TYPES OF GREEN ROOFS

In the UK we have adopted the German classification of green roofs. In Germany the regulators, known as FLL, divide green roofs into 3 categories. The categories are based on their use, technical considerations & construction type. The three categories are:

EXTENSIVE INTENSIVE SIMPLE INTENSIVE

We specialise in producing and installing our Extensive Green Roof System, using our sedum mats.

Extensive:
Providing environmental and cost benefits these roofs are very low maintenance and aesthetically pleasing. Generally a shallow layer of substrate (25-100mm) planted with low-growing succulents called sedum, and occasionally wildflowers, herbs and other alpine species. The plants will give excellent coverage of the entire roof. Extensive roofs are not designed for access, but are ideal for both retro-fitting & new build of shallow pitched roofs or flat roofs to provide insulation or water attenuation. These light-weight systems require only annual or twice yearly maintenance, and do not impose any significant weight on the building structure; therefore there are usually no structural implications. A low cost long-term solution that often does not require irrigation. The Extensive green roof is designed to be self-sustaining and to look 'natural'.

Intensive:
Intensive gardens are based on a thick layer of soil or substrate (150mm+). These, are roof gardens which are created to provide additional space for people to use as amenity; they usually have a flat roof or shallow pitch and can incorporate lawns and specially selected shrubs, trees and plants. Roof gardens require the same 'intensive' maintenance and upkeep as the ground level garden. Irrigation and drainage systems must be adequately designed. Pathways, terraces and other architectural features can be included. Intensive roof gardens place significant weight on the building structure and need to be engineered to conform to load requirements and health and safety. Visually they are very attractive but have high capital and maintenance costs.

Simple Intensive:
Of slightly greater depth than extensive systems (100-200mm), allowing a greater diversity of plants to be grown and local habitats recreated. Based on the same principles as extensive roofs, they are light weight and generally low maintenance. The planting usually covers the surface of the roof.

Brown or Rubble roofs:
The by-products of the development process, such as rubble, brick and subsoil are added to the roof and allowed to colonise naturally over time or planted with wildflower meadows. The concept behind such roofs is to replace the 'foot print' of the building on the roof thereby recreating 'Brownfield' conditions and providing a habitat to encourage the local species of plants, birds and invertebrates, displaced by development, to return and colonise the roof.
They consist of a lightweight growing medium, typically made up of crushed brick or concrete mixed with site excavated soil. This can be recycled material that has an association with the site; demolition material then left to colonize on its own. Similar results can be had by leaving a commercial substrate to colonize naturally but experience has shown that there is a need to seed and ALSO apply some sedums to such roofs to ensure that the roof develops to its maximum. The substrate will be free draining and has a low-fertility.The finished surface is 'sculpted', to provide habitat for the specific flora and fauna it is designed to accommodate. Features such a logs and boulders are often added.

BENEFITS

Green roofs act as a stormwater management device, quite simply because they replicate the open space previously at ground level. Vegetated roofs play an important role in modern urban drainage because of their ability to slow down and reduce runoff response. Unlike some other best management practices, green roofs may be able to offer controls and improvements in both the quantity and quality of stormwater runoff.

Improved insulation

Green roofs moderate and minimise temperature variations within the building. Any heat loss or heat gain through the roof creates a demand for energy. By installing a green roof the building is better insulated. Each layer of the green roof has an insulating effect; even the soil itself has a low insulating property. The soil and the plants absorb the energy from the sun and store it. A green roof is more effective at reducing heat gain rather than heat loss. Therefore it is sensible to consider the benefits from an annual perspective taking into account the variance between summer and winter.

Sound insulation

The growing medium or soil substrate acts as a noise barrier and reduces the transferred noise by up to 18dB.

Moderating the Urban "heat island" effect

In cities the buildings, pavements, car parks etc are all impervious surfaces. This can mean that on warm summer days the temperature in the city is several degrees higher than in surrounding rural areas. This is particularly noticeable at night, when urban areas take longer to cool down and the air quality is poor. Green roofs increase vegetation in urban areas. The plants cool the air and add moisture through 'evapotranspiration'. Green roofs also shade the heat absorbing surfaces, thereby reducing the albedo effect.

Improved biodiversity and ecology

Green roofs provide a habitat for birds, insects and wildlife; they replace the land lost to development. Specifically designed living roofs can focus on providing habitats for species native to the local environment.

Improve air quality

Green roofs take up CO^2 and filter dust and pollutants from the air and also from the rainwater that they hold. This means that the quality of the runoff is improved as well as the air that we are breathing.

