

Summary Bulletin Gardening at Home

**PEER
REVIEWED**

Authored by
Phillippa Carnemolla and Catherine Bridge

2nd ed. May 2014

ISBN: 978-0-7334-3457-0

Summary Bulletin Series
ISBN: 978-1-86487-753-3



www.homemods.info

Publication History

1st edition Gardening at Home: Summary Bulletin by Lara Oram and Lyndal Millikan, December 2007.

Contribution of Authors

This is the second edition of the Summary Bulletin: Gardening at Home replacing the original publication of the same name, authored by Lara Oram and Lyndal Millikan (2007).

Phillippa Carnemolla undertook the research for this second edition. She developed the content, and formatted and wrote the Summary Bulletin. Associate Professor Catherine Bridge also provided content for inclusion in the Summary Bulletin, and advised, restructured and reviewed the final report.

Acknowledgements

This material has been published by the Home Modification Information Clearinghouse within the City Futures Research Centre, Faculty of the Built Environment, UNSW Australia (University of New South Wales).

This material was produced with funding from the Australian Department of Social Services (DoSS), and Ageing, Disability & Home Care (ADHC), a part of the NSW Department of Family and Community Services (FACS).

This document retains some of the general structure of the original publication by Lara Oram and Lyndal Millikan.

All illustrations in this document are original line drawings by Michelle Svenger.

This document was reviewed by the HMinfo Specialist Review Panel. The review panel for this document consisted of:

Nell Rickard	Nell Rickard Landscape Architect Australian Institute of Landscape Architects	Guest Expert Reviewer
Sandra Lightfoot Collins	Macarthur Home Modifications and Maintenance Services	Industry Panel
Beverley Garlick	Beverley Garlick Architects Royal Institute of Architects	Industry Panel

Liability Statement

The HMinfo Clearinghouse team gives no warranty that the information or data supplied contain no errors. However, all care and diligence has been used in processing, analysing and extracting the information. HMinfo Clearinghouse will not be

liable for any loss or damage suffered upon the use directly, or indirectly, of the information supplied in this document.

Information was correct time of publication and the date of publication should be noted when using this information.

Reproduction of material

Any table or material published in this Summary Bulletin may be reproduced and published without further license, provided that due acknowledgement is made of this source. Preferred acknowledgment style is:

Carnemolla, P. and Bridge, C. (2014) Summary Bulletin: Gardening at Home [2nd Ed.]. Sydney: Home Modification Information Clearinghouse, University of New South Wales Australia (May) [online]. Available from www.homemods.info

Table of Contents

Contribution of Authors	2
Reproduction of material	3
Table of Contents	4
Figures 6	
Tables 6	
Introduction	7
Background	7
Section 1: The Accessible Garden Environment	9
The Residential Garden	9
Accessible Landscape Features	10
Stairs	18
Ramp Design	18
Plants and accessibility	19
Planting Schemes	19
Section 2: Accessible Garden Planning, Tools and Equipment	20
Accessible Garden Beds	20
Raised Garden Beds	20
Table Planters	21
Vertical Gardens	21
Watering	29
Garden Planning	29
Products to assist in safe and accessible gardening practice	32
Section 3: Safety in the garden	39
Handling soil, potting mix and mulches	40
Commercial products and chemicals	40
General gardening equipment safety	41
Plant Safety	42
Sourcing safe and sustainable plants	44
	4

Poisonous or venomous animals and insects	44
Conclusion	45
Appendix 1: Gardening at Home Checklist	47
Appendix 2: Standards Relevant to Accessible Gardening at Home	48
References	50

Figures

Figure 1. Raised Garden Beds.....	20
Figure 2. Example of a table planter providing under table access for seated gardening in a chair or wheelchair.	21
Figure 3. A typical Green façade arrangement. Shows the pot containing growing medium plants which will grow up in a supportive frame.	22
Figure 4. Living wall system. Showing a vertically supported growing medium with plants growing directly out of the vertical wall surface.	23

Tables

Table 1 Pathway Materials.....	13
Table 2. Accessible Garden Types	25
Table 3. Gardening Tools and products	33
Table 4. Online Resources for Identifying poisonous plants.....	42
Table 5. Online Resources for Non-toxic plants	44
Table 6: Australian Legislation and Standards Regulating construction within the residential landscape	48

Introduction

This Summary Bulletin recognises the importance of providing a safe and accessible environment for older people and those living with a disability when they enjoy and tend to a garden – be it their own private garden or a shared community area. This report provides a reference for modifying or designing garden spaces to be appropriate for a safe and enjoyable gardening experience for all abilities and ages. Inaccessible gardens and unmanageable house and garden maintenance are recognised as factors for older people making the decision to move house (Judd et. al, 2014). Therefore low maintenance, accessible gardens are important in the support of older people who want to remain in their homes as long as possible.

This report summarises how to approach accessible and safe garden designs and is laid out in three sections. Section One is titled “The Accessible Garden Environment” and discusses how to design or modify garden and landscape features to be more accessible and easier for those who are older or living with a disability to fully experience and enjoy. This section includes the main findings of a report examining why accessible landscapes are important and how to approach a landscape modification – the full paper is published by the Home Modification and Information Clearing house (Carnemolla & Bridge, 2012). This is followed by Section Two titled “Accessible Gardening tools and equipment” and it reviews the activity of gardening and the tools and equipment available to make gardening safe and enjoyable for all levels of ability. Section Three reviews safety in the garden, with discussions about regulatory requirements and safe handling of chemicals, equipment and plants.

Background

A garden is defined as a plot of ground on which plants (trees, flowers, vegetables, fruits, or herbs) are cultivated (Allaby & Park, 2013) and is a fundamental element of both residential and community environments. The act of gardening is the activity or pastime of tending and cultivating a garden, especially as a pastime (Simpson & Weiner, 1989). Gardening is a pastime that can contribute positively to people’s well-being and quality of life, while enjoying a connection with caring for natural surrounds. A well designed and maintained accessible garden can also provide a source of quality fruit and vegetables, bringing with it associate economic and health benefits.

Tasks associated with caring for and enjoying plants are considered a vitalising and multi-sensorial experience (Bhatti, Church, Claremont, & Stenner, 2009) and so gardening can be an important source of exercise, of sunlight and fresh air and contact with nature (Diamant & Waterhouse, 2010). For this reason gardening can be integrated as therapy or tailored to suit people’s exertion levels (Scott, 2012). Gardening can be therefore a positive and important activity, particularly for older people or those living with a disability, either in the home or amongst the community in community gardens.

The gardens of private homes are often an overlooked area of home modifications; in fact, academic literature rarely records the garden as a part of the home (Bhatti, 2006). People may find that their gardens become increasingly difficult and expensive to manage as they grow older (Smith & Smith, 2012). Despite the recognition of a lack of information about the modification of gardens for older people (Cranz & Young, 2006), the garden is considered (after kitchens and bathrooms) as one of the spaces most renovated and modified in Australian homes (KPMG, 2006).

There are a number of advantages to gardening for people of all ages. Benefits include the development of fine and gross motor skills, exercise, pleasure for the senses, self-esteem building through gardening accomplishments, and the social benefits of mingling with other gardeners (Heath & Gifford, 2001; Kwack, Relf, & Rudolph, 2005; Rodiek & Schwarz, 2006). Research conducted by the University of Liverpool (Ashley, 2005) found that gardening had a positive effect on physical and mental wellbeing, and gave the opportunity for participants to feel included, to socialise, and to boost their confidence in a task. More recent research published by the University of Queensland found that gardening contributed to older people's life satisfaction, both physiological and psychological (Cheng, Patterson, Packer, & Pegg, 2010).

While the outdoor environment can be daunting for people with physical and sensory impairments, it can also be designed to suit and challenge the gardener's abilities. A personalised garden enables people with disabilities, in particular, control over their environment (Larson, Hanchek, & Vollmar, 1996). The design and building of a garden can be challenging and expensive and can seem to be the realm of professional landscapers and gardeners. With some practical tips for garden design, however, consumers and their families can take charge of designing and building gardens themselves.

Problems associated with inaccessible gardens

A high maintenance or inaccessible garden can be the major reason why older people decide they have to move house (Judd et. Al, 2014). Issues compounding a decision to move include an inability to maintain the garden themselves and consequent deterioration of the garden, coupled with the cost of paying someone else to maintain the garden.

Section 1: The Accessible Garden Environment

This first section of the Summary Bulletin identifies what makes a garden accessible and why accessibility is important. It also summarises a number of accessible landscape design requirements and solutions. Further references are given as a guide for further information.

One in five Australians report having a disability (Australian Bureau of Statistics, 2009). When we consider not only those who have mobility limitations, but those who provide care for someone with mobility limitations or care for children and use prams, the accessibility of the built environment becomes recognisable as a major issue. Our outdoor garden areas are significant accessibility features as they impact on levels of participation, well-being and independence (Kingsley, Townsend, & Henderson-Wilson, 2009; Marcus, 2000; Stigsdotter & Grahn, 2004).

An accessible garden and landscape contributes to the liveability of a home. The garden and outside areas of a house provide two important functions. Firstly, they are an outdoor space for recreation and therapy, providing access to sunlight and plants. Secondly they are a connecting space between the street and the house entrance. Therefore an accessible garden supports not only the gardening pastime, but also independence and community participation.

