

Oswald Chambers Glasgow Drainage Strategy



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Document Information & History

Project title: Oswald Chambers, Glasgow

Client: MHM Clyde One Ltd

Project no: G8705

Issue	Date	Description	Prepared by:	Reviewed by:
01	21/05/2021	Planning	R. Crewe	R. Campbell

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1.0 Introduction

1.1 Appointment and Brief

Will Rudd Davidson has been appointed by HMM Clyde One Ltd to provide Engineering Consultancy Services to support a planning application for a new hotel development at Oswald St, Glasgow.

This Drainage Strategy Report has been prepared for the proposed hotel development.

1.2 Report objectives:

1. To describe the proposed surface and foul water management strategy for the Site, in accordance with the Sustainable Drainage Systems (SUDS) design guidance and Scottish Water guidance. This strategy is subject to change based on the outcome of a drainage survey at the Site, which has not yet been instructed.
2. To inform HMM Clyde One Ltd of key surface water drainage, foul water drainage and Sustainable Urban Drainage System (SUDS) issues and constraints, which may influence the development process and provide an integrated drainage solution for the development of the Site, ensuring compliance with all current design guidance and best practice.
3. To identify any capacity constraints and discharge points for the foul drainage and surface water drainage. This element of work is reliant on information being made available by Scottish Water within the reporting timescales.

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

2.0 Site Location & Description

The property is located on the corner of Oswald Street and the Broomielaw in Glasgow's City Centre. Two addresses make up the Oswald Street property, behind which sits the remnants of a public house building left damaged by a historical fire.

No. 9 and No. 5 Oswald Street are highlighted in orange and red in figures 1 & 2 below. The old public house remains are located on 70-74 & 66-68 Broomielaw, this shown in green in figure 1 & 2 below.

The Site is 1583m² (0.1583 hectares). The surface is currently all non-permeable. The topography of the Site is relatively flat. External level survey information has not been received yet.

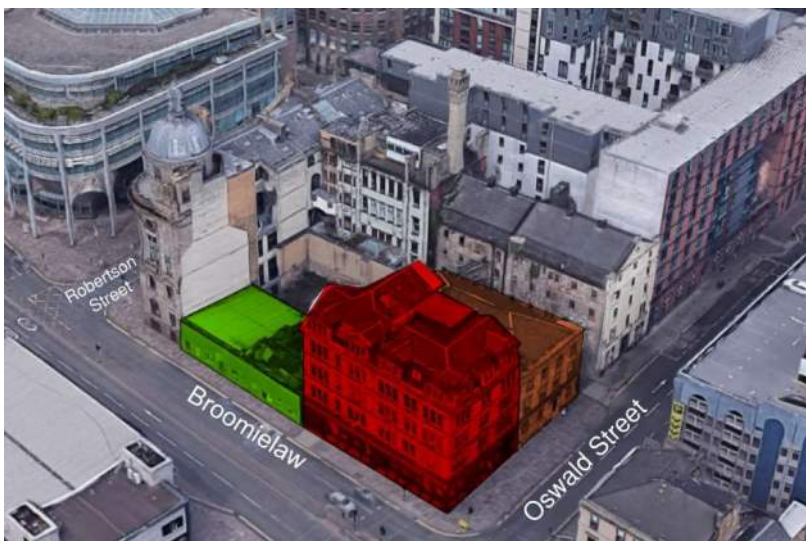


Figure 1. Satellite view of Site

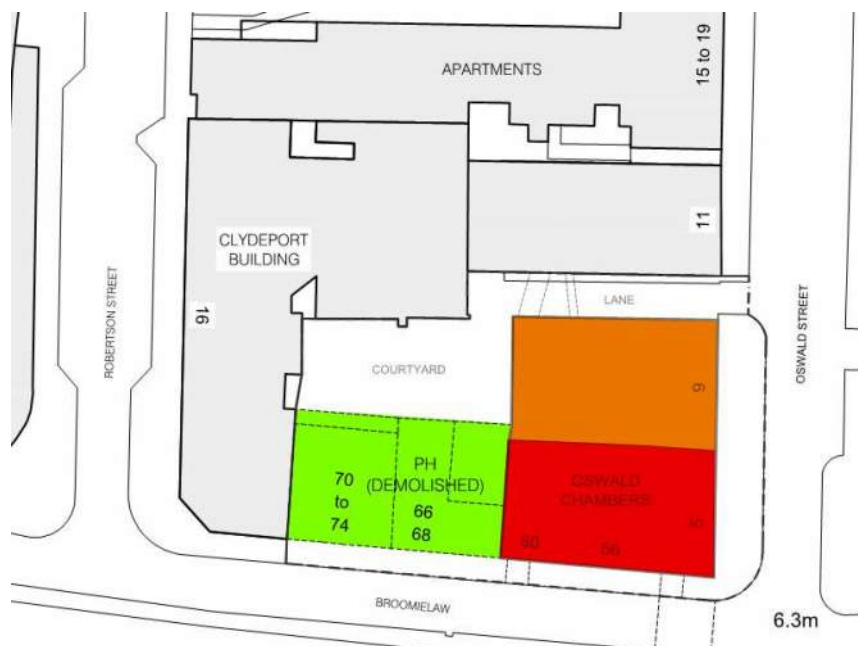


Figure 1. Plan view of Site

3.0 Development Proposals

3.1 General

The proposed development will comprise 123 hotel rooms. These are spread across the two existing buildings and a new six-storey hotel in the gap Site.

3.2 Existing Scottish Water Sewer Layout

The nearest watercourse within the vicinity of the site is the River Clyde which is approximately 50m to the South of the Site.

The Scottish Water sewer records indicate the main brick combined sewer located on the Broomielaw flows East to West. The combined brick sewer on Oswald St flows South to join the sewer on the Broomielaw.

There is a 450 diameter clay combined sewer within the Broomielaw that flows West to East past part of this proposed development, before joining the main brick sewer flowing parallel in the opposing direction.

These records also indicate that there are two combined sewer overflow pipes directly from the Broomielaw combined brick sewer into the Clyde.

A drainage survey has been sent out to tender and awaits instruction at the time of writing. One of the main objectives of this drainage survey will be to ascertain what the invert levels and diameter of these two combined surface overflow pipes.

3.3 Drainage Strategy

3.3.1 Summary

The drainage strategy for the two existing buildings and any hardstanding areas is to route surface & foul water along their existing drainage routes into the combined sewer. This includes the proposed three-storey extension to be added to No. 9 Oswald Street.

Surface water landing on the new six-storey hotel in the gap Site will be attenuated and infiltrated at roof level using a blue roof. It will then either be discharged:

A) Directly in the River Clyde via the nearby combined sewer overflow (CSO) pipe into the Clyde, bypassing the combined sewer manholes and therefore reducing the load on the existing combined sewer.

or

B) Into the combined sewer, subject to Scottish Water approval.

The drainage survey will confirm if option A is possible. If it is not possible to put this surface water directly into the CSO pipe then option B will be progressed. The PDE application to Scottish Water has been submitted on the basis of option B.

Both options represent a substantial reduction in the peak surface water discharge rate due to attenuation at roof level. The drawing contained in Appendix B shows option B.

3.3.1 Summary (cont.)

Foul water from the six-storey new hotel will be routed into the combined sewer on the Broomielaw.

The combined sewers on the Broomielaw are at least 3m deep at the proposed point of connection which will allow the development Site to be drained via gravity to the sewer. One of the main objectives of the drainage survey will be to ascertain what the invert levels and diameter of the nearby CSO pipe.

3.3.2 Foul Water Drainage

Foul water from the new build six-storey hotel will be routed to the Broomielaw via a new disconnected manhole provided within the footway. This will require the approval of Scottish Water.

Foul from the existing buildings will follow its existing courses which are expected to feed into the combined sewer on Oswald Street and the Broomielaw. There is expected to be a pump chamber in the basement of one of the existing buildings. This will be pumped to ground level via a rising main, and will then fall under gravity into the existing combined sewer (Location TBC) via a new disconnecting manhole.

It is intended to have separate foul and surface water networks within the development boundary.

Foul flow rates from the proposed development have been calculated using British Water's Code of Practice Flows and Loads 4.

3.3.3 Surface Water Drainage

The Site is brownfield and comprises 100% hard landscaping including roofs and hard surfaced areas (paving / car parks) and as such the surface water falling onto the Site pre-development will be discharging to the existing combined sewers.

Surface water landing on the proposed new build hotel will be attenuated and infiltrated by a blue roof. It is then either routed to the nearby CSO pipe on the Broomielaw if this is feasible, bypassing the combined public sewer. Otherwise, it will be directed into the combined public sewer on the Broomielaw, subject to Scottish Water approval. The blue roof will reduce the peak discharge rate from the overall site by 31% compared to the pre-development situation.

Surface water landing on the existing buildings and hardstanding areas will discharge directly into the combined sewers along existing lines. Due to the built-up nature of the Site, with extensive basements, it is not considered viable to provide above or below ground attenuation due to the Site constraints and insufficient structural capacity to add further load to these buildings.

A Pre-Development Enquiry (PDE) has been submitted to Scottish Water. We await a response back to confirm that there is currently capacity in the sewer and waste water treatment works infrastructure to accommodate the foul and surface water discharge from the development. A copy of the PDE calculations and Surface Water Options Report is included in Appendix D.

4.0 Flood Risk Assessment

4.1 General

Based on past sources of River Clyde food development hydrodynamic modelling information, it is recommended that flood defence design is not required at this Site. The recommended flood defence design level in this location is 6.0m above ordnance datum. This level represents a flood event of 0.5% annual probability (1 in 200 year event), taking into consideration climate change. The lowest external ground level of the Site is believed to be 6.14m (subject to confirmation by level survey). Therefore the Site should have a 140mm freeboard above flood level and water should not enter the development via door thresholds at the 6.0m flood level.

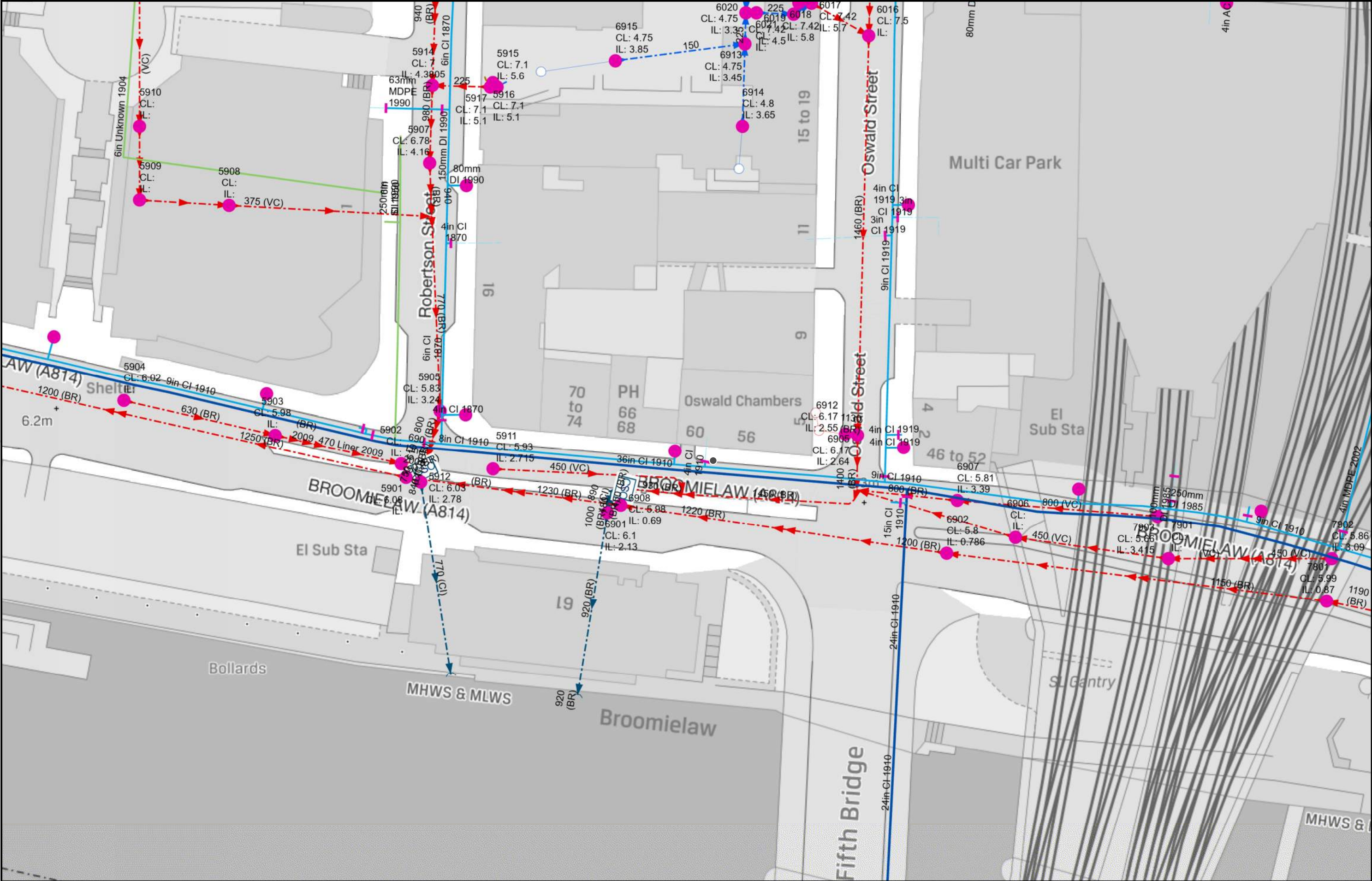
In the event that the water level reaches 6.0m above ordnance datum, the main public sewers will overflow before the water level backs up to ground floor level in our development. In this event, foul and surface water from the development may not be able to drain under gravity into the public sewers if these are overflowing.

