood property or its surrounding land. Thames Water are responsible for the management of urban drainage and sewerage within the Borough.

According to the 2011 London Borough of Camden Surface Water Management Plan (SWMP) the site is located within CDA Group 3_010 – West Hampstead which has a pluvial/sewer capacity issue. 104 properties in the NW6 1 postcode have experienced flooding in the past decade, due to overloading of the drainage network. In detail, Sumatra Road (approximately 120m to the east of the site) is prone to this type of flooding (SWMP, 2011). It should be noted that Sumatra Road is at a lower elevation than Glastonbury Road and any overland flows on Sumatra Road as a result of surcharging sewers would flow in a southerly direction and away from Glastonbury Road. There is no record of sewer related flooding in Glastonbury Street and problems in the Sumatra area may have been partly resolved by the Sumatra Road Scheme implemented by Thames Water. This scheme provides underground storage of storm water which is held before delayed discharge into the combined sewer network.

It is important to understand that previous sewer flood incidents do not indicate the current or future risk to the site as upgrade work could have been carried out to alleviate any issues or conversely in areas that have not experienced sewer flooding incidents the local drainage infrastructure could deteriorate leading to future flooding.

4.5 Groundwater flooding

Groundwater flooding generally occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. It is most common in low lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high water table.

Indicative information from British Geological Survey (BGS) shows that the sites underlying bedrock geology is composed of London Clay Formation – Clay, Silt and Sand. This is overlain by superficial deposits of Alluvium, composed of Clay, Silty, Peaty, Sandy. Clay is a known aquitard, characteristically impending groundwater flow. As clay is the main constituent of both the bedrock and superficial deposits that indicatively underlie the proposed development site there is thought to be a low risk of flooding from this source.

The North London SFRA (2008) confirms "*North London is almost entirely underlain by the London Clay formation which overlays a significant chalk aquifer. The London Clay layer varies in thickness from less than 10m near the Lee Valley to over 100m in the areas of higher ground in Camden and Barnet. The clay layer is almost entirely impermeable*".

The SFRA also confirms that central Camden lies within an area of higher ground where groundwater levels are at a depth of 80-90m below the surface. The 2008 SFRA suggested that groundwater flooding for the London Borough of Camden, was found to be a relatively low risk.

As a result the risk of groundwater flooding to the area is considered to be low.

4.6 Flooding from artificial water bodies

Reservoirs, canals and other artificial water bodies often hold large volumes of water above ground level. Should a breach, overtopping or failure occur, there may be a sudden release of deep fast-moving water with very little warning.

According to the Environment Agency's 'Risk of Flooding from Reservoirs' map, the development site lies outside an area that is expected to be affected by inundation should a reservoir fail

According to the Canal & Rivers Trust, there are no major canals near the property which are likely to pose a flood risk to the development.

4.7 Previous flood history

There is no known record of historical flooding at the site.

The North London SFRA (2008) shows no record of flooding at 1A Glastonbury Road during the 1975 or the 2002 flooding events.

4.8 Climate change

There is clear scientific evidence that global climate change is happening now. In the UK sea level has risen and more winter rain has fallen in intense wet spells over the past century. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

Looking ahead, greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

In assessing the impacts of climate change on flood risk emanating from the land and rivers, sensitivity ranges in Table 10 (Table 8 in this report) of the Technical Guidance to the National Planning Policy Framework may provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensity.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%	+20%		

Table 1 - NPPF Technical Guidance recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters and more rain falling in wet spells may increase river flooding. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected. Drainage systems in the borough have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently.

To mitigate against the risk of climate change causing increased rainfall and the risk of flooding to the property the development should consider incorporating the following mitigation measures (Section 5.0).

5.0 Mitigation Measures

5.1 Flood Resilience

- Tanking systems (waterproof lining for a basement by covering the inside walls with a coating or membrane bonded to the structure).

5.2 Resistance

- Non-return valves on foul drain pipes (sinks etc.).

6.0 Surface water runoff

The area for development is occupied by the garage building and is currently 100% impermeable. The residential development will incorporate guttering and downpipes to collect rainwater and discharge it via the existing system via a Thames Water sewer within Glastonbury Street.

