



RICS professional guidance, Australia

# Green roofs and walls

1st edition, April 2016



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# RICS professional guidance

## International standards

RICS is at the forefront of developing international standards, working in coalitions with organisations around the world, acting in the public interest to raise standards and increase transparency within markets. International Property Measurement Standards (IPMS – [www.ipmsc.org](http://www.ipmsc.org)), International Construction Measurement Standards (ICMS), International Ethics Standards (IES) and others will be published and will be mandatory for RICS members. This guidance note links directly to these standards and underpins them. RICS members are advised to make themselves aware of the international standards (see [www.rics.org](http://www.rics.org)) and the overarching principles with which this guidance note complies. Members of RICS are uniquely placed in the market by being trained, qualified and regulated by working to international standards and complying with this guidance note.

## RICS guidance notes

This is a guidance note. Where recommendations are made for specific professional tasks, these are intended to represent 'best practice', i.e. recommendations that in the opinion of RICS meet a high standard of professional competence.

Although members are not required to follow the recommendations contained in the guidance note, they should take into account the following points.

When an allegation of professional negligence is made against a surveyor, a court or tribunal may take account of the contents of any relevant guidance notes published by RICS in deciding whether or not the member acted with reasonable competence.

In the opinion of RICS, a member conforming to the practices recommended in this guidance note should have at least a partial defence to an allegation of negligence if they have followed those practices. However, members have the responsibility of deciding when it is inappropriate to follow the guidance.

It is for each member to decide on the appropriate procedure to follow in any professional task. However, where members do not comply with the practice recommended in this guidance note, they should do so only for good reason. In the event of a legal dispute, a court or tribunal may require them to explain why they decided not to adopt the recommended practice.

Also, if members have not followed this guidance, and their actions are questioned in an RICS disciplinary case, they will be asked to explain the actions they did take and this may be taken into account by the Panel.

In some cases there may be existing national standards that may take precedence over this guidance note. National standards can be defined as professional standards that are either prescribed in law or federal/local legislation, or developed in collaboration with other relevant bodies.

In addition, guidance notes are relevant to professional competence in that each member should be up to date and should have knowledge of guidance notes within a reasonable time of their coming into effect.

This guidance note is believed to reflect case law and legislation applicable at its date of publication. It is the member's responsibility to establish if any changes in case law or legislation after the publication date have an impact on the guidance or information in this document.

## Document status defined

RICS produces a range of professional standards, guidance and information documents. These have been defined in the table below. This document is a guidance note.

Type of document	Definition	Status
<b>Standard</b>		
International standard	An international high-level principle-based standard developed in collaboration with other relevant bodies.	Mandatory. RICS has adopted these and they apply to the profession.
<b>Professional statement</b>		
RICS professional statement [PS]	A document that provides the profession with mandatory requirements in the form of technical requirements or conduct rules that members and firms are expected to adhere to. An RICS professional statement sets out the expectations of the profession. RICS-qualified professionals must comply with the professional statement applicable to their area of practice or be able to explain any departure from it. The relevant professional statement will be used by RICS and other legal and regulatory authorities in judging complaints and claims against RICS-qualified professionals. This category may include documents approved by RICS but created by another professional body/stakeholder, such as industry codes of practice.	Mandatory on the basis of 'comply or explain'. Professional statements set out how the profession is expected to meet the requirements of the international standards.
<b>Guidance and information</b>		
RICS guidance note [GN]	Document that provides users with recommendations or approaches for accepted good practice as followed by competent and conscientious practitioners.	Recommended best practice but not deemed by RICS to be in category of 'mandatory' for all practitioners.
RICS protocol	Information and best practice framework, which stakeholders may sign up to and comply with, to assist the operation of the market in the public interest.	Information and/or recommended best practice.
RICS information paper [IP]	Practice-based information that provides users with the latest technical information, knowledge or common findings from regulatory reviews.	Information only.
RICS insights	Issues-based input that provides users with the latest information. This term encompasses Thought Leadership papers, market updates, topical items of interest, reports and news alerts.	Information only.
RICS economic/market reports	A document usually based on a survey of members, or a document highlighting economic trends.	Information only.
RICS consumer guides	A document designed solely for use by consumers, providing some limited technical advice.	Information only.
Research	An independent peer-reviewed arm's-length research document designed to inform members, market professionals, end users and other stakeholders.	Information only.

# 1 Introduction

There are many green roofs and walls guides; however this guidance note has been prepared to assist building owners, tenants and their advisers in the processes involved in understanding the various steps that will need to be considered if a green roof or wall is to be installed on a new building, or retrofitted onto an existing building. This guidance note looks at green walls and roofs from the property and surveyor's point of view, encompassing the technical, value and community impacts that green walls and roofs can bring. This guide is aimed primarily at commercial and medium to high-density residential buildings.

This guide aims to provide information on green roofs and walls to:

- surveyors
- owners
- tenants
- property managers
- builders and developers
- project managers
- facility managers
- services consultants
- local and national government.



## 2 What are green roofs and green walls?

### 2.1 What is a green roof?

A green roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It may also include additional layers such as a root barrier, and drainage and irrigation systems. Green roofs have their roots in early civilizations for reasons including temperature control, water conservation and control, and aesthetics. Modern green roofs continue to have many of the same purposes.

These days lightweight designs dominate, as the biggest cost of any green roof is the 'hidden cost' of engineering to support the roof loading. This is also the case where roofs are retrofitted with greenery.

Green roofs can be sparsely planted or very high in biodiversity, mimicking natural ecological systems and communities of plants and their associated fauna.

There are two main types of green roofs:

- extensive roofs, which are lightweight and typically require walking paths
- intensive roofs, which feature podium plantings, have lawns or walk access areas.

The major difference between the types is roof accessibility. There are two additional types:

- semi-intensive roofs, which have deeper sections over structural components
- brown/biodiverse roofs, which have a ground surface profile with rubble over the roof.

### 2.2 What is a green wall?

Green walls refer to vegetation grown directly onto a building's facade or to vertical vegetation that is grown on a separate structural system that can be freestanding and adjacent or attached to the facade. Vegetation may be grown in planter boxes and trained on a trellis system with mechanised watering.

There are generally two types of green walls: soil-less and modular.

- Soil-less green walls are when vertical gardens grow on the surface of built structures. They are designed to mimic the growing conditions found where green walls occur in nature. They are sometimes called living walls, green facades, bio walls or vertical vegetation.
- Modular green walls use pockets of plants and climbing plants and soil/media in prefabricated modules to produce a green wall. The cost is generally about half that of a soil-less green wall.

