



SarnaVert Green Roofing Systems

Sarnafil®



SarnaVert roofing - bringing natural

Green roofing: modern technology as old as the hills.

Human beings have utilised the benefits plants bring to structures since we emerged from caves, yet today many still see living green roofs as a new and unknown technology that remains to be proven.

The benefits of green roofing are clear and proven, with many national and/or local government authorities around the world providing grants, subsidies or planning benefits for buildings with living green roofs.

Through this document Sarnafil will use its 40 years of green roofing experience throughout Europe to demonstrate how a living green roof can provide social, economic and environmental benefits: the three cornerstones of sustainable development.

Positive climate change through living green roofs

Living green roofs provide a multitude of direct benefits including: social amenity, habitat creation to aid biodiversity, improved aesthetics, summer cooling, incident rainfall control, whole life cost savings, pollution control, oxygenation, absorption of solar energy, CO₂ capture and noise reduction.

Perhaps the most significant aspect of these multiple benefits is the contribution of green roofing to reducing the negative impact of development on climate change, especially global warming and flood risk.

Contributing to sustainable development

The increased population density of our cities, together with unsustainable construction practices, are widely recognised as significant contributors to climate change. The high density of buildings with predominantly black or dark coloured roofs contributes to extremes of temperature through the absorption and re-radiation of solar energy (the albedo or urban heat island effect), creating low humidity and high air pollution.

The use of a light coloured solar reflective membrane can make a significant reduction in the albedo effect. However,

the inclusion of planting on these roofs not only reduces the albedo effect, it can help to transform city areas, climatically and socially.

Successfully designed and installed living green roofs will provide an integral component in the sustainable development of the UK construction market by;

- *Increasing humidity and oxygenation of the atmosphere*
- *Reflection and absorption of solar energy without re-radiation, lowering temperatures (micro climate)*
- *Absorption of carbon dioxide and environmental pollution in general, providing air filtration, reducing pollution and binding airborne dust*
- *Reducing cooling and heating costs by stabilising building temperature through mass*
- *Reducing absorption of airborne noise (acoustics) through mass*

In particular, occupiers of higher floors benefit through evapotranspiration (the sum of evaporation and plant transpiration) from the living green roof in the summer, as moisture travels upwards, cooling the façade of the building.

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advantages to the built environment



Above: Private residence, Alresford, Hampshire.
Left: St John the Baptist Church Weston-super-Mare.
Both SarnaVert roofs by Hodge Single Ply with Blackdown Horticultural Consultants Ltd.



Green roofing provides a welcome contrast to concrete and tarmac areas surrounding Swan House in Newcastle upon Tyne.



Responsible solutions to urban

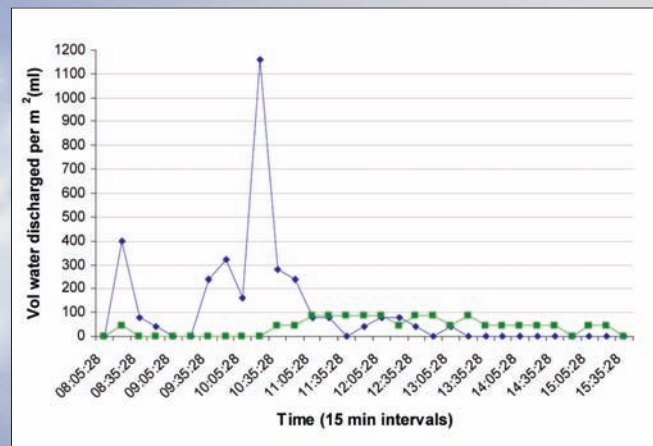
Water is our most precious natural resource. Green roofing can play an important role in its management and conservation.

Improved rainwater management

The management of incident rainfall is a significant issue facing the construction industry. Hard landscaping (car parks, pavements, etc) and roofs are all designed to remove rainfall from the point of incidence as quickly as possible, pushing masses of water into the same limited capacity underground drainage system, so that it all arrives at the same discharge point at the same time. These are the major factors that contribute to flooding and flood risk in urban environments.

A correctly designed living green roof, incorporating a growing medium, creates a replacement for the natural drainage reservoir removed through development of the site. Green roofs preserve the ability of the site to provide natural evaporation and transpiration lost through hard landscaping, by delaying the rainfall runoff from the roof for at least 30 minutes, enabling the incident rainfall to be managed, easing immediate demands on drainage and contributing to a sustainable drainage solution.

