

# Green Roofs

Why not take it from the top? Green roofs last a long time and contribute to many environmental benefits. They are used on premier architectural buildings, but often aren't noticed because you can't usually see them from the ground.





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**G**reen roofs—also known as vegetated roofs, eco-roofs, or living roofs—consist of vegetation on a relatively thin layer of growing medium. They are ideally suited to flat or slightly sloped (up to 40 degrees) surfaces.

Green roofs reduce the rate and volume of runoff by temporarily holding rainfall in the growing medium. Plants take up the water as it slowly filters through the soil, and water that stays on the surface of the vegetation can evaporate back into the atmosphere.

Green roofs don't have to be large to be effective. A green roof installed on a 15-square-metre shed can effectively reduce the runoff from that surface from a typical (2.5-centimetre) rain event to zero.



## Benefits of Green Roofs

**Durability.** Green roofs last at least twice as long as the best asphalt roofs.

**Insulation.** The thick layer of growing medium and plants insulates and buffers temperature and sound. Both heating and cooling demands are reduced. Utility bills go down.

**Stepping-stone habitat and increased biodiversity.** Green roofs are noted for providing refuges for many beneficial and rarer insects. Birds love them too.

**Reduced urban heat island effects.** Green roofs reduce the amount of heat reflected from rooftops, keeping urban areas cooler in summer.

**Improved air quality.** More plants equals more clean air.

**Fire suppression.** Green roofs can be designed to offer superior fire protection, as they don't generate as much burning heat-load as conventional roofs.

## Green Roofs are Best...

**For new construction.** Growing medium, plants and water add significant weight to structures. It is usually cheapest to get the proper load-bearing properties for a building when you are starting from scratch.

**For lower-slope roofs.** You don't have to have a flat roof, but the steeper the pitch, the more challenging it is to devise ways to keep components from sliding off.

**When you want a better view.** A common residential application is on top of a garage or outbuilding that you look out over.

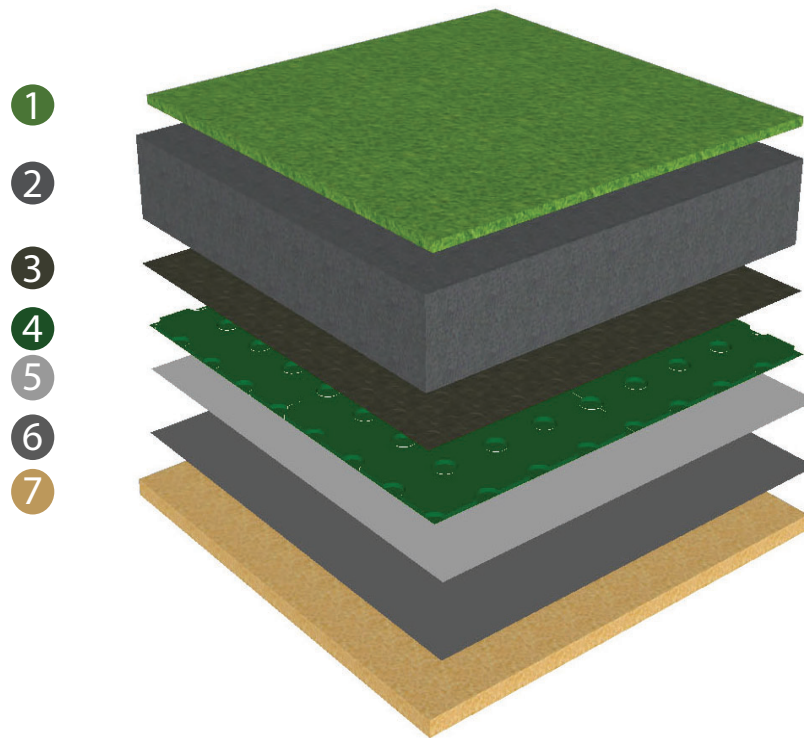
**In conjunction with a rooftop patio.** If you are adding enough load-bearing capacity to support people, incorporating some plants into your design is easy.

**When you are installing solar panels.** Green roofs extend the life of solar panels by moderating the temperatures that the panels are subjected to.

**When you are building a legacy home.** The planting medium protects the waterproof membrane from exposure to UV, hail, and micro-tears caused by temperature fluctuations. A green roof can last a very long time.

**ON THE COVER:** Berry Architecture Green Roof, Red Deer. Native plants in this view are Purple Prairie Clover (*Dalea purpurea*) in the foreground and Yellow Coneflower (*Ratibida columnifera*) in the background. Unirrigated.

CREDIT: Cynthia Pohl, Living Lands Landscape and Design <https://living-lands.ca/project/berry-architecture-associates/>



## Components of a Green Roof

Green roofs for residential applications are usually classified as **extensive**: they are shallow (5–15 cm) and lighter, have reduced variety of plants and maintenance needs, and are installed on generally inaccessible rooftops.

Some green roofs may be designed to support more weight and have a larger variety of plants with a thicker growing medium (20–90 cm). These **intensive** green roofs may offer accessible open space for people to enjoy.

Here’s a look at the layers that make up a green roof system.

