

Integrated Design - Appendix D

Landscape Design & Street Trees



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2 Introduction

As the scale and intensity of development continues to rise to meet population, economic and land supply pressures, Council recognises the importance of good quality landscape design in providing attractive, comfortable, safe and sustainable urban environments.

As part of an approach to facilitate higher development yields through increased allowances in density, site cover and reduced setbacks, the importance of landscaping to soften built form, add visual interest and provide engaging and functional spaces should not be underestimated.

This appendix provides the criteria, standards and guidance material for planning, designing and implementing successful landscapes in both private and public development. In all instances provision of infrastructure and services are required to be in accordance with the relevant Australian Standards and MBRC approved standard drawings, unless otherwise approved by Council.

For criteria, standards and guidance material concerning the design of public open space, park and civic spaces please refer to Appendix B - Open and Civic Space Design.

3 Information to be included in a Landscape Plan

Landscape plans will often be required to address criteria within the planning scheme or as a condition of a development approval to accompany subsequent applications such as Operational work.

In some circumstances, such as landscaping for gardens within private developments, a Landscape concept plan may be all that is required to justify compliance with criteria within the scheme. However, where soft or hard landscaping is in proximity or is being proposed in proximity to structures, services, trafficable areas or the like, the landscape plan is to be certified by a Registered Landscape Architect (as recognised by the 'Australian Institute of Landscape Architects'), confirming that all information provided on the plan is correct and can be implemented onsite without compromising the safety and functionality of any services, structures or the like. The plan is also to confirm that services and structures as part of the development do not compromise the ability for plantings to achieve their desired purpose.

It is considered that all Landscape plans submitted which include planting within the road reserve such as street trees, rain gardens, and planting within proximity of retaining structures and underground services must be accompanied by Registered Landscape Architect certification. In some instances (e.g. shade trees within car parks or in close proximity to publicly accessible walkways, parks or civic spaces) an independent Arborists certification may also be requested.

Landscape plans contain the following information:

- (a) A site plan showing:
 - i. the existing contours and proposed finished levels of earthworks;
 - ii. the location of existing and proposed buildings and other structures, including any landscaping or recreation features, on the site;
 - iii. the location of existing or proposed storage areas, including vehicle storage areas;
 - iv. the location of all existing and proposed underground services;
 - v. the location of existing footpaths, trees or other existing landscaped areas to be retained or removed;
 - vi. the location of all vehicular and pedestrian entries and exit on the site, and the internal layout of pathways, driveways and parking areas.

- (b) A planting design plan identifying the location of all plants and including a Plant Schedule. A Plant Schedule will:
 - i. be divided up into trees, palms, shrubs, ground covers, climbers and ferns

- ii. include botanical names in alphabetical order and used in conjunction with common names. Plant coding is appropriate to avoid plans being cluttered with lengthy annotations;
 - iii. identify the quantity and pot size of each individual species used in the planting design;
 - iv. identify the height and spread of trees at planting;
 - v. identify spacing of all species and staking (if necessary);
 - vi. identify any proposed irrigation strategy where irrigation is required;
- (c) For Landscape Concept Plan packages identify the following through the use of scaled plans, sections and details:
- i. Identification and description of the location and extent of views, and a description of local character and visual quality;
 - ii. Description and location of existing and proposed pedestrian and vehicular access routes and linkages into and around the site; (xxiv)
 - iii. Description of constraints (soil type, rock, location of existing roads and infrastructure such as water, sewer and stormwater drainage) that may impact on any landscape works associated with future development;
 - iv. Description of topographical features including slope analysis and location of any outstanding landscape features (including landmarks and built form);
 - v. Description of prevailing winds and any other climatic conditions that may impact on the landscaping works associated with development of the site; and
 - vi. Existing features on the site to be retained or removed e.g. vegetation, built form;
 - vii. Any structures or significant vegetation on adjoining properties that could impact on the site;
 - viii. The location of any buildings, retaining walls, structures (including electricity transformers, fire boosters and the like) site furniture and an indication of their form and character (including entry statements);
 - ix. Existing contours and proposed finish levels for earthwork and extent of cut/fill or retaining walls necessary for development of the site;
 - x. Surveyed location and botanical name of existing vegetation, including species' height and spread, specifying vegetation to be retained and that to be removed;
 - xi. Notations of design intent for any landscape works, including desired character themes and proposed function;
 - xii. location of softscape areas including buffers, screens; rehabilitation areas, any garden bed areas and delineation of principle hardscape areas;
 - xiii. Notation of potential proposed species for all areas to be planted (e.g. Native, exotic, feature planting, form and colour);
 - xiv. Proposed fence size and material;
 - xv. Surface, subsurface and drainage details associated with landscape works;
- (d) For Detailed Landscape Plan packages identify the following through the use of scaled plans, sections and details
- i. A Plant Schedule divided up into Trees, Palms, Shrubs, Ground Covers, Climbers, Ferns etc.
 - ii. Botanical names are to be in alphabetical order and used in conjunction with common names.
 - iii. Quantity and pot size of each individual species used in the planting design are to be included on the Plant Schedule.
 - iv. Height and spread of trees at planting is to be included on the Plant Schedule.
 - v. Spacing of all species and staking (if necessary) is to be included on the Plant Schedule.
 - vi. All species used and their planting locations are to be identified and notated graphically on the drawing by either full botanical name or by code which will be referred to on the plant schedule. The plan and plant schedule is to include plant coding where necessary to avoid plans cluttered with lengthy annotations.

- vii. The location of any buildings, retaining walls, structures (including electricity transformers, fire boosters and the like) site furniture;
 - viii. Specific construction details of surface treatment, edging, planting areas, turf areas, pavements, retaining walls, site furniture, fencing and any structure associated with the landscape works.
 - ix. Proposed finish levels for earthworks, batters retaining walls; pavements, turf field gullies;
 - x. A Maintenance Program is to be included as part of the information accompanying the Detailed Landscape Plan. The maintenance program is to address softscape and hardscape and reinforce the overall philosophy and objectives of the landscape design and include accepted horticultural practices and codes/best practices necessary to establish the proposed landscape works in the noted maintenance period.
- (e) All plans are to contain:
- i. Plan numbers, date and revisions
 - ii. Address and name and Job/File Number of project;
 - iii. Client's name and address;
 - iv. Designer's name and address;
 - v. Locality plan including any adjoining roads, waterways and land uses;
 - vi. North point;
 - vii. Real Property Description;
 - viii. A suitable scale – 1:100, 1:200, 1:500, 1:750
 - ix. A legend;
 - x. Be produced on a standard A0, A1, A2, A3 or A4 sheet of paper.

4 General Planting Design and Form

4.1 General

Generally, plants are to be arranged to ensure an even and attractive coverage of vegetation across all designated planting areas, to provide for visual interest, way finding, shade, screening, and weed suppression whilst ensuring that public safety is not compromised.

Root systems and mature height and width of the vegetation are to be considered to reduce the imposition on adjoining pathways, roads, infrastructure/services and structures. Similarly, the selection and planning of shrubs and trees is to be undertaken with care to ensure that sightlines and safety for users of the landscape spaces are not compromised. Crime Prevention Through Environmental Design (CPTED) principles are to be applied in the interests of public safety and Council's duty of care.

Plants used are to be predominately local, native species, however Council recognises the cultural association of some exotic species in urban areas and may approve their use where appropriate.