6.1 SuDS – Sustainable Drainage Systems

Paragraph 1.3.2 from the SuDS manual (C697) discusses the SuDS 'management train', which is intended to mimic the natural catchment process as closely as possible. Table 2 gives examples of the hierarchy of techniques that can be used to achieve the management train.

Technique	Description
Prevention	The use of good house design and housekeeping measures to prevent runoff and pollution; rainwater reuse/harvesting.
Source control	Soakaways, porous and pervious surfaces, water butts, green roofs.
Site control	Routing water to large Soakaways, infiltration or detention basins.
Regional control	Balancing pond, wetlands, swales, retention ponds.

Table 2 - Hierarchy of techniques and their descriptions

The use of some of the above techniques could be feasible for this proposed development as described in Table 3 below:

Technique	Issues	Feasible? Y / N / M (maybe)
Prevention		
Good building design and rainwater harvesting	Ensuring that drains and guttering are properly laid, located and maintained. Water butts could be used for collecting rainwater and using within the garden areas (e.g. watering flowers). This is considered betterment to the current arrangement as currently 50% of rainwater collected on the rooftop simply runs off. Grey water recycling has not been considered as part of the development proposal.	Y Y
Source Control		
Porous and pervious materials	The residential dwelling will incorporate the entire site replacing the existing building. There is no scope/opportunity for using porous/pervious materials e.g for walkways.	N
Soakaways	There no scope for soakaways on site as the residential dwelling will incorporate the entire site area. The North London SFRA (2008) confirms the area is above the Lodnon Clay formation which is almost entirely impermeable and therefore the likelihood of infiltration being successful is low.	N
Green roof	A green roof has not been incorporated into the design of the residential dwelling but could be considered.	M
Site and Regional Control		
Infiltration / detention basins / balancing ponds / wetlands / swales / retention ponds	There is no scope for providing site and regional control systems given the size of the site.	N

Table 3 – Feasibility of techniques at the proposed site

There is limited scope for SuDS on site given the residential dwelling will incorporate the whole site area. Good building design and rainwater harvesting should be incorporated into the design and green roofs could be considered.

7.0 Conclusion

RAB Consultants has prepared this Flood Risk Assessment (FRA) in support of a planning proposal for a residential development at 1A Glastonbury Street, London, NW6 1QJ.

The development site is located in Flood Zone 1 in accordance with the Environment Agency's Map for Planning (Rivers and Sea) but is located in the Critical Drainage Area (CDA) Group 3_010 – West Hampstead as identified within the London Borough of Camden SWMP (2011). This area has a pluvial/sewer capacity issue.

The site is at low risk of flooding from all other sources including fluvial, surface water and groundwater. To mitigate against climate change increasing the risk of flooding to the property floor levels will be raised above local ground level to protect against overland flows as a result of surface water or surcharging sewers.

The existing site is wholly occupied by a car garage and is entirely impermeable. The development proposal will replace the existing building with a 4 storey residential dwelling which also occupies the whole site. Therefore as a result of the development surface water run-off rates and volumes are not expected to increase from existing. Good building design and rainwater harvesting should be incorporated into the design and green roofs could be considered.

The development is considered to be appropriate given the flood risk and is not expected to increase flood risk elsewhere.

8.0 Recommendations

- Tanking should be incorporated into the basement construction up to 300mm above ground floor level; alternatively,
    - Finished floor levels should be raised to 300mm above the ground floor level to mitigate against any localised flooding that may occur.

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Appendix A – Development Plans

