MARK & PARTNERS

Project
14-19 Tottenahm Mews
London, W1T 4AA

Title
Surface Water Management Report

Project No
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Contents

Appendices

1. Introduction

Mark and Partners Ltd have prepared this surface water management report to discharge London Borough of Camden Council planning Condition 12, of full planning permission 2020/5633/P, for a new 6-storey building with basement at 14-19 Tottenham Mews, London, W1T 4AA (hereafter referred to as the 'Site'). Condition 12 states:

'Prior to commencement of development, full details of the sustainable drainage system including at least 29m³ of blue roof shall be submitted to and approved in writing by the local planning authority.

The details to include (as necessary) a revised drainage statement, SuDS pro-forma and supporting evidence.

Such a system should be designed to accommodate all storms up to and including a 1:100 year storm with a 40% provision for climate change such that flooding does not occur in any part of a building or in any utility plant susceptible to water, and shall demonstrate the run off rates approved by the Local Planning Authority.

The details shall include the proposed lifetime maintenance plan for each element.

All such systems shall thereafter be retained and maintained in accordance with the approved details.

Reason: To reduce the rate of surface water run-off from the buildings and limit the impact on the storm-water drainage system in accordance with Policies CC1, CC2, CC3 of the London Borough of Camden Local Plan 2017'.

Therefore, this report describes and demonstrates how the surface water run-off rate and volume from the post development Site will be managed to adhere to National and local planning policy, regulations, and relevant design guidance, which include:

- National Planning Policy Framework (NPPF), July 2021, Paragraphs 153-158 and 159-169;
- National Planning Practice Guidance (NPPG) ('Flood Risk and Coastal Change' section), released in March 2014 and updated in August 2022;
- National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2011);
- CIRIA (2010) Planning for SuDS – Making it Happen C687;
- CIRIA SuDS Manual C753 (2015);
- The London Plan (2021) Policy SI 12 (Flood Risk Management) and SI 13 (Sustainable Drainage) (see summary of policies in Section 2.0 of this report);
- London Borough of Camden - Surface Water Management Plan (July 2011);
- Camden Planning Guidance – Water and Flooding (March 2019);
- Camden Local Plan (2017) – Policies CC1, CC2 and CC3.

Subsequently, London Borough of Camden Council (LBCC), acting as Lead Local Flood Authority (LLFA), and Thames Water (TW), need to be satisfied that the design and drainage principles of the Site will address the surface water management and risk of flooding, and will ensure that the Site will not increase the risk of flooding to neighbouring land and property.

2. National / Local Policies and Water Management Guidance

2.1. National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

NPPF 2021 sets out the Government's national policy on development and flood risk, and seeks to provide clarity on what is required at regional and local levels, to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.

NPPF Paragraphs 153 to 158 provide guidance for developments to take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk.

NPPF Paragraphs 159 to 169 provide guidance for planning and flood risk, where are plans should apply a sequential, risk-based approach to the location of development taking into account current and future impacts of climate change; to ensure that flood risk is not increased elsewhere due to the development; and to incorporate sustainable drainage systems.

NPPG, Paragraph 020 Reference ID: 7-020-20220825, outlines that the objectives of this FRA are to establish whether a proposed development is likely to be affected by current or future flooding from any source; whether it will increase flood risk elsewhere; whether the measures proposed to deal with these effects and risks are appropriate; whether there is evidence for the local planning authority to apply (if necessary) the Sequential Test; and whether the development will be safe and pass the Exception Test, if applicable.

2.2. Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

2.3. London Plan (March 2021) - Policy SI 13 (Sustainable Drainage) states:

A. *'Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.*

B. *Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:*
   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.*

C. Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D. Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation'.

2.4. Camden Local Plan (2017)

The relevant planning policies in the Camden Local Plan are as follows:

Policy CC1 Climate Change Mitigation

'The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will:

a) promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b) require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c) ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d) support and encourage sensitive energy efficiency improvements to existing buildings;

e) require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f) expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g) working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h) protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

i) requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Policy CC2 Adapting to Climate Change

'The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

a) the protection of existing green spaces and promoting new appropriate green infrastructure;

b) not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Stainable Drainage Systems;

c) incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d) measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement'.

Sustainable Design and Construction Measures

'The Council will promote and measure sustainable design and construction by:

e) ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

f) encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;

g) encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

h) expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019'.

Policy CC3 Water and Flooding

'The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible. We will require development to:

a) incorporate water efficiency measures;

b) avoid harm to the water environment and improve water quality;

c) consider the impact of development in areas at risk of flooding (including drainage);

d) incorporate flood resilient measures in areas prone to flooding;

e) utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and

f) not locate vulnerable development in flood-prone areas.

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore'.

3. Site Setting and Description

3.1. Site Location

The Site is in a residential/ commercial area of Fitzrovia, is approximately 500m south of Warren Street station, approximately 750m north-east of Oxford Road station, and is bound commercial buildings, Tottenham Mews to the east, commercial buildings leading to Tottenham Street to the south, and commercial buildings leading to Cleveland Street to the west.

The nearest postcode is W1T 4AA, with the co-ordinates of the centre of the Site being: Easting: 529320, Northing: 181800.

3.2. Existing Site and Topography

As detailed in Appendix A, the Site currently consists of a demolished commercial building. As the Site was previously developed it is deemed to be a 'brownfield'.

In terms of topography, the Site is relatively flat with levels ranging from approximately 26.27m AOD to the north, to approximately 26.41m AOD towards the centre.

3.3. Proposed Development

Details of the proposed development have been stated by the Architect and are shown in Appendix B of this report. In brief, and as stated by LBCC, the Site is the:

'Erection of a six storey building (and basement) to provide office (use Class E) at part ground and basement levels and self-contained flats (use class C3) at ground and floors one to five; with associated landscaping, cycling parking and enabling works'.

3.4. Ground Conditions

A ground investigation is yet to take place at the Site. However, data for the ground conditions can be sourced from the British Geological Survey (BGS) website, where it identifies the development site to have superficial deposits of Lynch Hill Gravel Member (sand and gravel with lenses of silt and clay), over London Clay Formation.

The BGS website also shows borehole log data from areas within 50m of the Site and within the same strata, identify the strata of the ground to predominantly consist of made ground over clay, with narrow bands of sands and gravels.

3.5. Waterbodies

There are no waterbodies near the Site, with the nearest main waterbody being the River Thames approximately 2.5km to the south-east.

3.6. Existing Drainage / Sewers

The Thames Water asset plan in Appendix C identifies the nearest public sewer systems is a 381mm diameter combined water sewer in Tottenham Mews, which flows in a south-west direction, and connects / discharges to a 1219x813 combined water sewer in Tottenham Street.

A drainage survey was carried out by G.O. Drainage Services Ltd in July 2020, which shows the demolished commercial building was previously served by a 100mm combined water drainage network, which connects / discharges to the 381mm diameter combined sewer in Tottenham Mews.

3.7. Development Areas

The Site boundary area is approximately 540m² / **0.054 ha**.

The pre-development site is and was completely impermeable, with the surface water run-off from the area discharging off site to the combined water sewer in Tottenham Mews. Therefore, for the pre-development run-off calculation, the area is to be 0.054 ha.

The proposed building and external areas cover the whole development area, and therefore the post development site is also completely impermeable, which equates to a total surface water catchment area of 0.054 ha.

However, there will be above ground blu-roof systems on the fifth floor and roof level which will equate to 380m² / **0.038 ha**. The remaining 'normal' roof area and ground floor paved area will therefore equate to 160m² / **0.016 ha.**

A summary, the pre and post-development areas are as follows:

Pre-Development SW Catchment Area	-	0.054 ha
Fifth Floor Blu-Roof Area	-	0.012 ha
Roof Level Blu-Roof Area	-	0.026 ha
Remaining 'Normal' Roof and Ground Flood External Areas	-	0.016 ha
Total Surface Water Management Area	-	0.054 ha

Note that the surface water management will be for all areas of the site within the red line boundary as shown on drawing in Appendix E.

4. Surface Water Management Principles

4.1. Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain or other drain;
- Discharge to combined sewer.

4.2. The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are:

- Prevention - Prevention of run-off by good site design and reduction of impermeable areas;
- Source Control - Dealing with water where and when it falls (e.g. infiltration techniques);
- Site Control - Management of water in the local area (e.g. swales, detention basins);
- Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

4.3. Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property and critical infrastructure are protected from flooding;
- Ensure that the development does not increase flood risk off site;
- Ensure that SuDS can be economically maintained for the development.

4.4. Peak Surface Water Flow

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

*'**S3** For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event'.*

LBCC planning Condition 12 states:

'Such a system should be designed to accommodate all storms up to and including a 1:100 year storm with a 40% provision for climate change and shall demonstrate the run off rates approved by the Local Planning Authority'.

Therefore, based on the guidance and statement, the surface water run-off rates will be reduced so that the predevelopment rates or rates agreed at planning are not exceeded.

4.5. Volume Control

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

S5 *Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.*

S6 *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.*

4.6. Flood Risk

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

*'**S7** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.*

S8 *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

S9 *The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property'.*

4.7. Pollution

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with Ciria SuDS Manual C753, Chapter 4.

4.8. Designing for Exceedance

The development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. This will be achieved by designing suitable ground exceedance or flood pathways, and run-off will be completely contained within the drainage system (including areas designed to hold or convey water) for all events up to a 1 in 100-year event. The design of the site ensures that flows from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

5. Surface Water Run-Off Destination

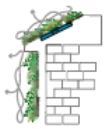
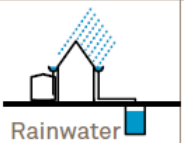
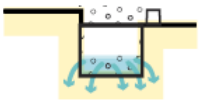
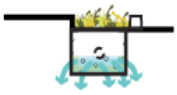
The destination of the surface water run-off from the Site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

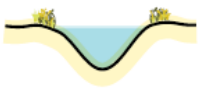
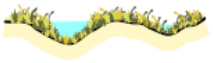
Run-Off Destination	Feasible	Description
Discharge to Ground	No	The BGS data identifies the ground at the Site to predominantly consist of clay with small bands of sands and gravels. Clay is known to have exceptionally low or no infiltration value, and the sand and gravel depths are relatively shallow. The proposed building also covers most of the Site, and therefore in accordance with Approved Document H, no soakaway can be built as the structure will not be greater than the required 5m. Therefore, due to the presence of clay, shallow bands of sand and gravel, and the extent of the building discharge to ground is not feasible.
Discharge to Surface Water Body	No	There are no known waterbodies near to the Site, and therefore discharge to a waterbody is not feasible.
Discharge to Surface Water Sewer	Yes	There are no known surface water sewers near to the Site, and therefore discharge to a surface water sewer is not feasible.
Discharge to Highway Drain or Other	No	There are no know highway drains near the Site, and therefore discharge to a highway drain is not a feasible destination.
Discharge to Combined Water Sewer	**Yes**	As discharge to ground is not feasible due to ground conditions and the extents of the building, and there are no known waterbodies, surface water sewers, or highway drains near the Site, the only alternative is to discharge to the 381mm diameter combined water sewer in Tottenham Mews. This will replicate the pre-development surface water discharge destination of the Site.

6. SuDS Feasibility

To reduce the surface water run-off to the greenfield rates, where possible, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenancce typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table below:

SuDS Method	Feasible Use	Description
Blu-Roofs	**Yes**	It is proposed to have blu-roof systems to restrict and attenuate the surface water run-off at the 5th floor and roof level. Details of the blu-roof system to be used can be found in the appendices.
Rainwater Harvesting	No	In accordance with BS8515:2009 + A1:2013, the annual demand of the building is likely to be greater than the annual rainwater yield (relatively small roof area compared to number of residential units). Therefore, the use of rainwater harvesting for use within the units is not a feasible SuDS method.
Soakaway	No	The BGS data identifies the ground at the Site to predominantly consist of clay with small bands of sands and gravels. Clay is known to have exceptionally low or no infiltration value, and the sand and gravel depths are reletively shallow.

		The proposed building also covers most of the Site, and therefore in accordance with Approved Document H, no soakaway can be built as the structure will not be greater than the required 5m. Therefore, due to the presence of clay, shallow bands of sand and gravel, and the extent of the building discharge to ground is not feasible.
Permeable Paving	No	There are only relatively small external areas within the Site, and therefore unsuitable areas for permeable paving to be used as a feasible SuDS method.
Filter Drain	No	There are no soft-landscaping areas at ground level of the Site, and theefore there are unsuitable areas for filter drains to be used as a feasible SuDS method.
Swales / Ponds / Bioretention areas	No	There are no soft-landscaping areas at ground level of the Site, and theefore there are unsuitable areas for swales, ponds or bioretnetion areas to be used as a feasible SuDS method.
Hardscape Storage	No	There are only relatively small external areas within the Site, and therefore unsuitable areas for hardscape storage to be used as a feasible SuDS method.
Underground Storage	**Yes**	The surface water run-off from the Site will be restricted. The rate will be lower than the surface water discharge, and therefore there will be a requirement to have underground storage to prevent flooding.

7. Pre-Development Surface Water Run-Off Rates

The pre-development surface water run-off rates and volumes are to be calculated, so that the post development rates, and volume can be compared to them.

The calculations to determine the pre-development surface water run-off rates and volume are based on the pre-development surface water run-off area of 0.054 ha, and the data given by the Flood Estimation Handbook (FEH).

The pre-development surface water run-off rates and volume have also been simulated in the MicroDrainage software (Appendix D), where the variables used (FEH data) to calculate the surface water run-off rates and volume are as follows:

Pre-Development Area	=	0.054 ha
Site Location	=	GB 529800 181850 TQ 29800 81850
C (1km)	=	-0.026
D1 (1km)	=	0.324
D2(1km)	=	0.301
D3 (1km)	=	0.244
E (1km)	=	0.333
F (1km)	=	2.498

Based on the above variables and computer software results, the pre-development surface water run-off rates will be as follows:

Q_1	=	7.0 l/s (15-minute storm duration*)
Q_{30}	=	25.2 l/s (15-minute storm duration*)
Q_{100}	=	37.9 l/s (15-minute storm duration*)

*The critical storm duration for each of the return period is 15 minutes.

Based on the above variables for the surface water run-off from the pre-development impermeable area, it has been calculated that the pre-development surface water discharge volume for the pre-development site (at 6-hour storm events) are as follows:

Q_{100}	=	36.82m³ (360-minute storm duration)

8. Approved Planning - Surface Water Run-Off Rates

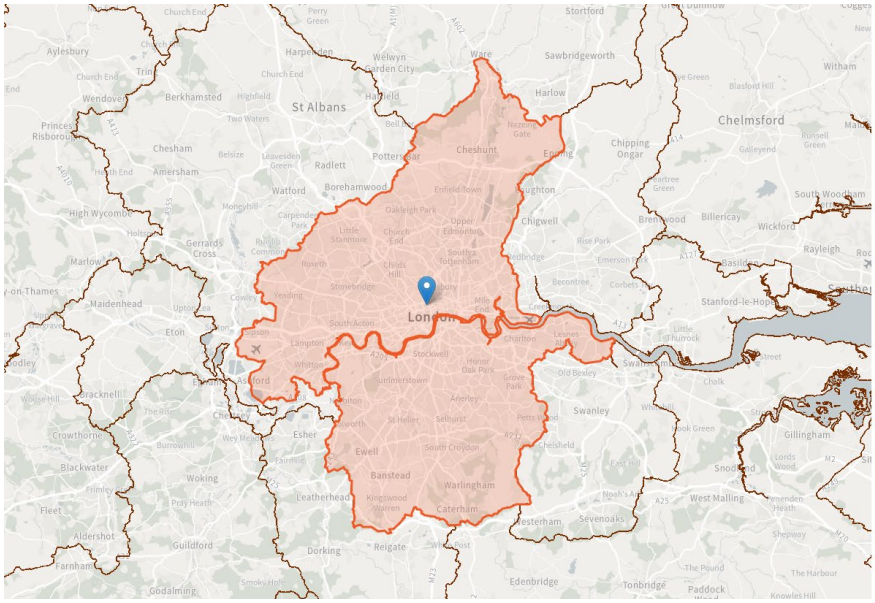
The surface water run-off rates approved at planning by LBCC are as follows:

Q_1	=	1.9 l/s
Q_{30}	=	4.6 l/s
Q_{100}	=	5.9 l/s
$Q_{100 + CC}$	=	7.6 l/s

9. Climate Change and urban Creep Allowances

9.1. Climate Change Allowance

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance summarised in Figure 5 below.



London Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	20%	35%
2070s	20%	35%

1% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

This map contains information generated by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080. Centre for Environmental Data Analysis, 2022

Figure 1 - DEFRA – Climate Change Allowances

The lifetime of the Site is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance.

Therefore, the climate change allowance for the Site surface water run-off will be 40% for the 100-year event.

10. Above Ground Surface Water Management Calculation

10.1. Blu-Roof Design

The surface water run-off from the blu-roof areas will discharge through a vortex at roof level (to reduce flows) and will flow directly to the combined water sewer in Tottenham Mews, and will not discharge to the new below ground layout.

Details of the above ground connection to the sewer and sections through the proposed blu-roof system are shown in Appendix E.

10.2. Surface Water Run-Off Rates

The restricted surface water run-off rates from the blu-roof areas are as follows:

Fifth Floor (0.012 ha)	-	0.3 l/s
Roof Level (0.026 ha)	-	0.4 l/s
Total SW Run-Off (0.038 ha)	-	0.9 l/s

Note that the dsurface water run-off rates will be constnt from the 1-year to 100-year + 40% cliamte change storm event.