Any foul water that is routed to a pump chamber in the basement of the development may struggle to discharge into the combined sewer during an extreme flood event and it may start to attenuate foul. It should therefore be sized to attenuate a certain volume of foul sewage before it overflows, this is to be advised by the M&E Engineer.

If our Site has a surface water connection directly into the combined sewer overflows, a non-return valve should be considered at this point where the connection is made to prevent the combined sewage from the main brick public sewer from travelling back up the line towards our Site in the event of a flood event. A specialist subcontractor would need to determine what pressure this valve should be rated for in each direction.

Basements within the Site should be made watertight against 6.0m water level.

Appendix A – Scottish Water Record Drawing



Warning! Damaging a large diameter trunk main (12"/300mm and above) can result in loss of life and major water supply and water quality problems. If you're planning any extension work in the vicinity of any large diameter mains shown on our maps, you must contact Scottish Water to arrange a site visit 08000 778 778 WELL IN ADVANCE OF THE WORKS

Plotted By: brian.mcmaster@national-one-call.co.uk



The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District office.

Date: 02/12/2020

OP-XVMUV682 - Water & Wastewater Plan

0 3.25 6.5 13 Meters

SCALE: 1:661

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Castle House,
6 Castle Drive,
Dunfermline,
KY11 8GG

Tel No: 08000 778 778

Appendix B – Proposed Site Drainage

OSWALD CHAMBERS - DRAINAGE STRATEGY

BUILDING 1: Existing 3-storey building with basement. New 3-storey lightweight vertical extension being added on top of existing building footprint. There is not sufficient structural capacity to incorporate a blue/green roof on this building.

BUILDING 2: Existing 5-storey building, no change to existing roof.

BUILDING 3: New 6-storey hotel. All surface water landing on this building will be attenuated at roof level in a blue roof. The discharge rate from this roof will be limited to 2.5L/s.

SURFACE WATER DRAINAGE
Surface water from the two existing buildings (1 & 2), the hardstanding area, and the lane, will discharge to the existing combined sewer via their existing rainwater pipes and below ground drainage runs.

Surface water from the new building 3 will be attenuated at roof level in a blue roof, then it will be discharged gradually into the combined sewer. This comprises 546m² which is 34% of the overall site surface area. This blue roof will limit the discharge rate from this area to 2.5L/s. This results in a reduction of ~30% compared to the pre-development surface water peak discharge rate.

TREATMENT:
The blue roof will provide a level of infiltration, prior to discharging to the combined sewer.

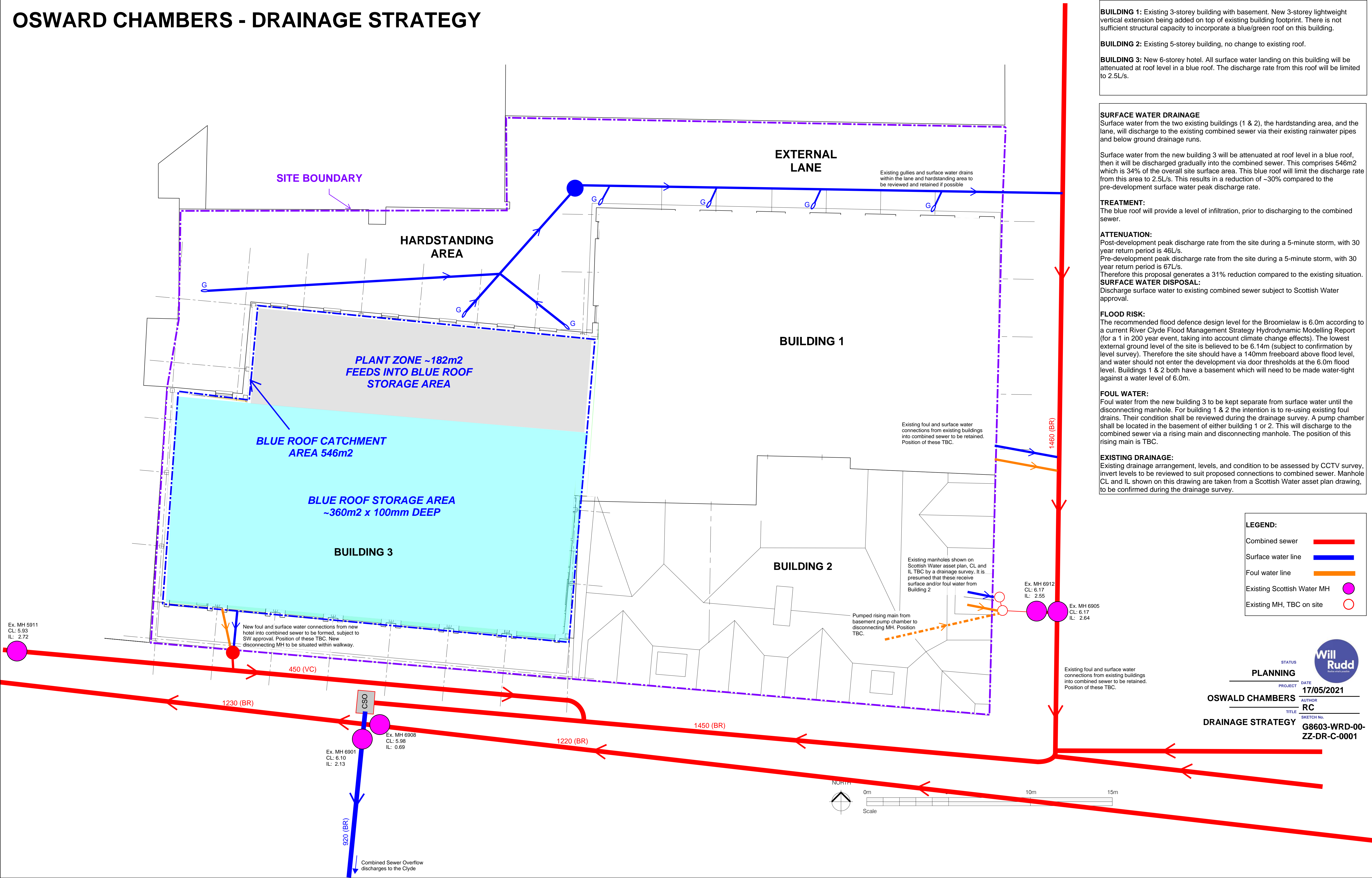
ATTENUATION:
Post-development peak discharge rate from the site during a 5-minute storm, with 30 year return period is 46L/s.
Pre-development peak discharge rate from the site during a 5-minute storm, with 30 year return period is 67L/s.
Therefore this proposal generates a 31% reduction compared to the existing situation.

SURFACE WATER DISPOSAL:
Discharge surface water to existing combined sewer subject to Scottish Water approval.

FLOOD RISK:
The recommended flood defence design level for the Broomielaw is 6.0m according to a current River Clyde Flood Management Strategy Hydrodynamic Modelling Report (for a 1 in 200 year event, taking into account climate change effects). The lowest external ground level of the site is believed to be 6.14m (subject to confirmation by level survey). Therefore the site should have a 140mm freeboard above flood level, and water should not enter the development via door thresholds at the 6.0m flood level. Buildings 1 & 2 both have a basement which will need to be made water-tight against a water level of 6.0m.

FOUL WATER:
Foul water from the new building 3 to be kept separate from surface water until the disconnecting manhole. For building 1 & 2 the intention is to re-using existing foul drains. Their condition shall be reviewed during the drainage survey. A pump chamber shall be located in the basement of either building 1 or 2. This will discharge to the combined sewer via a rising main and disconnecting manhole. The position of this rising main is TBC.

EXISTING DRAINAGE:
Existing drainage arrangement, levels, and condition to be assessed by CCTV survey, invert levels to be reviewed to suit proposed connections to combined sewer. Manhole CL and IL shown on this drawing are taken from a Scottish Water asset plan drawing, to be confirmed during the drainage survey.



Appendix C – Blue Roof Examples

BLUE GREENROOF



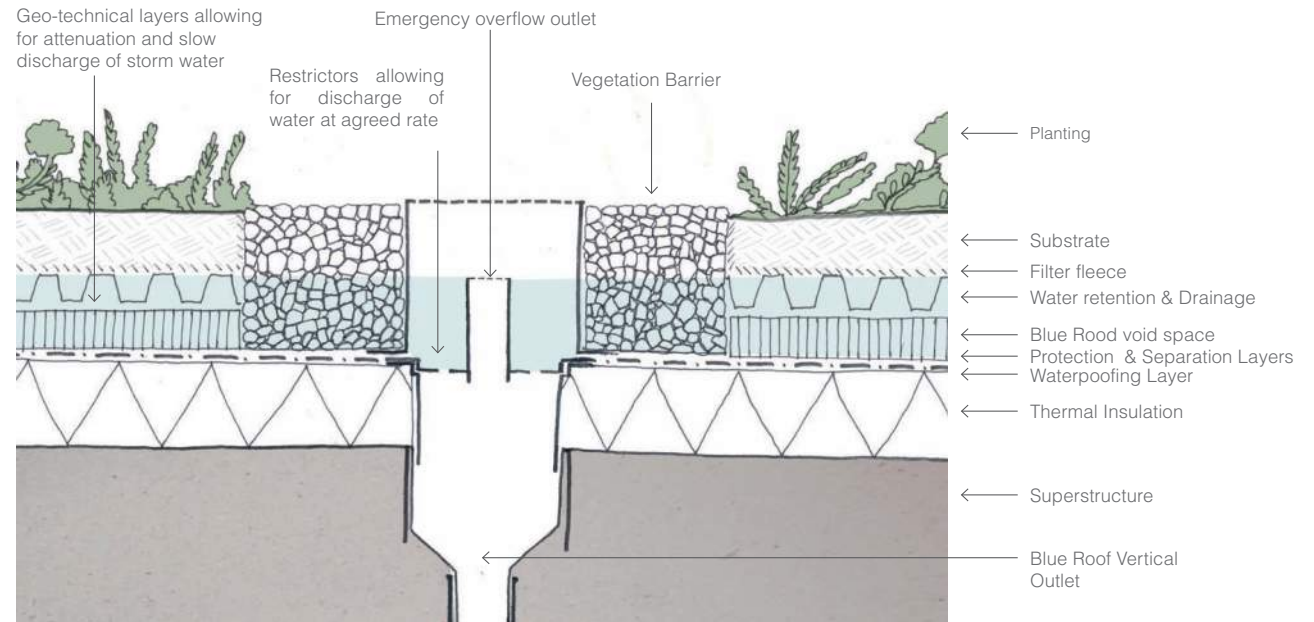
Fig:28

USE: Retaining and reusing rain water

MAINTENANCE AND COST: Low

SUBSTRATE/VEGETATION: Extensive and intensive green roofs can be integrated

- Blue roofs combine blue and green roof technologies. Whilst standard green roofs use conventional drainage layers, blue roofs aim to increase water volume and control water released.
- A blue roof retains rain fall within the roof structure before discharging it in a controlled manner.
- Blue roofs are designed for water retention above the waterproofing part of the roof. This is different from conventional roofs, where water is drained rather than stored.
- It is a form of Sustainable Urban Drainage Systems (SUDS) to help alleviate urban flooding caused by run-off.
- Unlike other forms of SUDS, blue roofs make use of spaces that may otherwise be redundant without extending beyond building footprints.



