

13 – 16
MARKET
PLACE,
READING,
RG1 2EG

Drainage Strategy & SUDS Appraisal

April 2023



Ref: 23-10362

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Revision	-
Date	10/04/2023
Prepared by	A. Norris
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1. Introduction

Syntegra have been appointed by their client to undertake a Drainage Strategy for the proposed development at 13 – 16 Market Place, Reading, RG1 2EG. The purpose of this document is to describe the existing site and associated drainage infrastructure and to identify a solution for the proposed surface and foul water drainage.

Reference Material

The Report has been prepared using the following documents for guidance:

- The National Planning Policy Guidance (NPPG)
- The Building Regulations 2010 – Approved Document H – Drainage and Waste Disposal.
- Sewers for Adoption 7th – August 2012
- Ciria Report C753 – The SUDS Manual – 2015

Scope of Drainage Strategy

The assessment is to be undertaken in accordance with the standing advice and requirements of NPPG and the Local Authority.

The strategy has:

- Considered the site constraints
- Developed the drainage philosophy.
- Considered the procedures of the National Planning Policy Guidance and Local Authority Guidance;
- Provide a strategy for surface water and foul systems from the site, making recommendations forms of sustainable drainage; and
- Make recommendations as to how surface water drainage features are to be operated and maintained.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, Syntegra shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Syntegra.

This report has been prepared in accordance with the instructions of our client, for their sole and specific use.

2. Proposed Development

The development proposals comprise for the demolition of the existing ground and first floor modern rear extensions, reconstruction of the ground floor for commercial, retention and extension to the

existing basement, and the construction of a part 3 no., part 4 no. storey residential extension above. The layout can be seen in Appendix A.

3. Existing Site and Topography

The application site is located in a prominent position in Market Place, Reading. The site is within the Town Centre Conservation Area. Pedestrian access is off Market Place with limited secondary pedestrian and vehicular access off The Forbury

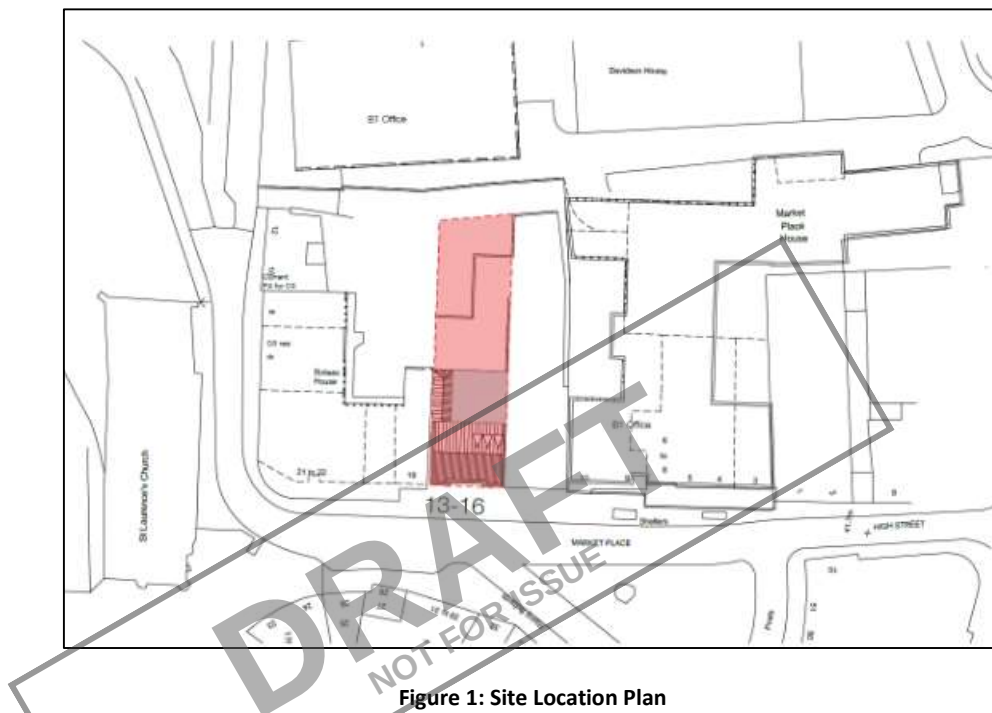


Figure 1: Site Location Plan

4. Existing Drainage and site investigations

No public sewers are identified within the site. The existing property drains to the existing public sewers via a positive drainage connection.

There are no watercourses in proximity to the development.

SuDS Principles

5.1 SuDS Design Philosophy

The CIRIA SuDS manual outlines the design philosophy for drainage for developments and states that SuDS design should, as much as possible, be based around the following:

- Using surface water run-off as a resource
- Harvesting and managing rainwater close to where it falls
- Managing run-off at the surface

- Allowing rainwater to soak into the ground
- Promoting evapotranspiration
- Slowing and storing run-off on the surface
- Reducing contamination of run-off through pollution prevention and filtering out pollutants
- Treating run-off to reduce the risk of urban contaminants causing environmental pollution.

Most sites will incorporate multiple solutions and their suitability is assessed based on an ascending scale of sustainability with associated amenity and environmental benefits as below:

Most Sustainable	Suds technique	Flood Reduction	Pollution Reduction	Landscape a & wildlife benefit
	Living Roofs	✓	✓	✓
	Basins and ponds -constructed wetlands -balancing ponds -detention basins -retention ponds	✓	✓	✓
	Filter Strips and Swales	✓	✓	✓
	Infiltration devices -soakaways -Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains -Gravelled area -Solid paving blocks -Porous paving	✓	✓	
Least Sustainable	Tanked systems -Oversized pipe/tanks -Storm Cells	✓		

means to

limiting discharge rates and volumes to discharge to existing SW flow pathways.

6. Appraisal of SuDS options

6.1 Site Constraints Impacting on SuDS

- No access to adjacent water courses or ditches.
- Existing Developed site
- Tightly constrained site adjacent to existing properties and highway
- Impermeable Geology

6.2 Infiltration Devices

Whilst infiltration testing has not yet been undertaken it is considered that soakaways would not be feasible given the constraints on site, its urban setting and having no available areas for soakaway systems.

6.3 Bio-retention/rain-gardens

Rain garden planters promotes the following SuDS design criteria:

- Manages rainwater close to where it falls
- Manages run-off at the surface
- Promotes evapotranspiration
- Slows and stores run-off to mimic natural run-off characteristics
- Treats run-off to reduce the risk of urban contaminants causing environmental pollution.

and also

- Promotes bio-diversity
- Provides amenity

Bio Retention areas can be provided by utilising a green roof over the extension roof.

6.4 Permeable Hard Standing

No additional hardstanding areas are proposed that could be utilised as permeable.