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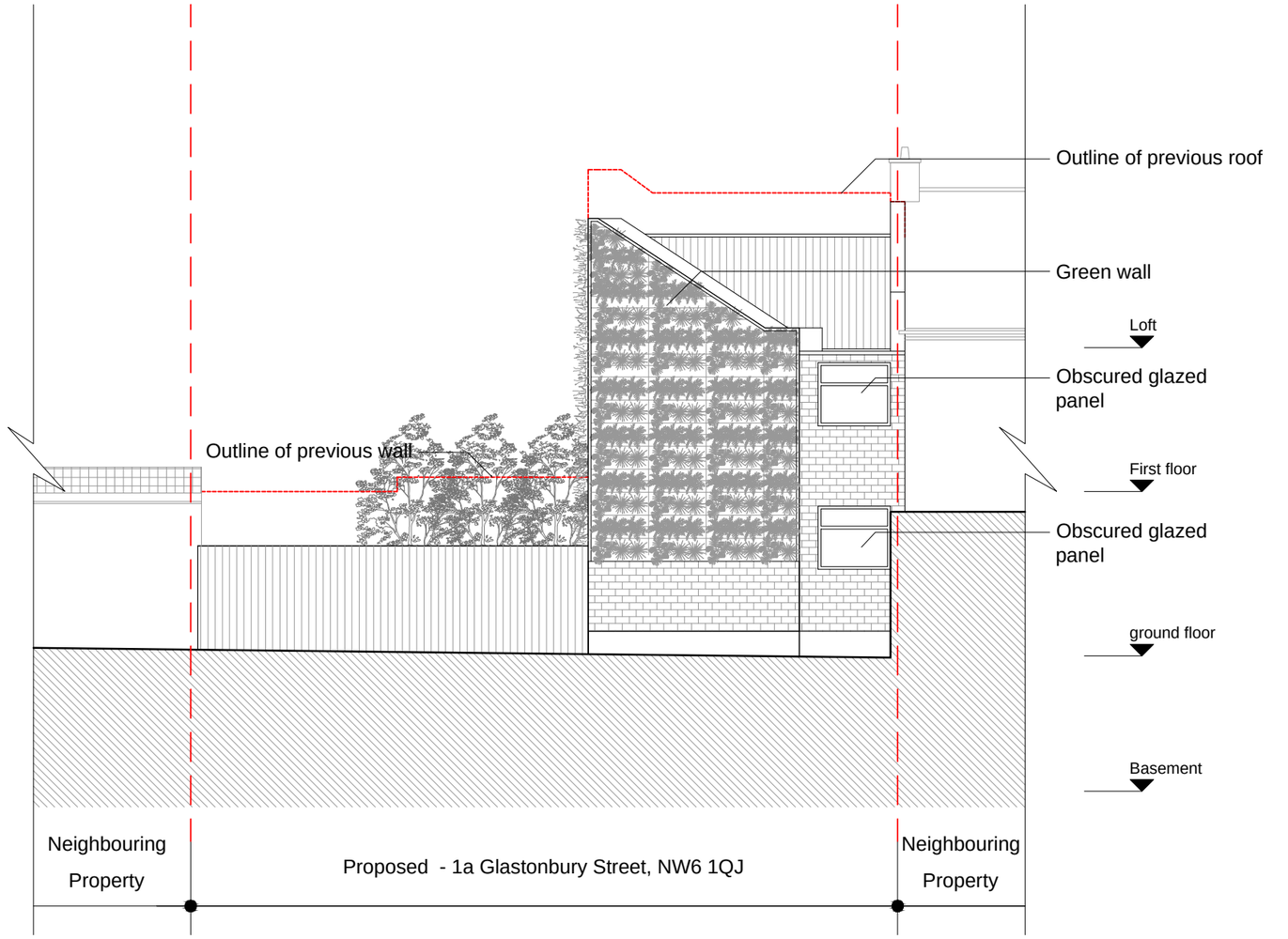

DRAWING NOTES

Dimensions	Written dimensions to be taken in preference to scaled dimensions. The Contractor is responsible for checking all dimensions before work starts.
Local Authority	All work is to be carried out to the requirements, and to the satisfaction of the Local Authority. These drawings are for planning purposes only.
Discrepancies	Any discrepancies to be brought to the attention of Drawing And Planning Ltd. Immediately.

REVISIONS

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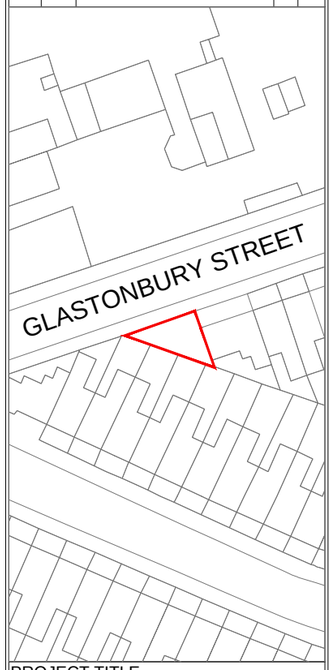

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - Rear Elevation

CLIENT

Cape Property Holdings Ltd.

