

Vertical garden walls

Perth and Peel region
industry best practice
guide

Image: Pawel Czerwinski / Unsplash



Introduction

Vertical garden walls (also known as green walls) are becoming increasingly popular around the world for their visual and functional appeal.

These living, breathing artworks improve air quality, increase biodiversity and provide sound insulation. They're also an exceptional insulator and can significantly decrease inside temperature. This means saving money on air conditioning bills as well as reducing greenhouse gas emissions.

Growing vertical gardens in Perth has its challenges. It has been suggested our climate makes it difficult to maintain vertical gardens, particularly with summers becoming hotter and winters drier. However, vertical gardens can thrive in the Perth and Peel region. The root of growth issues is usually poor construction methods, unsustainable use of growing media, inappropriate selection of plants and poor maintenance practices.

The following best practice guidelines provides the information you need to create vertical gardens that are sustainable, water efficient and viable.



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How to install

Step 1: Conduct an environmental assessment

About Perth and Peel's climate

Western Australia's climate is often referred to as Mediterranean; however, covering a huge land mass of 2,529,875km², the climate in the north is considerably different to the south.

In these guidelines, we focus on the climate in the Perth and Peel region, where we see the classic traits of a Mediterranean climate:

- more than half of all rainfall occurs in winter, which is slowly declining.
- warm to hot temperatures in summer, with high evaporation rates, when temperatures soar to 40 degrees Celsius.
- one of the windiest cities in the world, especially in the hotter months.

Environmental assessment checklist

During the initial planning phase of a vertical garden, it is critical that you conduct a full orientation of the site and assess the following:

- daily movement of sun
- impact from wind
- changes in shading over the course of the year
- possible heat reflection from neighbouring buildings
- drainage issues.

Of course, these considerations vary from site to site. It's especially important to note whether the vertical garden is constructed indoors or outdoors, as natural light and air movement are often important considerations for indoor locations.

Best practice tips

- When using a modular system, north or west wall orientation is best.
- For thinner felt or panel systems, a south aspect is better.

Step 2: Choose an appropriate system

There are two main types of vertical garden systems: green facades and living walls. Each type supports a particular style of vertical garden.

Green facades

There are two types of green facades:

- **direct:** typically climbing plants grown directly onto a wall without structural support. Best suited to plants like *ficus pumila*, *parthenocissus quinquefolia* (True Virginia Creeper), or *parthenocissus tricuspidata* 'Veitchii' (Boston ivy)
- **indirect:** climbing plants or cascading groundcovers supported by cables, mesh or trellis. Best suited to plants like *hibbertia scandens*, *trachelospermum jasminoides* and *pandorea jasminoides*.

Living walls

Living walls are based on more robust support structures.

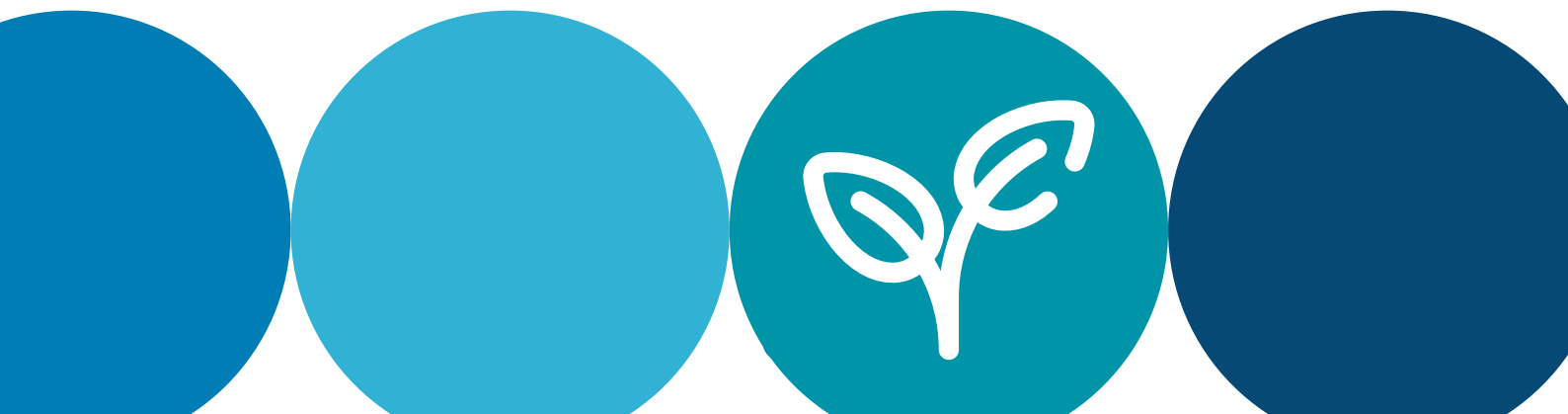
- **Modular:** utilising multiple modular elements or kits. Best suited to *Lomandra 'Tanika'*, *sedum crassulaceae* and *liriope 'Evergreen Giant'*

