

Introduction

This document discusses how the **ABG bluroof** system can be used to provide temporary attenuation of stormwater, and restrict the rate that water enters the wider drainage system, as part of a Sustainable Drainage System (SuDS). A selection of worked examples, demonstrate the effectiveness of ABG's blue roof systems in areas where only low outflows are permitted by planning requirements.

ABG bluroof Systems

The **ABG bluroof** system approaches the problem of stormwater management by dealing with rainwater 'at source'. It is based upon the concept of utilising roof or podium areas to temporarily store rainwater during storm events. The rainwater is then released at a controlled rate into the wider environment. ABG's bluroof system comprises a combined filtered drainage and attenuation void, with integrated restrictor chambers at roof outlet points, to control rainwater discharge at a designed rate.

Outflow restriction

The **ABG bluroof** system is entirely gravity driven. This means that the restricted outflow is governed by the water pressure (head) at the restrictor chamber. When the storage component of the **ABG bluroof** system is full, the restricted outflow will be at a maximum; and vice versa, when it is nearly empty, the outflow will be minimal. Due to this, the outflow from the system will vary throughout a storm, but will continue draining at a controlled rate after rainfall has ceased – as illustrated in Figure 2.

Outside of the design storm parameters, the system acts as a normal, continuous drainage path, and there is only a temporary storage of rainwater during higher intensity storm events.

Outlined on the following pages are examples of ABG's blue roof designs, which illustrate the capabilities of the system where local SuDS planning requirements mean stormwater outflows need to be controlled.