10.3. Above Ground Surface Water Attenuation

As detailed in the MicroDrainage calculations in Appendix F, the blu-roof system will be formed with a 100mm deep crate to attenuate the surface water at the fifth floor level, when restricting the area of 0.012 ha to 0.3 l/s (FEH data as stated in Section 7 is used for surface water run-off and attenuation calculations).

The maximum volume of storage within the blu-roof system will equate to 12.00m³ (120m² / 0.100m).

The calculation results in Appendix F show that the depth of water to up 71mm, which equates to an attenuation volume of 9.24m² (120m² x 0.077m). Therefore, the depth / volume of the above ground crate system will be acceptable to attenuate the restricted surface water for all storms up to and including the 100-year+ 40% allowance event.

As detailed in the MicroDrainage calculations in Appendix F, the blu-roof system will be formed with a 100mm deep crate to attenuate the surface water at the roof level, when restricting the area of 0.026 ha to 0.6 l/s (FEH data as stated in Section 7 is used for surface water run-off and attenuation calculations).

The maximum volume of storage within the blu-roof system will equate to 260.00m³ (260m² / 0.100m).

The calculation results in Appendix F show that the depth of water to up 74mm, which equates to an attenuation volume of 19.24m² (260m² x 0.074m). Therefore, the depth / volume of the above ground crate system will be acceptable to attenuate the restricted surface water for all storms up to and including the 100-year+ 40% allowance event.

10.4. Above Ground Surface Water Drain Down Time

The calculations in Appendix F show the half drain time from the 5th floor blu-roof system during the 100-year + 40% allowance storm event is 274-minutes, which is deemed to be acceptable (half drain time below 24-hours / 1440-minutes).

The calculations in Appendix F show the half drain time from the roof level blu-roof system during the 100-year + 40% allowance storm event is 338-minutes, which is deemed to be acceptable (half drain time below 24-hours / 1440-minutes).

11. Below Ground Surface Water Management Calculation

11.1. Below Ground Drainage Design

As detailed in Appendix E, the below ground drainage network is to be built in the external areas along the eastern boundary of the site, and will consist of 460mm diameter inspection chambers, 150mm diameter pipes, a flow control chamber containing an orifice, and an attenuation tank in the form of cellular units.

The below ground drainage network is to take the surface water run-off from the 'normal' roof and external areas only, with the surface water flowing through the control chamber prior to discharge to the combined water sewer in Tottenham Mews. The below ground drainage network will not rake the surface water run-off from the blu-roof areas, which will discharge directly to the sewer.

11.2. Surface Water Run-Off Rates

The surface water run-off from the normal roof and external areas (0.016 ha) is calculated using the FEH data (as stated in Section 7) for surface water run-off rates. The surface

The surface water run-off rates are to be restricted by a **70mm** orifice within the flow control chamber, where the rates will be reduced so that they don't exceed the pre-development or approved rartes (see Sections 7 and 8), when taking into account the discharge from the blu-roof systems.

Based on the FEH rainfall data, a catchment area of 160m², and a 70mm orifice, the calculations in Appendix G show the surface water run-off rates to be:

Storm	**-**	**Rate**	**-**	**Critical Storm Event**
Q_1	-	1.0 l/s	-	30-minute winter
Q_{30}	-	3.5 l/s	-	15-minute winter
Q_{100}	-	4.8 l/s	-	15-minutewinter
$Q_{100 + CC}$	-	5.9 l/s	-	15-minute winter

11.3. Surface Water Attenuation

As detailed in the below ground surface water management calculations in Appendix G, and demonstrated on the drainage drawing in Appendix E, the attenuation size / volume of the cellular units to prevent flooding, when restricted to the above rates is as follows:

Cellular Unit Length	-	26.00m²
Cellular Unit Width	-	0.50m
Cellular Unit Area	-	13.00m²
Cellular Unit Depth	-	0.40m
Tank Porosity	-	0.95
Attenuation Volume	-	4.94m³
Overall Tank Volume	-	5.20m³

The MicroDrainage calculations show that with this volume of atteantuion there will be no flooidng from the below ground ftraiange network when restricted, for all storms up to and including the 100-year + 40%.

11.4. Surface Water Drain Down Time

The calculations in Appendix G show the half drain time from the below ground drainage system during the 100-year + 40% allowance storm event is 8-minutes, which is deemed to be acceptable (half drain time below 24-hours / 1440-minutes).

12. Overall Surface Water Run-Off Rates

The combined surface water run-off rates from both the blu-roof and below ground drainage system are to be calculated to ensure the rates do not exceed the pre-development or LBCC agreed rates.

The total surface water run-off rates from the post-development site are as follows:

12.1. Total Surface Water Run-Off Rates

Storm	5th Floor Rate	Roof Rate	BG Rate	Total Rate
Q_1	0.3 l/s	0.6 l/s	1.0 l/s	**1.9 l/s**
Q_{30}	0.3 l/s	0.6 l/s	3.5 l/s	**4.4 l/s**
Q_{100}	0.3 l/s	0.6 l/s	4.8 l/s	**5.7 l/s**
$Q_{100 + CC}$	0.3 l/s	0.6 l/s	5.9 l/s	**6.8 l/s**

A comparison between the post development surface water run-off rates and the pre-development and the LBCC agreed rates are as follows:

12.2. Pre-Development Rate to Post Development Rate

Storm	Pre-Dev	Post Dev	Difference
Q_1	7.0 l/s	1.9 l/s	73% Reduction
Q_{30}	25.2 l/s	4.4 l/s	83% Reduction
Q_{100}	37.9 l/s	5.7 l/s	85% Reduction
$Q_{100 + cc}$	N/A	6.8 l/s	N/A

12.3. LBCC Agreed Rate to Post Development Rate

Storm	LBCC	Post Dev	Difference
Q_1	1.9 l/s	1.9 l/s	Equivalent
Q_{30}	4.6 l/s	4.4 l/s	4% Reduction
Q_{100}	5.9 l/s	5.7 l/s	3% Reduction
$Q_{100 + cc}$	7.6 l/s	6.8 l/s	11% Reduction

The calculations show that the post development surface water run-off rates are the equivalent to, or the reduction of, the pre-development and LBCC agreed rates. The rates also adhere to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S3 (see Section 4.4). Therefore, the rates are deemed to be acceptable.

13. Overall Surface Water Run-Off Volume

The combined surface water run-off volumes from both the blu-roof and below ground drainage system are to be calculated to ensure the volumes are at a rate that don't adversely affect flood risk.

The total surface water run-off volume for the 100-year + 40% climate change, 6-hour storm event, from the post-development site are shown in the MicroDrainage calculations (Appendix F and G), and are as follows:

13.1. Total Surface Water Run-Off Volume

Storm	-	5th Floor Vol	-	Roof Volume	-	BG Volume	-	Total Volume
$Q_{100 + CC}$	-	11.10m³	-	21.50m³	-	15.30m³	-	47.90m³

A comparison between the post development surface water run-off rates and the pre-development volume is as follows:

13.2. Pre-Development Volume to Post Development Volume

Storm	-	Pre-Dev	-	Post Dev	-	Difference
$Q_{100 + CC}$	-	36.82m³	-	47.90m³	-	30% Increase

The surface water run-off volume is a 30% increase of the pre-development run-off volume. However, as the rate of discharge is an 85% reduction of the pre-development rate, the volume will not adversely increase flood risk to the combined water sewer. Therefore, the volume still adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S6 (see Section 4.5).

14. Maintenance Requirements

The management and maintenance of the surface water drainage networks and SuDS features will be undertaken by contractors appointed by the owners / residents of the new residential units, where payments of the works will form part of the property deeds and / or rental agreements, and part of the overall service charge / ground rent for the overall development site and communal areas.

This is common practice for multi-unit residential buildings / development. The maintenance and management will be under the responsibility of the site owners (Derwent) until all units are occupied, and will be carried out as follows:

14.1. Surface Water Drainage Networks, Cellular Units and Flow Control

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

14.2. Living / Green / Blu-Roofs

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from on surface of green roof (where may cause risk performance)	Monthly
Where rainfall infiltration into green roof grass structure, lengths and ensure working effectively.	As required, but at least twice a year

14.3. Linked and Further Maintenance and Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas.

A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

15. Surface Water Exceedance Design

In the event of network exceedance (greater than 100-year + 40%), surface water would flow onto Tottenham Mews and subsequently Tottenham Street.

Flood water to discharge onto Tottenham Mews and Tottenham Street before flooding any area part of the new building. Flood water will be contained within the roads (due to kerb upstands) and will flow away from the development due to the topography of the ground. Therefore, the risk of flooding due to an exceedance event is deemed to be low.

16. Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment.

16.1. Roof Area Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level	=	Low
C753 Table 26.2 Pollution Hazard Index:		
Total Suspended Solid (TSS)	=	0.2
Metals	=	0.2
Hydrocarbons	=	0.05
Pollution Hazard Index	=	**0.45**

16.2. Roof Area Pollutant Mitigation

Mitigation Measures:

Blu-Roof System

The lowest of the Pollutant Mitigation Indices:

Total Suspended Solid (TSS)	=	0.4
Metals	=	0.4
Hydrocarbons	=	0.5
SuDS Mitigation Indices	=	1.30

The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

17. Conclusion / Summary

17.1. SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being blu-roofs, a flow control chamber, and an attenuation tank in the form of cellular units, with the surface water destination being to a combined water sewer.

17.2. Peak Flow Control

The post development surface water run-off rates are the equivalent to, or the reduction of, the pre-development and LBCC agreed rates. The rates also adhere to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S3 (see Section 4.4). Therefore, the rates are deemed to be acceptable.

17.3. Volume

The surface water run-off volume is a 30% increase of the pre-development run-off volume. However, as the rate of discharge is an 85% reduction of the pre-development rate, the volume will not adversely increase flood risk to the combined water sewer. Therefore, the volume still adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S6 (see Section 4.5).

17.4. Flood Risk within the Development

The blu-roof system and below ground attenuation tank in the form of cellular units are adequately designed to attenuate the surface water for all storm up to and including the 100-year + 40% climate change evet, wen being restricted to the required rates.

17.5. Exceedance Event

In the event of network exceedance (greater than 100-year + 40%), surface water would flow onto Tottenham Mews and subsequently Tottenham Street.

Flood water to discharge onto Tottenham Mews and Tottenham Street before flooding any area part of the new building. Flood water will be contained within the roads (due to kerb upstands) and will flow away from the development due to the topography of the ground. Therefore, the risk of flooding due to an exceedance event is deemed to be low.

17.6. Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be undertaken by contractors appointed by the owners / residents of the new residential units, where payments of the works will form part of the property deeds and / or rental agreements, and part of the overall service charge / ground rent for the overall development site and communal areas.

This is common practice for multi-unit residential buildings / development. The maintenance and management will be under the responsibility of the site owners (Derwent) until all units are occupied.

17.7. Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

Appendix A Topographical Survey

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
S1	529349.861	181778.665	26.638
S2	529353.361	181757.586	27.234
S3	529326.283	181814.204	26.437
S4	529344.581	181788.863	26.598

OS Note:

The Ordnance Survey tile is to be used as a guide only.

OS Buildings — *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net)

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36(15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid.

Building Survey Legend:

SHt 1.00 HHt 2.12	Sill Height from FFL. Head Height from FFL.
SL 51.03m HL 52.82m	Sill Level from defined datum. Head Level from defined datum.
Susp CHt: 2.00 Struct CHt: 3.00	Suspended Ceiling Height from FFL. Structural Ceiling Height from FFL.
Susp Ceil: 30.00m Struct Ceil: 31.00m	Suspended Ceiling Level from datum. Structural Ceiling Level from datum.
IFL: 100.00m +100.00m	Internal Floor Level (General). Internal Floor Level (Specific).
Insertion Point	Insertion Point for overlay drawings of other floors or details.

Incoming Services

Elec Gas Water

Topographical Survey Legend:

Buildings, Wall, Kerb line, Line marking, Drop kerb, Centre line, Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Canopy/Overhang, Verge, Station and Name, Station Level

IC Inspection chamber; PInv Pipe invert; Gy Gully; Bg Back gully; Dp Down pipe; Pipe Pipe above ground; MH Manhole; WL Water level; Boll Bollard; IB Illuminated bollard; Bin Rubbish bin; Vp Vent pipe; Grl Ground light; Lbox Letter box; Ldr Ladder; Sty Stile

P\W Post & Wire; C\L Chain Link; W\P Wooden Panels; C\P Concrete Panels; S\P Steel Palisade; BB Belisha beacon; CTV Cable tv; Mkr Marker post; Gmkr Gas marker post; So Soffit; TCL Tree canopy level; G: Girth; MG Multi girth; Stmp Tree Stump; CL: Cover level; IL: Invert level

Rev	Date	Description	Drawn	Q. Ref

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- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Bathymetric Surveys
- Measured Building Surveys
- 3D Laser Scanning
- 3D Revit & BIM Models
- Area, Lease & Fire Plans

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Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 736391

Central London: 27 Cornwall Terrace Mews, Regents Park, London, NW1 5LL, t. (0207) 2241806

CLIENT
Glenman Corporation

PROJECT
14-19 Tottenham Mews London, W1T 4AQ

TITLE
Topographical Survey

SCALE	DATE
A0@ 1: 100	14/04/2023
DRAWN	**QUALITY REF**
BP	GH16628

Level datum	Arbitrary (Station S1 50.00m)
Grid orientation	OS Graphical Fit
Job number	31273
Drawing No.	Rev.
31273a_01_P	0

Comments

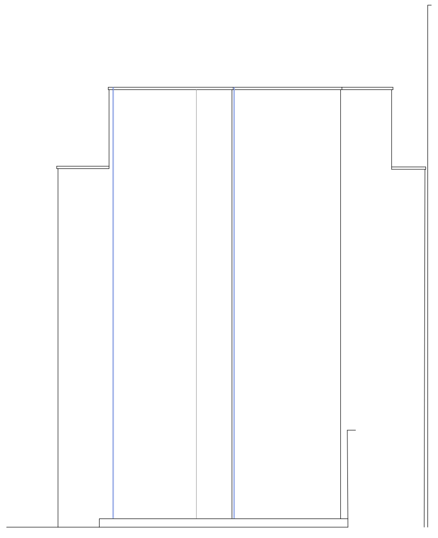
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Some services may have been omitted due to parked vehicles.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:



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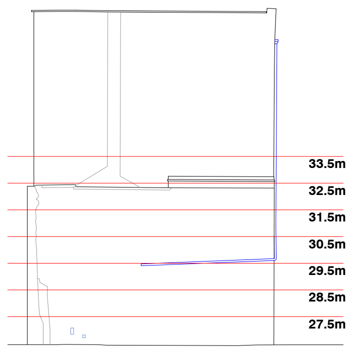
Elevation 1.



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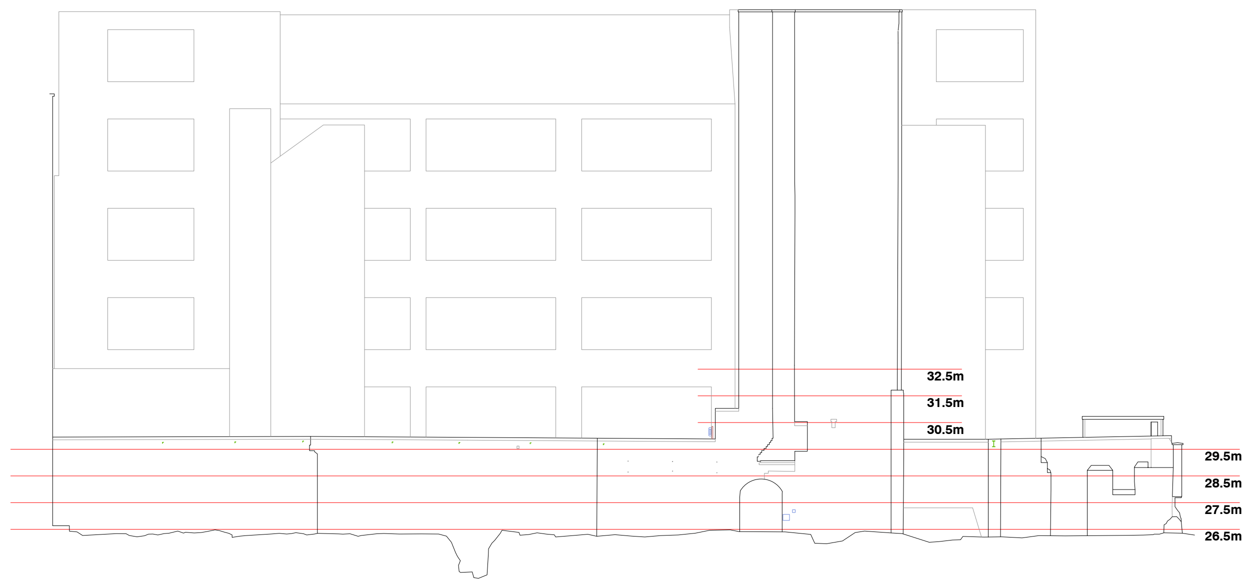
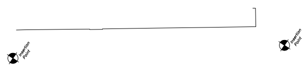
Elevation 2.

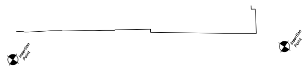


Datum: 20.00m.
Elevation 3.



