



PLANNING GUIDE

## Green Roof 4.0

SYSTEMS FOR ROOF UTILISATION FOR THE FUTURE

Life on Roofs





# Seeing urbanisation and climate change as a task!



The conurbations in our cities are facing considerable challenges due to climate change: new and intelligent solutions are required to combat increased overheating on the one hand and severe rain events with flooding on the other hand, in addition to the trend towards urbanisation combined with the basic human need for vibrant, green surroundings.

According to the German Environment Ministry, 69 ha of new settlements and traffic areas were designated in 2015. That is the equivalent of rezoning about 100 football pitches a day. The ongoing high rate of soil sealing has the effect that stormwater can no longer seep into the ground and the communal drainage systems become quickly overloaded during severe rain events, resulting in

flooding. Actions aimed at de-sealing are becoming increasingly important, for example, cities are incorporating green roofing in development plans and are rewarding the stormwater retention capacity of green roofs with reduced waste water charges. This capacity to hold back water is also referred to as "retention" and it has considerable potential.



Sealing



Severe local rain events



Urban heat islands



Green roofs counter the negative impacts by binding dust and air pollutants, reducing the urban heat island effect and disburdening the sewer system. ZinCo's development of pioneering solutions maximises this effect. They range from an effective stormwater management on the roof to an optimised cooling capacity to biodiversity.

# More options with ZinCo



System Build-up  
"Stormwater Management Roof"  
*Stormwater retention with a green roof*

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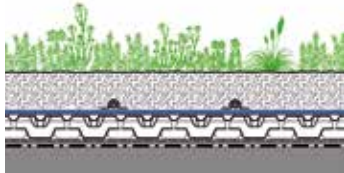
System Build-up  
"Urban Climate Roof"  
*System Build-up with maximum evaporation capacity*

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System Build-up  
"Irrigated Extensive Green Roof"  
*The System Build-up for biodiverse green roofs in regions with extended periods of drought*

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Biodiversity  
*Diversity over uniformity, biodiversity modules also for retro-installation*

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# System Build-up “Stormwater Management Roof”

## Why a Stormwater Management Roof?

The word “retention” in water management refers to the balancing effect of storage space on the run off of stormwater into watercourses. The need for retention is becoming more frequent as changing weather conditions (e.g. severe local rain events) can lead to an entire stormwater drainage system becoming overloaded. First of all, a large proportion of the precipitation is retained on the roof

area with a stormwater management roof, in the full sense of expanded flood control, and is then released over a pre-defined period (e.g. 24 hours) into the drainage system. All elements that are important for the correct functioning of the green roof are preserved (water storage for the plants, air-water household in the root area, etc.).



*Inner courtyard equipped with a Stormwater Management Roof build-up on top of an underground car park in Ratingen, Germany.*







## Stormwater retention with a green roof

Every green roof build-up has the effect of delaying water run off. This involves holding back water, at least temporarily. Peak flows that can be critical for the sewer system are effectively capped. Water storage in a standard green roof build-up cannot be increased arbitrarily because more water means greater growth intensity and could result in

changes to the vegetation used, which in turn could require added care and maintenance.

With intensive green roofs, water ponding is sometimes brought about purposely in order to facilitate capillary irrigation; however, this level of stormwater retention is maintained for irrigation purposes during the vegetation period

as a continuous water supply, and is therefore not available as a buffer storage in the event of a severe rain event. The space required for the temporary retention of water, which will enable the desired relief of all drainage systems down as far as the watercourses, can be created by installing a "spacer" beneath the actual green roof build-up.



Run off delay in an extensive green roof



Up to approx. 40 l/m<sup>2</sup> permanent water ponding are possible in the system build-up for the irrigation of an intensive green roof, ...



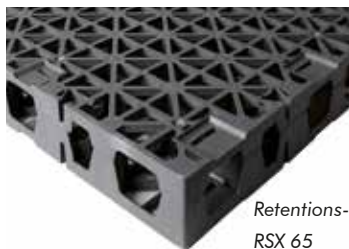
... depending on the type of retention spacer, the System Build-up "Stormwater Management Roof" retains a minimum of 80 l/m on the roof.