(Blue roof system shown based on a Bauder Blue roof)

Fig:29



Varies by roof type



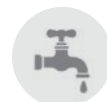
Saturated weight of roof types + 100 kg/m²



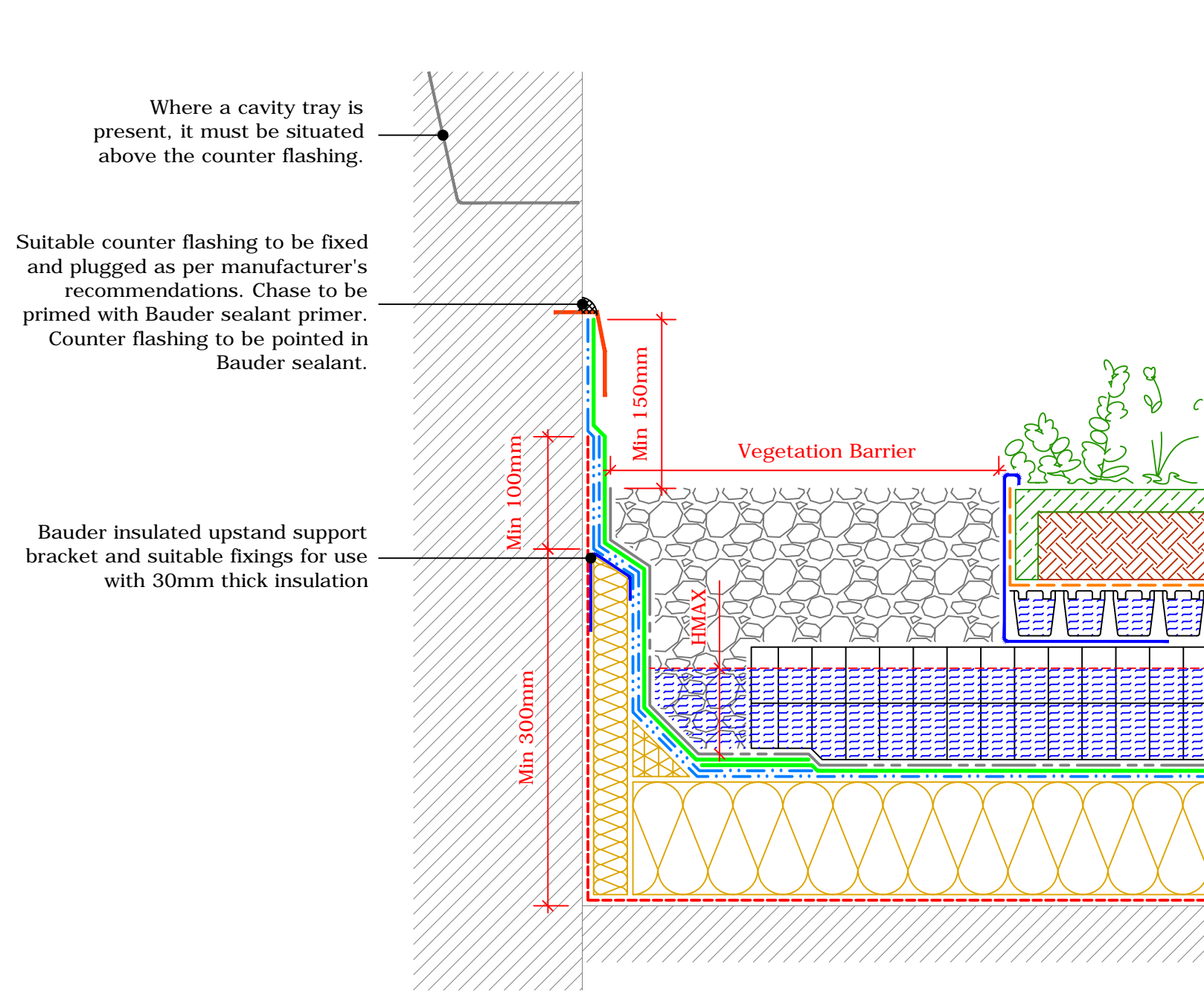
Low Maintenance



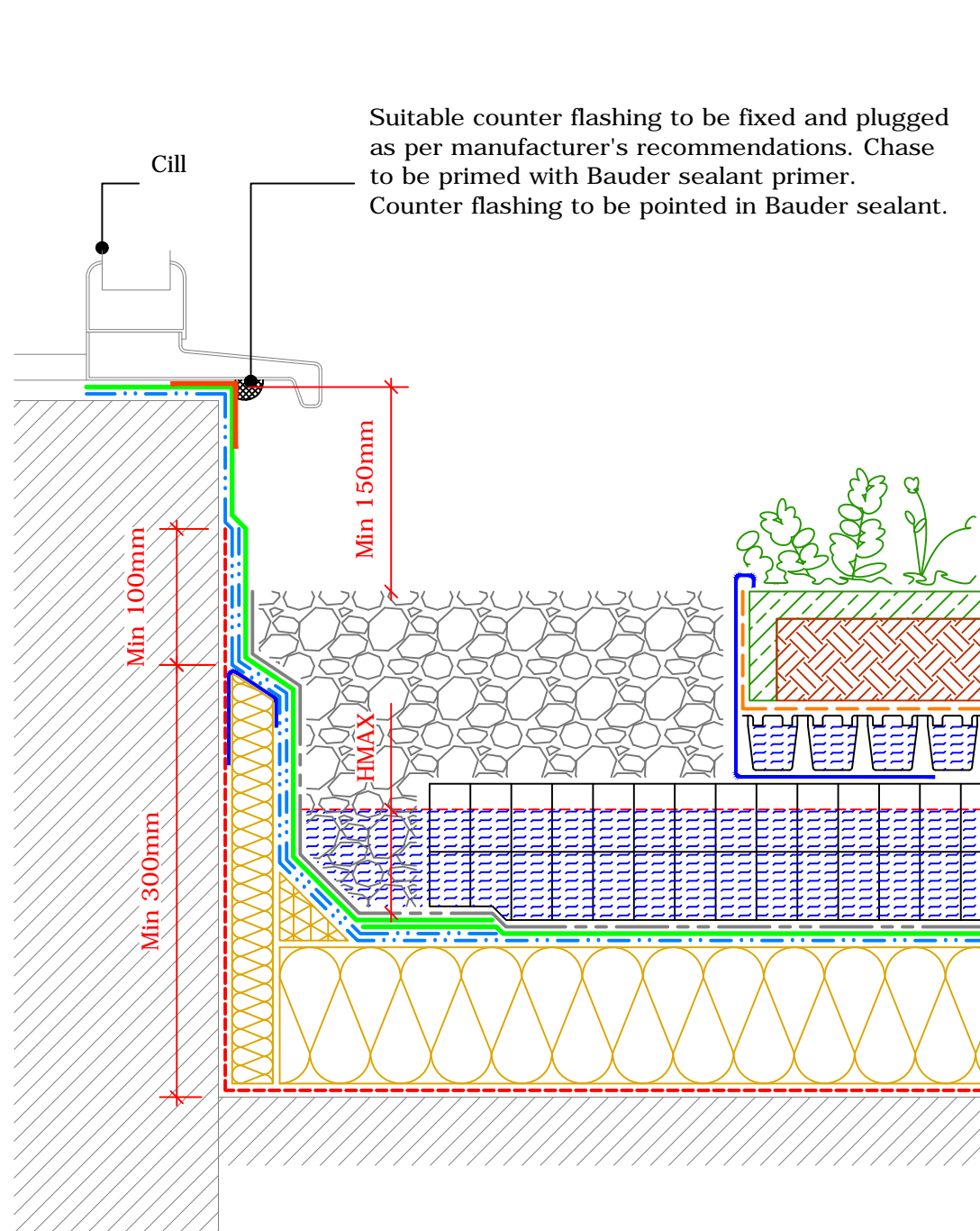
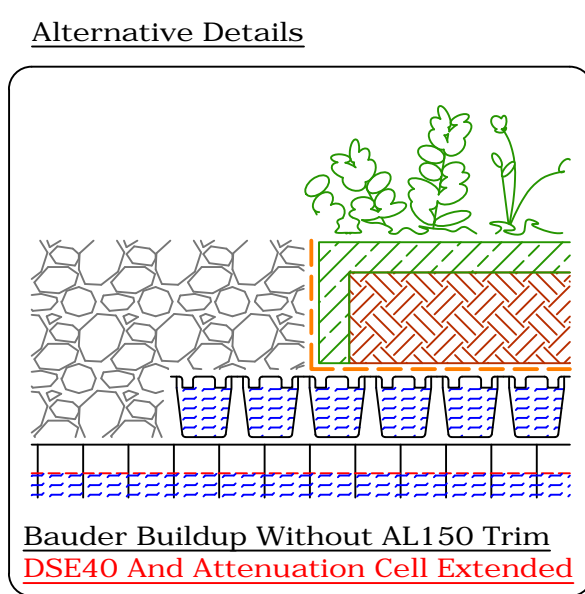
Medium Cost



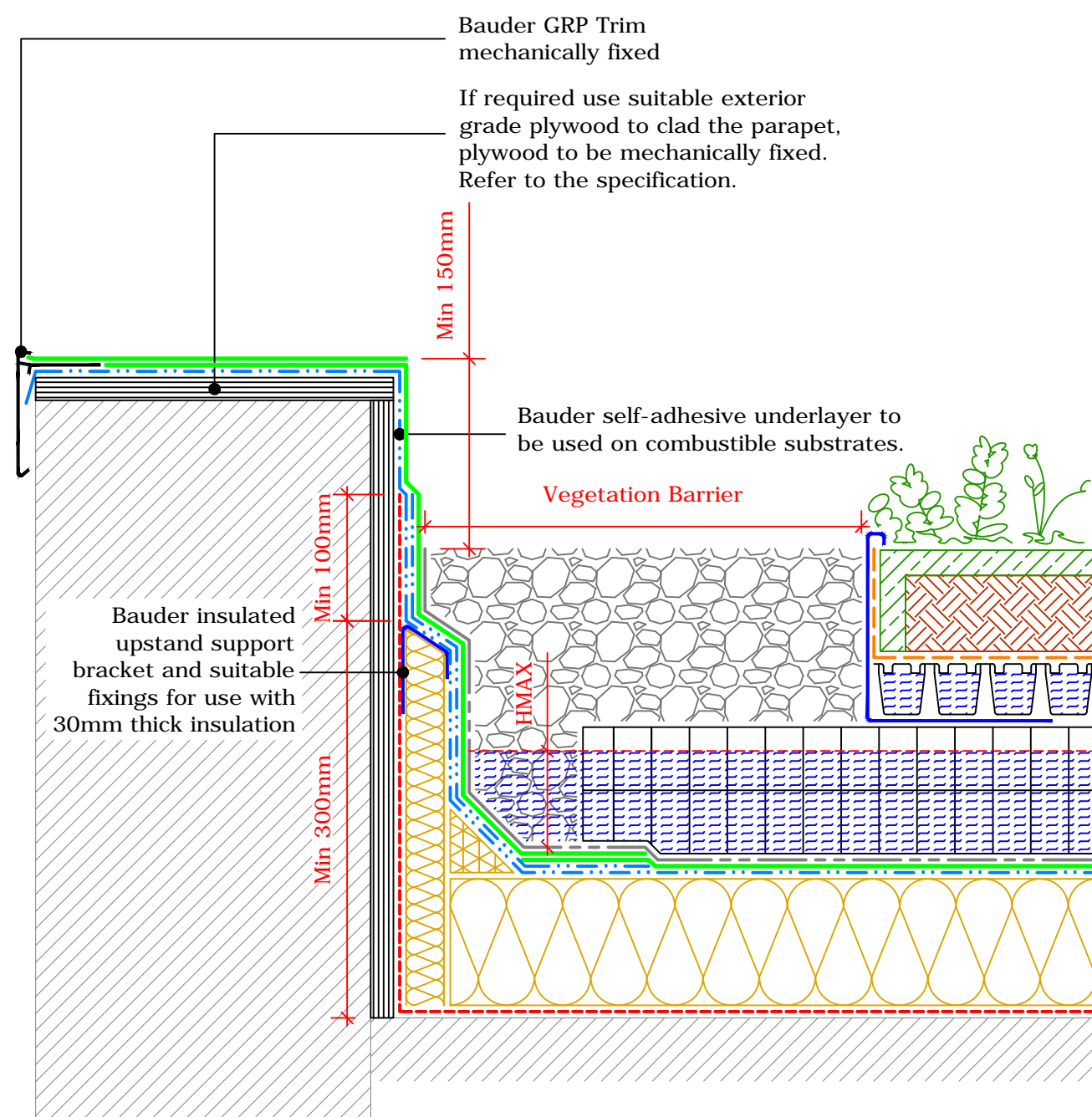
Some irrigation may be required, subject to substrate and type of vegetation



