GARDEN ROOF® PLANNING GUIDE

FROM CONCEPT TO COMPLETION

HYDROTECH®

BUILDING TRUST

Sika®

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Cover Photo - 1101 Dexter - Seattle, WA

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INTRODUCTION TO HYDROTECH'S GARDEN ROOF®

Tri-City Wastewater - Oregon City, OR

Challenges of the Built World

Introduction

As our cities continue to grow, the natural landscape and green open spaces are being replaced with buildings, parking lots and roadways of concrete and asphalt. Open green spaces within city centers are decreasing as the strong demand for buildable land increases.

Temperatures within dense urban areas have been observed to be 3 - 10 degrees F warmer compared to temperatures in the greener outlying areas. Commonly referred to as the "urban heat island effect," this dome of heated air creates an unhealthy environment in which polluted air, smog and higher temperatures take their toll on human, animal and plant life. While damaging to living systems, this increased temperature also increases energy demands to keep buildings cool in the heat of summer.

To a great extent, the building rooftops, parking lots and roadways that make up the cityscape are impervious to water. This often results in an overload of the existing drainage and sewer systems and increases the risk of flooding following a heavy rain. Continued development in cities only adds to these problems making improvements to the existing sewer infrastructure very costly.

Handling this ever increasing amount of stormwater runoff used to involve dumping this water into pipes that led to rivers where it was forgotten. In many instances across the United States, these sewers that carry stormwater runoff also transport raw sewage. Heavy rains often created unhealthy conditions especially in areas where drinking water was drawn from these waters. Construction of detention and retention ponds—another common method for dealing with stormwater—is extraordinarily expensive in urban areas due to high land costs.

Ultimately, the increasing pollution in this runoff led to the passage of laws to protect the rivers, streams and oceans and to new ways of handling this ever increasing volume of stormwater.

The Environmental Protection Agency has been tasked with developing and encouraging new ways to handle this stormwater issue while enforcing the laws and regulations designed to protect the nation's waterways, environment and drinking water supplies. Numerous technologies and innovations have been developed to bring permeability back to the built environment and to promote returning water to the ground as soon as possible.

Replacing the impervious surface of a conventional roof with a vegetated roof can help to substantially reduce stormwater runoff and help to restore the balance with nature in our urban centers.

Hydrotech's Garden Roof® Assemblies combine the proven performance of our Monolithic Membrane 6125® waterproofing/ roofing membrane with proven vegetated roof technology. Hydrotech's Garden Roof® Assemblies are lightweight and can be installed on a wider range and variety of new and existing structures and buildings.

Vegetated Roof Benefits

A vegetated roof can provide numerous economic and ecological benefits to the building's owner.

Economic Benefits

- **Increased Roof Life Expectancy:** A vegetated roof is in essence a Protected Membrane Roof (PMR) Assembly which protects the roof membrane from climatic extremes, UV degradation and physical abuse.
- **Additional Usable Space:** Property values can increase by making rooftop space a beautiful amenity for use by its occupants.
- **Building Incentives:** Many municipalities and government agencies offer incentives including tax relief, increased floor/area ratio (FAR) benefits and expedited permitting as well as outright payments for vegetated roof construction.
- **Marketing:** Many organizations have used vegetated roofs as examples of their commitment to sustainable initiatives. A vegetated roof can be a very public statement that contributes towards their image and branding efforts.

Environmental Benefits

- **Mitigates Urban Heat Island Effect:** Vegetated roofs can be up to 50 degrees cooler than traditional roofs and can help lower the ambient temperature of urban areas.
- **Re-creates Habitat:** Vegetated roofs can provide much needed green spaces to encourage the return of insects and animals to urban areas.
- **Oxygen Production and Carbon Sink:** Natural transpiration and respiration of plants on a vegetated roof generates oxygen and creates places for carbon sequestration.
- **Noise Mitigation:** Vegetated roofs can help to reduce noise transmission into the interior spaces of the building.
- **Reduction of Dust and Smog Levels:** Plants and growing media can trap particulates and pollutants.

Stormwater Benefits

- **Volume Reduction:** Vegetated roofs have the ability to greatly reduce the amount of runoff by keeping much of the water within the assembly and the growing media, much like a sponge.
- **Time Delay:** Along with volume reduction, vegetated roofs delay the release of stormwater from rooftops as it filters through the assembly to a drain.
- **Filtering Effects:** Vegetated roofs act as filters for stormwater by trapping fines within the growing media and components.
- **Downstream Benefits:** Vegetated roofs allow for downsizing or elimination of traditional stormwater management methods (pipe storage, cisterns, vaults, etc.).

Additional Benefits

- **Therapeutic and Healing Environments:** Vegetated roofs have been used to convert otherwise unused rooftops into unique healing landscapes for hospitals and healthcare facilities.
- **Urban Agriculture:** Rooftops in dense urban areas represent a valuable resource for food production. Production of many different kinds of high-value vegetable and fruit crops as well as beekeeping for honey have been generated on vegetated roofs designed for urban agriculture.

The Solaire - New York, NY

Denver Justice Center - Denver, CO

Green Building Design – Credits and Points

Vegetated roofs can significantly contribute to the various credits and points used by a number of organizations in evaluating green building design and construction, including:

- LEED™ (United States Green Building Council)
- Sustainable Sites Initiative™ (ASLA)
- Roof Point™ (Center for Environmental Innovation in Roofing)
- Living Building Challenge (International Living Future Institute™)

Hydrotech's Advantage

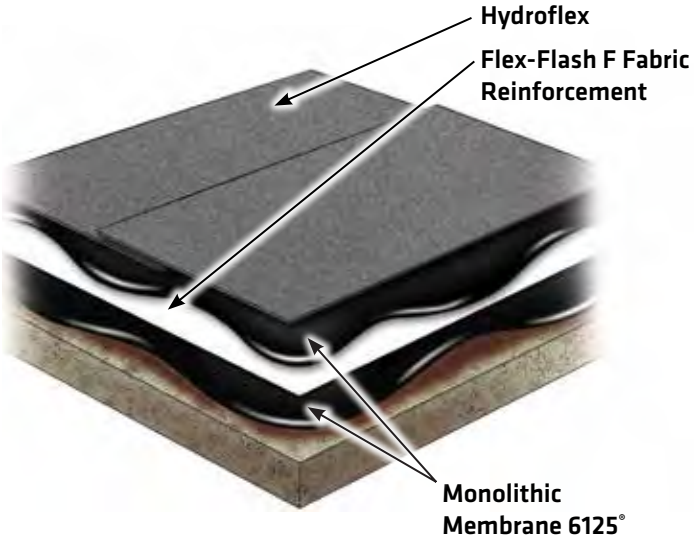
From the Roof Membrane to the Plants

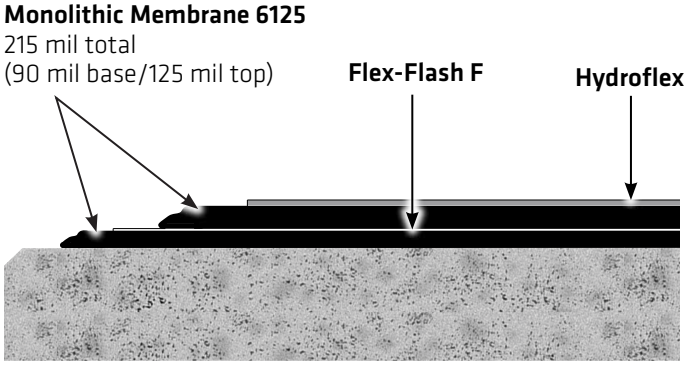
American Hydrotech, Inc. understands that a vegetated roof must function first as a roof, keeping the structure watertight and at the same time provide an environment conducive to the growth of vegetation. Hydrotech's Garden Roof® Assemblies accomplish this by incorporating the very best in moisture protection and proven vegetated roof technology.

Building from the bottom up

As a manufacturer of quality waterproofing and roofing products, Hydrotech's flagship product Monolithic Membrane 6125® (MM6125®), a hot, fluid applied rubberized asphalt, has been keeping buildings watertight for over 50 years. Monolithic Membrane 6125®, which contains up to 40% recycled post-consumer content, is the membrane of choice for Hydrotech's Garden Roof® Assemblies. MM6125® has been used in fountains, pools, reflecting ponds, planters and other applications where contact with water is to be expected. In addition to MM6125®'s ability to perform in a wet, submerged condition, MM6125® has many other unique qualities that make it the best choice for Garden Roof® applications.

- There are no seams to fail; it is completely monolithic
- Bonded directly to the substrate
- Can be installed on substrates with little or no slope
- Easy to detail all critical penetrations and terminations
- Resistant to fertilizers and other mild acids
- No VOC restrictions; contains no PVCs
- Installed only by authorized, trained applicators





*** Membrane shown at actual thickness**

Protected Membrane Roof (PMR) Advantage

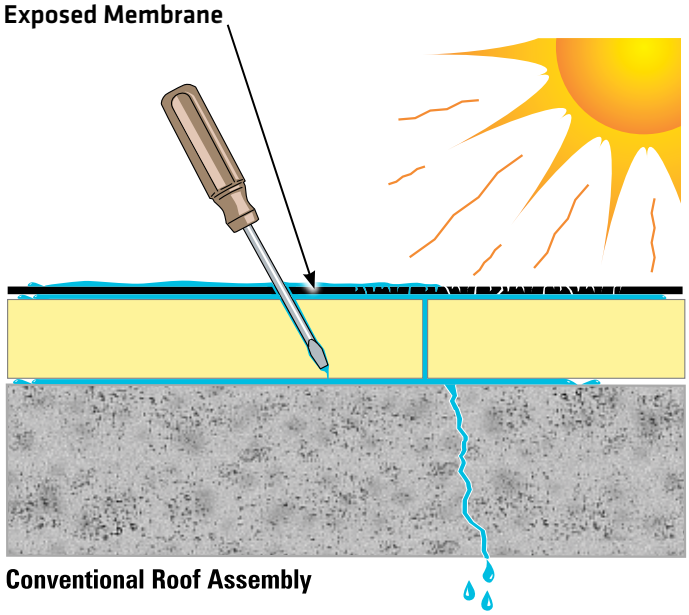
Conventional thinking in roof design

A short history lesson in roofing... As building structures became bigger (after WWII), and these larger areas could not be effectively covered with steep roofs, the technology of the flat roof evolved. Without steep sloped roofs to shed water, roofs required a new element - waterproofing. To meet this requirement, the roofing industry began to mop asphalt directly to the roof deck. As fuel costs increased, energy efficiency became an important factor and insulation was added to the roof assembly. Since most insulating materials were not water-resistant (and still aren't today), the insulation had to be placed on the deck, under the waterproofing membrane for protection. This system became known as a **conventional insulated roof assembly.** With the membrane now on top, it is no longer kept at a relatively constant temperature, exposing it to a new set of conditions and stresses.

A conventional roof design leaves the membrane vulnerable to many factors.

- Extreme and often sudden temperature changes: high summer roof temperatures, lower winter temperatures, as well as freeze-thaw cycling
- Physical abuse from heavy foot traffic and routine maintenance
- Ultraviolet light exposure

Exposure to all of these factors weakens the integrity of the membrane. Once the membrane is compromised, moisture can enter the assembly, which can cause a loss in thermal efficiency and water leakage into the building.

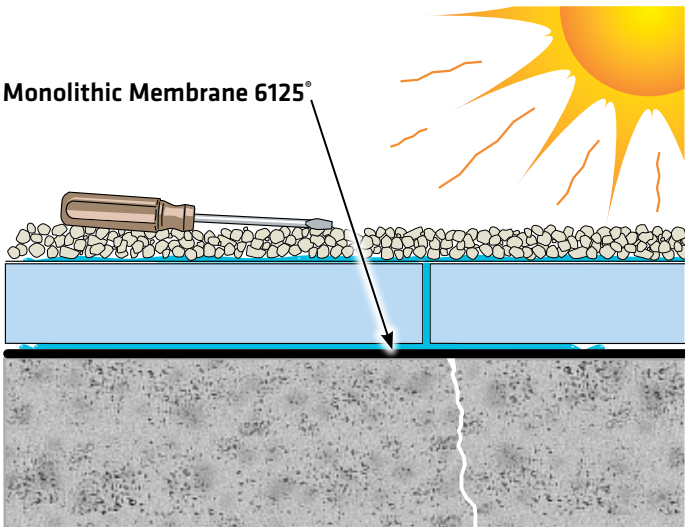


Conventional Roof Assembly

Unconventional common sense in roofing technology

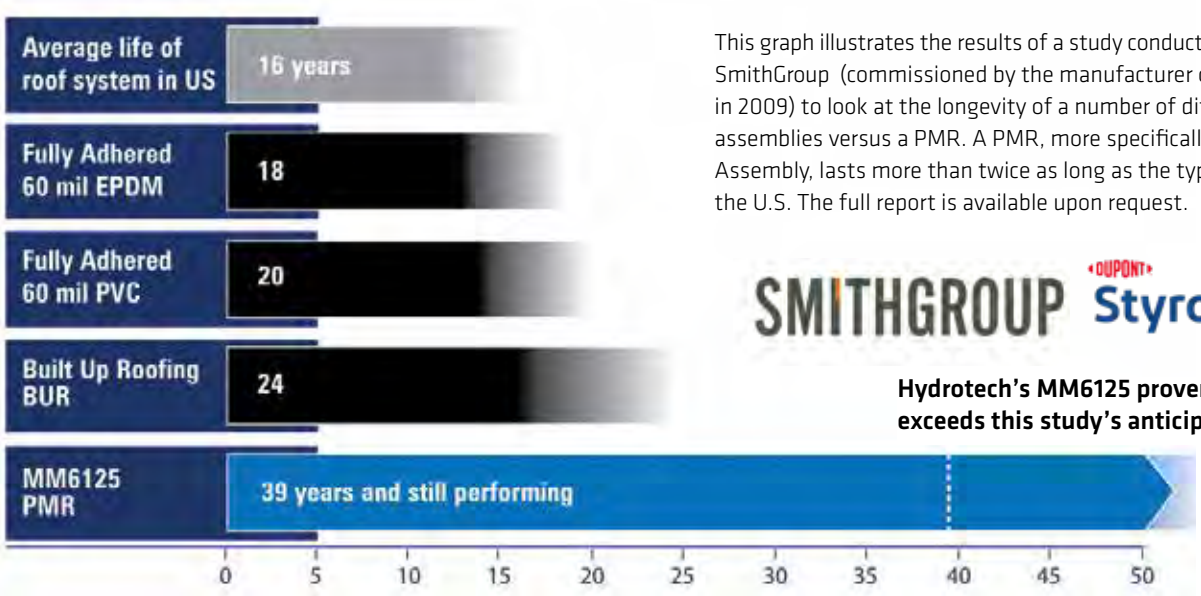
A better way is possible because of DuPont's STYROFOAM™ brand roof insulation, a closed cell polystyrene that is highly moisture-resistant. Placed on top of Hydrotech's Monolithic Membrane 6125®, it offers protection from the harsh roof environment. This arrangement of roofing materials - roof deck, waterproofing membrane, moisture-resistant insulation and ballast - is commonly referred to as a **Protected Membrane Roof (PMR) Assembly**. By simply placing insulation on top of the membrane rather than beneath, most roofing problems caused by Mother Nature and physical abuse can be eliminated.

An added benefit to a Hydrotech PMR is that Monolithic Membrane 6125® is fully bonded to the substrate, so if it is ever damaged (unlike a loose laid, single-ply membrane) water migration below the membrane is restricted, making it easy to locate and repair.



Protected Membrane Roof Assembly

Life Cycle Cost Advantage



Anticipated Service Life (per study)

This graph illustrates the results of a study conducted by the SmithGroup (commissioned by the manufacturer of STYROFOAM in 2009) to look at the longevity of a number of different roof assemblies versus a PMR. A PMR, more specifically a Hydrotech PMR Assembly, lasts more than twice as long as the typical roof system in the U.S. The full report is available upon request.

SMITHGROUP DUPONT Styrofoam Brand

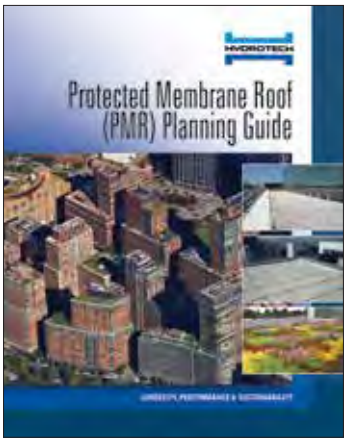
Hydrotech's MM6125 proven service life exceeds this study's anticipated service life

All vegetated roofs are not PMR Assemblies

Installing the vegetated roof components (drainage/water retention layers, growing media, gravel, vegetation, etc.) directly above the membrane in a conventional roof membrane assembly does not make it a PMR Assembly. The membrane is still above the insulation layer and therefore susceptible to physical abuse during installation, and to the forces of Mother Nature. Only a vegetated roof like Hydrotech's Garden Roof® Assembly can provide all the benefits of a PMR. Protect the roof membrane and it will keep the building dry.

Garden Roofs are a part of the wide array of assemblies that are part of the family of Protected Membrane Roofs that Hydrotech offers.

For further information, see Hydrotech's PMR Planning Guide.



Hydrotech's Advantage...

Hydrotech's first Garden Roof® Assembly (Mashantucket Pequot Museum; see right) was installed in 1996; the first **single source** fully warranted vegetated roof assembly in America. Since that time, Hydrotech has continued to lead the vegetated roof marketplace through the innovation of new products and assemblies.