Where wildlife habitat needs have been identified, plant selection which enhances wildlife movement opportunities are to be incorporated into landscape design of both the public and private realm. Design principles may include using gum trees as feature trees where space permits to provide refuge in urban ecological corridors and the use of wildlife friendly fencing.

Land form is also an important consideration during the Landscape design process, with gradients, batters, and retaining features needing to be adequately designed and integrated into the Landscape to address access, safety and maintenance outcomes.

4.2 Plant Size

At the time of installation selected species are provided at an appropriate size to efficiently achieve its proposed function, while ensuring its viability. General pot sizes are listed in Table 1 below, with an approximate resultant size of plant shown on Figure 1. In areas of high visual impact, screening areas and buffers, larger and more advanced stock may be required to be utilised to achieve a stated outcome within the planning scheme.

Table 1: Suggested General Pot Size

Landscape Type	Size
Groundcovers	140mm Diameter Pots (Minimum)
General Shrubs / Trees	200mm Diameter Pots (Minimum)
Shade & feature Trees in Car parks and Private landscape	45 Litre Pots (Minimum)
Street trees within verge	45 Litre Pots (Minimum)
Street trees within build-outs or wider verge areas (e.g. park and civic space frontage)	100 Litre Pots (Minimum)
Revegetation Areas	Tube Stock

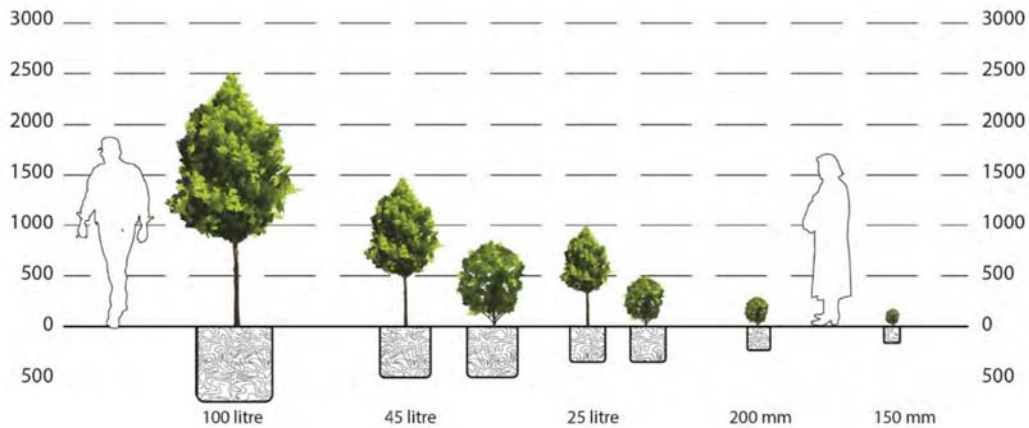


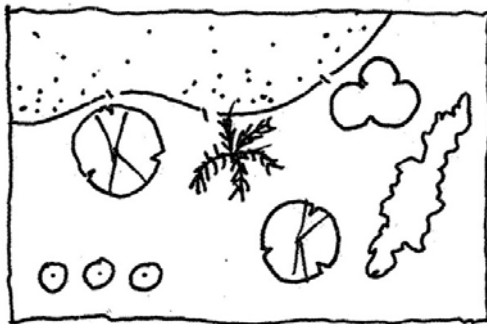
Figure 1: General pot size

4.3 Plant Density and Layout

Plant density is required to be adequate to suppress weed, provide full visual cover of garden beds and discourage access and development of shortcuts through garden beds. Figure 2 below provides an example of inappropriate versus appropriate planting density. Planting is to have a minimum planting ratio/density as per table 2 below:

Vegetation Type	Number
Tree	1 per 5m ²
Shrub	1 per 1m ²
Ground cover species	3 per 1m ²

Table 2: Minimum planting ratio (subject to individual species performance)



Inappropriate plant density



Appropriate plant density

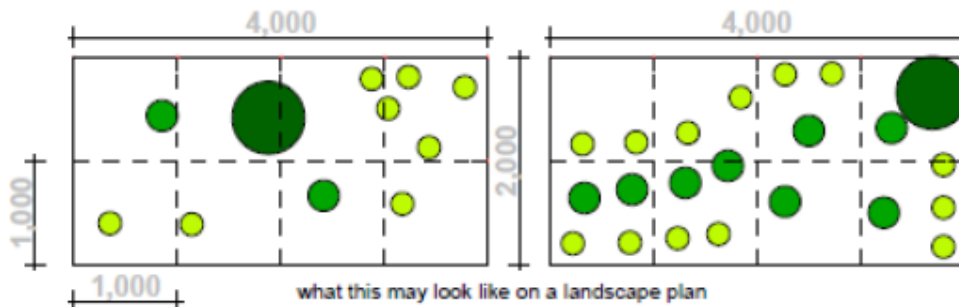


Figure 2: Inappropriate plant density vs appropriate plant density

Ideally, designers should adopt a tiered planting approach to achieve a successful plant design and form. As indicated in the Figure 3 below, taller trees and shrubs are to be used to provide shade, scale and vertical emphasis, while smaller shrubs, grasses and groundcovers are used to suppress weed growth, lower maintenance costs and provide an articulated depth to landscape features.



Figure 3: Tiered Planting

4.4 Plant Selection and Species

When considering plant selection, landscape design and layout, the designer is to ensure:

- The design uses predominantly naturally occurring local native species from the Region, incorporating koala habitat trees as street trees or features trees where connectivity is required within a mapped environmental area or corridor.
- Hardy, long lived Perennial species are to be utilised and annual species avoided, particularly where landscaping occurs in public areas managed by Council. If annuals are proposed in landscaped areas, a rigorous maintenance regime is to be provided for assessment ensuring the function of the space will be maintained.
- Garden beds are to contain a suitable and sustainable combination of trees, shrubs and groundcovers to create visual diversity. Where landscaping is undertaken on public land, Council may consider only tree planting options in intensive urban spaces where visual connectivity is required and it is not practical to achieve dense low level vegetation.
- Plants that have been grown to a standard that allows them to establish and grow to maturity are to be provided.
- Plant selection will be based predominately on the use of species indigenous to regional ecosystems found in the local area, sourced from local shire provenance or in the case of named varieties or cultivars, bred from species not identified as invasive.

Species selection must have regard for:

- the mature size of the species, particularly in those areas of high bushfire risk, adjacent to rail corridors or major roads, power lines, residential areas and substations. Large trees are to be located 1.5 times the clear fell radius away from essential infrastructure in these instances, unless otherwise approved by Council
- the growing media volume and depth available to sustain mature growth;
- the susceptibility of the species to poor drainage;
- flower, fruit and leaf litter issues;
- the pest and disease management requirements of the species in their proposed location;
- landscape character and amenity;
- shade considerations; and other ongoing maintenance requirements.
- Limb drops from susceptible species (e.g. Eucalypt sp.) when planted in high traffic or high use areas.

plants that are not to be planted in the region due to invasive or destructive characteristics are listed in Part 6 - Inappropriate Species for General Landscape Use.

