

## OPERATIONS & MAINTENANCE MANUAL

# YOUR SKY GARDEN WILDFLOWER SYSTEM

### SKY GARDEN WILDFLOWER SYSTEM

#### INTRODUCTION

This manual has been produced to benefit you, the owner of a Sky Garden wildflower system. It provides you with the documentation required to understand how your roof was installed and a breakdown of the Sky Garden wildflower system specification. This manual also offers you advice regarding your warranty and how to maintain your roof.

Sky Garden's wildflower system offers an extensive solution, utilising pre-grown wildflower mats or plugs, grown at our farm in the Cotswolds.

We recommend that green roofs are maintained bi-annually to remove unwanted species and ensure long term functionality.

By following the instructions supplied in this manual, you can enjoy your green roof for years to come.



## SYSTEM OVERVIEW

COMPONENT	SUMMARY	DEPTH
Protection Layer	300g/m <sup>2</sup> geosynthetic protection fleece, manufactured using high tenacity virgin polypropylene staple fibre. Conforms with BS EN ISO 9863:1.	3.5mm
Drainage / Reservoir Board	Cusplate board with adhered or loose laid top filter fleece and manufactured from HDPE. Combined function as a water retention layer and filtration layer.	10mm/20mm/40mm/60mm
Extensive Substrate	A specially blended mix of free draining organic material with clean, screened aggregates to provide a lightweight low nutrient water retentive growing medium. Tested in line with BS8616.	100mm+ for Wildflower Blanket 100mm + for Wildflower Plug
Wildflower Blanket	High quality, pre-cultivated Wildflower Blanket grown in the UK to provide the perfect solution for green roof systems. Contains 33 wildflower species and 5 grasses.	20mm including growing medium.
Wildflower Plug	Pre-cultivated propagated plugs grown in substrate in a controlled environment. 34 species.	Grown in 60mm deep trays.
Riverstone Border	Mixed, rounded naturally occurring stones. Washed.	75mm
Aluminium Edge Profile	A mid sheen, 1.5mm thick aluminium up stand and connecting plant, perforated for drainage.	100mm+

All product data sheets are available on our website.





## INSTALLATION PROCEDURE

- The Roof was initially checked to ensure that a safe working environment was in place i.e. edge protection/scaffold or man safe system was present. Sky Garden or the contractor ensured lifting equipment was ready to lift materials to the roof. Ensuring all other trades had finished working on the roof before work commences.
- Protection fleece was installed, if necessary, with overlaps of 100mm to ensure protection of the waterproofing layer.
- The drainage layer was placed onto the roof ensuring a continuous drainage layer was formed. Drainage was cut at perimeters of the roof leaving a neat edge. Where protruding skylights etc came through the roof the drainage layer was butted to the protrusion and in a similar method to that of the roof perimeter the drainage was cut leaving a neat edge.
- If required a filter fleece was rolled onto the drainage layer to protect the layer from being blocked by fines. The fleece was overlapped by 100mm to again prevent any blockage of the drainage layer.
- The aluminium edge retention detail was loose laid where required.
- Riverstone borders have been installed in line with GRO guidelines (500mm against vertical elements and openings) to provide a fire break around penetrations and vertical elements. Unless otherwise requested, Sky Garden have followed the DCLG and GRO Guidelines on river stone borders and fire breaks.
- Substrate is installed on top of the drainage board. An allowance for settlement over time has been included. The depth of the substrate on your green roof will depend on the vegetative finish specified.
- Vegetation layer is installed and is specific to your specification and project scope. The optimum period to install most vegetation is late September/early October, and late March/early April. Extra care must be taken during the months of June, July and August to ensure live material does not overheat – refrigerated delivery vehicles and off-loading within 24 hours are recommended. Extra irrigation may be required during summer months, these are discussed below.

**Live product must be unloaded and watered immediately upon installation. If watering is not implemented immediately and for the first 12 weeks in situ, Sky-Garden cannot take responsibility for the growth and success of the vegetation. This is especially important during the period 01/05 - 30/09 each year. For pitched roofs over 10 degrees, we would recommend the installation of a permanent irrigation system.**

- Irrigation should take the form of complete system saturation at least once a week, in the first 12 weeks following installation. These same steps should be taken during prolonged periods of hot and dry weather.
- If you have sprinklers, regularly check that the sprinklers are correctly positioned, prevailing wind may affect coverage.
- If you have a storage tank, regularly check that the tank water is suitable for the roof irrigation and regularly check that the submersible pump remains submerged in the tank.
- If the water becomes contaminated, turn off the irrigation immediately and drain the system.
- With the onset of winter, the system will need to be drained and decommissioned.