6.5 Rainwater harvesting

Rainwater harvesting is to be considered as part of detailed design.

6.6 End of pipe solutions

To be considered only after implementation of the above options. Retention tanks with outfall controlled by hydraulic means (e.g. hydrobrakes, pipe sizing, orifice plate etc.) to limiting rates and volumes to discharge to existing flow pathways.

End of pipe solutions shall be implemented to reduce runoff as appropriate.

7. Surface Water Drainage Strategy

The local Authority expects all developments to take advantage of any suitable opportunities to A water butt will be provided to further reduce and attenuate runoff

Developers should utilise SuDS on all developments, unless there are practical reasons for not doing so. Therefore, it is expected to see suitable consideration given to using sustainable measures in line with the following drainage hierarchy:

- Store rainwater for later use
- Use infiltration techniques, such as porous surfaces in non-clay areas
- Attenuate rainwater in ponds or open water features for gradual release
- Attenuate rainwater by storing in tanks or sealed water features for gradual release
- Discharge rainwater direct to a watercourse
- Discharge rainwater to a surface water sewer / drain
- Discharge rainwater to the combined sewer

In developing the drainage strategy for the scheme, each item in the above hierarchy has been successively appraised for its feasibility starting with the most preferred. A more preferred method of discharge is discounted in favour of a less preferred method only when it is demonstrably clear that the more preferred method is not viable.

7.1. Collection for reuse

There are no uses for re-use within the property and space requirements would limit the ability to provide such storage.

7.2. Infiltration to ground

It is considered that infiltration would not be feasible due to the ground conditions. In addition, the site proposals would not provide sufficient space to enable soakaways to be used.

7.3. Discharge to a surface water body

No surface water bodies are in proximity to the development.

7.4. Attenuate surface water within open features/closed tanks

Attenuation would be required to reduce runoff as far as practicable. It is considered that by utilising a green roof runoff could effectively be reduced. The proposed new upward extension will amount to approximately 430m² and replace the area of hardstanding that currently is positively drained. There is no option to retrofit SuDS to the existing building.

The green roof system is proposed as a sedum blanket on a minimum 80mm substrate. The roof areas are proposed as minimal or no access areas and therefore maintenance is required to be minimal.

Calculation presented in Appendix C indicate that a green- roof would provide attenuation during the 1 in 100 year event. When accounting for climate change uplift of 40% the resulting discharge is approximately 7.6l/s which is a significant betterment.

The proposed discharge rates result in a betterment as indicated below:

Storm Event	Existing l/s	Proposed l/s
1 in 1	5.2	1.1
1 in 30	12.7	3.8
1 in 100	16.5	5.3
1 in 100 +40%	n/a	7.6

This method of discharge represents the highest achievable item in the discharge hierarchy for the Scheme. Given the proposals, it is considered that no other SuDS systems are appropriate or achievable and that the maximum benefit is offered as a result of the above proposals.

7. Maintenance

The proposed development will be maintained by the existing and future owners or a designated management company.

A draft Maintenance Schedule is outlined in the Table below.

O & M activity	SuDS component																	
	Pond/wetland	Detention basin	Infiltration basin	Silt traps and catchpits	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavement	Swale/bioretenention/green roofs	Filter strip	Sand filter	Pre-treatment systems	Perforated ring soakaways	Bio retention areas	Rain gardens	Oil interceptors	Flow control devices
Regular maintenance																		
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	□	□	■	■	□	■	■	■	■	■	■	■	■	□	□
Grass cutting	■	■	■	□	□	■	■	□	□	■	■	□	□		■		□	□
Weed/invasive plant control	□	□	□			□	□		□	□	□	□	□		□	■		
Shrub management	□	□	□						□	□	□		□		□	■		
Shoreline vegetation management	■	□											□					
Aquatic vegetation management	■	□											□					
Sediment management (*)	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■
Vegetation/plant replacement	□	□	□							□	□		□		□	□		
Vacuum sweeping and brushing										■								
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

Infiltration surface reconditioning			☐		☐	☐	☐		☐	☐	☐	☐		☐	☐	☐		
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- Will be required
- May be required
- * Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

REGULAR MAINTENANCE ACTIVITIES

Inspections and reporting

Regular SuDS scheme inspections will:

- Help determine optimum future maintenance activities
- Confirm hydraulic, water quality, amenity and ecological performance
- Allow identification of potential system failures, e.g., blockage, poor infiltration, poor water quality etc.

Inspections can generally be required at monthly site visits (e.g., for grass cutting) for little additional cost, and should, therefore, be subsumed into regular maintenance requirements. During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functioning, but in practice this may be difficult or impractical to arrange.

Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include:

- Are inlets or outlets blocked?
- Does any part of the system appear to be leaking?
- Is the vegetation healthy?
- Is there evidence of poor water quality (e.g., Algae, oils, milky froth, odor, unusual colorings)?
- Is there evidence of sediment build-up?
- Is there evidence of ponding above an infiltration surface?
- Is there any evidence of structural damage that requires repair?
- are there areas of erosion or channeling over vegetated surfaces?

Litter/debris removal

This is an integral part of SuDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks.

IRREGULAR MAINTENANCE ACTIVITIES

Sediment removal

To ensure long-term effectiveness, the sediment that accumulates in SuDS should be removed periodically. The required frequency of sediment removal is dependent on many factors including:

- design of upstream drainage system
- type of system
- design storage volume

- characteristics of upstream catchment area (e.g. land use, level of imperviousness, upstream construction activities, erosion control management and effectiveness of upstream pre- treatment).

Sediment accumulation will typically be rapid for the entire construction period (including time required for the building, turfing and landscaping of all upstream development plots). Once a catchment is completely developed and all vegetation is well-established, sediment mobility and accumulation are likely to drop significantly.

Inspection programmes should identify areas of filtration, or infiltration surfaces where vegetation growth is poor and likely to cause a reduced level of system performance.

Such areas can then be rehabilitated, and plant growth repaired.