DRAWING No	REV
GLAST-E202	/
SCALE @A3 1:100	

DATE	DRAWING STATUS
Feb 2016	Planning

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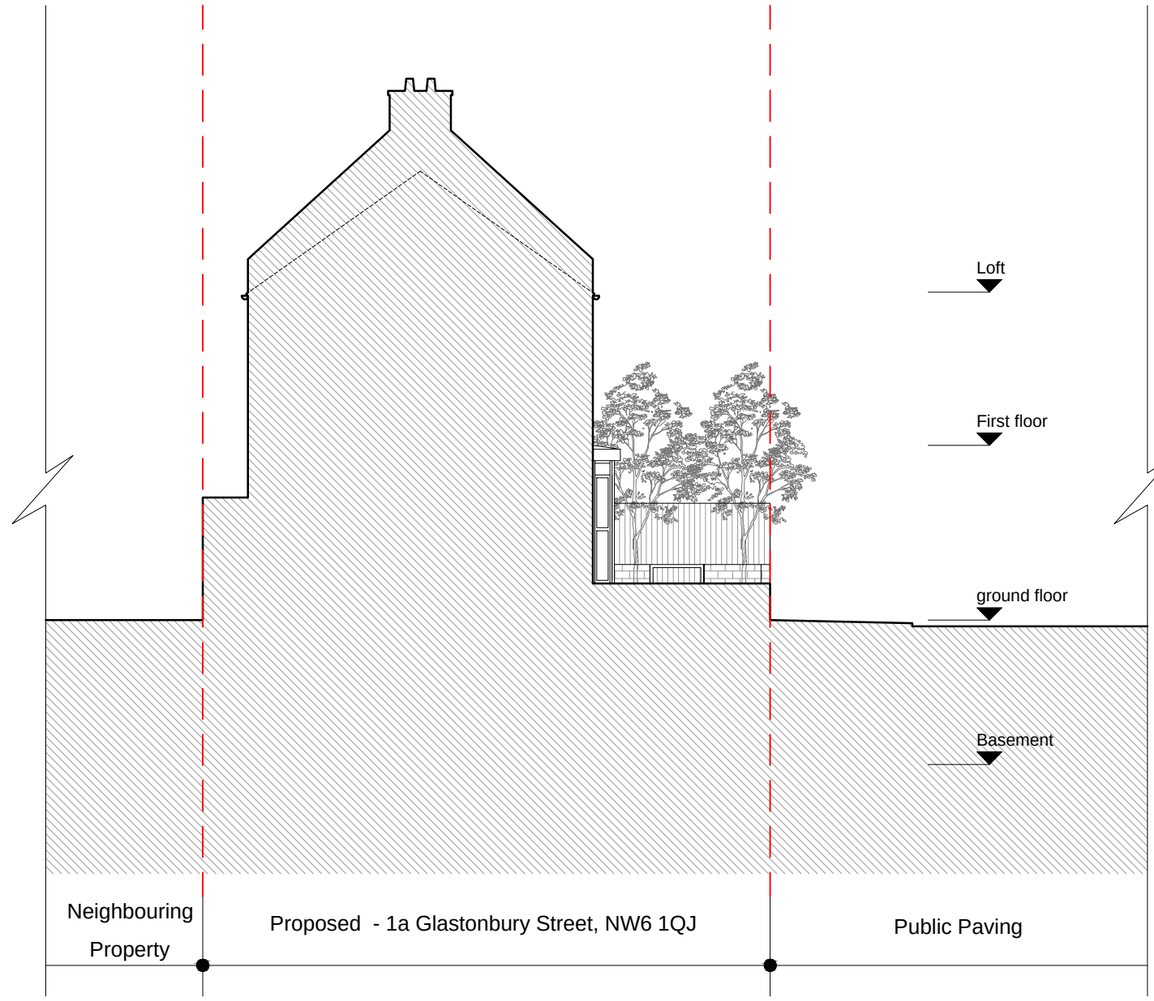

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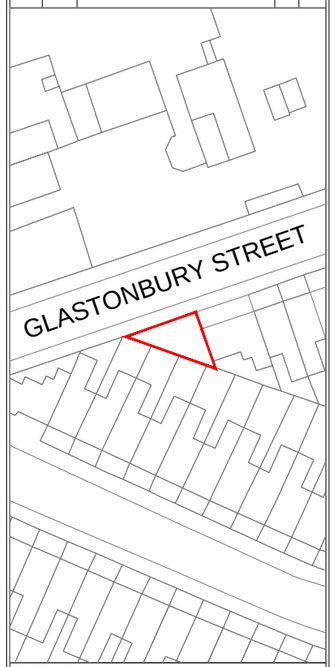

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - Side Elevation

CLIENT

Cape Property Holdings Ltd.