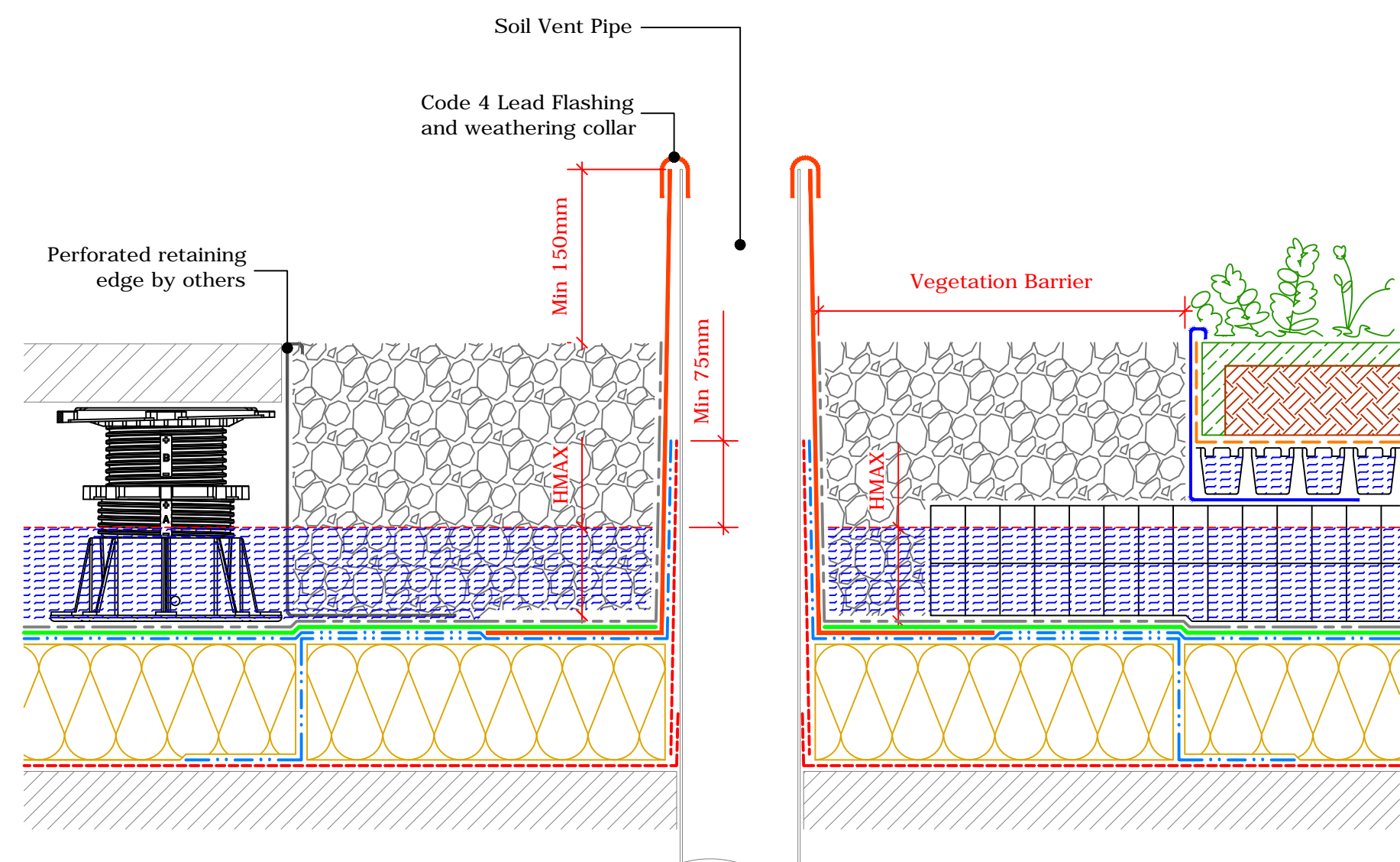
Insulated Upstand
(Drg.No: D0000-00W_BR_201-Ext-SL-S-D4-AC_001)



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

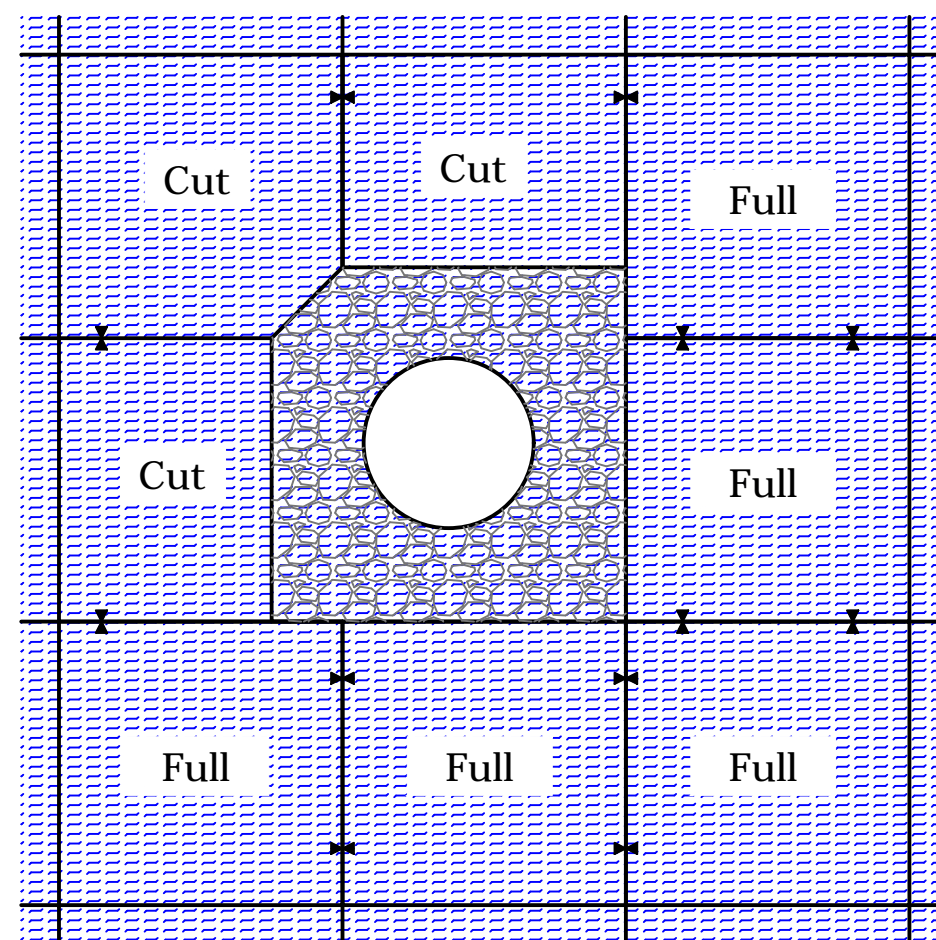


Parapet Upstand
(Drg.No: D0000-00W_BR_203-Ext-SL-S-D4-AC_001)

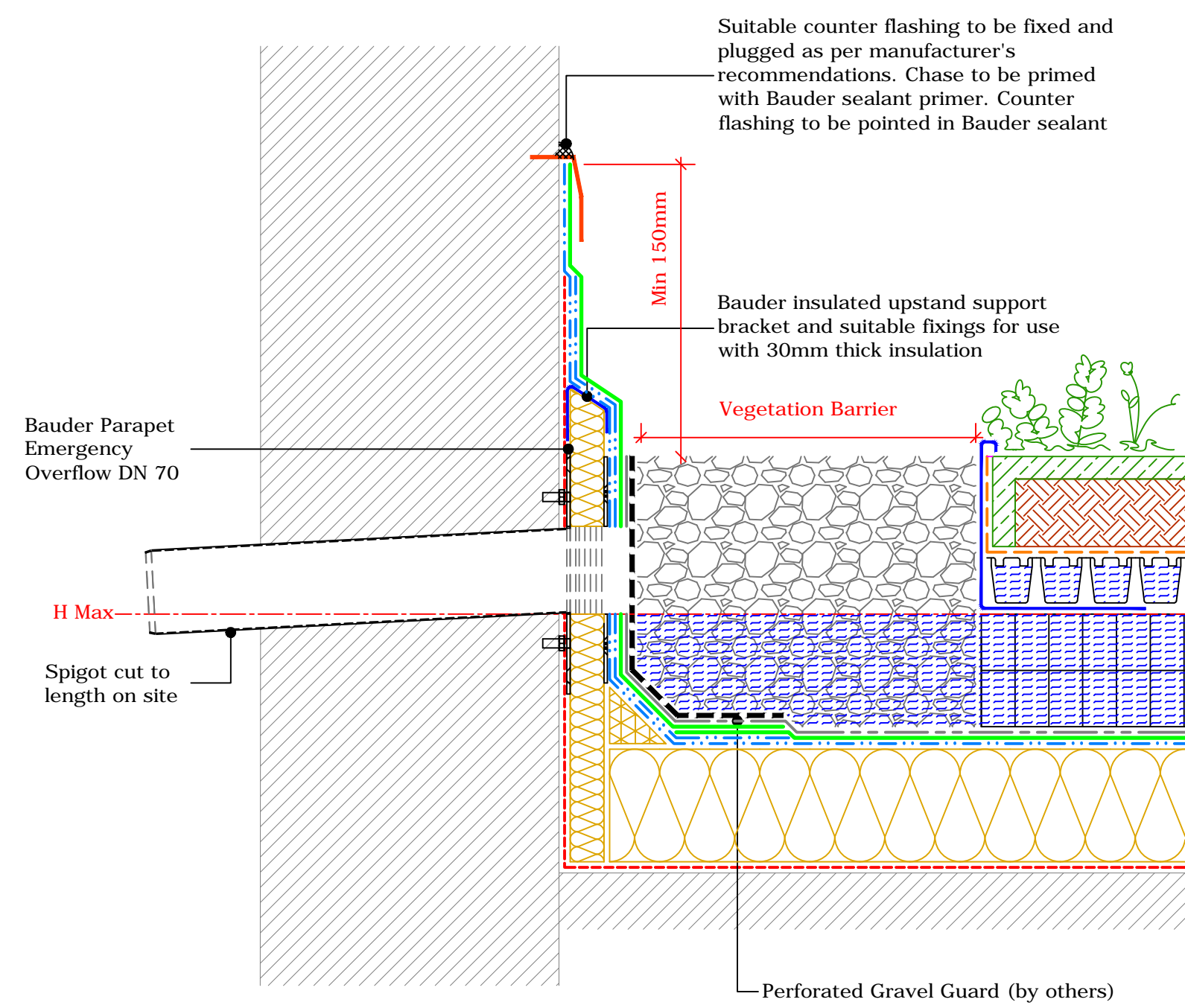


Soil Vent Pipe
(Drg.No: D0000-00W_BR_007-Ext-SL-S-D4-AC_001)

