

DESIGN
RIGHT



BY ALIDE ELKINK,
FREELANCE TECHNICAL
WRITER, WELLINGTON

The gen on green roofs

They deliver substantial environmental gains, so while New Zealand is slow to jump on the green roof bandwagon, there's reason to think this will change.

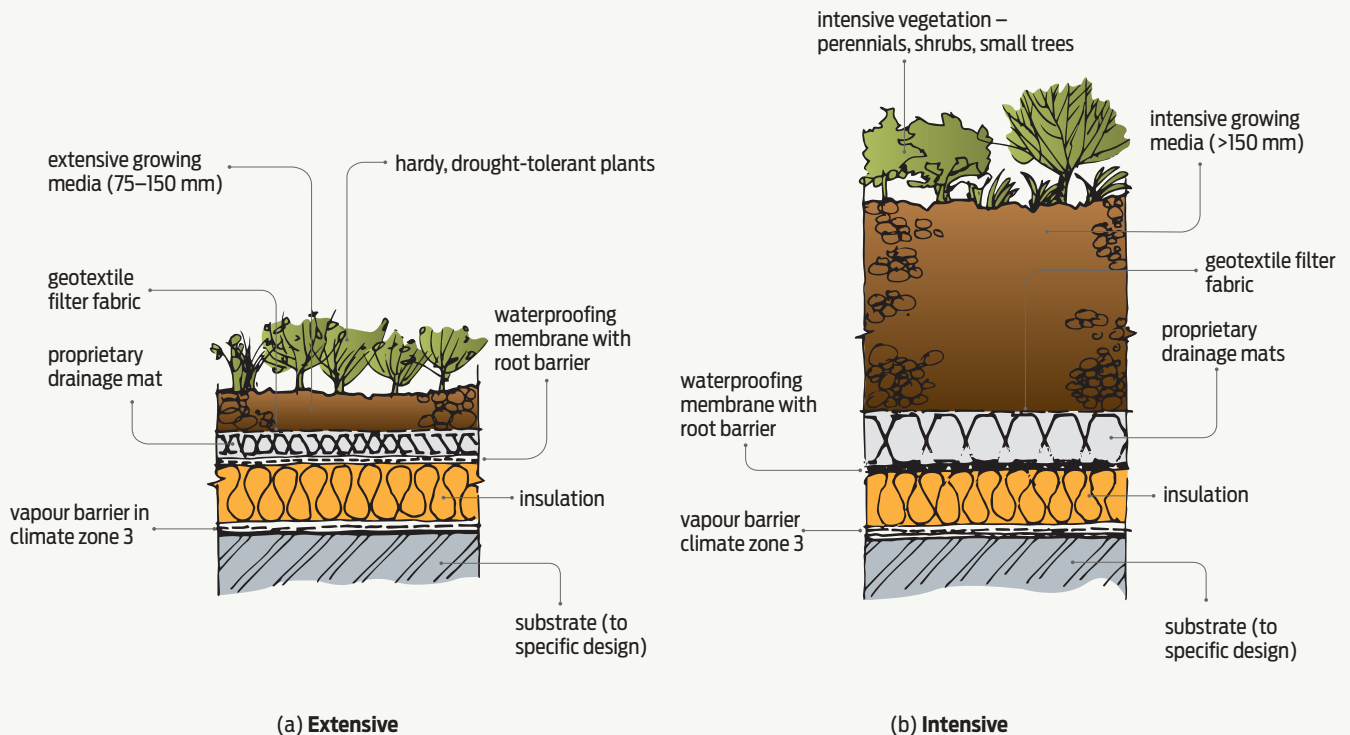


Figure 1 Typical warm green roof construction.

GREEN ROOFS, often referred to as eco-roofs or living roofs, are low-slope membrane roofs covered with a growing medium and plants to create a living roof system. They are popular overseas, but despite providing several environmental benefits, they are not so common in New Zealand. They should be constructed as a warm roof where the insulation is installed over the substrate.

Their eco credentials

- Green roofs contribute to:
- stormwater management
 - energy conservation

- creating a local microclimate effect
- removing CO₂ and releasing O₂
- reducing urban heat island effects
- reducing solar reflection to counter the high temperatures of urban hard surfaces
- encouraging biodiversity within the urban environment
- a useable space for building occupants.