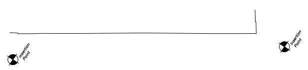
No 13, Wall Plan (Level 33.5m)

Boundary Wall Plan (Level 32.5m)



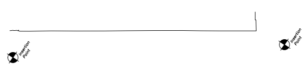
No 13, Wall Plan (Level 32.5m)

Boundary Wall Plan (Level 31.5m)



No 13, Wall Plan (Level 31.5m)

Boundary Wall Plan (Level 30.5m)

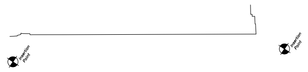


No 13, Wall Plan (Level 30.5m)

Boundary Wall Plan (Level 29.5m)

No 13, Wall Plan (Level 29.5m)

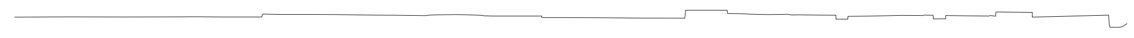
Boundary Wall Plan (Level 28.5m)



No 13, Wall Plan (Level 28.5m)

Boundary Wall Plan (Level 27.5m)

No 13, Wall Plan (Level 27.5m)



Boundary Wall Plan (Level 26.5m)

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Incoming Services
Elec Gas Water

Topographical Survey Legend:

Rev	Date	Description	Drawn	Q. Ref

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Bathymetric Surveys
- Measured Building Surveys
- 3D Laser Scanning
- 3D Revit & BIM Models
- Area, Lease & Fire Plans

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CLIENT
Glenman Corporation

PROJECT
14-19
Tottenham Mews
London, W1T 4AQ

TITLE
Existing Survey
Site Elevations

SCALE	DATE
A0@ 1: 100	13/04/2023
DRAWN	**QUALITY REF**
PC	GH16628

Level datum	Arbitrary (Station S1 50.00m)
Grid orientation	OS Graphical Fit
Job number	31273

Drawing No.	Rev.
31273a_02_E	0

Comments
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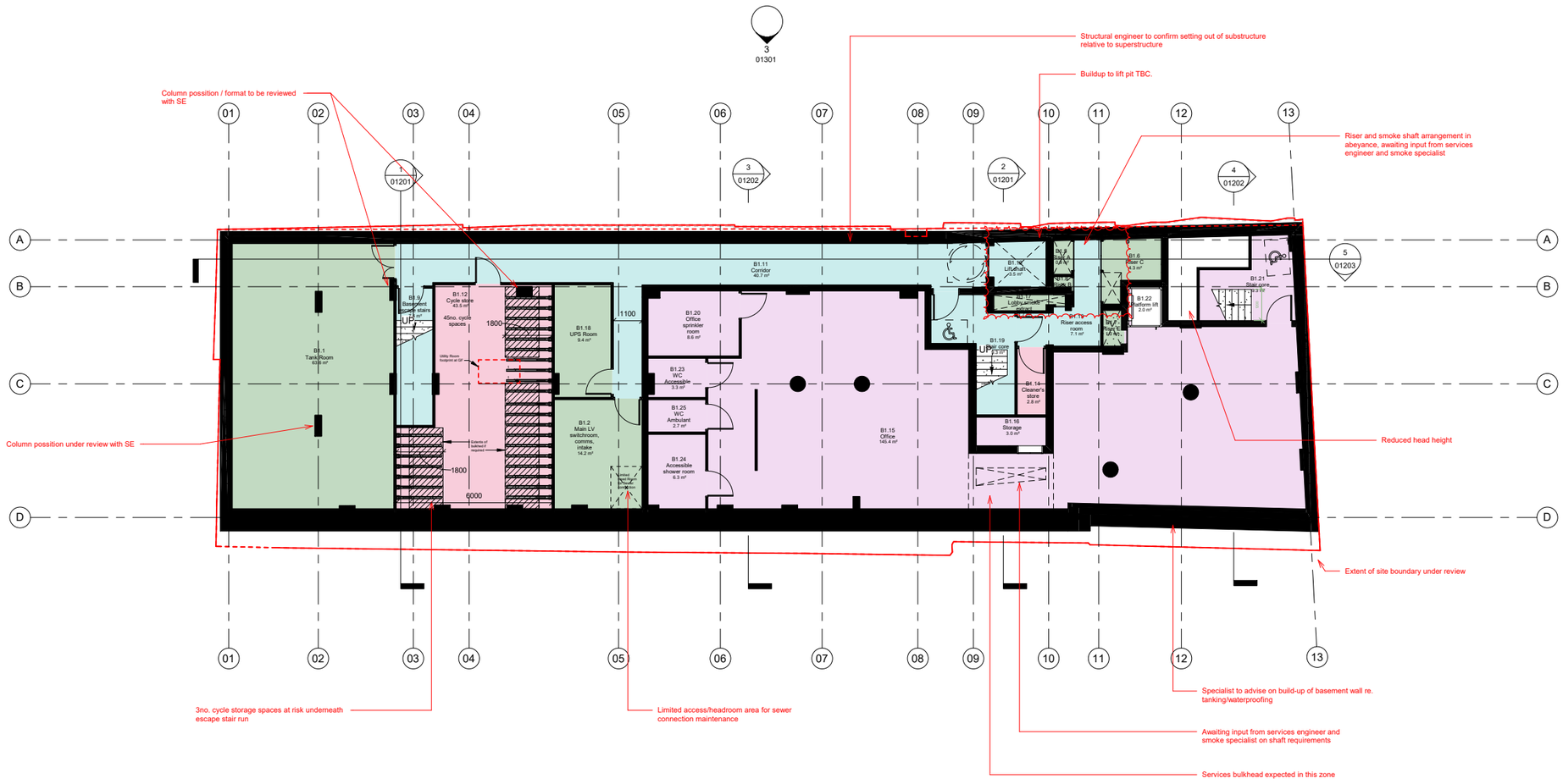
Notes:

Appendix B Proposed Site Plan

Department Legend

- Circulation
- Communal
- Office
- Plant



1 GA Plan - Basement Floor
1 : 100

SVP Locations for Coordination

- Starts at said floor
- Continues from above
- From above, transfer required

02 - B1 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
B1.9	Basement escape stairs	7.4 m²
B1.10	Lift shaft	3.5 m²
B1.11	Corridor	40.7 m²
B1.13	Riser access room	7.1 m²
B1.19	Stair core	9.3 m²
		68.1 m²
Communal		
B1.12	Cycle store	43.5 m²
B1.14	Cleaner's store	2.8 m²
		46.3 m²
Office		
B1.15	Office	145.4 m²
B1.16	Storage	3.0 m²
B1.20	Office sprinkler room	8.6 m²
B1.21	Stair core	9.3 m²
B1.22	Platform lift	2.0 m²
B1.23	WC Accessible	3.3 m²
B1.24	Accessible shower room	6.3 m²
B1.25	WC Ambulant	2.7 m²
		180.6 m²
Plant		
B1.1	Tank Room	63.6 m²
B1.2	Main LV switchroom, comms, intake	14.2 m²
B1.5	Riser A	0.9 m²
B1.6	Riser C	4.3 m²
B1.7	Riser E	1.0 m²
B1.8	Riser B	0.4 m²
B1.17	Lobby smoke extract	1.7 m²
B1.18	UPS Room	9.4 m²
		95.6 m²
Grand total: 23		390.6 m²

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) and Magnus Opifex Fire Strategy (09/04/23) under review and not yet fully incorporated. Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

All structural information currently shown is in developement and is under review. Refer to strucural engineer's information for notional locations of structural elements.

Internal layouts currently in development with consultant team and to be confirmed.

Building extents subject to review and incorporation of latest survey information.

Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	10/03/2023	Preliminary BFL & GFL layouts
P01.4	17/03/2023	Preliminary BFL & GFL layouts
P01.5	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Drawing Number	Rev.	Status
2960-CVA-TM-B1-DR-A-01101	P01.5	S0

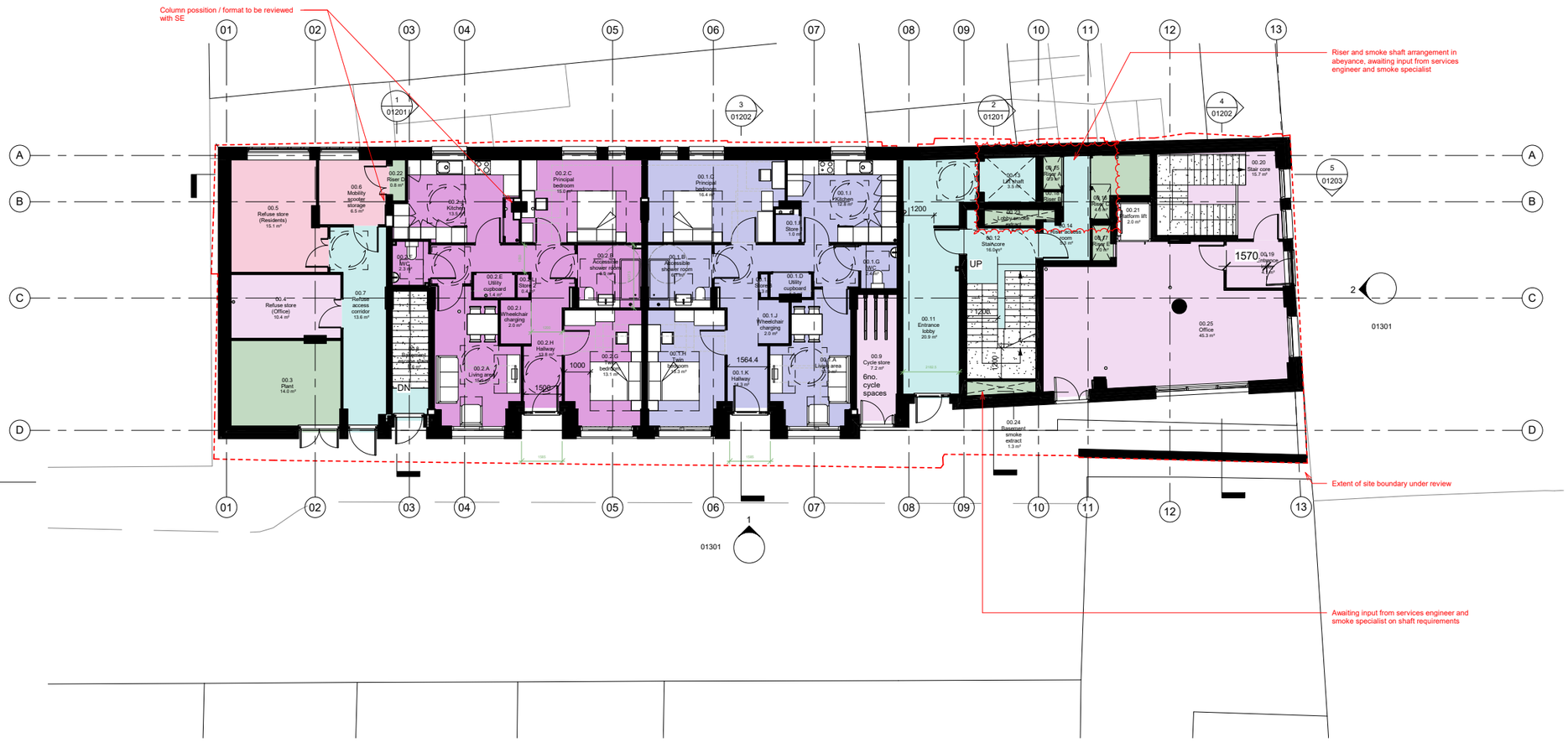
14-19 Tottenham Mews

GA Basement Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023

Department Legend

- Circulation
- Communal
- Flat 00.1 (2b4p)
- Flat 00.2 (2b4p)
- Office
- Plant



1 GA Plan - Ground Floor
1 : 100

02 - 00 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
00.7	Refuse access corridor	13.6 m²
00.8	Basement escape stairs	6.6 m²
00.10	Circulation lobby	Redundant Room
00.11	Entrance lobby	20.9 m²
00.12	Stair core	16.0 m²
00.13	Lift shaft	3.5 m²
00.14	Riser access room	5.3 m²
		66.0 m²
Communal		
00.5	Refuse store (Residents)	15.1 m²
00.6	Mobility scooter storage	6.5 m²
		21.6 m²
Flat 00.1 (2b4p)		
00.1.A	Living area	13.9 m²
00.1.B	Accessible shower room	6.1 m²
00.1.C	Principal bedroom	16.4 m²
00.1.D	Utility cupboard	1.3 m²
00.1.F	Store 1	1.0 m²
00.1.G	WC	2.4 m²
00.1.H	Twin bedroom	13.3 m²
00.1.I	Kitchen	12.8 m²
00.1.J	Wheelchair charging	2.0 m²
00.1.K	Hallway	14.3 m²
00.1.L	Store 3	0.3 m²
		83.6 m²
Flat 00.2 (2b4p)		
00.2.A	Living area	15.1 m²
00.2.B	Accessible shower room	6.0 m²
00.2.C	Principal bedroom	15.0 m²
00.2.E	Utility cupboard	1.4 m²
00.2.F	WC	2.3 m²
00.2.G	Twin bedroom	13.1 m²
00.2.H	Hallway	13.8 m²
00.2.I	Wheelchair charging	2.0 m²
00.2.J	Kitchen	13.5 m²
00.2.K	Store 1	0.7 m²
00.2.L	Store 2	0.4 m²
		83.5 m²
Office		
00.4	Refuse store (Office)	10.4 m²
00.9	Cycle store	7.2 m²
00.19	Entrance lobby	4.1 m²
00.20	Stair core	15.7 m²
00.21	Platform lift	2.0 m²
00.25	Office	45.3 m²
		84.8 m²
Plant		
00.3	Plant	14.0 m²
00.15	Riser A	0.9 m²
00.16	Riser C	4.3 m²
00.17	Riser E	1.0 m²
00.18	Riser B	0.4 m²
00.22	Riser D	0.8 m²
00.23	Lobby smoke extract	1.6 m²
00.24	Basement smoke extract	1.3 m²
		24.3 m²
Grand total: 45		363.8 m²

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) and Magnus Opitex Fire Strategy (08/04/23) under review and not yet fully incorporated. Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

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Internal layouts currently in development with consultant team and to be confirmed.

Building extents subject to review and incorporation of latest survey information.

Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	10/03/2023	Preliminary BFL & GFL layouts
P01.4	17/03/2023	Preliminary BFL & GFL layouts
P01.5	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

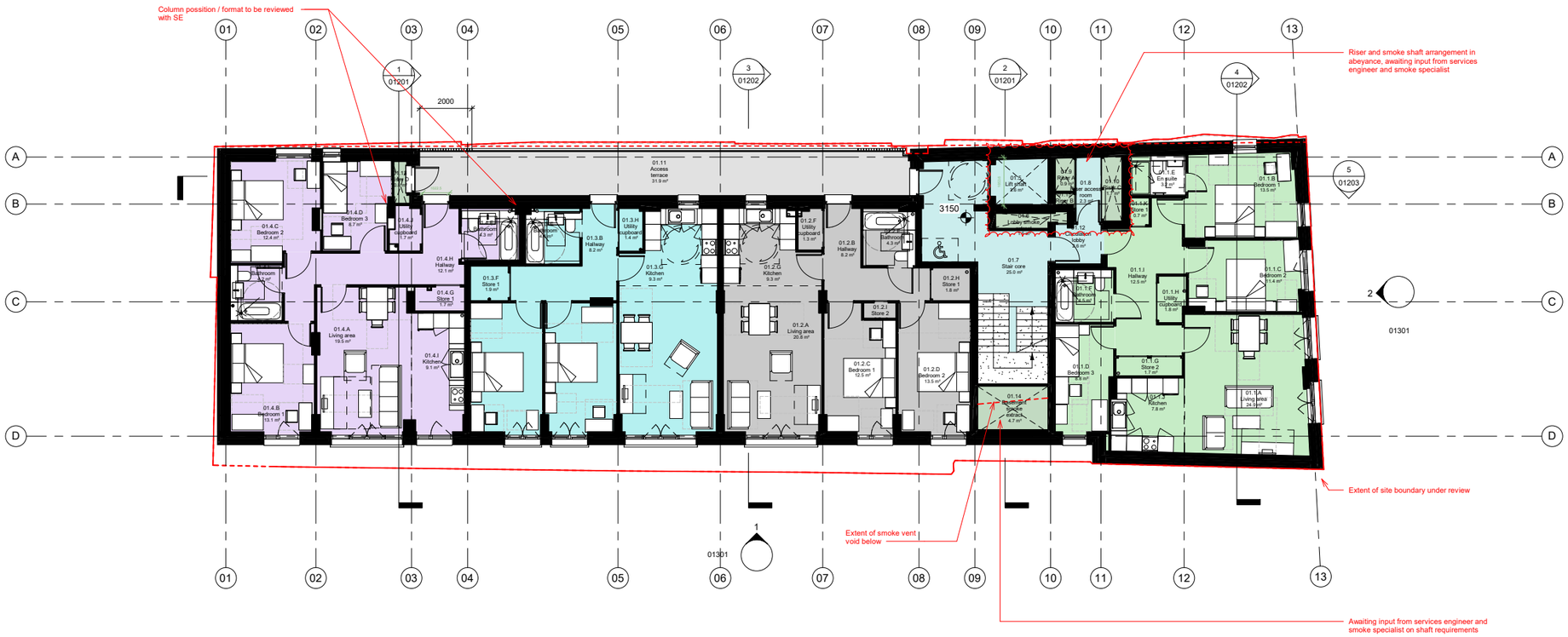
SVP Locations for Coordination
- Starts at said floor
- Continues from above
- From above, transfer required

Drawing Number	Rev.	Status
2960-CVA-TM-00-DR-A-01102	P01.5	S0

14-19 Tottenham Mews

GA Ground Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023



1 GA Plan - First Floor
1 : 100

Department Legend

- Circulation
- External communal
- Flat 01.1 (3b5p)
- Flat 01.2 (2b4p)
- Flat 01.3 (2b4p)
- Flat 01.4 (3b5p)
- Plant