### 2.3 The benefits of having green roofs and green walls

Green roofs and walls provide many benefits within an urban context. They include:

- lower energy consumption by providing shade
- lower greenhouse gas emissions by absorbing CO<sub>2</sub>
- reducing the urban heat island (UHI) effect. Inner city areas experience higher temperatures than surrounding suburban areas, and this is known as the urban heat island (UHI) or the UHI effect. At times of very high temperatures people can experience levels of discomfort and distress and this can lead to increased level of hospital visits due to heat stress.
- increasing the thermal performance of buildings (lowering energy costs)
- positive effects on stormwater control and improve water sensitive urban design (WSUD)
- improvement of air quality
- reduction of noise pollution
- increase in urban biodiversity and urban food production
- improvement in health and wellbeing\*(see Section 9 re concentration levels)
- an overall aesthetic appeal, particularly for those who look at the building or its roof
- recycling of water and strip nutrients.

## 3 Green roof and wall design considerations and briefings

This section provides an overview of the typical issues and factors to be addressed when designing and specifying green roofs and walls on new and existing buildings. The examples given here are general, and surveyors should note that every case will be different and is to be judged on its own merits.

### 3.1 Design for the life of the building

The green roofs and walls should be designed for the anticipated life of the building. There are many examples of green roofs and walls that were established more than 20 years ago. By using both CAD and hand-drawn plans, it is possible to generate a clear visual impression of the finished installation ahead of production. Furthermore, over time the planting on a green roof or wall grows and matures with the building.

The following are examples of green roof and green wall construction. The designs should be developed and adapted to suit the particular circumstances of the building.

### 3.2 Design considerations

An initial consideration is whether the installation is intended to be seen from both inside and outside the building. The following factors need to be taken into account.

#### 3.2.1 Sunlight orientation and overshadowing

Sunlight, orientation and overshadowing from surrounding buildings have to be taken into account. Care must be taken to ensure that the plants receive sufficient sunshine to grow, but not too much. Consultation with the landscape architect, green roof installer or horticulturalist will determine the best planting specification for the orientation.

#### 3.2.2 Wind exposure

Wind speed and exposure varies according to building height, orientation and location. The plants, soils and supporting structures must be able to withstand these forces. The plants and structure must be anchored so they cannot detach from the building and cause damage. The soils should be contained so the wind cannot blow them

away. Table 5 illustrates wind pressures that are typically experienced at different building heights.

**Table 1 – Wind loading and building height**

Load and height (in metres)	Approximate number of storeys
0.5kN/m <sup>2</sup> to 8m	3 and below
0.8kN/m <sup>2</sup> 8 to 20m	3 to 8
1.1kN/m <sup>2</sup> above 20m	8 and above

(Adapted from Dunnett and Kingsbury, 2008)

#### 3.2.3 Services

Green roofs and walls need water, power and drainage for maintenance. Care must be taken to keep roots and leaves out of the drainage system, and this should be factored into design and maintenance. There should be points where the drainage system can be inspected and cleaned out regularly.

#### 3.2.4 Power use

In respect of sustainability goals, it is recommended that green roofs and walls are designed to minimise power use. In this regard consider the orientation of the roof and wall(s), and the access to natural light. Where possible, use gravity and not pumps for watering systems as this results in less energy consumption.

#### 3.2.5 Installation

Green walls should be separated from the building elevations, so there is no moisture transfer to the wall. Trapped moisture will lead to building defects overtime.

#### 3.2.6 Existing buildings and parapets

Some roof parapets can lead to ponding and pooling of water. This can overload the roof and impose a high hydrostatic pressure on the roof's waterproof membrane. If the building has parapets, ensure that there is good drainage and no possibility of blockages from leaves or other plant matter that may lead to ponding.

Adequate drainage and the ability to keep the roof drainage clear is critical, as are overflows. The fitting of high-water alarm systems should be considered if there is no clear overflow path.

#### 3.2.7 Soil and substrates

Standard soils are not generally used in green roofs as they are too heavy for roof structures. As a result, lighter

soils and substrates are favoured. The total additional dead loads that the existing building can safely support should be established and included in the structural engineer’s load calculations. This should take into account the load from water when the medium becomes wet.

### 3.2.8 Extensive and intensive green roofs

The following table compares extensive and intensive green roofs.

**Table 2 – Extensive and intensive green roofs compared**

Extensive green roof	Intensive green roof
Shallow growing medium [<150mm]	Deeper growing medium [>150mm]
Lightweight structure to support roof	Heavier structure to support roof
Cover large expanses of rooftop	Small trees and shrubs feature
Requires minimum maintenance	More maintenance required

Lower capital cost	More expensive
Not usually recreational	More common in tropical climates
Accessible or inaccessible	Accessible or inaccessible
Does not usually require irrigation	Requires irrigation
Minimum structural implications for existing buildings	More likely to have structural implications

### 3.2.9 Use of recyclable materials

It is possible to specify high use of recyclable materials in each aspect of a green roof or wall. For example more than 94 per cent of the materials and media can be reclaimed from waste destined for landfill. These include media, metals and fabrics. Careful specification should maximise use of recyclable materials. However, care should be taken to contain soils with recycled materials such as plastics, including expanded polystyrene, to avoid them blowing away and entering the drains, rivers and harbours.

## 4 Green Star – Performance rating benefits of green roofs and walls

In 2014 the Green Building Council of Australia (GBCA) introduced the Green Star – Performance v1 rating tool. Green Star – Performance v1 is a holistic rating tool for sustainable building operations, which evaluates the performance of all types of existing buildings (with the exception of single detached dwellings).

Credit 24 is Ecological Value, and points are available to a building seeking to achieve a Green Star – Performance rating where they have building attributes or operational requirements for biodiversity and measurable biodiversity.

The Ecological Value Credit #24 has two pathways for demonstrating compliance. The first is by having a biodiversity policy in place, which addresses operational requirements for biodiversity during the performance period. The second pathway relates to the building attributes and its impact on the ecological diversity of the site. Points are awarded where the vegetated area for the site is equal to or greater than 7.5 per cent of the building footprint area. This includes all vegetated structures or planted areas, such as garden beds, vertical or roof gardens as present on the site during the performance period.

The achievement of points under the Green Star – Performance rating scheme will depend on complying with the requirements outlined in the Green Star – Performance v1 rating tool and the GBCA. Please refer to the GBCA website for more details ([www.gbca.org.au](http://www.gbca.org.au)).

