

Tree Management Guidelines 2010

City of Boroondara

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1.0 INTRODUCTION

The City of Boroondara is renowned for the rich diversity and maturity of trees found within its streetscapes, parkland and private gardens. Tree lined avenues, mature exotic gardens and specimen trees are all present throughout the city. There are approximately 125,000 Council managed trees.

The goal of tree management is based on an understanding of the dynamic nature of the resource, its aesthetic and safety requirements, public attitude and perception, and Council's commitment to engaging and working with the community. All avenues and stands of trees have a finite lifespan and at some point in time trees need to be removed and replaced.

As trees age, their ability to tolerate and adapt to change decreases and they require more and more management to maintain them in a safe and attractive condition. In an urban environment, some changes to the trees environment cannot be avoided however, to ensure the continued health of our tree population and in particular mature trees, all efforts are made to minimise the extent of change.

In order to sustain the landscape and meet public needs, trees need to be planted and established, maintained and removed. Planning is required in order to facilitate each of the processes to the benefit of the landscape and public requirements.

The Tree Management Guidelines provide an overview for the management of trees on Council managed land. This document is intended for use by staff dealing with issues relating to trees on Council managed land and as a document that can be referred to by the community. It is to be used in conjunction with the Tree Policy, a strategic document that articulates Council's philosophies on management and maintenance of trees on Council managed land.

The Tree Management Guidelines include:

- Tree Risk Management
- Tree Removals
- Street Trees and New Vehicular Crossovers
- Tree Planting
- Tree Selection, Planting and Establishment Overview
- Community Consultation
- Tree Pruning
- Tree Support Systems
- Management of Canary Island Date Palms
- Protection of Trees During Construction
- Tree Root Management
- Management of Pests, Disease, Animal and Weed Species
- Assigning a Monetary Tree Value.

The document is in line with the following City of Boroondara strategies and policies:

- Tree Policy
- Council Plan 2010 – 2015; Key Direction - *Ensuring liveability and amenity*
- Biodiversity Strategy
- Open Space Policy
- Electric Line Clearance Management Plan

1.1 Benefits of Trees

The value of trees in our urban landscape

The value of trees within an urban environment is widely accepted as high, due to their positive contribution towards maintaining a city's sustainability and to community health and serenity. Collectively, trees add beauty to our urban landscapes by softening the harsh lines of buildings, complimenting architecture, screening unsightly views and providing privacy and a sense of security and place.

Trees absorb air pollutants, release oxygen and sequester carbon dioxide. They reduce stormwater runoff and erosion, ameliorate climate, can save energy, provide wildlife habitat and strengthen a sense of community within a given area.

Trees provide social, environmental and economic benefits.

Social benefits

Trees and other landscape plantings provide the community with a fundamental reminder of nature as an important component of people's lives. In an urban environment, trees provide a critical link to the natural world from which we have evolved and help restore an individual's mind and spirit.

Humans respond to nature, we like trees around us because they make life more pleasant. The understanding of the role that trees play in our urban environment has lead to an increase in the veneration of trees and they can evoke strong passions, particularly when their removal is debated.

Environmental benefits

Trees alter the environment in which we live by moderating climate, improving air quality, conserving water and providing habitat for wildlife.

Trees modify local climate, primarily by lowering air temperature and increasing humidity. Trees shade buildings and hard surfaces reducing re-radiated energy and the 'heat island' effect. The evaporation of water from trees also has a cooling effect.

Wind speed and direction can be affected by trees. The more compact the foliage on the tree or group of trees, the greater the influence of the windbreak.

Trees can influence the flow of water in several ways. The downward fall of rain and hail is initially absorbed or deflected by trees, reducing its force. This allows greater capture of rainfall into the soil reducing runoff and erosion. Water is also allowed to percolate through the natural mulch layer created beneath the canopies of trees.

Trees remove carbon dioxide from the atmosphere and store (sequester) it as carbon in the plant material and the surrounding soil. Trees can have a significant impact through the effects they create when strategically planted near buildings, leading to a reduction in energy use.

Trees, in particular native vegetation, benefit biodiversity (diversity of ecosystems, species and genes within species). Diversity of trees and shrubs in the urban landscape return it to a more natural, less artificial environment. Birds and other wildlife are attracted to the area as a result of trees.

Economic Benefits

Individual trees and shrubs have value, but the variability of species, size, condition, and function makes determining their economic value difficult. The economic benefits of trees can be both direct and indirect.

Direct economic benefits are usually associated with energy costs. Well-placed shade trees can reduce energy consumption in a home by as much as 30 percent.

The indirect economic benefits of trees are based on the cumulative effect of individual savings and reliance on external energy sources.

Studies have shown that trees in the metropolitan area contribute between 13 and 20 percent of the value of the property. Houses located in tree-lined avenues have higher property values than those without street trees. Well treed suburbs are more appealing to newcomers.

Research has established a number of benefits in terms of consumer experiences of business districts with trees. Consumers generally reported a willingness to pay an average of 11% more for goods in a landscaped business district than a non-landscaped district, with this figure being as high as 50% for convenience goods.

Trees Require an Investment

While trees provide numerous benefits, they also incur some costs. The most significant costs incurred include the initial tree purchase and establishment, ongoing maintenance pruning and the disposal of leaves and branches and ultimately, tree removal.

The greatest benefit is derived from healthy, structurally sound trees planted in locations that support their development. Planting the right tree in the right place will maximise benefit while minimising the ongoing maintenance costs.

The long-term goal of urban tree management is sustainability; the maintenance of ecological, social and economic functions for the duration of a trees useful life.