Modular options

Felt-based and UV stabilised are the two most common modular options.

Felt-based: Light-weight felted pockets and wrap panel systems that allow plants to grow harmoniously with the system.

UV stabilised: For longevity, choose UV stabilised products which have a life expectancy of up to eight years.



Recommended industry specifications for modular installations

Height: 500mm

Width: 500mm

Depth: 140mm

Internal volume: 24L

Weight without media: 2kg

Weight with dry media: 12kg

Weight fully saturated: 21kg

Material: Recycled high-density polyethylene (HDPE)

Where the modules are subjected to harsh conditions, choose those which are at least 120-140mm.

Best practice tips

Weight can be a major consideration, especially for living walls. Allow for the cumulative mass of fixings, structures, plants (at various growth stages), growing media, irrigation/fertigation and drainage systems, and even the moisture contained in the wall.

Step 3: Choose the plants and their position on the wall

The best plants for vertical gardens are dense, compact and low-growing with fibrous root systems. You can [find Waterwise plants](#) that fit that description on Water Corporation's website.

While you may be working to an overall planting theme, it's also important to consider local climate and site orientation when selecting your plants.

Considerations when selecting your plants:

- 1. Suitability for vertical growth:** Make sure the plant is suited to a soil-less, vertical location.
- 2. Climate:** Choose plants that are suited to the local climate. Minimum temperature is especially important to know. You'll also need to assess whether there are any micro-climates to consider, such as high buildings, which create strong winds along a wall.
- 3. Orientation of site:** Sun exposure can vary significantly between sites, as well as throughout the year. Select species that suit the aspect of the wall on which they'll be growing. For example, a wall drenched in sun will need a selection of fairly drought-tolerant plants, whereas a shady spot will require a selection of shade lovers, such as ferns.
- 4. Plant relation:** Some plants may grow quicker than others, so ideally select plants with similar cultural requirements.

- 5. Root-zone size:** Shallow root systems and drought tolerance offer advantages.
- 6. Wall weight:** Remember that the bottom of the unit will hold more moisture than the top, so consider this when you're deciding what to plant.
- 7. Maintenance levels:** Consider the amount of work required to maintain the vertical garden. Low maintenance plants often offer the added bonus of requiring less water.
- 8. Pest and disease tolerance and the potential for biodiversity.**

Where to buy

The key to the success of the plants is the establishment phase. It's essential establishment takes place offsite at a suitable nursery, where where tube-form plants are grown for three to four months.

Choosing plants from non-accredited suppliers can often result in plants being pot bound, weed infested, pest and disease affected, or nutrient depleted.

Best practice tips

- Fast growing plants are best suited to compact areas because they allow better air movement and result in fewer pest and disease outbreaks.
- If edibles form part of the design, the use of bucket-style modular systems is best as this system will allow easier access for plant replacement.
- When it comes to fertilisers, synthetic-based products produce better results. Do not use organic based fertiliser products as these can block the irrigation system.