Experience and In-house Expertise

Since the introduction of the Garden Roof® Assembly in 1996, Hydrotech has developed extensive experience in the design and construction of thousands of vegetated roofs across the United States. Hydrotech's Garden Roof® staff has unparalleled design and construction experience to address any question you may have about your particular project.

Design Assistance

Hydrotech's sales representatives and staff work closely with the design team and can offer assistance with the specification development and details as part of the service offering. Each project is unique. Here are some of the many issues that must be considered.

- Structural requirements
- Wind uplift requirements
- Detailing of perimeter/penetrations
- Growing media (soil) requirements
- Maintenance issues
- Stormwater calculations
- Sun and shade patterns
- Watertightness of roof
- Safety
- Slope issues
- Plant choices
- USGBC's LEED™ credits
- Warranty offering
- Access to roof

Contractor Training Program

Hydrotech only sells its roofing, waterproofing and Garden Roof® materials to trained applicators. This helps ensure that the materials are properly installed and the owner receives the highest quality materials and installation.

Hydrotech's array of approved contractors have all undergone extensive training provided by Hydrotech's experienced Garden Roof® and Technical Departments' staff.

Hydrotech Hydrology Tool (HHT)

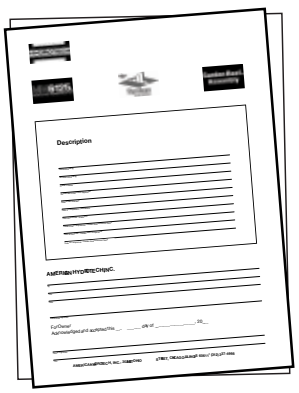
Hydrotech's Garden Roof® Assembly can be an ideal component of any stormwater management plan with its ability to store stormwater in the assembly. To aid engineers and designers in the development of these plans, Hydrotech has a unique tool for accurately predicting performance of our Garden Roof® Assembly and components, called the Hydrotech Hydrology Tool (HHT).

Hydrotech's Warranty for Owner Assurance

The Garden Roof® Assembly consists of proven components from the deck up, which may include the waterproofing/roofing membrane, root barrier, insulation, vegetated roof components, growing media and even the vegetation for extensive applications. Hydrotech offers a range of warranty options to an owner providing long term assurance and peace of mind from the watertightness of the membrane, up to and including removal and reinstallation of overburden.

Contact Hydrotech for specifics.

Mashantucket Pequot Museum and Research Center - Mashantucket, CT



Warranty Includes:

- Material and Watertightness
- Thermal Retention
- Wind Resistance
- Removal and Reinstallation
- Vegetation Coverage (sedum)
- Vegetation Thrive (all extensive plant materials supplied by Hydrotech

GARDEN ROOF® ASSEMBLIES

Lovejoy Apartments - Portland, OR

Components of a Garden Roof® Assembly

There are a number of components that can comprise a typical Hydrotech Garden Roof® Assembly. Each of the components in the assembly serves a specific purpose with the goal of creating a waterproof building with elements that promote vigorous plant growth.

⑧ **Carefully Selected Plants -** Extensive plants for low maintenance landscaping including drought resistant species and varieties available from Hydrotech. There is a wide range of plants for intensive landscaping that can be supplied by plant nurseries around the United States.

⑦ **LiteTop® Engineered Lightweight Growing Media -** Well-balanced internal structure and low weight with ideal aggregate size and components, pH values, nutrients, degree of porosity and permeability. The type and depth of the growing media is determined by the desired plant choices. This depth of growing media will affect the structural loads imposed on the roof structure. Hydrotech's LiteTop® blends are engineered to meet the requirements of each project.

⑥ **Systemfilter -** Prevents fine particles from being washed out of the growing media, out of the root zone and into the drainage systems.

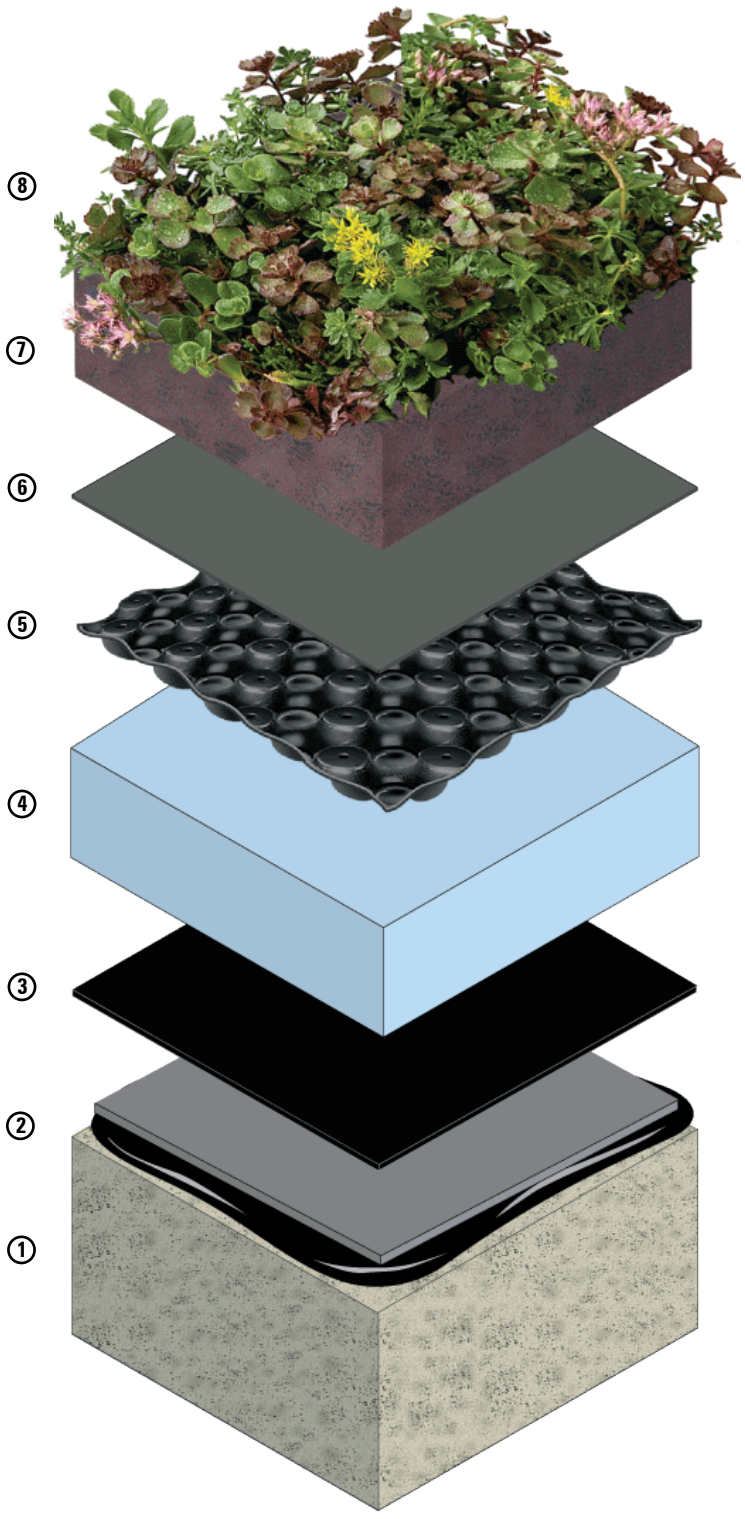
⑤ **Gardendrain® Retention/Drainage/Aeration Component -** Hydrotech's Gardendrain® retains water in the profiled cups, even on low slope roofs. Excess water drains away through channels between the cups. Strategically located holes in Gardendrain® provide necessary aeration and ensures that excess moisture found below the cups can air diffuse up into the growing media.

④ **Insulation -** Situated above the roof membrane and root barriers, an extruded polystyrene insulation is utilized. DuPont's STYROFOAM™ brand insulation exhibits excellent moisture resistance, is closed cell, dimensionally stable and has a high R-value.

③ **Root Barrier -** Prevents roots from damaging the roof membrane. The root barrier type, thickness and method of installation depend on the nature of the landscape planned, the plants selected and the slope of the roof.

② **Roofing Membrane -** Only the best: with a track record of over 60 years proven performance worldwide, Hydrotech's Monolithic Membrane 6125®FR fabric reinforced assembly is the ideal membrane for a vegetated roof (depicted with protection layer).

① **Structural Roof Deck -** Must be designed to support the weight of the vegetated roof as well as any other dead and live loads. Acceptable deck types include cast-in-place concrete, precast concrete, metal deck with cover board and plywood.



Extensive Assembly Depicted

Water Management in the Garden Roof® Assembly

Gardendrain®

Water Retention/Drainage/Aeration

At the heart of the Hydrotech Garden Roof® Assembly is the water drainage/retention/aeration component: **Gardendrain®**. With its array of cups and channels on the top and bottom sides, Gardendrain® is designed to ensure more than adequate water drainage even with roots growing into the cups. The profiled cups on the topside of the Gardendrain® panel retain water even on sloping roofs.

Strategically placed holes on top ensure the roots receive the necessary aeration and allow water vapor to diffuse up into the growing media when excess moisture is below the cups. This aeration helps the assembly "breathe" by allowing water vapor and air to pass throughout the assembly.

The availability of moisture for the roots is essential to maintain good, healthy plant growth on a vegetated roof. Much of the moisture is supplied by natural rainfall which is collected and stored by the layers within the Garden Roof® Assembly.

This Gardendrain® layer plays an essential part of storing rainwater that filters through the growing media. Once the cups in the Gardendrain are full, excess water can be soaked up and held by an optional moisture mat (not depicted). Water that is not held in the cups or within the moisture mat is free to drain off the roof.

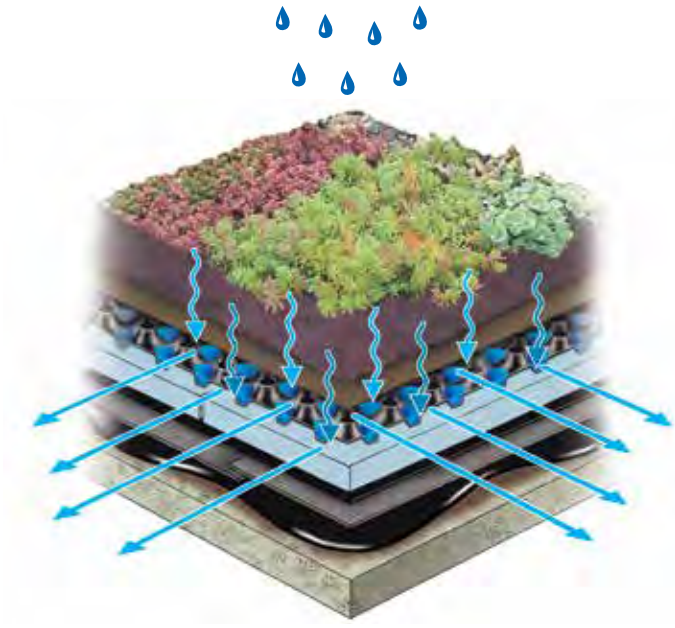
Releasing Stored Water

In dry periods, stored water will gradually diffuse up into the growing media for use by the plants' roots. Plants are also capable of dropping roots into the cups of the Gardendrain® drainage/retention/aeration layer to obtain much needed water. Additionally, the optional moisture mat can release its stored moisture by diffusion up through the holes in the top of the drainage layer and into the growing media.

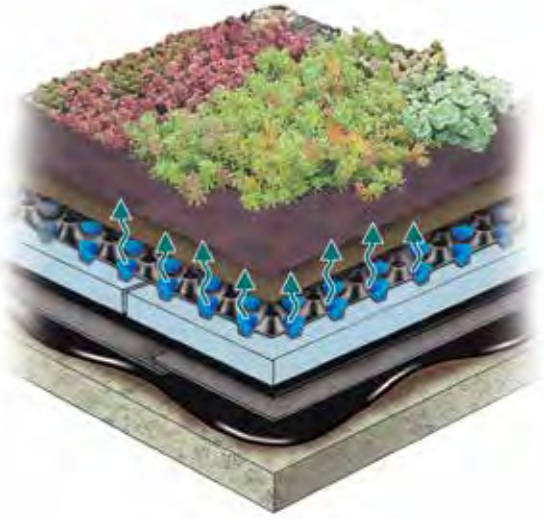
Gardendrain® GR15

Gardendrain® GR30

Gardendrain® GR50



Water Storage & Excess Water Drainage



Releasing Stored Water

Hydrotech's Assemblies

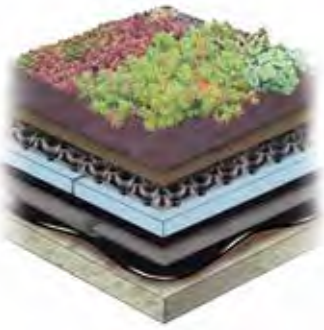
To address the numerous possible conditions and configurations that can be created on roof tops, Hydrotech has a wide range of **Garden Roof® Assemblies** to choose from. These assemblies range from thin, extensive vegetated roofs that support drought-tolerant plants to deep intensive assemblies featuring large trees and familiar landscape elements. The lawn assembly can be used to create spaces on roof tops for concert venues and athletic facilities. Sloped assemblies can be used to create unique aesthetic building treatments. Hydrotech's Urban Agriculture assembly brings food production to the rooftop.

As a companion to the Garden Roof® Assembly, The **Ultimate Assembly®** provides elements to create dynamic hardscape spaces. The wide range of elements in the Ultimate Assembly® include architectural pavers and wood tiles to create beautiful and long lasting pedestrian surfaces.

The typical Protected Membrane Roof can be combined with any Garden Roof Assembly for its simple visual appeal. RockCurb, a precast concrete curbing, can be used to create defined edging for containing plant materials used in the Garden Roof® Assemblies. When combined, the Garden Roof® Assembly and the Ultimate Assembly® can give the designer a nearly unlimited palette of elements to chose from when designing plazas, terraces and roof tops.

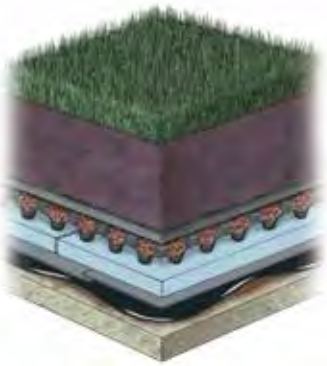
Stormwater management can be easily handled on roofs using one of Hydrotech's **Blue Roof Assemblies.**

Contact Hydrotech for additional information on the Ultimate and Blue Roof Assemblies.



Extensive

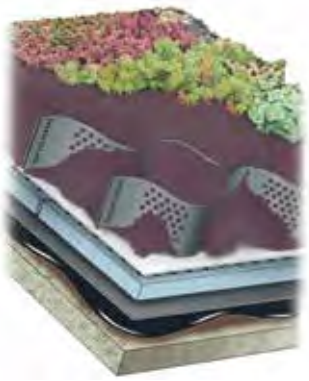
Extensive with Rock Mineral Wool



Lawn

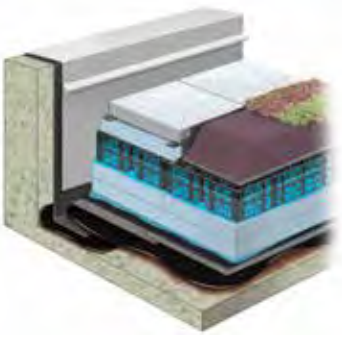
Intensive

InstaGreen® GT-4 Tray



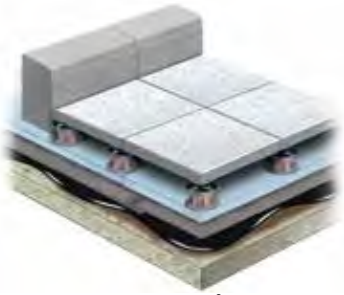
Sloped

Urban Agriculture

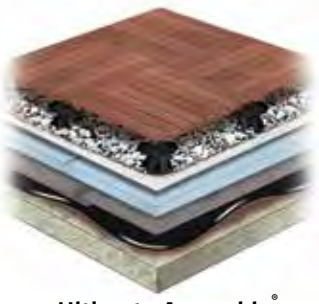


Blue Roof

Stone Ballasted Protected Membrane Roof



Ultimate Assembly® Architectural Pavers and RockCurb

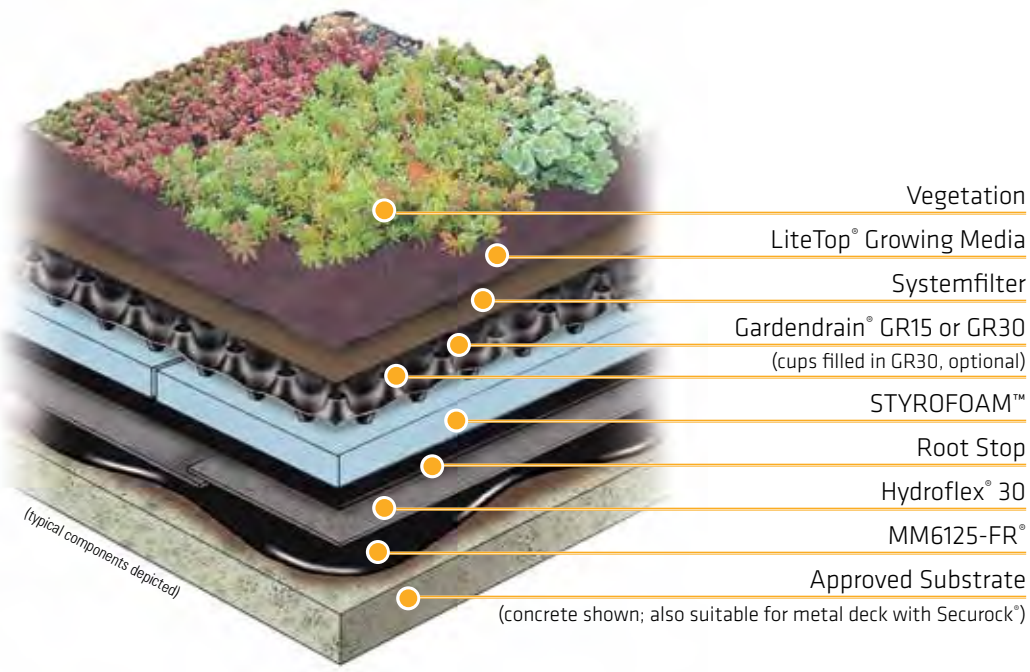


Ultimate Assembly® Wood Tile

All of the Hydrotech Garden Roof, Ultimate and Blue Roof Assemblies are an integral part of the Hydrotech Protected Membrane Roof family. Each assembly is intended to address the specific design need and intention for the roof top.