The Residential Garden

The ability to move easily and safely throughout a garden, and enjoy and work in its surrounds safely regardless of age or ability is a measure of its accessibility. The role and function of the garden has been well documented and explains in part why an accessible garden is so important. Research indicates that gardens are major contributors to quality of life; both community gardening (Teig et al., 2009) and private gardens (Wang & MacMillan, 2013).

A garden has relevance as a space to experience nature. The ongoing psychological and restorative benefits of nature and gardens have been well documented (Marcus, 2000) including research that directly correlates improved health, reduced stress and other symptoms with access to a home garden (Macintyre et al., 2003; Stigsdotter & Grahn, 2004). Horticulture and gardening have been used as a therapy by some rehabilitation hospitals to alleviate stress, increase wellbeing and promote participation in social life (Söderback, Söderström, & Schäländer, 2004). Therefore a garden that is inaccessible to its occupant will potentially have an impact on aspects of life as diverse as participation, sustainability, health and self-worth.

When modifications to a home garden are required, there is an opportunity to reassess the garden design in general and make improvements based on safety, participation, accessibility and inclusivity. Modifications to a garden setting incorporating inclusive design should make it safer, comfortable and a passive or active gardening experience

for the widest audience possible. Consideration of access between the front gate, letterbox, shed, garage, front and back entrances is important to maintain mobility and independence in daily life activities.

There are a wide variety of residential garden types, varying in scale and each with unique limitations and considerations for accessibility. Residential gardens can be;

- Suburban and rural gardens
- Inner city/courtyard gardens
- Balcony gardens
- Window gardens/box

In addition to a wide variety of garden types, the accessibility needs of an older person or someone living with a disability vary greatly and have an impact on the garden design features required for a space to be accessible and low maintenance, e.g. a gardener in a wheelchair has very different requirements to a gardener who is ambulant with a walking aid. The following tables and paragraphs include a number of accessible solutions, and because of the wide variety of garden types and gardener needs these accessible design features will not be appropriate in all cases.

Accessible Landscape Features

The landscape around a home can be considered a combination of a number of elements; gateway/entrances, pathways and recreation (garden) space. These three elements should be considered in combination when examining a safe and accessible garden and outdoor environment. The following paragraphs outline the important considerations for providing accessible design solutions for each of these three considerations, however for detailed analysis please consult the Landscape Modification paper published by the Home Modification Information Clearinghouse (Carnemolla & Bridge, 2012).

The benefits of providing accessible entrances and gateways to a home include the following:

- Level entry access for all who live in or visit the home
- Improved accessibility of the garden
- Improved safety and reduced risk of falls.

Accessible redesign of an entrance and gateway would mean the elimination of all hazards/obstructions through the implementation of graded pathways, ramps or lifts that comply with the Australian Standard AS 1428.1 (Standards Australia, 2009). In most instances, an accessible solution requires the absence of stairs. There are three access solutions available to remove the need for stairs:

- Graded walkway; An accessible walkway with slope gradient shallower than

1:20. Compliant with AS1428 (Standards Australia, 2010)¹.

- Ramp; A sloped path with gradient shallower than 1:14. Compliant with AS 1428 (Standards Australia, 2009)²
- Vertical Lift; A mechanically/electronically-operated, height-adjustable platform designed to lift and lower passengers. Compliant with AS1735.14³ (Standards Australia, 2006).

There are some circumstances where well-designed stairs are a safer or more accessible solution. For examples of situations and health conditions where stairs are a safer option, refer to the Landscape Modification report published by the Home Modification Information Clearinghouse (Carnemolla & Bridge, 2012). The National Construction Codes BCA (Building Code of Australia, 2014) includes guidelines on the design of stairs and appropriate dimensions of stair elements (see Volume 1, Part D2.13).

The optimum accessible solution for a home and garden will depend on the specifics of the site which comprises the house design and the surrounding land in the title. Land area as well as contour will dictate whether a graded walkway or ramp is possible, as these options require greater land area than a lift for a given height change (Carnemolla & Bridge, 2012). A graded walkway solution has a number of inherent benefits as, unlike a ramp or lift, it is able to be designed to fit in with the design of a home. A walkway can become part of the landscape and is not seen as an eyesore or display of vulnerability in the way that a ramp or lift can be. For a detailed review of how to analyse a site for suitability of a graded walkway solution please review the Landscape Modification report (Carnemolla & Bridge, 2012).

Accessible pathways

Pathways through and around a garden space provide important access not only from home to street, but within the garden areas for recreation and gardening. There are a variety of surfaces that are not accessible to people with mobility impairments. Passage through and to the garden spaces requires careful planning to ensure the paths are wide enough, made of navigable surfaces, and allow for turning around.

When designing pathways that circulate around the garden space the following main points should be considered:

- Pathways should be level, firm, and of a continuous gradient. In order to comply

¹ Australian Standard AS 1428 (Set)-2010: Design for access and mobility Set. Published by SAI Global.

² Australian Standard AS 1428.1 2009 Part 1: Design for access and mobility- General requirements for Access – New Building work. Published by SAI Global.

³ Australian Standard AS 1735.1-2003/Amdt 1-2006 Lifts, escalators and moving walks – General requirements

with the guidelines set out in AS1428 (Australian Standards, 2009), they should have a slope of less than 1:20. Cross fall (slope across the width of the pathway)


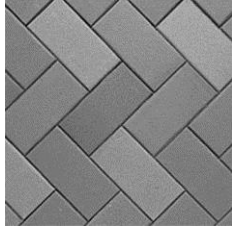
- Materials that cushion falls, such as rubber paving (see Table 1), should be considered to reduce the impact of falls. Alternately, pathways can be constructed from brushed concrete (brushed with a stiff brush when freshly poured), asphalt, brick, paving stones, or rubber paving. All have their advantages and disadvantages (see Table 1).
- Pathways should be wide enough for mobility aids and multiple garden users (if necessary).
- Handrails should be provided if necessary.
- Pathways should be well lit. This does not necessarily mean brightly lit, but there should be a good contrast between the path edges and the garden. Dark areas should be illuminated, pruned, or replanted to suit.


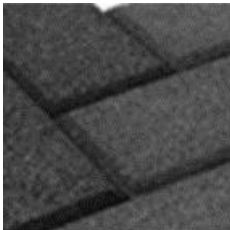
For more detailed specifications for accessible pathways please refer to Australian Standard 1428 Part 1 (2009); Design for access and mobility (Australian Standards, 2009)

Pathway material choice



When considering appropriate materials for a garden pathway, there are many options in the marketplace. A choice should be made based on the person's individual needs (e.g. visual limitation, mobility needs), ground type and terrain, location and budget. Table 1 overleaf is a review of a selection of pathway materials, providing a comparison of advantages and disadvantages of each material. It is intended as a starting point for materials choice.

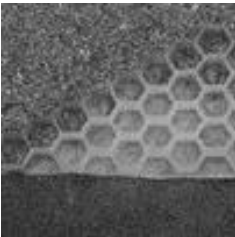
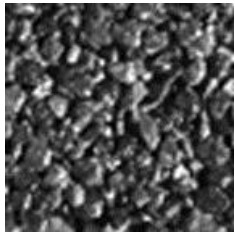
Table 1 Pathway Materials

Pathway materials	Advantages and disadvantages	Examples
Asphalt	<ul style="list-style-type: none"> ✓ Relatively inexpensive ✗ Absorbs heat, causing discomfort for gardeners and damage to plants ✗ Maintenance – needs to be resealed at least every 2 years, or else starts to break up ✗ Warps under heat, creating bumps and causing trip hazards 	
Clay Pavers	<p>Clay Pavers are rated for slip resistance, and a retailer would be able to advise what level resistance a paver has.</p> <ul style="list-style-type: none"> ✓ Loose pavers drain well ✓ Provide a high level of slip resistance ✓ Available in a variety of materials, textures, colours and shapes ✗ Proper installation is critical and may require a professional ✗ If pavers are too loosely butted at installation, the pathway can be bumpy and cobbled experience for a person in a wheelchair. ✗ Pathway edging is critical to contain the pavers and prevent shifting. <p>When paving a floor or ground surface, the appropriate specifications and processes used will depend upon characteristics such as slope of the surface, location, paver type and current ground type. For more information about installing paved surfaces correctly, please refer to the Clay Paving technical manual sponsored by the Australian clay brick, block and paver industry (Think Brick Australia, 2013)</p>	


