

# Siplast Vegetated Roof System Technology



## Siplast Was "Green" Before Green Was Cool.

Siplast has been associated with the green roofing business for over 30 years. Paradiene and Teranap membrane systems have been successfully keeping buildings watertight beneath vegetative roofs in France and Germany since the 1970s. The interest in vegetated roofing in the United States has grown considerably since 2000, and Siplast has been an active part of that movement.



## Why Vegetated Roofs?

There are a number of benefits associated with vegetated roofs. The most commonly recognized benefits are:

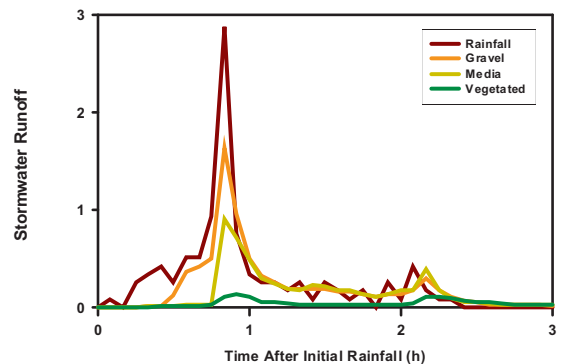
- Stormwater management.
- Reduction of building energy use.
- Increased roof longevity.
- Reduction of Urban Heat Island Effect.
- Providing urban green space.



## Stormwater Management.

The mitigation of stormwater runoff is considered by many to be the primary benefit of vegetated roof systems because of the prevalence of impervious surfaces in urban areas. The rapid runoff from roof surfaces can exacerbate flooding, increase erosion, and result in raw sewage that is discharged directly into rivers. The larger amount of runoff also results in a greater quantity of water that must be treated before it is potable. A major benefit of vegetated roofs is their ability to absorb stormwater and release it slowly over a period of several hours, as shown by the graph at the right. Vegetated roof systems have been shown to retain 60-100% of the stormwater they receive.

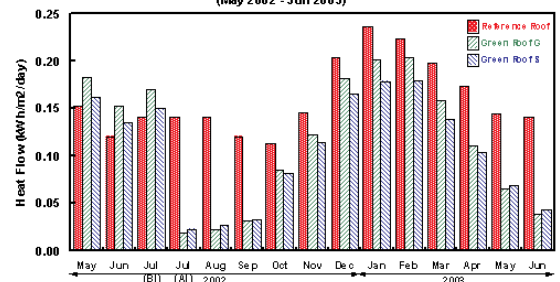
Stormwater Runoff Hydrograph



## Reduce Building Energy Use.

Vegetated roofs can reduce heating and cooling demands, as shown by the bar graph at the right. During a cold winter, the insulation layer and growing medium of a vegetated roof can add thermal value. In the summer, the impact is more significant. Plant material evaporating moisture will cool the rooftop surface, reducing cooling demand considerably.

Average Daily Heat Flow Through Roof Surfaces (May 2002 - Jun 2003)



## Green Roof Membrane Temperature

### Increased Roof Longevity.

Waterproofing membranes covered by vegetated roofs have a longer life-span than exposed membranes because they are protected from ultraviolet radiation and the extreme fluctuations in temperature that cause roof membranes to deteriorate. The graph at the right shows the results of a 10-month study on the temperature fluctuations between the surface of an exposed roof (reference) and beneath a vegetated roof cover over the referenced roof. Temperature differences were as much as 55°C (130°F).

**GREEN ROOF THERMAL STUDY -  
MICHIGAN STATE UNIVERSITY  
July 2006, 3 pm  
Ambient Temperature = 89°F**

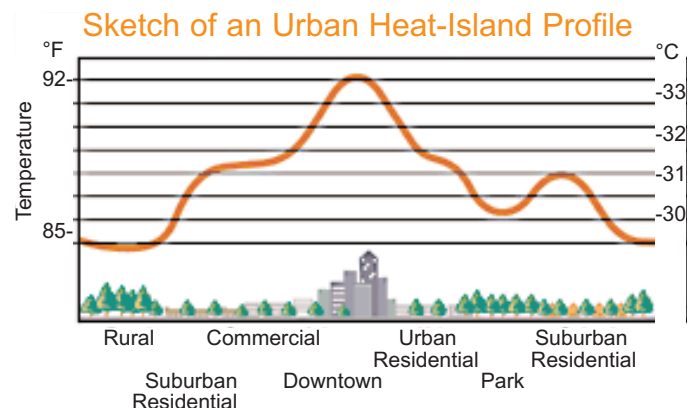
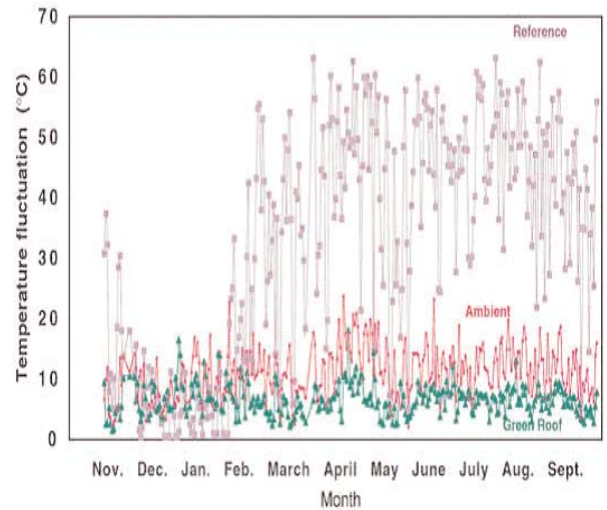
A 2006 study by Michigan State University verified temperature differences at various locations both inside and outside a test building, including a comparison between a gravel ballast roof and a vegetated roof. Sample results from the study are shown below.