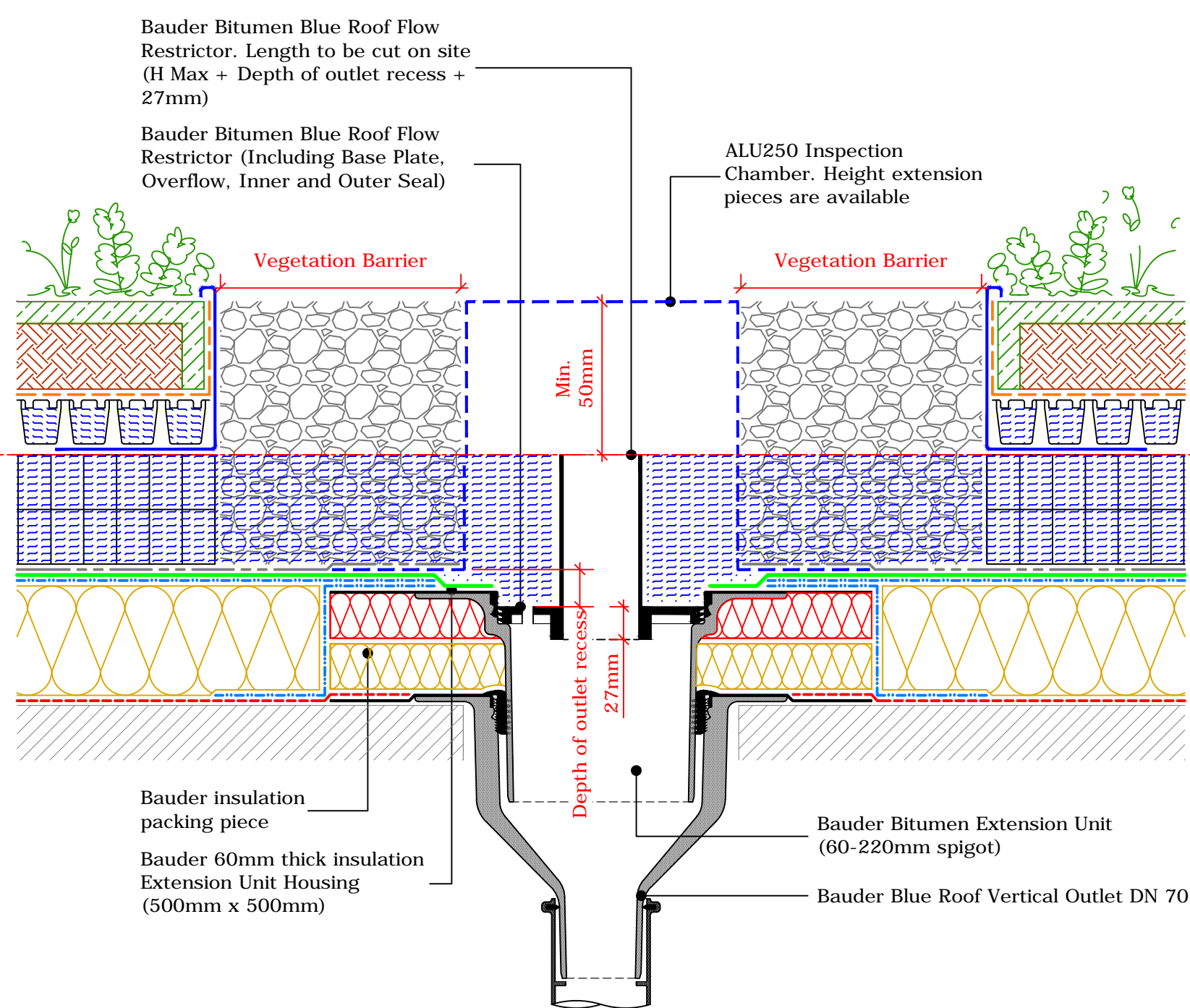
Plan Showing The Suggested Attenuation Cell Layout And Cut Locations



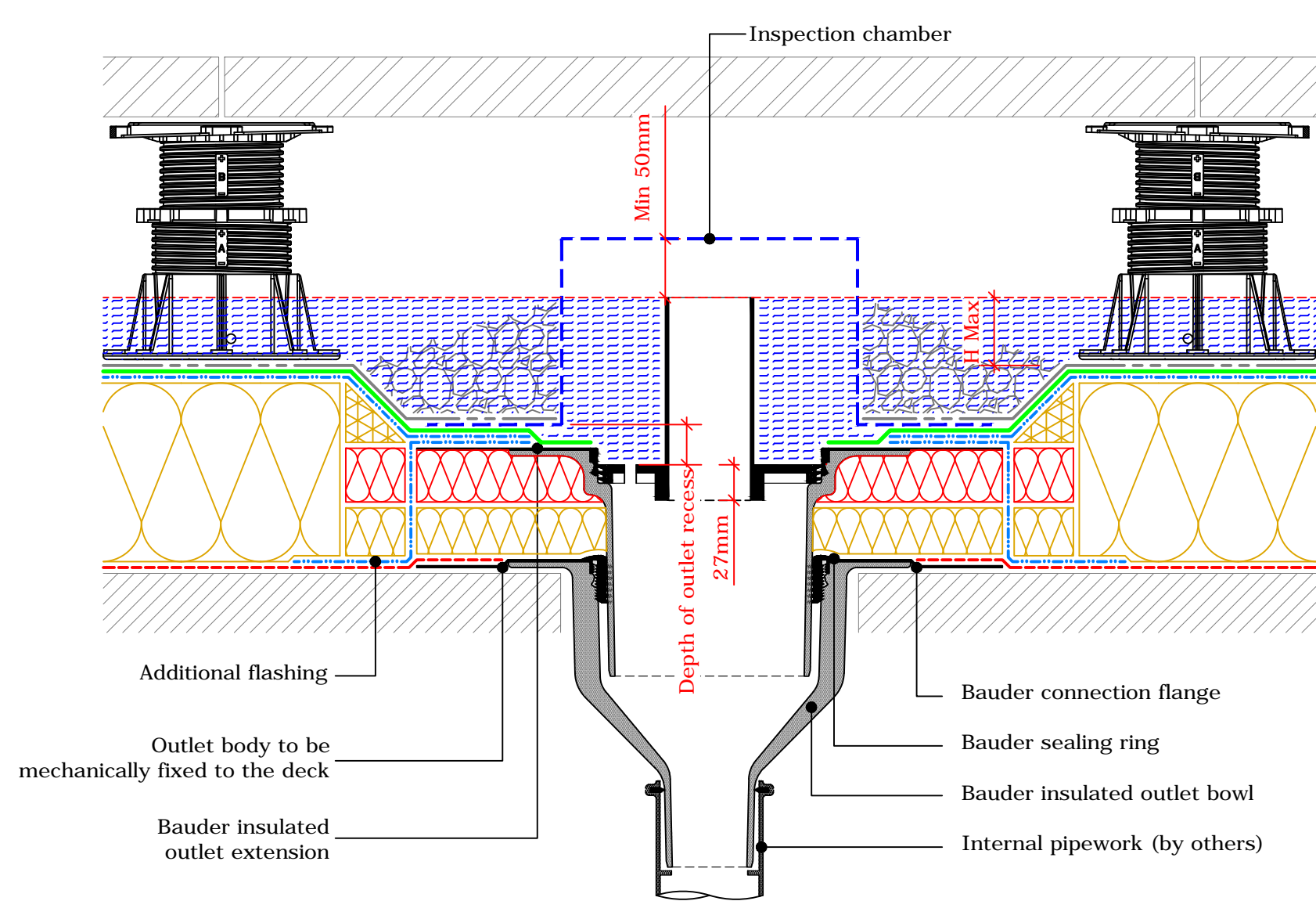
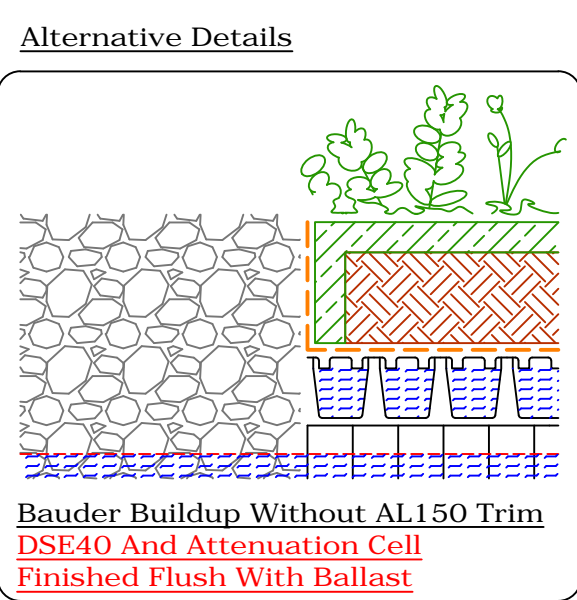
Attenuation Cell should be 100mm from Penetration. Cut pieces of Attenuation Cell must be 30% or bigger. Only a single cut per piece, all connectors fitted



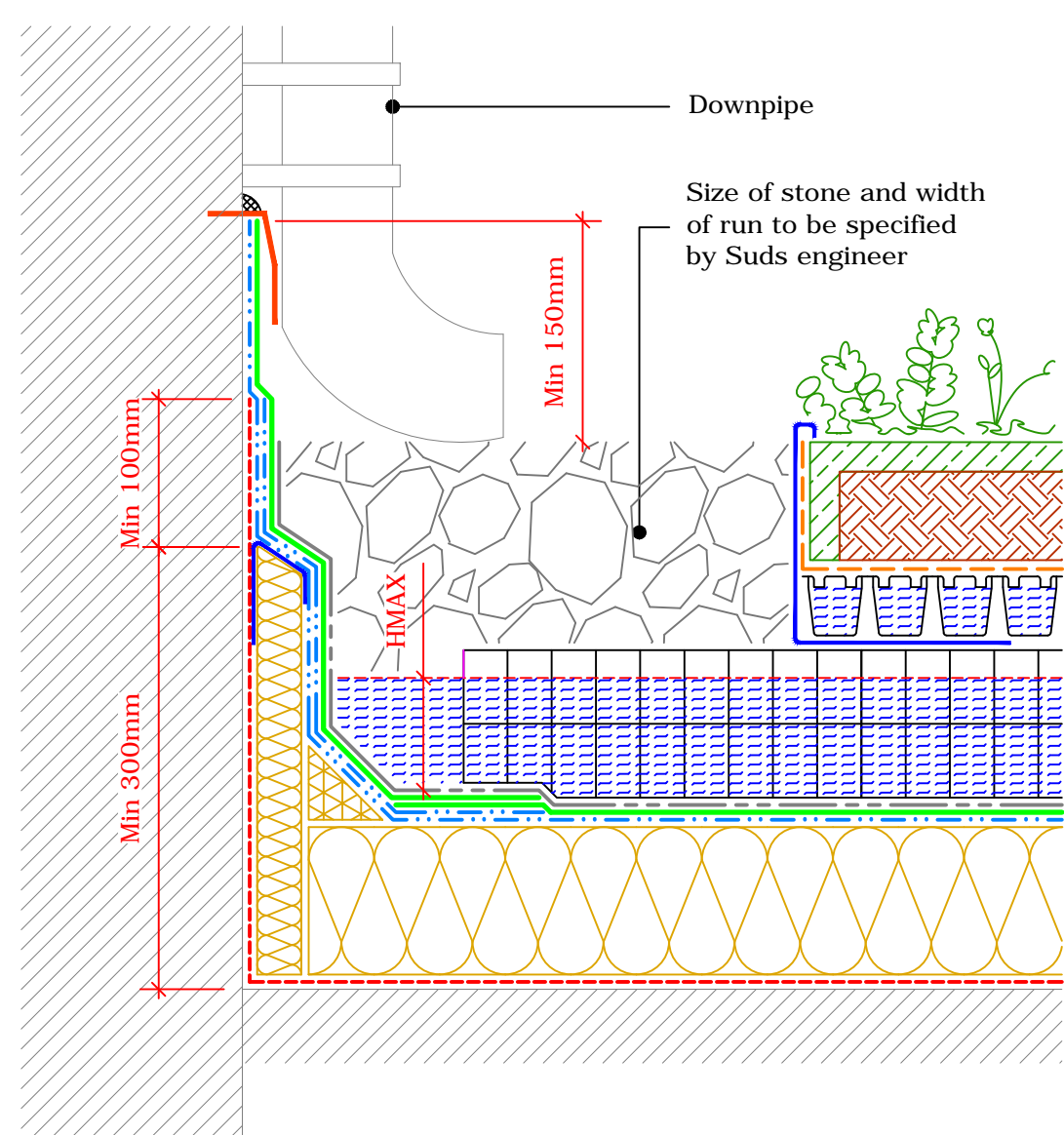
Bauder Outlet - Bauder Bitumen Blue Roof Emergency Overflow Outlet DN70
(Drg.No: D0000-00W_BR_006-Ext-SL-S-D4-AC_004)



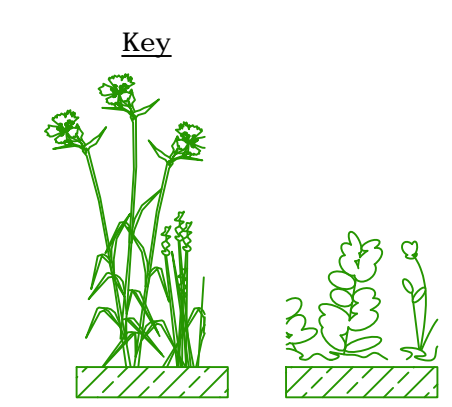
Bauder Outlet - Bauder Bitumen Blue Roof Vertical Outlet DN70
(Drg.No: D0000-00W_BR_006-Ext-SL-S-D4-AC_003)



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



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



- Key**
- Bauder WB Native Wildflower Blanket
 - Bauder SB Sedum Vegetation Blanket
 - 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)
 - Bauder Filter Fleeces
 - Bauder Protection Mat
 - Code 4 Lead Flashing
 - Bauder Insulation
 - Bauder Insulated Fillet
 - Bauder Attenuation Cell 100
 - DSE40 Drainage Board (Refer to the specification for the correct board to be used)
 - AL150 Edge / Drainage trim. Secured in place by separate pieces of torch applied Bauder Plant-E Capping Sheet. For vegetation substrate build up depths greater than 150mm, a bespoke perforated edge drainage trim is required.