### 4.1 Interiors rating benefits of green roofs and walls

The GBCA has developed the Green Star – Interiors rating tool, which takes a holistic approach to assessing the sustainability impacts of interior fit-outs.

Given the large amount of time spent by occupants in fit-out spaces, the Green Star – Interiors rating tool has a specific focus on occupant comfort and wellbeing across a number of credits. An interior fit-out with a well-designed green wall can set a project up to achieve a number of these credits.

The Green Star – Interiors credits that can be positively impacted by the provision of a green wall include:

‘Visual Comfort – Views’ criterion (11.2) where projects are awarded for providing occupants with a clear line of sight to a high quality internal or external view

‘Indoor Pollutants – Indoor Plants’ criterion (12.3) where projects are awarded for providing plants throughout the fit-out space

‘Quality of Amenities – Prescriptive Pathway’ criterion (14B.5) where projects are awarded for the provision of quality amenities, including a green wall.

The achievement of points under the Green Star – Interiors rating tool will depend on complying with the requirements outlined in the Green Star – Interiors Submission Guidelines. Please refer to the GBCA website for full details ([www.gbca.org.au](http://www.gbca.org.au)).

## 5 Assessing the physical aspects of existing buildings

When analysing an existing building to determine its suitability for a new build or retrofit to a green roof, a surveyor needs to consider the following.

### 5.1 Available space

Many rooftops accommodate mechanical equipment (such as an air-handling unit). When retrofitting a green roof, it is useful to undertake a survey of the roof space to determine the available space for a green roof. It may be worthwhile to determine whether any mechanical roof top units can be reduced in size or repositioned.

### 5.2 Structural capacity

Before designing any green roof or wall system it is critical to first conduct a structural investigation to determine the building's existing structural load-bearing capacity and to check for any damage. The building's structural capacity will determine the type of vegetation that can be grown.

*Intensive\** green roofs are significantly heavier than *extensive\** green roofs and are therefore more challenging and expensive to retrofit on existing roofs. If the structural capacity of the building is deemed insufficient to support the proposed green roof/wall system, structural reinforcements may be made – but these can be costly. (See Section 2)

A façade-supported green wall (where the planting medium is not integrated in the façade) will place fewer loads on an existing façade and is easier to retrofit to a building.

Arup has provided the following tables (3 and 4) of typical loads/weights but cautions that, when designing a green roof or wall and considering the structure of the building (existing or new build), an independent analysis of the design loadings will need to be carried out by a certified structural engineer.

Note that, in addition to the plants at maturity and soil loads, the weight of additional structures, membranes, frames, walls, trellis, cables, mesh, finishes, etc. and storm loading must be taken into account.

**Table 3 – Extensive green roof**

Vegetation	Depth (mm)	Weight (kg/m <sup>2</sup> )
Extensive green roof with sedum, grass, moss etc.	50–100mm	10kg 70–140kg*
Extensive green roof with soil, plants and small shrubs (below 0.5m tall)	100–150mm	15kg 140–225kg*

\* (Dunnett and Kingsway 2008) rain-loaded but not including plants

**Table 4 – Intensive green roof**

Vegetation	Depth (mm)	Weight (kg/m <sup>2</sup> )
Intensive green roof with larger plants and small shrubs (below 1m tall)	150–200mm	20 225–300 kg/m <sup>2</sup> *
Intensive green roof with larger plants and small shrubs (below 3m tall)	200–400 mm	30 300–600kg/m <sup>2</sup> *
Intensive green roof with larger plants and small trees (below 6m tall)	400–1000mm	60 600–1,500kg/m <sup>2</sup> up to 2,600kg/m <sup>2</sup>
Intensive green roof with larger plants and small trees (below 10m tall), one tree weighs more than 150kg	Over 1000mm	150kg when one tree is 1,000kg/m <sup>2</sup>

\* (Dunnett and Kingsway 2008) rain-loaded but not including plants

Note: large trees or other localised loads may need their own support. If in doubt consult a structural engineer.

## 5.3 Waterproofing membranes

Undertake a thorough inspection of the existing roof membrane to assess its condition before considering retrofitting a green roof – any damage should be repaired beforehand. If the roof membrane is in poor condition and due to be replaced within, say, two years, it could be worth waiting to fit a green roof until the membrane has been replaced or bringing the replacement of the membrane forward. A root-barrier membrane may be required to protect the membrane from the plant roots. The existing roof insulation should be checked to ensure it has sufficient compressive strength to support the weight of the new green roof system. Drainage must be designed to ensure water does not become trapped between existing roof and green roof. We recommend that, before specifying waterproof membranes, the parties should refer to the membrane manufacturer or installer to confirm existing warranty conditions.

## 5.4 Protection of the membranes

Membranes are generally flexible so they can absorb building movement without splitting or tearing; so by nature they may be soft. Loads applied to them should be spread over large areas. Care must be taken to protect membranes from damage from garden implements.

When designing and specifying a planter or green roof it may be worth installing a tough protective layer between the membrane and the area where garden tools will be used – materials vary but include compressed fibrous cement sheeting, thick tough sheeting, etc.

Where no protection is installed, the use of tools must be very limited and users must be briefed on the risks of damage to the membrane.

## 5.5 Accessibility and maintenance

Green roofs and walls require regular maintenance so safe access must be considered and included in any green roof or wall design. If a green roof is to be used as an amenity space, how the space is accessed for this purpose (e.g. via lifts/stairs) needs to be considered. Accessible roof amenity spaces need to meet access and health and safety legislation, and additional barriers/structures may need to be added to existing parapets.

## 5.6 Heritage

Consider this carefully, as the visual impact of the historic building is of primary importance. The heritage building must be able to accommodate a green roof/wall without negatively altering the historic character of the building. Structural consideration is a key factor with heritage buildings, as they may be structurally compromised due to their age and/or previous adaptations. (It may be necessary to seek additional approvals including compliance or amendment of a conservation management plan for the building.)

## 5.7 Access for maintenance

Green roofs and walls require regular monitoring and maintenance; this includes pruning and weed control, plant nutrition, plant installation/replacement, maintenance of supporting structure and waterproofing. As green roofs and walls will likely increase the ongoing maintenance requirements of the façade/roof, additional or improved access should be considered.

## 5.8 Green roof access

When considering green roof access, the following three green roof typologies should be considered:

### 5.8.1 Terrace

External covered or uncovered garden spaces typically housing vegetation such as planter boxes that can be accessed internally by maintenance persons or externally by one of the following:

- building maintenance unit (BMU) system
- abseiling
- cherry picker (depending on height from floor).