1.2 General tree management principles

To make effective management decisions it is necessary to have a core group of basic objectives. It is assumed that the following basic principles apply to most urban tree situations:

- Management is preferable to no management;
- Safety is the absolute priority;
- Reasonable management costs are an important secondary objective; and
- Sustaining amenity is an equally important secondary objective.

Specifically, Council will:

- Place public safety in respect to the planning, provision and maintenance of its trees as a priority;
- Maintain a tree management system for street and open space trees as part of Council's Asset Management System;
- Seek to achieve a sustainable urban forest taking into consideration the possible conflict between trees, community expectations and the built environment;
- Implement and manage appropriate tree removal/replacement programs that ensure the tree resource is continually renewed thereby ensuring a sustainable tree population; and

- Implement tree management in line with relevant legislative requirements, strategic policies, principles of sustainability and accepted tree care practices. Any operation that is known to be detrimental to long-term tree health will not be accepted.

1.3 Tree Management Guidelines goals

The Tree Management Guidelines provides a framework for the efficient and effective management of Council's tree stock.

Council will:

- *Maintain and enhance the existing tree population for inheritance by future generations by preserving tree health, aesthetic appearance and amenity value.*
- *Utilise a program of systematic tree assessment and best practice tree management to mitigate tree risk for residents and visitors to the City.*
- *Remove poor performing trees where necessary in order that the City's landscapes are reinvigorated and maintained with regard to safety.*
- *Select tree species for planting for their suitability to the site, performance, and potential to contribute to the landscape.*
- *Protect Council trees from development and other activities that threaten their health and viability. The conflict between trees and infrastructure will be minimised where possible.*
- *The community will be consulted and informed about all major projects involving tree removal and tree planting.*

1.4 Definitions

1.4.1 Tree

A tree is a woody plant with generally a single erect perennial trunk at least 75 millimetres in diameter at breast height (DBH). Most trees have definitely formed crowns of foliage and attain heights in excess of four (4) metres.

1.4.2 Significant Trees

The term "Significant" is commonly used within the arboricultural industry to describe a tree or group of trees as outlined below. The following criterion applies strictly to this Tree Management Guidelines and differs from that which qualifies a trees inclusion to the City of Boroondara Significant Tree Register.

Significant trees can be either living or dead and shall be defined by the contribution the tree makes to the area and the impact the removal shall have on the amenity of the area. A significant tree or group of trees shall specifically include:

- large specimen trees (trunk diameter greater than 250mm and more than five [5] metres tall);
- trees that are representative of more than 30% of trees in any street (may comprise both Significant and Non-Significant trees);

- habitat trees - living or dead;
- remnant indigenous vegetation;
- tree(s) identified in City of Boroondara Significant Tree Register;
- tree(s) identified as having heritage or cultural significance; or
- rare or endangered tree species or specimen.

1.4.3 Non-Significant Trees

Those trees that are not contributing significantly to the amenity of the streetscape or parkland due to one of the following:

- the tree is less than five (5) metres in height;
- the tree is 50% or more dead and not a habitat tree of value; or
- the tree is a weed species

1.4.4 Hazard

Source of potential harm or damage, or a situation with potential for harm or damage (Environmental Management Systems 2004; Standards Australia / Standards New Zealand 2004). "Hazard" is the general term for anything which has the ability to cause injury or for the potential to cause injury (Heriot Watt University 2005).

1.4.5 Risk

Expose to a chance of loss or damage (Cognitive Science Laboratory, Princeton University 2005); a prediction of the likelihood and extent of harm (negative consequences) resulting from a given action; risk = hazard x exposure (American Chemical Society 2005).

This term must not be confused with the term "hazard". It is most correctly applied to the predicted or actual frequency of occurrence of an adverse effect of hazard (Heriot Watt University 2005).

1.4.6 Hazardous Trees

Are defined as;

Those trees that have a defect that may cause injury or property damage if not removed such as;

- **Structurally Unsound** - bifurcation with high chance of failure within the next five (5) years, excessive borer activity, dying or dead
- **Exposed Roots** - having a high potential as a trip hazard (provided no remedial action is possible)
- **Inappropriately Located** - tall tree species with structural defects under power lines; a tree leaning over road/paths/property whose form cannot be corrected by pruning or other arboricultural methods
- **Trees Causing Major Damage** - where tree branches/roots are causing significant damage to Council, utility, or private infrastructure and where this has the potential to increase significantly

1.4.7 Immediate Hazard

Immediate attention required as the tree has a condition, which makes failure imminent or the tree be deemed to be structurally unstable due to:

- having the potential to shed a major portion of the canopy; or
- being unstable in the ground and susceptible to wind-throw.

Decisions on hazard rating are made after the tree has been inspected and assessed by a suitably qualified person.

1.5 Authority levels

Tree development and management within the City of Boroondara will be centralised under a person suitably qualified and with the necessary expertise to manage the resource. This person will have nominated officers assisting in the management of the resource.

The nominated officers should, as far as possible, deal with all tree related problems, but limit their involvement to one of fact and professional technical opinion. Council's Senior Arborist or the Manager Parks and Gardens will make decisions based on a balance of experience and informed judgements.

The diagram shows Council's management structure in relation to the authorisation for Tree Development and Management on Council managed land.

DIRECTOR ENVIRONMENT AND INFRASTRUCTURE



MANAGER PARKS AND GARDENS



SENIOR ARBORIST



ARBORIST(S)

1.5.1 Authority levels for tree removals

Removal shall be seen to be the last resort when alleviating tree related problems. All other options are to be assessed and used in preference to removal wherever reasonable. Options include, root severance / barriers, pruning, increased sweeper services, drain cleaning, infrastructure modification or other management programs.