02 - 01 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
01.5	Lift shaft	3.6 m²
01.7	Stair core	25.0 m²
01.8	Riser access room	2.3 m²
01.12	Circulation lobby	2.6 m²
		33.5 m²
External communal		
01.11	Access terrace	31.9 m²
		31.9 m²
Flat 01.1 (3b5p)		
01.1.A	Living area	24.9 m²
01.1.B	Bedroom 1	13.5 m²
01.1.C	Bedroom 2	11.4 m²
01.1.D	Bedroom 3	8.8 m²
01.1.E	En suite	3.2 m²
01.1.F	Bathroom	4.5 m²
01.1.G	Store 2	1.7 m²
01.1.H	Utility cupboard	1.8 m²
01.1.I	Hallway	12.5 m²
01.1.J	Kitchen	7.8 m²
01.1.K	Store 1	0.7 m²
		90.7 m²
Flat 01.2 (2b4p)		
01.2.A	Living area	20.8 m²
01.2.B	Hallway	8.2 m²
01.2.C	Bedroom 1	12.5 m²
01.2.D	Bedroom 2	13.5 m²
01.2.E	Bathroom	4.3 m²
01.2.F	Utility cupboard	1.3 m²
01.2.G	Kitchen	9.3 m²
01.2.H	Store 1	1.8 m²
01.2.I	Store 2	0.7 m²
		72.3 m²
Flat 01.3 (2b4p)		
01.3.A	Living area	20.9 m²
01.3.B	Hallway	8.2 m²
01.3.C	Bedroom 1	13.5 m²
01.3.D	Bedroom 2	13.3 m²
01.3.E	Bathroom	4.4 m²
01.3.F	Store 1	1.9 m²
01.3.G	Kitchen	9.3 m²
01.3.H	Utility cupboard	1.4 m²
		72.8 m²
Flat 01.4 (3b5p)		
01.4.A	Living area	19.5 m²
01.4.B	Bedroom 1	13.1 m²
01.4.C	Bedroom 2	12.4 m²
01.4.D	Bedroom 3	8.7 m²
01.4.E	Bathroom	4.2 m²
01.4.F	Bathroom	4.3 m²
01.4.G	Store 1	1.7 m²
01.4.H	Hallway	12.1 m²
01.4.I	Kitchen	9.1 m²
01.4.J	Utility cupboard	1.7 m²
		86.9 m²
Plant		
01.6	Lobby smoke extract	1.5 m²
01.9	Riser A	0.9 m²
01.10	Riser C	1.7 m²
01.13	Riser D	0.8 m²
01.14	Basement smoke extract	4.7 m²
01.15	Riser B	0.4 m²
		9.9 m²
Grand total: 49		398.0 m²

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) and Magnus Opifex Fire Strategy (09/04/23) under review and not yet fully incorporated. Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

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Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	22/03/2023	Preliminary layouts
P01.4	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

SVP Locations for Coordination
- Starts at said floor
- Continues from above
- From above, transfer required

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Do not scale from this drawing
Confirm all dimensions on site

Drawing Number	Rev.	Status
2960-CVA-TM-01-DR-A-01103	P01.4	S0

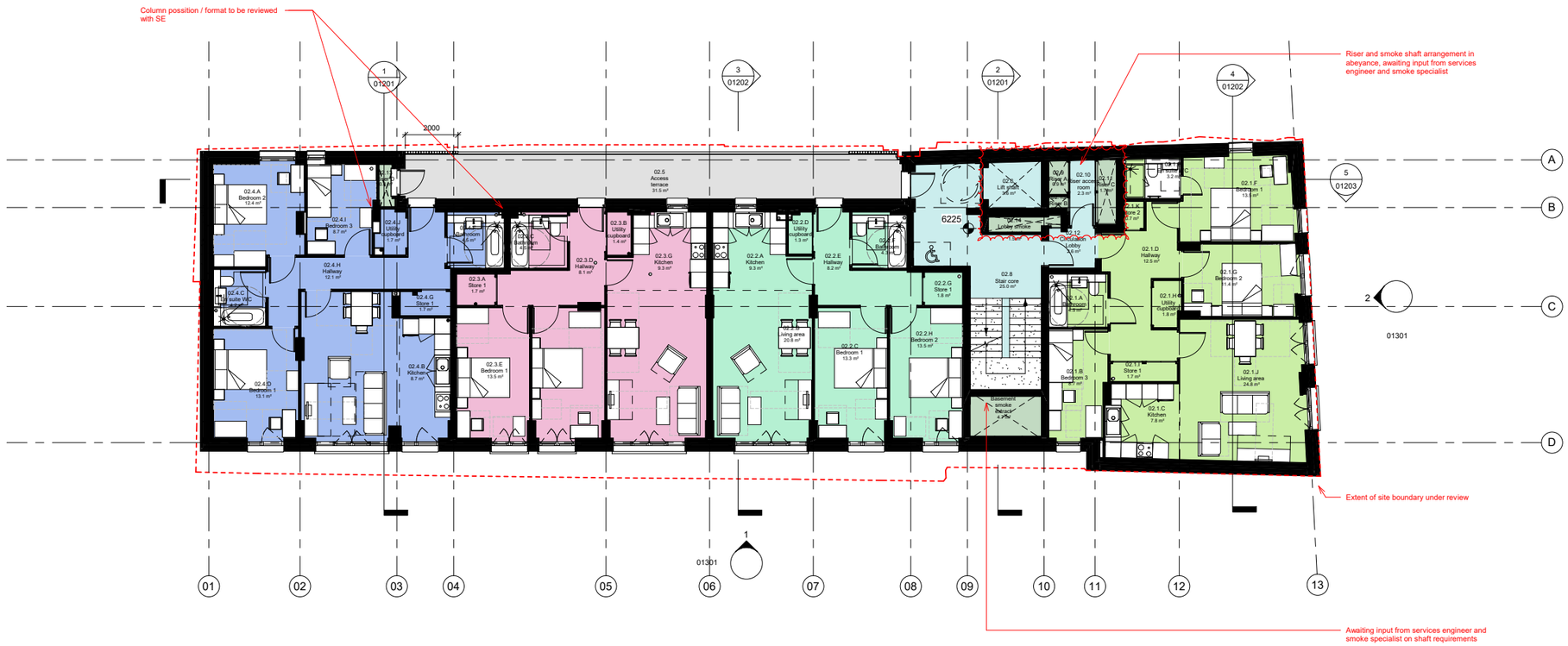
14-19 Tottenham Mews

GA First Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023

Department Legend

- Circulation
- External communal
- Flat 02.1 (3b5p)
- Flat 02.2 (2b4p)
- Flat 02.3 (2b4p)
- Flat 02.4 (3b5p)
- Plant



1 GA Plan - Second Floor
1 : 100

SVP Locations for Coordination
- Starts at said floor
- Continues from above
- From above, transfer required

02 - 02 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
02.6	Lift shaft	3.6 m²
02.8	Stair core	25.0 m²
02.10	Riser access room	2.3 m²
02.12	Circulation Lobby	2.6 m²
		33.5 m²
External communal		
02.5	Access terrace	31.5 m²
		31.5 m²
Flat 02.1 (3b5p)		
02.1.A	Bathroom	4.5 m²
02.1.B	Bedroom 3	8.7 m²
02.1.C	Kitchen	7.8 m²
02.1.D	Hallway	12.5 m²
02.1.E	En suite WC	3.2 m²
02.1.F	Bedroom 1	13.5 m²
02.1.G	Bedroom 2	11.4 m²
02.1.H	Utility cupboard	1.8 m²
02.1.I	Store 1	1.7 m²
02.1.J	Living area	24.8 m²
02.1.K	Store 2	0.7 m²
		90.5 m²
Flat 02.2 (2b4p)		
02.2.A	Kitchen	9.3 m²
02.2.B	Living area	20.8 m²
02.2.C	Bedroom 1	13.3 m²
02.2.D	Utility cupboard	1.3 m²
02.2.E	Hallway	8.2 m²
02.2.F	Bathroom	4.3 m²
02.2.G	Store 1	1.8 m²
02.2.H	Bedroom 2	13.5 m²
		72.5 m²
Flat 02.3 (2b4p)		
02.3.A	Store 1	1.7 m²
02.3.B	Utility cupboard	1.4 m²
02.3.C	Bathroom	4.5 m²
02.3.D	Hallway	8.1 m²
02.3.E	Bedroom 1	13.5 m²
02.3.F	Bedroom 2	13.3 m²
02.3.G	Kitchen	9.3 m²
02.3.H	Living area	20.9 m²
		72.7 m²
Flat 02.4 (3b5p)		
02.4.A	Bedroom 2	12.4 m²
02.4.B	Kitchen	8.7 m²
02.4.C	En suite WC	4.2 m²
02.4.D	Bedroom 1	13.1 m²
02.4.E	Living area	19.9 m²
02.4.F	Bathroom	4.5 m²
02.4.G	Store 1	1.7 m²
02.4.H	Hallway	12.1 m²
02.4.I	Bedroom 3	8.7 m²
02.4.J	Utility cupboard	1.7 m²
		87.1 m²
Plant		
02.7	Basement smoke extract	4.7 m²
02.9	Riser A	0.9 m²
02.11	Riser C	1.7 m²
02.13	Riser D	0.8 m²
02.14	Lobby smoke extract	1.5 m²
02.15	Riser B	0.4 m²
		9.9 m²
Grand total: 48		397.7 m²

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) and Magnus Opifex Fire Strategy (09/04/23) under review and not yet fully incorporated. Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

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Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	22/03/2023	Preliminary layouts
P01.4	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Drawing Number	Rev.	Status
2960-CVA-TM-02-DR-A-01104	P01.4	S0

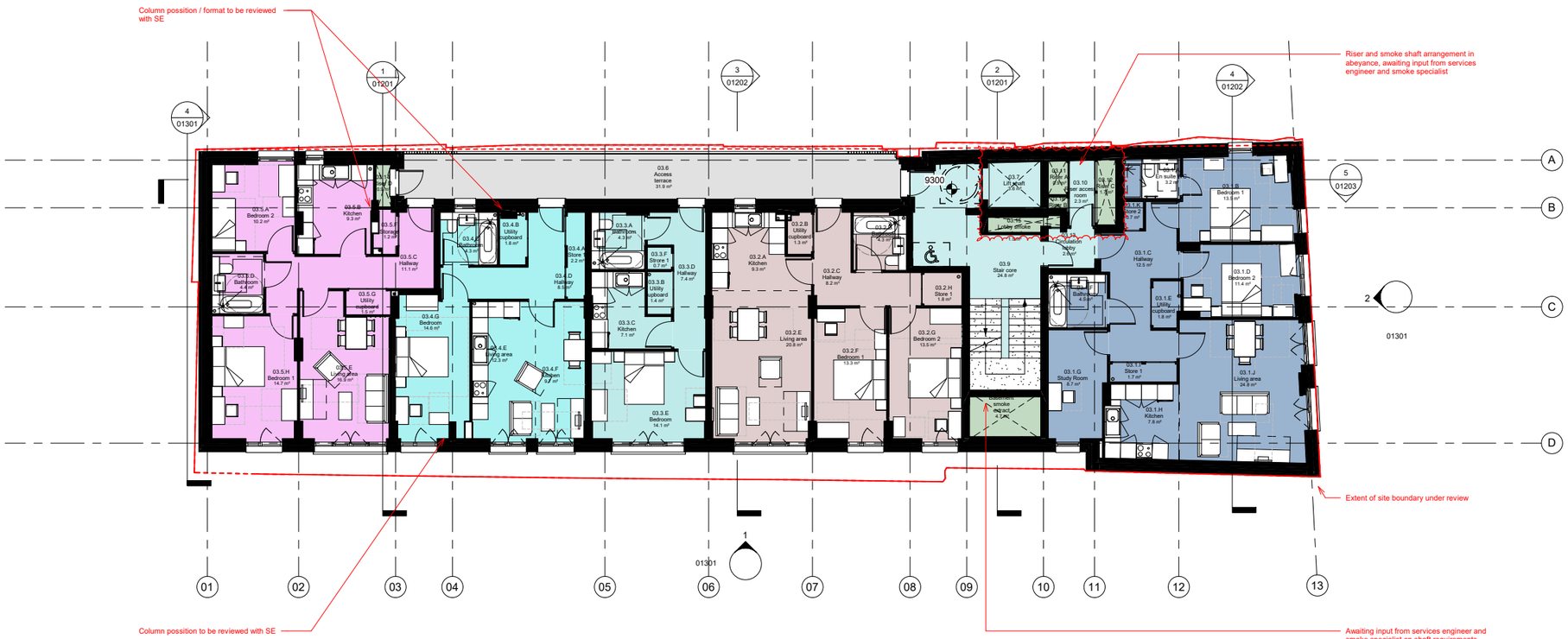
14-19 Tottenham Mews

GA Second Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023

Department Legend

- Circulation
- External communal
- Flat 03.1 (2b4p)
- Flat 03.2 (2b4p)
- Flat 03.3 (1b1p)
- Flat 03.4 (1b2p)
- Flat 03.5 (2b3p)
- Plant



1 GA Plan - Third Floor
1 : 100

SVP Locations for Coordination

- Starts at said floor
- Continues from above
- From above, transfer required

02 - 03 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
03.7	Lift shaft	3.6 m²
03.9	Stair core	24.8 m²
03.10	Riser access room	2.3 m²
03.13	Circulation lobby	2.6 m²
		33.3 m²
External communal		
03.6	Access terrace	31.9 m²
		31.9 m²
Flat 03.1 (2b4p)		
03.1.A	En suite WC	3.2 m²
03.1.B	Bedroom 1	13.5 m²
03.1.C	Hallway	12.5 m²
03.1.D	Bedroom 2	11.4 m²
03.1.E	Utility cupboard	1.8 m²
03.1.F	Bathroom	4.5 m²
03.1.G	Study Room	8.7 m²
03.1.H	Kitchen	7.8 m²
03.1.I	Store 1	1.7 m²
03.1.J	Living area	24.8 m²
03.1.K	Store 2	0.7 m²
		90.5 m²
Flat 03.2 (2b4p)		
03.2.A	Kitchen	9.3 m²
03.2.B	Utility cupboard	1.3 m²
03.2.C	Hallway	8.2 m²
03.2.D	Bathroom	4.3 m²
03.2.E	Living area	20.8 m²
03.2.F	Bedroom 1	13.3 m²
03.2.G	Bedroom 2	13.5 m²
03.2.H	Store 1	1.8 m²
		72.5 m²
Flat 03.3 (1b1p)		
03.3.A	Bathroom	4.3 m²
03.3.B	Utility cupboard	1.4 m²
03.3.C	Kitchen	7.1 m²
03.3.D	Hallway	7.4 m²
03.3.E	Bedroom	14.1 m²
03.3.F	Strore 1	0.7 m²
		35.0 m²
Flat 03.4 (1b2p)		
03.4.A	Store 1	2.2 m²
03.4.B	Utility cupboard	1.8 m²
03.4.C	Bathroom	4.3 m²
03.4.D	Hallway	8.5 m²
03.4.E	Living area	12.3 m²
03.4.F	Kitchen	9.7 m²
03.4.G	Bedroom	14.6 m²
		53.4 m²
Flat 03.5 (2b3p)		
03.5.A	Bedroom 2	10.2 m²
03.5.B	Kitchen	9.3 m²
03.5.C	Hallway	11.1 m²
03.5.D	Bathroom	4.4 m²
03.5.E	Living area	16.9 m²
03.5.F	Storage	1.2 m²
03.5.G	Utility cupboard	1.5 m²
03.5.H	Bedroom 1	14.7 m²
		69.3 m²
Plant		
03.8	Basement smoke extract	4.7 m²
03.11	Riser A	0.9 m²
03.12	Riser C	1.7 m²
03.14	Riser D	0.9 m²
03.15	Lobby smoke extract	1.5 m²
03.16	Riser B	0.4 m²
		10.0 m²
Grand total: 51		396.0 m²

Notes:
Drawing issued as preliminary WIP.
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Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	22/03/2023	Preliminary layouts
P01.4	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Drawing Number	Rev.	Status
2960-CVA-TM-03-DR-A-01105	P01.4	S0