### 5.8.2 Multi-terrace

External covered or uncovered garden spaces (with a minimum double height) housing vegetation such as planter boxes and trees. Trees can be accessed internally via a monorail and platform system or externally by one of the following:

- BMU system
- abseiling
- cherry picker (depending on height from floor).

### 5.8.3 Roof

Typically uncovered, rooftop space comprising a variety of vegetation such as lawns and trees. Access to trees on roof spaces is via a ladder or temporary scaffolding, depending on height from floor (see section 4.2).

## 5.9 Temporary or permanent access strategies

For external access of a terrace or multi-terrace system the maximum reach possible for a maintenance person is limited to 800mm (via a cherry picker or BMU) while rope access enables full access. Building code requirements may apply to the design of planter boxes and trees particularly when located in close proximity to balustrade: AS 1657 fixed platforms, walkways, stairways and ladders, and AS 1891 fall arrest systems. 600mm is recommended between balustrade and internal planter boxes for sufficient access.

## 5.10 Green wall access

When considering green wall access requirements the access strategy is generally determined by the size of green wall and height from ground.

- For green walls less than 4m in height and accessible from the ground or a protected level, a ladder system is utilised for access.
- For green walls approximately 4–10m and accessible from the ground or a protected level, a temporary scaffolding system is required for access.
- For green walls greater than 10m in height, one of the following access systems should be implemented for access:
  - BMU system
  - abseiling
  - cherry picker (depending on height from ground and access to levels about ground).

## 5.11 Maintenance frequency

Identifying and specifying low, medium and high maintenance walls/systems is critical when selecting systems and horticulture to minimise maintenance frequencies. To estimate the ongoing costs associated with the addition of a green roof or wall system of a building life cycle, it is recommended that a cost analysis based on data from precedent projects be implemented. Consider integrating green roof and wall access strategies with the current or proposed façade access plan for cost-effective solutions.

## 5.12 Drainage

Drainage must be carefully assessed and designed. Buildings with parapets and other potential dams must have adequate drainage, and the layout of the plantings and green roof materials and systems must be carefully designed and specified. This is to avoid water building up and imposing a high load on a structure not designed to take it during heavy rain, irrigation system failure or leakage or, simply, a hose being left on.

Suggested design details may include:

- filter cloth systems to keep plants, roots and soil in position
- multiple water drainage paths – in the event one becomes blocked the other should have sufficient capacity to take the water away
- installation of overflows
- installation of high-water alarms using float switches.

## 5.13 Other issues

### 5.13.1 Orientation and overshadowing

The orientation of the roof affects the amount of exposure to sun the roof will get, and this affects the type of plants that will flourish there (Wilkinson and Reed, 2009). Added to this the surveyor also needs to consider any overshadowing from surrounding buildings as this affects access to sunlight for the plants.

### 5.13.2 Height

The height above ground will affect exposure levels to high winds in particular. Some rooftop environments can be hostile in different seasons and planting specifications must take this into account (Williams et al, 2010). A checklist for building surveyors to appraise roofs for suitability for green roof retrofit is provided in Appendix 1.

## 6 Building maintenance and management

### 6.1 General maintenance comments and overview

After completion of the green roof or wall installation following handover, the green roof and/or walls will need to be actively maintained. Establishing a well-understood maintenance regime with facilities management personnel (especially at the specification stage) will greatly improve survival and long-term health of the roof and/or wall.

Green wall installation companies should include the first year's maintenance in the contract, and should provide maintenance costings for up to ten years so that this can be factored into budgets. Planting should be specified to fit the aspect and climate of the site. Thus the habitat is developed and the growth and size of plants as they mature should be considered.

Good green roofs and walls will be net exporters of plant material which can be used elsewhere. It is possible to reuse plants on the roof or the wall and rearrange them. Areas of dead planting can be replaced by plants, taken from an area where they are growing well. It is not always necessary to buy new plants and careful, planned maintenance can keep costs down.

Green roofs and walls should be resilient so that, in the event of a temporary water supply failure, the plants will not die. We recommend consulting a horticulturalist for the most appropriate plant selection on a building-by-building basis. The choices of plants will depend on location, exposure, and the size and type of green roof or wall.

### 6.2 Initial maintenance

Depending on the scale of the plantings and ownership of the building, specialist maintenance contractors for the roof and/or walls should be engaged. Typically allow for the following initial maintenance:

- four inspections in the first year for a green roof
- two or three inspections for external walls
- a first maintenance visit.

Consideration should be given to making the initial maintenance period part of the contract for the installation of the roof or wall. This can lead to improved outcomes such as the appropriate choice of plants, quality of materials and planting.

### 6.3 Costs

Ongoing maintenance costs are estimated to be between 2 to 12 per cent per year of installation costs. However, this amount will depend on factors such as design and selection, access to the roof and wall (note that this can be expensive, for example where cherry pickers, scissor or knuckle lifts are needed). Access and availability can be a major issue, especially in some CBDs, and should be considered when factoring in maintenance costs. Consider any access permits that may be required and paid for, including associated costs such as street protection and/or closures.

### 6.4 Using recycled grey or black water

Where irrigation is from grey or black water harvesting systems it may be necessary to install pumps, electronic water level sensors, system controllers and water treatment systems supported by municipal or private well water supplies as a back-up water source. Integrated systems mimic the delivery of domestic water, and are usually connected to back-up supplies through the use of plumbing cross-connections with backflow prevention.

The intent of the back-up water supply is to provide uninterrupted delivery where harvested water is depleted. The use of harvested water should be reviewed by a hydraulic engineer, who acts on behalf of the owner to ensure that the design and installation comply with appropriate codes. Where recycled grey or black is used local authorities may require signage to be installed advising maintenance staff. Check also if there are any restrictions in regard to the watering of edible plants, including herbs, which may be grown.

### 6.5 Pests

Pests include rodents and birds. Accessible roofs may deter some birds. Furthermore edible plants may attract marsupials. Birds may build nests, eat the plants and destroy sealant or timber items, while rats and mice can make homes behind plants and also chew through irrigation lines and fittings if not eradicated. Pests tend not to be an issue on exterior walls.



Some birds will cause no problems to the green roof and will bring increased benefits and amenity to them and the human observers, as may the establishment of native (and other) beehives.

### 6.6 Monitoring performance

Regular inspections need to be undertaken to ensure plants are healthy and growing as planned, and that there is no negative impact on the building.

The inspections should also examine moisture and growing conditions to ensure that they are suitable for the plants. Further, a check should be made on related energy use. Where applicable, there should be monitoring of food

production rates. Finally, where there is an amenity rooftop garden/green roof, owners and occupiers should monitor building occupant usage and seek feedback for improvements.