1.5.2 Removal of significant trees

The Senior Arborist or delegated officer(s) may authorise the removal of a tree identified as significant in order to avoid unreasonable risk or damage where a tree is assessed as being HAZARDOUS.

Where a tree is identified as an IMMEDIATE HAZARD removal may be authorised by the Senior Arborist or delegated officer(s) and undertaken immediately.

Where a tree does not comply with the General Guidelines for Removal and its removal is required as part of a park improvement program, Capital Works project or similar, the Senior Arborist or delegated officer(s) shall provide a brief overview report to the Manager Parks and Gardens for approval.

1.5.3 Removal of non-significant trees

Parks and Gardens Team Members and approved Parks and Gardens Contractors, may, without further authorisation, remove trees that are non-significant and are assessed as DEAD, NEARLY DEAD or HAZARDOUS. (See sections 1.4.6 & 1.4.7)

Where a tree is assessed as being non-significant and is inappropriately located, removal may be authorised by the Senior Arborist, delegated officer(s) or higher authority.

*Inappropriate locations shall be determined by distance and existing features restrictions defined in **5.2.6 Existing Street Features Restrictions** and **5.2.8 Existing Council Managed Park or Reserve Features Restrictions**.*

1.6 Appeals on tree development & management decisions

Residents or other interested parties may appeal a Council Officer decision to have a tree removed or retained or other tree management decision on Council Managed Land.

1.6.1 Appeals relating to tree removal

If a resident insists on the removal or retention of a tree despite advice and assurances from the Senior Arborist or delegated officer(s) that the contrary or an alternative is more appropriate, this request must be in writing and addressed to the Manager Parks and Gardens. Following receipt of the written request, the Manager Parks and Gardens shall initiate the following appeal process:

- The Senior Arborist will provide a brief 'objective over-view' report to the Manager Parks and Gardens that describes the arboricultural issues concerning the tree removal or retention.
- Following a site inspection, the Manager Parks and Gardens will either base his/her decision upon the information contained within the report from the Senior Arborist; or
 - determine to obtain an independent report from a qualified arborist to confirm the arboricultural issues; or
 - refer the matter to the Director Environment and Infrastructure for review in accordance with this policy.
- The Manager Parks and Gardens will inform the Ward Councillor of the issues regarding the tree removal or retention.

When considerable community concern is expressed following notification of the removal of a tree or group of trees, the Senior Arborist will refer the matter to the Manager Parks and Gardens.

- The Senior Arborist will provide a report to the Manager Parks and Gardens that describes the arboricultural issues concerning the removal of the tree or group of trees.
- The Manager Parks and Gardens will either base his/her decision upon the information contained within the report from the Senior Arborist; or

- determine to obtain an independent report from a qualified arborist to confirm the arboricultural issues; or
- refer the matter to the Director Environment and Infrastructure for review in accordance with this policy.
- The Manager Parks and Gardens will inform the Ward Councillor of the issues regarding the removal of the tree or group of trees.

Removal of a tree or group of trees for any reason in a road reserve, park or reserve (subject to statutory constraints) may be authorised by the Director Environment and Infrastructure where on the individual merits of the situation it is considered appropriate. These situations would involve judgment based on a combination of the related arboricultural issues combined with such factors as social, technical, economic or environmental considerations.

When the matter is referred to the Director Environment and Infrastructure for review, the Senior Arborist will provide a brief 'objective over-view' report and recommendation for action that is signed off by the Manager Parks and Gardens. Once the matter has been referred, the Manager Parks and Gardens will advise the resident in writing.

The Manager Parks and Gardens may liaise with the Director Environment and Infrastructure and consult with the resident or other interested parties in order to determine an outcome.

In situations where the Director Environment and Infrastructure does not support the removal or retention of a tree, the Manager Parks and Gardens will advise the resident in writing.

2.0 TREE RISK MANAGEMENT

Guiding principles

Public safety will be maintained through the use of generally accepted professional practices of tree evaluation and treatment in order to reduce risk associated with hazardous trees to an acceptable level.

- *Utilise a program of systematic tree assessment and best practice tree management to mitigate tree risk for residents and visitors to the City*
- *Maintain accurate and current documentation on the management of Council's tree assets*
- *Undertake proper selection, placement and planting of trees to reduce long-term risk*
- *Maintain high standards of tree management to current best practice and recognised standards*
- *Provide adequate resources to ensure proper tree management to mitigate risk potential*

2.1 Introduction & principles of tree risk management

A key issue confronting the community is how to manage an extensive tree resource, both from an ecological / landscape perspective and from a public safety standpoint of ensuring that reasonable care is taken to manage the risks associated with trees.

The City of Boroondara manages vast numbers of trees over a large area and within many varied landscape contexts. In the majority of cases, the sheer quantity of trees prohibits an individual tree assessment approach. The time involved in the inspection procedure and the works generated from such inspections would be extensive and prohibitively expensive for the community.

Consequently, a broader, systematic and proactive approach to tree assessment is required that prioritises works on hazard trees based on the establishment of tree risk. A tree risk management program provides a systematic process for scheduling and inspecting trees, enables the prioritisation of works based on perceived risk, and allows judicious use of community resources.

Tree risk management within the City of Boroondara encompasses a broad range of tree related issues. This section of the Tree Management Guidelines addresses the overall notion of tree asset inspection and management. Varying types of risk associated with trees and the City of Boroondara's processes for addressing these issues are included in other sections of the document, for example tree removal, tree pruning, species selection, tree planting and root and infrastructure conflicts.

2.2 Tree risk management procedure

The first step in a risk management program for public trees within Boroondara is to understand what the assets include and where the risks lie; secondly, to inspect the trees within the assets and perform maintenance to address the risk issues within a reasonable timeframe; and thirdly, to maintain a record of the inspections and the subsequent maintenance.