8. Conclusion

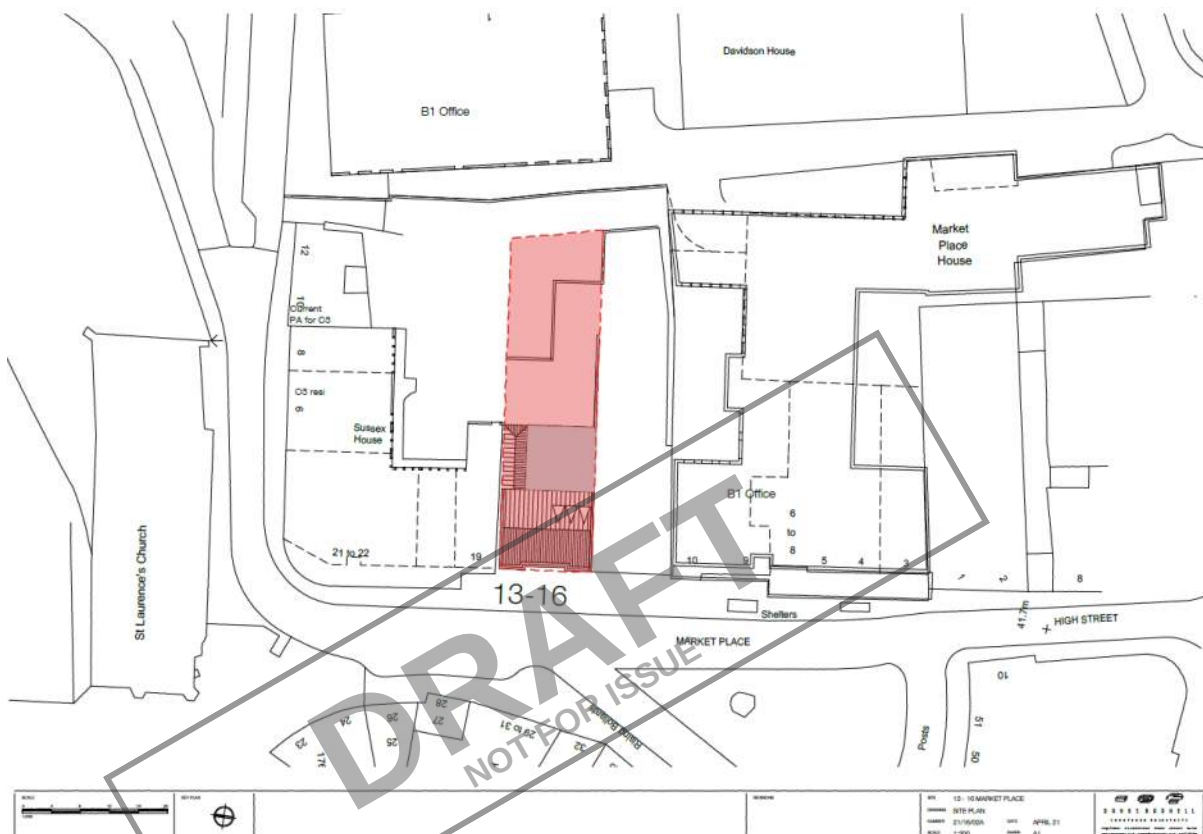
The proposed redevelopment at 13 – 16 Market Place, Reading, RG1 2EG will not be at increased risk of surface water flooding nor will offsite receptors as a result of the development.

A pragmatic approach should be taken to the drainage/SUDS requirements. All SUDS options have been explored and the drainage strategy is proposed based upon these findings. Site constraints limit the available options for discharge of surface water and all options have been considered with the most appropriate method of utilising SUDS being a green roof which would see discharge rates reduced for all events up to and including the 1 in 100 year event. There would be no options to retrofit SUDS systems to the existing building.

All surface water drainage systems will be designed to accommodate all storm events up to the 1 in 100 year event (plus climate change) with no flooding generated.

APPENDIX A – Site Location and Existing Layout

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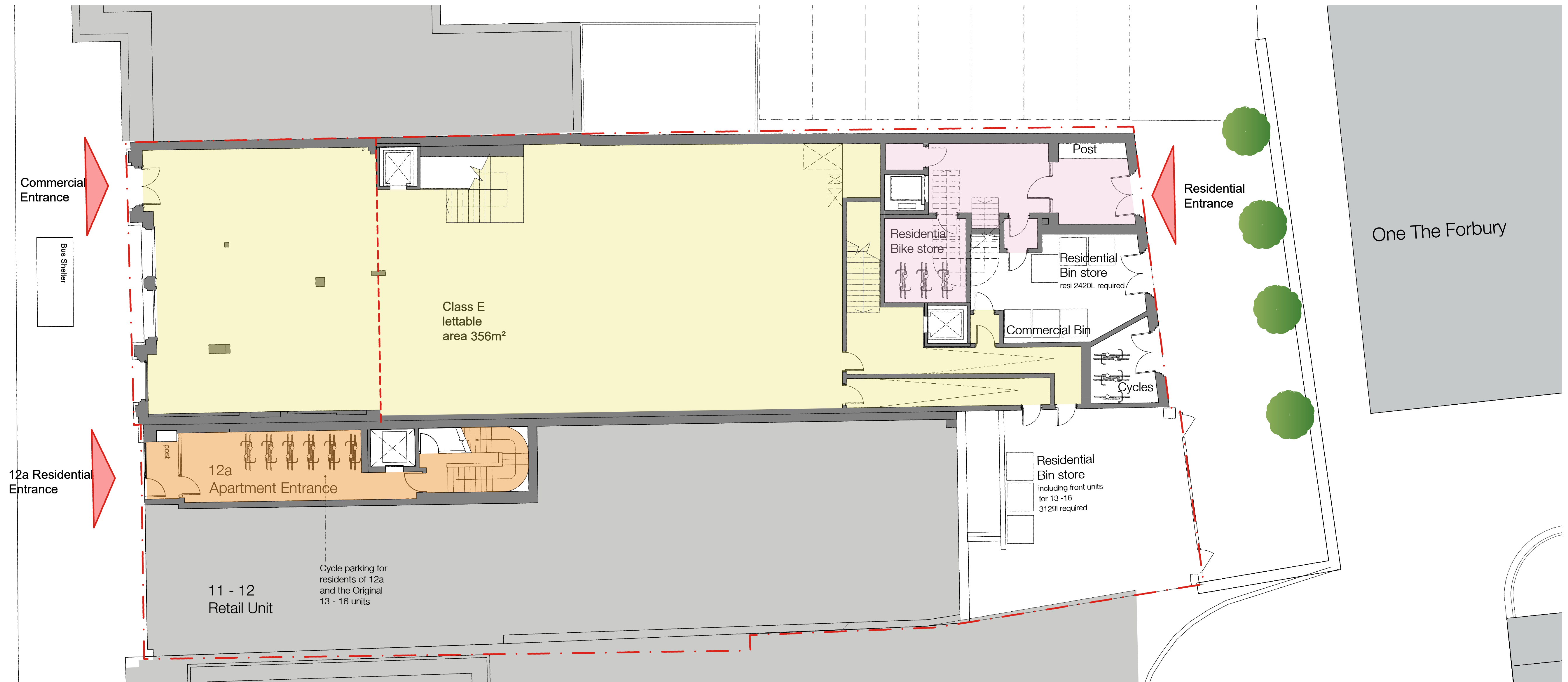