Reduce energy consumption

Because homes and buildings absorb the sun's energy, heat islands can increase the demand for summertime cooling and raise energy expenditures. For every 1° F (0.6° C) increase in summertime temperature, peak utility loads in medium and large cities increase by an estimated 1.5–2.0%. On hot summer days, the surface temperature of a green roof can be cooler than the air temperature, whereas the surface of a traditional rooftop can be up to 90°F (50°C) warmer. In Germany, studies have estimated the electricity savings to be £5.20 per m^2 per annum if you have a green roof.

Addressing Climate change with Sustainable roofing

It is important to address the issues of climate change on all our current and future developments. Green roofs are best placed to deal with the potential effects of increased rain fall, and stronger and more frequent winds.

BENEFITS CONT.

Aesthetic appeal & Psychological benefits of contact with nature

Green roofs naturally improve the outlook for the surrounding buildings. Health research has demonstrated the healing affects of nature and the general calming effects of having greenery to look out at.

Increased open space

Using the roof tops for Roof gardens, that are accessible, opens up a whole potential of open space for use as a public & recreational amenity. In towns and cities where land is at a premium roof gardens can address the needs of both housing and industry.

Aid planning applications

The intention to install a green roof can assist and speed up a planning application, by alleviating environmental policy issues. National Planning guidance states that local authorities should promote resource & energy efficient buildings. Several councils are considering policy options for living roofs.

'Green' awareness

Installing green roofs is a very visual statement of environmental awareness. Green roofs can score highly on environmental business rating schemes. Everyone can make a contribution to combating climate change, by installing a green roof.

Extending the life of the roof

When you install a green roof, it protects the roof and the waterproofing from the degradation caused by extreme temperature fluctuations, and the effects of ultraviolet light. This protection extends the life of the roof itself, eliminating the replacement costs and cutting down the use of resources.

SUSTAINABILITY and details of our nutrifoam mats

Buildings and developments can adversely affect climate change and also be adversely affected themselves by those changes. Consequently it is important to look at ways of mitigating against these issues at the outset and planning for the nature of predicted climate changes throughout the life of the building, not just the current climate.

The Buildings Research Establishment has concluded that green roofs are altogether better able to cope with the forecast climate changes, namely higher wind speeds, heavier rainfall and longer hotter summers.

The Green Roofs Naturally Green Roof System has been functioning for more than 25 years. It is tried and tested and it is self sustaining and will continue to be so, throughout "the life of the building". Installing a Green Roofs Naturally Green Roof will protect the waterproof membrane, preventing exposure to UV light and extremes of temperature, extending the overall life of the roof itself. The basis of the Green Roofs Naturally system is the recycled foam mat. Produced under modern efficient and economic production processes, the Nutrifoam Mat is embedded with slow release nutrients, to ensure there is minimal impact on the quality of the water runoff. The Extensive soil substrate, sourced locally, consists of recycled brick (non-contaminated). The simplicity of the system also makes it infinitely adaptable and practical for installation being non-labour intensive. The cost is competitive and our supply chain and partnership working are all designed to ensure the quality and value of this system is the imperative to ensure the whole of life costs are kept to a minimum.

The Nutrifoam mat is unique in its multi- functional purpose, providing both part of the growing medium and the drainage system. This minimises the manufacturing required to produce the Green Roofs Naturally system and the resource consumption.

The system itself is extremely lightweight. When the extensive green roof, with a substrate depth of 4cm, is fully saturated, it weighs 56 kilos per m^2. Water attenuation is a key element of the sustainable benefit of the Green Roofs Naturally system. From a hydrological point of view the roof functions differently from a hard roof. Rainwater is retained and evapotranspiration takes place from the vegetation, while the rainwater runs off directly from the hard roof. There is a clear seasonal effect for the runoff reduction, runoff does not occur until the mat and the substrate are fully saturated and is also dependant upon the precipitation period and volume. The Nutrifoam mat alone will hold 25 litres of water m^2, effectively acting as a sponge to control and slow the storm water runoff, which means that local urban flooding and combined sewer overflows can be lessened. Throughout the year due to the high level of water storage and transpiration, the runoff is less than 50% of the precipitation. This has important implications for SUDS and as such green roofs are now considered a SUDS technique.

The thermal mass of a building is important in how it responds to heat loss and gains. Lightweight systems can heat and cool faster. The Nutrifoam mat assists in reducing heat gain in summer to maintain comfortable temperatures within the building.