While it is not possible to avoid all risk associated with trees, it is possible to implement scheduled asset tree inspections in order to have a proactive tree management system that identifies and mitigates future incidents rather than a reactive system that attends to incidents as they occur.

The City of Boroondara uses a systematic process for the allocation of resources for the assessment and management of trees on Council managed land. It is cost prohibitive to continually assess and monitor all the trees. Rather, Council uses a system that prioritises tree assessments and maintenance works based on levels of risk. Based on these defined levels of risk a scheduled program of inspections is recommended, so that, given time, all sites within the municipality will have been inspected at varying levels of detail.

The scheduling of inspections does not negate the client request system available to residents and other stakeholders for requesting work on trees. The works produced from tree requests, once inspected, can be prioritised according to the level of risk.

Council managed facilities and properties that contain trees are allocated into risk zones. The zones, categorised as Very High Risk, High Risk, Moderate Risk and Low Risk, designate how these areas are to be treated with regard to the type and timing of scheduled tree inspections. The zones are based on the tree resource and the occupancy of the area surrounding the trees.

The risk zone determines the timing of scheduled tree inspections of Council assets; for example, Very High Risk zones require assessment every year, whereas Moderate Risk zones require inspection every 3-5 years. The method of scheduled inspection will also vary depending on the risk zone and asset type.

The first step is the inspection of the trees within the asset, which consists of either an on ground or drive-by/windshield visual inspection to determine if there are any trees that are hazardous and therefore, require maintenance works or a more detailed inspection. This inspection would be recorded on Council's Asset Management System.

The second step is to record and detail relevant information as to the location, species, size, health and structure of trees requiring maintenance works. This process involves a consistent, repeatable inspection process to identify and evaluate hazards within the trees. This assessment is also used for inspections performed through the works request system and for planning application requests. The tree inspection reports will also determine the priority for works required from the inspection.

Utilising this process, City assets containing trees will be inspected based on a scheduled basis. The inspections will generate maintenance works that will be prioritised. Priority for completing the works could vary within a site based on potential targets; for example, trees requiring work near facilities could be completed before those in open space or low use areas.

Implementation of scheduled asset tree inspections, with follow-up maintenance if required, shifts the activities of managing the tree resource from reacting to incidents as they occur, to proactive management to mitigate future incidents.

2.3 Identifying tree risk zones within the City

To assist the City of Boroondara with the prioritising of scheduled inspections, all Council assets with trees that require inspection are allocated into tree risk zones. The Senior Arborist will determine allocation of Council managed assets and facilities into risk zones and inspection frequency.

Determining the level of risk for each asset and therefore the corresponding zone is based on:

- Public use and occupancy patterns within public areas, which could be considered to be low, moderate or high;
- Tree resource characteristics, including tree condition, such as species characteristics or age, and location factors, for example the position of trees in relation to areas used by the public.

Table 1 presents the risk classification of assets within the City of Boroondara. The colour coding system of red, orange, yellow and green can also be plotted onto a map or GIS system to visually articulate the risk zones.

Individual assets may be classed into different risk categories from similar asset types based on further considerations, for example, the presence of known 'problem' species, declining tree populations, or different occupancy levels to similar assets.

Table 1: Tree risk zone categories (Adapted from Pokorny 2003).

Risk Zone Category	Parks	Municipal Properties
Very High Risk	High use areas within a park; <ul style="list-style-type: none"> • Playgrounds • Buildings • Picnic facilities 	Child-care centres Kindergartens Maternal & child health centres
High Risk	High-use parks and sports grounds	Council public car parks Senior Citizens Centres Aged accommodation, Respite & Day Care Centres Council Offices & Service Centres City Depots & waste transfer stations Community Halls
Moderate Risk	General parks Street trees	Car parks servicing moderate use public areas. Community/Neighbourhood Houses Libraries Public Toilet Blocks (other than those in high-use parks) Aquatic and Leisure Centres Tennis clubs, Bowling Clubs Guides / Scouts Clubs Accommodation houses Rental properties
Low Risk	Low use public areas with dispersed recreation, e.g. Walkways Easements Drainage Reserves Vacant land Open areas, riparian zones and peripheral areas with limited use and access	Low use Municipal properties Leased Office/property facility

2.4 Risk zones within parks and reserves

High-use parks will be inspected on a more regular basis than moderate to low use park. There will also be areas within particular open space (parks / reserves / sports grounds) that will present a higher risk due to tree type, condition and location. For example, trees around a playground, toilet block or car park, may present higher risk than trees on the periphery of the space, adjacent to semi-natural areas where occupancy rates are lower and targets are low.

Park facilities that attract high public use and are within the fall-zone of an adjacent tree will be inspected on an annual basis, e.g. playgrounds, pavilions and picnic facilities.

The general open space areas in high-use parks will be inspected on a two-year cycle. All areas within a site will be inspected at that time. Assessment of the trees and the level of work required will be based on the targets near the tree and the level of risk. A quantified assessment to establish tree risk can be used to determine risk thresholds.

2.5 Rating roads for tree risk

The risk management of street trees within roads is encapsulated within the routine tree maintenance cycle. The street trees located in the road reserve of every suburb are inspected and maintained on a two (2) year cycle.

The Contractors responsible for the management of street trees within the City, record details of street tree inspection and assessments.

Consideration is given to the road hierarchy, use and occupancy of the road, as well as the tree resource and expected management inputs.

Main roads and roads around commercial areas may need to be inspected on a more regular basis. The scheduling of inspections will take into consideration the tree condition and size, for example established avenues like Mont Albert Road and sections of Balwyn Road will be inspected on a more regular basis than Camberwell Road or Belmore Road, which have smaller, more recent plantings.