Types of green roofs

There are two broad classifications of green roofs based on the depth of the growing medium:

- Extensive green roofs – these have a

shallow growing medium, ranging between 75–150 mm deep with a weight of 75–150 kg/m² (see Figure 1(a)). This means they can be supported by a specifically designed light structure, making them reasonably economical. However, the thin layer of growing medium does not allow for water storage, so plants must be selected for hardiness and drought tolerance.

- Intensive green roofs – these have a deeper growing medium, ranging between 200–300 mm, and the weight may exceed 240 kg/m² (see Figure 1(b)). The increased ➤

depth of medium allows a greater range of planting, but a heavier roof structure is also required to support the additional weight, so the construction costs are higher.

Semi-intensive green roofs fall between the two in terms of both growing medium depth and plant selection.

Need to meet Building Code requirements

At present, there are no New Zealand standards for green roofs. However, a building consent application for a green roof will need to meet the requirements of several New Zealand Building Code clauses including:

- B1 *Structure* – requires that the design must be able to support the dead and live loads imposed by the green roof
- B2 *Durability* – the selection of materials should provide a minimum 15-year durability but specifying a system with a longer serviceable life is prudent as the membrane is not easy to replace
- D1 *Access routes* – accessible green roofs must have safe access routes
- E1 *Surface water* – deals with the collection and disposal of surface water
- E2 *External moisture* – deals with the roof's ability to shed precipitated moisture
- F4 *Safety from falling* – requires that, where roofs have permanent access, safety barriers must be provided
- H1 *Energy efficiency* – requires that energy efficiency requirements apply if the green roof encloses a habitable space.

The designs for a green roof should be submitted for building consent applications as an alternative method. If consented, it will become an Alternative Solution.

Structure must support the weight

Structural requirements of the green roof need to be considered early in the design stages of the

building. The building and roof structure must be able to support the weight of the growing medium, the planting and any water retained by the system as well as the loads imposed by the building structure itself. Point loads from trees, planters, tubs and water features also need to be considered.

Usually low-slope roof

Green roofs are generally designed for low-slope roofs (minimum 2°). They are generally recommended for roof pitches of no more than 10°, but light soils and a specialised water-retaining medium make green roofs possible on slopes of up to 30°.

A roof with a slope of 20° or more requires baffles and edge restraints to prevent soil slippage and erosion.

Components of a green roof

Green roof technology is simple. The basic components include:

- an insulation layer
- a waterproof membrane
- root barrier (some membranes are root resistant)
- a drainage layer
- a growing medium
- planting.

The waterproof membrane is critical to the successful installation of a green roof and must be resistant to plant root penetration. It typically consists of a double-layer, torch-on modified bitumen, butyl/EPDM, PVC or TPO membrane applied over the insulation and must have a fall of at least 1:30 or 2°.

Once the membrane is installed but before soil placement and planting occur, the membrane should be flood tested or electronic tested to ensure that it is fully watertight.

If possible, roof penetrations should be kept to a minimum or clustered at a part of the roof that will not be planted. In addition to

making the waterproofing simpler, it also allows easier access for repair if there is a leak in the membrane.

Drainage should be via an exposed silt trap or sump to a stormwater network or to on-site storage. Traditionally, gravel was used to provide drainage, but this has been superseded by lightweight plastic drainage cells that may be rolled out or laid out in panels over the waterproof membrane.

If the drainage material does not have a bonded filter cloth, a geotextile filter fabric should be laid over the plastic cell panels. A 20–25 mm layer of coarse sand should also be spread over the area to prevent clogging of the geotextile fabric with fine sediment.

Choose the right plants

Plant selection depends on geographical location, growing medium depth, level of exposure and water availability. Plants that have adapted to New Zealand's rocky, exposed shorelines and cliffs tend to make good green roof planting as they are drought and wind tolerant and best able to cope with local conditions. In addition, the use of locally sourced native plants supports the ecological uniqueness of an area.

Extensive roofs are typically planted with lower-growing spreading groundcovers and grasses, whereas intensive roofs can support a wider variety of plants as well as taller growing plants. Always check with the supplier that the proposed planting is suitable.

Maintenance required

As with gardens, green roofs require maintenance so roof access must be provided. Maintenance should include:

- regular visual and manual checks on the condition of plants and drainage
- removal of weeds and pruning as required
- annual soil tests and application of slow-release fertilisers as required. ◀