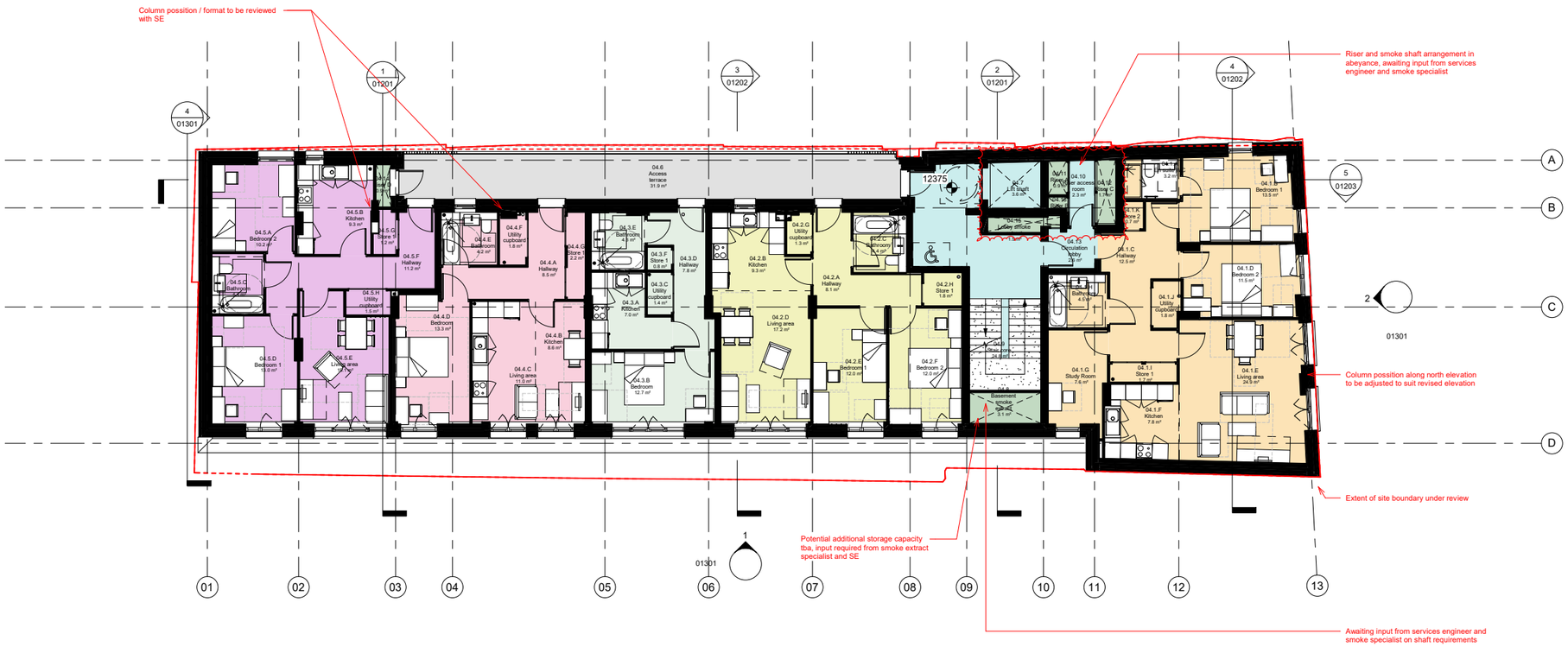
14-19 Tottenham Mews

GA Third Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023

Department Legend

- Circulation
- External communal
- Flat 04.1 (2b4p)
- Flat 04.2 (2b3p)
- Flat 04.3 (1b1p)
- Flat 04.4 (1b2p)
- Flat 04.5 (2b3p)
- Plant



1 GA Plan - Fourth Floor
1 : 100

SVP Locations for Coordination
- Starts at said floor
- Continues from above
- From above, transfer required

02 - 04 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
04.7	Lift shaft	3.6 m²
04.9	Stair core	24.8 m²
04.10	Riser access room	2.3 m²
04.13	Circulation lobby	2.6 m²
		33.3 m²
External communal		
04.6	Access terrace	31.9 m²
		31.9 m²
Flat 04.1 (2b4p)		
04.1.A	En suite WC	3.2 m²
04.1.B	Bedroom 1	13.5 m²
04.1.C	Hallway	12.5 m²
04.1.D	Bedroom 2	11.5 m²
04.1.E	Living area	24.9 m²
04.1.F	Kitchen	7.8 m²
04.1.G	Study Room	7.6 m²
04.1.H	Bathroom	4.5 m²
04.1.I	Store 1	1.7 m²
04.1.J	Utility cupboard	1.8 m²
04.1.K	Store 2	0.7 m²
		89.6 m²
Flat 04.2 (2b3p)		
04.2.A	Hallway	8.1 m²
04.2.B	Kitchen	9.3 m²
04.2.C	Bathroom	4.4 m²
04.2.D	Living area	17.2 m²
04.2.E	Bedroom 1	12.0 m²
04.2.F	Bedroom 2	12.0 m²
04.2.G	Utility cupboard	1.3 m²
04.2.H	Store 1	1.8 m²
		66.1 m²
Flat 04.3 (1b1p)		
04.3.A	Kitchen	7.0 m²
04.3.B	Bedroom	12.7 m²
04.3.C	Utility cupboard	1.4 m²
04.3.D	Hallway	7.8 m²
04.3.E	Bathroom	4.3 m²
04.3.F	Store 1	0.8 m²
		34.0 m²
Flat 04.4 (1b2p)		
04.4.A	Hallway	8.5 m²
04.4.B	Kitchen	8.6 m²
04.4.C	Living area	11.0 m²
04.4.D	Bedroom	13.3 m²
04.4.E	Bathroom	4.2 m²
04.4.F	Utility cupboard	1.8 m²
04.4.G	Store 1	2.2 m²
		49.6 m²
Flat 04.5 (2b3p)		
04.5.A	Bedroom 2	10.2 m²
04.5.B	Kitchen	9.3 m²
04.5.C	Bathroom	4.4 m²
04.5.D	Bedroom 1	13.0 m²
04.5.E	Living area	15.1 m²
04.5.F	Hallway	11.2 m²
04.5.G	Store 1	1.2 m²
04.5.H	Utility cupboard	1.5 m²
		65.9 m²
Plant		
04.8	Basement smoke extract	3.1 m²
04.11	Riser A	0.9 m²
04.12	Riser C	1.7 m²
04.14	Riser D	0.9 m²
04.15	Lobby smoke extract	1.5 m²
04.16	Riser B	0.4 m²
		8.5 m²
Grand total: 51		379.0 m²

Notes:
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P01.2	20/02/2023	Preliminary GA information
P01.3	22/03/2023	Preliminary layouts
P01.4	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Do not scale from this drawing
Confirm all dimensions on site

Drawing Number	Rev.	Status
2960-CVA-TM-04-DR-A-01106	P01.4	S0

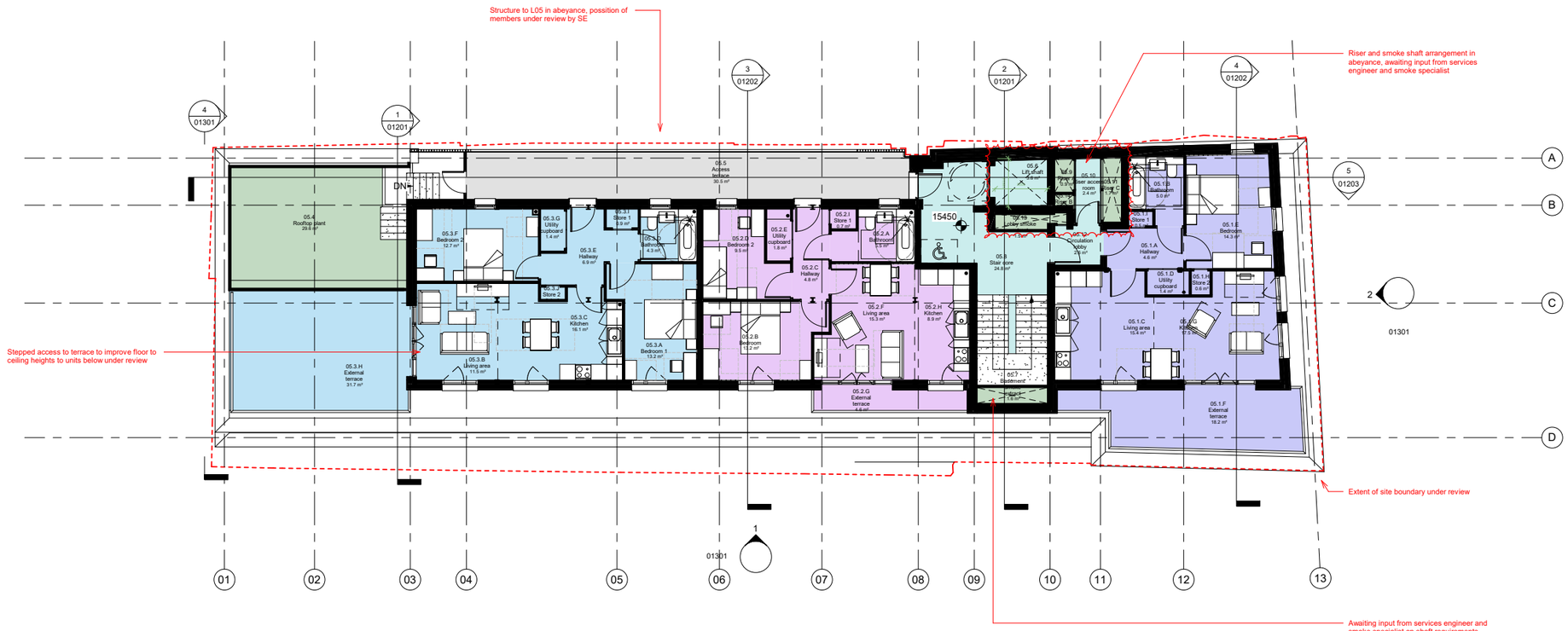
14-19 Tottenham Mews

GA Fourth Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023

Department Legend

- Circulation
- External communal
- Flat 05.1 (1b2p)
- Flat 05.2 (2b3p)
- Flat 05.3 (2b4p)
- Plant



1 GA Plan - Fifth Floor
1 : 100

SVP Locations for Coordination
- Starts at said floor
- Continues from above
- From above, transfer required

02 - 05 - Room Schedule

Room Number	Room Type	Actual Area
Circulation		
05.6	Lift shaft	3.6 m²
05.8	Stair core	24.8 m²
05.10	Riser access room	2.4 m²
05.12	Circulation lobby	2.6 m²
		33.3 m²
External communal		
05.5	Access terrace	30.5 m²
		30.5 m²
Flat 05.1 (1b2p)		
05.1.A	Hallway	4.6 m²
05.1.B	Bathroom	5.0 m²
05.1.C	Living area	15.4 m²
05.1.D	Utility cupboard	1.4 m²
05.1.E	Bedroom	14.3 m²
05.1.F	External terrace	18.2 m²
05.1.G	Kitchen	17.5 m²
05.1.H	Store 2	0.6 m²
05.1.I	Store 1	0.5 m²
		77.5 m²
Flat 05.2 (2b3p)		
05.2.A	Bathroom	5.5 m²
05.2.B	Bedroom	13.2 m²
05.2.C	Hallway	4.8 m²
05.2.D	Bedroom 2	9.5 m²
05.2.E	Utility cupboard	1.8 m²
05.2.F	Living area	15.3 m²
05.2.G	External terrace	4.6 m²
05.2.H	Kitchen	8.9 m²
05.2.I	Store 1	0.7 m²
		64.2 m²
Flat 05.3 (2b4p)		
05.3.A	Bedroom 1	13.2 m²
05.3.B	Living area	11.5 m²
05.3.C	Kitchen	16.1 m²
05.3.D	Bathroom	4.3 m²
05.3.E	Hallway	6.9 m²
05.3.F	Bedroom 2	12.7 m²
05.3.G	Utility cupboard	1.4 m²
05.3.H	External terrace	31.7 m²
05.3.I	Store 1	0.9 m²
05.3.J	Store 2	0.4 m²
		99.1 m²
Plant		
05.4	Rooftop plant	29.6 m²
05.7	Basement smoke extract	1.6 m²
05.9	Riser A	0.9 m²
05.11	Riser C	1.7 m²
05.13	Lobby smoke extract	1.5 m²
05.14	Riser B	0.4 m²
		35.7 m²
Grand total: 39		340.3 m²

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) and Magnus Opifex Fire Strategy (09/04/23) under review and not yet fully incorporated. Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

All structural information currently shown is in developement and is under review. Refer to strucural engineer's information for notional locations of structural elements.

Internal layouts currently in development with consultant team and to be confirmed.

Building extents subject to review and incorporation of latest survey information.

Revisions

Rev. no.	Date	Description
P01.1	09/02/2023	GA Plans Initial Studies
P01.2	20/02/2023	Preliminary GA information
P01.3	22/03/2023	Preliminary layouts
P01.4	19/04/2023	For Information

1:100 0m 1m 2m 5m

WIP

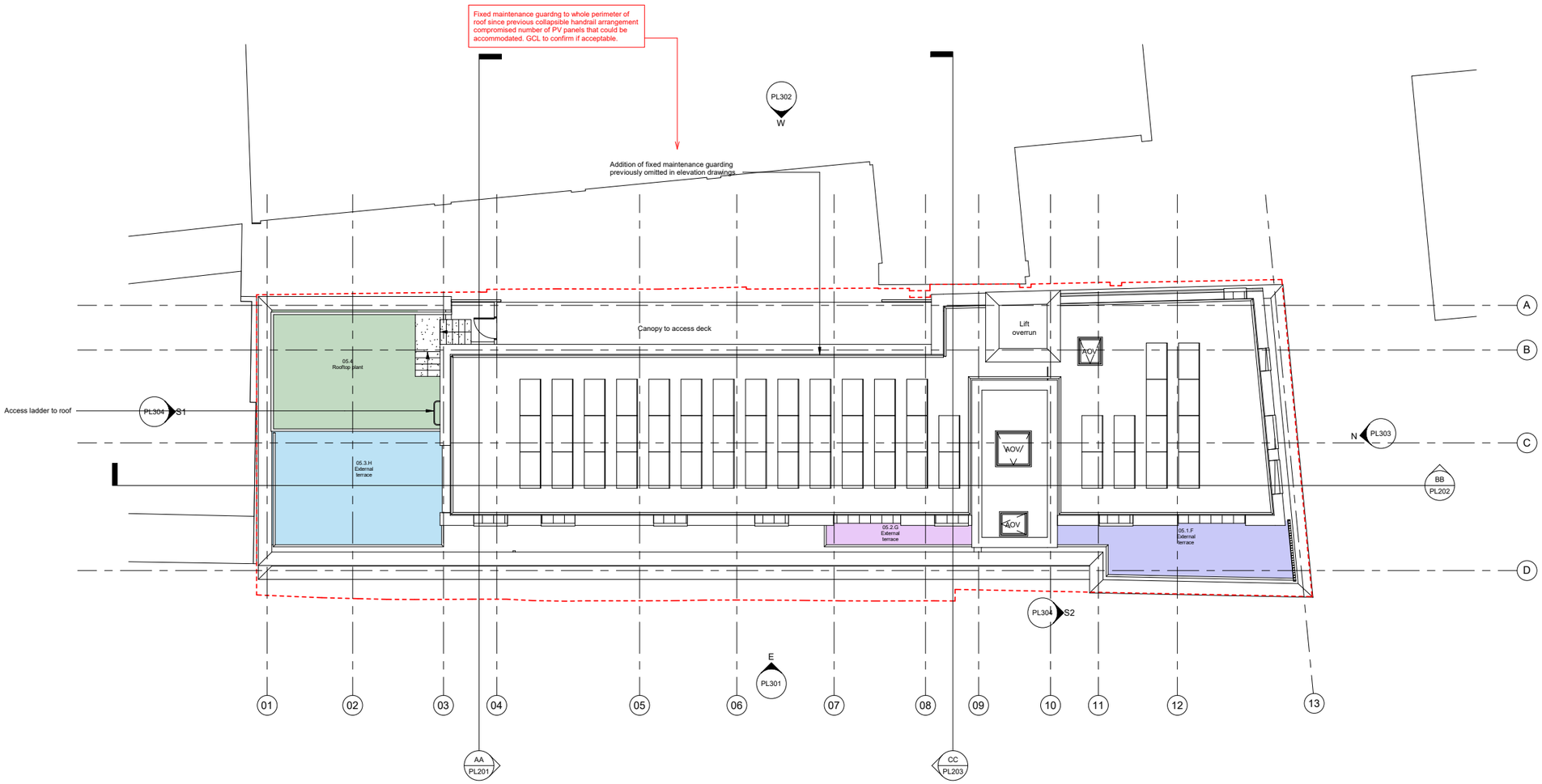
COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567

Drawing Number	Rev.	Status
2960-CVA-TM-05-DR-A-01107	P01.4	S0

14-19 Tottenham Mews

GA Fifth Floor Plan

Drawn by:	MS	Checked by:	RC	Date:
Scale:	1 : 100	Size:	A1	19/04/2023



RL Proposed Roof

1 : 100

General notes to plans

1. Structural information not shown - awaiting updated model from Structural engineer.
2. Awaiting further review by building control.
3. Final layouts TBC with fire engineer.
4. External landscaping design in abeyance - awaiting proposed levels to Middlesex Annex.

Notes:
Drawing issued as preliminary WIP.
Greenhatch Survey Information (12/04/23 + 19/04/23) incorporated and Building repositioned to suit. Awaiting revised consultants models for coordination.

Magnus Opifex Fire Strategy (09/04/23) under review and not yet fully incorporated. Awaiting revised strategy confirming unprotected area allowances.

Proposals shown also subject to review by Building Control Approved Inspector and Smoke Specialist.

All structural information currently shown is in developement and is under review. Refer to strucural engineer's information for notional locations of structural elements.

Internal layouts currently in development with consultant team and to be confirmed.