Pathway materials	Advantages and disadvantages	Examples
Concrete	<ul style="list-style-type: none">✓ Hard and level surfaces✓ Can be brushed (with a stiff brush while wet) for greater slip resistance and traction.✓ Can be mixed with stone and coloured dyes for desired architectural aesthetic✓ Low maintenance✗ Cracking over time can cause trip hazards✗ Joints between slabs can cause trip hazards✗ Can increase glare in bright sunlight <p>The Cement Concrete and Aggregates Australia publish a guide to skid resistance of various concrete path surfaces (Cement Concrete and Aggregates Australia, 2002).</p>	
Rubber Paving	<ul style="list-style-type: none">✓ Slip resistant in wet/dry conditions✓ Cushions falls✓ Range of colours✓ Suitable for wheelchairs✗ Maintenance – can get mouldy✗ Relatively expensive	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Pathway materials	Advantages and disadvantages	Examples
<p>Timber</p>	<ul style="list-style-type: none"> ✓ Natural look ✓ Cooler than other hard pathway surfaces ✓ Can be reeded/ribbed for increased slip resistance ✗ Maintenance- can get mouldy ✗ Decays and deteriorates under weather exposure ✗ Splitting and warping – can cause trip hazards ✗ Additional costs – needs to be sealed ✗ Slippery when wet <p>The Home Modification Information Clearinghouse publishes a Consumer Factsheet on Reeded Timber for Decks (Cameron & Bridge, 2003a).</p>	
<p>Stabilised gravel or crushed oyster shell (embedded in bitumen)</p>	<p>Although a sealed surface is recommended, a well compacted or cement stabilised gravel can be suitable, and possibly preferable in rural settings (Martin, 1999).</p> <ul style="list-style-type: none"> ✓ Gravel can be firmly embedded into bitumen or resin giving the appearance of a traditional gravel finish but providing an accessible surface ✓ Weeds do not grow through resin bound paving ✓ Resins are highly durable ✓ Some prefabricated resin bound panels are permeable when installed on concrete surfaces ✗ Loose gravel is not an appropriate pathway material – particularly for wheelchair users or ambulant users with mobility aids. ✗ Resin bound gravel is impermeable (except for some pre-fabricated panels) ✗ Relatively costly 	

Pathway materials	Advantages and disadvantages	Examples
<p>Stabilised gravel (using hexagon grid panels)</p>	<ul style="list-style-type: none"> ✓ Gravel can be stabilised via a core of interlocking panels of closed hexagon cells such as COREGravel® which is American Disability Act (ADA) compliant which prevent gravel from migrating laterally ✓ Remains a permeable substrate ✓ Relatively cost effective ✗ Loose gravel is not an appropriate pathway material – particularly for wheelchair users ✗ Needs constant maintenance to avoid loose material. ✗ Possibly hazardous for people using mobility aids such as sticks and crutches if the gravel is not packed tightly and above the line of the cells.. 	
<p>Recycled glass permeable paving</p>	<p>Recycled glass stabilised in resin Hand applied and trowelled</p> <ul style="list-style-type: none"> ✓ Fully permeable/porous ✓ Non toxic ✓ Durable ✓ Recycles waste material – sustainable solution ✗ Uses polyurethane pre-polymer that requires safe handling during installation, due to irritant fumes. Stable once set. 	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Pathway materials	Advantages and disadvantages	Examples
House bricks	<ul style="list-style-type: none">✓ Can be recycled - sustainable✓ Durable✗ Can grow mossy and slippery – may require regular cleaning✗ Can become a trip hazard if tree roots push up from beneath✗ If not installed tightly the finished surface can be a bumpy or cobbled experience for a wheel chair user.	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Stairs

Stairs, also referred to as steps, are a common feature in most garden environments. Modifications such as sloping pathways or ramps are two ways gardens can be made more accessible in situations where stairs become hazardous. However, there are cases where stairs are a preferred method of managing a change in level, particularly for people with gait or balance impairment, or those using a walking frame. Ensuring stairs are well designed and maintained, and have a handrail for additional support, can reduce the likelihood of falls. For more details on stair design for accessibility, refer to the Landscape Modification report published by the Home Modification Information Clearinghouse (Carnemolla & Bridge, 2012). The National Construction Codes BCA (Building Code of Australia, 2014) also provide guidelines on the design of stairs and appropriate dimensions of stair elements (see Volume 1, Part D2.13). For correct selection and placement of handrails, the Home Modification Information Clearinghouse website (www.homemods.info) has published a number of research, industry and consumer papers including (Oram et al. 2006a) and (Gohar et al., 2008).

Ramp Design

When considering access throughout a garden environment where there are substantial level changes it may be necessary to remove steps and consider the integration of a ramp. When designing access ramps it is important to consider the gradient and width of the ramp. The Australian Standard 1428.1 (Standards Australia, 2009) provides recommended gradients for individuals who can walk or wheel themselves and for those who need someone to help them up and down a ramp.

There are several features to consider when having a ramp built:

- Handrails should be provided at an appropriate height along both sides of the ramp. Rounded handrails provide the best grip. The handrail's diameter should 'fit' the user's hand size, enabling the hand to enclose the rail comfortably.
- Kerbs, or kerb rails, should be provided along both sides of the ramp to prevent wheelchair footplates or walking aids becoming trapped or going over the edge. A covered ramp reduces weathering and wetness. Covered ramps can also reduce the risk of slips in wet weather.

Ramps will require care and maintenance, and can be constructed from brushed concrete, textured aluminium, or reeded timber. Refer to the consumer factsheet Using reeded (ribbed) timber for decks, ramps and paths (Cameron & Bridge, 2003b) for more information on reeded timber options.

Plants and accessibility

A safe, comfortable and participatory garden depends upon a carefully planted design. The plant materials selected are critical to the success of a garden, and the Enabling Garden research conducted by (G Rothert, 2002) defines specific goals for a successful, enjoyable and participatory design solution. These goals encompass:

- Designing for seasonal interest
- Selection based upon sensory characteristics
- Attracting birds butterflies and harmless “wildlife”
- Avoiding toxic plants
- Limiting exotics so that plants are easily available to gardeners
- Specifying pest and disease tolerant plants
- Require minimum maintenance

Selecting plants that meet the above criteria will help to ensure the creation of an accessible garden that is sustainable, easy to care for and safe to enjoy, regardless of age or ability.

Planting Schemes

The optimum planting scheme depends upon the site location and aspect of the landscape. Design of planting schemes should be sensitive to the local landscape and ecology (Burchett, 1994).

The garden location and the particular soil types and ground conditions of the site will determine what plant species will thrive in an accessible landscape. The aspect of the landscape will determine what sunlight is available to the plants, and will again impact upon what plant types will survive and thrive. There is a careful balance required between the plants surviving or thriving. Although the plants must not die, they also must not be prone to weed behaviours and overtake other plants or the built environment.

Many local governments and councils publish native plant recommendations for their respective local government area (LGA) to assist with appropriate plant selections. Some LGAs insist on a minimum percentage of native plants indigenous to the particular location. The NSW Government have introduced BASIX: an online Building Sustainability Index and certification process (www.basix.nsw.gov.au). According to BASIX, planting Indigenous and low water plants will improve the sustainability rating of a building development, specifically in the area of water consumption. BASIX also publish an online table of available indigenous species/low water use species appropriate for each NSW Local Government area (LGA).

Section 2: Accessible Garden Planning, Tools and Equipment

This second section summarises how to approach accessible garden planning, and reviews the tools and equipment available for accessible and inclusive gardening. Once the garden environment and landscape have been made accessible there are a number of tools and support equipment available that will further assist in the gardening activity, helping those with mobility or fine motor limitations.

Accessible Garden Beds

Typical ground-level gardening presents many problems for people with disabilities. The garden itself can be out of reach for those who sit for gardening, as well as those who cannot manage to bend to that level. Commonly available long-handled gardening tools can help provide some access to ground-level gardens, but raised garden beds, planter boxes, or large pots are better options as they bring the plants/garden to the gardener.

Raised Garden Beds

A raised garden bed facilitates access to planting areas and provides a recognisable structure in the garden. Raised gardens can be designed in a number of ways to suit people who prefer to sit, stand or garden from a wheelchair. Raised garden beds are bottomless boxes that contain soil and permit drainage (see Figure 1). Raised garden beds should be built to a height and width suitable for the particular user/users, so that all areas of the garden bed are reachable. Guidelines from the Horticultural Therapy Association of Victoria (2006) give suggested heights and widths of raised garden beds.

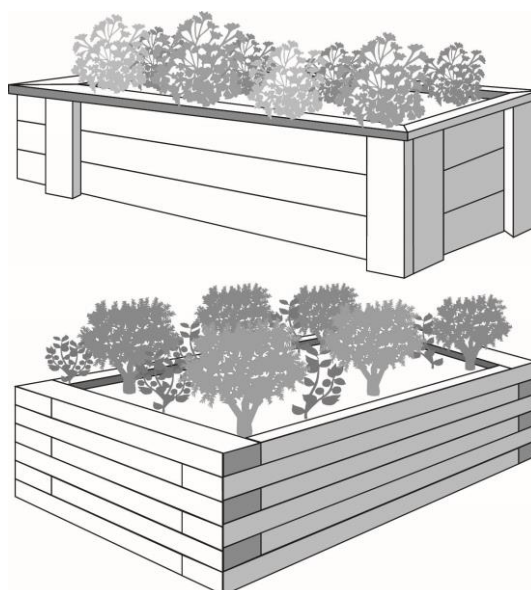


Figure 1. Raised Garden Beds

Raised garden beds can be constructed from a variety of materials, including sleepers, bricks, cypress pine, corrugated iron, etc. If a user intends to sit on the edge of the raised bed whilst gardening then the width of the garden bed and edge must be considered. Wider edges increase the overall size of the raised bed and might impede the user's ability to reach the far side of the bed. As raised garden beds can be expensive to set up, cheaper options include utilising an old wheelbarrow, old laundry tubs or baths, or stacking old tyres to create a raised garden bed. Portable garden beds, such as those on wheels, can be moved between sun and shade. Prefabricated raised garden beds are also available made from corrugated iron or plastic. These are comparatively less expensive than custom solutions and quick to install.