The Senior Arborist will determine scheduling of tree inspections on main roads.

2.6 Tree risk zone inspection schedule

Scheduling of asset tree inspections in the risk zones is based on the classification of each zone. Therefore, trees in municipal assets in Very High Risk zones are inspected more frequently than, for example, those classified into Moderate Risk zones.

The type of inspection for municipal properties, parks and reserves will primarily be via ground based visual assessments with follow-up detailed inspections if required. Initial assessment of roads will be via drive-by/windshield tree inspections. If potentially hazardous trees are identified by Council arborist's then more detailed tree inspection procedures would be implemented.

Table 2 recommends minimum guidelines for inspection schedules and methods for each risk zone.

Table 2: Tree risk zone assessment methods and inspection schedules
(Adapted from Pokorny, 2003)

Risk Zone Category	Timing of Inspections	Suggested Inspection Method
Very High Risk	Annual	Scheduled Tree Inspections Ground – municipal properties, parks reserves & roads Individual tree inspections
High Risk	1-2 years	Scheduled Tree Inspections Ground – municipal properties, parks reserves Drive-by/windshield – roads Individual tree inspections
Moderate Risk	3-4 years	Scheduled Tree Inspections Ground – municipal properties, parks reserves Drive-by/windshield – roads Individual tree inspections
Low Risk	5-7 years	Scheduled Tree Inspections Ground – municipal properties, parks reserves, vacant land, leased properties
All Zones	After severe storms	Resident observations & requests Scheduled maintenance programs Other Council employees Emergency services Community requests Individual tree inspections (if required)

2.7 Tree risk assessment methods

Tree inspections within the municipality will be undertaken by qualified and experienced arborists that can demonstrate good judgement based upon sound arboricultural knowledge utilising a range or combination of tree assessment methods dependent on condition of the trees, their location, land use and perceived risk.

The underlying principles of the tree assessment are reiterated in the Visual Tree Assessment (VTA) method developed by Mattheck and Breloer (1997).

The VTA is a method of evaluating structural defects and stability in trees. The first stage is the visual inspection of the tree for defect symptoms and vitality. If problems are suspected on the basis of symptoms a thorough examination is carried out. If a defect is confirmed it could be measured or further diagnostic work undertaken, for example testing the strength of the defective tree part, root plate investigation, or pathogen identification.

i) Drive-by / Windshield assessment method

The assessment of roads can initially use a drive-by / windshield inspection method. One person drives a vehicle slowly along the road while another person inspects and records the trees. Drive-by inspections could use two passes along the road. The first pass is to get a feel for the tree resource and the second to evaluate and record the trees that require work. Windshield surveys are most efficient when the arborist is looking for one or two particular tree characteristics.

The assessment aims to identify visual indicators of faults or road clearance issues, which suggest a tree requires further inspection. The method is limited in that it can only assess defects that are visible from the road, as only that side of the tree will be visible. Furthermore, even on the visible side, small defects, such as narrow cracks or girdling roots, may not be apparent. Rooney et al. (2005) compared the reliability of windshield inspections to walk through inspections. They found that the reliability of identifying highly hazardous trees with the windshield method was as high as 89%, but the inclusion of less hazardous defects decreased the reliability to as low as 58%. In short, the method is better in picking major, more visible hazards than minor hazards.

Given the resource limitations of some communities, drive-by / windshield inspections can provide a cost-effective approach to assess large areas or long sections of roadside vegetation. This method may also be useful after storms, where damage to trees or fallen branches may be visible from the road.

The main factor in deciding when and where to use the windshield survey is efficiency. Some limitations of the survey method are outlined below:

- The windshield survey works well in low-traffic areas as in high-traffic areas the drivers and assessors are concerned about the traffic. In high-traffic areas, walking or using other means, such as a bicycle to move from tree to tree, would be advisable.
- Poor weather conditions can limit visibility and delay assessment schedules.
- If the trees are not well maintained the method may not be suitable due to the volume of work it generates or that some tree defects may be missed, a thorough street tree inventory may be the best choice. If the trees are reasonably maintained, the windshield survey could be used just to locate quickly developing hazardous conditions such as hanging branches or recent storm damage.

The drive-by / windshield inspection method can also be used for regular update of streetscape conditions for the development of planting programs.

ii) Ground inspection assessment method

Ground inspections of trees can be used for scheduled tree inspections of Council managed properties and parks. The method can also be used to undertake more detailed inspections of street trees.

The process consists of a walk through inspection of trees located in a site. In remote sites it may only be necessary to inspect trees within striking distance of a target. The inspection is based on overt, visual indicators of faults that suggest a tree requires further inspection. Trees should be inspected from all sides for indicators of tree defects, not limited to (adapted from Pokorny 2003):

- Dead tree – a dead tree or branches.
- Decline – Reduced vigour, crown thinning or dieback.
- Decay – wood that has rotten or is missing from trunk or major structural branches, includes cavities, holes, open cracks, bulges or fungal fruiting bodies.
- Crack – a split through the bark into the wood where the wood has separated, in the trunk or major branches.
- Root problems – inadequate anchorage of the roots, includes dead, severed, decayed, or girdling roots, trunk lean, or evidence of soil root movement, soil movement or soil lifting.

- Canker – an area where the bark or cambium are dead on trunk or branches.
- Weak branch union - an epicormic branch attachment or branch union with included bark includes co-dominant stems or unions of large branches. Pronounced collar formation.
- Poor architecture – growth patterns indicate structural imbalance or weakness in the branch, stem or tree.

Other considerations are altered growing conditions, for example excavation, increased exposure.