## THE VEGETATION

Please note that plants will not be 'green' all year around. It is quite common for the plants to change colour at different times of the year, particularly when under stress from lack of water or in frosty conditions. In the Spring and Summer, the plants will flower, and it is quite common for some of the varieties of plant in the blanket to die back in the Winter. Maintenance of the vegetation should concentrate on the removal of weeds and to ensure healthy growth, in the unlikely event the live vegetation appears to be of low coverage or struggling then fertiliser should be applied to aid long-term growth.

Should the weather be particularly dry during the first 2 months post installation, watering is essential to ensure the green roof establishes itself as quickly as possible. This should be administered once every two to three days system is at full saturation. If you want it to remain 'green and luscious' in dry conditions, you should consider the installation of an irrigation system. Permanent or Temporary irrigation system should be drained during the winter months. Frost build up in the pipes will expand them and potentially cause leaks and a drop in pressure, we recommend this is done between October and April months each year after installation. A maintenance package with Sky Garden can ensure this is undertaken when needed.



Regular checks should be undertaken to ensure that high winds or heavy rainfall have not moved or dislodged any of the materials. This is essential during the first few months as the plants will not have fully rooted into the underlying layers and will be more vulnerable. The movement of products is unlikely but possible in extremes of weather. Should it move, providing it has not been damaged, simply move it back and water in well.

## DRAINAGE

Open drains should be checked for build-up of dead vegetative material and cleaned as appropriate at each 6 month/annual inspection. This also applies to covered drainage outlets. It is important that you ensure good drainage off the roof is maintained for the lifespan of the green roof.

## MAINTENANCE

If our Sky-Garden maintenance package has been purchased then it includes bi-annual visits: one in the spring / early summer and one autumnal visit, we also offer general roof inspections and assessments. All visits are carried out by our own registered living roof maintenance teams who are experienced with our systems and understand the key elements of long-term living roof success.

Any fertiliser and/or weed control treatments are included as part of the package and will be undertaken by certified employees only. Our fertiliser or weed killer applications come from a range of products developed specifically for Sky-Garden roof systems and are natural organic or naturally derived. Herbicides are species specific, low impact and used only as a last resort to tackle invasive or widespread weed problems.

The standard maintenance package will run over a 12 month period from the date of the contract and will contain two visits to inspect and carry out the required works.

Should you require more information on Green Roof maintenance, or if you would like to purchase a Maintenance package, please scan the QR code below or visit our website: <https://www.sky-garden.co.uk/green-roofs/green-roof-maintenance/>.



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DATA SHEET

# SKY GARDEN PROTECTION FLEECE PF01

Version 1.0

## SKY GARDEN PROTECTION FLEECE

Sky Garden protection fleece is a thick needle punched non-woven geotextile manufactured from 100% virgin polypropylene high tenancy fibres containing 1% active carbon black. Manufactured from a unique blend of high tenancy fibres providing class leading durability. Optimised for maximum strength, performance and UV stability.

- For use on all green roof and podium systems.
- 100% virgin polypropylene.
- 3.5mm thick.
- Supplied in 50m x 1m rolls weighing 14kg.
- BS EN ISO9001



## TECHNICAL PROPERTIES

Mechanical Properties	Test Standard	Units	Product Value
Static Puncture (CBR)	EN ISO 12236	kN	2.5
Push through displacement	EN ISO 12236	mm	65
Tensile Strength (MD/CMD)	EN ISO 10319	kN/m	15
Tensile Elongation (MD/CMD)	EN ISO 10319	%	80
Cone Drop	EN ISO 13433	mm	10

Filter Properties	Test Standard	Units	Product Value
Apparent opening size	EN ISO 12956	µm	150
Water Permeability	EN ISO 11058	(l/m <sup>2</sup> -s)	100
Coefficient of permeability	EN ISO 11058	(m/s 10 <sup>-3</sup> )	7

Durability	Test Standard	Product Value
Weathering 50 MJ/m <sup>2</sup> (1 month)	EN ISO 12224	>90% Retained Strength
Microbiological Resistance	EN ISO 12225	No Loss in Strength
Resistance to Acids & Alkalis	EN ISO 14030	No Loss in Strength
Oxidation at 112 days (110 years)	EN ISO 13438	>90% Retained Strength