Table Planters

Table planters are raised platforms with shallow trays for soil and plants that provide under table knee access for seated gardeners. As the soil trays are shallower than raised garden beds, they are not as appropriate for deep rooted plants and vegetables such as carrots, but are ideal for herbs. Removable covers can provide protection from possums and birds.



Figure 2. Example of a table planter providing under table access for seated gardening in a chair or wheelchair.

Table Planters are appropriate not only for seated gardening, they can be height adjusted for standing gardening. This is a consideration for someone with mobility limitations, such as severe arthritis or conditions that limit the ability to bend or sit easily.

Vertical Gardens

Vertical gardens are also known as green walls, living walls and green facades and refer to plantings that are supported and grow on a vertical surface such as a timber or

metal frame against a building wall or fence. Vertical gardens have been designed for both residential and public landscapes and buildings and providing good water supply is available, can have the following benefits:

- Improved environmental and ecological value
- Improved access to plants for maintenance and recreational gardening
- Plants are less susceptible to diseases and pests.

Vertical gardens provide ecological and environmental benefits by greening the building envelope (Perini, Ottelé, Haas, & Raiteri, 2013) and restoring the environmental integrity of urban areas. They have been shown to have both improved yield of fruit and vegetables as well as a reduced susceptibility to diseases and pests (Utami & Jayadi, 2011). In terms of access, they have the ability to bring the garden up to a comfortable working height for the gardener, and can be designed for access by someone in a wheelchair or those who cannot bend or kneel down on the ground. The following paragraphs describe the types of vertical gardens including Green façade and Living wall systems.

Green façades

Green façades are a type of vertical garden where the garden bed remains on the ground but the foliage is trained to grow up a vertical surface. Green façades can use climbers attached directly to the building or wall surface or supported by cables or trellis. Figure 3 overleaf shows a diagram of a generic green façade depicting the pot containing the growing medium (e.g. soil), the climbing plants and the supportive frame.



Figure 3. A typical Green façade arrangement. Shows the pot containing growing medium plants which will grow up in a supportive frame.

It is important to consider that any root or soil maintenance requires the ability to

access the ground. When planning a green façade with this method it is important to consider that some climbing plants can grow up to six metres high, others around 10 - 25 metres (Dunnett & Kingsbury, 2004).

Living wall systems

Living wall systems (LWS), which are also known as green walls and vertical gardens, are constructed from modular panels which contain soil or other artificial growing mediums, for example foam, felt, perlite and mineral wool (Perini et al., 2013). Panels require hydroponic cultures using balanced nutrient solutions to provide all or part of the plants' food and water requirements (Dunnett & Kingsbury, 2004; Perini et al., 2013). Figure 4 shows a diagram of a typical living wall system.

LWS can be supported on various structures such as fences, latticework, mesh, or hanging plant containers and pots, to bring the garden to a comfortable working height for the user. In this case, the LWS requires nutrients and a watering system if the rooting space is not sufficient and can be defined as a living wall system (Dunnett & Kingsbury, 2004; Köhler, 2008).

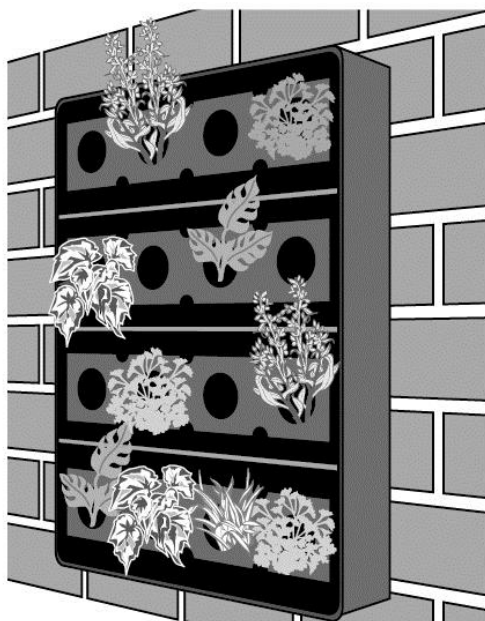


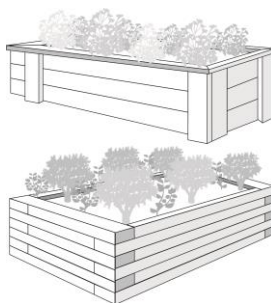
Figure 4. Living wall system. Showing a vertically supported growing medium with plants growing directly out of the vertical wall surface.

LWS with panels based on felt layers have an average life expectancy of 10 years, and living wall systems based on planter boxes last more than 50 years. A thorough design is always necessary to avoid damages such as corrosion or rot caused by the leakage



of water and nutrients (Ottelé, 2011).

There are many resources for constructing any of the above accessible gardens. Contact the Horticultural Therapy Association in your state or speak with your local nursery. An internet search for “vertical gardens” will also provide a large number of ideas and products available to build and maintain vertical gardens.

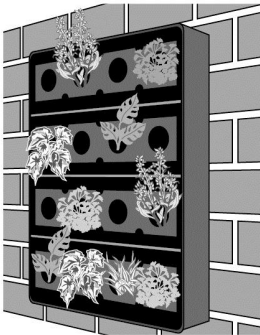
Table 2. Accessible Garden Types

Accessible Garden Types	Advantages and disadvantages	Examples
<p>Raised Garden Bed</p>	<ul style="list-style-type: none"> ✓ Raised beds make gardening easier for those with a disability because they mean people can comfortably garden while seated or standing. ✓ If soil is poor raised beds allow the introduction of good quality soil to grow flowers, herbs and vegetables with better results. ✓ Beds at different levels add shape, and form to a garden design. Higher beds can partially screen areas. ✗ Raised beds will need more watering than those at ground level because they drain and dry out more quickly. ✗ Working at a straight sided raised bed can be difficult from a wheelchair because it may require gardening from a side position – requiring twisting of the body (there are some raised bed designs with a formed cavity to allow for wheelchairs or seated knees under the bed). ✗ Once installed they can be difficult to remove ✗ Some people may prefer to garden at ground level while using long handled tools instead of raising a garden bed. <p>For recommended heights and depths of raised garden beds, please refer to the Society for Horticultural Therapy UK information sheet (Thrive UK, 2008)</p>	



Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Accessible Garden Types	Advantages and disadvantages	Examples
Table Planters	<p>Table planters are tables with shallow trays for soil and plants;</p> <ul style="list-style-type: none"> ✓ Can provide under table knee access for seated gardeners ✓ Shallow planting bed makes them ideal for herbs ✓ Can be designed to be portable ✓ Can be especially designed for wheelchair access ✗ As the soil trays are shallower than raised garden beds, they are not as appropriate for deep rooted plants and vegetables such as carrots, but are ideal for herbs. 	
Vertical Garden: Green Facade	<ul style="list-style-type: none"> ✓ Can provide some insulation on brick walls full sun ✗ Even though the plants are growing vertically, maintenance requires accessing the soil at the base/on the ground 	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Accessible Garden Types	Advantages and disadvantages	Examples
Vertical Garden Living Wall systems	<ul style="list-style-type: none">✓ Provide vertical access to planting mediums for maintenance✓ Can be used to grow edible plants – e.g. herbs, strawberries, lettuce✓ Suited to small or courtyard gardens✓ Water and space efficient✗ Can be expensive to purchase – although Hobogro* has developed a vertical garden made from recycled pallets.✗ To remain in good condition long term they need to be well designed to avoid corrosion or rot✗ May require a special watering system <p>* HoboGro is a Sydney based community enterprise that offers and teaches composting, fertilising, community gardening, seed raising, energy auditing and waste reduction. HoboGro offer community workshops teaching how to make vertical gardens out of pallets.</p>	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Accessible Garden Types	Advantages and disadvantages	Examples
<p>Potted Garden</p>	<ul style="list-style-type: none"> ✓ Potted gardens are a creative and easy way to manage a garden ✓ Potted gardens are suitable for large, small, courtyard and balcony gardens ✓ Pots can be filled and planted in the most suitable place for the gardener and moved around depending on the season, the weather and personal choice ✓ Smaller pots can spend some time inside, and can be rotated in and out to suit the plant ✓ Larger pots can be placed on wheeled frames/trolleys to assist with moving them around (see resource list). ✓ Pots are less susceptible to weeds than open gardens, and it is easier to contain any weed breakouts when using pots. Anything can be used as a pot ✓ Used containers, damaged saucepans and cake tins, even old wheelbarrows, can be used as pots, as long as they are stable and there is adequate drainage in the base ✗ Require frequent watering for most plants. 	
<p>Hanging basket</p>	<ul style="list-style-type: none"> ✓ Hanging baskets are practical for gardening from a wheelchair ✓ Pulleys can be attached to the basket, and gardeners can raise or lower the basket minimizing the amount of reaching ✗ Require individual and frequent watering 	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Water use

Another important consideration is how the garden will be watered. Different gardens require different irrigation methods and watering levels, and the gardeners' abilities and anthropometrics will also need to be taken into consideration. Watering options include (but are not limited to); watering cans, hand held hoses, drip irrigation systems, sprinkler systems, and time delay systems. Local water restrictions may preclude or limit the use of some options. Tap height and faucet operation should meet the needs of the gardener and other users of the garden area. Make sure that the person watering the garden is able to attach, remove, and use any hose attachments and able to lift and use any watering cans.