For more information see Hydrotech's Protected Membrane Roof (PMR) Assembly Planning Guide.

Extensive Garden Roof® Assembly



Vegetation Options:
- **Cuttings**
- **Plugs**
- **InstaGreen® Carpet**
- **InstaGreen® Tile**

An Extensive Garden Roof® Assembly uses a select range of hardy plants, making it attractive to look at while requiring little maintenance. While extensive Garden Roof® assemblies are not intended for recreational use they are very valuable as stormwater management BMPs to help minimize water run-off and to reduce the urban heat island effect.

Typically, Extensive roofs have a growing media depth of 3" to 6" (depending on the region and plant palette) and therefore add little weight to the roof structure below when compared to a standard ballasted PMR roof. Warmer and drier climates require increased media depths.

Plant types for Extensive Roofs should be drought, frost, and wind resistant such as sedums and other compatible perennials. See pages 50 - 57 for more information on Hydrotech's Extensive Plant Program.

The water retained in the growing media and Gardendrain® drainage/retention/aeration layer is typically sufficient to sustain the drought resistant plants between periods of normal rainfall. While access to sufficient water is required on all roofs (especially during installation and establishment), many owners are opting for full irrigation systems to help ensure their investment in their Garden Roof® is protected from extended drought periods.

Standard Extensive Assemblies can be installed on flat roofs up to a pitch of 2:12 (10°). Sloped roofs with a pitch of up to 12:12 (45°) are possible, provided the appropriate measures are taken to retain the growing media. Please see page 16 for additional information regarding sloped applications.

Features:

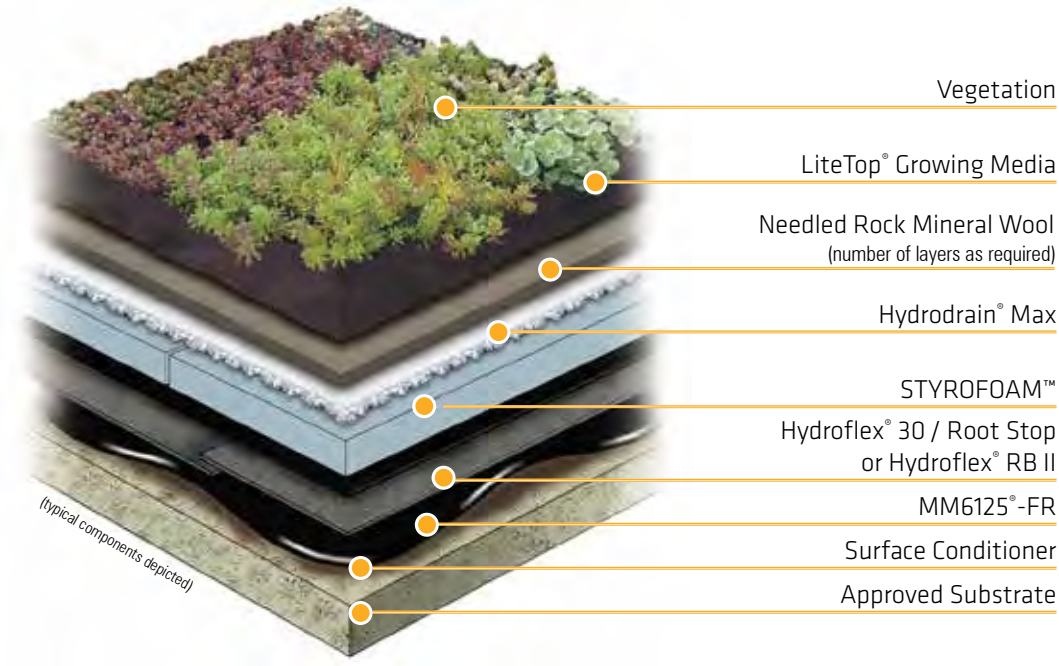
- Typical depth: 3" to 6" of LiteTop® growing media
- Depths and related weights are regionally dependent (in warmer climates, greater growing media depth is required)
- Reduce and delay stormwater runoff volumes and rates
- Can be used on flat or sloped roofs with max. 2:12 slope
- Permanent irrigation is highly recommended (sufficient water is required for establishment and maintenance)
- Requires minimal maintenance once established
- Tested to 110 mph (with Disk Anchors) in accordance with CSA A123.24-15, with no noticeable effect.

Thinner assemblies and very lightweight growing media blends are available for customized extensive Garden Roof® Assemblies. **Contact Hydrotech for further information.**

550 W. Adams - Chicago, IL

Fountaindale Library - Bolingbrook, IL

Garden Roof® Rock Mineral Wool Assembly



Vegetation Options:
- **InstaGreen® Carpet**
- **InstaGreen® Tile**

To provide enhanced stormwater capabilities and lower assembly weights, Hydrotech offers its Garden Roof® Rock Mineral Wool Assembly. Originally created for its insulative qualities, rock wool has long been used in the horticulture industry for propagation and growing plants due to its ability to store moisture. This ability to store a great volume of water increases the stormwater capacity of a Garden Roof® while keeping the overall assembly height thinner and the assembly weight to a minimum.

Rock wool comes in several types however Hydrotech only works with needled rock mineral wool. Needled rock mineral wool does not have the added binders of other rock wool products which can degrade and decrease effectiveness in a short time.

Rock mineral wool can be installed in multiple layers if needed to achieve higher stormwater capacities. Designers should work with Hydrotech staff to determine the proper number of rock mineral wool layers.

Rock mineral wool can also be used to address horticulture issues in drier climates. Its substantial water holding capacity can provide more moisture for plant use.

Hydrotech's Hydrodrain® Max is required in this assembly to provide a proper drainage and air layer over the STYROFOAM™ insulation or the finished membrane when insulation is not used. Hydrodrain® Max creates an effective drainage pathway for water to flow to the drains.

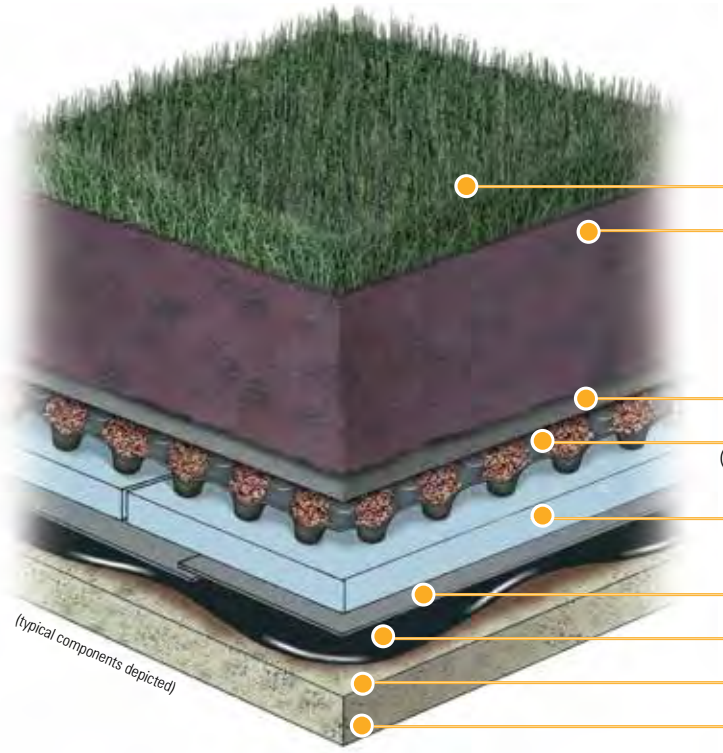
Features:

- Requires minimum of 3" of LiteTop® growing media for proper STYROFOAM™ ballasting
- Depths and related weights are regionally dependent
- Permanent irrigation is highly recommended (sufficient water is required for establishment and maintenance)
- Requires maintenance similar to an Extensive Garden Roof Assembly

Needled Rock Mineral Wool

Hydrodrain® Max

Lawn Garden Roof® Assembly



Vegetation Options:
- **Lawn sod or seed** (by others)

Lawns have unique needs due to the foot traffic they experience. Designers have the ability to create large lawn areas on rooftops using a lawn Garden Roof® Assembly. This assembly incorporates a LiteTop® growing media that provides a firm structure for pedestrian areas while providing proper aeration for good turf grass root growth.

Lawns require more water for proper establishment and long term growth and Hydrotech strongly recommends that a permanent irrigation system be included in this assembly. Typically, pop-up irrigation systems (identical to at-grade systems) are incorporated into this assembly.

By combining a lawn assembly with GardNet®, designers can create dramatic lawn spaces on complex sloped roof shapes.

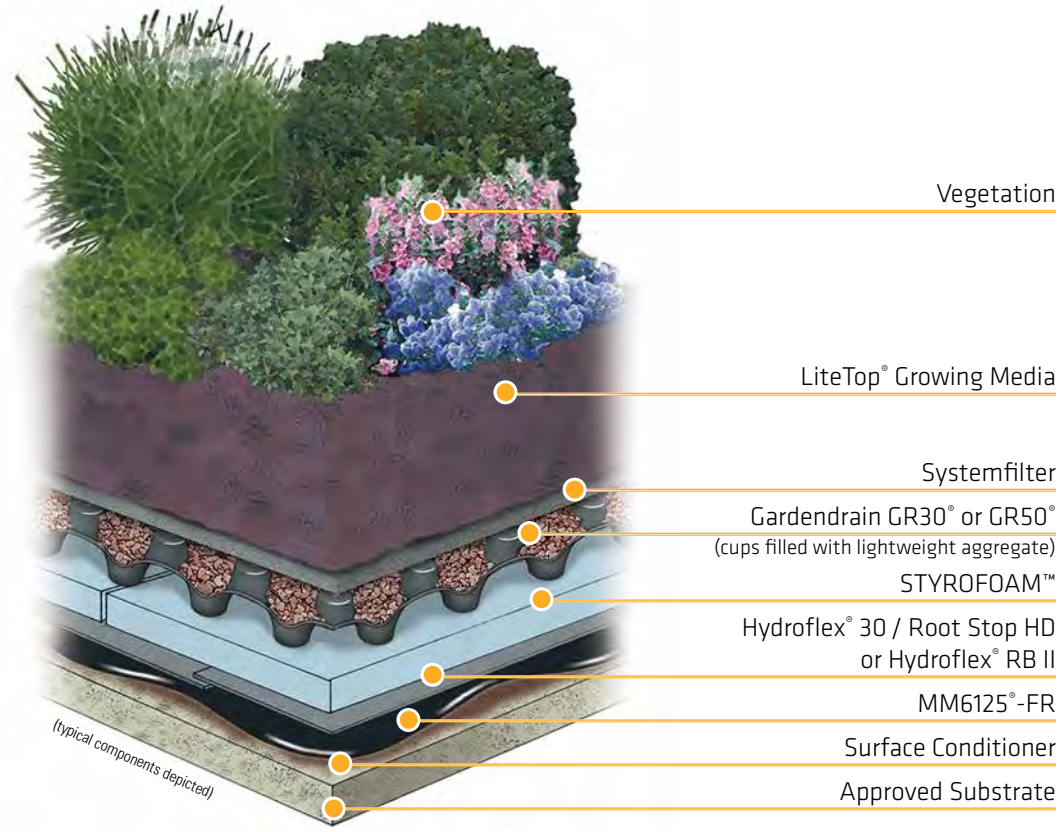
Features:

- Typical depth: 8" to 12" or more of LiteTop® Lawn growing media
- Depths, related weights and type of grass used are regionally dependent (in warmer climates, greater growing media depth is required)
- Ideal for increasing usable space
- Can be used on flat or sloping roofs
- Hardscape options can be integrated into assembly
- Irrigation is strongly recommended
- Requires maintenance similar to at-grade lawn areas


Hypar Pavilion at Lincoln Center - New York, NY


Residences at Quorum Center - Raleigh, NC

Intensive Garden Roof® Assembly



Vegetation Options:

- **Sedums**
- **Perennials**
- **Groundcovers**

- **Intensive vegetation; Shrubs, Ornamental Trees, Shade Trees, etc.** (by others)

The landscape possibilities with an Intensive Garden Roof® are virtually limitless. They are intended for recreational, sporting and leisure purposes and are often indistinguishable from at-grade landscapes.

An Intensive Assembly follows the same design concept as an Extensive Assembly; however, the Gardendrain® component has a taller profile and is filled with expanded aggregate to provide greater water storage and to support a greater depth of media.

Intensive landscapes often contain a wide variety of plant types with differing LiteTop® media depth requirements. Trees will require deeper media than shrubs or perennials. To help minimize weight, DuPont STYROFOAM™ is used in areas of the Intensive Garden Roof® assembly to reduce the depth of the growing media where it is not needed. Wells can be created in the insulation to accommodate tree rootballs. See page 60 and 61 for additional information.

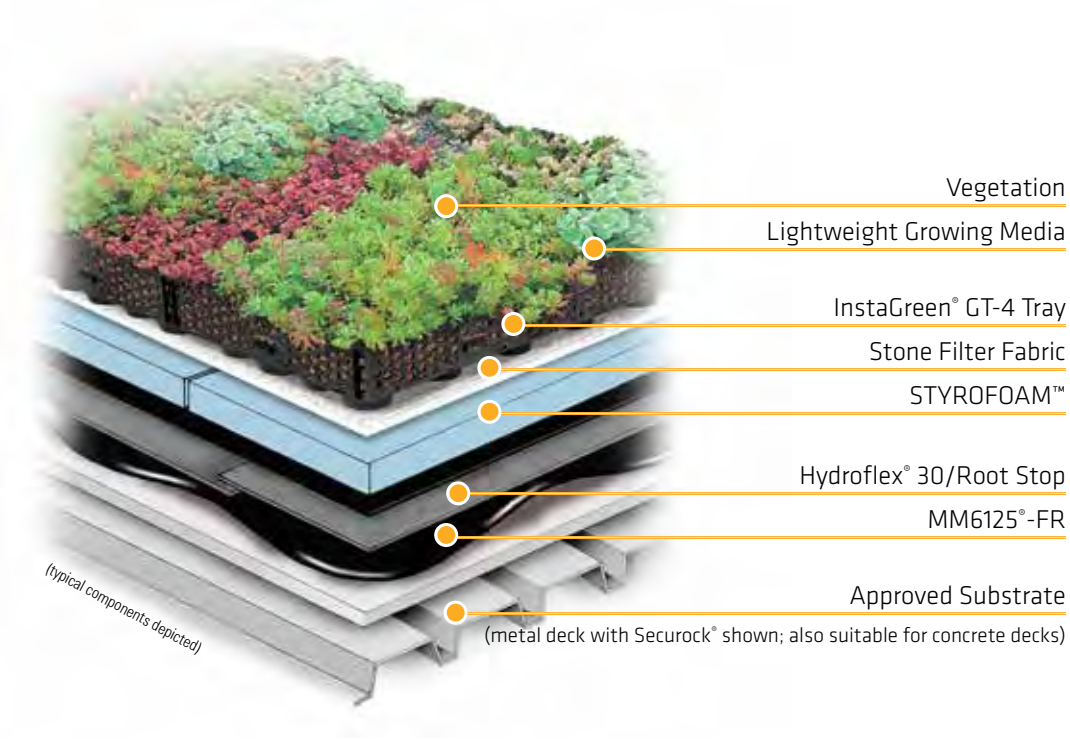
Features:

- Requires greater LiteTop® growing media depths: 6" to 36" or more of growing media
- Depths and related weights are regionally dependent
- Accommodates a wider variety of plants/shrubs/trees
- Hardscape options, site amenities and water features are possible
- Irrigation is strongly recommended
- Requires regular maintenance
- Requires Root Stop HD or Hydroflex® RB II to resist woody plant root intrusion
- Requires Root Stop Bamboo for clumping bamboo installations

1101 Dexter - Seattle, WA

801 Vine Street - Louisville, KY

InstaGreen® GT-4 Tray Assembly



Vegetation Options:

- Sedums and other succulents
- Grasses
- Perennials (herbaceous)
- Groundcovers

Should a designer choose a modular system, Hydrotech is pleased to offer the InstaGreen® GT-4 Tray Assembly.

Designed to mimic Hydrotech's built-up Garden Roof Assemblies, the InstaGreen® GT-4 provides a modular system with a high performance water storage reservoir built into the bottom of the tray.

Sidewall Clip - Six per tray

Sidewall Slot - Six per tray

Made from 100% recycled polyethylene, the sidewalls are perforated to allow for tray-to-tray root movement and sharing of moisture and nutrients. Built-in clips and receiving slots provide positive connections at six points along the perimeter of the tray to resist wind uplift.