ATTENUATION and stormwater management implications of green roofs.

Rainfall in urban areas is typically more problematic than in rural environments. Under natural conditions, precipitation is impeded from running off by vegetation, ground surface retention and subsurface storage. The retained rainwater will contribute to the soil moisture and ground water replenishment.

Urban landscapes are dominated by impervious surfaces, such as pavements, building walls and roofs and paved car parks and roads. These collect the flow and direct it into storm drains, sewers and engineered channels (the urban drainage system). Urban runoff eventually reaches receiving waters as sudden uncontrolled surges. Many surface contaminants are carried with this torrent of stormwater. Common contaminants include suspended solids, heavy metals, chlorides, oils and grease and other pollutants that arise from the use of roads and other surfaces that water has passed over. Increased land development results in increased runoff volumes, runoff velocities and peak discharge rates.

Green roofs act as a stormwater management device, quite simply because they replicate the open space previously at ground level. Vegetated roofs play an important role in modern urban drainage because of their ability to slow down and reduce runoff response. Unlike some other best management practices, green roofs may be able to offer controls and improvements in both the quantity and quality of stormwater runoff. The temporal storage of water in the soil and vegetation reduces peak flow, which prolongs the time-of-concentration, which means that local urban flooding and combined sewers overflows can be lessened. (CSO)

Green roofs have great potential benefit in terms of protecting water health and reducing flood risk to urban areas. It has also been shown that green roof redevelopment on existing buildings could help to restore watershed health over time. (Graham and Kim 2003) Not only are green roofs able to filter contaminants out of rainwater that has flowed across the roof surface (Dramstad et al., 1996), but they can also degrade contaminants, either by direct plant uptake, or by binding them within the growing medium itself (Johnston and Newton, 1996).

Numerous studies have demonstrated quantitatively that a properly installed and maintained green roof will absorb water and release it slowly over a period of time, as opposed to a conventional roof where stormwater is immediately discharged. Typical extensive green roofs, depending on the substrate depth, can retain 60 to 100% of the stormwater they receive (Thompson, 1998). In addition, living roofs are normally able to retain 70 to 80% of the stormwater that falls on them during the summer months, depending on the frequency of rain and drying rates. In winter months, green roofs are predicted to retain 25 - 40% of the stormwater. These data are subject to variation based on variations in climatic conditions. The amount retained also depends on numerous factors such as the volume and intensity of rainfall, the amount of time since the previous rainfall event, and the depth and saturation level of the existing substrate (Monterusso, 2003).

Green roofs can retain up to 60% of stormwater on an annual basis (Liesecke, 1993). Liesecke also indicated that there were noticeable differences between retention in warm weather and in cool weather. In warm weather, shallow substrate depth can retain 11% more stormwater than it can during cold weather (Liesecke, 1993). Liptan et al, (2003) demonstrated similar findings. Within a 15-month monitoring period, they found that precipitation retention was approximately 69% of the total. However, between December and March the rainfall retention was 59%, while from April to November, rainfall retention was 92%. Research conducted by Jennings et al. (2003) in North Carolina showed that a green roof can retain

up to 100% of the precipitation that falls on it in warm weather. However, the percentage retained for each storm decreased when there had not been an adequate amount of time between each storm event.

During a heavy downpour, pollution is mobilized from impermeable surfaces and transported with the water. Green roofs not only reduce the quantity of runoff from roofs but can also filter contaminants from rainwater. Runoff from urbanized areas is the leading source of water quality impairment. Most of the stormwater runoff enters water bodies directly without any treatment.

The substrate on the Green roof has the ability to retain particulate matter in the stormwater and to reduce the quantity of the runoff and, as a result the total mass of pollutants that flow off the roof. Thus, the stormwater runoff quality as well as the receiving surface water quality can be improved.

A number of studies have looked at green roof runoff quality. Dramstad et al. 1996 showed that the physical and chemical properties of the growing substrate, and the vegetation itself, help to control the nitrogen phosphorous and contaminants. These are either broken down by the plants themselves, or more usually bound in the substrate instead of being discharged in the runoff.

Of the many benefits of green roofs, the benefits from stormwater flow reduction including impact on the combined sewer overflow (CSO), are included in those with the most quantifiable monetary value. Capital expenditures and operating costs for wastewater treatment in combined sewer areas and stormwater treatment in separated sewer areas are typically assumed to be lessened by the rainfall captured by green roofs. Acks (2003)