There are a number of government funded programs that have been introduced to encourage and manage the efficient use of our water supplies in the home. The Office of Water in Victoria, and the NSW Metropolitan Water Directorate both have programs advising on how to use water supplies wisely⁴. Mulching can reduce evaporation and thus reduce the amount of water required. Consider using low maintenance, hardy and low water plants to reduce your garden's need for water. It is also important to consider and comply with the environmental restrictions and guidelines for your area such as current water restrictions.

Standard garden tap handles (with a "T" head) can be difficult to use for people with any sort of fine motor or hand/wrist strength impairment, and small aids may be helpful. Lever taps can be easier to use for those who may have difficulty with standard garden taps. Lever taps have an extended handle or bar for use with the hand, forearm or elbow, thereby reducing the pressure placed on small joints of the hand and wrist when twisting or turning a standard tap.

Garden Planning

Planning a garden modification is an important process that improves efficiencies in terms of cost and time and maximises outcomes, most importantly it supports good decision making. When considering a new and accessible design for a garden, simple planning techniques will help to maximise the potential of a site. A preliminary consideration is to establish exactly what the garden is going to be used for and who's going to use it. As a first approach, site analysis is an important step in understanding the potential of a new design. For more detailed site analysis information refer to Carnemolla & Bridge (2012).

Various gardening software exists for both computers and mobiles devices

⁴ Victorian Water has developed permanent water saving rules that can be found here <http://www.depi.vic.gov.au/water/saving-water/water-restrictions/permanent-water-saving-rules>

NSW "Water for Life" Program can be found at www.waterforlife.nsw.gov.au

(software known as *apps*) that enable users to plan plantings, map out garden beds, lawns, and pathways in order to virtually plan a garden. Some software also allows users to virtually tour their garden plan. When looking at gardening design or planting planning software, consider the features that will benefit your needs when designing a domestic garden. Some considerations include

- All aspects - from the garden layout, to the types of plants - can be programmed into the software
- Guidelines for garden dimensions can be set to a scale and that objects inserted take the appropriate perspective (i.e., objects shrink in size when moved further away from view)
- Topography can be set to include the natural slopes and hills in a backyard or garden area
- Pathway surfaces, colours, and shapes can be determined and that objects can be inserted, such as park benches and water features
- Completed plans can be printed in both 3D and landscape views.

Some programmes have an extensive plant encyclopaedia, to assist users in choosing plants that are suitable to particular seasons or provide a plant care feature which instructs gardeners on how to care for plant types - for example, how often they need watering, sun or shade, etc.

Considerations for accessible gardening

There are a number of considerations particularly appropriate when planning for accessible gardens. These include:

1. Maintenance

When planning the garden, it is important to consider maintenance and ongoing care. Weeding, mulching and fertilizing are necessary tasks that a person with mobility or vision impairment may be able to perform. However, the purchase, storage and preparation of the products associated with these tasks may require the assistance of another person. Annual tasks such as pruning and mulching may also require the assistance of a professional garden care service

2. Seating

Seating has a dual role of being a place for rest during gardening work and also recreational enjoyment such as eating, reading or simply enjoying the garden. These are important considerations for maximising the quality of life improvements that a garden can provide. Seating is an important health and safety consideration when considering accessible gardening activities. Plan for seating throughout a garden to provide safe and stable rest areas.

3. Lawn alternatives

Large lawns require high maintenance which can become difficult to finance or physically manage. Alternatives to high maintenance lawn includes replacement with synthetic lawn, or natural lawn substitutes. Synthetic lawn can look life-like and can be sourced from local hardware suppliers. Some natural, living alternatives to lawn include ground hugging plants such as herbs. For more information on lawn alternatives refer to Gardening Australia's *Lawn Alternatives-Fact Sheet* (Gardening Australia, 2004). For existing lawns, and when manual mowing becomes difficult, there are robotic, automated and self-propelled mower alternatives available in the marketplace

4. Managing garden borders and beds

Borders are more easily reached if they are kept no more that 600mm wide (if they are accessed from one side) or 120 cm wide if accessible from both sides. As discussed earlier in this report, raised garden beds can also provide opportunity for accessible gardening.

5. Native Garden as garden bed alternative

Garden beds that require intensive weeding can be replaced with native plants from the local area. A system of bush regeneration can be used and this can significantly reduce the need for weeding maintenance.

6. Pathways and layout.

As discussed earlier in this report, paths in a garden should have a slip resistant, even surface, and be a minimum of 1 metre wide. A gradient no steeper than 1:20 is recommended in Australian Standard 1428.1 (AS1428.1) (Standards Australia, 2009). Edges should be visible and lighting along paths should be designed into the garden, particularly along main access paths between the street and home access. Turning circle areas will be required for those using mobility aids such as walking frames or wheelchairs. A minimum of 1.5 metres x 1.5 metres is recommended for a turning circle in AS 1428.1 (Standards Australia, 2009). I would stipulate what turning circle- 90 degrees? Alternatively, a circuit pathway will reduce the need for a person with a mobility aid to reverse or turn. For more detailed information about accessible pathways in a landscape please refer to both Carnemolla and Bridge (2012) and AS 1428.1 (Standards Australia, 2009).

7. Fencing



Garden boundaries help increase the safety of children, keep out unwanted guests such as dogs, and encourage garden users to remain in a place that is supportive of their needs. Examine existing fencing to ensure that no hazards exist, such as protruding nails and splinters. Consider pets and animals that may be located at, or adjacent to, the property. New fences should comply with local council regulation and be aesthetically pleasing without compromising the

safety of the garden user. Consider the effect the size, materials and location of the fence will have on the garden users and on the people around it. Boundary fences are a common cause for a neighbour's complaint to local councils or instigation of legal action. Therefore, any changes to fencing, particularly an increase in height or the addition of new materials, should be discussed with affected neighbours and an agreement should be reached with regard to sharing (or not) of costs. There are a number of resources available to assist with this process, such as a fact sheet about Dividing Fences Law published by the NSW Government in Australia (NSW Land and Property Management Authority, 2011).

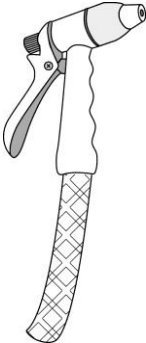
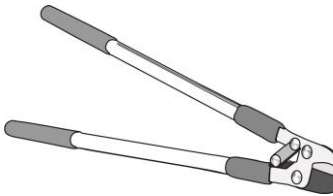
Products to assist in safe and accessible gardening practice

The following table outlines a range of products available to make gardening safer, easier and more accessible for older people or those living with a disability. The table has been designed to keep the product descriptions generic and not brand specific.

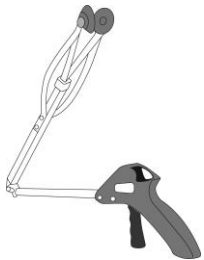

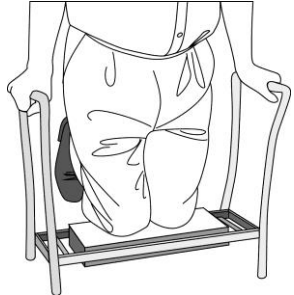
Table 3. Gardening Tools and products

Gardening tools and products	Advantages and disadvantages	Examples
Specialised Pots	<ul style="list-style-type: none"> ✓ Some modified pot designs provide easy access 	
Angled ceramic/concrete pots	<ul style="list-style-type: none"> ✓ Good design for gardening while in a wheel chair or seated ✓ Angled edge and large scale allows a seated gardener to closely access plants at waist height ✗ Ceramic/concrete pots are heavy and are not portable 	
Angled plastic pots	<ul style="list-style-type: none"> ✓ Large range of sizes ✓ Relatively light weight compared to ceramic pots ✓ Larger pots can still be bulky and heavy to move 	



Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Gardening tools and products	Advantages and disadvantages	Examples
Tools and reaching aids	<ul style="list-style-type: none"> ✓ Gardening tools are available with extended handles – to extend reach. Some models are length adjustable and have interchangeable tool parts. 	
Hose extension with trigger release	<ul style="list-style-type: none"> ✓ At time of printing, Sydney Water requires that hoses be fitted with a trigger nozzle when watering the garden (www.sydneywater.com.au) ✓ A <i>Trigger-Release</i> is suitable for watering plants extended beyond reach. This is an extension tool that attaches to the end of a hose ✓ Allows accurate watering reach beyond average distances of a hose. The on/off switch is controlled with a thumb-lever shut-off valve that can easily be pushed despite limited finger and hand mobility. A self-coiling hose is also useful and hassle-free. ✗ Hand hosing can be strenuous or difficult for those with weakened upper body strength 	
Long handled tools	<ul style="list-style-type: none"> ✓ A <i>Cut and Hold Flowerer Gatherer</i> is particularly useful for gardeners in wheelchairs. ✓ It can cut and grip a flower stem that is out of reach - making it easy to bring it back or place it elsewhere. ✗ May be cumbersome for some people to hold 	