Step 4: Choose your growing media

Cocopeat (coir) perlite, sphagnum moss, vermiculite and composted pine bark are the most common media combinations. Soil is not used since it increases the weight of the vertical garden. Potting mix is also rarely used as it's considered inefficient when compared to customised combinations growing media.

When choosing your growing media, you should consider the following:

- weightless media (understand the saturated bulk density of the media being used)
- high water-holding capacity using a percentage of coir e.g. 15%
- high nutrient-holding capacity using a percentage of peat e.g. 15%
- good porosity
- neutral pH.

Always trial the plants in the growing media before transporting them to the site.

Best practice tips

- Inferior and particularly cheaper growing media mixes create poor growing vertical gardens and often have greater ratios of sand in their mix, creating problems with weight.
- Growing media suppliers offer vertical garden media blends for a range of situations, including indoor and outdoor use. To ensure the best possible results, select a supplier that falls under the Australian Plant Production Standard (APSS)'s 'Industry Best Management Practice' guidelines. Look out for the accreditation logo below on their products.



Step 5: Irrigation

Water and nutrient management are critical to ensure a successful and cost-effective vertical garden. Following the best practice irrigation requirements below will ensure your vertical garden thrives and is as water efficient as possible.

Best practice irrigation system requirements

- Automated system
- Irrigation to be fitted with a tested master valve
- System to be fitted with a backflow prevention device. For example, RPZ or dual check valve
- System to be monitored and linked to moisture sensors in the vertical garden via Wi-Fi connected irrigation controller
- System to allow liquid fertigation
- On modular systems, use one row on your drip system for efficient watering. Panel system to use a minimum of two rows
- Each vertical garden must be metered with a requirement to monitor and record water use every visit in the vertical garden maintenance reports
- On larger walls, have a drainage tray at base to allow run-off into an agricultural pipe in nearby garden beds if applicable.

Best practice watering requirements

- Water three times a day for the first three months.
- After three months, water twice a day.
- The amount of water applied weekly must not exceed 20 litres per m².
- Ensure water use is closely monitored.

Additional tips to ensure your vertical garden is water efficient:

- Use water-retention fibre within the modules and a spaghetti shape of drip irrigation. This combination is one of the most effective practices in reducing the amount of water applied.
- Add a liquid fertigation system to the irrigation to ensure the vertical garden gets all the nutrients it needs for healthy root development.



Best practice tips

- Overwatering and poor drainage can cause root rot, so be sure to only provide as much water as the plants need.
- The location and aspect of the vertical garden has an impact on the volume of water used. For example walls located in a westerly or north-westerly aspect are subject to higher summer temperatures and drying winds.
- The growing media composition can create a varied movement of water and also nutrient availability. Ensure that the media is developed to retain as much moisture as possible.
- Plant selection is a key component in water use, with some plants being more drought tolerant than others. Because not all sites are the same, shading factors may come into play and plants that thrive in scorching temperatures may fail if positioned in semi or deep shade.
- Daily and seasonal changes in climate can create fluctuations in evaporation rates. Plants that have reached wilting point, will take larger amounts of water for recovery than if they were maintained at ideal growing conditions from the onset.

Maintenance

Maintenance is essential to guarantee the success of your vertical garden.

Regular maintenance and inspections by a vertical garden technician or horticulturalist is critical for the adjustment of irrigation and fertigation, and the health and well-being of the plants. In some cases, there may be vandalism and theft of plants in public spaces, which a rigorous maintenance program can also help to avoid.

Failure to implement a yearly maintenance program can result in financial loss, waste of resources and in some cases, the project having to be redone.