4.5 Land Form

In the design of landform as part of a landscape plan, the designer ensures:

- Gradient transitions are to be shaped to allow a variation of mowing patterns over a given area without causing scalping or excessively long grass.
- Mounding on the high side of pathways laid on low permeability soils may require subsurface drainage at the path edge to prevent flooding or siltation over the path.
- Turf adjacent to paths must be flush to mitigate drop off from the path which can lead to trips and falls
- Mounding is designed and constructed to minimise impacts on downstream properties or vegetation and minimise impacts to site drainage.
- Mounding is decompacted to a depth of 150mm by surface ripping prior to the application of soil, mulch or turf.
- Batters, steep rock slopes and retaining walls are designed, constructed and stabilised for function and durability, to minimise adverse impacts to the natural environment and adjoining premises caused by erosion or siltation and to protect the safety of residents and maintenance staff.
- Where sustainable vegetative cover is not achievable on extreme slopes, retaining walls will be required. Retaining walls over 1.0 metre high must be designed and certified by a suitably qualified and experienced Structural Engineer and are to be approved by Council prior to works commencing.
- The toe of any batters and associated drainage are to be contained within the boundaries of the development site and are not extended onto neighbouring lands or into adjoining vegetation protection zones.
- Retaining wall surfaces prone to unsightly graffiti will be required to be coated with an anti-graffiti material or screened with appropriate planting.

Maximum slope requirements for specific landscaped finishes are provided in the following table. Slopes greater than 1:3 will require civil design, carried out by a suitably qualified RPEQ.

Landscape Finish	Maximum Slope
Turfed Areas	1 in 4
Recreation Land	1 in 6
Garden Areas	1 in 3

Table 3: Maximum Slope Requirements Plant Selection

4.6 Materials and Media

In the design of materials and media for use in landscape planting the designer ensures:

- A minimum 450mm finished depths of topsoil is required across the entire vegetated area for intensive urban landscapes, medians and roundabout landscapes.
- Drainage is to be provided to all garden beds particularly in centre medians and road verges.
- In ground planting areas are cultivated to a minimum depth of 300mm including subsoil cultivation and decompaction measures.
- Planting media, mulch and other landscaping materials are free of pests (including declared and environmental weeds) and are appropriate for the ongoing growth of the proposed species.

- The use of recycled materials is encouraged where safe and appropriate; and integrated into the landscape design.
- To ensure the long term viability of the landscape and to reduce maintenance, durable materials are utilised in the design.
- To reduce weed growth and maximise water retention, planting areas are mulched to a minimum depth of 100mm with organic or appropriate inorganic mulch.
- Where native vegetation is unavoidably cleared, habitat features such as hollow logs are to be harvested to enhance remaining and newly established habitat areas.

4.7 Maintenance

The maintenance of planting is minimised by suitable species selection and even mulch coverage. Landscape is designed with consideration for ease of access to maintain all landscape elements. The following considerations are required:

- Landscaping is designed to have a low water requirement and utilises appropriate species that do not require permanent irrigation after the establishment period. Effective use of rainwater is required.
- Landscaping is designed and constructed so the space can be efficiently and effectively maintained with low intervention rates.

4.8 Irrigation

Drought tolerant plants are to be used in the first instance, however where irrigation is required to effectively maintain the development landscape, because of species chosen or harshness of the micro-climate, an irrigation system is to be installed, tested and commissioned by an irrigation consultant. Irrigation works are to be designed and installed utilising best management practices whilst taking into consideration future maintenance costs to the asset owner and the safety of the asset users.

4.9 Edging

Edging is designed to provide adequate separation between turf and gardens; to contain playground and fitness station soft fall zones, to separate turf and gravel swales, and to provide safety for maintenance staff and other user groups. Concrete is the preferred material for edging council owned lands and timber edging is not to be used where adjoining or within Council managed lands.

4.10 Shade

Landscape design provides shade in a manner that maximises user health and safety i.e. shade trees located adjacent to footpaths and situated around recreation areas. The integration of existing tree vegetation into the design helps to maintain canopy coverage and reduce impermeable surface heat reflectivity creating cooler urban spaces.

Natural shade is Council's preferred outcome and hard shade solutions require approval due to increased long term maintenance costs and vandalism risk. Play facilities in particular should be located in close proximity to retained vegetation to maximise natural shade without compromising tree health.

5 Specific Design Requirements

5.1 Entry Statements

Development entrance features or estate names are an optional element that can be included in landscape plans to define and promote estates and enhance the character of the streetscape. Where the applicant chooses to include entrance statements details of the feature or structure are to be

included in the landscape plans and submitted to council for approval. The following criteria applies where a development includes such features:

- a) Entry statements are established in a manner that allows for appropriate management and maintenance.
- b) Designs are to take into consideration pedestrian and traffic safety and be compatible with surrounding area's character and streetscape.
- c) Entry statements are to be located wholly within private property.
- d) Entry statements are to be treated with an appropriate anti-graffiti product.
- e) Short term entry statements for marketing purposes are to be removed by the developer prior to the granting of off maintenance.
- f) Vegetation is to be low maintenance and preferably local native species.
- g) Long term entry statements must be made of durable, long life, low maintenance materials, soundly constructed with engineered certification

Council reserves the right to condition the removal of the entry statement at the developer's expense at the conclusion of a project.

5.2 Street Tree planting within Council road reserve

Trees provide a wide range of aesthetic and environmental benefits. They increase the biodiversity and amenity values of urban environments, can increase property values and reduce urban temperatures.

Street trees should be planted at the following minimum rates:

Zone / Precinct	Rate
General Residential Rural Township – Township Residential	1 per lot frontage (maximum 25 spacing)
Rural Residential	1 per 25 Metres
Centre Rural Township – Township Centre	1 per 25 metres
Industry Rural Township - Township Industry	1 per 50 metres

Table 4: Street Tree Planting rates

Street trees are to be planted in build outs, within the verge and within footpath cut outs or a combination of depending on road type and cross section. Refer to Appendix A Roads, Streets and Utilities. Refer to Appendix H for standard drawings on planting detail and Appendix C for water sensitive urban design inclusions.

General criteria:

- Use of indigenous species local to the area is to be encouraged wherever possible and practical.
- Ensure 10m spacing is achieved generally where practical, but not exceeding the maximum spacing as specified in Table 4 above.

- Be a mix of species unless otherwise approved on a Landscape Plan. Species selection is to avoid the use of Problem Species or planting monocultures (refer to Section 3).
- Make use of existing streetscape character including existing view lines.
- Be placed in a location that is unlikely to pose future infrastructure or maintenance access issues.
- Be provided with a minimum of 1.2 metres of clear verge width to ensure enough space for root growth and sustainability.
- In high pedestrian traffic areas, a higher rate of tree planting or additional street trees in select locations may be required to provide adequate shade and pedestrian amenity.
- Location and species selection is to be mindful of planned street infrastructure such as traffic signs, street lighting and underground services.
- Significant existing trees are to be identified and incorporated into parkland and road reserve planting where possible and once assessed for form, function and safety.
- Generally street trees will be planted at regular intervals and at a density that will provide a sense of continuity and scale to the streetscape.

5.3 Planting in Car Parks

Council requires the incorporation of landscaping in car parks to provide shade and ameliorate the micro-climatic temperature extremes of expanses of hard stands, improve the visual amenity of car park and complement the landscape character of adjoining streetscapes.