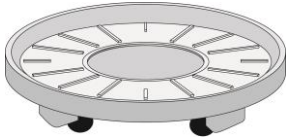
Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Gardening tools and products	Advantages and disadvantages	Examples
Gripper reaching tool	<ul style="list-style-type: none"> ✓ Extended gripping or reaching tools are used to pick up items out of reach ✓ Are durable and can pick up small, light objects as well as larger, heavy objects such as a brick 	
Arm support handles for gardening tools	<ul style="list-style-type: none"> ✓ Supportive and light weight ✓ Can be interchanged with different tool types ✗ May be too restrictive for some gardeners 	
Garden kneeler/seat	<ul style="list-style-type: none"> ✓ Provides support when bending to reach low areas ✓ Provides support to raise from kneel to stand position. ✓ Doubles as a stool for seated gardening ✗ May be too low for some gardeners 	

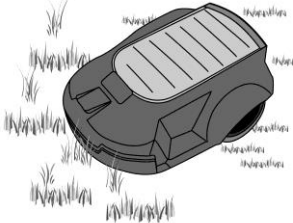
Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Gardening tools and products	Advantages and disadvantages	Examples
Garden wheeled cart/seat	<ul style="list-style-type: none">✓ Garden cart and mobility aid designed for use by individuals with arthritis or lower extremity balance or mobility disabilities✗ May be difficult to navigate	
Balcony friendly gardening		
Portable balcony garden	<ul style="list-style-type: none">✓ Different designs can be freestanding or hung over a balcony or fence✓ Good for growing small herbs.✓ Suitable for small balcony spaces✓ Can be moved✗ Limits choice of plants✗ Requires frequent watering for most plant species.	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Gardening tools and products	Advantages and disadvantages	Examples
Moving pots around		
Pot mover	<ul style="list-style-type: none"> ✓ Simple to use – leverage action ✓ Some models Supports loads of up to 50-75kg when used correctly ✓ Are adjustable and able to adapt to high or low pots 	
Mobile pot (pots within built castors)	<ul style="list-style-type: none"> ✓ Are designed to be lightweight an portable ✗ May be low for some gardeners 	
Wheel pot bases	<ul style="list-style-type: none"> ✓ Increases mobility of pots ✓ Reduces strength required to relocate pots 	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Gardening tools and products	Advantages and disadvantages	Examples
Automated gardening products		
Automated mower	<ul style="list-style-type: none"> ✓ No emissions – solar and battery powered ✓ Mows lawns automatically without the need for physical exertion. ✗ Requires cost investment and maintenance ✗ Possible theft risk 	

Note: Table key for advantages and disadvantages column: ✓ Advantages ✗ Disadvantages

Over time new accessible products become available and many items become obsolete. The above table of accessible gardening products is by no means an exhaustive one. It is intended to provide a snapshot of the diversity of available products at the time of printing and to encourage further independent research.

Section 3: Safety in the garden

Section Three looks at the important aspect of safety, critical to the accessibility and enjoyment of a garden environment, and summarises a range of the more common considerations and possibly hazardous situations to avoid in a typical home garden environment. Of primary concern when providing a garden space for older people or those with a disability is to ensure that risk to gardeners is minimised and safety practises are maintained. There are a number of hazards that can be present in a gardening setting including chemicals, toxic plants, and even potting mix. Therefore working in the garden has a number of associated risks in addition to physical falls and accidents - and consideration should be given to the potential for exposure to pathogens and chemicals.

Gardens can be dangerous places as well as places of enjoyment and relaxation. Rates of home accidents increase with age and the most common location for home accidents is outside (Carter, Campbell, Sanson-Fisher, & Gillespie, 2000). All users of gardens, including professionals, clients, and visitors should take care when in the garden environment.

There are a number of safety precautions that should be considered when working outside with garden equipment, bio- materials and chemicals. These include:

- Risk of accidents
- Handling of soils, potting mix and mulches
- Handling of commercial products and chemicals
- UV exposure
- General gardening equipment safety
- Plant safety
- Poisonous or venomous insects/animals
- Minimising bushfire risk

Sun protection (hats, shades or shelters) should be considered to manage UV exposure. Both clients and professionals should seek advice if any medications being taken could be affected by direct sunlight. The NSW Department of Health has comprehensive information on sun protection at their website (State Government of NSW, 2007).

Risk of bushfire will be more of a consideration for regional, semi-rural and rural gardens, however some urban areas adjacent to bushland can also be at risk. Minimising the very real risks of bushfire can mean a lot of maintenance work, in and around the garden and property. Vegetation clearing is expected by some LGAs, and if in doubt do contact your local council to better understand the expectations around

preparing for bush fire. The Rural Fire Service publish a checklist online outlining general preparation and maintenance advice⁵. In the event that you feel unable to prepare properly for bushfire season, The NSW Rural Fire Service AIDER Programme (Assist Infirm Disabled and Elderly Residents) offer a free, one-off service to provide assistant with such things as clearing gutters, thinning vegetation, removing leaf and tree debris, trimming branches from around and overhanging the home, mowing or slashing long grass.

Handling soil, potting mix and mulches

Care should also be taken when working with potting mix. Composts and potting mixes, both bagged and un-bagged, are a known source of pathogens including *L. longbeachae* – which is has been a known cause of *Legionellosis* or Legionnaires Disease (Whiley & Bentham, 2011). Studies show that the most likely way Legionnaires Disease is spread is by poor garden hygiene and the breathing in or ingestion of aerosols and dust from potting mixes, compost and garden mulches (O'Connor et al., 2007).

Awareness of the risks has been shown to reduce the incidence of contamination from potting mix (O'Connor et al., 2007). A number of government health and community publications (Pacuola, Leivers, & Haintz, 2013) document ways to reduce the risks associated with handling potting mixes, compost and mulches, and these include:

- Read the warning on the bagged compost/potting mix before use
- Always wear gloves when handling soil, potting mix or compost
- Avoid inhaling the mix by wearing a face mask
- Carefully dampen the mix to reduce airborne particles
- Wash hands thoroughly after using potting mix or compost, even if you've been wearing gloves.

Tetanus vaccinations or boosters are also recommended for professionals and people working regularly with soils because the *Clostridium tetani* spores that cause tetanus can be found in manured soil (Australian Government Department of Health and Ageing, 2013). A medical practitioner should be consulted for further information.

Commercial products and chemicals

People working in an outdoor garden environment should also ensure use of Personal Protective Equipment and read the precautions on the packaging prior to use. It would be advisable to review the associated Material Safety Data Sheet (MSDS) for any products or chemicals as part of a risk assessment, prior to commencing work in a

⁵ Source:

http://www.rfs.nsw.gov.au/file_system/attachments/State08/Attachment_20091022_79866928.pdf

garden area.

A MSDS is a document containing important information about a hazardous substance. This document must state:

- the product name of any hazardous substances
- the chemical and generic names of certain ingredients
- the physical and chemical properties of the hazardous substances
- health hazard information
- precautions for safe use and handling
- the manufacturer's or importer's name with an Australian address and telephone number.

The MSDS provides employers, self-employed people, workers, and other health and safety representatives, with the necessary information to safely manage the risks associated with hazardous substance exposure.

General gardening equipment safety

Accidents in the garden are not uncommon and result in serious injury, particularly when working with lawn mowers (Greenhagen, Raspovic, Crim, Ryan, & Gruen, 2013). Common lawn mower injuries include injuries of the hands, feet and eyes. Remember the following safety advice when mowing:

- Wear enclosed shoes – preferably safety boots
- Wear appropriate eye protection such as safety goggles
- Wear trousers to protect your legs
- Drive ride-on mowers carefully as they can tip over (Horticulture Therapy Association of Victoria, 2013).

When using general gardening equipment, including electric, petrol powered, or hand powered tools, be aware of the associated risks with each item. Follow the following suggestions made by the Horticultural Therapy Association of Victoria (2013):

- Purchase equipment with safety devices and features
- Comply with all safety instructions when using
- Keep equipment well maintained
- Wear safety clothing including goggles
- Be careful not to sever electrical leads
- Don't stand at the highest rung of the ladder.

Plant Safety

Plant safety should always be considered in tandem with an understanding of who will be using the garden. For example when designing gardens for children or for people with limited awareness of their personal safety, there is a need to ensure that the plants within it are safe to touch and smell and that no adverse reactions will occur if the plants are put into someone's mouth (or in touch with other mucous membranes). Poisonous plants are commonly found in established gardens throughout Australia and a number of poisonous plants are available in Australian nurseries.

There are a number of websites and publications that provide information on identifying potentially poisonous plants. A number of books have been published in Australia on this topic (Shepherd, 2004; Wilson, 1997). A table of online resources can be found in Table 4.

