

6.8 Green Roof

Overview

Description



Figure 6-44: Parking Lot with Turf-Covered Intensive Green Roof, Google building, Mountain View; and Modular Extensive Green Roof installation, Emeryville. (Credit: EOA, Inc.)

A green roof can be either **extensive**, with 3 to 7 inches³⁶ of lightweight substrate and a few types of low-profile, low-maintenance plants, or **intensive** with a thicker (8 to 48 inches) substrate, more varied plantings, and a more garden-like appearance. The extensive installation at the Gap Headquarters in San Bruno (Figure 6-45) was installed in 1997. Green roofs provide energy savings, and native vegetation may be selected to provide habitat for endangered species of butterflies, as at the extensive green roof of the Academy of Sciences in San Francisco.

Best uses

- For innovative architecture
- Where limited space at grade is available

Advantages

- Minimizes roof runoff
- Reduces “heat island” effect
- Absorbs sound and saves energy
- Provides bird/insect habitat
- Longer “lifespan” than conventional roofs

Limitations

- Sloped roofs may require steps
- Non-traditional design
- Can increase structural costs

³⁶ www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/muni/mrp/05-02-2011/Green_Roof.pdf

Siting

- For strategies and examples of how to retrofit sites and parcels to include green roofs, *see Sections 3.2 and 3.3 of the GI Design Guide.*
- See www.greenroofs.com for information about and more examples of green roofs.
- Remember that stormwater control measures should be located in areas that can be accessible at any given time for the purpose of operation and maintenance and inspections.
- Green roofs can be sited on podium levels, roof tops, garbage enclosures, parking garages, plazas over underground buildings etc. Example projects are shown in the pictures below.

Table 6-11: Recommended locations for green roofs

Recommended Locations	Green Roof
Parking Lot	
Roof	●
Driveway	
Podium-level	●
Close to building	
Away from Buildings	
Underground	



Figure 6-45: Top: Extensive Green Roof at YouTube Headquarters, San Bruno (Courtesy of William McDonough & Partners); Bottom: Intensive Green Roof, Kaiser Center Parking Garage, Oakland. (Credit: Gene Anderson)

Design and Sizing Guidelines

Treatment Dimensions and Sizing

- Green roofs are considered “self-treating areas” or “self-retaining areas” and may drain directly to the storm drain, if they meet the following requirements specified in the MRP:
- The green roof system planting media should be sufficiently deep to provide capacity within the pore space of the media to capture 80 percent of the average annual runoff.
- Extensive green roof systems contain layers of protective materials to convey water away from roof deck. Starting from the bottom up, a waterproof membrane is installed, followed by a root barrier, a layer of insulation (optional), a drainage layer, a filter fabric for fine soils, engineered growing medium or soil substrate, and plant material.
- The components of intensive green roofs are generally the same as those used in extensive green roofs, with differences in depth and project-specific design application.
- Follow manufacturer recommendations for slope, treatment width, and maintenance.
- Green roof should be free of gullies or rills.

Vegetation

- The planting media should be sufficiently deep to support the long-term health of the vegetation selected for the green roof, as specified by the landscape architect or other knowledgeable professional.
- Either grass or a diverse selection of other low growing, drought tolerant, native vegetation should be specified. Vegetation whose growing season corresponds to the wet season is preferred. See Appendix A for planting guidance.
- Irrigation is typically required.



Figure 6-46: Plants selected to support endangered butterflies on the extensive Green Roof at the California Academy of Sciences, San Francisco (Credit: Tim Griffith)

Construction and Maintenance Plans

Design and Installation Recommendations


- Design and installation are typically completed by an established vendor.
- ***For additional construction guidelines, see Chapter 4 of the GI Design Guide.*** Even though the GI Design Guide does not include specific construction guidance for green roofs, general information on runoff capture and utility constraints can apply to green roofs.

Maintenance Recommendations


- Although green roofs are often categorized as “site design measures”, a Maintenance Agreement may be required by the municipality. The Maintenance Agreement should state the parties’ responsibility for maintenance and upkeep.
- Inspections should be conducted by the project owner at least semiannually. Confirm adequate irrigation for plant health.
- Care for plants and replenish growing media as specified by landscape designer and as needed for plant health. See Appendix A for IPM methods.

Typical Design Details





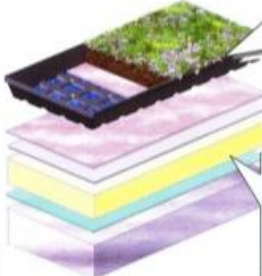
GREENGRID
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THE MODULAR GREEN ROOF SYSTEM

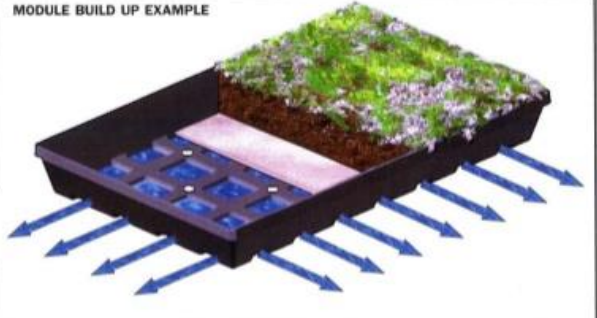
- Water reservoirs retain 99% of a 25mm rainfall
- Drainage holes allow water run-off to roof surface
- Non woven geotextile filtration layer
- Plants flourish in depth of growing media
- Wide variety of plant choice
- Recycled material content



ROOF BUILD UP EXAMPLE

- Protection Fleece
- Waterproofing Membrane
- Insulation
- Vapour Control Layer
- Concrete deck

MODULE BUILD UP EXAMPLE



Module Dimensions	600mm (W) x 600mm (L) x 100mm (D)	Extensive
	600mm (W) x 1200mm (L) x 100mm (D)	Extensive
	600mm (W) x 1200mm (L) x 200mm (D)	Intensive
Saturated Weight	75kg/m ² - 100mm depth module	
	134kg/m ² - 200mm depth module	

Trelleborg - Suite 3D, Willow House, Stratfields Business Park, Beckett, Leamington CV4 3PB Tel: +44 (0)1698 464620 Fax: +44 (0)1698 464623 Email: thecustomers@trelleborg.com
www.greengridroofs.co.uk

Figure 6-47: Green roof cross-sections (Credit: American Wick Drain Corp and GreenGrid)