This method may not detect all problems with all trees, yet it should identify the majority of major faults or those most likely to cause harm.

2.8 Additional inspections

If required, the initial tree inspection can lead to additional assessments, for example:

A quantified risk assessment, which involves recording of the target value and occupancy rates to determine a probability of harm;

- An aerial inspection of the tree crown;
- Root plate investigation;
- Diagnostic works, e.g. pathogen identification, decay detection.

2.9 Quantified risk assessments

It may be occasionally necessary to further define the level of risk using a numerical or quantified tree assessment method. This component can help identify acceptable risk levels and priority for action.

These detailed risk assessments estimate the degree of risk associated with a given tree to fail and potentially injure persons or damage property. There are many evaluation systems that rate the risk of damage or injury posed by a defective tree or tree part Paine (1971), Helliwell (1990, 1991), and Matheny and Clark (1994), Forbes-Laird (2007) and Ellison (2005). Some systems define a numerical risk value while others are categorical, e.g. low to very high.

As far as hazards are concerned, the need is to be able to quantify them and any associated risk, so that the risk can be kept within acceptable or reasonable limits, without implementation of disproportionate risk control measures, e.g. unnecessary tree removal. The use of quantification in the assessment of tree hazards will enable managers to operate, as far as is reasonably practicable, to a predetermined limit of reasonable or acceptable risk.

Once a threshold has been reached, according to a particular risk assessment method, action can be instigated to mitigate the risk or the quantified level of tree risk can be presented to appropriate Council Officers for a decision on the management of the tree.

Tree risk assessment methods generally consider three components of tree failure: risk-target value, probability of failure, and impact potential.

All tree details and risk assessment information is to be documented.

2.10 Programming works

Tree maintenance generated through the tree risk management process will be recorded and scheduled for works. Trees recommended for removal will be subject to the tree removal procedures outlined in Section 3.

Completed works will be documented and recorded with the asset tree inspection details.

2.11 Emergency work - Immediate hazard

Emergency work is defined as tree removal required due to the immediate risk of damage to property or personal safety as deemed by a suitably qualified person. A tree must only be removed as emergency work if it is considered to be hazardous or structurally unsound and is likely to fail in the near future and there is a potential target.

A record of trees removed under the emergency work provisions will be maintained to ensure replanting occurs, where replacing is appropriate.

Notification of nearby residents may be required in accordance with **3.8 Notification of removals / works to residents and committees.**

2.12 Documentation systems

The key to the success of tree risk management program is accurate and current documentation. Accurate recording of all aspects of Council's tree assets provides management with clear information on the resource being managed and enables the tracking of issues related to specific trees.

Council will develop and implement recording systems either in line with current systems, for example the Asset Management System, or independently to document and record information related to the tree asset. The system should address the following requirements:

- A clear documented procedure for inspection of assets and trees detailing relevant information as to the location, species, size, health and structure of public trees within the City.
- A documented system of logging customer requests or notification of problems with respect to public trees.
- A documented system for assessing the risk posed by trees identified and prioritising the risk posed by such trees.
- A documented system for addressing the risks posed through appropriate maintenance procedures for abating risks identified consistent with the general financial constraints upon the authority having regard to its general responsibilities.

Adapted from Gardner (2005)

2.13 Method of review

In line with AS/NZS 4360:2004 (Risk Management) ongoing review is essential to ensure that tree risk management remains relevant. Factors that affect the likelihood of inspection activities may change, for example, severe drought may cause rapid tree decline prompting the need for more frequent inspections. Similarly, knowledge

gained through experience and implementation of tree management could provide beneficial insights and allow refinement of tree risk management.

Monitoring and review also involves learning lessons from the risk management process, by reviewing events, the treatment plans, and their outcomes.

The tree risk management program will be reviewed every five years. The process will include reassessment of Council's asset classification into risk zones, and evaluation of the tree inspection and assessment methods and recording processes.

3.0 TREE REMOVAL

Guiding principles

The City of Boroondara will seek to avoid tree removal wherever possible. Tree removal is an acceptable management option in road reserves, parks and other Council managed land when required for public health and safety, to protect infrastructure, to facilitate approved development and infrastructure improvements, to maintain a healthy urban forest or for ecological restoration.

Tree removal in road reserves, public open space and Council managed properties will meet the following objectives:

- *Council will investigate all tree management options prior to the recommendation for tree removal.*
- *Council will consider the removal of trees where necessary in order that the City's landscapes are reinvigorated and maintained with regard to safety.*
- *In all cases, tree removals will be conducted within the procedures outlined and in regard to tree assessment and risk management procedure (See section 2) and with minimal environmental impacts.*
- *Council will consult and inform the community about all major projects involving tree removal.*

3.1 Introduction

This policy for the removal of trees on Council managed land (parks, reserves and road reserves) for the City of Boroondara is to be referred to by all Council officers when assessing a proposal for tree removal.

All avenues and stands of trees have a finite lifespan and at some point in time trees need to be removed and replaced. As trees age they require more and more management to maintain them in a reasonably safe and attractive condition. Consequently, a difficult decision has to be made about how to manage mature trees and avenues, including how, when and over what period of time to replace old or declining trees.

Significant reductions of mature trees would not be generally considered as good practice or acceptable. It is also not good practice to artificially keep trees in a position that they are clearly unsuitable for.

Trees provide many benefits but in all situations close to people or property, safety must be the priority consideration above economics, amenity or sentiment. In addition, managers of public open space have a duty of care under law to ensure that a reasonable degree of safety is maintained. The measure for action is hazard potential.