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# SKY GARDEN 40MM DRAINAGE BOARD DDRD40

Version 1.0

## SKY GARDEN 40MM DRAINAGE BOARD

Rigid drainage board manufactured from HDPE. Combined function as a water-retention, drainage and filtration layer. Rigid sheet with integrated Polypropylene filter layer. Studded HDPE sheets contains perforations to drain surplus water and high capacity dimples (height c.20mm) for water retention. High compressive strength (115kPa). Delivery and installation according to Sky Garden instruction. Product arrives in 48.5 m2 size rolls.



## TECHNICAL PROPERTIES

Property	Test Standard	Units	Product Value
Polymer	100% Recycled High Density Polyethylene		
Nominal Thickness		mm	40
Grammage		g/m2	1,800
Colour			Black/Grey
Max. Compressive Strength (Unfilled)	DIN EN ISO 25619-2	kN/m2	118
Flammability	DIN EN ISO 11925-2		E
Water Reservoir (Unfilled)		l/m2	8.7
Filling Volume		l/m2	16
Drainage Board Size		m	2.0 x 1.0
Quantity per Pallet (2.05 x 1.05m Pallet)		m2	600
Weight (per 2.0 x 1.0m Board)		kg	3.6



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# SKY GARDEN EXTENSIVE SUBSTRATE SBS01

Version 1.0

## SKY GARDEN EXTENSIVE SUBSTRATE

A free draining, low nutrient and moisture retentive growing medium made from 100% recycled material in line with the UK Green Roof Code of best practice. Testing conforms within the BS8616:2019 green roof substrate testing methods and was completed by STRI.





## SYSTEM CONSIDERATIONS

- A free draining substrate suitable for use on Extensive Roof Systems and all plant finishes.
- Minimum recommended depth: 50 mm
- Free draining when saturated
- Allows root penetration
- Recycled content
- Organic material PAS100 certified.

## PHYSICAL PROPERTIES

Bulk Density When Oven Dried	0.80 g cm <sup>-3</sup> (800 kg/m <sup>3</sup> )
Bulk Density at Field Capacity	1.10 g cm <sup>-3</sup> (1100 kg/m <sup>3</sup> )
Calculated Bulk Density at Saturation	1.36 g cm <sup>-3</sup> (1360 kg/m <sup>3</sup> )
Field Capacity (% v/v)	29.2 % v/v
Total Porosity (%)	55.80%
Porosity at Field Capacity (%)	26.60%

## TECHNICAL PROPERTIES

Organic matter (% weight)	2.6%
pH	7.8
Electrical Conductivity (mS cm <sup>-1</sup> )	2.22 mS cm <sup>-1</sup>
Phosphate (mg l <sup>-1</sup> )	127 mg l <sup>-1</sup>
Potassium (mg l <sup>-1</sup> )	435 mg l <sup>-1</sup>
Total nitrogen (%)	0.04%

## SPECIFICATION DESCRIPTION

All testing of Sky Garden Ltd Substrate was completed by Sports Turf Research Institute under the BS8616:2019 Specification for Performance Parameters and Test Methods for Green Roof Substrates. A specially blended mix of free draining organic material with clean and screened aggregates, recycled from certifiable waste products from the building industry to provide a low nutrient water retentive growing medium.



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# SKY GARDEN ALUMINIUM EDGE RE100

Version 1.0

## SKY GARDEN ALUMINIUM EDGE

An attractive, contemporary alternative to purpose built, rendered lead or aluminium capped parapets. For use on exposed system edges to maintain the integrity of the green roof system during aeolian or storm events. Can be loosely laid and ballasted in place, but recommended to be glued in place. Adhesive is available from Sky Garden Ltd, however we recommend that any adhesive used is checked with the waterproof membrane manufacturer before use. The aluminium edging is lightweight, robust and can be cut to length, slots cut into edging for drainage requirements.