1. Rainfall episode preceded by a period of drought



Control —◆— Planted —■—



development challenges

Rainwater harvesting

As well as managing drainage, green roofs allow captured rainwater to be harvested for grey water use.

When contemplating this type of use, potential contaminants must be carefully considered, especially if using a copper based root barrier, which many bitumen based green roofing systems require. Sarnafil single-ply roofing membranes provide an ideal solution to overcome this problem.

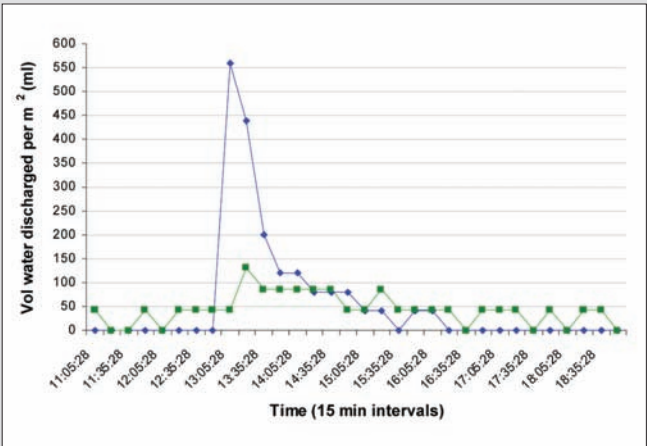
Habitat, amenity and aesthetics

With virtually every new building potentially removing a piece of the natural green landscape, a living green roof can be designed to replicate the pre-construction habitat, create an area of visual amenity for those in higher levels or turn the roof space into a functional garden for the building's users.

On multi-level buildings, in new and refurbishment applications, all of these can be achieved, potentially meeting the

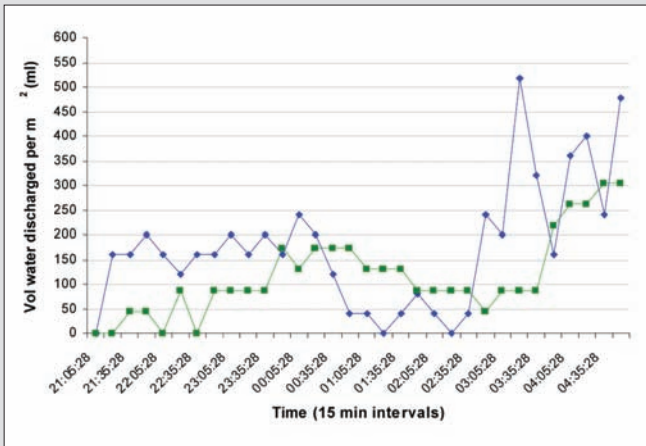
needs of planners, environmentalists and the building's occupiers. Additional benefits to the building's occupiers have been detailed in studies worldwide, with hospital patients' recovery times shortened, companies' productivity increased and inner city temperatures reduced.

2. Rainfall episode preceded by a period of intermittent rainfall



Control —●— Planted —■—

3. Rainfall episode preceded by a period of continuous rain



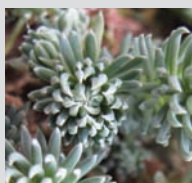
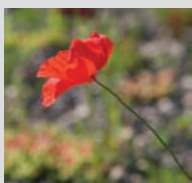
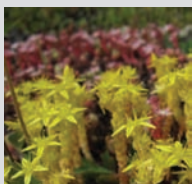
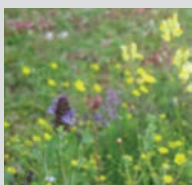
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Source: Blackdown Horticultural Consultants Ltd



SarnaVert extensive living green roofs

Proven green roofing benefits in a practical, low maintenance system.



A wide range of plant species is available

Extensive system overview

SarnaVert extensive living green roofs are self-sustaining, naturalistic and low maintenance systems, designed to incorporate a growing medium. They provide a raft of building performance benefits, reduce building impact and over time create a general habitat for a variety of flora and fauna.

SarnaVert extensive green roofs utilise vegetation designed to establish itself as a natural self-sustaining plant community, consisting of closely grown low plants such as mosses, succulents, herbaceous plants and grasses. These are able to withstand frost and drought, having modest nutrient requirements and a high regenerating capacity, enabling them to survive adverse conditions.