# System Build-up “Stormwater Management Roof”



By the use of the newly developed Retention Spacer RS 60, an additional 55 l/m<sup>2</sup> of rain water can be stored on the roof. Compared to traditional spacer elements, the Spacer Element RS 60 stands out for a considerably reduced transport volume due to the excellent stacking capability of the elements. Depending on the roof size this can result in significant cost savings.



*Retentions-Spacer  
RSX 65*

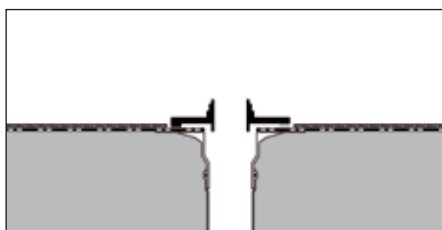
If Stormwater Management Roofs are to be realised with walkways, driveways or lush vegetation, our range of products includes further spacer versions available in different heights.



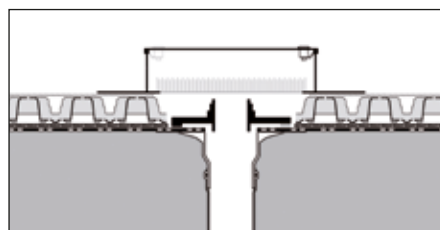
*Run-off Limiter RD 28  
to be installed on flat  
roofs over water outlets  
with a contact flange*

*Run-off Limiter RD 48  
to be installed on flat  
roofs over water outlets  
with a clamping flange*

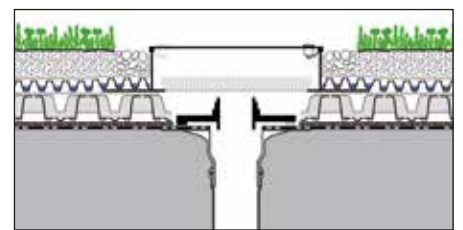
## Structure and operation



A Stormwater Management Roof includes a flow control device put onto the roof outlet. This flow controller has an opening on the lower side which can be adjusted according to the discharge rate required and a water overflow pipe (also adjustable in height).



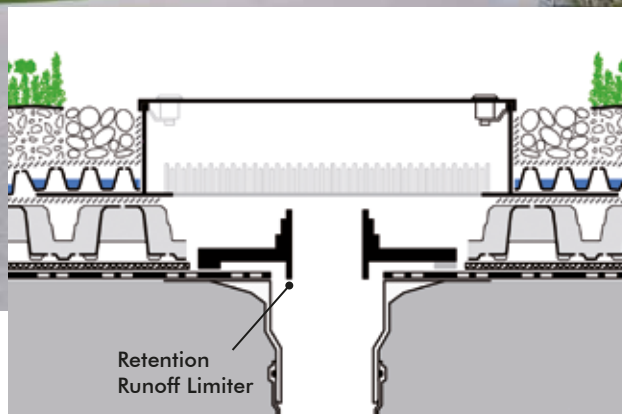
The Retention Runoff Limiter can be inspected using the inspection chamber. We recommend installing the Retention Runoff Limiter at the earliest a few weeks after installation of the build-up to allow for dirt particles to be flushed out.



A dam-up height of 100 mm can be exceeded only for a short period of time, otherwise the German Standard DIN 18535 “Waterproofing of tanks and pools” applies.



Weight kg/m <sup>2</sup>		Height mm
dry	water-saturated	
67	84	60
2	6	30
3	62	60
72	152	



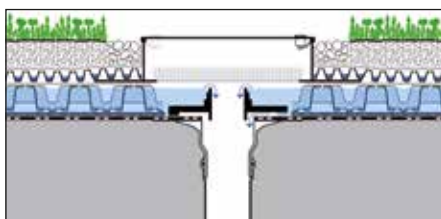
Plant Community  
 "Sedum Carpet"  
 System Substrate  
 "Sedum Carpet"  
 Filter Sheet SF  
 Floradrain® FD 25-E  
 Filter Sheet PV  
 Retention Spacer RS 60  
 Filter Sheet PV

Build-up height: ca. 150 mm  
 Weight, saturated: ca. 155 kg/m<sup>2</sup> \*  
 Water retention capacity: ca. 80 l/m<sup>2</sup> \*