DRAWING No	REV
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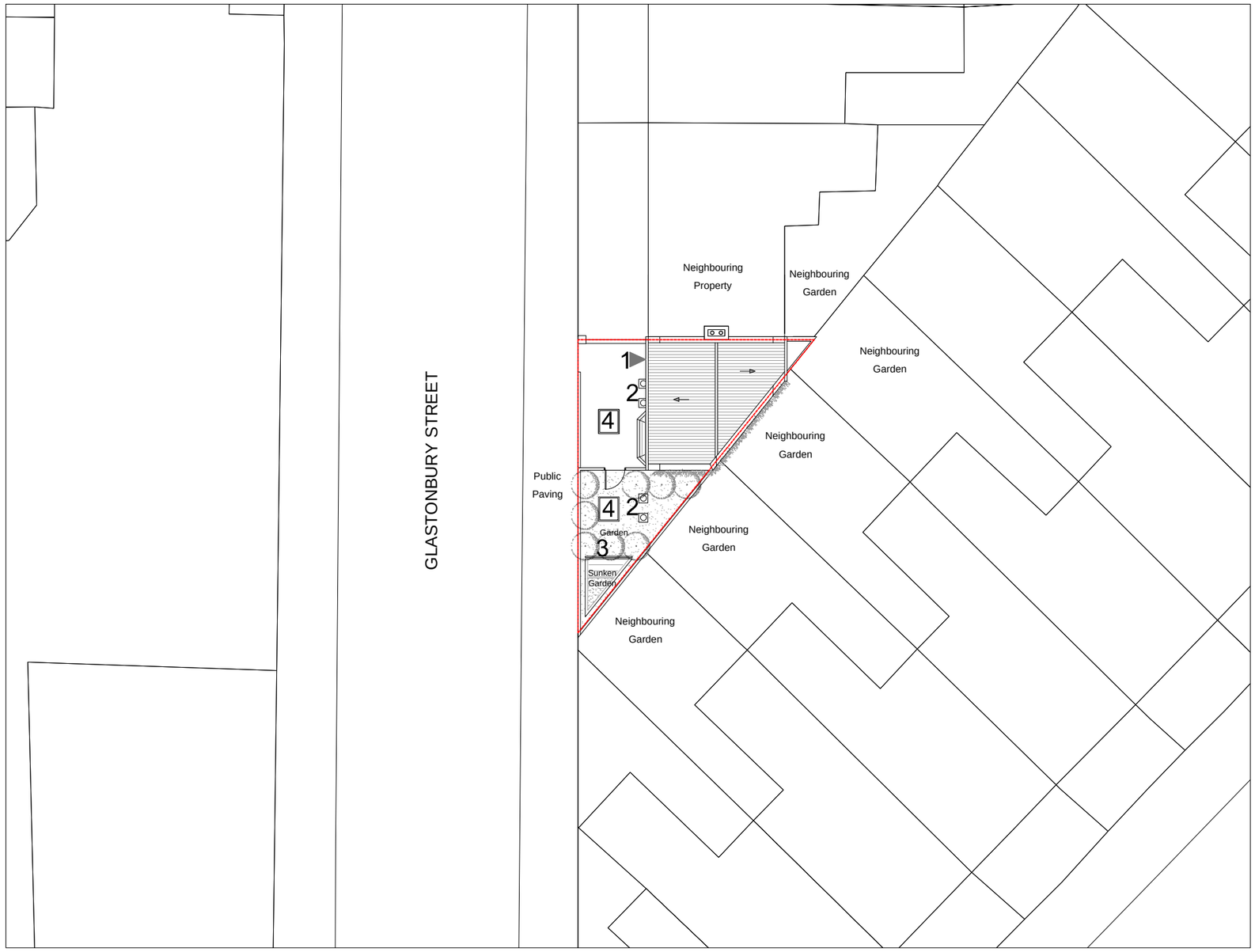