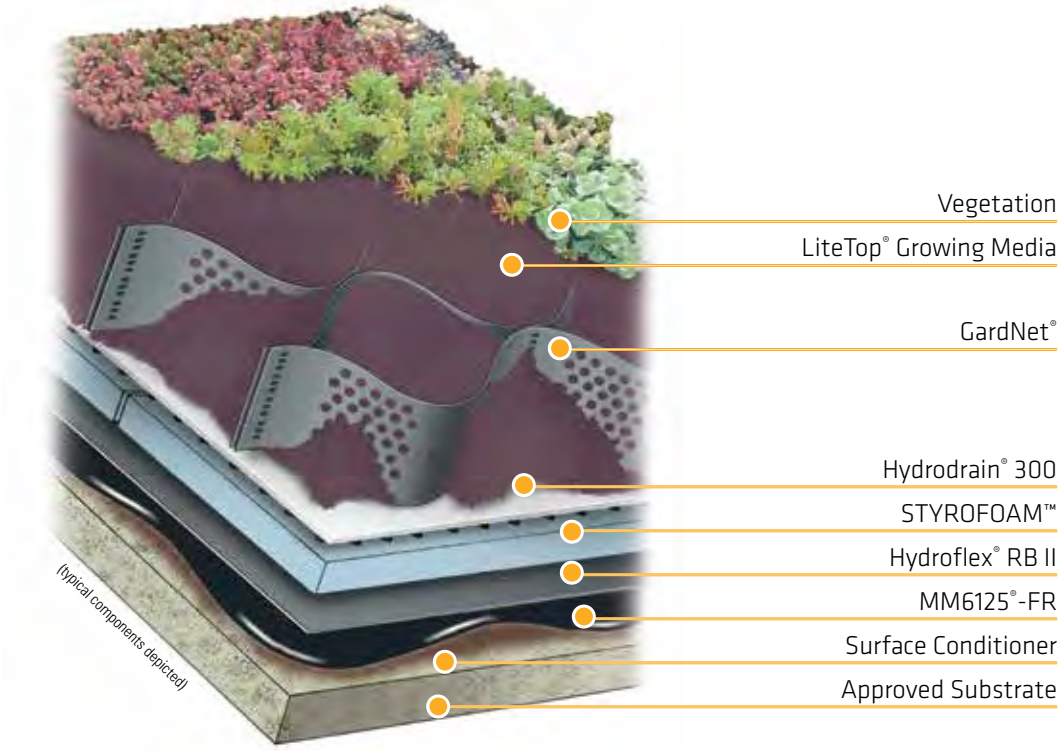
Depending on the project, InstaGreen® GT-4 Tray can be shipped in various planting configurations.

Contact Hydrotech for further details.

Features:

- 12"W x 24"L x 5.75"D (2.0 SF/tray)
- 4" media depth
- 1.75" tall tray bottom creates substantial water reservoir capacity
- Tested to 110 mph (with Disk Anchors) in accordance with CSA A123.24-15, with no noticeable effect.
- Made from 100% recycled polyethylene
- Can be used on roof slopes up to 2:12
- Permanent irrigation is highly recommended (sufficient water is required for establishment and maintenance)
- Requires maintenance similar to an Extensive Garden Roof Assembly

Sloped Garden Roof® Assembly

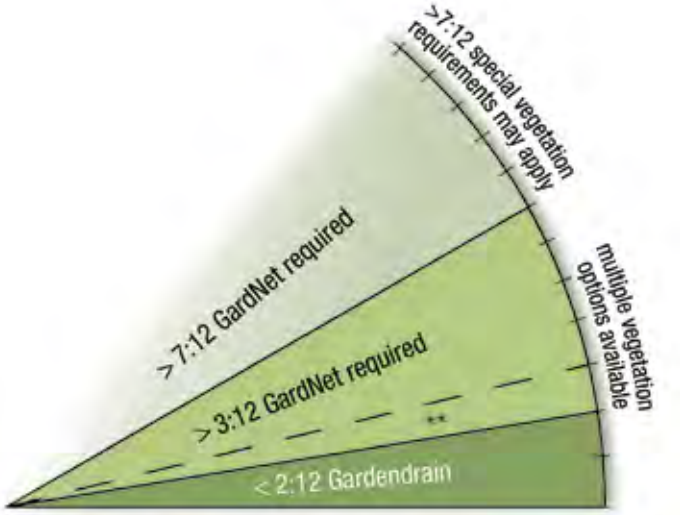


Vegetation Options:
- **Plugs with GardMat®**
- **InstaGreen® Carpet**
- **InstaGreen® Tile**
- **Lawn sod** (by others)
- **Select intensive plants** (by others)

GardNet® is a growing media confinement component within the Garden Roof® Assembly that is manufactured from high density polyethylene. It is used primarily for steep slope applications ranging from 3:12 to 12:12 (45 degrees). Available in depths of 3, 4, 6, 8 and 12 inches, it can be used in extensive and limited intensive applications. Its ability to conform to irregular slopes makes it ideal for complex and undulating roofs. Erosion control is required (i.e. plugs with GardMat®, InstaGreen® Carpet, InstaGreen® Tile or lawn sod).

Features:

- Depth: 4" to 13" of LiteTop® growing media; stackable for greater depth
- Weight dependent upon local and regional media blends
- Easily conforms to complex roof slope shapes involving convex, concave and compound surfaces.
- Permanent irrigation is highly recommended (sufficient water is required for establishment and maintenance)
- Requires maintenance depending on vegetation selection
- **Project specific engineering is required. Please contact Hydrotech early in the design phase.**



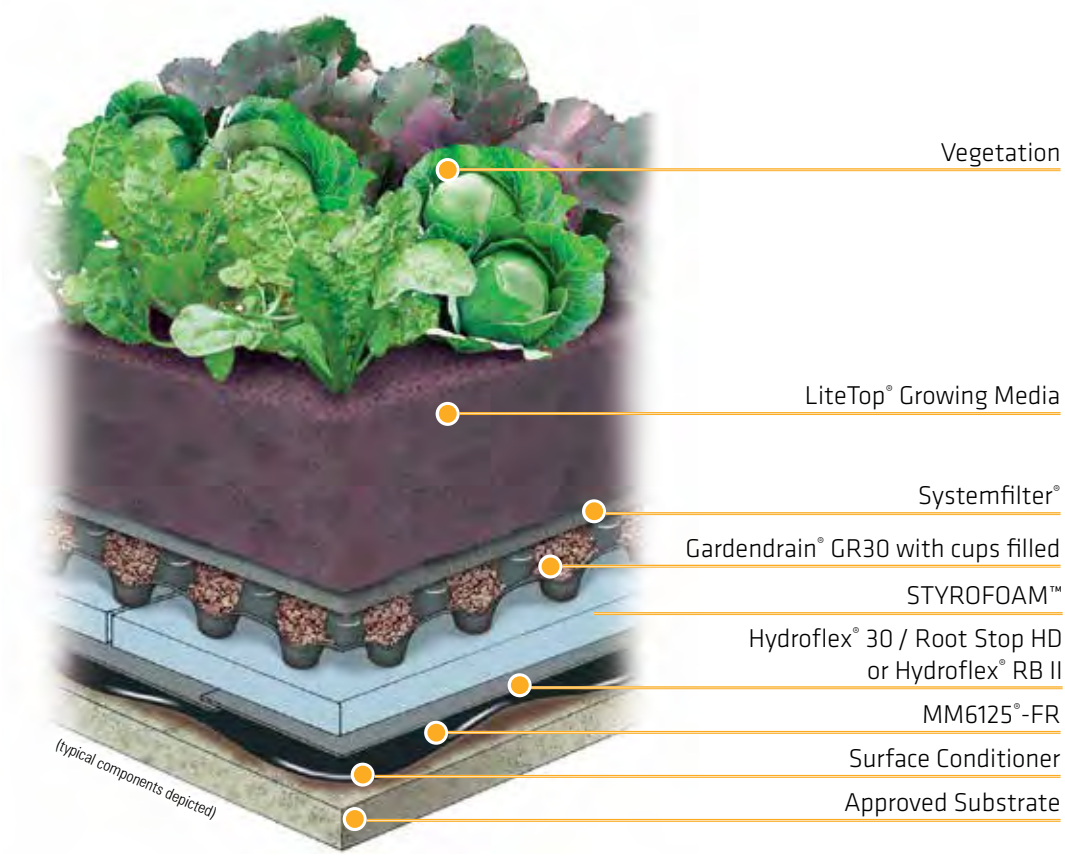
**Gardendrain may be acceptable, contact Hydrotech for specifics.

Roof Slope

Georgian Court University - Lakewood, NJ

h2hotel - Healdsburg, CA

Urban Agriculture Garden Roof® Assembly



Vegetation Options
(by others):

- **Vegetables**
- **Herbs**
- **Flowers**
- **Fruit crops**

(with additional considerations)

Bringing food production to the rooftop is becoming an increasingly important activity in urban environments. A wide variety of vegetables, herbs and flowers have been brought to the roofs of buildings such as community centers and supermarkets.

The anticipated vegetable crops will determine the depth of LiteTop® growing media needed. Irrigation is typically installed to provide the amount of water required for vegetable production. Often planting rows are mounded up above aisles to create deeper planting areas while minimizing weight.

Bee keeping can also be incorporated on Urban Agriculture Garden Roofs to bring these ever important pollinators closer to the target flowers in vegetable and flower crops.

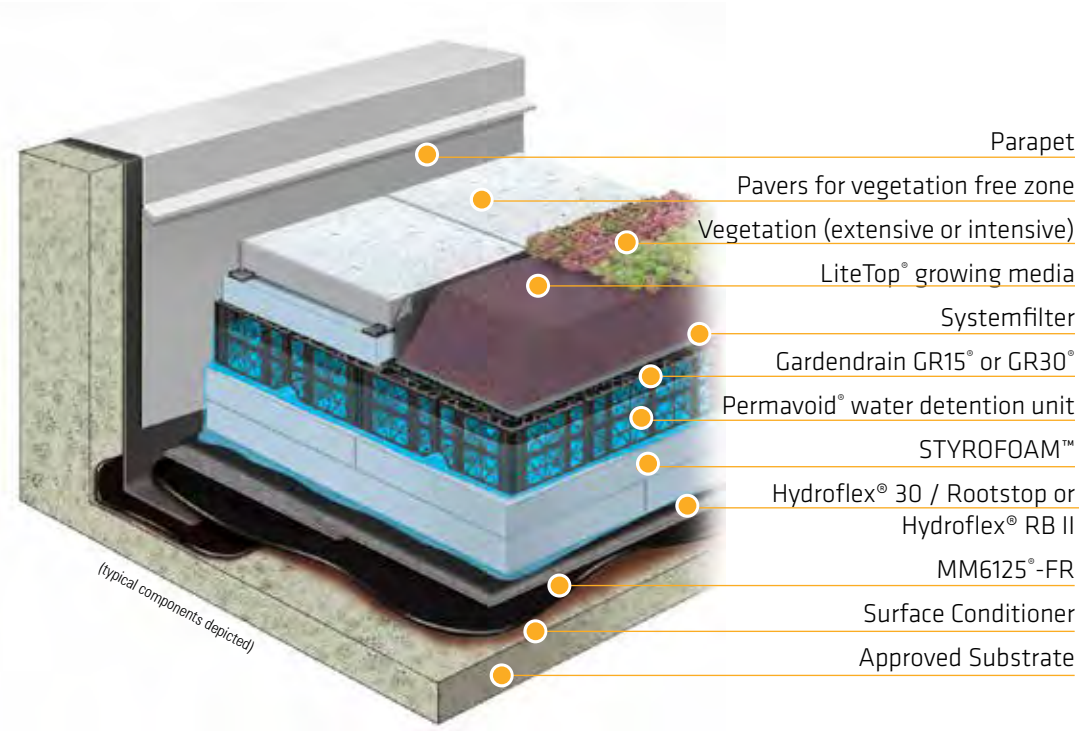
Features:

- Requires 8" or more of LiteTop® growing media depending on intended vegetable crops
- Depths and related weights are regionally dependent
- Accommodates a wide variety of vegetable crops
- Must be irrigated
- Requires maintenance common to at-grade gardens
- Requires Root Stop HD or Hydroflex® RB II to resist woody plant root intrusion

Gary Comer Youth Center - Chicago, IL

1015 Half Street - Washington, DC

Garden Roof® Blue Roof Assembly



Vegetation Options:

- **Plugs with GardMat®**
- **InstaGreen® Carpet**
- **InstaGreen® Tile**
- **Lawn sod** (by others)
- **Select intensive plants (by others)**

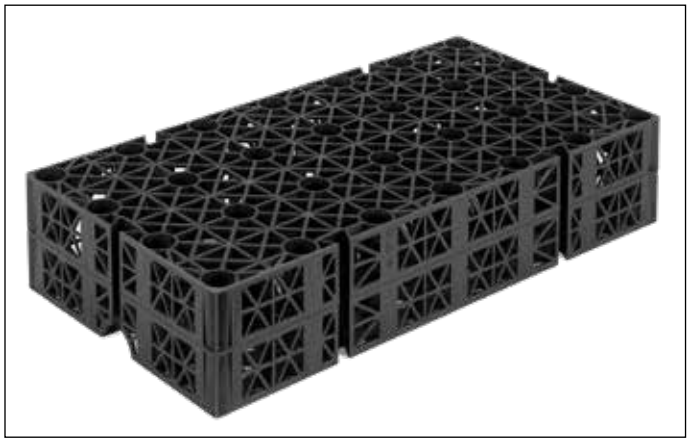
Blue Roofs are specially designed stormwater management features built on rooftops. Ideally constructed on flat, zero-slope roof decks to maximize volume efficiency, blue roofs are intended to temporarily store rain water for 24-48 hours (depending on the municipality) while releasing it at a controlled rate. This helps to prevent large, uncontrolled volumes of water from entering the storm sewers at one time; overwhelming them and resulting in flooding.

Hydrotech has developed a series of Blue Roof assemblies including the Garden Roof® Blue Roof which combines the features of a Hydrotech Garden Roof with the high capacity of ABT's Permavoid® water detention unit*. Permavoid® provides a void space that is 95% open and structurally stable to support pavers and Garden Roof components and assemblies.

Features:

- Best water detention volumes achieved with flat, zero-slope roof deck
- Permavoid® sizes available:
  14" x 28" x 5.91" (355 mm x 710 mm x 150 mm) nominal
  28" x 28" x 3.35" (710 mm x 710 mm x 85 mm) nominal
- Provides 95% open space
- High strength lightweight polymer units provide structural foundation for Garden Roof® and Ultimate Assembly® components
- Interlocking units create stability
- **Project specific information is required. Contact Hydrotech early in the design phase.**

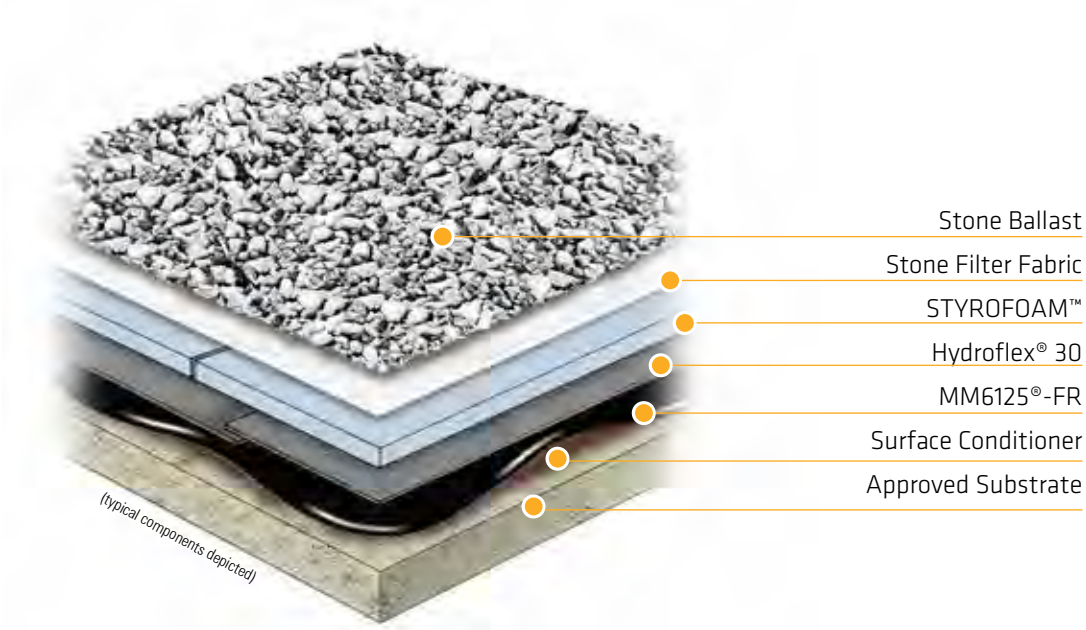
* Permavoid® is manufactured by ABT Plastics, Inc. and marketed exclusively by American Hydrotech, Inc. for use in rooftop and podium deck applications



Permavoid® 150 (150 mm tall unit)

Permavoid® 85S (85 mm tall unit)

Stone Ballasted Protected Membrane Roof



The original and still very practical protected membrane roof (PMR) assembly utilizes crushed or washed stone as the ballasting material over the STYROFOAM™ insulation. Stone provides the weight to keep the insulation materials in place over the membrane.

Stone used for ballasting is graded in accordance with ASTM D448 and is typically referred to as follows:

- #5 stone; nominally 1.0" size aggregates
- #4 stone; nominally 1.5" size aggregates
- #2 stone; nominally 2.5" size aggregates

The depth of stone is determined by the weight of stone needed for the particular portion of the roof in which it is being applied. In general terms, these weights can range from 10 pounds to 20 pounds of stone per square foot depending on the area of the roof. Areas that are subjected to higher wind pressures will, in turn, require potentially larger and heavier stone weights to counter the pressure.