### 6.7 Managing maintenance

Maintenance crews and personnel need to be managed diligently. Most property management organisations have their own workplace health and safety procedures; these should be used in the planning and organisation of works. This should apply to maintenance and repair crews and visitors, particularly for a green roof.

# 7 Preparing and assessing an application to install a green roof or wall

**Make it easy to maintain**  
Maintenance is the key to lasting success  
By building a Business Plan you can suggest a plan to measure inputs [costs] and outputs [benefits] of your green wall or roof.

## 7.1 Landlord's design review process

It is expected that there should be a formal review process on behalf of the landlord. Generally the landlord or their property manager will provide the applicant with a list of documents that will be required for the landlord to review the proposal. Appropriately qualified and experienced professionals, who act on the applicant's behalf, should prepare the design and consultancy.

The tenant or licensee, or applicant's representative, will provide a full set of documents to the landlord for review by their consultants. The applicant can expect to pay costs of the landlord's review. Details normally include:

- design and layout
- structural design and calculations
- services design
- option/implications for staff amenity.

## 7.2 Maintenance plan – tenants' documentation package

The tenant should provide details that address the landlord's requirements, which are described above.

## 7.3 Assessing a proposal to install a green roof or wall

Here is a brief checklist of things to look for:

- penetrations
- fixings
- water source
- drainage.

## 7.4 Design review

Designing the base building with an understanding of green walls can reduce maintenance costs. For example, designing the green wall as a pivoting or removable screen can reduce the use of lift equipment for maintaining the green walls that are placed high on a building. The design and specification of the planting should be undertaken by a landscape architect or a horticulturalist and should meet the needs of the type and amount of maintenance the owner/occupier can undertake.

## 7.5 Schedules of condition at lease commencement

With leased property it may be necessary for the landlord and tenant to agree a schedule of condition for the property prior to any installation works being carried out. This should include plans, written descriptions and annotated photographs. The schedule should be comprehensive, so there is no doubt as to the arrangement and condition of the premises before any works are carried out. Areas that are known to be affected, such as fixing and bearing points, or drainage outlets, should be recorded in detail.

## 7.6 Making good at lease or licence end

- There will normally be a make good clause in the lease agreement. Make good or reinstatement obligations generally require that, at the expiration or earlier determination of the lease or licence, the tenant or licensee will be required to return the premises to the owner, head lessee or licensee in the condition it was in immediately prior to when they took occupation.
- It is critical that the condition immediately prior to when the lessee or licensee takes possession is recorded accurately. This is normally in the form of a schedule of condition (see above) and will contain both a written explanation and photos showing the condition. The schedule of condition should be dated

and signed by the person preparing it and also preferably the landlord/licensor and tenant/licencee. This process mitigates the risk of dispute as to the original condition at the termination of the lease/licence when the landlord and tenant need to establish the scope of works, if any, that are required to meet the tenant/licencee's make good obligations.

- Make good can be a complex and costly exercise. For more information on make good in regard to a lease or licence agreement for green walls and roofs (and commercial buildings in Australia) in general consult the RICS Make Good Guide ([www.rics.org.au](http://www.rics.org.au)).

## 8 Legal aspects – leases and licences

By its nature, a green roof or wall has unique characteristics which present issues that must be dealt with in a legal and practical context. Each roof or wall will have to be treated in a unique way; each building will have different ownership structures, aspects, orientations and qualities, and the building will have physical limitations that will determine the type of use to which it is put. Outlined below are the top 11 issues that are most commonly dealt with when a green roof or wall is built.

**Table 5 – Top 11 issues**

1	Structural loads	Extra loads, both point loads and overall mass, have to be accommodated with the existing structure. Analysis by a structural engineer is required.
2	Lease or licence to occupy	There will usually be an agreement whereby the property owner or head lessee grants a user, lessee or licensee permission to use a particular area for a particular purpose, over a particular time, in return for a consideration. The lease or licence will contain obligations and commitments on both the lessor/licensor and lessee/licensee.
3	Maintenance of the waterproof membrane	A building surveyor or suitably experienced structural engineer can advise on the integrity of the existing waterproof membrane, and how it may be affected by structures and soil being placed on top of it.
4	Irrigation and drainage	Water supply is usually a simple tap, but a horticulturalist may be required to determine if irrigation is needed, and a hydraulic engineer to review how it is to be serviced and drained. Drainage is critical, particularly at times of heavy rainfall.
5	Access	A rooftop may require access through third-party property. The rights of the party through which access is granted will need to protect their interests.
6	Storage of equipment	Equipment will be required to maintain the plants and this will need to be stored safely in close proximity. A dedicated room or shed may be required.
7	Insurance	Insurance will be required by the party maintaining the garden or produce area, as well as insurance for visitors and general public; also liability for work, health and safety legislation.
8	Repair and maintenance	The garden, rooftop or wall will have to be maintained. The biomass will not tolerate absentee landlords or licensees with other commitments. The maintenance contracts will have to be articulated so that the tenant or third-party landlord knows that ongoing care and maintenance will be required to a certain standard.
9	Make good or dilapidation liability	Green walls and roofs are relatively new to the urban context. If the green roof or wall has been installed by a tenant they may have to remove it and reinstate the original finishes and structure at the end of their lease.
10	Consideration or rent	A licensee may agree to pay a token rent, take part in commercial profit sharing or give any outputs to a worthy third-party cause, i.e. a charity. The licence can describe how these non-monetary considerations are to be paid or delivered.
11	Social or environmental standards	The licensee may commit to uphold certain environmental or social standards. These can be graded, described or accredited by third parties, i.e. the roof may contribute to a green star rating.

## 8.1 Ownership of the property

There is a clear difference between an owner (landlord) and a tenant (lessee). A landlord has exclusive rights to their property to use in any manner according to the planning constraints and permissions in each jurisdiction (and no third-party consent is generally required to create a green roof or wall). A tenant is bound by the terms of their lease, and a green roof or wall may be prohibited or a permissible use with consent. Consent is likely to be required from the landlord.

## 8.2 Lease and licence

It is important to differentiate between a lease and a licence. They are very different interests in property and have characteristics that can either constrain or promote the green wall or roof use.

- *Lease*: An interest in property that grants exclusive rights of access and tenure, and has a definite term that can only be extinguished by the freeholder or by effluxion of time. If a green wall or roof is a permitted use with consent, a sub-lease may have to be created for the area devoted to the growing area. A lease may not give the flexibility required for both parties, and we have therefore concentrated our review on a licence.