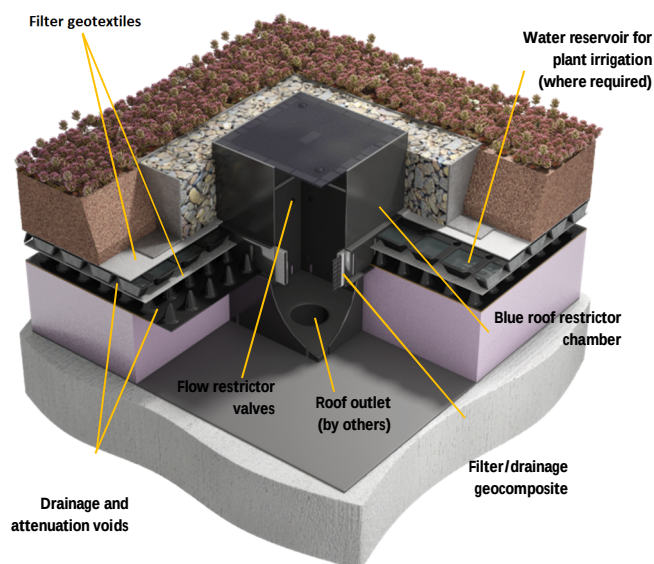


Figure 1: Typical ABG bluroof layout with a green roof surface finish

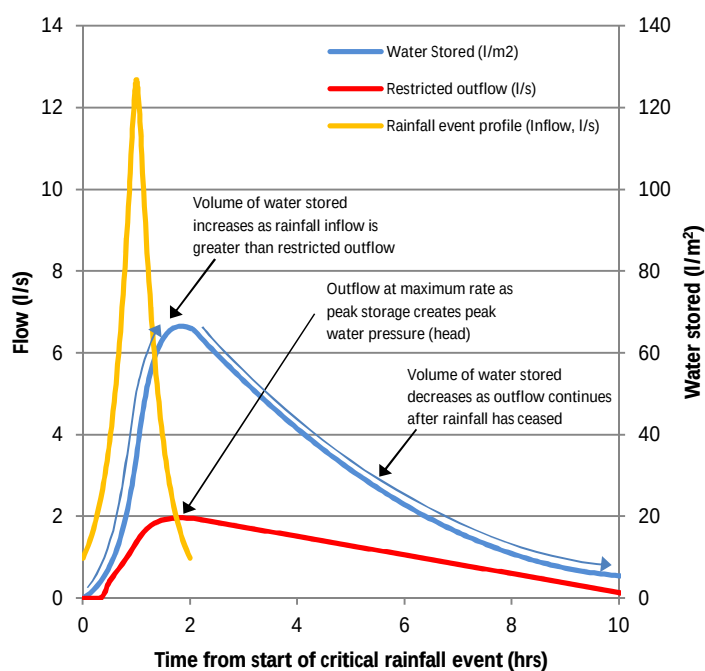


Figure 2: ABG bluroof water flows and storage

Discussion

The topic of stormwater management, and the associated SuDS 'best practice' requirements, is an increasingly important element of construction design. At the cutting edge are the **ABG bluroof** systems, and the concept of using the roof or podium areas to store rainwater during peak storm events, and then releasing the water at a controlled rate back into the wider environment.

The **ABG bluroof** system has the ability to provide a SuDS attenuation solution for a new or retrofit development. The drainage/attenuation layers are specifically designed with enhanced water storage capacity, and the discharge is controlled using a patented outlet.

Designing a green, paved, ballasted or landscaped roof or podium in this way, allows storage capacities suitable for different storm events up to and even exceeding 1-in-100 year storm events. The stormwater attenuation requirements are met within the roof or podium build-up, and therefore the need for expensive underground storage or other SuDS processes can be reduced or eliminated.

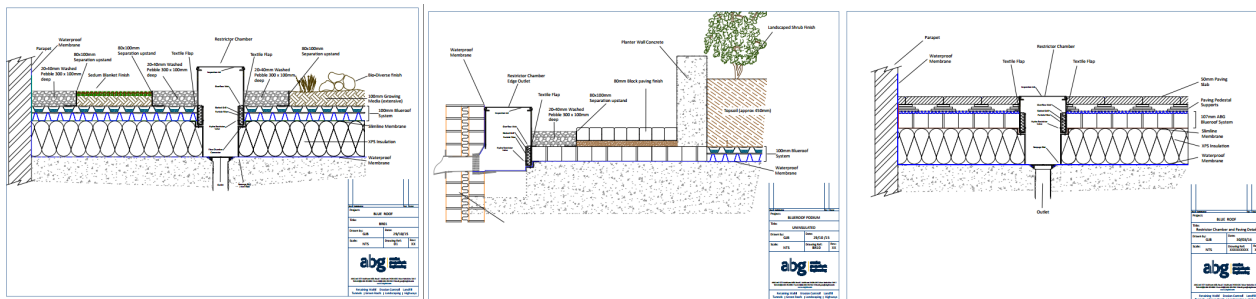


Figure 3: Examples of ABG bluroof build-ups

Benefits

The benefits of the **ABG bluroof** system include:

- An 'at source' solution, and at the top of the 'SuDS Hierarchy'.
- Controlled storage and release of stormwater in line with SuDS best practice/legislation.
- Reducing the requirement and associated costs involved, for installation of underground tanks.
- Reduction in roof penetrations and RWO's required.
- Places stormwater storage within the footprint of the building on tight sites.
- A zero-falls system.
- Overall time benefits and cost savings vs. traditional methods for the project team.
- Can be designed for multiple surface finishes, including podium decks up to HGV or fire engine access.

Final Remarks

ABG are a market leader in the development of high-performance systems with geosynthetics at their core. Our head office is in Meltham, in the heart of the Yorkshire Pennines, and for over 25 years we have built our reputation for developing and manufacturing innovative solutions with outstanding customer service. All our products are supported by our in-house technical department, many of whom are Chartered Engineers, who can offer design & technical assistance for all our product solutions. Our technical sales-team can also provide specific project design & calculations, CAD drawings, relevant NBS/technical clauses and site surveys.

We can also deliver a CPD seminar on our blue roof systems, on request.

Example 1: Medium-sized commercial building, central London – roof only.