In considering landscaping within car parks the designer ensures:

- Shade trees are to be provided at a rate of not less than one shade tree per six car parking spaces. Council may consider a reduction in the rate of provision within car parking bays, where a greater overall density within landscape areas can be achieved, particularly where within WSUD landscapes.
- Trees within car park areas are to be able to attain a minimum clear trunk height of 2m at maturity.
- A minimum 2m wide landscape area is provided along any boundary of a car park that adjoins publicly accessible walkways, parks or civic spaces. For residential development a minimum 1m wide landscaped buffer is provided along any boundary of a car park that adjoins another residential zoned lot.
- Connected islands of planting areas accommodating shade tree species throughout the car park are provided. The planting of shade trees within small garden areas (e.g. 1m² diamonds) is to be avoided unless engineered soil structures are used with sufficient interconnected and free draining soil volume for sustained plant growth. (typically not less than 8 cubic metres per tree), and certified by an independent Arborist.
- Continuous runs of more than 10 parking bays without a shade tree is not permitted.
- Trees and gardens are also to be located adjacent to speed control devices to reduce incidence of rat running.
- The provision of planting areas on top of podium levels and on the roof level of car parking structures is encouraged to reduce the visual dominance of the car park area.
- All planting areas within car parks maintain adequate sight lines for pedestrian safety and traffic visibility.
- Ensure design maximises natural surveillance and pedestrian visibility and ensure that there is safe and convenient pedestrian access.
- Optimise shade tree planting patterns to minimise glare and maximise shade.
- The landscape design and construction of car park planting areas provide appropriate growing media volume and drainage to promote healthy and ongoing growth. Suggested cultivated media depths of planting areas within car parks are as follows:

Area	Media Depth (mm)
Garden Beds	300
Tree Planting Areas	450
Median / Island Beds	450

Table 5: Suggested Cultivated Media Depth for Car parking

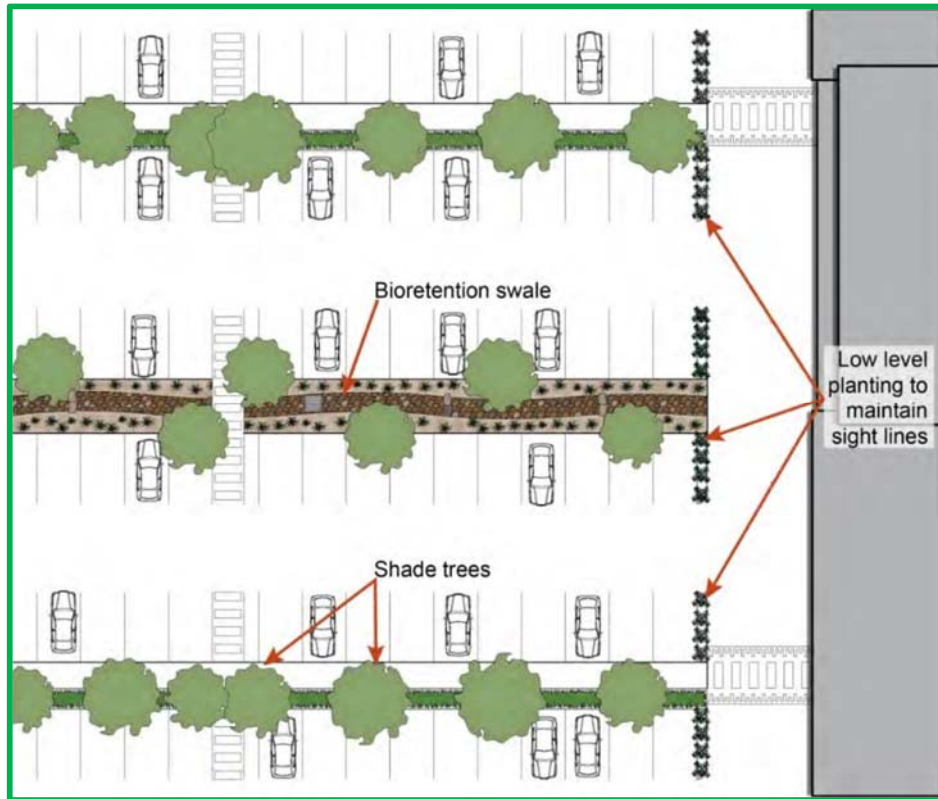


Figure 3: Example of good car park design (above)

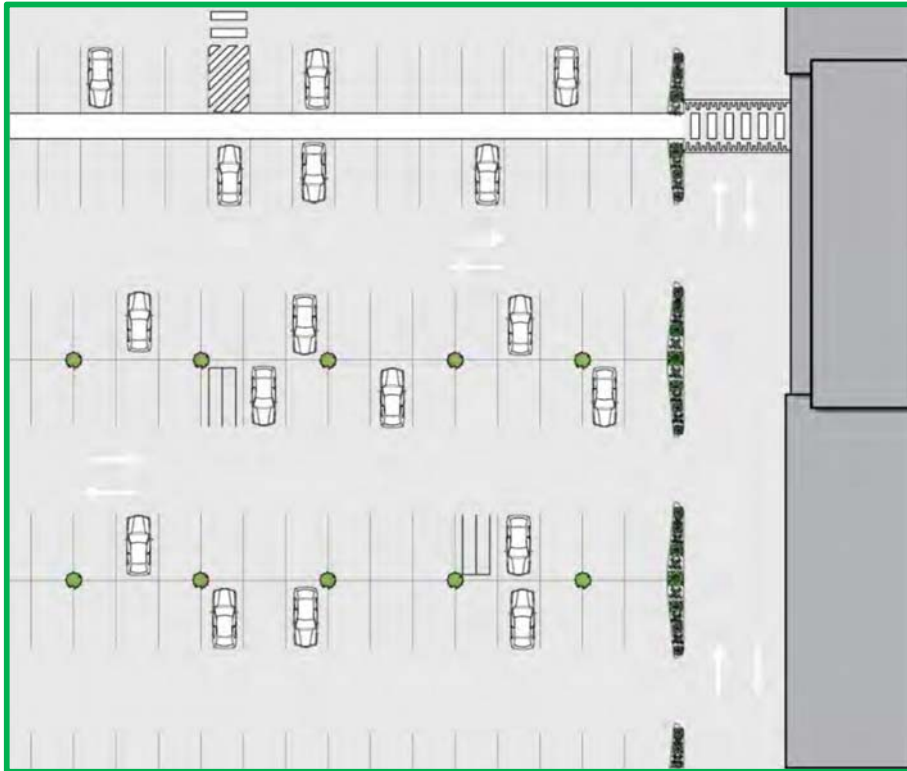


Figure 4: Example of bad car park design (above)

5.4 Streetscape Treatment & Screening within Private Property

To address the streetscape, a landscaped buffer is to be provided within the property boundary with a minimum width (unless specified otherwise in the Planning Scheme or as required to screen the height of particular development i.e. acoustic fencing) as identified in the Table 6. This is to be provided along the entire length of frontage excluding those areas required for site access (both vehicular and pedestrian), outdoor dining or active building facade purposes. Where land is required for road widening or realignments, the minimum width of landscaping is to be provided in addition to this widening. Council may accept land required for landscape screening of structures such as acoustic fencing, to be handed over to Council for road purposes where it is deemed inappropriate for maintenance to be undertaken by private land holders.