- *Licence*: A licence does not grant exclusive rights of access or tenure, but it does grant a right to use a space and the equipment on it. The licence may be able to be terminated at short notice in writing by either party. It may suit the parties to give them the flexibility to try the alternative use for a trial period, or longer by mutual agreement. A licence does not bind the licensee to onerous terms (for example the term of a lease) and relies on a more significant degree of mutual cooperation and trust. A licence cannot be registered at the relevant Land Titles office.

### 8.2.1 The licence

The items below are the key components of the licence and are a minimum requirement to adequately protect the interests of both parties and ensure the intent of the parties is clear. There may be many more clauses and further complexity, but the essence of the licence is to reflect the interests of the parties, protect their respective estate in the property and chattels, and facilitate a successful and productive relationship to allow the facility to flourish. Table 6 summarises the issues to consider.

**Table 6 – Issues to consider regarding rooftop licences**

1	The parties	<i>The licensor</i> : This could be a landlord, or a leaseholder. If the latter, the leaseholder has to have the authority to grant the licence. The landlord may also be required to be a party to the licence. <i>The licensee</i> : The licensee may be an individual or a company. If the latter, other directors may be required for consent.
2	The premises	Roofs and walls are spatial entities, and a plan or diagram showing the licensed area is recommended. For example, roof access may be restricted to part, and a wall may only be suitable at a certain height.
3	Definitions	These are the main defined items. There may be more depending on the complexity of the licence. <i>Commencement date</i> . Usually the date that the licence is signed by both parties. <i>End date</i> . The last day of occupation. Particularly important if the licence is terminated early, or there is a make good to do. <i>Equipment</i> . What equipment is owned by the licensor, and what equipment belongs to the licensee, i.e. a shed, tools, equipment for maintenance. This may be helpful if specified in an appendix. <i>Licensed area</i> . This benefits from definition on a plan. For example, the licensee may be restricted to certain areas of the premises and common parts. The licensee may invite guests onto the premises. The licensee may be sharing toilets or amenities off the licensed area. <i>Purpose</i> . A non-monetary consideration may be the purpose, i.e. growing produce or keeping a thermal or other technical standard for the licensor. This can also include a user or general description of the type of use being contemplated by the parties: growing grass or growing plants for production. There may be restrictions on what may not be grown, i.e. illegal drugs. <i>Term</i> . The length of the licence and a statement explaining the start and finish date. <i>Water supply</i> . The licence fee may include water consumption, or there may be a separate metered supply.
4	The grant of licence	There may be an explicit statement indicating that the agreement is a licence and not a tenancy. This is such an important and fundamental term, a tenancy could create problems of exclusive possession to the detriment of the licensor. There may be restrictions on the transfer of the benefit, and there may be no warranty, i.e. that the roof is suitable for the plants.

5	Term of the licence	The licence will be terminated either by effluxion of time, by mutual agreement or by the termination of the lease from which the licence is derived. For example the licensor may be a tenant of a building and when their lease expires the licence will automatically terminate. This will trigger a make good.
6	Make good	Make good or reinstatement obligations generally require that, at the expiration or earlier determination of the lease or licence, the tenant or licensee will be required to return the premises to the owner, head lessee or licensee, in the condition it was in immediately prior to when they took occupation. This will usually specify that the licensee must remove any material and the associated equipment and tools from the leased or licensed area, and repair any damage. This could be an onerous obligation, particularly as the biomass may have increased in volume, mass and weight over a period of years, and damage may have been caused to the existing structure.
7	Positive obligations of the licensee	The licensee may have to uphold certain standards and act in a certain way, i.e. the licensee should not block roof drains, pierce membranes, drop rubbish, etc. The licensee may have to undertake certain works to make the licensed area fit for purpose. For example erect a shed, organise a water supply or clear the licensed area of fixtures and fittings that hinder the licensed area.
8	OH&S	The licensee will be required to adhere to current OH&S guidelines, the relevant State law, and generally comply with all Council regulations.
9	Insurance	The licensee will require insurance cover for the following: <ul style="list-style-type: none"> <li>· workers' compensation</li> <li>· public liability</li> <li>· third-party property</li> <li>· professional indemnity.</li> </ul> The licensee may have to provide copies of their insurance cover to the licensor at the commencement date.
10	Security	The security of both the licensee's equipment and personnel and the licensor's may have to be protected. For example, the licensor may themselves be subject to strict entry-and-exit provisions at their main entrance, and the licensee may have to acquire the same access rights [security passes or codes] for access to the licensed premises. Notice may have to be given to the licensor to access the premises. If this is too restrictive, the licensee and invitees may not be able to manage their obligations.
11	Supervision	The licensee may have to supervise their invitees to the site, and the licensee may have to walk through the licensor's premises to gain access to the licensed area.
12	Conflict of use	The roof space and terraces of commercial buildings are typically used for corporate functions and activities. These activities may conflict with the licensed area and the protection of plants and equipment. As the licensee does not have exclusive possession of the premises, a management arrangement may have to be put in place to accommodate this conflict.
13	Indemnities and risk	The licensee may have to indemnify the licensor from legal actions that could be taken by third parties that may suffer an injury from the licensee's activities, for example if an item is accidentally dropped from the roof onto the pavement below, causing injury. Another example would be a hose accidentally left turned on overnight, which may cause flooding below. The licensee may have to accept the risk of damage to plants, materials and equipment left on the licensed area. Some main indemnities could be: <ul style="list-style-type: none"> <li>· third-party personal injury</li> <li>· breach of any term of the licence</li> <li>· wilful misconduct of the licensee</li> <li>· negligence or omission</li> <li>· a breach of confidentiality.</li> </ul>
14	Costs and expenses	Electricity, water, gas or other utilities may be supplied to the licensed area, but typically they may not be separately metered. An allowance should be made in the licence fee or an acknowledgement from the licensor that these consumption costs will not be charged.

15	Use and care	Signage may be proscribed or restricted by the licensor. The licensee may have to protect and secure the lessor's property close to the licensed area, and the licensee may have to indemnify the licensor for theft or vandalism of their property. The licensee may have to conform to a prescribed growing regime, which is subject to third-party scrutiny.
16	Confidentiality	There is a general obligation on the licensee not to divulge the commercial details of the licence to third parties, or to disseminate information gained from the licensor's premises.
17	Termination	There may be reserved rights by the licensor to terminate the agreement without reasons. It is recommended that a verbal termination is not sufficient and a written termination is required.
18	Assignment and sub-licensing	There may be a restriction on assignment and sub-licensing to ensure that control and supervision can be maintained by the licensor.
19	Legal fees	It is usual for each party to pay their own legal fees, and that the laws of the relevant State apply.
20	Annexures	There may be annexures to help the parties understand the licence. For example: a plan of the licensed area a list of equipment supplied by each party a schedule of condition before and after the installation of the biomass.