Revisions

Rev. no.	Date	Description

WIP

COTTRELL & VERMEULEN ARCHITECTURE
1B Iliffe Street
London SE17 3LJ
0207 708 2567
Do not scale from this drawing
Confirm all dimensions on site

Drawing Number	Rev.	Status
2960-CVA-TM-RL-DR-A-PL108		DRAFT

14-19 Tottenham Mews

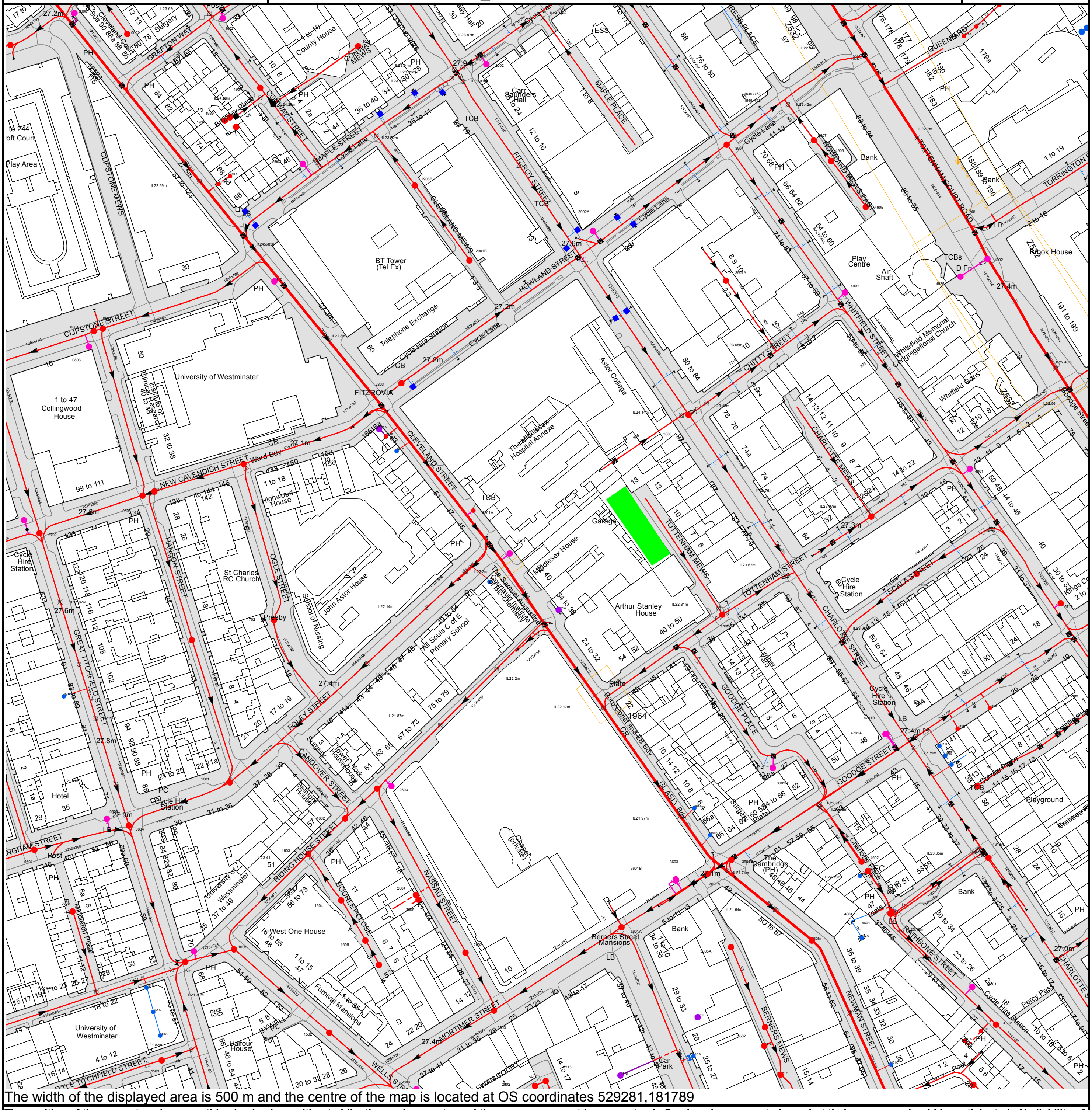
Proposed Roof Plan

Drawn by:	Author	Checked by:	Checker	Date:
Scale:	1 : 100	Size:	A1	

DRAFT

Appendix C Thames Water Asset Plans

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3878101



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529281,181789

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Appendix D Pre-Development Rates and Volume Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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 Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 0	Number of Storage Structures 0	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850

Synthetic Rainfall Details

C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	30/15 Summer				10.056
1.001	2	15 Winter	1	+0%	30/15 Summer				9.971

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.094	0.000	0.30			4.7	OK	
1.001	2	-0.079	0.000	0.45			7.0	OK	

30 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%	30/15 Summer				10.305
1.001	2	15 Winter	30	+0%	30/15 Summer				10.205

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.155	0.000	1.01			16.0	SURCHARGED	
1.001	2	0.155	0.000	1.60			25.2	SURCHARGED	

100 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%	30/15 Summer				10.766
1.001	2	15 Winter	100	+0%	30/15 Summer				10.526

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.616	0.000	1.53			24.1	SURCHARGED	
1.001	2	0.476	0.000	2.40			37.9	SURCHARGED	

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Summary Wizard of 360 minute 100 year Winter I+0% 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

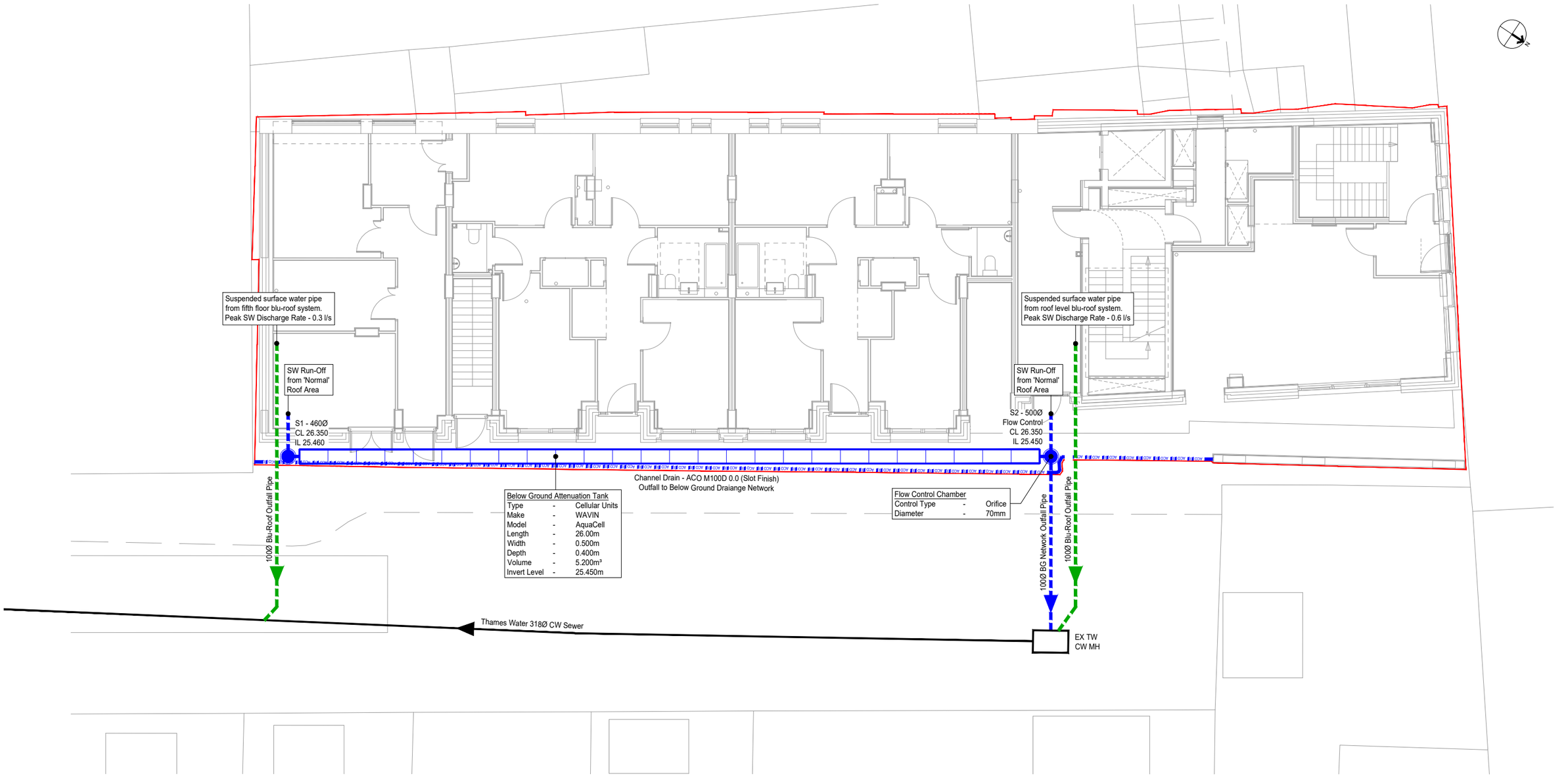
PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	1	360 minute 100 year Winter I+0%	12.000	10.041	-0.109	0.000	0.17
1.001	2	360 minute 100 year Winter I+0%	12.000	9.953	-0.097	0.000	0.27

PN	US/MH Name	Overflow (l/s)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	1		23.170	2.7	OK

Summary Wizard of 360 minute 100 year Winter I+0% for Storm

PN	US/MH Name	Overflow (l/s)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.001	2		36.815	4.3	OK

Appendix E Surface Water Management Layout and Details



REV.	DATE	DRAWN BY	ENG BY	DESCRIPTION OF REVISION
P1	18.05.23	MDS	NS	Issued for Approval

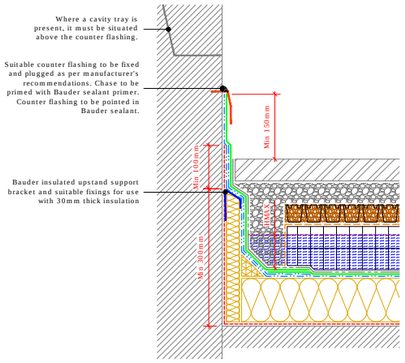
MARK & PARTNERS
13 Quarry Street, Guildford, GU1 3UY
01483 323 121
www.markandpartners.co.uk

Job Name:
14-19 Tottenham Mews
W1T 4AA

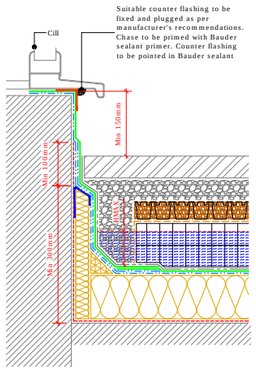
Drawing Title:
Surface Water Managements Layout and Details

Project Status:	REV.it Version:	Scale at A1
Approval	**May 2023**	**1 in 100**

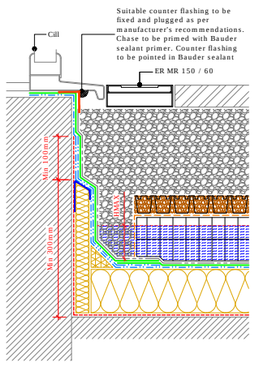
Drg No.	Sheet	REV
0231-M&P-XX-00-DR-C-	1100	P1



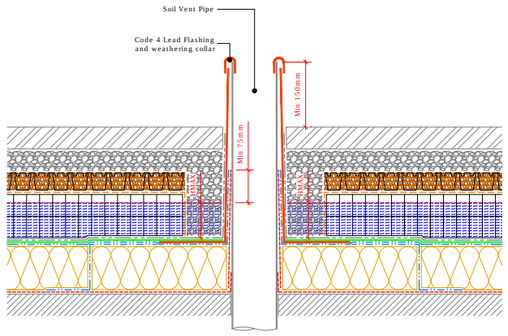
Insulated Upstand
(Drg.No: D0000-00W_BR_201-Int-SL-S-D4-AC_001)



Upstand To Raised Cill
(Drg.No: D0000-00W_BR_201-Int-SL-S-D4-AC_003)

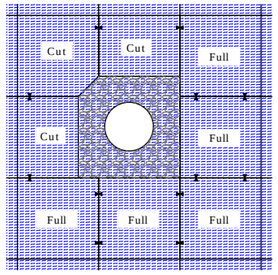


Door - Window Cill - Bauder Support Pedestals
(Drg.No: D0000-00W_BR_201-Int-SL-S-D4-AC_007)

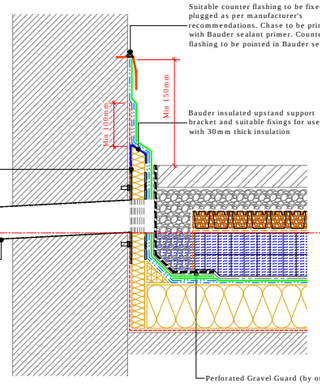


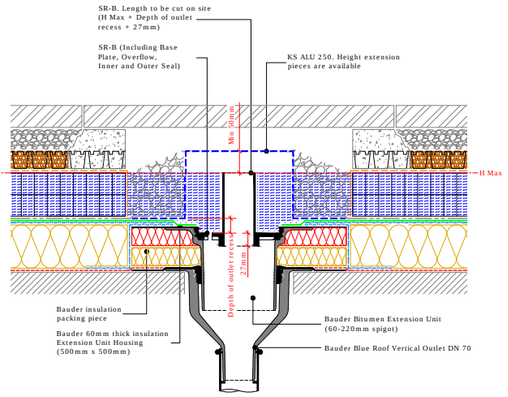
Soil Vent Pipe
(Drg.No: D0000-00W_BR_007-Int-SL-S-D4-AC_001)

Plan Showing The Suggested Attenuation Cell Layout And Cut Locations



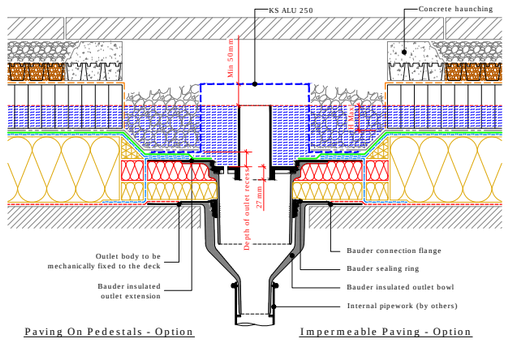
Attenuation Cell should be ≥100mm from Penetration.
Cut pieces of Attenuation Cell must be 50% or bigger,
Only a single cut per piece, all connectors fitted





Bauder Outlet - Bauder Bitumen Blue Roof Emergency Overflow Outlet DN70
(Drg.No: D0000-00W_BR_006-Int-SL-S-D4-AC_004)

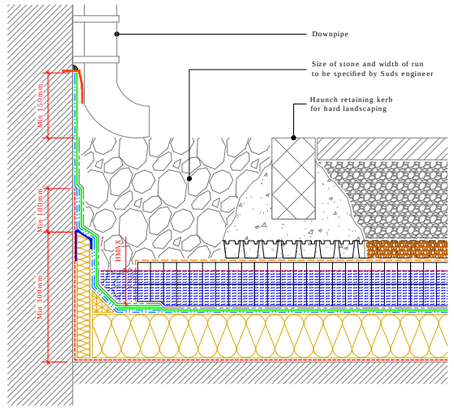
Bauder Outlet - Bauder Bitumen Blue Roof Vertical Outlet DN70
(Drg.No: D0000-00W_BR_006-Int-SL-S-D4-AC_003)



Paving On Pedestals - Option

Impermeable Paving - Option

Bauder Outlet - Bauder Bitumen Blue Roof Vertical Outlet DN70 - Sump
(Drg.No: D0000-00W_BR_006-Int-SL-S-D4-AC_002)



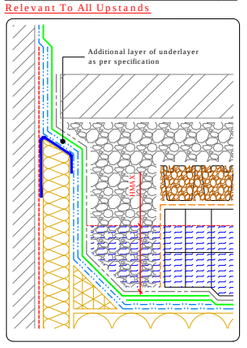
Diffuser Chamber
(Drg.No: D0000-00W_BR_201-Int-SL-S-D4-AC_009)

Key

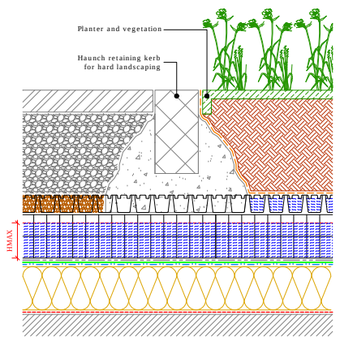
Bauder XF118 UK Native Species WB Native Wildflower Blanket
Planting (Medium Sized Mix Planting)

Bauder Capping Sheet (For all Green Roof details use Bauder Root Resistant Cap Sheet)
Bauder Underlayer
Bauder Air And Vapour Control Layer (Use Bauder Self Adhered Vapour Control Layer on Combustible Substrates)
FV 125 100 / 200 Filter Fleece - 1m / 2m Roll
GGM 6 Rubber Protection Mat
Code 4 Lead Flashing
Bauder Insulation
Bauder Insulated Fillet
RWB 100 Attenuation Cell
DSE 40 Drainage Board (Refer to the specification for the correct board to be used)
AL 150 Edge / Drainage trim. Secured in place by separate pieces of trim applied Bauder Plant-E Capping Sheet.
For vegetation/substrate build-up depths greater than 150mm, a bespoke perforated edge/drainage trim is required.
Water
SUB-IM UK Intensive Substrate / SUB-BM UK Biodiverse Substrate
SUB-MD UK Or Type 1 Or Type 3
Ballast
≥ 20-40 Rounded Stone
Weight Of Ballast ≥ 80kg/m²
Bedding Layer
Large Cobbles Or Rounded Stone Pebbles
Concrete Slab / Support Kerb
Blockwork
Concrete
Deck / Substrate

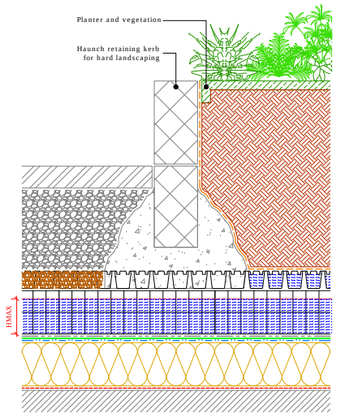
IMPORTANT NOTES:
1. This detail is suitable for the following Bauder Systems:
Bauder Total Roof System, Bauder Total Green Roof System
2. Do not scale to ascertain dimensions.
3. All dimensions to be checked and verified on site prior to commencement of work.
4. This drawing is to be read in conjunction with the specification and associated drawings.
5. This detail is a guideline only, representing typical detailing conditions and illustrates the correct application of the above Bauder System. It may be necessary to modify this detail to suit specific project design constraints and exposures.
6. Refer to the Bauder Specification for the product description and method of application. For clarity the method of attachment has not been shown.
7. Provision should be made by the installer for mechanically fixing the top leading edge of all upstand details in excess of 250mm in height using appropriate fasteners.