Land Use	Minimum Width (m)
Industrial	2
Commercial	2
Dual Occupancy	2
Medium Density Residential	2
Relocatable Home and Caravan Parks	2
Service Station	2

Table 6: Minimum Landscape Buffer Requirements in Relation to Land Use

The streetscape treatment buffer is to contain a suitable combination of trees, shrubs and groundcovers (see Table 2) to create visual diversity, soften the built form and promote a green subtropical character. The retention of existing mature trees within the streetscape landscape buffer is maximised to retain

the streetscape character. In some situations, street frontage landscape buffers may contain some gaps in vegetation coverage, for CPTED and better commercial exposure. The use of more groundcovers instead of larger shrubs in these instances may be appropriate to maintain surveillance of the street.

No buildings, other structures, goods storage areas, refuse storage areas, items of plant, loading unloading areas, parking or service vehicle facilities are to encroach upon the buffers required by this section.

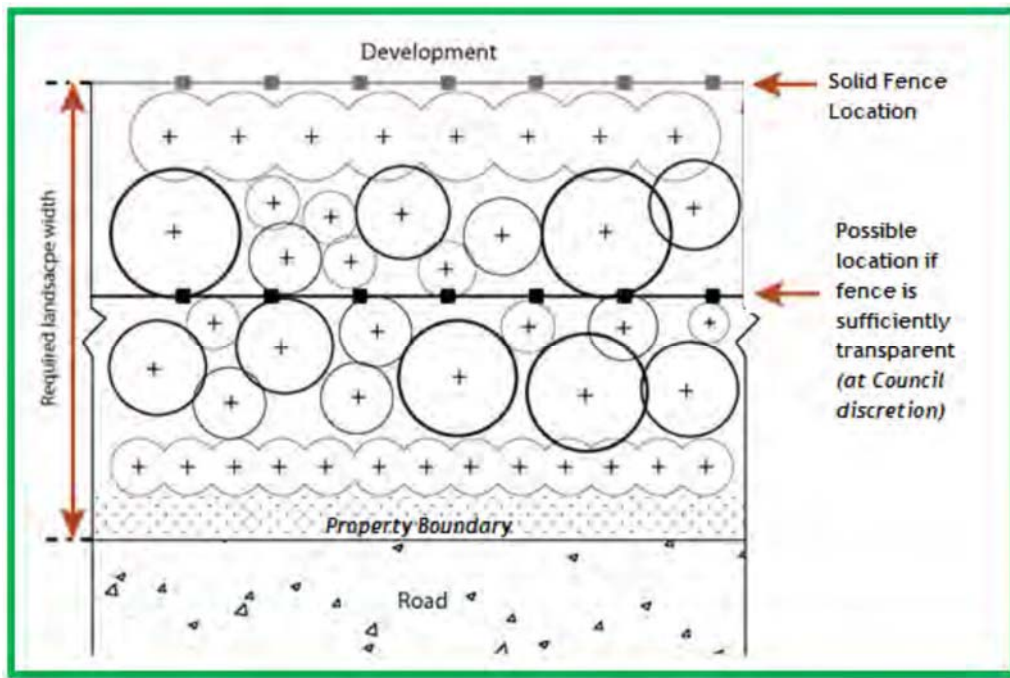


Figure 5: Recommended fence location for street boundary fencing

Where fencing is also proposed along the frontage of a site, it is to be located behind the minimum landscape buffer width when viewed from the street. Where fencing contains large gaps or is sufficiently transparent, Council may allow for it to be located within the landscape buffer width.

Where bio-retention areas are to be included within buffer areas or along the frontage of the site, they are designed with a high visual amenity and provisions to accommodate a combination of suitable tree, shrub and groundcover species to achieve screening and buffering of the development.

5.4.1 Screening and Buffering

Planted buffers are used to provide:

- Visual screening to undesirable land uses, acoustic and other types of fencing and busy road frontages.
- Protection and enhancement of environmental values associated with vegetation, natural habitat and watercourses.
- Refuge for wildlife.
- Serve as windbreaks.

Buffer planting is to use species with demonstrated ability to be sustainable with low maintenance intervention. Council's preference is to use native species with limited use of exotic species where appropriate.

Where a landscape buffer is required to screen a structure, acoustic fence or the like, the buffer is to have a width that is able to accommodate vegetation that can grow to a sufficient height to screen or soften the height of the development that requires screening. Table 7 provides the minimum width of buffer to achieve a desired screening height, which is approximately shown on Figure 7.

Screening Height (m)	Buffer Width (m)
> 8.0	8.0 to 10.0
8.0	5.0
5.0	3.0
2.5 (Maximum)	2.0
1.2 (Maximum)	1.0

Table 7: Screening Height in Relation to Landscape Buffer Width

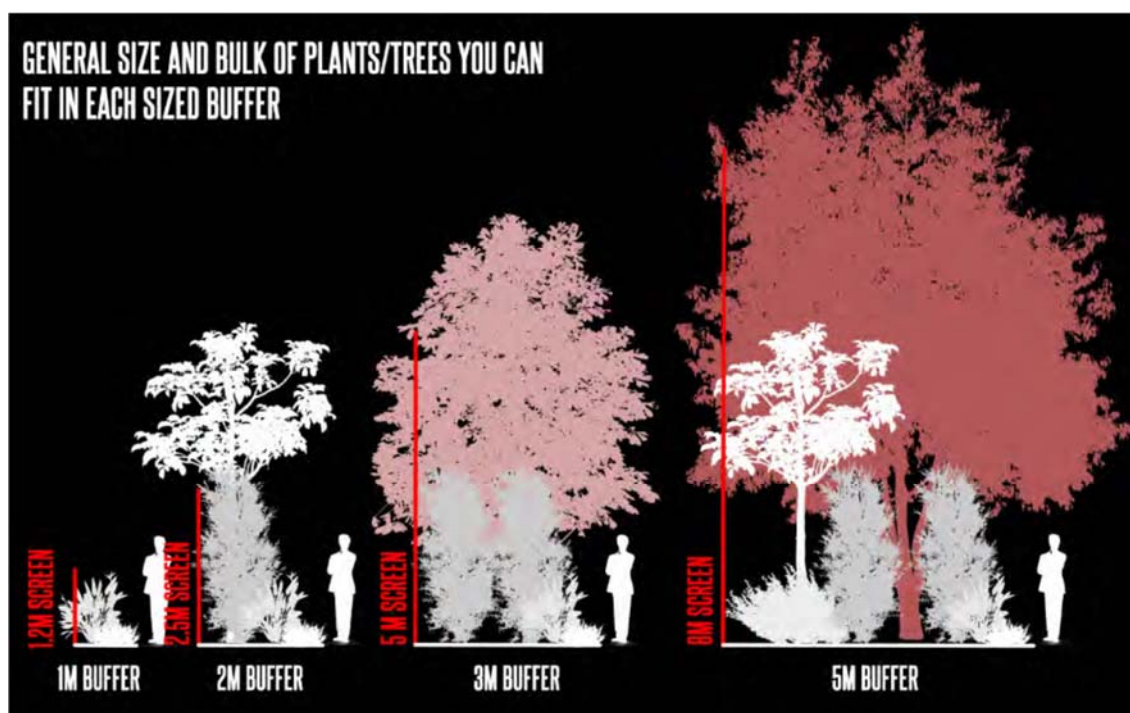


Figure 7: Approximate size and bulk of vegetation buffers

Table 8 provides guidance on landscape buffer widths in relation to adjacent land use. Unless specified differently within the planning scheme, a landscape buffer at the widths identified in the table is to be provided as a minimum and maintained along the common boundary.