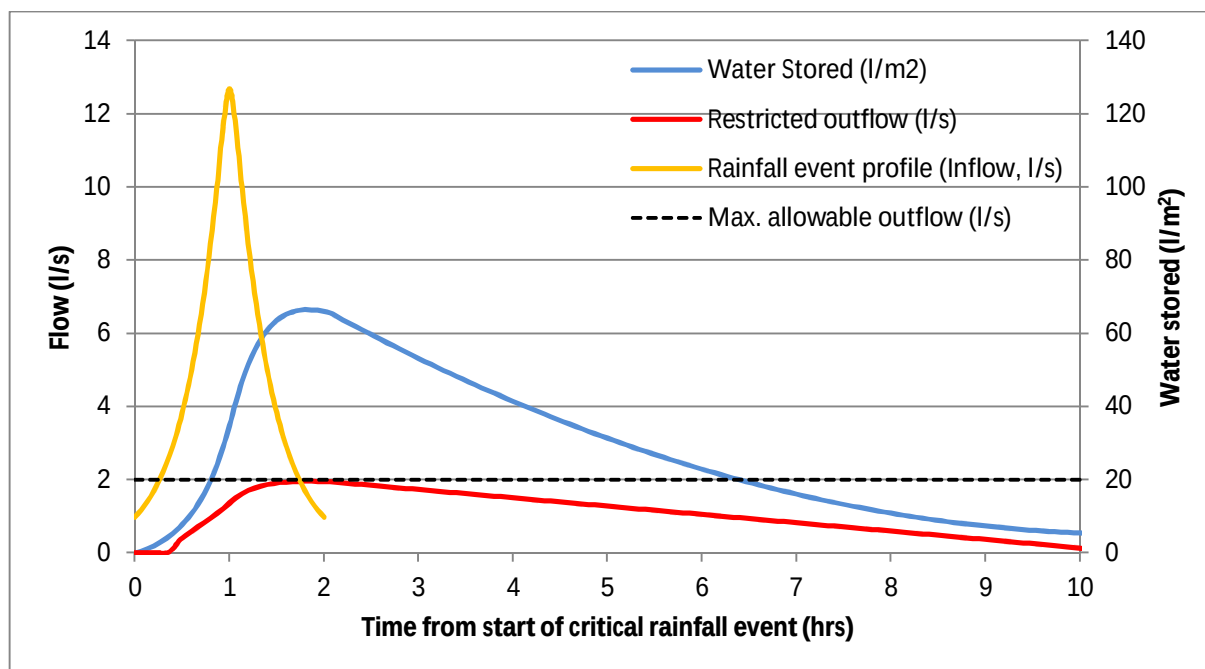
A new office building in central London is on a very, constrained/landlocked site, with a green roof area of 500m². The roof area has a maximum allowable discharge rate of 2 l/s for a 1-in-100 year storm event, plus 40% to account for climate change (CC). The site is very confined, with little space for other SuDS processes, such as permeable paving or ground attenuation tanks, except in the basement area.

Input

Rainwater catchment area:	500m ²	Location:	Central London
ABG bluroof 'storage' area:	500m ²	Rainfall data source:	FSR ¹
Design rainfall event:	1-in-100 year + 40% CC	Rainfall ratio, r:	0.41
Max. allowable discharge rate:	2 l/s	M5-60 expected rainfall:	20.6 mm/h

Notes:

1. Flood Studies Report (1975)
2. Calculations below are based on three ABG bluroof restrictor chambers.



Calculations show that the critical duration is a 2 hour rainfall event. In this case, the resulting maximum outflow is 2.0 l/s which meets the allowable maximum of 2 l/s; and the **ABG bluroof** 97mm system provides storage of up to 71 l/m².

Results

Critical storm event:	2 hrs	Maximum restricted outflow:	2.0 l/s
Storage required:	66 l/m ²	50% discharge time:	2hrs, 50 mins

Conclusion

The **ABG bluroof** system means that additional SuDS processes in the basement and elsewhere onsite are either reduced in size or not required, and valuable office/basement space is freed up for the building owner's tenants and other uses. The blue roof is also easily combined with a biodiverse surface finish for additional biodiversity and BREEAM points for planning purposes.

Example 2: Retrofit of a mixed development, Sheffield – roof & podium areas.