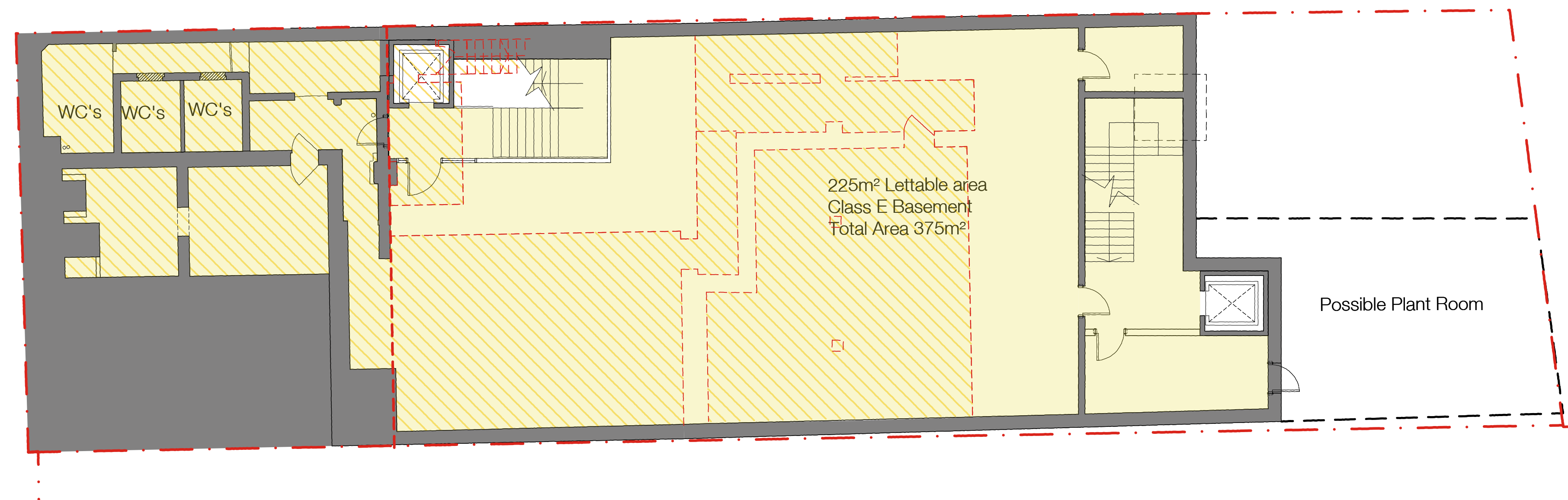
APPENDIX B – Proposed Layout

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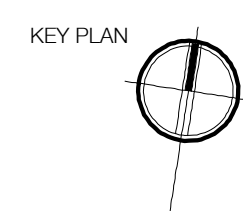
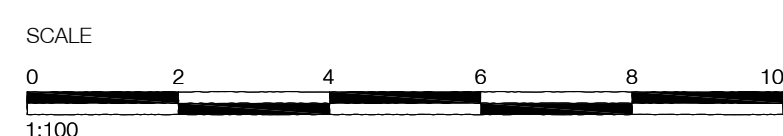
PROPOSED GROUND FLOOR PLAN



PROPOSED BASEMENT PLAN

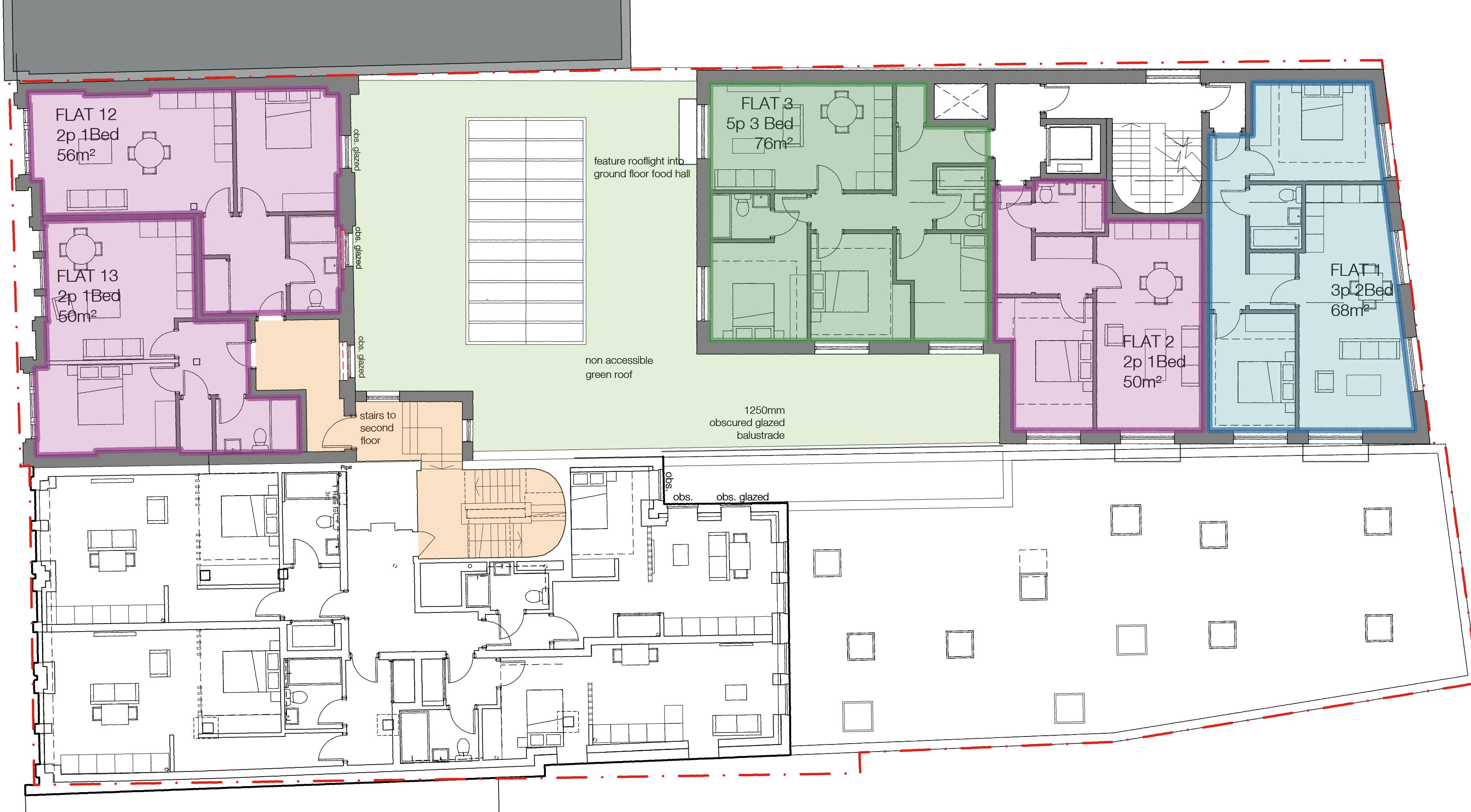
Legend

- Access from 12a for Listed Building Apartments
- Commercial
- Residential
- Existing Basement