- 1 Vegetation:** On extensive green roofs, plants selected should be native, drought- and wind-resistant. Sedum roofs are an alternative but don’t contribute to as much biodiversity.
- 2 Growing Medium:** Supplies the vegetation with moisture and nutrients. Typically a manufactured mix of mineral materials, lightweight aggregates, and stabilized organic matter.
- 3 Filter Fabric:** Stops fine particles that may leach from the growing medium from entering the drainage layer.
- 4 Drainage Layer:** Porous media transport excess water to the roof drain(s) or scupper(s).
- 5 Root Barrier/Membrane Protection:** Protects the waterproof membrane from plant roots.
- 6 Waterproofing Membrane:** A high-quality membrane should be leak-tested after installation.
- 7 Roof Structure/Assembly:** Must be built to handle the additional load, especially when the green roof is saturated with water.

## Types of Green Roof Installations

There are a number of systems or approaches for installing green roofs. They can be *loose-laid*, which means the roof is built up layer by layer. This is the most time-consuming approach, but allows your system to be customized to your roof and site conditions, giving you control over your selection of materials and vegetation.

Modular plant systems are also available. These are usually pre-grown off-site and offer a faster installation option. These can take the form of trays or pre-vegetated mats of plants to be placed over growing medium and drainage material. Since these modular systems are quite thin, they are usually used for extensive green roofs.

## Things to Consider

**Installation.** A small-scale extensive green roof on your shed could make a fun DIY project if you're willing to put in the time and research to make sure you're using appropriate materials and techniques. However, it is generally recommended that installation be done by an experienced green roof professional to ensure that all components are installed correctly and the work can be warrantied and insured.

**Weight.** A green roof installed atop a sturdy shed probably doesn't require much additional support. However, green roofs do increase the weight applied to the structure (especially when saturated with water), so you may need to consult a structural engineer when installing a larger-scale system (for example, on your home's rooftop).

**Roof Slope.** Green roofs can be installed on roofs that slope between zero and 40 degrees. Any slope above 10 degrees should include measures to prevent erosion, stabilize the slope, and retain moisture. The top of the slope will always be drier, as water drains downward, so the vegetation in this area should be more drought-resistant or may require some additional watering.

**Irrigation.** After installation, extensive green roofs usually only need extra watering when the vegetation is establishing itself, for the first season or two. Keep an eye on your green roof during dry/drought weather to see if it requires more water. Some green roofs are set up to use runoff from other hard surfaces as their watering source. If a variety of native plants are included, die-off during drought may not be a problem and the roof will naturally rejuvenate in subsequent years from seed sources.



ABOVE:| Innisfail Library

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## Maintenance

Extensive green roofs are usually designed with hardy native plants, with little variation, to reduce overall maintenance needs. However, there are a few things to attend to over the course of the year.

### Spring:

- Clean up, remove debris and dead plants.
- Replace or add new plants (if required).
- Clean out drains and ensure overflow system is not blocked with material.
- Water (if necessary, particularly during establishment period) or activate irrigation system (if installed).

### Summer:

- Check on plant health and repair as needed (pruning, replanting, fertilizing, pest control).
- Weeding and debris removal.
- Clean out drains and ensure overflow system is not blocked with material.
- Test irrigation system to make sure it's functioning properly (if installed).

### Fall:

- Clean up and remove dead plant material and debris
- Add fertilizer (if needed).
- Shut down and winterize irrigation system (if installed).

### Winter:

- Examine roof according to green roof supplier's recommendations.

**Waterproof Membrane Inspection.** The coverage and insulation provided by a green roof helps extend the lifespan of a roof's waterproofing membrane. Most leaks occur due to improper installation, particularly around seams, joints, flashings, roof penetrations, and drains. Professional installation will help eliminate this risk.

Annual inspection of your waterproofing membrane is a good idea, though it's tough to do when it's completely covered by the green roof system. For larger applications, an electronic leak-detection system could prove a worthwhile investment.