Stone acts as the ballast and protection in a PMR roof by keeping the insulation in place. In addition, it shields the roof from the effects of weather, including the damaging effects of rain and ultraviolet light. The mass of the stone absorbs the energy of the sun and rain and prevents damage to underlying layers in the roof.

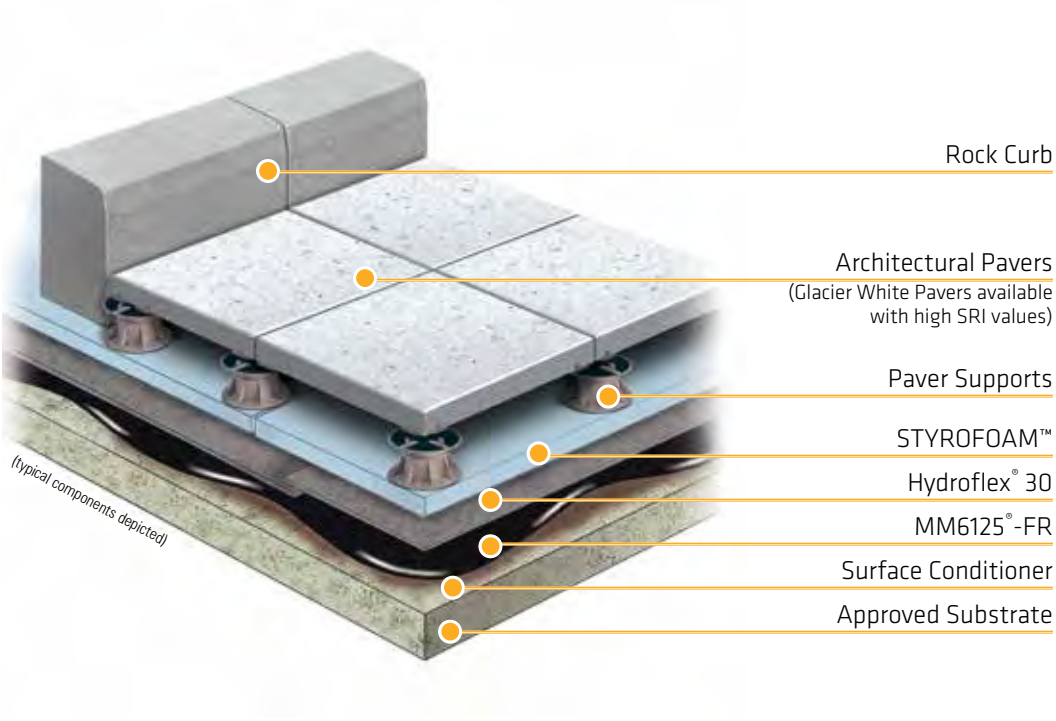
Stone ballast is inexpensive and easy to install; it conforms to any space it is placed. In many areas, it is used as a vegetation free zone adjacent to a Garden Roof.

Stone ballast is just one of the family of non-vegetated Hydrotech PMR assemblies. **For further information, see Hydrotech's "Protected Membrane Roof (PMR) Planning Guide".**

1225 Connecticut Avenue - Washington, DC

PacBell - San Ramon, CA

Ultimate Assembly® - Architectural Pavers



Standard Paver Colors

Custom Colors Also Available

Creating usable space on a Garden Roof® through the addition of hardscape is easy to accomplish with Hydrotech's Ultimate Assembly®.

Architectural pavers resting on pedestals or tabs can convert sloped decks to dead level usable roof areas. This open joint assembly accommodates drainage by allowing water to flow beneath the pavers unobstructed to the drains.

Architectural pavers are available in a number of standard sizes, colors and finishes. The Glacier White paver is the perfect choice in rooftop applications where a LEED™ compliant high SRI value may be desired. Custom colors and finishes to meet your specific needs are also available.

Rock Curbs in complementary colors and finish are often combined with architectural pavers to define the transition between the vegetation and hardscape on a roof.

Features:

- Can be installed dead level over sloped decks
- Multiple paver sizes available including oversized pavers
- Standard paver colors and finishes
- Custom colors and finishes are available upon request
- Hanover Glacier White is a high reflectance (SRI) paver
- Granite pavers are also available
- Paver systems available for high-wind situations
- Typical weight of a 2' x 2' x 2" paver is 23 lbs./SF

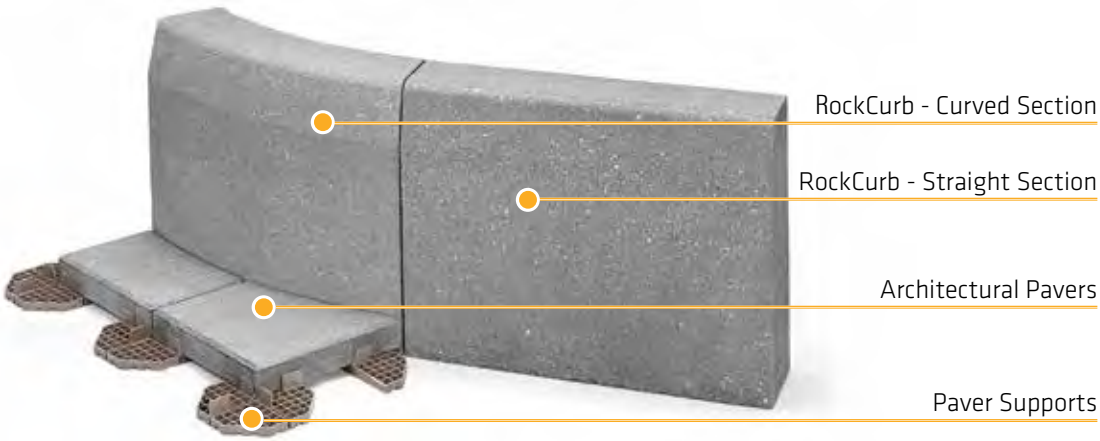
For more information, please contact Hydrotech for a copy of the Ultimate Assembly® brochure.

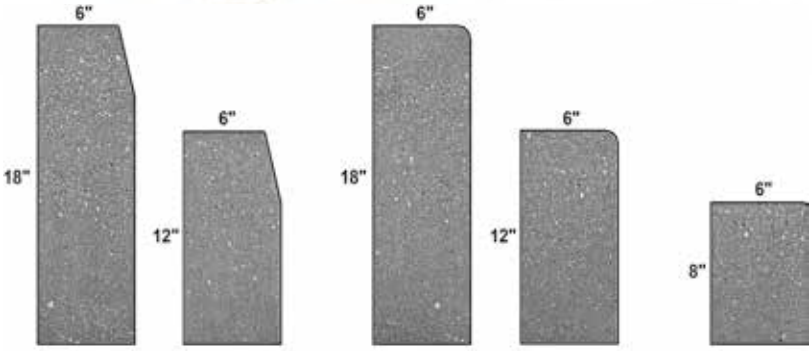
* Hanover Architectural Pavers, marketed by American Hydrotech, Inc. for The Ultimate Assembly®

555 W. Monroe - Chicago, IL

4th Ward Lofts - Madison, WI

Ultimate Assembly® - RockCurbs





Battered **Bullnose** **Rounded**

Standard RockCurb Colors

Custom Colors Also Available

RockCurb precast concrete curbing units can be used to create landscape areas with intensive or extensive assemblies. RockCurb is hydraulically pressed concrete with a minimum strength of 8,500 psf. It comes in eight colors that complement the architectural pavers in the Ultimate Assembly®.

RockCurbs are available in a variety of configurations. Each piece is 6" thick and comes in 8", 12" and 18" heights and 12", 24", and 36" lengths. Radius pieces are also available.

Features:

- 6" thick
- 8", 12" and 18" heights
- 12", 24" and 36" lengths
- 15° battered, bullnose and rounded profiles available
- Limited radius shapes available
- Standard and custom colors available
- Glacier White RockCurbs available with high SRI values.

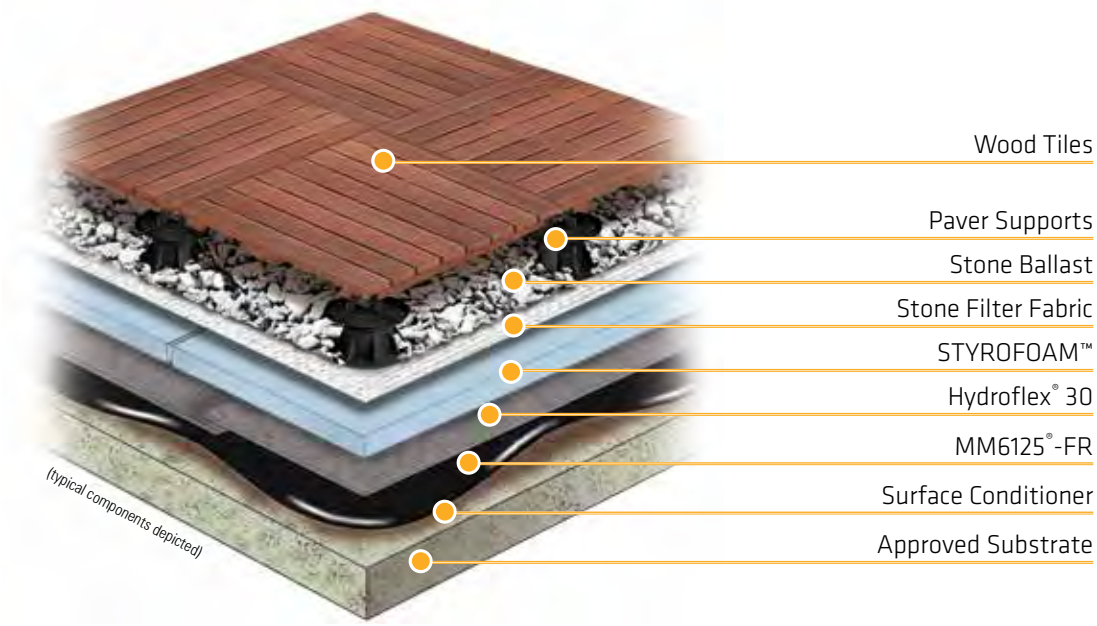
For more information, please contact Hydrotech for a copy of the Ultimate Assembly® brochure.

* Hanover RockCurbs, marketed by American Hydrotech, Inc. for The Ultimate Assembly®

Baptist East Hospital - Louisville, KY

Resurrection Medical Center - Chicago, IL

Ultimate Assembly® - Wood Tiles



Wood Tiles - made from an array of hardwood species - are a great alternative to concrete architectural pavers in an Ultimate Assembly®, providing warmth and charm to any roof deck. These wood tiles are fabricated from very dense, durable hardwoods that exhibit excellent resistance to weather. The wood tiles can be periodically treated with oil to preserve and enhance their original color or left untreated to develop a natural, aged finish. Available with a smooth surface or with a ribbed scuff resistant surface, the tiles are assembled with stainless steel screws.

Made from repurposed wood from the furniture and other industries, wood tiles may be able to satisfy certain recycled content requirements.

This assembly requires supplemental stone ballast (as depicted above) under the wood tiles to provide proper ballasting for the loose laid STYROFOAM™ insulation. The wood tiles are installed on Hydrotech Adjustable Pedestals that include a fastening kit to help lock them down for added security.

For more information please contact Hydrotech for a copy of our Wood Tile brochure..

Features:

- Available in a variety of wood species
- No sealing or staining required if weathered patina is desired
- Can be installed dead level over sloped decks
- 24" x 24" and 24" x 48" sizes available
- Weight: 5.63 - 6.13 lbs/SF (depending on species)
- Surface texture can be smooth or ribbed (depending on species)
- Modular planter cubes are also available


Smooth


Ribbed

Wood Species


Ipê


Massaranduba


Mahogany


Cumaru


Garapa

* Bison Wood Tiles, marketed by American Hydrotech, Inc. for The Ultimate Assembly®


Rich Tree Open Kitchens - Skokie, IL


Elgin Country Club - Elgin, IL

DESIGN CONSIDERATIONS

Church Street Station - Evanston, IL

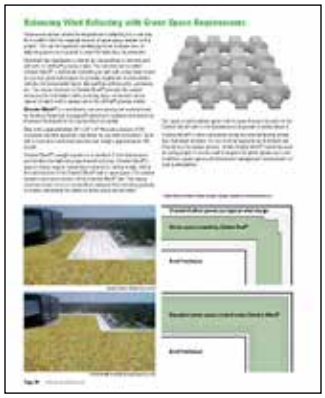
Unabriged Version of Planning Guide Available

For a complete copy of the Garden Roof Planning Guide, please send an email to **guide@hydrotechusa.com**. The full PDF will contain 42 pages of additonal content that includes critical information pertinent to:

- Vegetated Roof Design Considerations

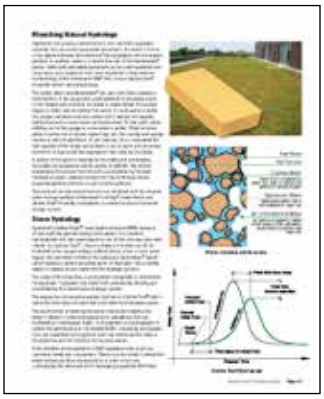
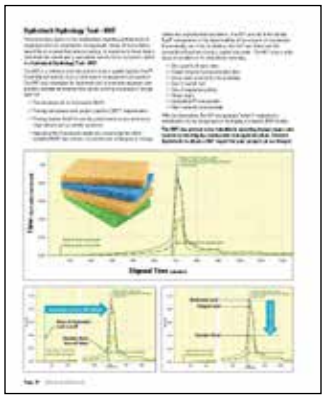




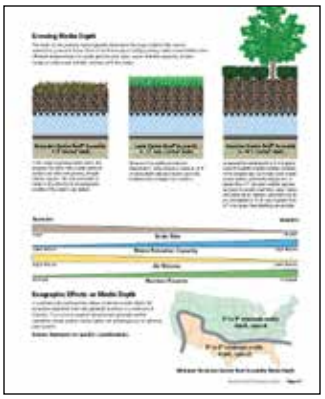



LEED™ and Stormwater Management



- LiteTop® Growing Media

Unabriged Version of Planning Guide Available

For a complete copy of the Garden Roof Planning Guide, please send an email to **guide@hydrotechusa.com**.

- Hydrotech Plant Material Program








- Importance of Access to Water on the Roof




- Installation Guidelines and Maintenance



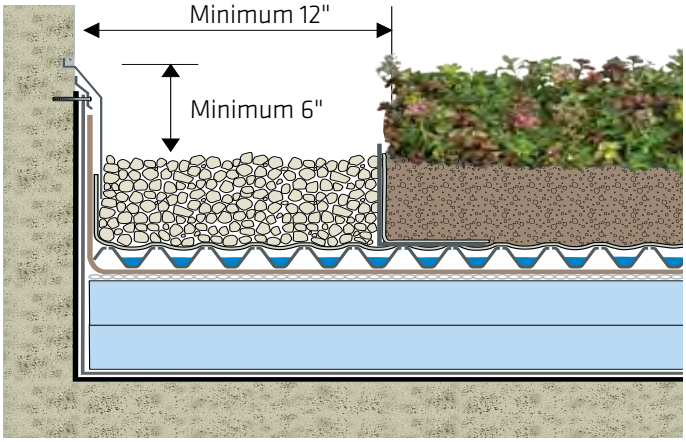

Typical Perimeter and Transition Conditions

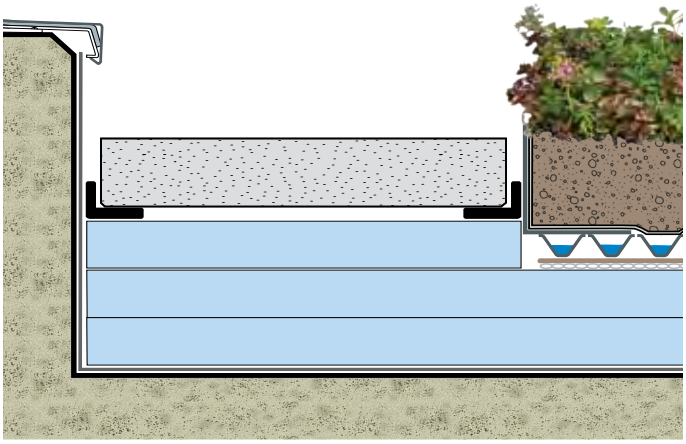
Building Walls, Parapets and Curbs

Membrane flashing must be extended above the final grade of the Garden Roof® Assembly, and must be properly terminated in accordance with Hydrotech guideline details. Vegetation Free Zones (VFZs), a minimum width of 12" of gravel ballast or pavers, provide many functions including easy access to critical flashings and improved drainage.