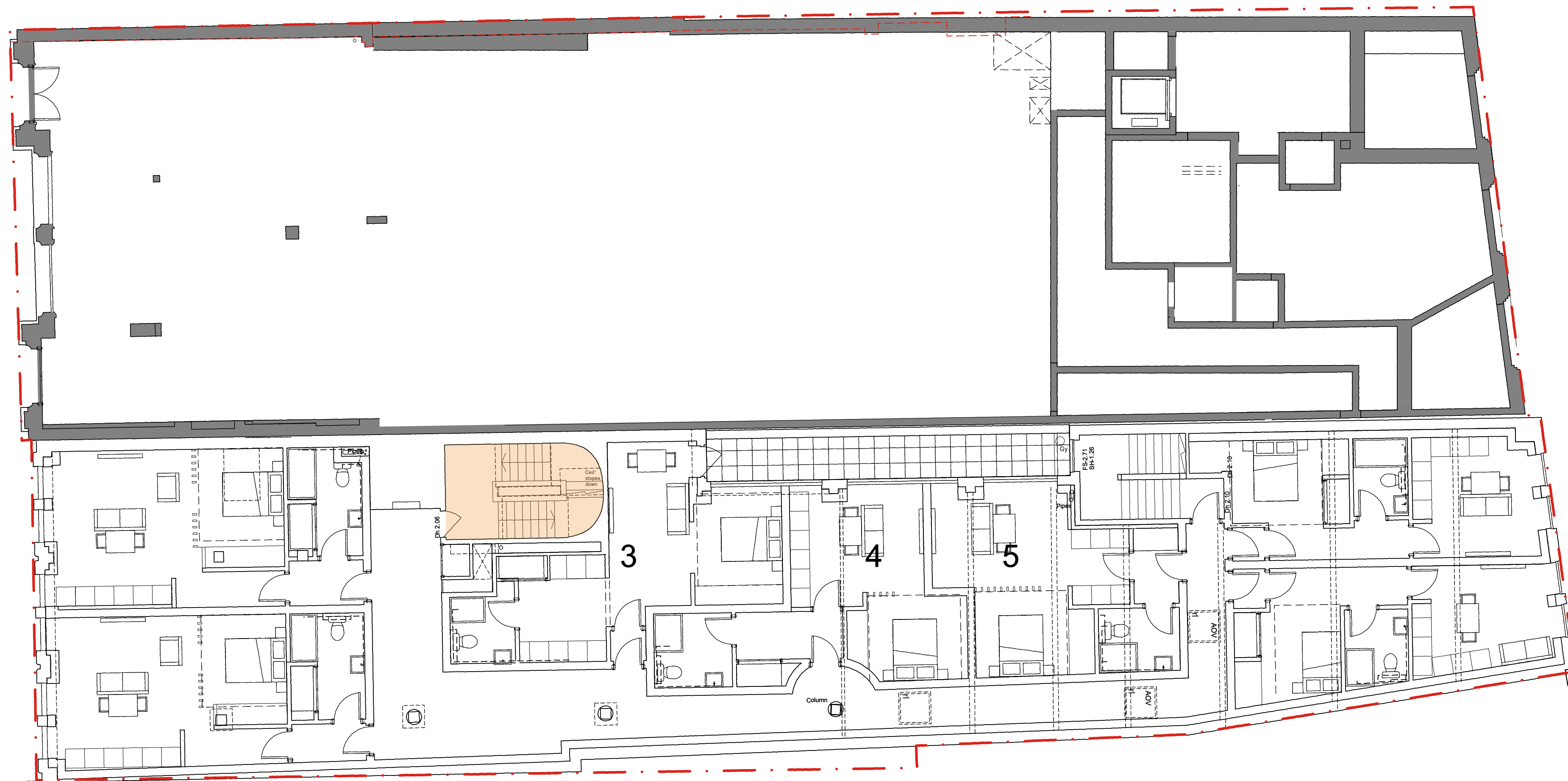


REVISIONS

SITE 13 - 16 MARKET PLACE READING
DRAWING GROUND AND BASEMENT FLOOR PLANS
NUMBER 21/16/71A DATE JAN '23
SCALE 1:100/1:200 PAPER A1 / A3



PROPOSED FIRST FLOOR PLAN

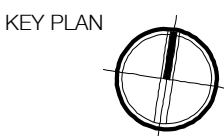
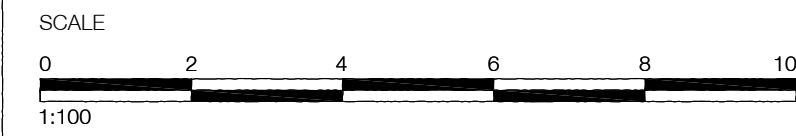


MEZZANINE FLOOR PLAN (11 - 12 FIRST FLOOR)

SCHEDULE OF ACCOMMODATION 13 - 16						
	1p 1 bed	2p 1 bed	3p 2 bed	4p 2 bed	5p 3 bed	total
First Floor	1	2	1		1	5
Second Floor			3	2		5
Third Floor			3			3
Fourth Floor	1		1			2
total	2	2	8	2	1	15

Legend

- 1 Bedroom Apartment
- 2 Bedroom Apartment
- 3 Bedroom Apartment
- Access from 12a for Listed Building Apartments
- Commercial
- Residential