Installed on a relatively thin layer of growing medium with a correspondingly low weight, the system is suitable for new and refurbishment, flat- and pitched-roof projects where only small additional loads are possible.

Extensive planting systems require

minimal maintenance. However, annual inspection, removal of contaminants and a nutrient check are important for care and upkeep. The low-growing planting provides relatively limited scope for biodiversity.

- Naturalistic style planting systems require little care, irrigation or maintenance.
- Thin layer of lightweight growing medium, typically from 65 to 150mm.
- A wide range of grass, herbaceous, succulent and moss species can be used to establish self-sustaining plant communities.
- Annual maintenance is required.
- Applicable to 0 to 45° slope with special measures needed from 8° upwards. Pitches greater than 45° can be accommodated subject to design.
- Saturated system weights typically start at 80 to 90 kg/m². Lighter variations can be specified but the membrane will require independent attachment.

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The Northern Line Control Centre features a SarnaVert biodiverse roof. The building is adjacent to Highgate Wood, an important natural site in a built-up part of London. The roof provides an extension to natural habitats in the wood.

Growing Medium

SarnaVert growing medium is formulated on a project specific basis according to the geographical location, roof pitch and orientation, ensuring that optimal rates of plant establishment and development are achieved following installation. Installation is either by a trained SarnaVert roofing contractor or a Sarnafil horticultural partner.

Planting

Hydroplant and seed – vegetative parts and seeds are spread onto a prepared substrate at a density of 100-150g per m² and covered with liquid applied organic mulch. After application, the plant parts root and the seeds germinate, generating approximately 60% plant cover in 12 months. Installation is by a Sarnafil horticultural partner.

Plug plant, hydroplant and seed – as above with the addition of rooted plant material (plug plants) hand planted at a density of 16-20 plug plants per m². Approximately 60-70% coverage is achieved in 9 months. Note: Even though coverage is not

complete the appearance is still attractive, particularly if the roof is viewed from the ground. The appearance is similar to that of an Alpine scree bed.

NatureMat® System – developed and grown in Somerset by our horticultural partners, BHC, NatureMat® is a pregrown Sedum based plant layer with a minimum 90% mature plant cover.

When mature, after eight to ten months growth, the NatureMat® is rolled, transported to the roof and unrolled onto a prepared substrate to give an 'instant' green roof. In addition to the standard product NatureMat® can be contract grown to suit a client's requirements, subject to a 50% proforma payment.

NatureMat® is a registered trade mark of Blackdown Horticultural Consultants Ltd.

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London Zoo's Komodo Dragon House features a SarnaVert biodiverse green roof. This has been planted to replicate the favoured habitat of the Black Redstart (below). This protected bird species colonised the site almost as soon as construction was complete.



SarnaVert biodiverse living green roofs

SarnaVert biodiverse roofs extend the advantages of the green roof concept, to replace wildlife habitats lost by urban development.

Biodiverse system overview

Biodiverse living green roofs, also known as a brown roofs, are designed to meet the specific requirements of the local flora and/or fauna. Typically sympathetic to the original ground conditions, a biodiverse system will often be specified to meet local planning constraints or to meet a BAP (Biodiversity Action Plan). The correct design of a biodiverse living roof system should therefore involve parties with expertise relevant to the ultimate requirements of completed system.

In addition to utilising a growing medium, biodiverse living green roof specifications will often include boulders, shrubs, tree branches and other items to create an uneven surface to provide habitats for a variety of insect and bird species.

Growing medium

A biodiverse growing medium is typically similar to that of an extensive system but can, in some cases, include larger diameter medium and/or recycled aggregates from site. This can provide a cost benefit, by removing the requirement for removal of rubble or subsoil from the site.

Planting

Planting will always be specific to the biodiversity requirements and can therefore be left to nature to pollinate. Alternatively a wide variety of seed or annual wildflower mixes can be sourced to suit the requirements.

Intensive planting systems

In addition to its SarnaVert extensive and biodiverse green roofs, Sarnafil can also facilitate intensively planted roofs. These comprise a thick layer of soil (100mm+), in which a variety of plants, vegetables, shrubs and trees can be planted. These permit landscape design of roof areas for recreational or public spaces.