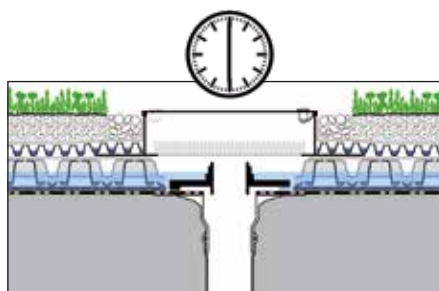
(\* values apply where the full 60 mm are accumulated)

### Requirements

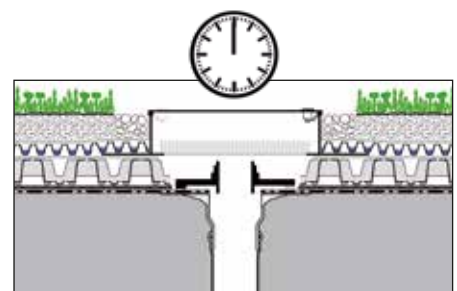
- Zero-pitch roof structure
- Relevant load-bearing capacity of roof
- There must be an air layer between the top of the water layer and the filter sheet.
- Throttle orifice is to be adapted to suit local requirements.
- The remaining overflow is important for extreme rain events. Emergency overflows are "still" required.
- The max. water spreading quantity, the period of time until the storage space is available again and the max. drainage quantity per time unit are values that must be determined for each individual building.



During extreme rainfall events, the water in the retention space of the spacer element will rise up to the upper edge of the inlet pipe.



The water will run off again through the retention orifice at a strictly controlled rate and over a pre-defined period (e.g. 24 hours)



... so that the retention space is emptied and is then available for the next precipitation event.



# System Build-up “Urban Climate Roof”

## Understanding the Urban Heat Island Effect as a task!

The sealing of former planted areas continues unabated. This has a considerable impact on the heating up of towns and cities. As a result, global radiation is used in a totally different way. On sealed surfaces, it can no longer be used as an engine for plant growth and can therefore hardly be used for cooling evaporation. This means that the considerable rise in thermal radiation is heating up urban centres and the resulting urban heat islands are having a negative effect on well-being. In addition, an increased level of sensible heat, or perceived heat, will ensure that time spent here will be associated with discomfort. There are various types of green roof that can help

to counter this. The decisive thing in each case is that there is sufficient water for evaporation. The comparison below

shows the evaporation capacity generally achieved in an urban context by various types of green roof.



## Evaporation cools

The perceived cooling effect in street gorges is, of course, impacted by factors such as the height of a building, its position in the topography, prevailing wind direction and speeds, etc.. Generally speaking, increased evaporation will always ensure greater cooling capacity in urban centres.

Urban trees have a considerable cooling capacity, provided certain conditions are fulfilled (sufficient root-penetrated space, water supply etc.). In the summer, for example, an urban tree can enable the evaporation of 300 l/day. This is

enough to cool the air volume of a 100m × 100 m × 100m cube by 3–5 °C, depending on the existing humidity! However, a planted tree requires a comparatively long time until it can achieve full capacity. Herbaceous plants are quicker in this case!

“Standard” green roofs have considerable evaporation capacity when considered across the year as a whole. However, this decreases particularly in hot, dry periods, often to zero evaporation.

In contrast, thanks to irrigation, an urban climate roof with its specially developed plant community will ensure a high level of evaporation also or particularly during hot, dry periods. The maximum evaporation capacity can already be achieved during the first, or at the latest, the second vegetation period.

## Overview of evaporation capacity per 100 m<sup>2</sup>:



A mature, well-irrigated urban tree has an evaporation capacity of **300–500 l/d** (litre per day).



A conventional extensive green roof build-up (“Sedum Carpet”) evaporates **20–50 l/d** in the summer heat.

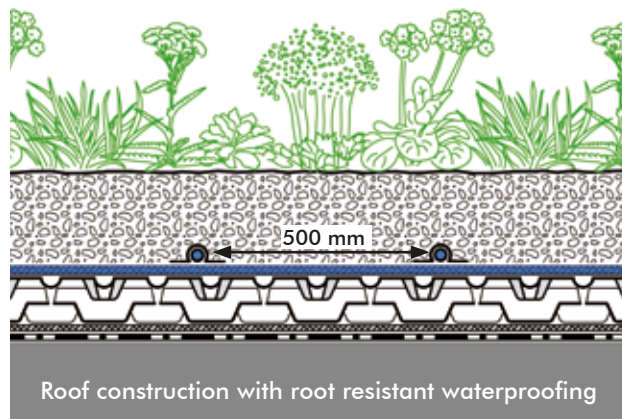


The System Build-up “Urban Climate Roof” (incl. the appropriate plant layer) evaporates **700–1000 l/d**.