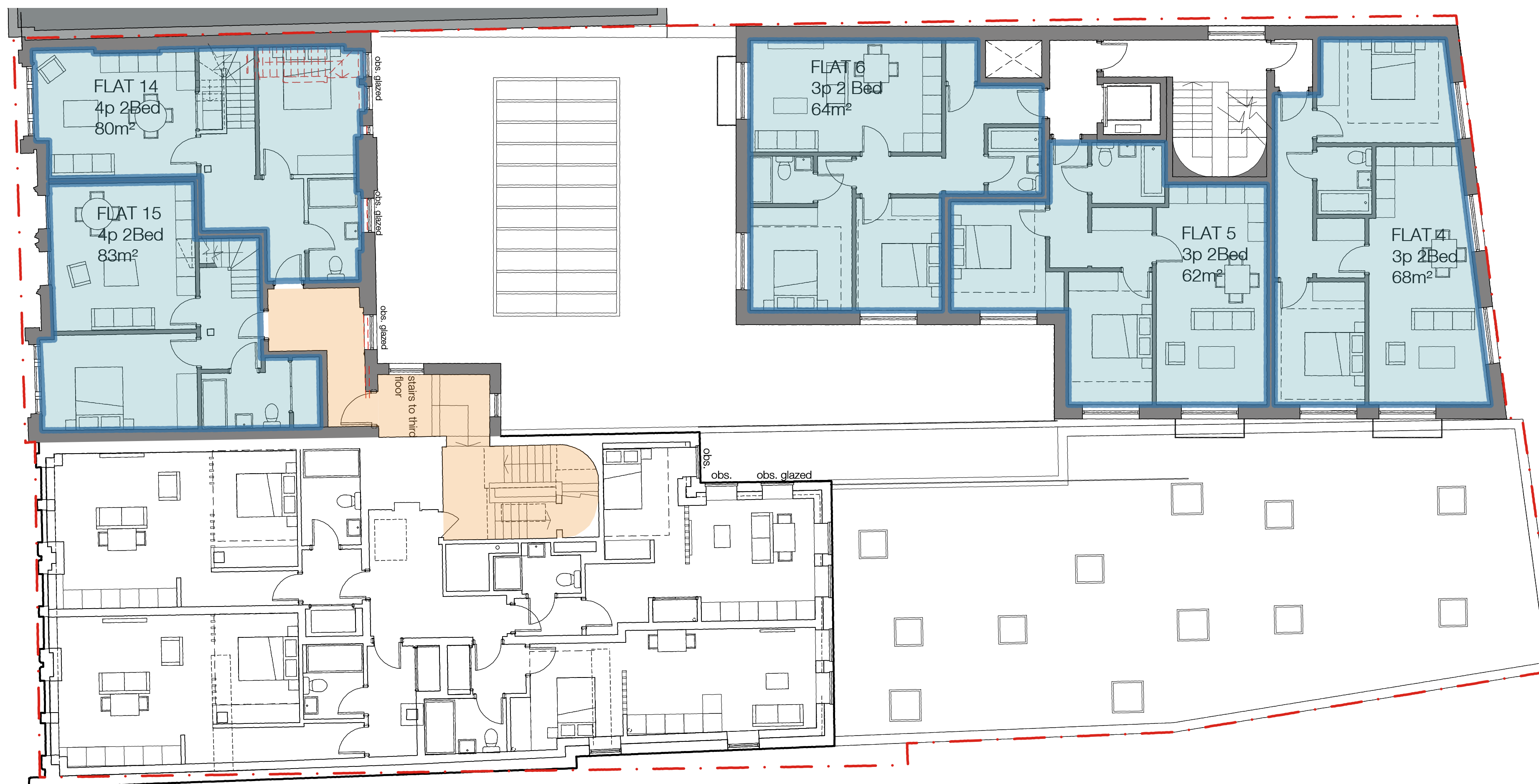
REVISIONS

SITE 13 - 16 MARKET PLACE READING
DRAWING MEZZANINE AND FIRST FLOOR PLANS
NUMBER 21/16/72A DATE JAN '23
SCALE 1:100/1:200 PAPER A1 / A3

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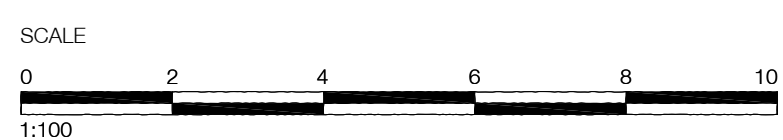
PROPOSED THIRD FLOOR PLAN



PROPOSED SECOND FLOOR PLAN

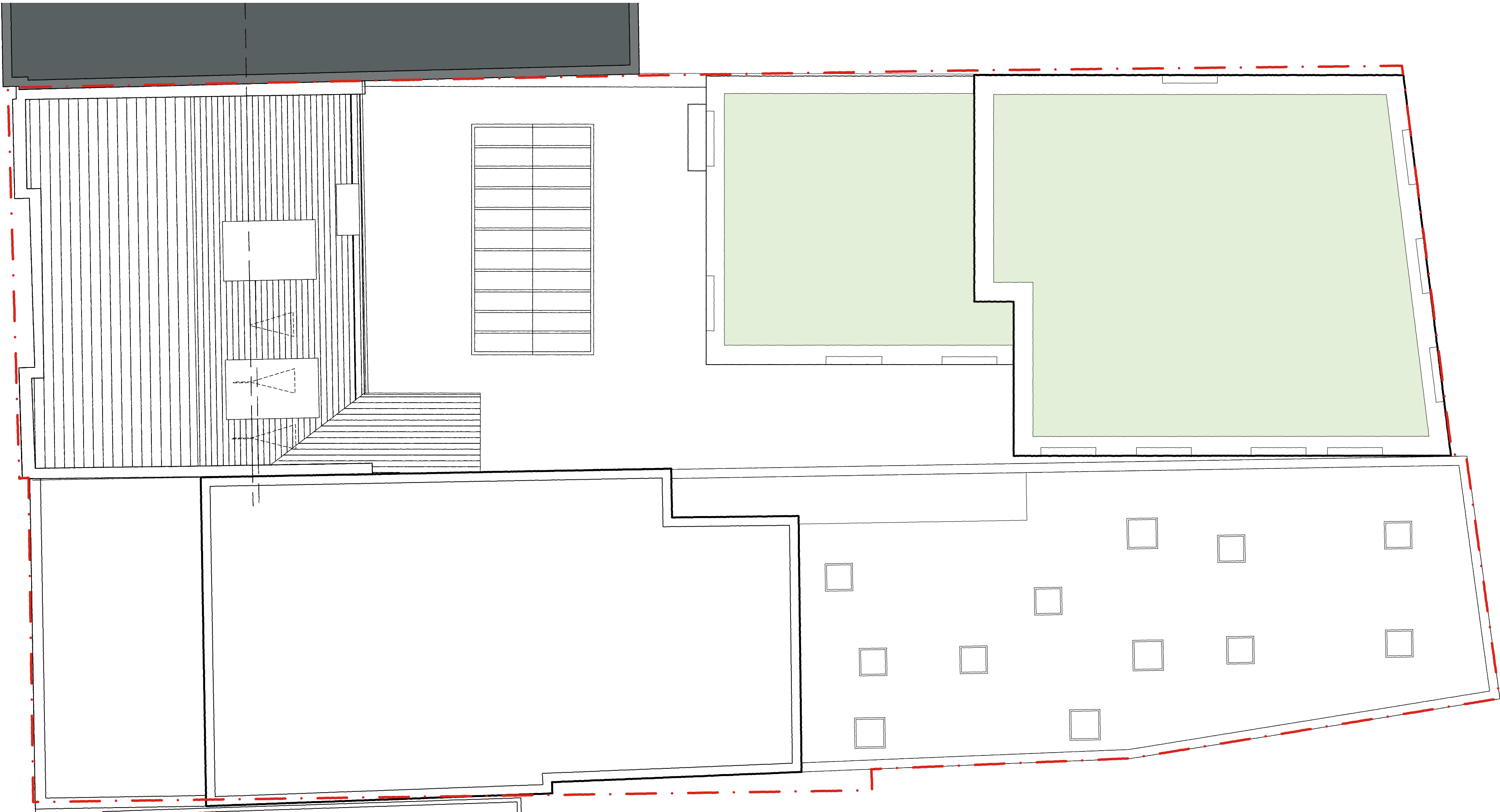
Legend

- 1 Bedroom Apartment
- 2 Bedroom Apartment
- 3 Bedroom Apartment
- Access from 12a for Listed Building Apartments
- Commercial
- Residential