## TECHNICAL PROPERTIES

Material	A mid sheen 1.5 mm thickness aluminium up-stand and connecting plate, perforated for drainage.
Thickness	1.5mm
Finish	Mid Sheen Natural (Unpainted)
Height	100mm (Available in Other Sizes)
Length	2400mm or 1000mm
Base	100mm
Lengths Per Pallet	Max 210
Powder Coating	Available in any RAL colour



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# SKY GARDEN RIVERSTONE RS01

Version 1.0

## SKY GARDEN RIVERSTONE

Natural rounded stones for use as system ballast and perimeter borders to all living roof and bio-diverse roof installations, providing areas of free drainage, whilst acting as an effective barrier, helping to restrict the spread of plant material to drainage and gutter outlets.

- Provides free flowing drainage
- Contemporary, natural and aesthetic,
- Stone borders should be installed to 75mm in depth to a minimum width 500mm around all openings, penetrations and vertical abutments.



## TECHNICAL PROPERTIES

Composition	Mixed Rounded Naturally occurring Stones
Depth	c.75mm (Typical Ballast Margin)
Colour	Mixed (Normally Grey/Brown)
Shape	Rounded
Unit Width	20-40mm
Consignment Size	25kg Bags/Bulk Bags 1 m <sup>3</sup>
Treatment	Washed



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# SKY GARDEN WILDFLOWER BLANKET SGWB01

Version 1.0

## SKY GARDEN WILDFLOWER BLANKET

Sky Garden's UK provenance Biodiverse Wildflower Blanket contains 38 native species (33 wildflower and 5 grasses) as a pre-grown vegetation cover for use on Extensive and Intensive green roofs, podiums and landscaping projects. Species have been carefully chosen to provide a long flowering season from Spring through to late Autumn. It has a varied range of colour and habitat which is attractive to pollinators and in aesthetic appearance. Sky Garden's Biodiverse Wildflower Blanket can be used to meet local and national Biodiversity Action Plans and BREEAM energy credits. A pre-cultivated UK grown vegetation blanket, containing 38 species specifically chosen to encourage biodiversity on Extensive, Intensive and Podium roof applications. Grown on 20 mm substrate base on a carrier membrane.





## SYSTEM CONSIDERATIONS

- Instant vegetative cover for wildflower systems.
- Recommended minimum substrate depth 100mm.
- Sky Garden recommends bi-annual maintenance of wildflower roofs to remove unwanted invasive species and to ensure long term system functionality and sustainability.
- Spring remedial and Autumn strimming.

## PHYSICAL PROPERTIES

Composition	Base - Geotextile fabric	
	Growing Medium - 20 mm Biodiversity Mix	
	Vegetation - Plants grown from native provenance seed.	
Total Height	150 mm plant height, pre delivered and mown. Fully established height up to c. 1000 mm	
Weight (dry)	10 kg/m <sup>2</sup>	
Weight (saturated)	30 kg/m <sup>2</sup>	
Consignment Size	30 m <sup>2</sup> per Pallet (approx.)	
Colour	Seasonal variation	
Sizes	2m x 1m	
Species	<p><b>Wildflowers:</b></p> <ul style="list-style-type: none"> <li>• Achillea Millefolium (Yarrow)</li> <li>• Agrimonia Eupatoria (Agrimony)</li> <li>• Anthyllis Vulneraria (Kidney Vetch)</li> <li>• Betonica Officinalis (Betony)</li> <li>• Campanula Glomerata (Clustered Bellflower)</li> <li>• Campanula Rotundifolia (Harebell)</li> <li>• Centaurea Nigra (Lesser Knapweed)</li> <li>• Echium Vulgare (Viper's Bugloss)</li> <li>• Galium Verum (Lady's Bedstraw)</li> <li>• Glebionis Segetum (Cornflower Corn Marigold)</li> <li>• Hypericum Perforatum (Perforate St John's Wort)</li> <li>• Hypochaeris Radicata (Catsear)</li> <li>• Knautia Arvensis (Field Scabious)</li> <li>• Leontodon Hispidus (Rough Hawkbit)</li> <li>• Leucanthemum Vulgare (Oxeye Daisy)</li> <li>• Linaria Vulgaris (Common Toadflax)</li> <li>• Lotus Corniculatus (Birdsfoot Trefoil)</li> <li>• Medicago Lupulina (Black Medic)</li> <li>• Origanum vulgare (Wild Marjoram)</li> </ul>	<ul style="list-style-type: none"> <li>• Papaver Rhoëas (Common Poppy)</li> <li>• Plantago Media (Hoary Plantain)</li> <li>• Primula Veris (Cowslip)</li> <li>• Prunella Vulgaris (Selfheal)</li> <li>• Ranunculus Acris (Meadow Buttercup)</li> <li>• Rhinanthus Minor (Yellow Rattle)</li> <li>• Rumex Acetosa (Common Sorrel)</li> <li>• Sanguisorba Minor SSP. Minor (Salad Burnet)</li> <li>• Scabiosa columbaria (Small Scabious)</li> <li>• Silene Sioica (Red Campion), Silene Vulgaris (Bladder Campion)</li> <li>• Thymus (Thyme), Trifolium Pratense (Red Clover).</li> </ul> <p><b>Grasses:</b></p> <ul style="list-style-type: none"> <li>• Agrostis Capillaris (Brown Top Bent)</li> <li>• Anthoxanthum Odoratum (Sweet Vernal Grass)</li> <li>• Briza Media (Quaking Grass)</li> <li>• Cynosurus Cristatus (Crested Dogstail)</li> <li>• Festuca Rubra (Red Fescue)</li> </ul>