- IMPORTANT NOTES**
- This detail is suitable for the following Bauder Systems:
Bauder Total Blue Roof System, Bauder Total Green Roof System
 - Do not scale to ascertain dimensions
 - All dimensions to be checked and verified on site prior to commencement of work
 - This drawing is to be read in conjunction with the specification and associated drawings.
 - This detail is a guideline only, representing typical detailing conditions and illustrate the correct application of the above Bauder System. It may be necessary to modify this detail to suit specific project design constraints and conditions.
 - Refer to the Bauder Specification for the product description and method of application. For clarity the method of attachment has not been shown.
 - 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.

BAUDER

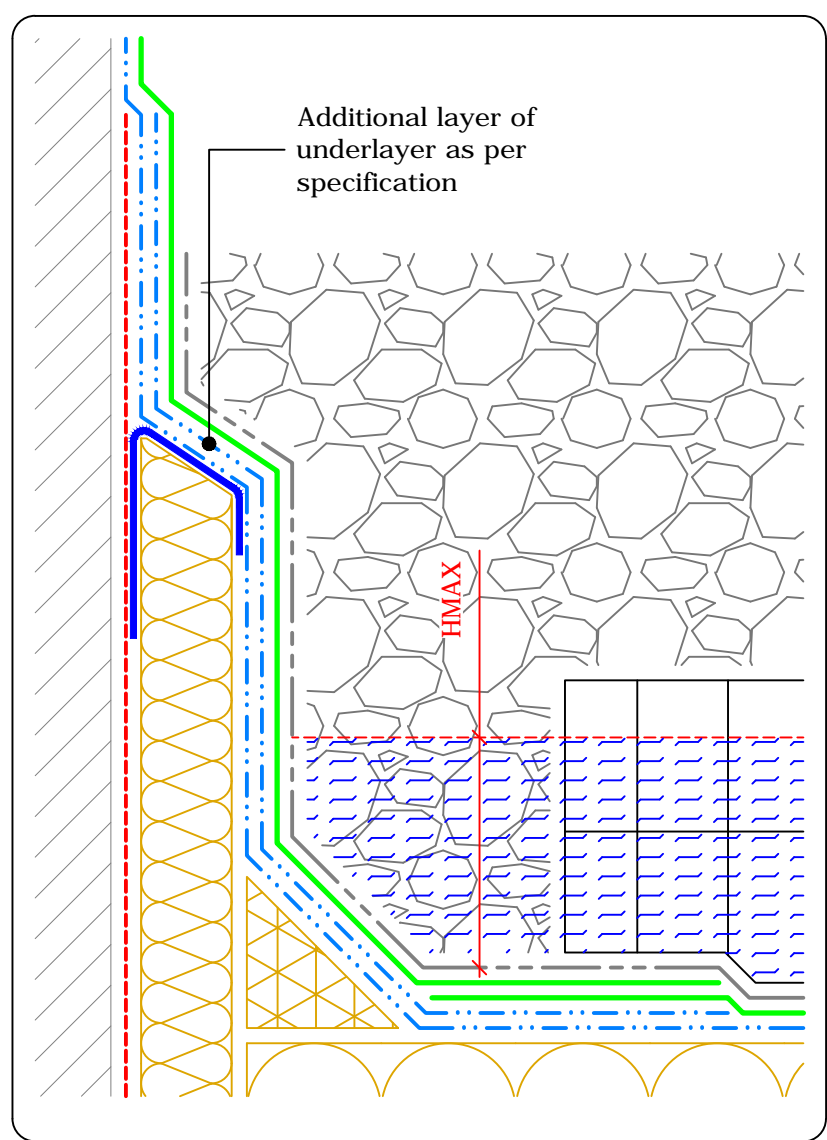
UK OFFICE
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Email: technical@bauder.ie
bauder.ie

**BITUMINOUS TYPICAL DETAILS
(BLUE ROOF - EXTENSIVE)**

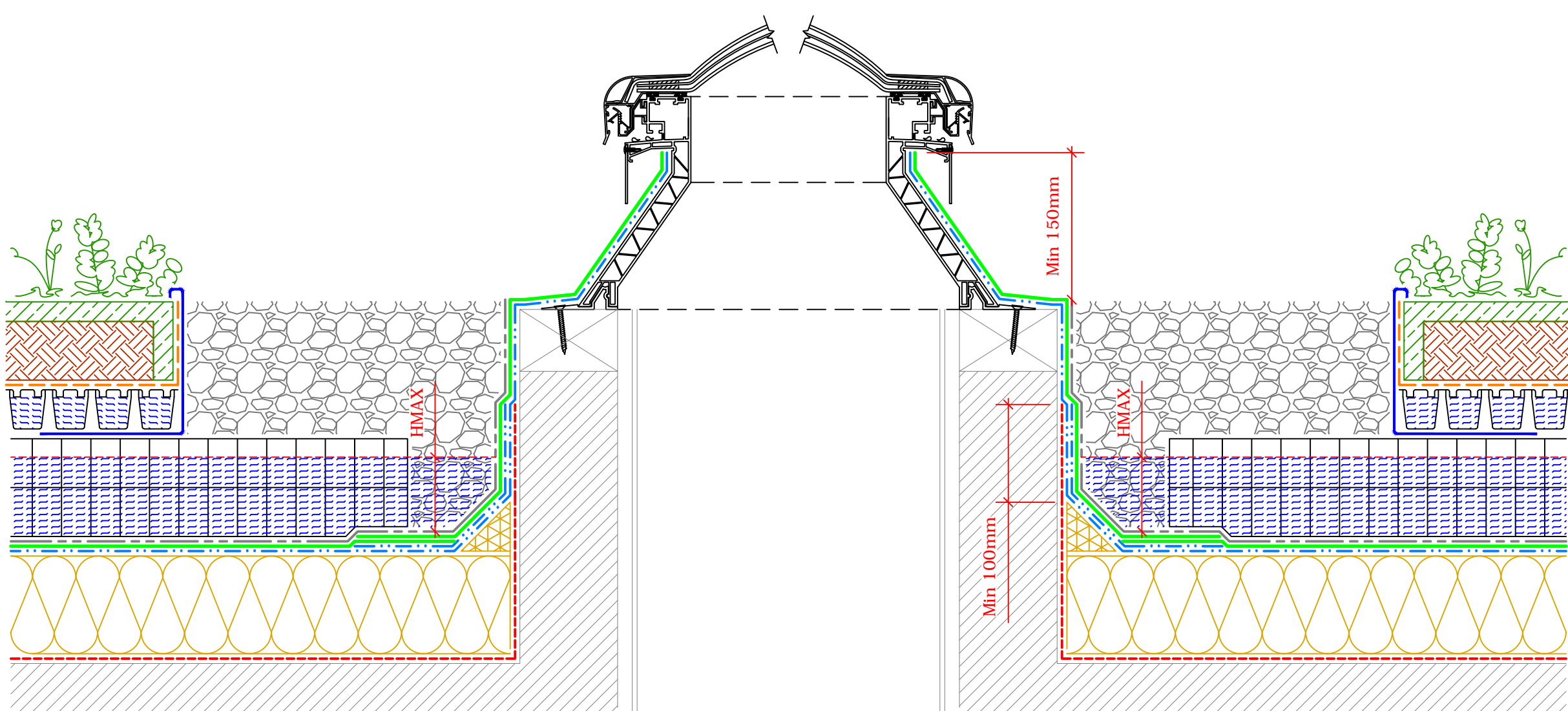
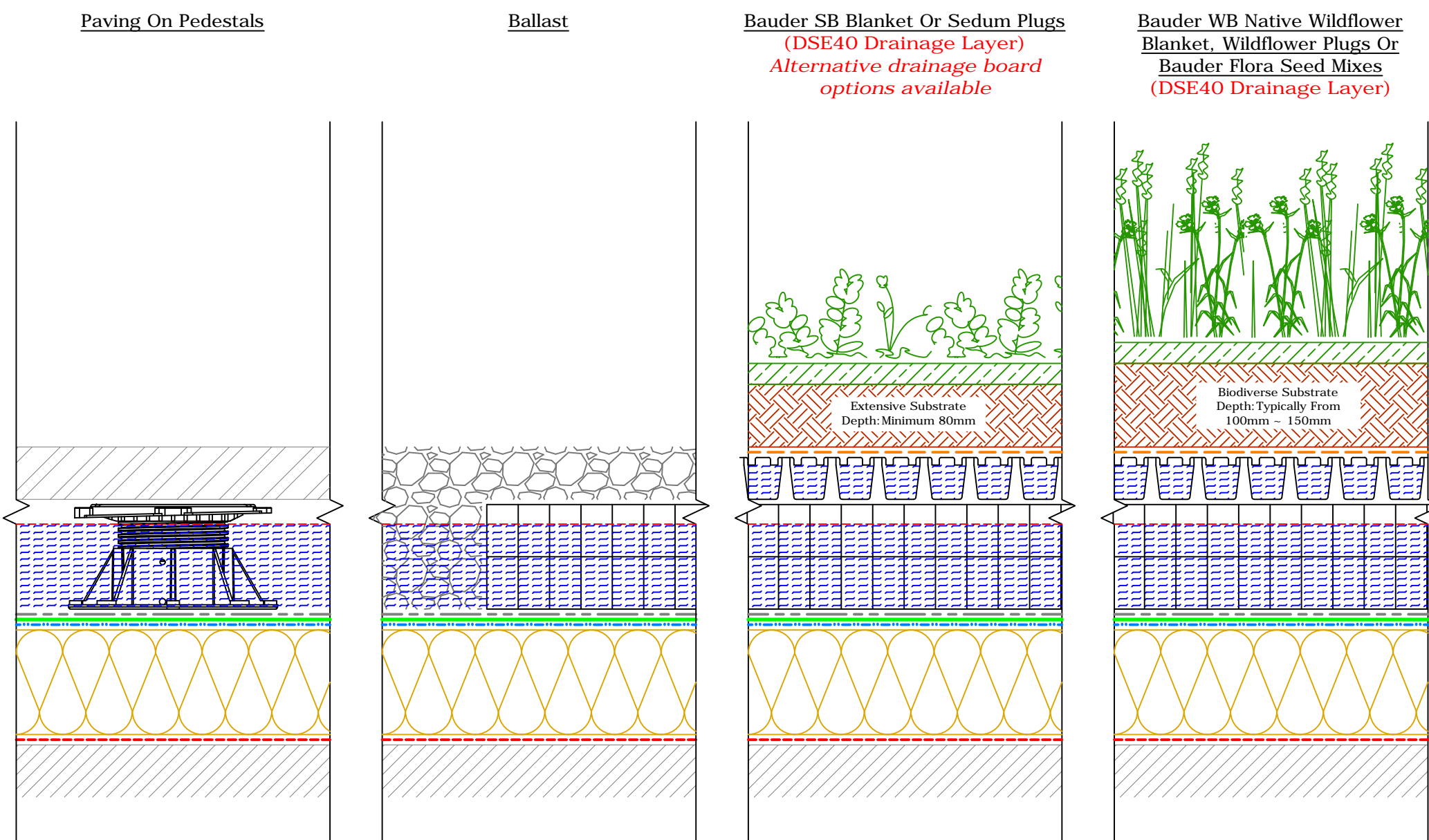
Scale:	Drawn By:	Checked By:	Approved By:	Date:			
1:5 @ A0	D0000-00W_BR_200-Ext-SL-S-D4-AC_001			22.10.20			
Drawn By:	CD	Checked By:	PH	Approved By:	CR	Date:	22.10.20

Enlarged View Of Additional Underlayer Relevant To All Upstands




Landscape Options

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



Rooflight - Euroglaze
(Drg.No: D0000-00W_BR_008-Ext-SL-S-D4-AC_001)

Appendix D – PDE Calculations & Surface Water Options Report

 <div>100 Brunswick Street Glasgow G1 1TF</div>	Project Oswald Chambers				Job Ref. G8705	
	Section Drainage Calculations					
	Calc. by RC	Date 19/05/2021	Chk'd by KB	Date 03/05/21	App'd by	Date

Oswald Chambers PDE information

Planning reference number (optional) 21/00082/PAN.