Risk potential is related to the tree/tree part size, tree structure/hazard and the number of targets that it could hit. As trees grow bigger their potential to cause damage increases; as tree structure becomes more suspect so the probability of failure increases; as the number and value of targets that could be hit increases so the potential cost of damage or injury increases.

All trees are capable of shedding branches and no guarantee of absolute safety can ever be given to a living dynamic organism. It would be unreasonable and unnecessary to remove every tree on the basis that it may have the potential to cause harm or damage.

The priority when managing trees with a high hazard potential should be to reduce the risk to an acceptable level or to mitigate it entirely. This can be achieved through removing the tree, removing the targets or treating the tree.

Removing targets from beneath established trees is often impractical, particularly in a street situation. It may be possible to barricade a tree located in public open space with suspect structure to restrict access thus eliminating target potential.

Treating the tree can include canopy management techniques such as reduction pruning, crown maintenance and the installation of hardware to reinforce or arrest failing structures.

All tree management options will be investigated prior to the recommendation for removal.

3.2 General guidelines for tree removal

A set of tree removal criteria is used to prevent indiscriminate removal. Wildlife habitat is considered a factor in making all tree management and removal decisions.

Trees and groups of trees may be removed only when one or more of the following criteria are met:

- The tree or tree group poses a severe safety hazard that cannot be corrected by pruning, transplanting or other treatments. The tree risk assessment and Council's Risk Management Officer perceives an unacceptable risk.
- The tree or tree group severely interferes with a neighbouring tree or tree group to the extent that neither tree can develop to its full potential. The more desirable tree will be preserved.
- The aesthetic values of the tree or tree group are so low or negative that the site is visually enhanced by the trees removal.
- Trees or tree group is dead or close to death.
- The tree or tree group poses an extreme public nuisance because of its species, size, location or condition. The nuisance could be caused by excessive fruit or seed drop, suckering, harbouring of insects or excessive twig or limb breakage.
- Work improvements or infrastructure repair or maintenance required to be made around the tree or tree group will kill or render the tree a hazard or significantly impact on the trees condition and useful life expectancy.
- The tree may be found to be substantially contributing to damages or nuisance to public or private property and no other viable means are available to rectify the situation.
- The tree or tree group is infected with an epidemic insect or disease where the recommended control is not applicable and removal is the recommended practice to prevent transmission.
- The tree or group of trees is a recognised woody weed species.
- The tree or group of trees is included in the Street Tree Replacement Program (See section 5.4.2)

The tree or tree group needs to be inspected and assessed for the above criteria by a suitably qualified person. Tree health (vigour), structure, useful life expectancy, and hazard potential must be assessed.

3.3 Tree removal associated with allergic reactions

Trees can cause allergic reactions to people. Examples of tree taxa include the plane tree, cypress, silver birch, maple, olive, pine, poplar, ash, wattle, tea-tree and oak (Allergy Net Australia, 2002), which are all commonly grown ornamental trees in Melbourne.

In relation to vegetation and pollen production the pasture grasses and weeds are the worst offenders. Melbourne has millions of hectares of grassland to the north, and spring in Victoria is characterised by hot, gusty northerly winds, which carry the pollen over Melbourne.

Melbourne can become quite polluted, as it is a large city with a great number of cars and a great deal of industry, particularly to the west. This type of pollution has been shown to increase allergies.

In order to clarify the cause of personal allergies there should be a requirement to undertake scientific/medical testing to ascertain the causal agents of the allergies. A reaction to these tests however, does not necessarily mean the substance reacts in the lungs (Asthma Victoria, 2001) and may not provide definitive answers as to the cause of the allergy.

It would seem that the removal of problem trees alone would not solve the problem of allergenic reactions within people. There are simply too many other species of plant that cause the same responses and there are extenuating circumstances in Melbourne that can exacerbate the condition.

Therefore tree removal will be considered when:

- medical testing indicates a particular tree species growing on Council managed land is causing the allergy; or
- Council's Risk Management Officer perceives an unacceptable risk; or
- the tree fulfils one of the criteria under **3.2 General guidelines for removal** in this policy.

3.4 Tree removal associated with infrastructure improvements by Council or other authority

There will be instances where utility companies, Council and other public authorities require the removal of trees to facilitate the construction of new infrastructure or the maintenance of existing infrastructure.

As part of a consultation process with the relevant authorities or Council department, design and construction alternatives should be sought.

If alternatives cannot be established and the project cannot be reasonably re-routed away from the tree(s) and the infrastructure works require the removal of the trees or the works will have detrimental impact on the health and structure of the trees, residents visually affected by the tree removal will be notified of the proposed tree removal as outlined in **3.8 Notification of removals / works to residents and committees**.

3.5 Unauthorised tree removal

If a Council managed tree or group of trees is removed by any person or authority without Council authorisation, that person or authority may be subjected to

enforcement action under the jurisdiction of the City of Boroondara Local Law. That person or authority shall also meet the full cost of reinstatement (purchase of an advanced tree, tree planting and a minimum two-year tree establishment period) of the tree within the landscape. See Section 13 – **Tree Valuation**.

3.6 Planning Scheme Overlays & Provision 52.17 - Native Vegetation

The Boroondara Planning Scheme has three Overlays and one particular Provision within the municipality that applies to vegetation.

The Overlays are located primarily along the banks of the Yarra River from Balwyn North, Kew through to Hawthorn. The Overlays are as follows:

- Significant Landscape Overlay (SLO)
- Environmental Significance Overlay (ESO)
- Vegetation Protection Overlay (VPO)

A permit is required to remove destroy or lop vegetation as specified in the Overlay. Exemptions apply.

Provision 52.17 - Native Vegetation applies to all areas within the City that have a cumulative area greater than 0.4 hectares. The provision focuses on the retention of Victorian Native species and offsetting what is removed. Exemptions apply.