Location	Buffer Width (m)
Any uses adjacent to or visible from the Bruce Highway Road Reserve	10
Industrial uses adjacent to residential uses	10
Centre Uses adjacent to residential uses	3
Industrial uses adjacent to any use other than industrial or residential	3

Table 8: Landscape Buffer Width in Relation to Location

No buildings, other structures, goods storage areas, refuse storage areas, items of plant, loading unloading areas, parking or service vehicle facilities are to encroach upon landscape buffers. For large landscaped buffers, a mulched or gravel maintenance path should be provided between any fence or structure and the required landscape buffer. Refer to Figure 8 below for guidance.

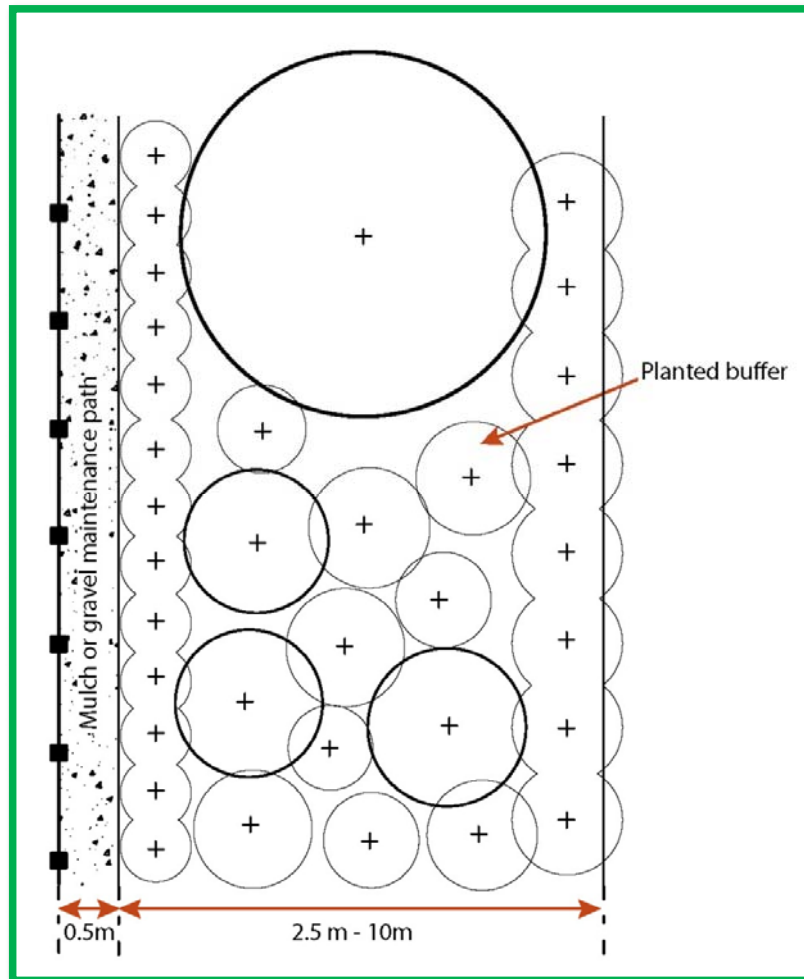


Figure 8: Recommended maintenance corridor for landscape buffers.

5.5 Landscaping in mosquito buffer zones

For landscaped areas within close proximity of a known or potential mosquito breeding area, vegetation barriers, such as hedges, are encouraged to be integrated into landscape design to function as an on-ground control option.

Dense vegetative barriers can attract mosquitoes and midges to rest amongst cool, thick foliage that has been pre-sprayed with residual control product.

To enable the vegetation to be used for this purpose, the following specifications need to be considered:

- The barrier must consist of dense vegetative matter to provide a cool, still, space for insects to land.
- Lower branches must remain on the vegetation - pruning needs to occur so that branching close to the ground is encouraged as many mosquito/midge species fly at 20 - 50 cm height above the ground.
- Low flowering species to be used as product cannot be applied to vegetation in flower.
- Barriers cannot be placed immediately adjacent to water, due to label restrictions of the product, and need a 3m buffer from these areas.
- Leaves cannot have excessively waxy surfaces, or spines as the product needs to stick to the leaves.
- The resulting barrier is to be maintained to an optimal height of 2-3m and width of 1m by natural growth or pruning.
- The barriers can be planted on mounds to promote root growth on poorly drained sites.
- Barriers should be continuous with limited breaks and accessible from both sides to facilitate effective spraying. Rows may be offset slightly or overlapping with breaks to prevent excessively long rows.
- Maintenance is essential to create an effective barrier.

It is recommended that a variety of plants be considered for this purpose. This is beneficial because:

- it makes the landscape more attractive;
- if one plant in a monoculture is attacked by insect or disease the whole hedge can fail.
- Recommended species are listed in Table 9 below.

Safety issues have to be addressed with the design of any vegetative barrier. It is recommended that layering of species be employed so as to provide good view lines at critical points (Figures 9 & 10).

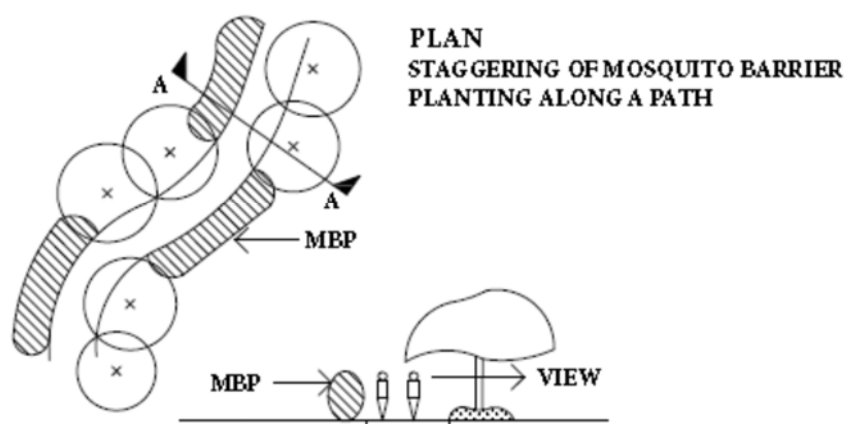


Figure 9 - Examples of mosquito barrier planting (MBP) in a landscaped area.