Maintenance checklist

- Inspect the vertical garden at least once a fortnight.
- Once a month, carry out cultural checks of the plants. This involves:
 - » appropriate tip pruning to keep plants in check and compact.
 - » weed, pest and disease control.
 - » check the effectiveness of the irrigation/fertigation system. In particular, check for debris in the flush valves and any other filters used.
- Replacement of plants quickly as needed so the vertical garden fills out and reaches its potential.

Common pests and diseases

The key to achieving a healthy vertical garden is ensuring that it is regularly monitored for signs of pest or disease.

The following can increase pest and disease outbreaks:

- poorly draining growing media
- lack of airflow around the plants

- over and under watering
- lack of maintenance inspections
- misidentification of a pest or disease
- excessive fertilising
- not purchasing plants from an accredited nursery

Here are a few of the common pests and diseases to look out for in your vertical garden:

Fungus gnats

Small flying insects that are attracted to the moisture of potting mix. Adult gnats lay their eggs (up to 200) on organic matter near the soil surface. Lower leaves may turn yellow and drop and the plant's growth may slow down or stop completely. In particularly bad cases, wilting of the entire plant could occur, followed by the death of the plant if roots are extremely damaged.

Best practice tips

Where possible use organic based products for control. These are applied as a spray or wipe.

Occupational Health & Safety

Accessing large vertical gardens can be daunting. A simple ladder may not be suitable for a thorough inspection. During the design phase, a Job Safety Analysis needs to be completed and documented. Considerations should be made regarding how the vertical garden will be maintained in restricted areas, in particular where walls are over two metres tall.

Resources:

[Working at Heights - Safe Work Australia](#)



Image: Paul Hanaoka//Unsplash

Vertical garden watering exemption

How to get a watering exemption

Do you qualify?

To apply for an exemption, email Wepartnerships@watercorporation.com.au

Water Corporation will review the exemption request and advise applicants within 5-10 working days of approval.

In your email, please include:

Email title

Include the type of request, property address and property account number.

For example: Vertical garden Exemption Request - 4 MCCARTHY WAY LANDSDALE - 9001234567.

Email text

- Company name
- Name of the person requesting the exemption (key contact)
- Email address and mobile number for the key contact
- For vertical gardens that have already been installed, please also include the location of installed garden

Conditions of the exemption

Applies only to the use of scheme water for the purposes of watering plants in the vertical garden.

Only applicable for vertical gardens in the Perth-Peel region. Regional applications will be assessed on a case-by-case basis.

Follow the Best Practice Guidelines stipulated in this document for construction and management of vertical gardens.

Each vertical garden must be metered. Water use must be monitored and recorded in a monthly maintenance report including monthly images of the wall.

The irrigation system may operate a maximum of three times per day. The total amount of water applied weekly must not exceed 20 litres per m².

Water Corporation will conduct random audits of the vertical garden to ensure it is complying with these conditions.

Industry references

Landscape Industries Association WA
<https://landscaping.net.au>

Nursery & Garden Industry WA
<https://www.ngiwa.com.au/>

Nursery Production Farm Management System
<http://nurseryproductionfms.com.au>

Performance of Vertical gardens in Mediterranean Climates
July 2018
https://api.research-repository.uwa.edu.au/portalfiles/portal/43627161/Green_Wall_Literature_Review_final.pdf

Nursery & Garden Industry Australia - Nursery Paper
September 2018
https://www.greenlifeindustry.com.au/Attachment?Action=Download&Attachment_id=2125

Hort Journal April 2020 - 'The Only Way is Up'

Hort Journal May 2020 - 'The Future of Green Infrastructure'

Deep Green Landscaping - Julian Rose
<https://deepgreenlandscaping.com.au>

South Metro TAFE - Lisa Hall (Landscape Design) & Neil
Marriott (Irrigation)
<https://www.southmetrotafe.wa.edu.au>

Western Australian Agricultural Authority, Department of
Primary Industries and Regional Development - Pia Scanlon &
Dr Darryl Hardie

Richgro - David Miles <https://www.richgro.com.au>