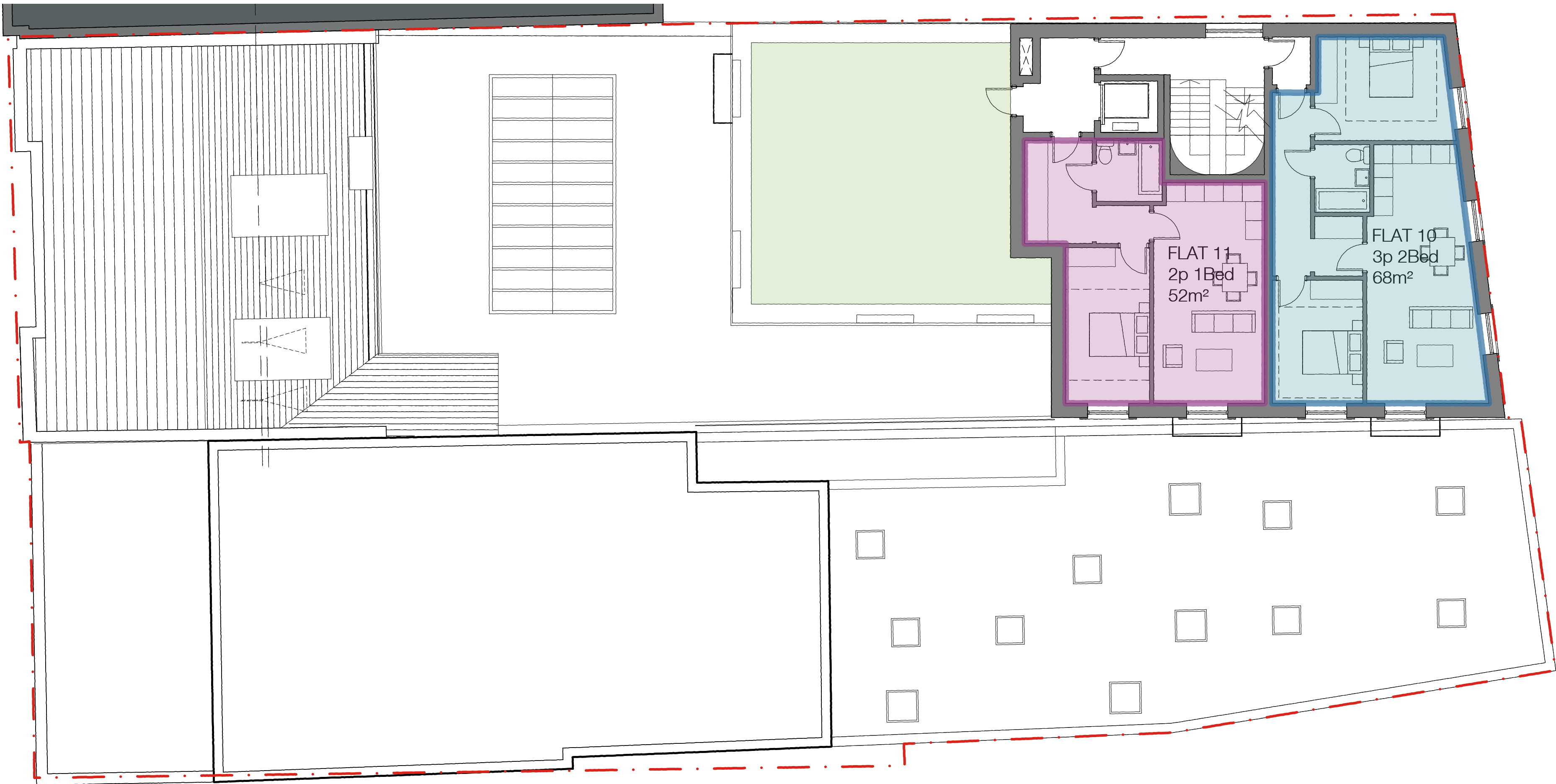


REVISIONS

SITE	13 - 16 MARKET PLACE READING		
DRAWING	SECOND AND THIRD FLOOR PLANS		
NUMBER	21/16/73A	DATE	JAN '23
SCALE	1:100/1:200	PAPER	A1 / A3

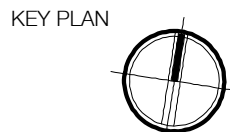
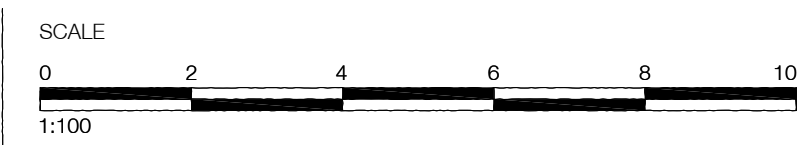


PROPOSED ROOF PLAN



PROPOSED FOURTH FLOOR PLAN

- Legend
- 1 Bedroom Apartment
 - 2 Bedroom Apartment
 - 3 Bedroom Apartment
 - Access from 12a for Listed Building Apartments
 - Commercial
 - Residential



REVISIONS

SITE 13 - 16 MARKET PLACE READING
DRAWING FOURTH AND ROOF PLANS
NUMBER 21/16/74A DATE JAN '23
SCALE 1:100 / 1:200 PAPER A1 / A3

APPENDIX C – Calculations

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.700	Minimum Backdrop Height (m)	0.200
Ratio-R	0.440	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	120.00	Enforce best practice design rules	✓

Nodes

Name	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Green Roof	120.00	20.000		4.711	80.258	0.100
outfall		10.000	450	7.509	79.974	0.900