Table 4. Online Resources for Identifying poisonous plants

Title and Reference	Online resource type	Location and details
Garden Plants poisonous to people Department of Primary Industry (2006)	Downloadable fact sheet	Department of Primary Industry http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/112796/garden-plants-poisonous-to-people.pdf
Poisonous Plants Fact Sheet Horticulture Therapy Association of Victoria (2007)	Downloadable fact sheet	The Horticulture Therapy Association of Victoria http://www.kidsafensw.org/growplantssafely/ List of poisonous plants commonly found. Text only no images.
Grow Plant Safely Kidsafe NSW (2011)	website	Kidsafe http://www.kidsafensw.org/growplantssafely/ Provides over 30 common plants and weeds found in Australian gardens that are toxic and should be avoided. With colour photos for identification. Also gives a list of alternative safe plants.

For plants that cannot be easily identified, The Royal Botanic Garden, Sydney provides a plant identification service, including an urgent service for poisonous plants. This service provides free identifications for up to six (6) specimens (or two hours' work) per year for members of the public⁶.

⁶ More information about the plant identification service provided by the Royal Botanic Garden Sydney can be found at http://www.rbgsyd.nsw.gov.au/science/Herbarium_and_resources/plant_identification_service

Sourcing safe and sustainable plants

When designing new gardens or selecting new plants for an established garden, there are a number of resources that help to ensure the selected varieties are safe and non-toxic. Native plant selections can be made from identified bush tucker varieties – meaning parts of a native plant are edible. There are a number of publications of Australian bush tucker species (Low, 1989; Stewart & Percival, 1997). Online resources for both native and non-native safe plants are included in Table 5.

Table 5. Online Resources for Non-toxic plants

Title and Reference	Online resource type	Location and link
Bush Foods of NSW (Stewart & Percival, 1997)	Downloadable book as pdf	Royal Botanic Garden, Sydney http://www.rbg Syd.nsw.gov.au/__data/asset/s/pdf_file/0006/85542/Bushfoodsbook.pdf
Plant selection for children Better Health	Downloadable factsheet	Better Health Victoria http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Gardening_for_children Describes some plant varieties safe for children. No images.
Grow Plant Safely Kidsafe NSW (2011)	website	Kidsafe http://www.kidsafensw.org/growplantssafely/ Provides a list of alternative safe plants with images for identification.

Local nurseries are also excellent sources of knowledge regarding safe and sustainable plants. Some nurseries specialise in plant species indigenous to the local area. Seeds can also be purchased online, many local and specialty providers can be found using search engines and combining relevant terms such as “seed” and “native” or “seed” and “bush tucker”.

Poisonous or venomous animals and insects

The potential for contact with insects and animals is high in both suburban and regional gardens. In particular, care should always be taken when disturbing old wood, leaves or rocks and gloves should be worn. The Safe and Sustainable Garden series (Smith &

Smith, 2012) outlines in more detail how to plan to safely garden alongside insects and larger animals in a garden setting. Depending on the location of your garden an awareness of insects, reptiles and rodents should include:

- Spiders
- Ants
- Caterpillars
- Ticks
- Mosquitos
- Sand-flies
- Snakes
- Rats
- Flying foxes

This list is not exhaustive, and there may be other insects and animals unique to certain locations that will require attention when gardening.

Conclusion

Although gardens and outdoor areas are recognised as an important contributor to quality of life for all people, the ability to enjoy a garden at home for those who are older, or who are living with a disability, relies critically on whether the garden is safe and accessible. This Summary Bulletin recognises the importance of understanding what potential barriers to gardening may arise as people age, and what design features make a garden accessible and safe to enjoy and participate in gardening activities.

This report summarises how to approach accessible and safe garden designs and is laid out in three sections. The first section identifies what an accessible garden is and why it is important. It also summarises a number of accessible landscape design requirements and solutions. Further references are given as a guide for further information. The second section summarises how to approach accessible garden planning, and reviews the tools and equipment available for accessible and inclusive gardening. Section Three looks at the important aspect of safety, critical to the accessibility and enjoyment of a garden environment, and summarises a range of the more common considerations and possibly hazardous situations to avoid in a typical home garden environment. A checklist that further summarises the considerations raised on accessible and safe gardening approaches is included in Appendix 1 of this report.

This paper presents a condensed picture of accessible gardening practices, and where possible further references have been provided for access to more detailed or specific information. Seeking professional help is always advised, particularly for larger more

substantial modification work, with a number of key industry bodies in the gardening and landscape sectors providing services to source a recommended garden maintenance contractor, landscape contractor or landscape architect. National industry associations include, but are not limited to, the Australian Institute of Landscape Architects (AILA) and Landscaping Australia – these associations usually act as a national umbrella group for regional arms and should be able to provide information on contacting relevant state and local landscape contractor organisations.

Appendix 1: Gardening at Home Checklist

When modifying a garden and deciding upon the safest and most accessible option, consider the following:

SAFETY

- Have all hazardous items or chemicals in the garden been identified and removed or managed properly?
- How will potting mix be handled?
- What personal safety equipment is required e.g. for lawn mowing?
- Where will tools and safety equipment be stored and how will they be maintained?
- Have all existing and new plants been confirmed as non-poisonous and low maintenance? Have all plants identified as toxic been managed accordingly?
- Does risk of bushfire need to be addressed?

ACCESS

- How will a person enter and move throughout the garden space?
- Are pathways non-slip and a minimum of 1metre wide?
- Have the maintenance requirements of the plants and built elements been reviewed?
- How will plants be accessed for maintenance – are they within reach for the person who will be gardening?
- How will plants be watered?
- How can plants be made more accessible for the gardener – e.g. raised bed, vertical gardens or hanging baskets?
- What will be the changing needs or future needs of the client or person using the garden?

Appendix 2: Standards Relevant to Accessible Gardening at Home

The implementation of landscape change in a residential environment is also subject to a wide range of standards and codes, with each document addressing specific landscape and construction elements, from earthmoving to soil types. A selection of Australian Standards pertaining to landscape modification is outlined in Table 6 below.

Table 6: Australian Legislation and Standards Regulating construction within the residential landscape

Legislation/standards	Description
Australian Standard AS 3798-2007: Guidelines on earthworks for commercial and residential developments	Provides guidance on the specification, execution, and control testing of earthworks and associated site preparation works for commercial and residential developments; and on the interpretation and application of the relevant test methods specified in the AS 1289 series of Standards (AS 1289.1.1-2001 Methods of testing soils for engineering purposes – Sampling and preparation of soils – Preparation of disturbed soil samples for testing).
Australian Standard AS 2159-2009	Piling – Design and installation
Australian Standard AS 2870-2011	Residential slabs and footings
Australian Standard AS 3727-1993	Guide to residential pavements
Australian Standard AS 4419-2003	Soils for landscaping and garden use Specifies requirements for landscape and garden soils. This Standard specifies physical and chemical requirements such as bulk density organic matter, wettability, pH, dispersibility, toxicity, nitrogen drawdown index and permeability for low density, organic and natural soils or soil blends. Documentation requirements include information to be supplied to the consumer and health warnings. Guidance is given on the selection and use of soils.
Australian Standard AS 1735.1-2003	Lifts, escalators and moving walks - General requirements
Building Code of	The Building Code of Australia (BCA) is produced and

Australia – 2014

maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and State and Territory Governments. The BCA has been given the status of building regulations by all States and Territories. According to the ABCB, the goal of the BCA is to “*enable the achievement of nationally consistent, minimum necessary standards of relevant, health, safety (including structural safety and safety from fire), amenity and sustainability objectives efficiently*”⁷ by The Building Code of Australia (BCA) 2011 is effective from 1 May 2011 and supersedes the BCA 2010. The draft BCA 2011 extends the application of the Access to Premises Standard to all residential apartments rather than only apartments with short-term rental, as the Government has not established a clear definition for short-term rental.

The documents included in Table 6 sample the wide range of landscape construction elements which require governance in the form of standards and codes. These documents are performance based with objectives including;

- Maintaining Occupational Health and Safety standards during construction
- Safeguarding people from injury due to structural failure or contamination
- Protecting other property from physical damage caused by structural failure or contamination.

The legislative context surrounding accessibility and landscape are not shared ones, hence the need for separate tables to indicate the range of standards and codes. The BCA is the single document that contains performance guides for both access and landscape, however these are completely separate bodies of information and are not cross-referenced. This further highlights the need for research that establishes the important links between landscape modification and access to inform both accessibility and landscape professions.