Calculations are based on British Water, Flows and Loads – 4.

Water demand

Pre-development

Peak water demand (litres/sec):

0.3166

2.5 x the average demand calculated below.

M&E engineer's advised value is higher, therefore this is used instead: 3.19 L/s The reason this differs from the flows and loads calculated value is explained as follows:

The reason the peak demand differs is because we have an obligation through our guidance (BS documents) to select a time frame within which the water tanks will fill up. We have selected 60 minutes. So if we were to apply the 0.591l/s figure, it would take us 4.5 hours to fill the tank. A fill time of around 4.5 hours is not acceptable to us. Hence why we have calculated our figure, that's how it works from a Building Services point of view.

Average water demand (litres/sec):

0.1266

Currently there are retail and office premises within the pre-development site: 90L per member of full time staff per day.

Estimated number of full-time staff at basement offices / hairdressing areas: 8

Estimated number of full-time staff at ground floor retail and hairdressing areas: 8

Estimated number of full-time staff in the office space at first floor: 40

Estimated number of full-time staff in the office space at second floor: 40

Estimated number of full-time staff in the office space at third floor: 20

Estimated number of full-time staff at fourth floor: 0

Total number of full time staff: 116

Additional demands for hairdressing activities: 500L per day.

Total pre-development demand: $116 \times 90 + 500 = 10940\text{L/day} = 0.1266\text{ L/s}$

M&E engineer's advised value is higher, therefore this is used instead: 0.219 L/s


Post-development

Peak water demand (litres/sec):

0.591

2.5 x the daily average demand calculated below

Average water demand (litres/sec):

 <div> 100 Brunswick Street Glasgow G1 1TF </div>	Project				Job Ref.	
	Oswald Chambers				G8705	
	Section					
Drainage Calculations						
Calc. by	Date	Chk'd by	Date	App'd by	Date	
RC	19/05/2021	KB	03/05/21			


0.236

Bedroom only accommodation: 80L pppd

Additional demand added for basic kitchen self-catering facilities: 15L pppd

Number of guests is based on 123 rooms having an average occupancy of 1.75 guests per room: 215 guests

Total demand: 95L * 215 = 20425 L = 0.236 L/s.

 <div>100 Brunswick Street Glasgow G1 1TF</div>	Project				Job Ref.	
	Oswald Chambers				G8705	
	Section					
	Drainage Calculations					
Calc. by	Date	Chk'd by	Date	App'd by	Date	
RC	19/05/2021	KB	03/05/21			

Foul Discharge

Pre-development

Peak foul discharge (litres/sec): 0.285

90% of the peak water demand calculated under Water Demand section.

Average foul discharge (litres/sec): 0.1139

90% of the average water demand calculated under Water Demand section.


Post-development

Peak foul discharge (litres/sec): 0.532

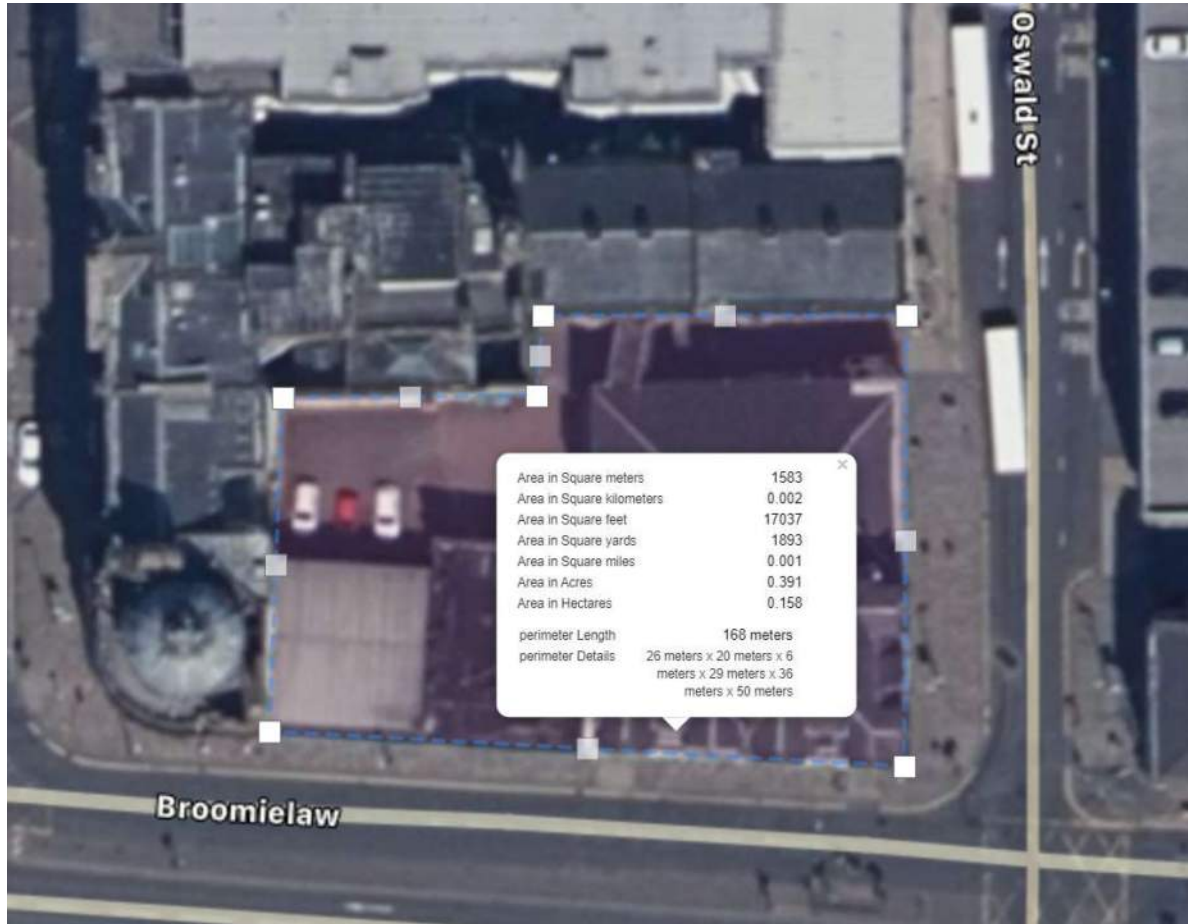
90% of the peak water demand calculated under Water Demand section.

Average foul discharge (litres/sec): 0.212

90% of the average water demand calculated under Water Demand section.

 <div>100 Brunswick Street Glasgow G1 1TF</div>	Project				Job Ref.	
	Oswald Chambers				G8705	
	Section					
	Drainage Calculations					
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	RC	19/05/2021	KB	03/05/21		

Surface water discharge



1583

Area of site (all non-permeable)

Subtract area of 6-storey new build of 546m²;

$$A_{\text{unrestricted}} = 1583\text{m}^2 - 546\text{m}^2 = \mathbf{1037.00\text{m}^2}$$

Area of site in hectares that will discharge unrestricted;

$$A_{\text{s.hec}} = 0.1037$$

Pre-development peak discharge rate from full 1583m² area, calculated in Tedds calculation below based on the Wallingford Procedure, based on a 5 minute duration storm of 30 year return period (L/s);

$$D_{\text{Pre}} = 66$$

Post development peak discharge rate from reduced 1037m² area, calculated in Tedds calculation below based on the Wallingford Procedure, based on a 5 minute duration storm of 30 year return period (L/s);

$$D_{\text{redu}} = 43$$

Peak discharge rate from 546m² blue roof (L/s);

$$D_{\text{new}} = 2.5$$

Total post-development peak discharge rate (L/s);

$$D_{\text{total,post}} = D_{\text{new}} + D_{\text{redu}} = \mathbf{45.50}$$

Project Oswald Chambers				Job no. G8705	
Calcs for PDE Application, Post-development				Start page no./Revision 1	
Calcs by RC	Calcs date 18/05/2021	Checked by KB	Checked date 18/05/2021	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Glasgow
Storm duration	D = 5 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 16.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 55 %
Factor Z1 (Wallingford procedure)	Z1 = 0.34
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 * M5_60min * (1 + p _{climate}) = 8.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.47
Rainfall for 5min storm with 30 year return period	M30_5min = Z2 * M5_5min _i = 12.4 mm
Design rainfall intensity	I _{max} = M30_5min / D = 149.2 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1037 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} * p * I _{max} = 43.0 l/s

Project Oswald Chambers				Job no. G8705	
Calcs for PDE Application, Pre-development				Start page no./Revision 1	
Calcs by RC	Calcs date 18/05/2021	Checked by KB	Checked date 18/05/2021	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Glasgow
Storm duration	D = 5 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 16.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 55 %
Factor Z1 (Wallingford procedure)	Z1 = 0.34
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 * M5_60min * (1 + p _{climate}) = 8.4 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.47
Rainfall for 5min storm with 30 year return period	M30_5min = Z2 * M5_5min _i = 12.4 mm
Design rainfall intensity	I _{max} = M30_5min / D = 149.2 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1583 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} * p * I _{max} = 65.6 l/s

Date: 18/05/2021

Revision: A

Page: 1

Client: Will Rudd Davidson
Project: (1155) G8705 Oswald Chambers
Location: Glasgow
Roof Location: New Hotel

Roof Details:

BlueRoof	364 m ²	x 100 %
Additional Area	182 m ²	x 100 %
Effective Area	546 m ²	

Storage Details:

Length	364 m
Width	1 m
Depth	100 mm
Porosity	95 %

Rainfall Details - FEH Method:

Return Period	200 years
Climate Change Factor	30 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	21.5	257.4	11.5
10 min	32.2	193.2	17.0
15 min	40.8	163.4	21.3
30 min	56.1	112.2	28.3
45 min	65.2	87.0	31.9
60 min	71.8	71.8	34.0
2 hours	81.4	40.7	34.0
6 hours	96.6	16.1	29.8
24 hours	121.8	5.1	17.5

Outflow Details:

Attenuation Control	BlueRoof Outlet
Control	12 holes
Sump Depth	None
Discharge rate	2.32 l/s
Outlet	2 No
Flow Per Outlet	1.16 l/s

Result:

Outcome	Pass
Critical Storm Duration	1.4 hrs
Hmax	99 mm
Required Volume	34.3 m ³
Time to half empty	2.1 hrs
Roof Loading	94.23 Kg/m ²

All results based on input data. Please check that input data has been correctly interpreted.

The Bauder Blue Flat Roof Rainwater Calculation Software will perform calculations in accordance with industry best practice for blue roof design based upon provided data relating to a specific building's dimensions geographical location and the flow rate performance of the selected Bauder rainwater outlet product.

Whilst the information contained herein is to the best of our knowledge true and accurate we specifically exclude any liability for errors omissions or otherwise arising therefrom.

Details practices principles values and calculations should be verified for accuracy and suitability for the required purpose for use.

NOTE: These calculations are valid for a zero fall roof with minimal variation in levels. Any significant variation will affect the volume of water stored and the roofs ability to attenuate extreme rain events. Typically variations in roof level should be less than 0 to +30mm with no back falls. The H-Max is measured from the mean roof level

Oswald Chambers | Glasgow

Pre-Development Enquiry

Surface Water Options

Report



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Document Information & History

Project title: Oswald Chambers

Client: MHM Clyde One Ltd

Project no: G8705

Issue	Date	Description	Prepared by:	Reviewed by:
01	18/05/2021	PDE	R. Crewe	

Contents

- 1.0 Introduction**
- 2.0 Existing Site**
- 3.0 Surface Water Options**
- 4.0 Conclusion**

1.0 Introduction

1.1 Appointment and Brief

Will Rudd Davidson has been appointed by MHM Clyde One to provide engineering consultancy services to support a Pre-Development Enquiry for a hotel development on Oswald Street and the Broomielaw, Glasgow.