Depending on soil depth and planting, correspondingly higher loadings have to be allowed for. According to the plants selected, regular care and upkeep will be required, at a level approximately equivalent to that required for an ornamental garden.

Multiple design possibilities can be accommodated, incorporating pavers, decking and planters. Intensive planting is only suitable for roofs with shallow inclines.



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Above: Biodiverse planting and recycled aggregates on the roof of the Komodo Dragon House

This mimics the scrubland habitat of the Black Redstart (left), which has successfully colonised the site.

Shortwood Primary School in Telford features a dramatic, curved extensive green roof which complements the surrounding landscaping.



SarnaVert roofing - practical, cost-efficient

A good living green roof begins with design and ends with maintenance but lasts for decades.

A team approach to success

The most successful roofing systems are always the result of close collaboration between involved parties throughout the design and specification, installation and maintenance processes. That is why Sarnafil invests so heavily in supporting specifiers; training and working with roofing contractors; and providing comprehensive maintenance instructions that support market-leading guarantees.

Sarnafil living green and biodiverse roofs conform to this model. Each completed project is the culmination of a team effort between construction industry professionals – often with the added support of a horticulturalist.

Right from the start

For every project, a local Sarnafil Technical Adviser will work with the client or specifier to develop the initial specification and design details, establishing the parameters for the project and the correct living green roof systems to meet the demands.

Whole life cost benefits

Whichever Sarnafil living green roof system is selected and installed, it will provide a whole life cost benefit to the project and contribute to lower BREEAM ratings.

In a whole life cost study carried out by The Solution Organisation, Sarnafil extensive and biodiverse green roof systems each achieved lower whole life cost ratings than a traditional exposed flat roof membrane. Calculated using the Whole Life Cost Forum's online WLC calculator (www.wlcf.org.uk), this detailed report can be found at www.sarnafil.co.uk.

It is important to remember that a living green roof will change at the will of nature as it is established and matures. Living green roofs cannot be evaluated in the same way as man-made construction products.



solutions for all kinds of buildings

Green Roof System	Installed Cost	Net Present Value (NPV)	Total Whole Life Cost (TWLC)	Annual Whole Life Cost (AWLC)	WLC Ranking
Exposed only	£47,000	-£49,160	£51,500	£1,716	3
Sedum covered	£93,000	-£21,268	-£132,000	£2,640	2
Biodiverse covered	£79,000	£7,453	-£175,800	-£3,516	1

NPV is net present value using a 6% discount rate in a discounted cash flow; a negative number indicates cost rather than value. The highest positive number indicates best option.

TWLC is total whole life cost using a non-discounted cash flow. A negative number indicates a net inflow of cash; highest negative number is best option.

AWLC is the TWLC divided by the life of the product. It is in effect the annualised cost of the product. A negative number indicates a net annual inflow; highest negative number is best option.



Above and above right: Larmenier and Sacred Heart Primary School, Hammersmith, London
Photographs courtesy of Studio E

Draw on our knowledge and expertise

Sarnafil offers a comprehensive range of information and support resources for architects, contractors and other specifiers, including:

- Experienced Technical Advisers, who can help you to develop specifications
- Comprehensive technical literature
- Scaleable, layered CAD detail drawings available to download free online at www.sarnafil.co.uk

Sarnafil is the complete single ply roofing specialist for:

- Surveys and site inspections
- Specification and design support
- New installations
- Refurbishment
- CPD Seminars
- Installer training
- ISO 9000:2000 quality management system
- ISO 14001 environmental management system

The Single Ply Roofing Association (SPRA)

represents membrane manufacturers, associated component manufacturers and specialist sub contractors and aims, through a quality assured partnership, to ensure the delivery of best value single ply roofing systems.

By specifying products and specialist installation by SPRA Manufacturer, Associate and Contractor members you can be assured that all parties meet strict quality criteria. Compliance with these criteria and with the Code of Conduct is assessed at application, by annual audit and by random spot checks.

For further information, and to obtain copies of the SPRA Design Guide and other documents, go to www.spra.co.uk or call 0115 914 4445.



www.sarnafil.co.uk



Sarnafil Ltd.

Robberds Way, Bowthorpe, Norwich NR5 9JF
Tel: 01603 748985, Fax: 01603 743054, www.sarnafil.co.uk

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