Temperature Reading	Gravel Ballast	Vegetated Roof	$\Delta T$
1 meter above surface	90°F	88°F	2°F
On surface	122°F	98°F	24°F
On roof membrane	118°F	92°F	26°F
Inside building	92°F	83°F	9°F

### Reduce Urban Heat Island Effect.

Urban areas are generally 2 – 5° F warmer than surrounding rural areas. This is known as the Urban Heat Island Effect. On top of that, the United States Environmental Protection Agency projects a 2 – 7° F increase in aggregate temperature for urban regions over the course of the 21<sup>st</sup> century. By cooling rooftop surfaces, vegetated rooftops can help to mitigate this effect.

Membrane temperature daily fluctuation  
(Nov. 22, 2000 - Sept. 30, 2001)



## Providing Urban Green Space.

Vegetated roofs offer interesting opportunities for architectural design. A vegetated roof can allow a structure to merge with the surrounding landscape, provide a dramatic accent, or reinforce the defining aspects of the structure's geometry. In Germany—and increasingly in the United States—green roofs are frequently integrated into the design of hospitals and care facilities in order to provide a more restful and restorative environment for patients. In fact, city hospital administrators have observed that patients who can see green space outside often recover more quickly. Multi-unit residences and hotels are finding that views of vegetated roofs substantially enhance property values. In commercial settings, job satisfaction and effectiveness could be enhanced by providing window views of garden areas that can be used for breaks.

Vegetated roofs can add serene communal space in urban areas, improving both property values and quality of life.

### Additional Benefits

Vegetated roofs provide other environmental, economic, and aesthetic benefits that have yet to be fully studied and quantified. These benefits include potential removal of airborne dust, pollutants, and greenhouse gases, as well as sound reduction and, production of oxygen.

### Siplast Vegetated Roof Systems

Siplast Vegetated Roof Systems are the centerpiece of the siplastgreen product group. Our comprehensive offering includes both SBS-modified bitumen and PMMA liquid-applied waterproofing options, as well as multiple flashing options, Paragreen pre-grown vegetated mats, and all the components required for extensive, intensive, and lawn landscaping. So, with Siplast Vegetated Roof Systems, building owners can enjoy the benefits of a vegetated roof with the convenience of a single-source system package.

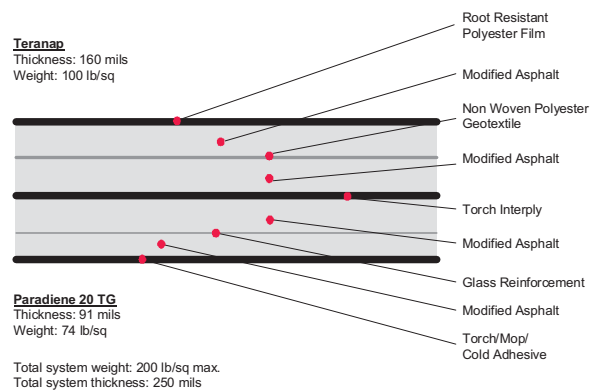
### Teranap Green Roof Waterproofing System

Green roofs add a great deal of aesthetic appeal, utility, and environmental friendliness to a building project, but they also create significant waterproofing challenges. For over 30 years, Teranap has met the needs of these demanding applications.

Teranap vegetated roof applications can be specified with many landscape options, including both extensive green and intensive green assemblies. Teranap Extensive Vegetated Roofs are characterized by low weight, low capital cost, and minimal maintenance. The growing medium is typically composed of a



### The Teranap System



mineral based mix of sand, gravel, crushed brick, leica, and peat organic matter. In an extensive system, soil varies in depth from 2 to 6 inches, and weighs 13-18 lb/sq ft dry and 15-25 lb/sq ft saturated. Plant selections appropriate for extensive assemblies include sedum, grasses, wildflowers, and other low maintenance vegetation. Plants are watered and fertilized until they are established. At that point, minimal maintenance is required.

Teranap Intensive Vegetated Systems are used to waterproof elaborately designed roofscapes that are intended for pedestrian access. In an intensive system, soil depth starts at 8 inches. Therefore, a more diverse plant selection, including trees and shrubs, is possible.

The weight of intensive systems starts at approximately 50 lb/sq ft, so they must be engineered to conform to structural load requirements. Intensive vegetated systems require regular maintenance and watering. Siplast offers all of the components required for vegetated roof installations, including filter fabric, drainage mat, soil, Insulperm Geofoam Extruded Polystyrene, and vegetated growing systems.



## Parapro Vegetated Roof System.

For vegetated roof applications where project circumstances, local regulations, or a tight construction schedule make the application of sheet materials difficult, Siplast offers a proven high-performance option: liquid-applied Parapro.

The Parapro System is built on advanced polymethyl methacrylate (PMMA) technology developed for demanding waterproofing applications. PMMA's root and chemical resistance properties make Parapro a smart choice for vegetated roofs and planter waterproofing.



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