⁷ Source: Australian Building Codes Board <http://www.abcb.gov.au>

References

- Allaby, M., & Park, C. (2013). *A dictionary of environment and conservation*: Oxford University Press.
- Australian Bureau of Statistics. (2009). ABS Survey of Disability, Ageing and Carers
- Australian Government Department of Health and Ageing. (2013). *The Australian Immunisation Handbook*.
- Bhatti, M. (2006). 'When I'm in the garden I can create my own paradise': Homes and gardens in later life. *The Sociological Review*, 54(2), 318-341.
- Bhatti, M., Church, A., Claremont, A., & Stenner, P. (2009). 'I love being in the garden': enchanting encounters in everyday life. *Social & Cultural Geography*, 10(1), 61-76.
- Building Code of Australia. (2014). Volume 1 & 2 of the National Code of Construction (NCC). Initiative of Council of Australian Governments. Maintained by Australian Building Codes Board (ABCB). Retrieved from <http://www.bca.saiglobal.com>
- Burchett, M. (1994). Horticultural aspects of environmental issues in urbanized society: the gardens as a model for caring for the earth. *Horticulture in Human life, Culture and Environment* 391, 77-88.
- Cameron, J., & Bridge, C. (2003a) Consumer Factsheet Reeded (Ribbed) Timber for Decks, Ramps and Paths. University of Sydney: Home Modification Information Clearinghouse.
- Cameron, J., & Bridge, C. (2003b). Industry Factsheet: Reeded (ribbed) timber for decks, ramps and paths. Home Modification Information Clearinghouse, : University of Sydney.
- Carnemolla, P., & Bridge, C. (2012). Landscape Modification as an Alternative to Ramps and Lifts in Homes. Retrieved from www.homemods.info website: <http://www.homemods.info/author/carnemolla>
- Carter, S. E., Campbell, E. M., Sanson-Fisher, R. W., & Gillespie, W. J. (2000). Accidents in older people living at home: a community-based study assessing prevalence, type, location and injuries. *Australian and New Zealand journal of public health*, 24(6), 633-636.
- Cement Concrete and Aggregates Australia. (2002). Skid resistance of Residential Concrete Paving Surfaces. Sydney, Australia: Cement Concrete and Aggregates Australia.
- Cheng, E. H. P., Patterson, I., Packer, J., & Pegg, S. (2010). Identifying the Satisfactions Derived from Leisure Gardening by Older Adults. *Annals of Leisure Research*, 13(3), 395-419.
- Cranz, G., & Young, C. (2006). The role of design in inhibiting or promoting use of common open space: The case of Redwood Gardens, Berkeley, CA. *Journal of Housing for the Elderly*, 19(3-4), 71-93.
- Diamant, E., & Waterhouse, A. (2010). Gardening and belonging: reflections on how social and therapeutic horticulture may facilitate health, wellbeing and inclusion. *The British Journal of Occupational Therapy*, 73(2), 84-88.
- Dunnett, N., & Kingsbury, N. (2004). *Planting green roofs and living walls* (Vol. 254): Timber Press Portland, OR.
- Gardening Australia. (2004). Lawn Alternatives, Fact Sheet. <http://www.abc.net.au/gardening/stories/s1148898.htm>: Gardening Australia.
- Gohar, N., Von Behrens, T., & Bridge, C. (2008). Consumer Factsheet: Installing your own grabrail: Sydney: Home Modification Information Clearinghouse, University of Sydney. January [online]. Available from www.homemods.info.
- Greenhagen, R. M., Raspovic, K. M., Crim, B. E., Ryan, M. T., & Gruen, G. G. (2013). Lawn Mower Injuries to the Lower Extremity A 10-Year Retrospective Review. *Foot & ankle specialist*, 6(2), 119-124.
- Heath, Y., & Gifford, R. (2001). Post-occupancy evaluation of therapeutic gardens in a multi-level care facility for the aged. *Activities, Adaptation & Aging*, 25(2), 21-43.

- Horticultural Therapy Association of Victoria. (2006). Raised Garden Beds.
- Horticulture Therapy Association of Victoria. (2013). Gardening Safety Retrieved June 30 , 2013, 2013, from <http://www.horticulturaltherapy.com.au/download/pdf/OnlineRes/Gardening%20safety.pdf>
- Judd, B., Liu, E., Easthope, H., Davy, L. and Bridge, C. (2014) Downsizing amongst older Australians, AHURI Final Report No.214. Melbourne: Australian Housing and Urban Research Institute.
- Kingsley, J. Y., Townsend, M., & Henderson-Wilson, C. (2009). Cultivating health and wellbeing: members' perceptions of the health benefits of a Port Melbourne community garden. *Leisure studies*, 28(2), 207-219.
- Köhler, M. (2008). Green facades—a view back and some visions. *Urban Ecosystems*, 11(4), 423-436.
- KPMG. (2006). Draft report on existing HACCC models in NSW: Home Modification and Maintenance. NSW.
- Kwack, H., Relf, P. D., & Rudolph, J. (2005). Adapting Garden Activities for Overcoming Difficulties of Individuals with Dementia and Physical Limitations. *Activities, Adaptation & Aging*, 29(1), 1-13.
- Larson, J., Hanchek, A., & Vollmar, P. (1996). *Accessible gardening for therapeutic horticulture*: Minnesota Extension Service, University of Minnesota, College of Agricultural, Food, and Environmental Sciences.
- Low, T. (1989). *Bush tucker: Australia's wild food harvest*: Angus & Robertson Publishers.
- Macintyre, S., Ellaway, A., Hiscock, R., Kearns, A., Der, G., & McKay, L. (2003). What features of the home and the area might help to explain observed relationships between housing tenure and health? Evidence from the west of Scotland. *Health & Place*, 9(3), 207-218.
- Marcus, C. C. (2000). Gardens and health. *Design and health: the therapeutic benefits of design*, 461-471.
- Martin, E. (1999). Improving access to heritage buildings: Australian Heritage Commission: Canberra.
- NSW Land and Property Management Authority. (2011). Dividing Fences Law. In N. L. a. P. M. Authority (Ed.), *lpma.nsw.gov.au*.
- O'Connor, B. A., Carman, J., Eckert, K., Tucker, G., Givney, R., & Cameron, S. (2007). Does using potting mix make you sick? Results from a Legionella longbeachae case-control study in South Australia. *Epidemiology and infection*, 135(1), 34-39.
- Oram, L., Cameron, J., & Bridge, C. (2006a). Evidence based research: Selecting diameters for grabrails. Sydney: Home Modification Information Clearinghouse, University of Sydney. 14th March [online]. Available from www.homemods.info.
- Ottel , M. (2011). The green building envelope: vertical greening: TU Delft.
- Pacuola, C., Leivers, N., & Haintz, S. (2013). *Water-learn it. Live it*. Melbourne, Australia.
- Perini, K., Ottel , M., Haas, E., & Raiteri, R. (2013). Vertical greening systems, a process tree for green fa ades and living walls. *Urban Ecosystems*, 1-13.
- Rodiek, S., & Schwarz, B. (2006). Introduction: The Outdoors as a Multifaceted Resource for Older Adults. *Journal of Housing for the Elderly*, 19(3-4), 1-6.
- Rothert, G. (1994). The enabling garden: a guide to lifelong gardening: Taylor Publishing Company.
- Rothert, G. (2002). *From Vision to Reality: The Chicago Botanic Garden's Buehler Enabling Garden*. Paper presented at the Interaction by Design: Bringing People and Plants Together for Health and Well-Being: An International Symposium.
- Scott, T. L. (2012). Examining the therapeutic effect of gardens and gardening activities for older adults residing in the community and in aged-care facilities.

- Shepherd, R. C. H. (2004). *Pretty but poisonous: plants poisonous to people: an illustrated guide for Australia*: RG and FJ Richardson.
- Simpson, J. A., & Weiner, E. S. (1989). *The Oxford english dictionary* (Vol. 2): Clarendon Press Oxford.
- Smith, S., & Smith, J. (2012). *Safe and Sustainable Gardening Central Coast*. NSW: NSW Home Modifications & Maintenance Service State Council.
- Söderback, I., Söderström, M., & Schäländer, E. (2004). Horticultural therapy: the healing garden and gardening in rehabilitation measures at Danderyd hospital rehabilitation clinic, Sweden. *Developmental Neurorehabilitation*, 7(4), 245-260.
- Standards Australia. (2009). *Design for access and mobility Part 1 - General Requirements for access - new building work*. Sydney: SAI Global.
- Standards Australia. (2010). *Design for access and mobility Set*. Sydney: SAI Global.
- State Government of NSW. (2007). *Sun Protection*. Retrieved from http://www0.health.nsw.gov.au/factsheets/general/sun_protect.html.
- Stewart, K., & Percival, B. (1997). *Bush foods of New South Wales: a botanic record and an Aboriginal oral history*: Royal Botanic Garden, Sydney.
- Stigsdotter, U. A., & Grahn, P. (2004). *A garden at your doorstep may reduce stress—Private gardens as restorative environments in the city*. Paper presented at the International Conference on Inclusive Environments “Open space: people space”. Edinburgh (Scotland).
- Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & Place*, 15(4), 1115-1122.
- Think Brick Australia. (2013). *Manual 1: Clay Paving Manual*. In T. B. T. Manuals (Ed.). Sydney, Australia.
- Thrive UK. (2008). *Carry On Gardening - Raised Beds*. In S. f. H. T. UK (Ed.), www.thrive.co.uk. UK.
- Utami, S., & Jayadi, R. (2011). *Vertical Gardening for Vegetables*. Paper presented at the I International Symposium on Sustainable Vegetable Production in Southeast Asia 958.
- Wang, D., & MacMillan, T. (2013). The Benefits of Gardening for Older Adults: A Systematic Review of the Literature. *Activities, Adaptation & Aging*, 37(2), 153-181.
- Whiley, H., & Bentham, R. (2011). *Legionella longbeachae* and legionellosis. *Emerging infectious diseases*, 17(4), 579.
- Wilson, S. (1997). *Some plants are poisonous*. Kew, Victoria: Reed Books Australia.