## 9 Value of green roofs and walls

There is a debate about whether green roofs or walls add or subtract value to property. Some argue that a poorly maintained installation will add to maintenance costs and be a very visual sign to deter buyers or tenants, thereby subtracting value. Others argue that a well-maintained attractive space that can be used by owners or tenants as an amenity will add value.

Traditionally valuers will only look at economic factors such as income to assess value; these are tangible. However there are also non-tangible aspects that may add value. One is the 'amenity' benefit or value of green roofs. Research published in 2015 by Dr Kate Lee from the University of Melbourne showed that students were able to concentrate better after ten minutes of exposure to a green roof. She gave students a series of repetitive tasks to do and then a break where half looked at a green roof and the others looked at a non-green roof. Afterwards, the students who had looked at the green roof were able to perform the tasks more accurately and faster.

Commercial buildings rated using recognised sustainability rating tools such as Green Star, BREEAM and LEED do

show a higher value compared to non-rated stock (Eichholz at el, 2013; Newell at al, 2011, RICS 2013); however it is difficult to isolate the different sustainability features to determine exactly how much value is added by each. On this basis currently each property has to be examined on its merits as to whether, and how much, value is added or lost by the presence of a green roof. It is likely that over time this will change as more evidence becomes available regarding valuation of sustainability features in buildings.

Some opportunities to write off tax may exist, for example where a green roof is used to grow food to be donated to charities (see Wilkinson & Dixon, 2016 forthcoming).

Some planning authorities encourage the installation of green walls and roofs so that occupants and users of adjacent buildings can enjoy a 'greener' outlook, rather than stark buildings. This is the case in the city of Singapore where the planners encourage developers to install greenery for the benefit of adjoining and overlooking neighbours.

(See Appendices 2 and 3 for Case Studies.)



# Appendix 1: Checklist for appraising roofs for suitability for green roof retrofit

## A1.1 Green roof retrofit checklist

This checklist is designed for building surveyors and building consultants to use in an initial appraisal of an existing building for green roof retrofit.

Please review the following aspects and take into account in your decision-making.

### 1. Position of the building

- What is the position of the building within the settlement? Is it overshadowed by other adjoining buildings, which may affect access to sunlight and the growth of plants?
  - Not overshadowed (good).
  - Partly overshadowed (maybe OK).
  - Overshadowed (may not be OK).
- What is the quality of the building? For example those with a high quality may experience an increase in capital value and yield as a result of having sustainability features such as a green roof or walls.
  - High quality (in Australia PCA Grade Premium and A) – more likely to enhance value.
  - Medium quality – may enhance value.
  - Low quality – less likely to enhance value.

### 2. Location of the building

- What is the prevailing climatic condition? For example, is the building in a hot arid climate zone or a maritime zone? Each has different characteristics, which favour different types of green roof solution. For example, those locations that experience heavy rainfall may favour a stormwater solution aimed to reduce as much runoff as possible.
  - The prevailing climate is .....
- The building and roof location is exposed to:
  - high winds
  - medium winds
  - low winds
- The building and roof location is exposed to:
  - high rainfall
  - medium rainfall
  - low rainfall
  - wide seasonal variation in rainfall
- Does the location favour (tick all which apply and rank in order of preference):
  - stormwater design
  - improving water quality entering sewer system
  - thermal design
  - reducing urban heat island
  - reducing noise pollution
  - biodiversity design

- aesthetic and social space design

### 3. Orientation of the roof

- What is the orientation of the roof? (North facing is good in the southern hemisphere, whereas south facing is better in the northern hemisphere.)
  - Good
  - OK
  - Poor

### 4. Height above ground

- How high is the building? (In some locations high buildings are subject to high winds and/or fierce heat, which can make growing plants challenging.)
- How high is the roof? ..... floors

### 5. Roof pitch

- What is the roof pitch? (Minimum roof pitch should be less than three degrees).
  - Up to 21 degrees (suited to a green roof retrofit).
  - Exceeding a 22-degree pitch (too steep and not suited to a green roof retrofit).

### 6. Existing roof construction

- What is the existing structural form of the roof?
  - Timber (size and spacing of beams).....
  - Concrete slab (depth in mm) .....
  - Structural steel (size and spacing of beams).....
  - Other (describe) .....

### 7. Load limitations of the building

- What is the dead load bearing capacity of the existing roof? .....
- What is the live load capacity of the existing roof? .....

### 8. Preferred planting options

- What is the budget?
  - High
  - Medium
  - Low
- How much maintenance is available for the green roof plants?
  - High
  - Medium
  - Low
- Is there a water supply on the roof?
  - Yes
  - No
- Is there a power supply to the roof?
  - Yes
  - No
- Are there any potential environmental hazards?
  - Yes
  - No

**9. Presence of (mechanical or building) plant and other equipment on the roof. (The presence of plant such as air conditioning or HVAC may affect plant growth by creating micro-climates on the rooftop through the discharge of fumes and warm air.)**

- Is there HVAC equipment on the roof?
  - Yes (please indicate approximate area covered in m<sup>2</sup> and proximity to green roof or wall) .....
  - No
- Are there window cleaning tracks on the roof?
  - Yes (please indicate location) .....
  - No
  - Partly
- Is there a safety guardrail/balustrade around the roof?
  - Yes (please indicate height and type).....
  - No
  - Partly .....
- Are there any PV panels mounted on the roof (please indicate type)?
  - Yes (please indicate approximate area covered, in m<sup>2</sup>) .....
  - No
- Is there other equipment on the roof which affect the area which could be retrofitted (please indicate)?
  - Yes (please indicate type of equipment and approximate area covered, in m<sup>2</sup>) .....
  - No

**10. Access for construction and installation of the roof**

- What is the access like for construction and installation? (Materials and equipment will have to be taken up to the roof during construction and installation. The presence of scaffolding for other external works may provide a good means of moving materials to the roof.)
  - Access is very good (i.e. lift directly to roof level)
  - Access is OK (wide stairs to roof say one floor below roof)
  - Access is poor (narrow/winding stair access only)

**11. Levels of maintenance**

- What is the access for maintenance of the plants? To the roof?
  - Access is very good (i.e. lift directly to roof level)
  - Access is OK (wide stairs to roof, say one floor below roof)
  - Access is poor (narrow/winding stair access only)

**12. Costs**

- How much is the client prepared to pay for a green roof?
  - High
  - Medium
  - Low
- Can the costs be partially offset by the improvement in thermal performance and energy savings?