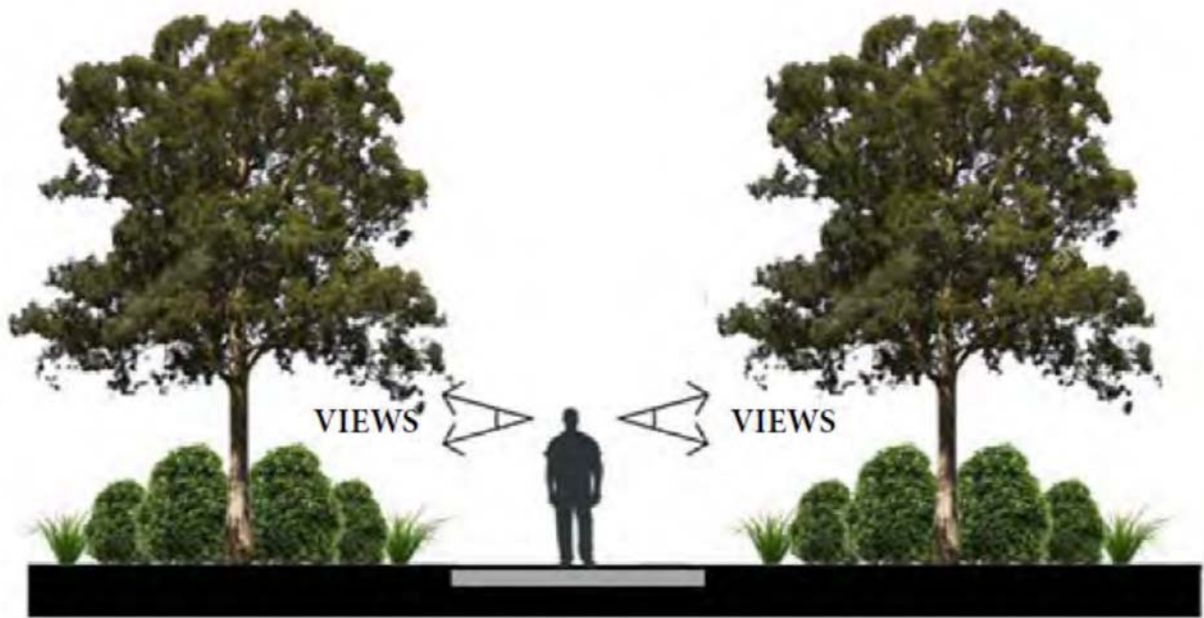


Figure 10 - Examples of mosquito barrier planting (MBP) in a landscaped area.

It is important to consider the context and values of the whole park or open space when designing a planting layout. Where a vegetative barrier is required, it should fit into the whole scheme and not be a dominant element within that scheme.

Potential Mosquito Hedging Plants	
Species	Approximate dimensions
Australian Native Species and Cultivars	
Acmena smithii 'Fire Screen'	2-4h x 1.2m w
Acmena smithii 'Forest Flame'	2h x 1m w
Acmena smithii 'Hot Flush'	3h x 1.5m w
Acmena smithii 'Minipilly'	2h x 1.5m w
Syzygium 'Aussie Boomer'	1-2h x 1.2-1.5m w
Syzygium 'Aussie Compact'	2-3.5h x 1.5m w
Syzygium australe 'Express'	4h x 2.5m w
Syzygium 'Resilience'	2-3h x 2m w
Westringia 'Blue Gem'	1-1.5h x .8-1.3m w
Westringia 'Naringa'	2.2h x .1.5m w
Exotic Species	
Metrosideros 'Fiji Fire'	3h x 2m w
Metrosideros 'Little Dugald'	1-2h x 1-2m w
Photinia glabra 'Rubens'	2-3h x 2-3m w
Photinia 'Red Robin'	3-4h x 2m w

Table 9 - Recommended species to be used for vegetative barriers

6 Inappropriate Plant Species for General Landscape Use

6.1 General

Many species of plants and trees are not suitable for planting within the Region. These plants are seen as problems because they:

- are listed as prohibited or restricted under the biosecurity Act 2014
- are poisonous.
- have thorns, spines, or prickles.
- have invasive root systems.
- have inappropriate growth habits.
- are known as potentially invasive environmental weeds.
- These plants are not to be used in any landscape works on Council owned land

6.2 Inappropriate species not to be used in the region

Table 1: Undesirable Species not to be used in the Region

GENUS	SPECIES	COMMON NAME
Abrus	precatonus	Crab's Eye
Acacia	boliviana	Bolivian Wattle
Acacia	farnesiana	Mimosa Bush
Acacia	Macradenia	Zig-zag wattle
Acanthocereus	tetragonus	Sword Pear
Acetosa	sagittata	Rambling Dock
Acokanthera	oblongifolia	Wintersweet
Adenophora	riparia	Mistflower
Ageratina	adenophora, riparia	Crofton Weed
Ageratum	houstonianum	Blue Billygoat Weed
Ailanthus	altissima	Tree Of Heaven
Alisma	lanceolatum	Alisma
Allamanda	species	Yellow Allamanda
Alocasia	brisbanensis	Cunjevoi
Alternanthera	dentata	Ruby Leaf
Alternanthera	pungens	Khaki Weed
Amaranthus	spinousus	Needle Burr
Ambrosia	psilostachya	Perennial Ragweed
Andropogon	virginicus	Whisky Grass
Araujia	sericifera	Mothvine
Archontophoenix	alexandrae	Alexandra Palm
Arecastrum	romanzoffianum	Cocos (Queen) Palm
Argemone	ochroleuca	Prickly Poppy
Arundo	donax	Giant Reed
Asclepias	curassavica	Red Cotton Bush

GENUS	SPECIES	COMMON NAME
Asparagus	africanas, plumosus	Asparagus Ferns
Aster	subulatus	Wild Aster
Austroeupatorium	species	Austroeupatorium
Baccharis	cordifolia	Romerillo (Toxic Groundsel)
Barleria	repens	Coral Creeper
Bauhinia	variegata	Bauhinia
Bidens	pilosa	Cobbler's Pegs
Bougainvillea	glabra	Paper Flower
Bougainvillea	spectabilis	Great bougainvillea
Brachiaria	decumbens	Signal Grass
Brachiaria	mutica	Para Grass
Brugmansia	candida	Angel's Trumpet
Buddleja	madagascariensis	Buddleja
Cactus	species	Cacti
Caesalpinia	decapetala	Thorny Poinciana
Caesalpinia	ferrea	Leopard Tree
Cakile	edentula	American Sea Rocket
Callisia	fragrans	Purple Succulent
Calophyllum	inophyllum	Beauty Leaf
Canna	indica	Canna
Carpobrotus	aequilaterus	Angled Pigface
Carthamus	lanatus	Safron Thistle
Cassia	floribunda, obtusifolia	Smooth Senna
Cassia	pendula	Easter Cassia
Cassia	javanica	Apple Blossom Tree
Catharanthus	roseus	Pink Periwinkle
Cenchrus	ciliaris	Buffel Grass
Cenchrus	echinatus	Mossman River Grass
Cestrum	species	Cestrum
Chamaecrista	rotundifolia	Round Leaf Cassia
Chamaedorea	atrovirens	Mexican Parlor Palm
Chloris	gayana	Rhodes Grass
Coffea	arabica	Coffee Bush
Colocasia	esculenta	Taro
Commelina	benghalensis	Wandering Jew
Conium	maculatum	Hemlock
Conyza	bonariensis	Flax-Leaf Fleabane
Conyza	canadensis	Canadian Fleabane
Conyza	sumatrensis	Tall Fleabane
Coreopsis	lanceolata	Coreopsis
Cortaderia	selloana	Pampas Grass