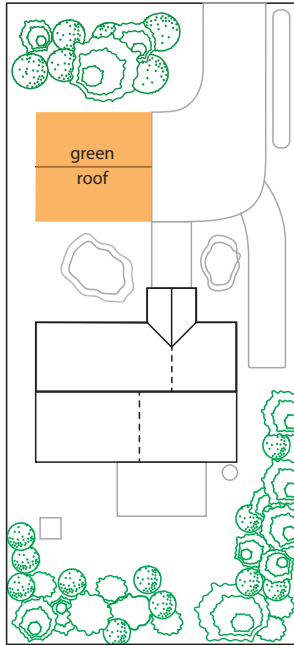


**TOP:** Mixed native extensive green roof irrigated from a cistern that harvests parking lot runoff.

**BOTTOM:** Sedums blooming and going to seed.

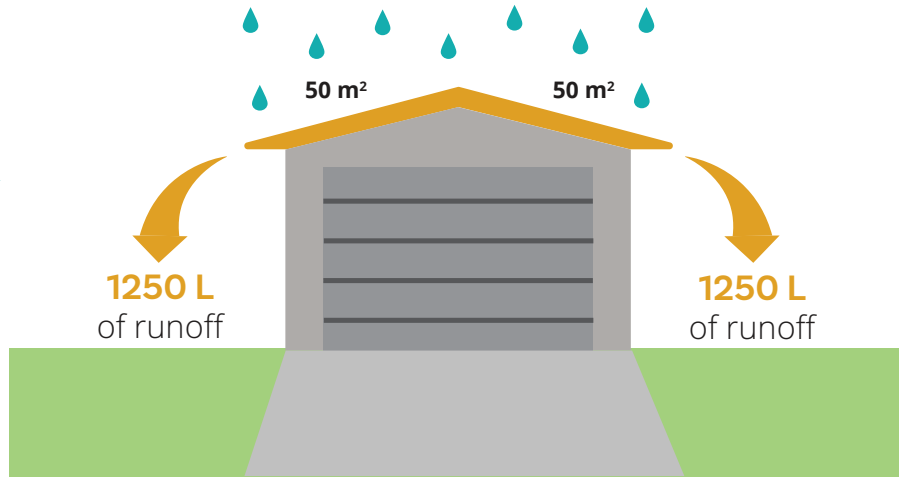
## CONSIDER THIS EXAMPLE

### EXAMPLE PLAN



### HOW MUCH RUNOFF?

On each side of the garage's roof, a 2.5-cm rain event generates...

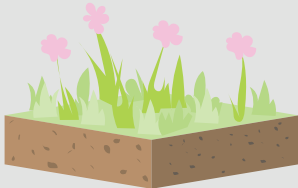


### IDEAS

This garage can support a 7.5-cm depth of growing media and plants without requiring additional structural support, so an **extensive green roof** has been added. To allow for drought, the preferred media depth for a green roof in Alberta is 15 cm. More intensive green roofs usually need to be implemented on flatter surfaces.

3,750 L

Semi-intensive Green Roof



Call the Pros

(difficulty: intermediate)

\$\$\$\$

7,500 L

Intensive Green Roof



Call the Pros

(difficulty: advanced)

\$\$\$\$\$

1,875 L

Extensive Green Roof



Call the Pros

(difficulty: intermediate)

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**Have you evaluated your site yet?** Our **Evaluate Your Site** section walks through the steps of identifying source flows, calculating runoff volumes, identifying opportunities to reduce runoff, and sizing your solutions.

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## Put a fine point on it

Your turn to do the math. As in the rest of this guide, the amount of runoff to retain is calculated based on the 2.5 cm rain event, which is the amount needed to protect our water bodies from excess runoff and pollution.

The table below shows how much difference a small increase in the depth of growing material makes to runoff retention.

It should be noted that green roofs often have a higher concentration of nutrients than regular roofs, but Alberta research has shown that the total contribution to the watershed is lower with a green roof because the quantity retained is so significant. The overall *loading* is lower with a green roof.

**Example Green Roof Retention Performance with Two Different Media Depths for the 2.5 cm rain event**

Contributing Area	7.5 cm depth growing material		10 cm depth growing material	
	Extensive Green Roof Storage	Runoff	Extensive Green Roof Storage	Runoff
10 m <sup>2</sup>	188 L	63 L	250 L	0 L
20 m <sup>2</sup>	375 L	125 L	500 L	0 L
50 m <sup>2</sup>	938 L	313 L	1250 L	0 L
100 m <sup>2</sup>	1875 L	625 L	2500 L	0 L

**BELOW:** Home-owners are choosing green roofs on garages to camouflage unsightly second-story views. You can even make a roof 'green-roof ready' and add plants later, when budget allows.



CREDIT: Renotech Roofing <https://renotechroofing.com/green-roofing/>



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## Products and Suppliers

### Soprema

Complete green roof system, seedling, seed, potted plants for preplaced growing media

### Live Roof

Plant material only - modular trays (Retailer: Eagle Lake Landscape Supply)

### XeroFlor Canada

Complete green roof system, pre-vegetated moss-sedum mat

### Elevated Landscape Technologies

Pre-vegetated mats with panels

### Hydrotech Canada

Complete green roof system, available

planting methods: trays, plugs, sedum mat

### Zinco Canada

Complete green roof systems, planting methods: seeding, hydroseeding, cuttings, plugs

### Siplast

Roofing membranes

### Tremcor

Modified bitumen roofing membrane

**ABT, Inc.** Permavoid wicking storage layer  
<https://www.abtdrains.com/products/environmental-products/permavoid/>

## More Information

Alberta Low Impact Development Partnership  
**alidp.org**

Pigeon Lake Watershed Association  
**plwa.ca**

The City of Calgary's Low Impact Development Guidelines Module 3 – Green Roofs  
**<https://www.calgary.ca/content/dam/www/uep/water/documents/water-documents/development-approvals-documents/2019/module-three-green-roofs.pdf>**

Green Roofs for Healthy Cities: A non-profit association working to promote green roof technology across North America.  
**greenroofs.org**

The Green Roof & Green Wall Industry Resource Portal: Very comprehensive hub of information. Check out the GREENROOFS 101 section.  
**greenroofs.com**



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