KEY

1 Entrance
2 Light tunnel
3 Balustrade
4 Roof light

Property Boundary

N

0 1m 5m 10m 20m

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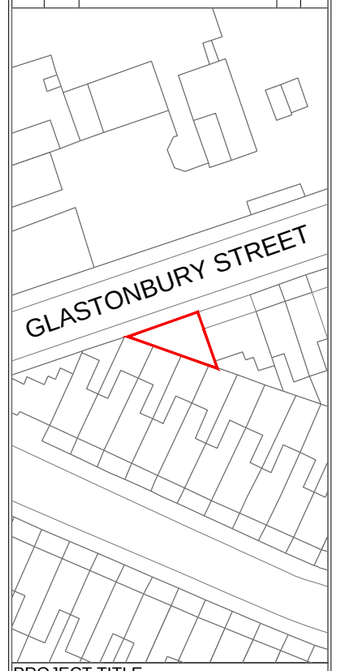

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - Site Plan

CLIENT

Cape Property Holdings Ltd.

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DATE	DRAWING STATUS
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Typology	G.I.A
2 Bedroom 4 Persons	84.2 Sqm

GLASTONBURY STREET

Neighbouring Property

Neighbouring Garden

Neighbouring Garden

A

A'

WM

Kitchen

Bathroom
4.5 sq.m

Dining

39.2 sq.m

Living

Public Paving

Neighbouring Garden

Sunken Garden

Neighbouring Garden

Neighbouring Garden

N

0 1m 5m 10m

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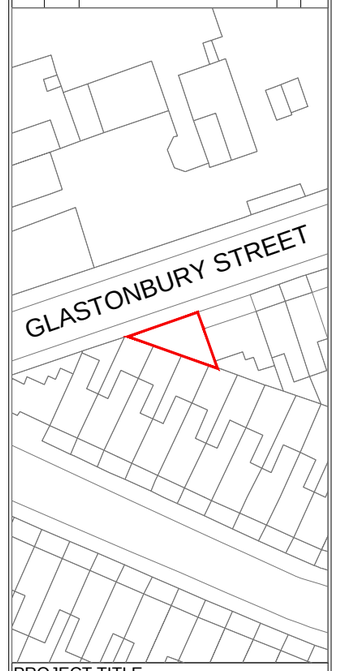

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - Basement Plan

CLIENT

Cape Property Holdings Ltd.

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DATE	DRAWING STATUS
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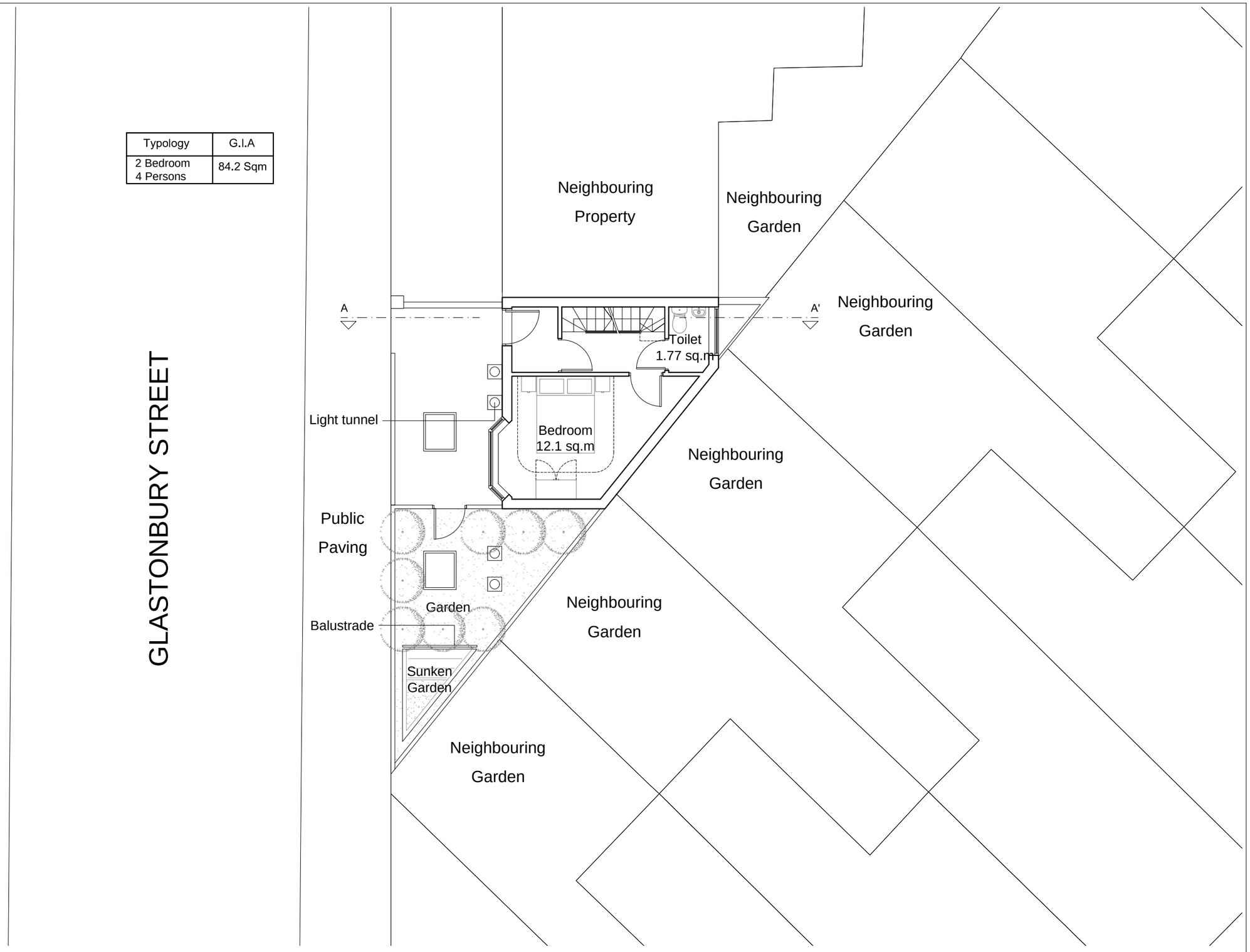
2 Bedroom 4 Persons	84.2 Sqm