GENUS	SPECIES	COMMON NAME
Corymbia	torelliana	Cadaghi
Cosmos	bipannatus	Cosmos
Cotoneaster	pannosus	Cotoneaster
Crocosmia	crocosmifolia	Montbretia
Crotalana	Pallida	Rattlepod
Cuscata	species	Dodder
Cycas	species	Cycas
Cyperus	aromaticus, brevifolious, involucratus	Navua Sedge, African Sedge
Datura	ferox, metelodies, taulua, stramonium	Thornapples
Delonix	regia	Poincianna
Dendrocnide	excelsa, moroides, photinophylla	Stinging Trees
Desmodium	intortum, uncinatum	Desmodium
Dieffenbachia	species	Dumb Cane
Digitaria	eriantha	Pangola Grass
Diospyros	kaki	Persimmon
Duranta	erecta/ repens	Duranta
Echinochloa	collona, crus-galli	Barnyard Grass
Egeria	densa	Dense Waterweed
Eleusine	indica	Crowsfoot Grass
Elodea	canadensis	Elodea
Emex	australis	Spiny Emex
Eragrostis	curvula	African Love Grass
Erigeron	karvinskianus	Seaside Daisy
Eriobotrya	japonica	Loquat
Eriocereus	species	Harrisia Cactus
Erythrina	crista-galli	Coral Tree
Eugenia	uniflora	Brazillian Cherry
Euonymus	japonica	Spindle Tree
Euphorbia	cyathaphopra, heterophylla	Milkweed
Ficus	elastica	Indian Rubber Tree
Furcraea	foetida, selloa	Hemp
Gloriosa	superba	Glory Lily
Gomphocarpus	physocarpus	Balloon Cotton Bush
Heteranthera	reniformis	Kidneyleaf mudplantain
Hiptage	benghalensis	Hiptage
Hydrocleys	nymphoids	Water Poppy
Hydrocotyle	ranunculoides	Hydrocotyle
Hypochoeris	radicata	Flat Weed
Hypoestes	phyllostachya, sanguinolenta	Polka Dot Plant
Impatiens	hawkeri	New Guinea Impatiens
Impatiens	walleriana	Balsam

GENUS	SPECIES	COMMON NAME
Ipomoea	indica, cairica	Morning Glory
Isolepis	prolifera	Isolepis
Jacaranda	mimosifolia	Jacaranda
Jagera	pseudorhus	Foambark
Juncus	acutus	Spiny Rush
Juncus	articulatus	Jointed Rush
Justicia	betonica	Squirreltail
Koelreuteria	species	Golden Rain Tree
Leonotis	nepetifolia	Klip Dagga/Lion's Tail
Leucaena	leucocephala	Leucaena
Lilium	formosanum	Formosan Lily
Lonicera	japonica	Japanese Honeysuckle
Lonicera	nitida	Boxleaf Honeysuckle
Macroptilium	atropurpureum	Siratro
Macrotyloma	axillare	Perennial Horse Gram
Macrozamia	species	Zamia Palms
Malus	Species	Malus, Crab Apple
Melia	azederach	White Cedar
Melinis	minutiflora, repens	Molasses Grass
Mimosa	invisa, pigra, pudica	Sensitive Plant
Montana	hibiscifolia	Anzac Flower
Morus	alba	Mulberry
Murraya	exotica, paniculata	Murraya, Mock Orange
Myriophyllum	aquaticum, spicatum	Watermilfoil
Nandina	domestica	Heavenly Bamboo
Nasturtium	officinale	Water Cress
Nelumbo	Species	Water Lotus
Neonotonia	wightii	Glycine
Nephrolepis	cordifolia	Fishbone Fern
Nerium	oleander	Oleander
Nymphaea	caerulea subsp. zanzibarensis	Cape Blue Waterlily
Nymphaea	mexicana	Yellow Waterlily
Ochna	serrulata	Ochna
Oenothera	drummondi	Evening Primrose
Olea	africana, europaea	Olive
Panicum	maximum	Guinea Grass, Green Panic
Paspalum	conjugatum, dilatatum, mandiocanum, notatum	Paspalum Grass
Passiflora	foetida, suberosa, subpeltata, edulis	Passion Vine
Paulownia	tomentosa	Paulownia
Peltophorum	pterocarpum	Yellow Poinciana

GENUS	SPECIES	COMMON NAME
Pennisetum	alopecuroides	Swamp Foxtail
Pennisetum	purpureum	Elephant Grass
Phyla	canescens	Condamine Couch
Phyllostachys	aurea	Running Bamboo
Phytolacca	dioica, octandra	Inkweed
Pinus	carribaea, elliottii, patula, radiata	Pine Trees
Polygala	virgata	Polygala
Polypogon	monspeliensis	Annual Beardgrass
Pontederia	cordata, rotundifolia	Pickereel Weed
Praxelis	clematidea	Praxelis
Prunus	munsoniana	Wild Goose Plum
Psidium	guajava, guineense	Guava
Pyrostegia	venusta	Flame Vine
Radermacheria	species	Asian Bell Tree
Rhaphiolepis	indica	Indian Hawthorn
Rhoeo	discolor	Moses in the Cradle
Ricinus	communis	Castor Oil Plant
Rivina	humilis	Baby Pepper
Rubus	bellobatus, discolor, ellipticus, fruticosus, ulmifolius	Blackberry
Ruellia	malacosperma	Ruellia
Rumex	crispus	Curled Dock
Ruppia	maritima	Sea Tassel
Russelia	equisetiformis	Firecracker Plant, Coral Plant
Sagittaria	graminea, platyphylla, pygmaea	Arrowhead
Salvia	coccinea	Red Salvia
Sambucus	canadensis, nigra	Elder Berry
Sansevieria	trifasciata	Sansevieria
Sasa	species	Dwarf Bamboo
Schefflera	actinophylla	Umbrella Tree
Senecio	mikanioides, tamoides	Ivy
Setaria	palmifolia	Palm Leaf Setaria
Setaria	sphacelata	African Pigeon Grass
Sida	cordifolia	Flannel Weed
Sida	rhombifolia	Common Sida
Sigesbeckia	orientalis	Indian Weed
Solandra	maxima	Chalice Vine
Solanum	erianthum	Tobacco Bush
Solanum	hispidum, torvum	Devil's Fig
Solanum	mauritanum	Wild Tobacco
Solanum	seafortianum	Brazilian Nightshade

GENUS	SPECIES	COMMON NAME
Solidago	altissima	Golden Rod
Solidago	canadensis var. scabra	Canadian Goldenrod
Sorghum	halepense	Johnson Grass
Stylosanthes	scabra	Shrubby Stylo
Syagrus	romanzoffiana	Queen Palm
Synadenium	grantii	African Milkbush
Tagetes	minuta	Stinking Roger
Tecoma	capensis	Cape Honeysuckle
Tecomeria	capensis	Fire Flower
Tephrosia	glomulifera	Pink Tephrosia
Themeda	quadrivalvis	Grader Grass
Thevetia	peruviana	Yellow Oleander
Thunbergia	alata	Black-Eyed Susan
Tipuana	tipu	Tipuana
Tithonia	diversifolia	Japanese Sunflower
Tithonia	rotundifolia	Mexican Sunflower
Tradescantia	albiflora, zebrina, fluminensis	Wandering Jew
Tradescantia	pallida	Purple Heart
Triumfetta	rhomboidea, semitriloba	Sacramento Burr
Tropeolum	species	Nasturtium
Urtica	dioica	Stinging Nettle
Verbena	tenuisecta	Mayne's Pest
Verbesina	enceliodes	Crownbeard
Watsonia	meriana var. bulbillifera	Bulbil Watsonia
Xanthium	pungens	Noogoora Burr
Xanthium	spinosum	Bathurst Burr
Xanthosoma	violaceum	Blue Taro
Zantedeschia	aethiopica	Arum Lily
Zebrina	pendula	Wandering Jew
Zephyranthes	grandiflora	Pink Storm Lily
Zinnia	peruviana	Wild Zinnia