All of these details shown are conceptual and must be adapted to the specific conditions of each project. Many of these details are available on Hydrotech's website (www.hydrotechusa.com)

To qualify for the limited wind blow-off warranty, VFZ must be a minimum of 24" wide or more depending on parapet height, roof height, wind zones and other factors. Contact Hydrotech for further details

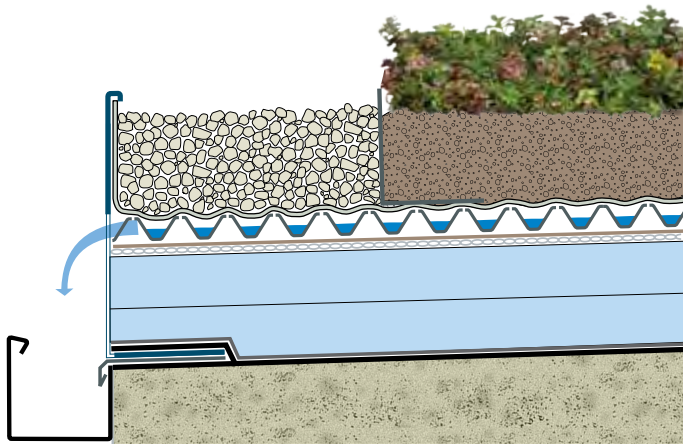




Roof Edges

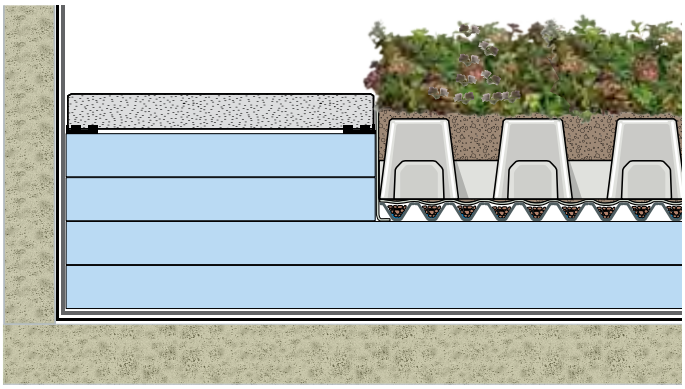
Perforated metal angles, properly engineered to accommodate anticipated loads (in sloped conditions), are necessary to retain Garden Roof® Assembly components and allow water to drain off the roof edge into perimeter gutters. Edge restraints must be properly flashed in accordance with Hydrotech guideline details. VFZs, a minimum width of 12" of gravel ballast or pavers, provide many functions including easy access to critical flashings and improved drainage.

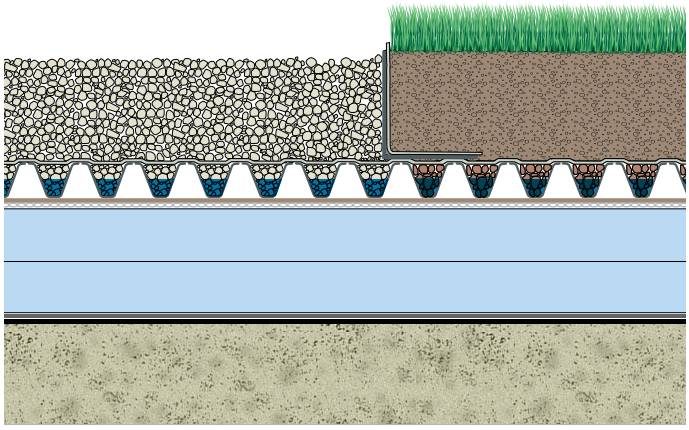
To qualify for a wind blow-off warranty, VFZ must be a minimum of 24" wide or more depending on parapet height, roof height, wind zones and other factors. Contact Hydrotech for further details.



Checker Block

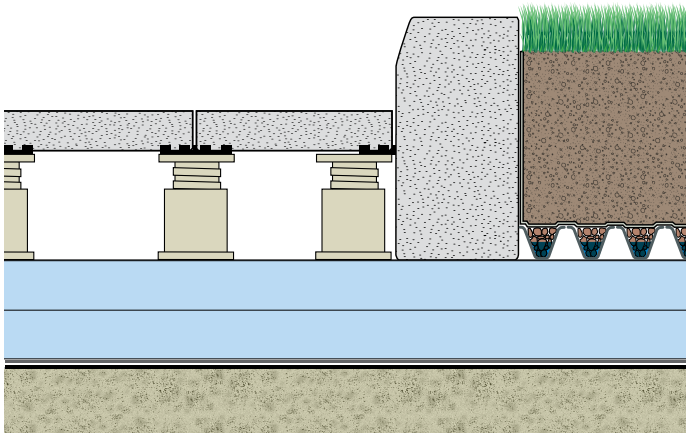
Under certain circumstances, Checker Block® can be used in lieu of standard ballast pavers to increase the green space in a Garden Roof® Assembly while still providing the permanent ballasting function of a concrete paver. The open and interconnected void spaces in Checker Block® are ideal for growing the typical extensive Garden Roof® plants like sedums and smaller perennials. Checker Block® can also be incorporated into deeper Intensive Assemblies for the same purpose of providing ballasting within the Garden Roof® assembly.





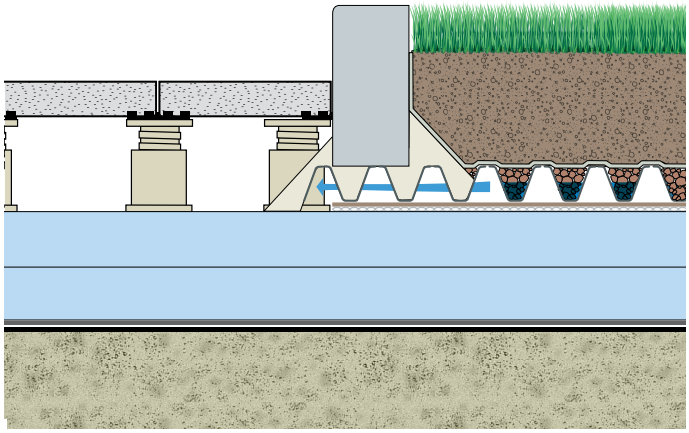
Transition with GardenEdge®

Various materials such as Hydrotech's GardenEdge® Metal Edging, RockCurbs, precast concrete or other materials can provide a border between hardscape and softscape elements on a Garden Roof® that range from almost invisible to a hard defined border. This can occur without interrupting the continuous monolithic roof membrane, insulation layer or the drainage of the assembly from one section to another.



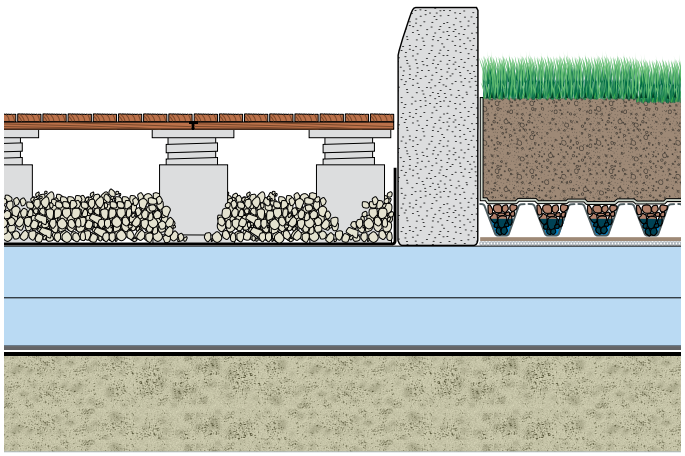
RockCurb

Hydrotech offers a line of architecturally finished precast concrete curb units in a variety of colors and finishes to complement Architectural Pavers. RockCurbs can be supplied in several different heights and widths and limited radii and can be installed directly over the STYROFOAM® insulation layer in the Garden Roof® Assemblies.



RockCurb and Natural Stone Edging

RockCurb or natural stone can be installed over the top of Gardendrain® by pouring stiff concrete as a footer for the curb material directly into the Gardendrain®. The open structure of the Gardendrain® allows for free movement of water beneath the curb while providing strong and secure support.



Wood Tile

Hydrotech offers a line of Wood Tiles made from various hardwoods. These tiles are installed on pedestals with hidden internal hardware to secure the tiles to the pedestals. Supplemental stone ballast must be installed underneath Wood Tiles to provide DuPont's recommended ballast loading over STYROFOAM™ insulation.

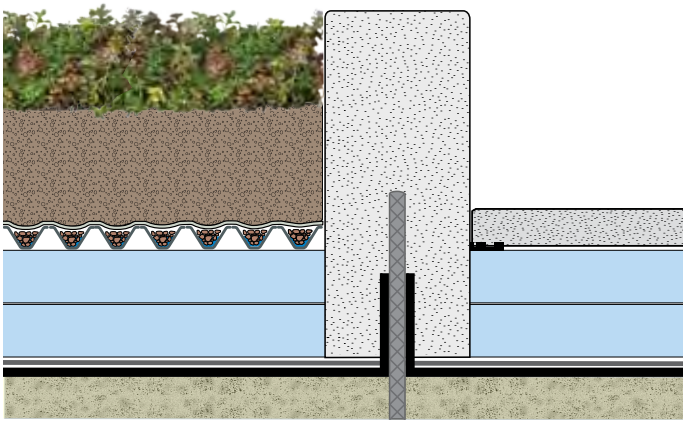
Contact Hydrotech for further details.

Typical Perimeter and Transition Conditions

Cast-in-Place Wall / Curb

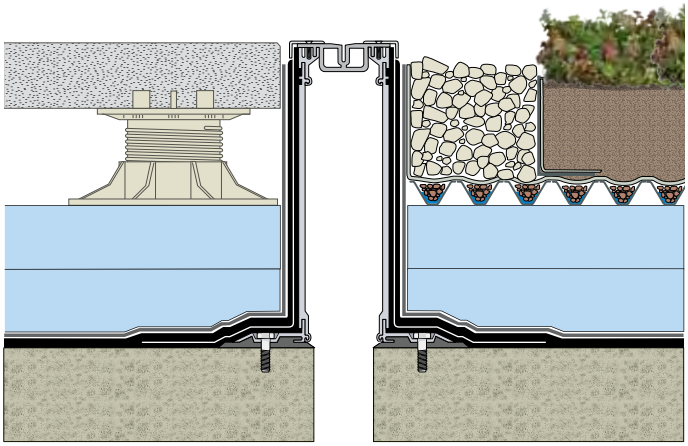
Walls and curbs can be easily installed on structural decks with embedded rebar connections. It is vitally important that Hydrotech's MM6125® waterproofing membrane assembly be installed first on the deck and around the rebars to ensure proper waterproofing. The waterproofing and flashings are installed on the protruding rebars and are entombed in the subsequent concrete mass.

Drainage can be conducted under the walls via Hydrodrain® or through the walls via scuppers.



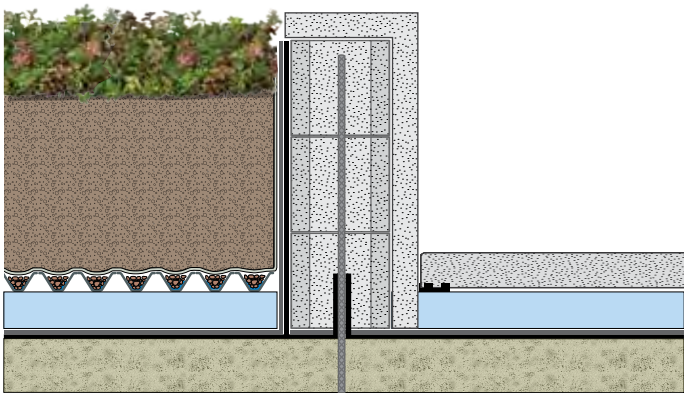
Expansion Joints

Accommodating movement in building structures is an important function for expansion joints. Hydrotech's MM6125® waterproofing assembly works very well with a number of prefabricated expansion joint products. Proper waterproofing detailing is critical to keeping water out of the building in these assemblies. The Garden Roof® and Ultimate Assemblies® work well with these expansion joints as a transition element.



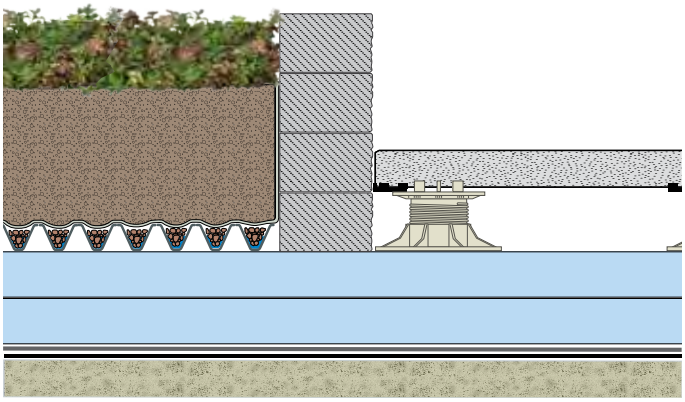
CMU Wall

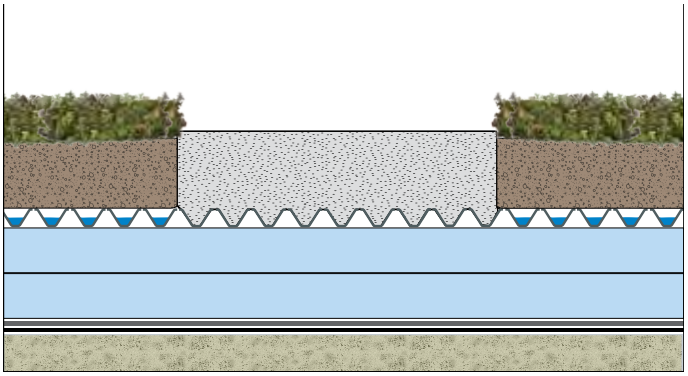
Concrete blocks are often used to create wall cores that accept a wide variety of finishes and veneers. Rebars that connect these structures to decks are waterproofed during the deck waterproofing process before the walls are constructed. Hydrotech strongly recommends that the cores of concrete block walls be thoroughly filled with grout or concrete to entomb the waterproofed and flashed rebars to protect the waterproofing assembly. Additional waterproofing can be applied on the planted side of the wall to help eliminate water transmission through the wall that can lead to efflorescence on the outer face of these walls.



Landscape Block Wall

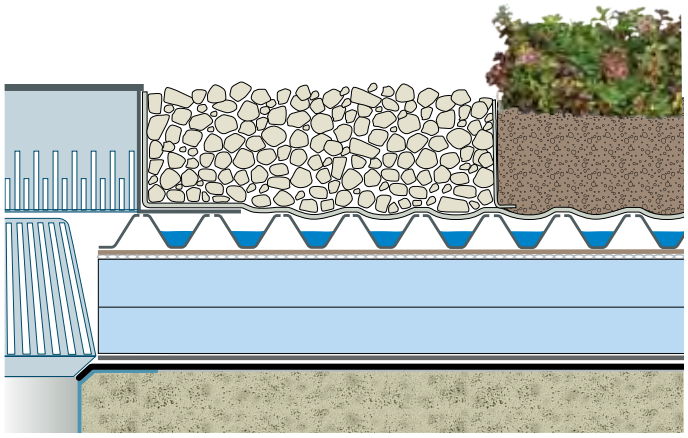
Loose-laid, precast concrete retaining wall blocks can be used to create Intensive Garden Roof® planting areas with a wide range of depths. Systemfilter should be wrapped up on the inside of the finished wall stack to prevent fine particles in LiteTop® media from migrating through the joints in the wall systems.





Concrete Sidewalk

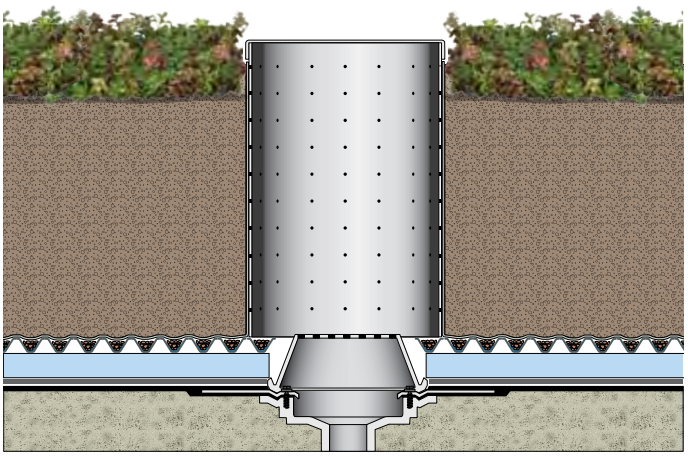
Sidewalks can be created on Garden Roofs® by pouring concrete directly into Gardendrain®. The structure of Gardendrain® creates a drainage plane under the concrete surface which allows for water flow to simplify roof drainage.



Roof Drains

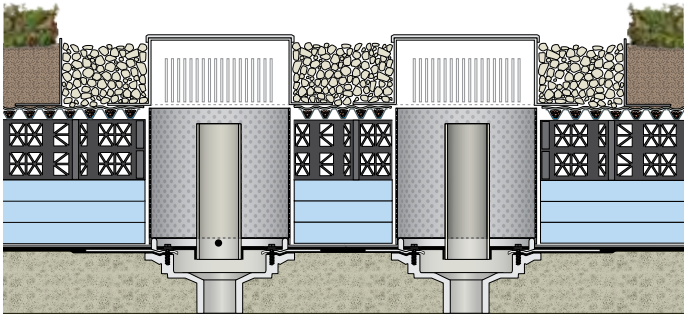
When roof drains are located within planted areas, GardenHatch® Inspection Chambers provide for easy maintenance access. This is especially important in deeper intensive applications. Typical PMR drains with perforated gravel guard rings are acceptable in shallower extensive applications.

GardenHatch® is available in various heights (with extensions) to suit the final assembly depth. VFZs, around the GardenHatch®, a minimum width of 12 inches of gravel ballast or pavers, are necessary to prevent unwanted plant growth and promote increased drainage.



Deep Intensive Drain Access Detail

Access to roof drains is critical to be sure they are performing as designed. For deep Intensive Garden Roof® projects, access to roof drains can be created by using perforated plastic piping and a lid structure. Polypropylene or PVC pipe components can be utilized to create the access to deeply set drain structures.