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# SKY GARDEN WILDFLOWER PLUGS SGWP01

Version 1.0

## SKY GARDEN WILDFLOWER PLUGS

Pre-cultivated propagated plug-plants planted directly into the substrate. The biodiverse plug-plants are seeded and grown with a wide range of native wildflower species suited to the harsh Green Roof environment. Installed and maintained correctly, plants will colonise the roof area. Sky Garden's Wildflower Plugs are available as 34 native species for use on extensive and intensive green roofs, podiums and landscaping projects. The species have been chosen to provide a long flowering season from Spring through to Autumn. Sky Garden's Wildflower Plugs can be used to meet local and national biodiversity action plans and BREEAM ecology credits.



## SYSTEM CONSIDERATIONS

- Plugs are propagated and nurtured at the Sky Garden nursery which ensures plants are fully acclimatised for UK installation.
- Recommended minimum substrate 100mm planted at 20 per m<sup>2</sup>.
- Wildflower systems must be watered before and after planting and for at least 3 months following installation.
- Sky Garden recommends bi-annual maintenance of wildflower roofs to remove unwanted invasive species and to ensure long term system functionality and sustainability.

## Physical Properties

Material	Propagated and germinated in recycled green waste and mineral blend growing medium in a controlled environment, ensuring stronger plant growth and development.
Recommended Substrate Depth	100 mm
Unit Size	40 x 40 x 60 mm
Plugs Per Tray	60





## SPECIES MIX

### WILDFLOWER:

- Achillea Millefolium (Yarrow)
- Agrimonia Eupatoria (Agrimony)
- Anthyllis Vulneraria (Kidney Vetch)
- Betonica Officinalis (Betony)
- Campanula Glomerata (Clustered Bellflower)
- Campanula Rotundifolia (Harebell)
- Centaurea Nigra (Lesser Knapweed)
- Echium Vulgare (Viper's Bugloss)
- Galium Verum (Lady's Bedstraw)
- Glebionis Segetum (Cornflower Corn Marigold)
- Hypericum Perforatum (Perforate St John's Wort)
- Hypochaeris Radicata (Catsear)
- Knautia Arvensis (Field Scabious)
- Leontodon Hispidus (Rough Hawkbit)
- Leucanthemum Vulgare (Oxeye Daisy)
- Linaria Vulgaris (Common Toadflax)
- Lotus Corniculatus (Birdsfoot Trefoil)
- Medicago Lupulina (Black Medic)
- Origanum Vulgare (Wild Marjoram)
- Papaver Rhoenas (Common Poppy)
- Plantago Media (Hoary Plantain)
- Primula Veris (Cowslip)
- Prunella Vulgaris (Selfheal)
- Ranunculus Acris (Meadow Buttercup)
- Rhinanthus Minor (Yellow Rattle)
- Rumex Acetosa (Common Sorrel)
- Sanguisorba Minor SSP. Minor (Salad Burnet)
- Scabiosa Columbaria (Small Scabious)
- Silene Dioica (Red Champion)
- Silene Vulgaris (Bladder Champion)
- Thymus (Thyme)
- Trifolium Pratense (Red Clover).

### GRASSES:

- Agrostis Capillaris (Brown Top Bent)
- Anthoxanthum Odoratum (Sweet Vernal Grass)
- Briza Media (Quaking Grass)
- Cynosurus Cristatus (Crested Dogstail)
- Festuca Rubra (Red Fescue)



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