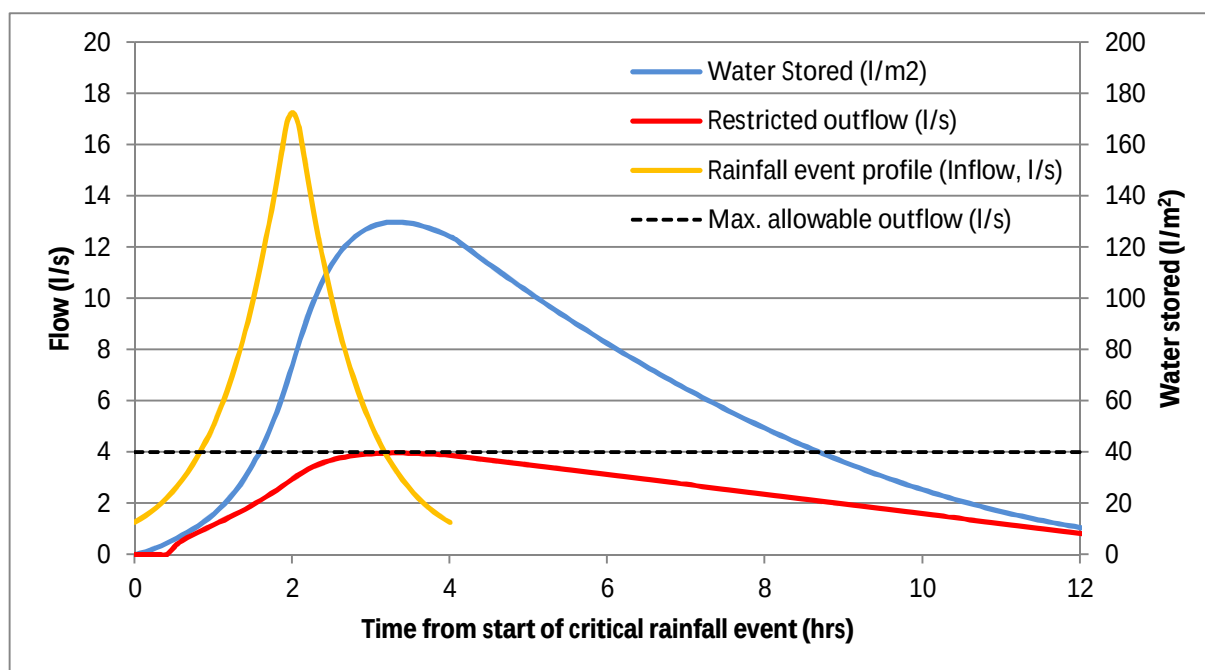
An existing building in Sheffield has a 600m² roof & 600m² podium area. Due to restricted build-ups on the roof, the retrofitted **ABG bluroof** system is installed at podium level; and the higher roof cascades into the lower podium area, managing the rainfall for both areas. The podium is a mixture of soft and hard landscaping, and has regular HGV traffic access.

Input

Rainwater catchment area:	1200 m ²	Location:	Sheffield
ABG bluroof 'storage' area:	600 m ²	Rainfall data source:	FSR ¹
Design rainfall event:	1-in-100 year + 40% CC	Rainfall ratio, r:	0.34
Max. allowable discharge rate:	4 l/s	M5-60 expected rainfall:	19.0 mm/h

Notes:

1. Flood Studies Report (1975)
2. Calculations below are based on six ABG bluroof, restrictor chambers.



Calculations show that the critical duration is a 2 hour rainfall event. In this case, the resulting maximum outflow is 3.9 l/s which is still within the allowable maximum of 4 l/s; and the selected **ABG bluroof** system provides storage of up to 144 l/m².

Results

Critical storm event:	2 hrs	Maximum restricted outflow:	4.0 l/s
Storage required:	130 l/m ²	50% discharge time:	3hrs, 0 mins

Conclusion

The attenuation storage required is quite large, but well within the capabilities of a standard **ABG bluroof** system. Retrofit of an **ABG bluroof VF HD+ 165mm** system means that the stormwater management is entirely controlled within the existing footprint of the building, and also avoids major issues of contaminated land and existing services below ground, onsite.