Blue Roof Flow Control and Overflow Drain

Blue Roofs require specialized drain details to create the detention volume on the roof. As is customary in many areas, paired combination drains are installed together - one to function as the flow-control drain that is needed to create the blue roof detention and the second to act as a standard overflow to protect the roof and building from excessive water.

Hydrotech Maintenance Program

Importance of Maintenance

Maintenance is a critical component in the long term viability of any vegetated roof. **There is no such thing as a no-maintenance vegetated roof.** Keeping a watchful eye on the roof will maximize plant health, maintain the aesthetics of the roof and ensure any issues such as clogged drains, wind erosion, irrigation malfunctions, weed growth and debris are handled before they become problems. A well thought out and executed maintenance plan will make certain that the vegetated roof is performing as intended and meets the designer's and owner's expectations.

The maintenance of a vegetated roof must be considered in the early stages of the design process and those requirements should be included in the project specifications. Designers play a large part in helping to ensure good vegetated roof maintenance, including:

- Provide easy access to roof for maintenance
- Anticipate water needs of plant material by providing sufficient water on the roof level
- Provide vegetation free zones of sufficient width so that roof and equipment maintenance workers can safely traverse and not damage plant material
- Provide fall protection including railings and places to anchor safety harnesses

There are a number of tasks that go into proper maintenance of a vegetated roof.

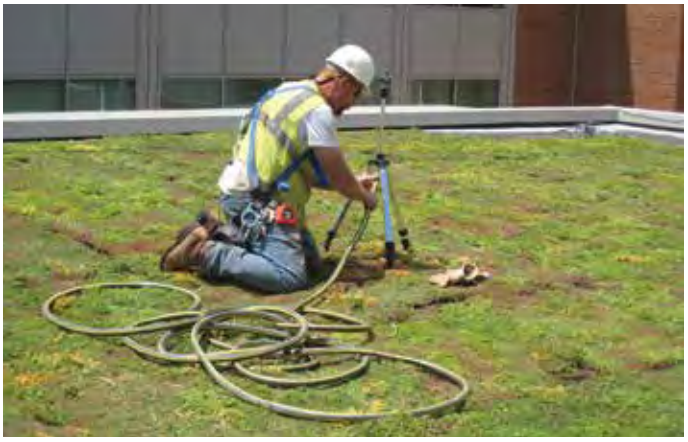
- General inspections (plant material, parapets, vegetation free zones and drains)
- Filling in thin vegetation areas
- Growing media inspections for wind scour
- Monitoring growing media for nutrient levels
- Weeding and removal of undesirable plants
- Debris removal

Initiating Maintenance

Maintenance activities must begin immediately after installation of the new vegetated roof. The newly installed vegetation will require close monitoring in the early months to help ensure proper establishment. The installing contractor often is the contractor responsible for this maintenance. This maintenance must continue until the project is accepted and the maintenance efforts are extended or transferred to another contractor or to the owner.

In many projects, the installation of the Garden Roof® can occur months before final acceptance of the project by the building owner.

It is very important that maintenance of the newly installed Garden Roof® be coordinated between the owner, the general contractor and the installing contractors so that gaps in the maintenance do not occur.



Maintenance Activities

Hydrotech works with its trained contractors to help them understand the importance of timely and proper maintenance of the vegetated roof. Hydrotech has developed a Maintenance Program to help guide contractors and building owners in the steps needed for maintaining their Garden Roof® Assembly and its warranty. There are a number of primary maintenance tasks including:

Primary Maintenance Activities

- General plant inspection
- LiteTop® growing media replacement
- Debris and trash removal
- Weed removal
- Vegetation Free Zone check
- GardenHatch® Inspection Chamber check

Secondary Maintenance Activities

(Contact Hydrotech before undertaking any of these secondary tasks)

In addition to the primary tasks, there are a number of secondary maintenance tasks that may be needed, including:

- LiteTop® growing media testing and monitoring
- Fertilizer application
- Pesticide application
- Herbicide application

Maintenance Documentation

Hydrotech has specific reporting requirements in its maintenance program that help to ensure that the vegetated roof is receiving the maintenance that is needed and the owner is expecting. This includes a visitation checklist for each visit and supplemented by photographs to help document the establishment and progression of the vegetated roof.

This consistent documentation is required for maintaining the Hydrotech plant warranty.

Contact Hydrotech for further maintenance information.

VISITATION CHECKLIST

PROJECT NAME:

Location: Date of Visit:

Installation Contractor: Date of Installation:

Maintenance Contractor: Maint. Contract in place? ☐ Yes ☐ No

Water Sources at roof: _____ Volume (GPM) _____ Pressure (PSI) Length of Contract:

Original Plant Material (check all that apply):
☐ Plugs ☐ Cuttings ☐ Sedum Carpet ☐ Sedum Tile ☐ Garden Tray ☐ Other: _____

Scheduled Visit (check one):

Quarter by Week:

1	2	3	4	5	6	7	8	9	10	11	12
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

First Year by Month:

1	2	3	4	5	6	7	8	9	10	11	12
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Second Year by Quarter:

1	2	3	4
☐	☐	☐	☐

Photos submitted digitally? ☐ Yes ☐ No (See next page for instructions on submitting photos)

Primary Tasks Comments:
(Check all that apply)
☐ Watering
☐ Irrigation Inspection
☐ Drainage Inspection
☐ Hand Weeding

Secondary Tasks Comments:
(Check all that apply)
☐ General Plant Inspection
☐ LiteTop Replacement
☐ Debris / Trash Removal
☐ Plant Replacement

Optional Tasks Comments:
(list any tasks performed)

Additional comments

Estimated Plant Coverage at time of this visit: _____% Copy submitted to Property Owner? ☐ Yes ☐ No

I hereby certify that the above tasks have been performed in accordance with the American Hydrotech, Inc. Garden Roof Maintenance Plan.

Print Name: Title:
(Maintenance Contractor Representative)

Signature: Date:

Please return to: American Hydrotech, Inc. 303 E. Ohio Street, Suite 2700 Chicago, IL 60611 Phone: (312) 337-4998 Fax: (312) 661-1831 Email: (contact@hydrotech.com)

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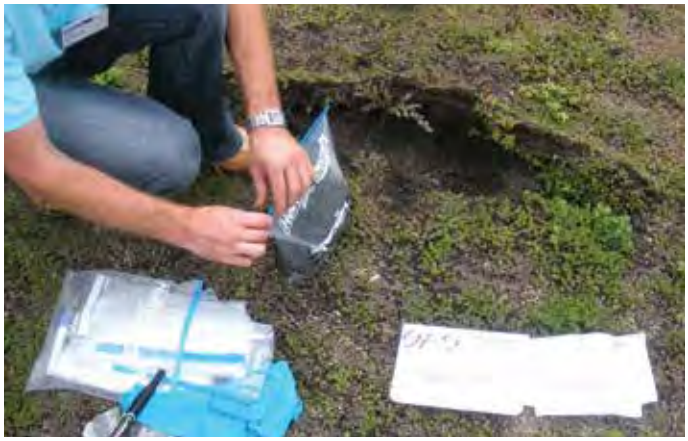


Garden Roof® Assembly Components

Monolithic Membrane 6125®

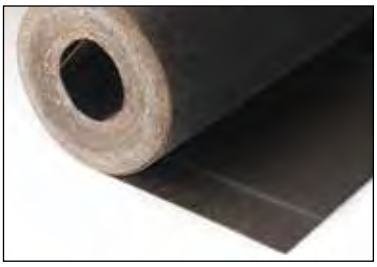
Hydrotech's Monolithic Membrane 6125® is a seamless, rubberized asphalt membrane that can be applied to structural concrete decks, plywood or gypsum board over metal decks. It consists of one coat of membrane at 90 mils (2.3 mm) into which Hydrotech's FlexFlash-F (a spunbonded polyester fabric) is embedded. A second coat of membrane is then installed at 125 mils (3.2 mm). The total membrane thickness is 215 mils (6.0 mm)

Weight: 1.4 lbs./SF installed (7.3 kg./sq.m)

Size: 40 lbs. solid cakes

Thickness: 215 mils (total installed thickness)

Recycled Content: Up to 40% post-consumer by weight



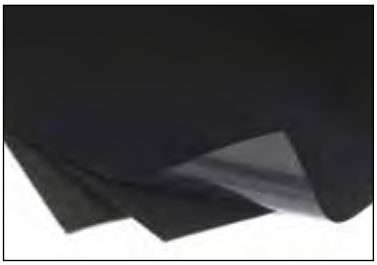
Hydroflex® 30

Hydroflex® 30 is a modified asphalt protection course that is embedded into MM6125® while still hot to provide a primary protection layer that allows for light foot traffic while completing the rest of the roof construction.

Weight: 0.75 lbs./SF (3.66 kg/sq.m)

Size: 39.4" x 66' rolls (216 SF) - East (1 m x 20.1 m)
39.37" x 50.25' (164 SF) - West (1 m x 15.3 m)

Thickness: 0.090" (2.2 mm)



Root Stop (10 mil)

Root barriers are intended to prevent damage of the roof membrane from the growth of plant roots. The type of root barrier is determined by the type of vegetation.

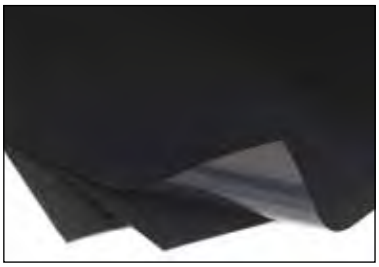
Root Stop is a general purpose root barrier and is used under typical extensive vegetated roofs that have sedums and perennials plants that don't have aggressive root systems.

Weight: 0.05 lbs./SF (0.24 kg/sq.m)

Size: 15' x 100' rolls (4.5 m x 30.5 m)

Effective coverage: 950 SF with 5' laps, 1218 SF with 2.5' taped laps

Thickness: 0.010" (10 mils, 0.25 mm)



Root Stop HD (30 mil)

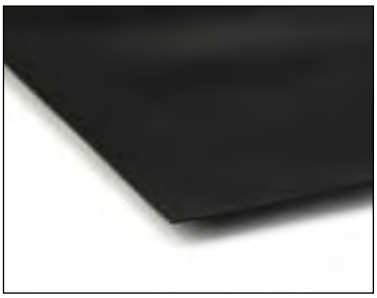
Root Stop HD is used when vegetation consists of larger, woody-type perennials, shrubs and trees when an added measure of root penetration protection is required. For installations involving bamboo or other plants with aggressive root structures, see Root Stop Bamboo.

Weight: 0.17 lbs./SF (0.83 kg/sq.m)

Size: 15' x 100' rolls (4.5 m x 30.5 m)

Effective coverage: 950 SF with 5' laps, 1218 SF with 2.5' taped laps

Thickness: 0.030" (30 mils, 0.70 mm)



Root Stop Bamboo (60 mil)

When clumping bamboo is included in the mix of vegetation, Root Stop Bamboo root barrier is required. Root Stop Bamboo will stop the aggressive roots of clumping bamboo.

Note: Running-type bamboo or other species with aggressive root structures are not allowed on Hydrotech's vegetated roofs.

Weight: 0.32 lbs./SF (4.4 kg/sq.m)

Size: 5' x 100' rolls (1.52 m x 30.5 m)

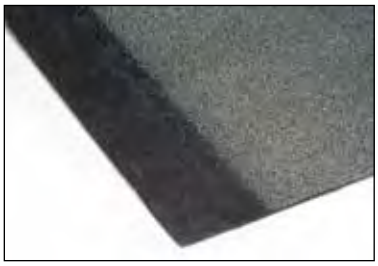
Thickness: 0.060" (60 mils, 1.5 mm)

Root Stop Tape

Root Stop Tape is a white, single-sided tape combining a weather resistant polyethylene backing with an aggressive rubber adhesive. Root Stop Tape is designed to help seal the laps between sheets of Hydrotech's Root Stop, Root Stop HD, and Root Stop Bamboo.

Size: 4" x 210' rolls

Hydroflex® RB II



A heavy duty, granular-surfaced, modified asphalt sheet with a factory applied root inhibitor. Used in intensive vegetated roof applications or whenever aggressive root growth is anticipated. It is also used in sloped applications as the granular surfacing provides additional slip resistance.

SpinOut must be field applied at all seams and lap edges.

Weight: 0.91 lbs./SF (4.4 kg/sq.m)

Size: 39.4" x 33.4' rolls (1 m x 10.2 m)

Effective coverage: 97 SF per roll

Thickness: 0.160" (160 mils, 4.0 mm)

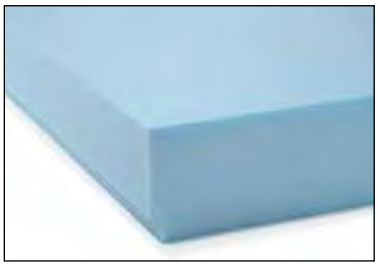
SpinOut®

SpinOut is a water based, latex coating with a built-in root inhibitor that is applied at all seams and lap edges of Hydroflex RB II.

Size: 1 gallon containers

Coverage: When diluted with 2 quarts of water, Spinout will cover approx. 2,000 LF of Hydroflex RBII sheet edges with a band 3 inches wide.

DuPont STYROFOAM™



STYROFOAM™ an extruded polystyrene insulation provides a design R-Value of 5 per inch of thickness. STYROFOAM™ provides thermal insulation to the building, protection to the membrane, and is ideally suited to wet environments due to its low water absorption.

Weight: 0.17 lbs./SF per inch of thickness (0.83 kg./sq.m)

Size: 2' x 8' (0.6 m x 2.4 m)

Thickness: 1" to 4" thickness available

Compressive Strength: 40, 60, or 100 psi (275.8, 413.7, 689.5 kPa)

R-Value: 5 per inch of thickness

Recycled Content: 40% post-industrial by weight

Hydrodrain® AL or 300

Hydrodrain® AL or 300 are prefabricated air layers made of a three-dimensional, crush-proof core to which is bonded a white non-woven, needle punched filter fabric. The Hydrodrain® air layer is designed to be used as the air space between the DuPont STYROFOAM™ insulation and Moisture Mat when extra water holding capacity is desired in the assembly.

Weight: 0.24 lbs./SF (1.17 kg./sq.m)

Size: 4' x 75' rolls (1.2 m x 22.9 m)

Thickness: 0.22 inch (5.6 mm)

Recycled Content: 100% post-industrial by weight

Moisture Retention Mat

Moisture Mat, with its tangled mesh of fibers, traps and stores additional water that is released through diffusion/ evaporation up through the holes of the Gardendrain® components.

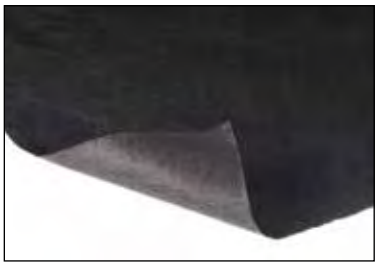
Note: Moisture Mat is optional and is not used on all projects. If Moisture Mat is placed above the insulation, Hydrodrain® AL or 300 is required between the mat and insulation.

Weight: 1.2 lbs./SF wet weight (5.3 kg./sq.m)

Size: 7.5' x 100' rolls (2.3 m x 30.5 m)
Effective coverage: 715 SF per roll (66.4 sq.m per roll)

Thickness: 3/16 (0.188)" (4.8 mm, 188 mils)

Systemfilter



Systemfilter helps prevent soil particles from washing through the system and potentially clogging drainage layers and drains. It is also used to retain aggregate ballast where required (i.e. vegetation free zones).

Weight: 0.04 lbs./SF (195 g/sq.m)

Size: 12.5' x 120' rolls (3.8 m x 36.6 m)

Thickness: 0.010" (10 mils, 0.25 mm)

Gardendrain® GR15

Hydrotech's Gardendrain® drainage/retention/aeration components are designed specifically for vegetated roofs. Drainage channels above as well as below ensure that excess water is free to drain out of the system, even in the presence of heavy root growth. Cups designed into the panels provide water storage capacity, while holes in the panels provide air and vapor circulation. Gardendrain® GR15 is generally used in extensive vegetated roof conditions.

Weight: 1.0 lbs./SF (4.9 kg/sq.m) empty/wet

Size: 3' x 8' panels (0.9 m x 2.4 m)

Thickness: 5/8" (15 mm)

Compressive Strength: 7,455 lbs./SF (357 kPa)

Recycled Content: 100% post-industrial by weight

Gardendrain® GR30

With more drainage and water storage capacity than GR15, GR30 is commonly used in extensive and intensive roofs.

Cups can be filled with light weight aggregates which help to provide additional water storage capacity, as well as support greater growing media depths above.

Weight: 1.6 lbs./SF (7.81 kg/m^2) empty/wet
3.8 lbs./SF (18.5 kg/m^2) with cups filled/wet

Size: 4' x 6' (1.2 m x 1.8 m) panels

Thickness: 1-1/4" (30 mm)

Compressive Strength: 5,069 lbs./SF - empty
13,000+ lbs./SF - cups filled
(242.7 kPa empty, 622.4+ kPa filled)

Recycled Content: 100% post-industrial by weight

Gardendrain® GR50

With even more drainage and water storage capacity than GR15 or GR30, GR50 is commonly used in intensive roofs.

Cups must be filled with light weight aggregate which helps to provide additional water storage capacity.

Weight: 2.0 lbs/SF (9.76 kg/m^2) empty/wet
6.3 lbs/SF (30.76 kg/m^2) with cups filled/wet

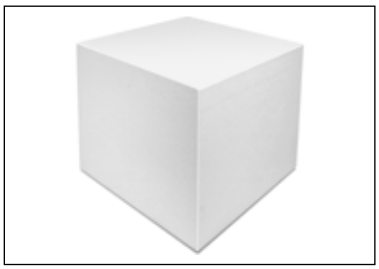
Size: 4' x 6' (1.2 m x 1.8 m) panels

Thickness: 2 inch (50 mm)

Compressive Strength: 7,000+ lbs./SF (335.2+ kPa)

Recycled Content: 100% post-industrial by weight

Geofoam



Expanded polystyrene (EPS) is often used as a fill material in assemblies to save weight. It is stacked to create topography on a roof structure.