Enlarged View Of Additional Underlayer Relevant To All Upstands

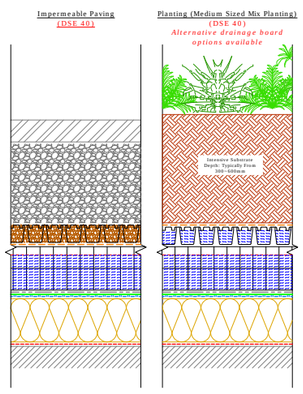


Hard Landscaping - Intensive
(Drg.No: D0000-00W_BR_010-Int-SL-S-D4-AC_005)



Hard Landscaping - Raised Planter
(Drg.No: D0000-00W_BR_010-Int-SL-S-D4-AC_006)

Landscape Options
(Heights and weight loadings may vary, allowance must be made for any fully established planting / vegetation and landscaping)



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BITUMINOUS TYPICAL DETAILS (BLUE ROOF - INTENSIVE)

Scale:	Drawing Number:	Rev:
1:5 @ A0	D0000-00W_BR_200-Int-SL-S-D4-AC_002	A

Drawn By:	Checked By:	Approved By:	Date:
CD	GW	CR	19.12.22

Appendix F Above Ground SW Management Calculations

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 274 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	10.046	0.046	0.0	0.2	0.2	5.2	Flood Risk
30 min Summer	10.052	0.052	0.0	0.3	0.3	5.9	Flood Risk
60 min Summer	10.057	0.057	0.0	0.3	0.3	6.5	Flood Risk
120 min Summer	10.062	0.062	0.0	0.3	0.3	7.0	Flood Risk
180 min Summer	10.063	0.063	0.0	0.3	0.3	7.2	Flood Risk
240 min Summer	10.063	0.063	0.0	0.3	0.3	7.2	Flood Risk
360 min Summer	10.064	0.064	0.0	0.3	0.3	7.2	Flood Risk
480 min Summer	10.063	0.063	0.0	0.3	0.3	7.2	Flood Risk
600 min Summer	10.062	0.062	0.0	0.3	0.3	7.1	Flood Risk
720 min Summer	10.061	0.061	0.0	0.3	0.3	7.0	Flood Risk
960 min Summer	10.059	0.059	0.0	0.3	0.3	6.7	Flood Risk
1440 min Summer	10.053	0.053	0.0	0.3	0.3	6.1	Flood Risk
2160 min Summer	10.046	0.046	0.0	0.2	0.2	5.3	Flood Risk
2880 min Summer	10.041	0.041	0.0	0.2	0.2	4.7	Flood Risk
4320 min Summer	10.034	0.034	0.0	0.2	0.2	3.9	Flood Risk
5760 min Summer	10.030	0.030	0.0	0.2	0.2	3.4	Flood Risk
7200 min Summer	10.027	0.027	0.0	0.1	0.1	3.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	237.285	0.0	4.7	22
30 min Summer	136.701	0.0	5.5	36
60 min Summer	78.753	0.0	6.8	64
120 min Summer	45.370	0.0	7.8	122
180 min Summer	32.860	0.0	8.5	172
240 min Summer	26.138	0.0	9.1	198
360 min Summer	18.931	0.0	9.9	260
480 min Summer	15.058	0.0	10.5	328
600 min Summer	12.609	0.0	11.0	396
720 min Summer	10.906	0.0	11.4	464
960 min Summer	8.618	0.0	12.0	598
1440 min Summer	6.184	0.0	12.8	858
2160 min Summer	4.437	0.0	14.2	1236
2880 min Summer	3.506	0.0	14.9	1592
4320 min Summer	2.458	0.0	15.5	2332
5760 min Summer	1.911	0.0	16.4	3056
7200 min Summer	1.572	0.0	16.8	3752

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	10.025	0.025	0.0	0.1	0.1	2.8	Flood Risk
10080 min Summer	10.023	0.023	0.0	0.1	0.1	2.6	Flood Risk
15 min Winter	10.051	0.051	0.0	0.3	0.3	5.8	Flood Risk
30 min Winter	10.058	0.058	0.0	0.3	0.3	6.6	Flood Risk
60 min Winter	10.065	0.065	0.0	0.3	0.3	7.4	Flood Risk
120 min Winter	10.070	0.070	0.0	0.3	0.3	8.0	Flood Risk
180 min Winter	10.071	0.071	0.0	0.3	0.3	8.1	Flood Risk
240 min Winter	10.071	0.071	0.0	0.3	0.3	8.1	Flood Risk
360 min Winter	10.071	0.071	0.0	0.3	0.3	8.1	Flood Risk
480 min Winter	10.070	0.070	0.0	0.3	0.3	7.9	Flood Risk
600 min Winter	10.068	0.068	0.0	0.3	0.3	7.8	Flood Risk
720 min Winter	10.066	0.066	0.0	0.3	0.3	7.5	Flood Risk
960 min Winter	10.062	0.062	0.0	0.3	0.3	7.0	Flood Risk
1440 min Winter	10.053	0.053	0.0	0.3	0.3	6.1	Flood Risk
2160 min Winter	10.044	0.044	0.0	0.2	0.2	5.0	Flood Risk
2880 min Winter	10.038	0.038	0.0	0.2	0.2	4.3	Flood Risk
4320 min Winter	10.030	0.030	0.0	0.2	0.2	3.5	Flood Risk
5760 min Winter	10.026	0.026	0.0	0.1	0.1	3.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.340	0.0	17.2	4496
10080 min Summer	1.171	0.0	17.4	5240
15 min Winter	237.285	0.0	5.3	22
30 min Winter	136.701	0.0	6.2	36
60 min Winter	78.753	0.0	7.6	64
120 min Winter	45.370	0.0	8.8	120
180 min Winter	32.860	0.0	9.6	174
240 min Winter	26.138	0.0	10.2	222
360 min Winter	18.931	0.0	11.1	276
480 min Winter	15.058	0.0	11.8	354
600 min Winter	12.609	0.0	12.3	428
720 min Winter	10.906	0.0	12.8	502
960 min Winter	8.618	0.0	13.5	642
1440 min Winter	6.184	0.0	14.4	912
2160 min Winter	4.437	0.0	15.9	1296
2880 min Winter	3.506	0.0	16.7	1644
4320 min Winter	2.458	0.0	17.4	2380
5760 min Winter	1.911	0.0	18.4	3112

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	10.024	0.024	0.0	0.1	0.1	2.7	Flood Risk
8640 min Winter	10.022	0.022	0.0	0.1	0.1	2.5	Flood Risk
10080 min Winter	10.020	0.020	0.0	0.1	0.1	2.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.572	0.0	18.9	3784
8640 min Winter	1.340	0.0	19.2	4560
10080 min Winter	1.171	0.0	19.5	5352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.012

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006	4	8	0.006

Model Details

Storage is Online Cover Level (m) 10.100

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	0.0	1.300	0.0	0.0
0.100	120.0	0.0	1.400	0.0	0.0
0.200	0.0	0.0	1.500	0.0	0.0
0.300	0.0	0.0	1.600	0.0	0.0
0.400	0.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 10.000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 338 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	10.046	0.046	0.0	0.4	0.4	11.3	Flood Risk
30 min Summer	10.052	0.052	0.0	0.5	0.5	12.8	Flood Risk
60 min Summer	10.058	0.058	0.0	0.5	0.5	14.4	Flood Risk
120 min Summer	10.063	0.063	0.0	0.5	0.5	15.7	Flood Risk
180 min Summer	10.065	0.065	0.0	0.6	0.6	16.1	Flood Risk
240 min Summer	10.066	0.066	0.0	0.6	0.6	16.3	Flood Risk
360 min Summer	10.067	0.067	0.0	0.6	0.6	16.4	Flood Risk
480 min Summer	10.067	0.067	0.0	0.6	0.6	16.5	Flood Risk
600 min Summer	10.066	0.066	0.0	0.6	0.6	16.4	Flood Risk
720 min Summer	10.066	0.066	0.0	0.6	0.6	16.3	Flood Risk
960 min Summer	10.064	0.064	0.0	0.6	0.6	15.8	Flood Risk
1440 min Summer	10.060	0.060	0.0	0.5	0.5	14.8	Flood Risk
2160 min Summer	10.054	0.054	0.0	0.5	0.5	13.3	Flood Risk
2880 min Summer	10.049	0.049	0.0	0.5	0.5	12.2	Flood Risk
4320 min Summer	10.042	0.042	0.0	0.4	0.4	10.5	Flood Risk
5760 min Summer	10.038	0.038	0.0	0.3	0.3	9.3	Flood Risk
7200 min Summer	10.035	0.035	0.0	0.3	0.3	8.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	237.285	0.0	9.4	22
30 min Summer	136.701	0.0	11.0	36
60 min Summer	78.753	0.0	14.1	66
120 min Summer	45.370	0.0	16.4	122
180 min Summer	32.860	0.0	17.9	180
240 min Summer	26.138	0.0	19.1	210
360 min Summer	18.931	0.0	20.8	270
480 min Summer	15.058	0.0	22.1	336
600 min Summer	12.609	0.0	23.1	404
720 min Summer	10.906	0.0	24.0	472
960 min Summer	8.618	0.0	25.2	608
1440 min Summer	6.184	0.0	27.0	870
2160 min Summer	4.437	0.0	30.3	1256
2880 min Summer	3.506	0.0	31.9	1616
4320 min Summer	2.458	0.0	33.0	2376
5760 min Summer	1.911	0.0	35.3	3112
7200 min Summer	1.572	0.0	36.2	3824

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	10.032	0.032	0.0	0.2	0.2	7.9	Flood Risk
10080 min Summer	10.030	0.030	0.0	0.2	0.2	7.3	Flood Risk
15 min Winter	10.051	0.051	0.0	0.5	0.5	12.7	Flood Risk
30 min Winter	10.058	0.058	0.0	0.5	0.5	14.4	Flood Risk
60 min Winter	10.065	0.065	0.0	0.6	0.6	16.2	Flood Risk
120 min Winter	10.072	0.072	0.0	0.6	0.6	17.7	Flood Risk
180 min Winter	10.074	0.074	0.0	0.6	0.6	18.2	Flood Risk
240 min Winter	10.074	0.074	0.0	0.6	0.6	18.4	Flood Risk
360 min Winter	10.074	0.074	0.0	0.6	0.6	18.4	Flood Risk
480 min Winter	10.074	0.074	0.0	0.6	0.6	18.3	Flood Risk
600 min Winter	10.073	0.073	0.0	0.6	0.6	18.0	Flood Risk
720 min Winter	10.072	0.072	0.0	0.6	0.6	17.7	Flood Risk
960 min Winter	10.068	0.068	0.0	0.6	0.6	16.8	Flood Risk
1440 min Winter	10.061	0.061	0.0	0.5	0.5	15.1	Flood Risk
2160 min Winter	10.053	0.053	0.0	0.5	0.5	13.0	Flood Risk
2880 min Winter	10.047	0.047	0.0	0.4	0.4	11.7	Flood Risk
4320 min Winter	10.039	0.039	0.0	0.3	0.3	9.7	Flood Risk
5760 min Winter	10.034	0.034	0.0	0.3	0.3	8.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.340	0.0	36.8	4584
10080 min Summer	1.171	0.0	37.2	5336
15 min Winter	237.285	0.0	10.7	22
30 min Winter	136.701	0.0	12.6	36
60 min Winter	78.753	0.0	16.0	64
120 min Winter	45.370	0.0	18.5	120
180 min Winter	32.860	0.0	20.2	176
240 min Winter	26.138	0.0	21.5	228
360 min Winter	18.931	0.0	23.4	284
480 min Winter	15.058	0.0	24.8	360
600 min Winter	12.609	0.0	26.0	436
720 min Winter	10.906	0.0	27.0	510
960 min Winter	8.618	0.0	28.4	654
1440 min Winter	6.184	0.0	30.4	926
2160 min Winter	4.437	0.0	34.1	1304
2880 min Winter	3.506	0.0	35.8	1676
4320 min Winter	2.458	0.0	37.2	2424
5760 min Winter	1.911	0.0	39.6	3176

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	10.031	0.031	0.0	0.2	0.2	7.7	Flood Risk
8640 min Winter	10.028	0.028	0.0	0.2	0.2	7.0	Flood Risk
10080 min Winter	10.026	0.026	0.0	0.2	0.2	6.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.572	0.0	40.6	3896
8640 min Winter	1.340	0.0	41.4	4672
10080 min Winter	1.171	0.0	41.8	5352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.026

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.013	4	8	0.013

Model Details

Storage is Online Cover Level (m) 10.100

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	260.0	0.0	1.300	0.0	0.0
0.100	260.0	0.0	1.400	0.0	0.0
0.200	0.0	0.0	1.500	0.0	0.0
0.300	0.0	0.0	1.600	0.0	0.0
0.400	0.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 10.000

Appendix G Below Ground SW Management Calculations

Summary of Results for 1 year Return Period

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.498	0.048	0.0	0.8	0.8	0.6	O K
30 min Summer	25.500	0.050	0.0	0.9	0.9	0.6	O K
60 min Summer	25.498	0.048	0.0	0.9	0.9	0.6	O K
120 min Summer	25.493	0.043	0.0	0.7	0.7	0.5	O K
180 min Summer	25.489	0.039	0.0	0.6	0.6	0.5	O K
240 min Summer	25.487	0.037	0.0	0.5	0.5	0.5	O K
360 min Summer	25.483	0.033	0.0	0.4	0.4	0.4	O K
480 min Summer	25.481	0.031	0.0	0.4	0.4	0.4	O K
600 min Summer	25.478	0.028	0.0	0.3	0.3	0.4	O K
720 min Summer	25.477	0.027	0.0	0.3	0.3	0.3	O K
960 min Summer	25.474	0.024	0.0	0.2	0.2	0.3	O K
1440 min Summer	25.471	0.021	0.0	0.2	0.2	0.3	O K
2160 min Summer	25.468	0.018	0.0	0.1	0.1	0.2	O K
2880 min Summer	25.467	0.017	0.0	0.1	0.1	0.2	O K
4320 min Summer	25.464	0.014	0.0	0.1	0.1	0.2	O K
5760 min Summer	25.463	0.013	0.0	0.1	0.1	0.2	O K
7200 min Summer	25.462	0.012	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	31.036	0.0	0.9	16
30 min Summer	19.425	0.0	1.2	23
60 min Summer	12.158	0.0	1.5	38
120 min Summer	7.610	0.0	1.8	70
180 min Summer	5.785	0.0	2.1	100
240 min Summer	4.763	0.0	2.3	130
360 min Summer	3.621	0.0	2.6	190
480 min Summer	2.981	0.0	2.9	252
600 min Summer	2.564	0.0	3.1	312
720 min Summer	2.266	0.0	3.3	372
960 min Summer	1.854	0.0	3.6	494
1440 min Summer	1.396	0.0	4.0	738
2160 min Summer	1.052	0.0	4.5	1104
2880 min Summer	0.860	0.0	4.9	1452
4320 min Summer	0.633	0.0	5.5	2204
5760 min Summer	0.509	0.0	5.9	2920
7200 min Summer	0.430	0.0	6.2	3672

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	25.461	0.011	0.0	0.1	0.1	0.1	O K
10080 min Summer	25.460	0.010	0.0	0.0	0.0	0.1	O K
15 min Winter	25.502	0.052	0.0	0.9	0.9	0.6	O K
30 min Winter	25.502	0.052	0.0	1.0	1.0	0.6	O K
60 min Winter	25.498	0.048	0.0	0.8	0.8	0.6	O K
120 min Winter	25.490	0.040	0.0	0.7	0.7	0.5	O K
180 min Winter	25.486	0.036	0.0	0.5	0.5	0.4	O K
240 min Winter	25.484	0.034	0.0	0.4	0.4	0.4	O K
360 min Winter	25.479	0.029	0.0	0.3	0.3	0.4	O K
480 min Winter	25.477	0.027	0.0	0.3	0.3	0.3	O K
600 min Winter	25.475	0.025	0.0	0.2	0.2	0.3	O K
720 min Winter	25.473	0.023	0.0	0.2	0.2	0.3	O K
960 min Winter	25.471	0.021	0.0	0.2	0.2	0.3	O K
1440 min Winter	25.468	0.018	0.0	0.1	0.1	0.2	O K
2160 min Winter	25.466	0.016	0.0	0.1	0.1	0.2	O K
2880 min Winter	25.464	0.014	0.0	0.1	0.1	0.2	O K
4320 min Winter	25.462	0.012	0.0	0.1	0.1	0.1	O K
5760 min Winter	25.461	0.011	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.375	0.0	6.5	4360
10080 min Summer	0.334	0.0	6.7	5136
15 min Winter	31.036	0.0	1.0	16
30 min Winter	19.425	0.0	1.3	24
60 min Winter	12.158	0.0	1.6	40
120 min Winter	7.610	0.0	2.0	70
180 min Winter	5.785	0.0	2.3	100
240 min Winter	4.763	0.0	2.6	130
360 min Winter	3.621	0.0	2.9	194
480 min Winter	2.981	0.0	3.2	254
600 min Winter	2.564	0.0	3.4	312
720 min Winter	2.266	0.0	3.6	376
960 min Winter	1.854	0.0	4.0	490
1440 min Winter	1.396	0.0	4.5	732
2160 min Winter	1.052	0.0	5.1	1068
2880 min Winter	0.860	0.0	5.5	1460
4320 min Winter	0.633	0.0	6.1	2144
5760 min Winter	0.509	0.0	6.6	2888