Weight kg/m <sup>2</sup>		Height mm
dry	water-saturated	
from 100	from 140	from 100
2	7	50
102	147	



Plant Community  
 "Urban Climate Roof"  
 System Substrate "Rockery Type Plants"  
 Dripperline 500-L2  
 Aquafleece AF 300  
 Floraset® FS 50\*  
 Protection Mat TSM 32

Build-up height: from approx. 150 mm\*  
 Weight, saturated: from approx. 150 kg/m<sup>2</sup>  
 Water retention capacity: from approx. 45 l/m<sup>2</sup>  
 Evaporation capacity: to approx. 7–10mm/d

\* The Build-up height can be reduced or increased as required using a different drainage element.

## Plants with maximum evaporation capacity – thanks to intensive research!



The plant community "Urban Climate Roof" was developed at Weihenstephan University as part of the DBU Research project "Optimisation of Evapotranspiration and Cooling Capacity in extensive Green Roofs through the targeted use of grey water".

Apart from weeding that is required with all extensive green roofs, the build-up only requires an annual mowing and the removal of dead plant material after the winter.



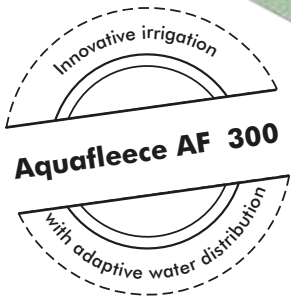
# Two functions – one product: Aquafleece AF 300 ensures perfect water distribution and serves as a filter sheet at the same time.



The new Aquafleece AF 300 (utility model protected) is at the heart of the new system build-ups "Urban Climate Roof" and "Irrigated Extensive Green Roof". The combination of a high-level capillary fleece with woven material allows the Aquafleece to distribute the water during irrigation while allowing excess water to pass through across the full area during a precipitation event. This allows for evenly distributed irrigation, while preventing the substrate from water logging.



Velcro strips are used to attach the driplines to the Aquafleece.







## Types of irrigation suitable for an Urban Climate Roof

Drinking water is certainly one possible type and should always be available as an emergency supply. However, due

to the quantity required and from an ecological point of view, the following resources are considered to be more suitable.

It is imperative for various departments to collaborate if the project is to be successful.



### Stormwater management

Stormwater can be stored during precipitation and used for irrigation during dry periods, given the right climate conditions and project circumstances. However, this is often difficult with an existing system.



### Using grey water

The advantage here is that it is always available as a water resource, even in the dry heat of summer. It can be one of the elements used to supply the Urban Climate Roof with water. The plants were selected as part of a large-scale research project (funded by the Deutsche Bundesstiftung Umwelt – German Federal Foundation for the Environment) specifically due to their suitability for irrigation with grey water.



### Ground water management

This is available in many regions! There is a lot of stormwater seepage in many settlements today. Very often, on balance, seepage and groundwater formation is greater than the original natural state. If the quality of the ground water is suitable and it can be made available economically, this type of irrigation is an effective means of large-scale active evaporation.



# System Build-up “Irrigated Extensive Green Roof”

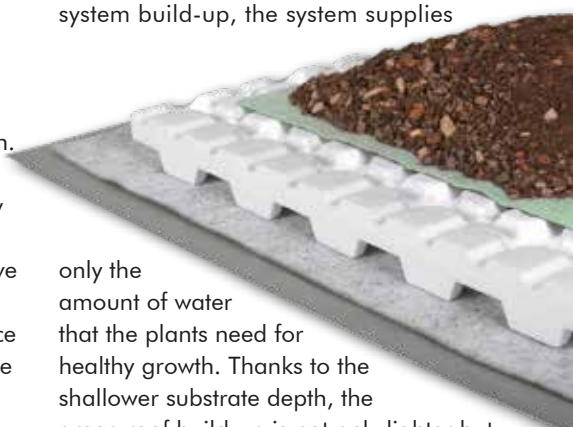
The System Build-up for biodiverse green roofs in regions with extended dry periods.