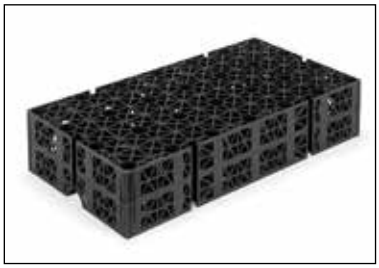
Weight: 0.7 lbs./ft^3 (2.85 kg/m^3) empty/wet

Size: 4' (1.2 m) widths
8' (2.4 m) up to 16' (4.8 m) lengths

Thickness: 1" (25 mm) up to 36" (914 mm)

Compressive Strength: 2.2 - 18.6 psi at 1% deformation, per ASTM D6817

Permavoid® 150 mm



Permavoid® is a 150 mm tall voiding element used to support Garden Roof Assemblies and pavers above the water detention zone in a Hydrotech Blue Roof. It creates a layer that is 95% open in which water can be temporarily held during heavy storm events.

Size: 14" x 28" x 5.91" nominal
(355 mm x 710 mm x 150 mm, nom.)

Percentage open space: 95%

Permavoid® 85S

Permavoid® 85S is a 85 mm tall voiding element used to support Garden Roof Assemblies and pavers above the water detention zone in a Hydrotech Blue Roof. It creates a layer that is 95% open in which water can be temporarily held during heavy storm events.

Size: 28" x 28" x 3.35"
(710 mm x 710 mm x 85 mm, nom.)

Percentage open space: 95%

GardMat® LT

Erosion control blankets help to provide wind and water surface erosion protection to assist in the establishment of the vegetation.

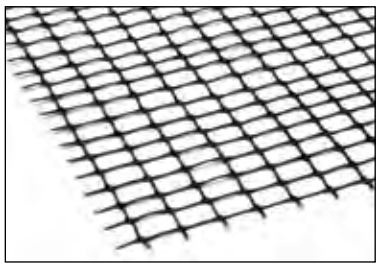
For general use, GardMat® LT is fabricated from biodegradable fibers with a coconut coir interior layer.

Weight: 0.073 lbs./SF (1.09 kg./sq.m)

Size: 6.67' x 108' rolls (2.03 m x 32.92 m)

Thickness: 0.28" (7.11 mm)

GardMat® N



For projects where an added measure of erosion control is needed, especially in high wind applications, Hydrotech offers GardMat® N. GardMat® N is a UV resistant polypropylene netting with approximately 1/2" square openings.

Weight: 0.021 lbs./SF (0.031 kg./sq.m)

Size: 6.67' x 80' rolls (2.03 m x 24.38 m)

Thickness: Nominal

Disk Anchors

Disk Anchors are used to secure GardMat® LT or N as well as InstaGreen® Carpet and InstaGreen® Tile to the vegetated roof. Permanent and biodegradable disk anchors are available. Color may vary depending on recycled content. **Contact Hydrotech for placement and spacing requirements.**

Base: 5" dia. x 0.1875" thick (nom.)

Shaft: 12" ht. x 0.375" dia.

Top Disk: 4.75" dia. x 0.0625" thick (nom.)

Height: 3" to 8.5" (custom heights are available)

GardenEdge® Metal Edging

Hydrotech offers a range of metal edging products to create divisions between vegetation free zones and the LiteTop® growing media. Fabricated from uncoated aluminum or stainless steel, it is available in straight and flex edge configuration that allows free-form curves. A powdered epoxy coating with a wide range of colors is also available.

Height: 3" to 8.5" (custom heights are available)

Length: 8'

Thickness: 0.10" (aluminum)

GardenEdge® Leveling Strips

Aluminum leveling strips that bolt to the edging are available to accommodate variable roof slopes. **Contact Hydrotech for details.**

Height: 4", 6" and 8" ht.(custom heights are available)

Length: 8'

Thickness: 0.10" (aluminum)

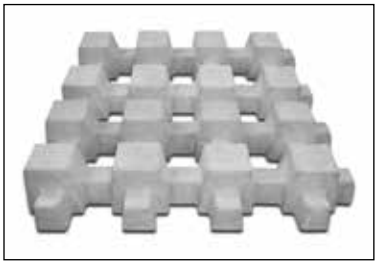
Stone Filter Fabric

Stone Filter Fabric is a white, UV stabilized, needle-punched, non-woven polypropylene fabric designed to be used as a separation sheet between the stone/gravel ballast, InstaGreen® GT-4 trays and Permavoid® units, and DuPont STYROFOAM™ insulation. Stone Filter Fabric serves three main functions. It protects the insulation board from exposure to the sun, prevents stone/gravel ballast from falling in between the joints of the insulation boards and rafts them together.

Weight: 3.0 oz/sq yd or 101 lbs./roll (101 g/sq m or 45.8 kg/roll)

Size: 13.5' (4.1 m) wide x 360' (109.7 m) long

Checker Block®



Checker Block® is used for adding permanent ballasting to Garden Roof areas. The open and connected void structure in Checker Block® creates an ideal environment for growing perennials and sedum. The concrete structure of Checker Block® units provides the same ballasting weight of a 2 inch thick concrete paver. Each unit is connected together with stainless steel zip ties provided by Hydrotech.

Size: 24" x 24" (4.0 SF / unit)

Thickness: 4"

Weight: 92 lbs / unit plus LiteTop® media

GardenHatch® Inspection Chambers

GardenHatch® Inspection Chambers are used to keep ballast and LiteTop® Growing Media away from roof drains and to allow their inspection. They are fabricated from stainless steel and slotted to permit free water drainage into the roof drains. Two sizes are available along with extensions to add additional height to the base units.

Custom sizes are available.

Size: 11" x 11" and 18" X 18"

Height: 4.75"

GardenHatch® Extensions

GardenHatch® Inspection Chamber Extensions are used to accommodate deeper Garden Roof® Assemblies. Three sizes are available and can be combined (up to three extensions) to work with intensive Garden Roof assemblies up to 24 inches deep.

Custom sizes are available.

Size: 11" x 11" and 18" X 18"

Extensions: 1", 3" and 8.5" in each size

LiteTop® Engineered Growing Media

Blended at many facilities across the United States and Canada, LiteTop® is the core of the Hydrotech extensive and intensive Garden Roof assemblies. Designed using local materials, LiteTop® provides the ideal growing media for optimum plant growth.

Hydrotech creates various blends of LiteTop® to address the different assemblies including:

- Extensive
- Intensive
- Lawn
- Urban Agriculture
- Custom (project specific)

Rock Mineral Wool

Rock Mineral Wool is a needled material used for increasing the water holding capacity of Hydrotech Garden Roof® Assemblies. This additional capacity is often used to increase the stormwater capacity of the total Garden Roof® Assembly. Rock Mineral Wool can also be used in lightweight assemblies to provide extra water holding for plant use.

When used in an assembly with DuPont STYROFOAM™, Rock Mineral Wool must be installed with Hydrodrain® Max.

Size: 1.0" thick (nominal)

Roll Width: 39" (1 meter)

Roll Length: 197" (5 meters)

Hydrodrain® Max

Hydrodrain® Max is an air layer used in combination with Rock Mineral Wool when installed over DuPont STYROFOAM™. Composed of entangled filaments and a lightweight scrim on top, Hydrodrain® Max promotes proper drainage underneath Rock Mineral Wool as well as providing the required air layer over the DuPont STYROFOAM™.

Size: 0.775" thick (nominal)

Roll Width: 42.5"

Roll Length: 153.8"

GardNet®

GardNet® is a cellular confinement component designed to hold LiteTop® growing media on sloped Garden Roof® Assembly applications.

Contact Hydrotech for detailed installation guidelines.

Depth: Available in various depths: 3", 4", 6", 8" and 12"

InstaGreen® GT-4 Tray

For a modular assembly, Hydrotech offers the InstaGreen® GT-4 tray. With interlocking clips, wind resistance is built-in to this tray unit. The GT-4 tray is available in a number of planting formats and multiple delivery options are available.

Contact Hydrotech for details.

Size: 12" x 24" x 4" deep media plus 1.75" water reservoir base

Weight: Regionally dependent; approx. 30-35 lbs/SF

Sedum Cuttings

Sedum cuttings can be provided in varieties that will vary by the region of the country. Cuttings are harvested, packaged and shipped to the project ready to install.

Packaging: 18" x 18" x 9" boxes

Weight: 20 to 25 lbs. per box

Plugs

Hydrotech offers a wide range of sedum and perennial plugs for use on its Garden Roof® Assemblies. Available plant species will vary by the region of the country.

Size: 50-count and 72-count size in full flats

(Count size is dependent on variety and region of the country)

Packaging: Dependent upon size of order

InstaGreen® Carpet

Hydrotech's InstaGreen® Carpet creates very economical, instantly green vegetated roofs. It is available for many areas of the United States.

Size: 4' x 6.25' (25 SF) rolls

Weight: 80 lbs./roll - dry
120 lbs./roll - wet

Packaging: Rolled and shipped on pallets

InstaGreen® Tile

Hydrotech's InstaGreen® Tile is offered in a number of different blends to provide instant vegetated roofs. Custom tiles can be created with sufficient lead time.

Size: 12" x 24" (2.0 SF/tile)

Blends: Four Seasons, Full Color, and Rugged (contact Hydrotech for specific blend information)

Custom blends are available

Weight: 4-6 lbs./SF - wet

Packaging: Shipped on pallets

Additional Resources

Hydrotech Info Sheets

This Planning Guide is designed to provide some overview guidelines on most topics that arise during the design and installation of a vegetated roof.

Hydrotech has Info Sheets available that include more in-depth information beyond what's published in this Planning Guide. These Info Sheets have been developed in response to some of the more commonly asked questions related to various Hydrotech's Garden Roofs®, including:

- Water Accessibility and Extensive Vegetated Roofs
- Weeds on Vegetated Roofs
- Lawn Establishment on Garden Roofs®
- Frost Dates and Proper Planting Times
- Sedum Cuttings and Hydromulching

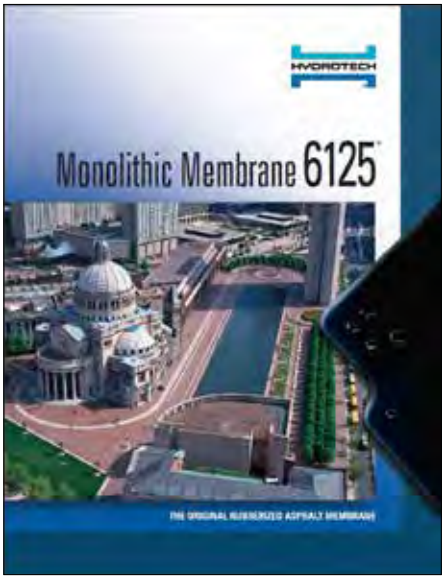
These Info Sheets are available from your local Hydrotech Representative or by contacting Hydrotech directly.

Plant Identification Cards

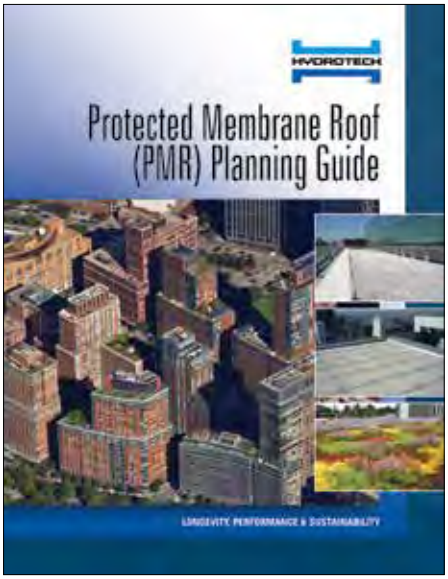
Hydrotech has developed a set of Plant Identification Cards to assist designers with their choice of vegetation when designing a Garden Roof®.

These cards are also useful in field identification of vegetation on the rooftop. Each card contains photographs of the species, USDA hardiness zones, plant height, bloom color, bloom timing and other additional horticultural information.

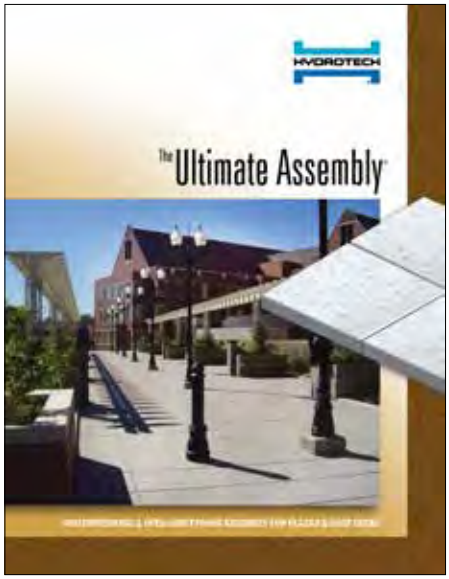
Hydrotech has a wide array of additional resources for consideration and expansion of the Protected Membrane Roof assemblies.



Monolithic Membrane 6125®
This brochure outlines the capabilities of Hydrotech's flagship product, MM6125®, and its value in the most important aspect of any roofing and waterproofing project: **keeping the structure watertight.**



Protected Membrane Roof Planning Guide
Based on more than 60 years of experience in protected membrane roofing, this brochure is indispensable to designers, architects and engineers who need information of which PMR assemblies are appropriate for their roof top projects.



The Ultimate Assembly®
Often projects involve hardscape elements and the Ultimate Assembly® brochure outlines the assemblies that are appropriate for creating a wide array of paved pedestrian friendly surfaces on roof tops and plazas.

Website - www.hydrotechusa.com

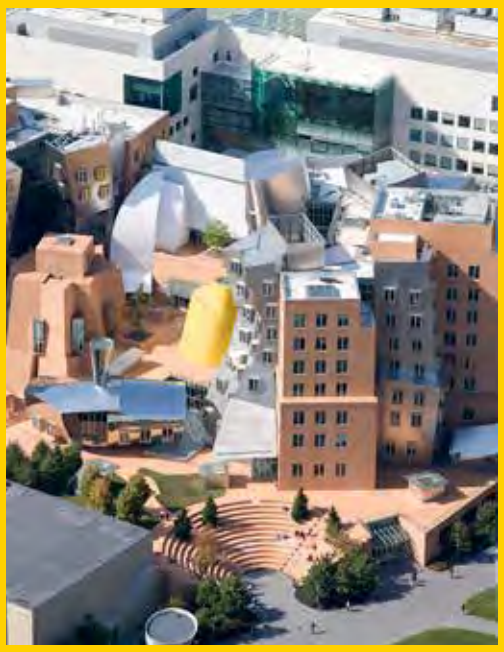
Hydrotech's website has been optimized for viewing from whichever device a user prefers. Whether browsing from a desktop, tablet or smartphone, the following resources are available...

- Brochures
- Specifications
- Details
- Installation Guidelines
- Project Spotlights
- Project Photography
- Plant Lists
- Product Data Sheets
- Material Safety Data Sheets
- Ask an Expert

People Make the Difference

Hydrotech's most valuable resource is the knowledge and experience we have gained from each and every Garden Roof® in which we have been involved. We encourage you to talk to your local sales representatives or directly with our Garden Roof Department personnel. We are available to assist you with your next project, whether you need design input, details reviewed, or help with your specifications.

Please contact us at **800-877-6125** or visit our website at **www.hydrotechusa.com.**



Stata Center, Massachusetts Institute of Technology - Cambridge, MA

Walt Disney Concert Hall - Los Angeles, CA

In 1980, American Hydrotech, Inc. purchased the Construction Products Division of Uniroyal Ltd. in Canada, giving the company exclusive worldwide ownership for the manufacture and distribution of Monolithic Membrane 6125®.

One early strength of American Hydrotech, Inc., that continues today, is its established relationships with the architectural community. The highly respected architectural firm Skidmore, Owings and Merrill first used MM6125® in the late 1960's for the Finance and Management Center at the Illinois Institute of Technology in Chicago.

We have best-in-class brands that provide exceptional performance and owner value: Monolithic Membrane 6125®, our premium (flagship) waterproofing product has been successfully installed on the world's most prestigious structures in over 62 countries for more than 50 years.

In 2021, Sika Corporation acquired American Hydrotech for its position as the market leader in the development and production of premium waterproofing and roofing products and assemblies. With more than 100 years of experience, Sika is a worldwide innovation and sustainability leader in the development and production of systems and products for commercial and residential construction, as well as the marine, automotive, and renewable energy manufacturing industries. Sika has offices in over 103 countries with over 400 manufacturing facilities and more than 33,000 employees worldwide. With annual sales of 12 billion dollars in 2023, our commitment to quality, innovation, and the environment as well as putting our customer's needs first, encompasses why Sika is the global leader in our industries. Sika, beyond the expected.

WE ARE SIKA

With more than 100 years of experience, Sika is a worldwide innovation and sustainability leader in the development and production of systems and products for commercial and residential construction, as well as the transportation, marine, automotive, and renewable energy manufacturing industries.

Sika has subsidiaries in 102 countries around the world and, in over 400 factories, produces innovative technologies for customers worldwide. In doing so, it plays a crucial role in the transformation of the construction and transportation sector toward greater environmental compatibility. With more than 34,000 employees, the company generated sales of CHF 11.76 billion in 2024.

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