**13. Amenity**

- Is the green roof intended to be used for amenity of building occupants?
  - Yes
  - No
- Is safe access available to occupants?

- Yes
- No
- Is there a continuous accessible path of travel for persons with a disability to access the space (if used for amenity)?
  - Yes
  - No
- Do other amenities need to be provided to the roof (such as seating, drinking water, signage and identifying/learning tools)?
  - Yes
  - No

**Other notes**

In this section please note down any other factors, which affect the installation of a retrofit green roof.

**Final evaluation**

List the results of your evaluation and recommendations:

**Outcome:**

Recommend green roof / wall subject to the following:

- 1 .....
- 2 .....
- 3 .....

Or recommend not to proceed based on the following:

- 1 .....
- 2 .....
- 3 .....

## Appendix 2: Case studies

Two illustrative case studies demonstrate the application of green roof technology in Australia. They are a combination of new build and retrofit projects.

### A2.1 Case 1: Biodiversity green roof retrofit at the University of Melbourne, Burnley Campus, Victoria

The building, originally constructed between 1946 and 1949, is used for teaching purposes and is on the Victorian Heritage register. The roof is concrete, with a load-bearing capacity of 150kg/m<sup>2</sup> and a one-degree slope. This biodiversity roof comprises Victorian grassland plant species in a shallow scoria substrate. The retrofit was completed in February 2013 at a cost of \$13,930 and covers 49m<sup>2</sup>. The existing waterproofing was patch-repaired saving \$2,000. The green roof components include ZinCo SSM45 protection mat and high-density polyethylene (HDPE) root barrier, a ZinCo FD40 drainage layer and ZinCo Filter Sheet SF. The roof receives run-off from two downpipes that drain a roof area above. One is directed into the pond and ephemeral stream, the other enters a buried drain pipe that travels along the long axis of the roof. Drainage off the roof is achieved through two drains on the northern perimeter of the building. The costs were as follows: design and preliminaries \$3,000, patch repairs \$1,500, green roof \$5,150 and labour \$1,650, with the remaining \$2,630 spent on plants and planting.

### Figure 1: Bio-diversity roof retrofit – University of Melbourne



Source: Wilkinson, 2013

University staff maintain the roof, which takes about an hour per month. A photographic record of weed species is maintained with timely removal preventing them from becoming more widespread. The rooftop plants recovered well in spring, and Australian ravens and magpies visited the roof to use the pond and to bring food to consume on the roof. Spiders colonised the tree debris, and an ant colony has moved into the rocky substrate near the end of the stream. Building occupants have commented on their enjoyment of the colourful grassland species planted outside the first floor window.

## A2.2 Case 2: Stormwater roof, UTS Alumni green roof, Ultimo, Sydney, NSW

This building was completed in October 2014 as part of a major redevelopment of the UTS campus. Alumni Green is a green roof of 6,500m<sup>2</sup> overall, with a sports hall and a library retrieval system located directly below. There is easy access to the green roof for staff, students and the public. Native and drought-tolerant plants occupy the eastern part of the roof, and an open space covered with turf comprises the western part of the roof. Some deciduous trees provide much needed shade in summer months but allow sunlight to penetrate the space in winter periods. Stormwater is captured, stored in 60,000 litre tanks, treated and reused to supply approximately 87 per cent of the Alumni Green water requirements. A 32,000 litre tank provides on-site detention and is used to manage stormwater during excessive rainfall.

Other environmental benefits are increased quality of stormwater run-off and mitigation of the urban heat island. Water economy is managed through a system of irrigation, which is controlled to ensure efficient watering of the plants and turf. A key driver was the opportunity to create a green space on campus for UTS staff and students in which to socialise and relax. Being a city-centre campus, many students tend not to remain on site after classes.

Figure 2: Alumni Green Roof UTS Sydney, Ultimo NSW



Source: Wilkinson, 2015.

## Appendix 3: How other countries encourage installation of green roofs and walls

Broadly speaking there are two options for authorities when it comes to green roofs and green walls; either they adopt a mandatory or a voluntary approach. Mandatory approaches exist where an authority makes it a legal requirement to install a green roof or wall when certain conditions prevail.

The City of Toronto, Canada has a green roof by-law enacted in 2009, which requires green roofs on new commercial, institutional and residential development with a minimum GFA of 2,000m<sup>2</sup> as of 31 January 2010. From 30 April 2012, the by-law required compliance for new industrial buildings.

A further example is in Copenhagen in Denmark, the first Scandinavian city to adopt a policy that requires green

roofs for all new buildings with roof slopes of less than 30 degrees. Copenhagen has 20,000m<sup>2</sup> of flat roofs. It is hoped that as much as 5,000m<sup>2</sup> of new development each year will be covered with vegetation (Inhabitat, 2015).

The alternative approach is to facilitate and encourage green roof and green wall installations. The city of Sydney undertook this approach when, in 2012, it set up the Green Roofs and Green Walls Policy. The policy is also intended to support the green roofs and walls industry sector in Sydney (City of Sydney, 2012). A similar approach to encouraging the uptake of green roofs has been adopted in Melbourne (City of Melbourne, 2015).

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## Confidence through professional standards

RICS promotes and enforces the highest professional qualifications and standards in the development and management of land, real estate, construction and infrastructure. Our name promises the consistent delivery of standards – bringing confidence to the markets we serve.

We accredit 118,000 professionals and any individual or firm registered with RICS is subject to our quality assurance. Their expertise covers property, asset valuation and real estate management; the costing and leadership of construction projects; the development of infrastructure; and the management of natural resources, such as mining, farms and woodland. From environmental assessments and building controls to negotiating land rights in an emerging economy; if our members are involved the same professional standards and ethics apply.

We believe that standards underpin effective markets. With up to seventy per cent of the world's wealth bound up in land and real estate, our sector is vital to economic development, helping to support stable, sustainable investment and growth around the globe.

With offices covering the major political and financial centres of the world, our market presence means we are ideally placed to influence policy and embed professional standards. We work at a cross-governmental level, delivering international standards that will support a safe and vibrant marketplace in land, real estate, construction and infrastructure, for the benefit of all.

We are proud of our reputation and we guard it fiercely, so clients who work with an RICS professional can have confidence in the quality and ethics of the services they receive.

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