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.700	Check Discharge Rate(s)	✓
Ratio-R	0.440	1 year (l/s)	5.2
Summer CV	0.740	30 year (l/s)	12.7
Winter CV	0.840	100 year (l/s)	16.5
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	15.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	0.043	Q 1 year (l/s)	5.2
PIMP (%)	100	Q 30 year (l/s)	12.7
CV	1.000	Q 100 year (l/s)	16.5

Node Green Roof Time-Area Diagram

Overrides Design Area	✓	Depression Storage Depth (mm)	5
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	3
Depression Storage Area (m²)	430		
Applies to All storms			

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.008	20-24	0.003	40-44	0.001	60-64	0.000	80-84	0.000	100-104	0.000
4-8	0.006	24-28	0.002	44-48	0.001	64-68	0.000	84-88	0.000	104-108	0.000
8-12	0.005	28-32	0.002	48-52	0.001	68-72	0.000	88-92	0.000	108-112	0.000
12-16	0.004	32-36	0.002	52-56	0.001	72-76	0.000	92-96	0.000	112-116	0.000
16-20	0.004	36-40	0.001	56-60	0.000	76-80	0.000	96-100	0.000	116-120	0.000

Node Green Roof Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	19.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	430.0	0.0	0.100	430.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Green Roof	90	19.907	0.007	1.5	0.8924	0.0000	OK
120 minute winter	outfall	90	9.107	0.007	1.1	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	Green Roof	1.000	outfall	1.1	4.697	0.009	0.0007	3.2

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Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Green Roof	47	19.913	0.013	4.3	1.6641	0.0000	OK
60 minute winter	outfall	47	9.112	0.012	3.8	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Green Roof	1.000	outfall	3.8	6.843	0.032	0.0016	8.7

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Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

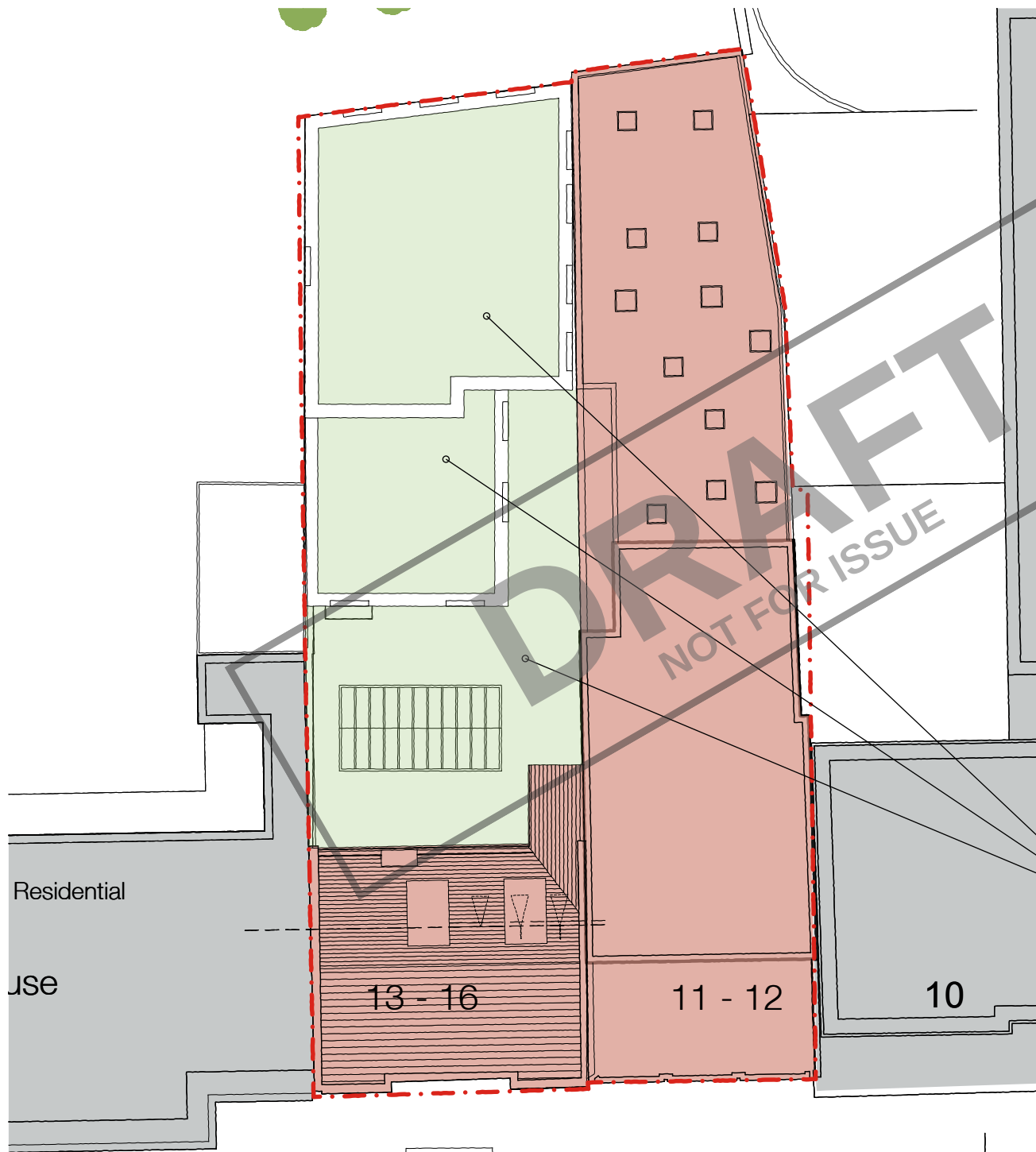
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Green Roof	44	19.915	0.015	5.7	1.9566	0.0000	OK
60 minute winter	outfall	44	9.114	0.014	5.3	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Green Roof	1.000	outfall	5.3	7.521	0.044	0.0020	12.1

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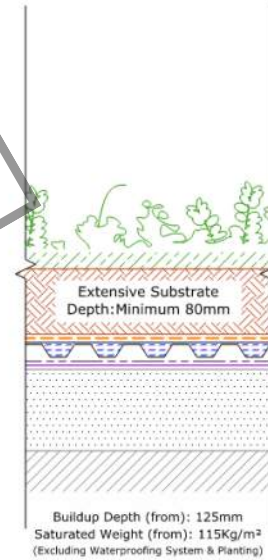
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Green Roof	43	19.918	0.018	7.9	2.3664	0.0000	OK
60 minute winter	outfall	43	9.117	0.017	7.6	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Green Roof	1.000	outfall	7.6	8.358	0.064	0.0026	17.9

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XF300 Sedum Vegetation
Blanket or Sedum & Wildflower
Plug Planting
(DSE20 Drainage Layer)
Alternative drainage board
options available



Proposed Green Roof
system with internal
outlets to connect to
existing drainage
system