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	25.460	0.010	0.0	0.0	0.0	0.1	O K
8640 min Winter	25.459	0.009	0.0	0.0	0.0	0.1	O K
10080 min Winter	25.458	0.008	0.0	0.0	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	0.430	0.0	6.9	3680
8640 min Winter	0.375	0.0	7.2	4280
10080 min Winter	0.334	0.0	7.5	5144

Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.016

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008	4	8	0.008

Model Details

Storage is Online Cover Level (m) 26.350

Cellular Storage Structure

Invert Level (m) 25.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	13.0	0.0	1.300	0.0	0.0
0.100	13.0	0.0	1.400	0.0	0.0
0.200	13.0	0.0	1.500	0.0	0.0
0.300	13.0	0.0	1.600	0.0	0.0
0.400	13.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 25.450

Summary of Results for 30 year Return Period

Half Drain Time : 7 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.588	0.138	0.0	3.3	3.3	1.7	O K
30 min Summer	25.582	0.132	0.0	3.2	3.2	1.6	O K
60 min Summer	25.563	0.113	0.0	2.9	2.9	1.4	O K
120 min Summer	25.540	0.090	0.0	2.2	2.2	1.1	O K
180 min Summer	25.527	0.077	0.0	1.8	1.8	1.0	O K
240 min Summer	25.519	0.069	0.0	1.5	1.5	0.9	O K
360 min Summer	25.509	0.059	0.0	1.1	1.1	0.7	O K
480 min Summer	25.501	0.051	0.0	0.9	0.9	0.6	O K
600 min Summer	25.496	0.046	0.0	0.8	0.8	0.6	O K
720 min Summer	25.493	0.043	0.0	0.7	0.7	0.5	O K
960 min Summer	25.488	0.038	0.0	0.6	0.6	0.5	O K
1440 min Summer	25.483	0.033	0.0	0.4	0.4	0.4	O K
2160 min Summer	25.478	0.028	0.0	0.3	0.3	0.3	O K
2880 min Summer	25.475	0.025	0.0	0.3	0.3	0.3	O K
4320 min Summer	25.471	0.021	0.0	0.2	0.2	0.3	O K
5760 min Summer	25.469	0.019	0.0	0.1	0.1	0.2	O K
7200 min Summer	25.467	0.017	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.211	0.0	3.2	16
30 min Summer	63.722	0.0	3.8	23
60 min Summer	37.524	0.0	4.5	38
120 min Summer	22.096	0.0	5.3	68
180 min Summer	16.210	0.0	5.8	98
240 min Summer	13.012	0.0	6.2	128
360 min Summer	9.546	0.0	6.9	190
480 min Summer	7.662	0.0	7.3	250
600 min Summer	6.461	0.0	7.7	310
720 min Summer	5.621	0.0	8.1	370
960 min Summer	4.482	0.0	8.6	488
1440 min Summer	3.258	0.0	9.4	736
2160 min Summer	2.368	0.0	10.2	1092
2880 min Summer	1.888	0.0	10.9	1468
4320 min Summer	1.341	0.0	11.6	2188
5760 min Summer	1.052	0.0	12.1	2904
7200 min Summer	0.871	0.0	12.5	3672

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	25.466	0.016	0.0	0.1	0.1	0.2	O K
10080 min Summer	25.465	0.015	0.0	0.1	0.1	0.2	O K
15 min Winter	25.603	0.153	0.0	3.5	3.5	1.9	O K
30 min Winter	25.589	0.139	0.0	3.3	3.3	1.7	O K
60 min Winter	25.558	0.108	0.0	2.8	2.8	1.3	O K
120 min Winter	25.531	0.081	0.0	1.9	1.9	1.0	O K
180 min Winter	25.518	0.068	0.0	1.5	1.5	0.8	O K
240 min Winter	25.510	0.060	0.0	1.2	1.2	0.7	O K
360 min Winter	25.499	0.049	0.0	0.9	0.9	0.6	O K
480 min Winter	25.493	0.043	0.0	0.7	0.7	0.5	O K
600 min Winter	25.489	0.039	0.0	0.6	0.6	0.5	O K
720 min Winter	25.487	0.037	0.0	0.5	0.5	0.5	O K
960 min Winter	25.483	0.033	0.0	0.4	0.4	0.4	O K
1440 min Winter	25.478	0.028	0.0	0.3	0.3	0.3	O K
2160 min Winter	25.474	0.024	0.0	0.2	0.2	0.3	O K
2880 min Winter	25.472	0.022	0.0	0.2	0.2	0.3	O K
4320 min Winter	25.468	0.018	0.0	0.1	0.1	0.2	O K
5760 min Winter	25.466	0.016	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.747	0.0	12.9	4344
10080 min Summer	0.656	0.0	13.2	5024
15 min Winter	108.211	0.0	3.6	16
30 min Winter	63.722	0.0	4.3	24
60 min Winter	37.524	0.0	5.0	38
120 min Winter	22.096	0.0	5.9	68
180 min Winter	16.210	0.0	6.5	100
240 min Winter	13.012	0.0	7.0	130
360 min Winter	9.546	0.0	7.7	190
480 min Winter	7.662	0.0	8.2	250
600 min Winter	6.461	0.0	8.7	312
720 min Winter	5.621	0.0	9.1	370
960 min Winter	4.482	0.0	9.6	494
1440 min Winter	3.258	0.0	10.5	732
2160 min Winter	2.368	0.0	11.4	1068
2880 min Winter	1.888	0.0	12.2	1468
4320 min Winter	1.341	0.0	13.0	2152
5760 min Winter	1.052	0.0	13.6	2936

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	25.464	0.014	0.0	0.1	0.1	0.2	O K
8640 min Winter	25.463	0.013	0.0	0.1	0.1	0.2	O K
10080 min Winter	25.462	0.012	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	0.871	0.0	14.0	3680
8640 min Winter	0.747	0.0	14.5	4376
10080 min Winter	0.656	0.0	14.8	5136

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.016

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008	4	8	0.008

Model Details

Storage is Online Cover Level (m) 26.350

Cellular Storage Structure

Invert Level (m) 25.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	13.0	0.0	1.300	0.0	0.0
0.100	13.0	0.0	1.400	0.0	0.0
0.200	13.0	0.0	1.500	0.0	0.0
0.300	13.0	0.0	1.600	0.0	0.0
0.400	13.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 25.450

Summary of Results for 100 year Return Period

Half Drain Time : 9 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.677	0.227	0.0	4.5	4.5	2.8	O K
30 min Summer	25.660	0.210	0.0	4.3	4.3	2.6	O K
60 min Summer	25.622	0.172	0.0	3.8	3.8	2.1	O K
120 min Summer	25.575	0.125	0.0	3.1	3.1	1.5	O K
180 min Summer	25.550	0.100	0.0	2.6	2.6	1.2	O K
240 min Summer	25.538	0.088	0.0	2.2	2.2	1.1	O K
360 min Summer	25.523	0.073	0.0	1.7	1.7	0.9	O K
480 min Summer	25.514	0.064	0.0	1.3	1.3	0.8	O K
600 min Summer	25.508	0.058	0.0	1.1	1.1	0.7	O K
720 min Summer	25.503	0.053	0.0	1.0	1.0	0.7	O K
960 min Summer	25.496	0.046	0.0	0.8	0.8	0.6	O K
1440 min Summer	25.488	0.038	0.0	0.6	0.6	0.5	O K
2160 min Summer	25.483	0.033	0.0	0.4	0.4	0.4	O K
2880 min Summer	25.479	0.029	0.0	0.3	0.3	0.4	O K
4320 min Summer	25.474	0.024	0.0	0.2	0.2	0.3	O K
5760 min Summer	25.472	0.022	0.0	0.2	0.2	0.3	O K
7200 min Summer	25.469	0.019	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	169.489	0.0	5.1	16
30 min Summer	97.643	0.0	5.9	24
60 min Summer	56.252	0.0	6.7	40
120 min Summer	32.407	0.0	7.8	70
180 min Summer	23.472	0.0	8.4	98
240 min Summer	18.670	0.0	9.0	128
360 min Summer	13.522	0.0	9.7	188
480 min Summer	10.756	0.0	10.3	250
600 min Summer	9.006	0.0	10.8	310
720 min Summer	7.790	0.0	11.2	370
960 min Summer	6.156	0.0	11.8	490
1440 min Summer	4.417	0.0	12.7	736
2160 min Summer	3.169	0.0	13.7	1088
2880 min Summer	2.504	0.0	14.4	1452
4320 min Summer	1.756	0.0	15.2	2204
5760 min Summer	1.365	0.0	15.7	2912
7200 min Summer	1.123	0.0	16.2	3640

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	25.468	0.018	0.0	0.1	0.1	0.2	O K
10080 min Summer	25.467	0.017	0.0	0.1	0.1	0.2	O K
15 min Winter	25.703	0.253	0.0	4.8	4.8	3.1	O K
30 min Winter	25.675	0.225	0.0	4.5	4.5	2.8	O K
60 min Winter	25.619	0.169	0.0	3.7	3.7	2.1	O K
120 min Winter	25.558	0.108	0.0	2.8	2.8	1.3	O K
180 min Winter	25.537	0.087	0.0	2.1	2.1	1.1	O K
240 min Winter	25.525	0.075	0.0	1.7	1.7	0.9	O K
360 min Winter	25.512	0.062	0.0	1.3	1.3	0.8	O K
480 min Winter	25.504	0.054	0.0	1.0	1.0	0.7	O K
600 min Winter	25.498	0.048	0.0	0.8	0.8	0.6	O K
720 min Winter	25.493	0.043	0.0	0.7	0.7	0.5	O K
960 min Winter	25.488	0.038	0.0	0.6	0.6	0.5	O K
1440 min Winter	25.483	0.033	0.0	0.4	0.4	0.4	O K
2160 min Winter	25.478	0.028	0.0	0.3	0.3	0.3	O K
2880 min Winter	25.475	0.025	0.0	0.2	0.2	0.3	O K
4320 min Winter	25.471	0.021	0.0	0.2	0.2	0.3	O K
5760 min Winter	25.468	0.018	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.957	0.0	16.5	4360
10080 min Summer	0.836	0.0	16.9	5120
15 min Winter	169.489	0.0	5.7	16
30 min Winter	97.643	0.0	6.6	24
60 min Winter	56.252	0.0	7.6	40
120 min Winter	32.407	0.0	8.7	70
180 min Winter	23.472	0.0	9.5	98
240 min Winter	18.670	0.0	10.0	130
360 min Winter	13.522	0.0	10.9	190
480 min Winter	10.756	0.0	11.6	250
600 min Winter	9.006	0.0	12.1	310
720 min Winter	7.790	0.0	12.6	370
960 min Winter	6.156	0.0	13.2	490
1440 min Winter	4.417	0.0	14.2	736
2160 min Winter	3.169	0.0	15.3	1092
2880 min Winter	2.504	0.0	16.1	1480
4320 min Winter	1.756	0.0	17.0	2200
5760 min Winter	1.365	0.0	17.6	2928

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	25.466	0.016	0.0	0.1	0.1	0.2	O K
8640 min Winter	25.465	0.015	0.0	0.1	0.1	0.2	O K
10080 min Winter	25.464	0.014	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.123	0.0	18.1	3672
8640 min Winter	0.957	0.0	18.5	4256
10080 min Winter	0.836	0.0	18.9	5200

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.016

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008	4	8	0.008

Model Details

Storage is Online Cover Level (m) 26.350

Cellular Storage Structure

Invert Level (m) 25.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	13.0	0.0	1.300	0.0	0.0
0.100	13.0	0.0	1.400	0.0	0.0
0.200	13.0	0.0	1.500	0.0	0.0
0.300	13.0	0.0	1.600	0.0	0.0
0.400	13.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 25.450

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 8 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.784	0.334	0.0	5.6	5.6	4.1	O K
30 min Summer	25.760	0.310	0.0	5.4	5.4	3.8	O K
60 min Summer	25.707	0.257	0.0	4.8	4.8	3.2	O K
120 min Summer	25.635	0.185	0.0	4.0	4.0	2.3	O K
180 min Summer	25.592	0.142	0.0	3.3	3.3	1.8	O K
240 min Summer	25.566	0.116	0.0	2.9	2.9	1.4	O K
360 min Summer	25.542	0.092	0.0	2.3	2.3	1.1	O K
480 min Summer	25.530	0.080	0.0	1.9	1.9	1.0	O K
600 min Summer	25.522	0.072	0.0	1.6	1.6	0.9	O K
720 min Summer	25.516	0.066	0.0	1.4	1.4	0.8	O K
960 min Summer	25.508	0.058	0.0	1.1	1.1	0.7	O K
1440 min Summer	25.496	0.046	0.0	0.8	0.8	0.6	O K
2160 min Summer	25.488	0.038	0.0	0.6	0.6	0.5	O K
2880 min Summer	25.485	0.035	0.0	0.5	0.5	0.4	O K
4320 min Summer	25.479	0.029	0.0	0.3	0.3	0.4	O K
5760 min Summer	25.475	0.025	0.0	0.3	0.3	0.3	O K
7200 min Summer	25.473	0.023	0.0	0.2	0.2	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	237.285	0.0	7.1	16
30 min Summer	136.701	0.0	8.2	24
60 min Summer	78.753	0.0	9.5	40
120 min Summer	45.370	0.0	10.9	70
180 min Summer	32.860	0.0	11.8	100
240 min Summer	26.138	0.0	12.5	130
360 min Summer	18.931	0.0	13.6	188
480 min Summer	15.058	0.0	14.4	248
600 min Summer	12.609	0.0	15.1	308
720 min Summer	10.906	0.0	15.7	370
960 min Summer	8.618	0.0	16.5	490
1440 min Summer	6.184	0.0	17.8	732
2160 min Summer	4.437	0.0	19.2	1092
2880 min Summer	3.506	0.0	20.2	1460
4320 min Summer	2.458	0.0	21.2	2200
5760 min Summer	1.911	0.0	22.0	2880
7200 min Summer	1.572	0.0	22.6	3624

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	25.471	0.021	0.0	0.2	0.2	0.3	O K
10080 min Summer	25.470	0.020	0.0	0.2	0.2	0.2	O K
15 min Winter	25.823	0.373	0.0	5.9	5.9	4.6	O K
30 min Winter	25.787	0.337	0.0	5.6	5.6	4.2	O K
60 min Winter	25.706	0.256	0.0	4.8	4.8	3.2	O K
120 min Winter	25.611	0.161	0.0	3.6	3.6	2.0	O K
180 min Winter	25.565	0.115	0.0	2.9	2.9	1.4	O K
240 min Winter	25.544	0.094	0.0	2.4	2.4	1.2	O K
360 min Winter	25.526	0.076	0.0	1.8	1.8	0.9	O K
480 min Winter	25.516	0.066	0.0	1.4	1.4	0.8	O K
600 min Winter	25.510	0.060	0.0	1.2	1.2	0.7	O K
720 min Winter	25.505	0.055	0.0	1.0	1.0	0.7	O K
960 min Winter	25.496	0.046	0.0	0.8	0.8	0.6	O K
1440 min Winter	25.488	0.038	0.0	0.6	0.6	0.5	O K
2160 min Winter	25.483	0.033	0.0	0.4	0.4	0.4	O K
2880 min Winter	25.479	0.029	0.0	0.3	0.3	0.4	O K
4320 min Winter	25.474	0.024	0.0	0.2	0.2	0.3	O K
5760 min Winter	25.472	0.022	0.0	0.2	0.2	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.340	0.0	23.1	4344
10080 min Summer	1.171	0.0	23.6	5104
15 min Winter	237.285	0.0	8.0	16
30 min Winter	136.701	0.0	9.2	25
60 min Winter	78.753	0.0	10.6	42
120 min Winter	45.370	0.0	12.2	72
180 min Winter	32.860	0.0	13.2	100
240 min Winter	26.138	0.0	14.0	128
360 min Winter	18.931	0.0	15.3	190
480 min Winter	15.058	0.0	16.2	250
600 min Winter	12.609	0.0	16.9	310
720 min Winter	10.906	0.0	17.6	372
960 min Winter	8.618	0.0	18.5	494
1440 min Winter	6.184	0.0	19.9	718
2160 min Winter	4.437	0.0	21.5	1076
2880 min Winter	3.506	0.0	22.6	1472
4320 min Winter	2.458	0.0	23.8	2196
5760 min Winter	1.911	0.0	24.6	2936

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	25.469	0.019	0.0	0.1	0.1	0.2	O K
8640 min Winter	25.468	0.018	0.0	0.1	0.1	0.2	O K
10080 min Winter	25.467	0.017	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.572	0.0	25.3	3696
8640 min Winter	1.340	0.0	25.9	4408
10080 min Winter	1.171	0.0	26.4	5080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 529800 181850 TQ 29800 81850
C (1km)	-0.026
D1 (1km)	0.324
D2 (1km)	0.301
D3 (1km)	0.244
E (1km)	0.333
F (1km)	2.498
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.016

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008	4	8	0.008

Model Details

Storage is Online Cover Level (m) 26.350

Cellular Storage Structure

Invert Level (m) 25.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	13.0	0.0	1.300	0.0	0.0
0.100	13.0	0.0	1.400	0.0	0.0
0.200	13.0	0.0	1.500	0.0	0.0
0.300	13.0	0.0	1.600	0.0	0.0
0.400	13.0	0.0	1.700	0.0	0.0
0.500	0.0	0.0	1.800	0.0	0.0
0.600	0.0	0.0	1.900	0.0	0.0
0.700	0.0	0.0	2.000	0.0	0.0
0.800	0.0	0.0	2.100	0.0	0.0
0.900	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Orifice Outflow Control

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 25.450