While the automated irrigation of extensive green areas was always more common in regions around the Mediterranean, it is now becoming more important in Germany too. Due to the ongoing climate change, many regions in Germany are increasingly having to deal with long periods of drought. This will lead to species-poor green roofs with plant growth being more or less up and down. Very often only succulents will survive with perhaps bare patches that are only temporarily green. Therefore, irrigation in many regions is the only way to achieve biodiversity on green roofs. This green roof build-up will help to strike a balance between a cost-effective solution and the permanent proper functioning of green roofs in dry climates.

As is the case with the “Urban Climate Roof” build-up, irrigation takes place beneath the substrate. As a result, the water is available where a plant needs it. However, unlike the Urban Climate Roof system build-up, the system supplies

only the amount of water that the plants need for healthy growth. Thanks to the shallower substrate depth, the green roof build-up is not only lighter but also other plant communities are used.



The irrigation manager BM 4 is used for controlling irrigation.

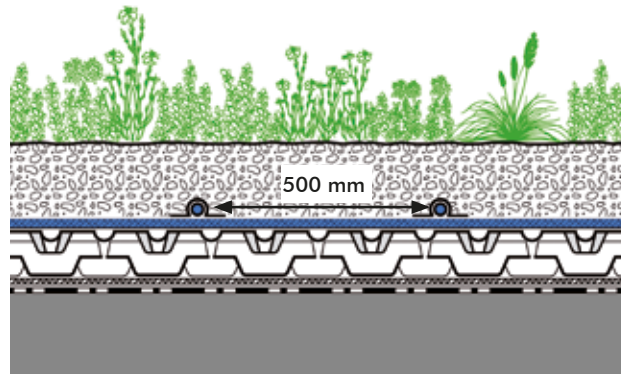
Sufficient water pressure and water quality have both to be taken into consideration when planning the system.







Weight kg/m <sup>2</sup>		Height cm
dry	water-saturated	
from 80	from 112	from 8
2	7	5
82	119	



Plant Community "Rockery Type Plants"

System Substrate "Rockery Type Plants"

Dripperline 500-L2

Aquafleece AF 300

Floraset® FS 50\*

Trenn- und Schutzmatte TSM 32

**Build-up height:** : from approx. 130 mm\*  
**Weight, saturated:** from approx. 120 kg/m<sup>2</sup>  
**Water retention capacity:** from approx. 37 l/m<sup>2</sup>

\* The Build-up height can be reduced or increased as required using a different drainage element.

- Biodiversity and long-term green roof success will be ensured by using specific underfloor irrigation.

- Irrigation is carried out by means of special dripperlines that are attached to the Aquafleece AF 300 every 500 mm with Hook & Loop Tape and are supplied with water by the BM 4 irrigation manager, as required.

- Given that the water is distributed across the Aquafleece AF 300 and brought to the plants from below, water consumption is relatively low.

- The system build-up can be used on roofs with a pitch from 0°–5°.

- Suitable drainage elements are to be chosen depending on the roof pitch and potential water ponding. Possible and useful versions are, for example: Floraset® FS 50 or FS 75 or Floradrain® FD 25-E, each with the matching protection mat. Fixodrain® XD 20 is also suitable for large roof areas.

- The Plant Community "Rockery Type Plants" are installed as plug plants.

- For example, the grass/herb mixture "Country Colours" can be planted during seasons favourable to it. In this case, a covering layer of 10 l/m<sup>2</sup> Zincohum should also be applied.

- "Rockery Type Plants" and "Country Colours" Plant Communities are designed for the average Central European climate conditions. If the climate conditions are different, then the plant communities should be adapted accordingly.



# Biodiversity

In areas where nature has been destroyed by construction works and the ground is sealed, green roofs can partially compensate for lost green areas and can provide replacement habitats for flora and fauna. Above all, natural, low-maintenance extensive green roofs are important refuges for flora and fauna. Wild bees,

butterflies and ground beetles find food and shelter there. However, the development of biodiversity depends to a great extent on how the habitats that are provided for the flora and fauna on a roof are structured. Pure sedum green roofs that are frequently installed in conjunction with very shallow substrate

depths are not suitable for exploiting this potential. Indeed, the biotope function of greened roof areas can be specifically fostered with very little work using various design features and applying basic biodiversity principles during the planning and implementation stages.