1.2 Report Objectives

The purpose of this report is to demonstrate to Scottish Water as part of the Pre-Development Enquiry that the proposed developments surface water can be treated, attenuated, and then drained in a sustainable manner. The report describes the proposed surface water management strategy for the site, in accordance with The SuDS Manual (C753).

The report summarises the existing arrangement of foul and surface water drainage on the proposed development site; a description of the proposed development and provides reasons behind the chosen drainage option while following the Scottish Water Surface Water Options hierarchy.

2.0 Existing Site

2.1 Site Location

The property is located on the corner of Oswald Street and the Broomielaw in Glasgow's city centre. Two addresses make up the Oswald Street property, behind which sits the remnants of a public house building left damaged by a historical fire.

No. 9 & No. 5 Oswald Street are highlighted in orange and red in figures 1 & 2 below. These are existing buildings which are currently in-use as offices.

The old public house remains are located on 70-74 & 66-68 Broomielaw, this shown in green in figure 1 & 2 below. This part of the site has remained derelict for at least 5 years.

There is also an asphalt yard to the North of the site, and a cobble-stone access lane which leads into this from Oswald St.

The site is 1583m² (0.1583 hectares). The surface is currently all non-permeable. The topography of the site is relatively flat.

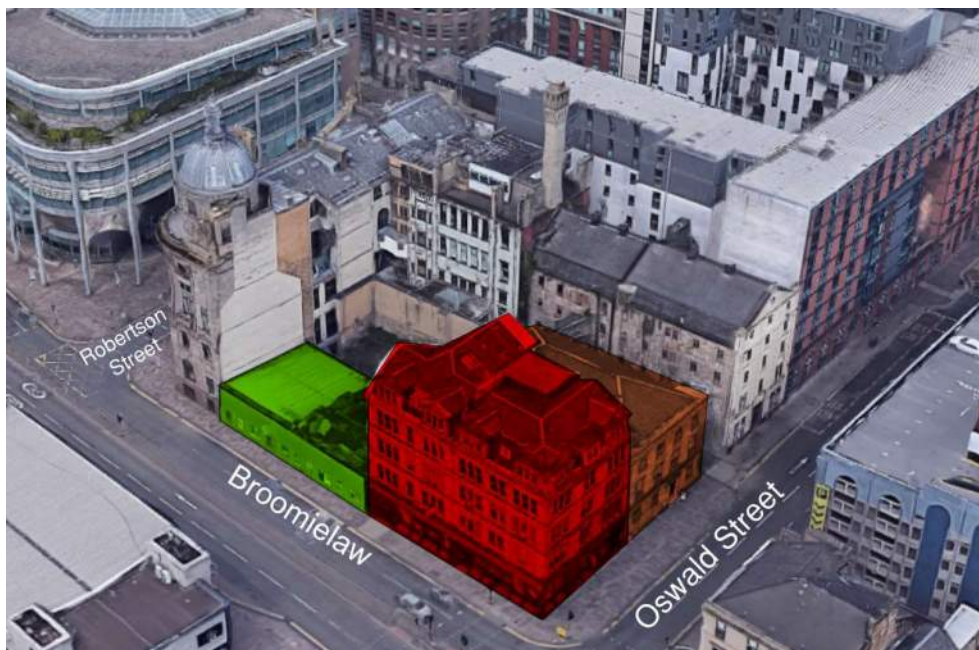


Figure 1. Satellite view of site

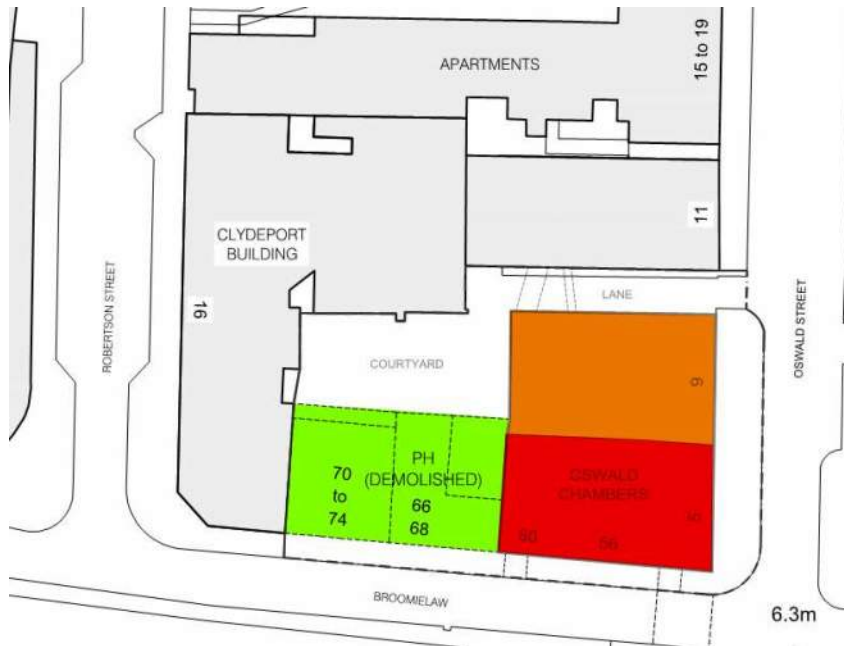


Figure 1. Plan view of site

2.2 Existing Drainage

The nearest watercourse within the vicinity of the site is the River Clyde which is approximately 50m to the South of the site.

The Scottish Water sewer records indicate the main brick combined sewer located on the Broomielaw flows East to West. The combined brick sewer on Oswald St flows South to join the sewer on the Broomielaw.

As there are currently 2 existing buildings within the site, it is expected that the roof and tarmac hardstanding is positively drained to the combined sewer. A CCTV survey should be undertaken to determine the condition, layout and levels of the existing drainage system within the site.

3.0 Surface Water Options

3.1 Proposed Development

The proposed development will comprise 123 hotel rooms. These are spread across the two existing buildings and a 6 storey new-build hotel where the derelict pub currently sits.

One of the existing buildings will receive a 3-storey vertical extension on top of its existing structure.

Part of the hardstanding area to the North is retained, along with the access lane to the North.

The proposal will look to treat surface water landing on the 6 storey new-build through Sustainable Urban Drainage Systems in the form of a blue roof.

3.2 Surface Water Drainage Strategy

The design of the surface water drainage system for the site development is to manage surface water sustainably as close to the source as possible, and to ensure the proposed flow rate is restricted to existing flow rates.

The new-build 6-storey hotel is proposed to have a blue roof to provide a form of SUDS / source control management. This can be stone ballast which does not require maintenance. This blue roof will attenuate up to 100mm deep rain over a 364m² area, therefore offering 36.4m³ of attenuation volume. This rainwater will also receive one level of infiltration.

The blue roof restricts the discharge rate to 2.5L/s for an extreme rainfall event of 5 minutes duration and 30 year return period. This is a substantial betterment compared to the pre-development, unrestricted flow rate of 22 L/s for the same rainfall event.

This blue roof then discharges into the combined public sewer on the Broomielaw.

Surface water landing on the existing buildings and the retained hardstanding areas will discharge directly into the combined sewers along existing lines. Due to the built-up nature of the site, with extensive basements, it is not considered viable to provide above or below ground attenuation due to the site constraints, and insufficient structural capacity to add further load to these existing buildings.

3.3 Surface Water Discharge Options

Scottish Water provide guidance for new developments, which demonstrates a hierarchy of surface water options to be used and justification required to allow consideration of the next favored option to be assessed when designing solutions for surface water management (1= most preferred, 5=least preferred).

Preferred Option 1: Rainwater to be stored and reused, such as rainwater harvesting and/or water butts.

Justification Rule to move to Option 2:

1. There is no significant demand for non-potable water on the site throughout its design life; and
2. The re-use of rainwater is not a viable/cost effective part of the solution for managing surface water onsite, taking into account of the potential water supply benefits of such a system.

Option 1 WRD Design Statement:

1. Storage of the surface water run off would be cost prohibitive for developments situation, there is not a suitable location within the site to provide storage and therefore excavations would need to be deeper and would implicate more cost negative.

WRD Summary – Scottish Water Option 2 to be considered.

Preferred Option 2: Surface water is drained into the soil through the use of a soakaway.

Justification Rule to move to Option 3:

1. The use of infiltration drainage is not practicable due to the lack of permeability of the soil for disposal of surface water;
2. The use of infiltration drainage would result in a risk of instability through ground movement or subsidence;
3. The use of infiltration drainage would pose an unacceptable risk of pollution of groundwater or watercourses;
4. The use of infiltration drainage would result in an unacceptable risk of flooding from groundwater to nearby properties; and
5. The use of infiltration may cause surface water to indirectly enter a combined sewer which might result in an increased risk of flooding or pollution on the site or downstream.

Option 2 WRD Design Statement:

1. The available site investigation results demonstrated that the ground strata are made up of silty clayey sand and gravel. As the sand and gravel materials recorded fines were greater than the allowable for a groundwater body, the material does not satisfy the SEPA document WAT-PS-10-01 guidance and therefore, cannot to be used for purposes such as infiltration.

WRD Summary – Scottish Water Option 3 to be considered.

Preferred Option 3: Surface water is drained to a watercourse (open or piped), canal, loch or existing/proposed SUDS.

Option 3 WRD Design Statement:

1. The nearest watercourse to the proposed development is the River Clyde, which is located 50m to the South. Scottish Water asset plans show that there are 2-No combined sewer overflow (CSO) pipes into the Clyde. These will be investigated as part of the drainage survey to establish whether we can route surface water from the 6 storey new-build directly into these CSO pipes, however this is not expected to be feasible, due to existing combined sewer infrastructure in the way, and the nature of the busy dual carriageway within which these are located.
2. It is not considered practicable to install any other above or below ground SUDS or attenuation features within this site due to the build-it city-centre location with basements.

WRD Summary – WRD will investigate the possibility to route surface water from the 6 storey new-build directly into the River Clyde via the CSO, however if this is not feasible, Scottish Water Option 5 shall be considered for all surface water from the site.

Preferred Option 4: Surface water is drained to a surface water sewer.

Justification Rule to move to Option 5:

1. It is not reasonably practicable to drain surface water to a surface water sewer (Note – additional funding may be available where the offsite sewer and/or SUDS can be designed to provide additional capacity for future development identified within the current Local Development Plan);
2. Pumping would be required to drain surface water to a surface water sewer.

Option 4 WRD Design Statement:

1. The existing Scottish Water system within close proximity to the surrounding site is a combined sewer only. Therefore, it would be proposed that the surface water connection would be to the combined sewer network.

WRD Summary – Scottish Water Option 5 to be considered for all surface water from the site.

Preferred Option 5: Surface water is drained to a combined sewer.

1. Consideration must be given to removing an equivalent amount of surface water from another part of the sewer catchment area to enable a zero net detriment to the sewer catchment area with.
2. Scottish Water will set a maximum discharge rate and minimum amount of storage required based on the specific characteristics of the receiving combined sewer and the proposed development.

Option 5 WRD Design Statement:

1. 36.4m³ of rainwater attenuation volume can be accommodated on the roof of the 6-storey new-build hotel.
2. This 6-storey new-build hotel represents 35% of the surface area of the site (546m² of 1583m²). This will be attenuated by a blue roof which provides one level of infiltration. The discharge of this 546m² area will then be limited to 2.5L/s, this reduces the overall post-development surface water peak discharge rate to 45L/s from the pre-development value of 66L/s. I.e. a 32% reduction.
3. The surface water for the two existing buildings and retained hardstanding area is proposed to be routed along the existing surface water drains within the site, and discharge via existing connections into the combined sewer.
4. Please refer to PDE calculations.

4.0 Conclusion

From following the Scottish Water policy and outlined hierarchy and justification required for choosing the preferred option of rainwater management solutions, Options 1, 2 and 4 would not be suitable for this specific site. This is due to the below ground soil not being suitable for infiltration, no surface water sewers for connection, and the tight site constraints of the city-centre location with basements.

Option 3, discharging to a watercourse, may be possible if a direct connection into the nearby CSO pipe on the Broomielaw can be achieved. This is subject to a drainage investigation to confirm the connection route.

Option 5, discharging to the combined sewer is the preferred option for the site, with a 32% reduction in peak discharge rate achieved by the introduction of a blue roof with a catchment of 546m².