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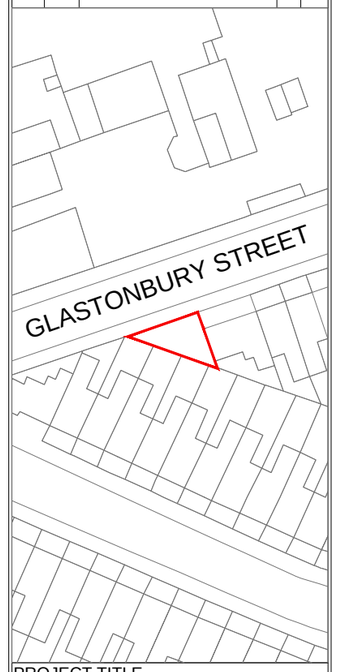

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - Ground Floor

CLIENT

Cape Property Holdings Ltd.

DRAWING No	REV
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SCALE @A3 1:100	

DATE	DRAWING STATUS
Feb 2016	Planning

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0208 202 3665

Typology	G.I.A
2 Bedroom 4 Persons	84.2 Sqm

GLASTONBURY STREET

Neighbouring Property

Neighbouring Garden

A

A'

En-Suite
2.1 sq.m

Bedroom
15.4 sq.m

Neighbouring Garden

Neighbouring Garden

Public Paving

Green wall

Garden

Sunken Garden

Neighbouring Garden

Neighbouring Garden

N

0 1m 5m 10m

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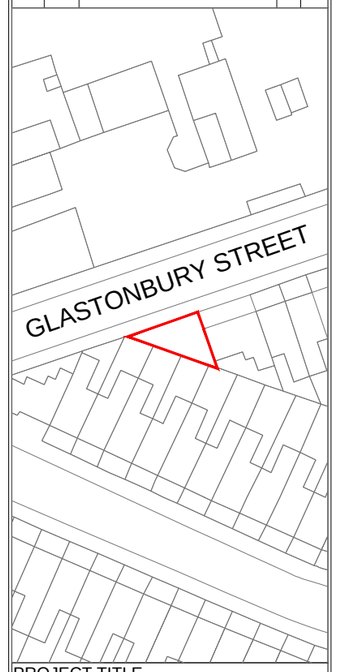

PROJECT TITLE

1a Glastonbury Street, NW6 1QJ

DRAWING TITLE

Proposed - First Floor

CLIENT

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