## Biodiversity module



### Modulating the substrate surface

Varying the substrate depth creates different habitats that will extend the range of species available in the planting areas.

### Introducing deadwood

Dead branches and tree trunks are a particularly valuable structural element. Deadwood is used as a habitat by moss, lichens, fungi, beetles, flies, midges, ants and wild bees, among others.

### Temporary water bodies

Using borders and sheeting, areas can be created to retain stormwater on the roof for an extended period of time. It improves the amount of water available, e.g. for insects and birds.

### Sand pockets and coarse gravel beds

Plant-free areas are an important enrichment of the biotope and are used by insects and other roof inhabitants as a hideaway, breeding ground and a sun trap.

### Plant selection, e.g. forage plants

If areas with a deeper substrate are available (e.g. by creating hilly mounds), forage plants can be used for insects and birds or even a wider range of indigenous plants.

### Nesting aids

The use of nesting aids specifically fosters insect colonisation.

The number of biodiversity modules to be used can be freely chosen. As can be seen with the example of the IGA visitor centre as shown below, this can be taken into consideration as early as the planning stage and individual modules can be fitted retrospectively.

## Creating a biodiversity green roof on the IGA visitor centre



A biodiversity roof is installed on the IGA 2017 visitor centre in Berlin.



The System Build-up "Rockery Type Plants" provides the foundation, this is the drainage element Fixodrain® XD 20.

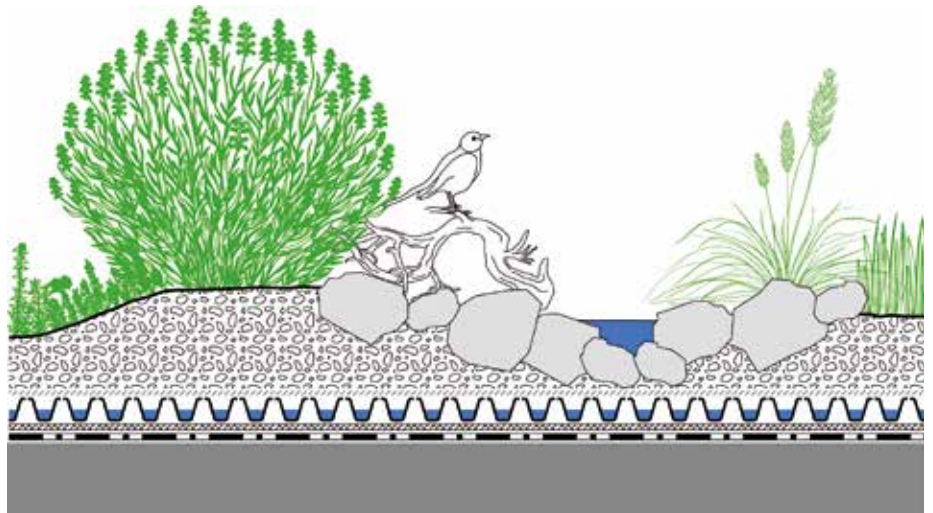


Installed system substrate "Rockery Type Plants".





System Build-up “Rockery Type Plants” with the drainage element Floradrain® FD 25-E as a possible basis for a biodiversity green roof.



Landscape mounds allow for a greater range of plants.



Temporary water areas created using drainage pipes and sheeting.



The hilly areas are planted with forage plants, for example, for wild bees.



# What ZinCo can do for you

ZinCo provide a comprehensive package of environmentally sound Green Roof Systems and customized project support, based on:

- 35+ years of experience in Green Roofs
- Tested & proven Green Roof Systems
- Exceeding quality standards & permanent innovation through research and development
- Compliance with relevant international standards
- Experts in structural engineering, landscape architecture, horticulture, material and soil science, ...
- Support from planning to completion (design, specifications, CAD, consultancy, on-site)
- An international network of partners
- Comprehensive warranties

To date, ZinCo Green Roof solutions have inspired planners and contractors throughout the world, providing them with the necessary flexibility to accommodate a wide range of designs and building needs.

**Tell us about your project!**

**We've got the expertise to bring it to life.**

Credits photos@Drone-view



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