When required, Parks and Gardens will consult Statutory Planning for advice and direction when removing vegetation in these areas.

3.7 Procedures for tree removal

3.7.1 Removal requests

Tree removals may be generated through either Council Officers and approved Parks and Gardens contractors as part of on-going maintenance works and inspections or via residents.

Residents may request a tree removal by contacting Parks and Gardens. All requests for tree removal shall be recorded, inspected and assessed by a suitably qualified person.

3.7.2 Approvals

All approvals for removal of a significant tree or non-significant tree on Council Managed Land shall be authorised as outlined in 1.4.2 and 1.4.3.

Where removal is not justifiable because a tree does not meet one of the criteria under **3.2 General guidelines for tree removal** in this policy and a member of the community insists on such action, a standard format letter of refusal is to be sent by the Senior Arborist.

3.7.3 Appeals

Residents or other interested parties may appeal a Council Officer decision to have a tree removed or retained on Council Managed Land.

If a resident or other interested party insists on the removal or retention of a tree despite advice and assurances from the Senior Arborist or delegated officer(s) that the contrary or an alternative is more appropriate, this request must be in writing and addressed to the Manager Parks and Gardens. Following receipt of the written request, the Manager Parks and Gardens shall initiate the appeal process as outlined in section 1.6.

3.7.4 Costs of tree removal

Costs for the removal of a tree that complies with the **General guidelines for removal** shall be borne by Council.

If through an appeal process (See section 1.6) a healthy tree located on Council managed land is approved for removal and its condition does not comply with any of the **General guidelines for removal**, in the majority of instances, the party requesting the tree removal will incur the full cost imposed upon Council for the tree's removal, purchase of an advanced tree, tree planting and a minimum two-year tree establishment period. See Section 13 – **Tree Valuation**.

The costs assigned to the value of a tree will be established by Council, based on current suppliers of such goods and services. Planting of a replacement tree ensures no net loss of Council managed trees.

Application of the City of Boroondara Amenity Value Formula may also be applied in some instances. The Amenity Value Formula can be seen in Appendix 7.

3.7.5 Request / response times

Requests shall be actioned within the following time frames;

- Imminent danger - immediate action
- Identified as hazardous - 2 working days
- Require removal, but not hazardous - as soon as possible
- Stump removal - within 4 weeks of tree removal.
- Tree replacements - the following planting season.

3.7.6 Inspection of a hazardous tree

All Council trees reported as being unsafe or hazardous by the public or identified as being of concern by staff are to be inspected by an appropriately qualified and experienced Arborist.

3.7.7 Records

If a significant tree (See 1.4.2) is removed, a tree inspection report, including photographs and the details of the removal are to be entered into Council's Asset Management System. The report and photograph is to be maintained for a period of no less than (12) twelve months.

3.8 Notification of removals / works to residents and committees

The Notification to relevant committees or residents of any proposed action must include details of relevant arrangements for stump removal, site reinstatement and tree replacement.

In emergency situations notification prior to removal may not be possible, but follow-up advice, including notification details, must occur within one (1) workday.

3.9 Notification for Non-Significant Trees

3.9.1 Road Reserves

At the time of tree removal works being undertaken in a road reserve, the resident immediately adjacent to the site is to be given written or verbal notice of the proposed action including arrangements for stump removal, reinstatement & tree replacement.

3.8.2 Parks, Reserves and other Council Managed Land

No resident, management or Park Committee notification is required for the removal of Non-Significant trees in parks, reserves and other Council managed land.

3.10 Notification for Significant Trees

3.10.1 Road Reserves

Prior to the works being undertaken in a road reserve, residents immediately adjoining or adjacent to the site ("visually" affected by the trees removal) are to be given no less than fourteen (14) days written notice of the proposed action, including arrangements for stump removal, reinstatement & tree replacement.

When more than 30% of street trees are to be removed from a given street or location and their removal may impact upon the wider community the following will apply.

- Resident and Ward Councillor notification will be undertaken as above.
- Signage, that explains the reason/s for tree removal and providing Council contact details for further information, will be erected no less than fourteen (14) days prior to the proposed works occurring. Size of signage will be:
 - A2 – Residential Streets;
 - A1 – Main & Secondary Roads.

3.10.2 Parks, Reserves and other Council Managed Land

Prior to the work being undertaken in parks, reserves or other Council managed land, any Park Committee, Friends of Group or residents immediately adjoining or adjacent to the site ("visually" affected by the trees removal) are to be given no less than 14 days written notice of the proposed works, including arrangements for stump removal, reinstatement & tree replacement.

When the extent of tree removal works are significant enough to have an impact upon the wider community, signage that explains the reason/s for tree removal and providing Council contact details for further information will be erected no less than 14 days prior to the proposed works occurring. Size of signage will be a minimum A3.

When considerable community concern is expressed following notification of the removal of a tree or group of trees, the Senior Arborist will refer the matter to the Manager Parks and Gardens.

- The Senior Arborist will provide a brief 'objective overview' report to the Manager Parks and Gardens that describes the arboricultural issues concerning the removal of the tree or group of trees
- The Manager Parks and Gardens will either base his/her decision upon the information contained within the report from the Senior Arborist or,

- determine to obtain an independent report from a qualified arborist to confirm the arboricultural issues or,
- refer the matter to the Director Environment and Infrastructure for review in accordance with this policy.
- The Manager Parks and Gardens will inform the Ward Councillor of the issues regarding the tree removal or retention.

A public meeting may result dependent on the community response where the issues associated with the proposed works will be presented. Proposed tree removals may be part of a broader landscape concept plan in which case other representatives of the project can be present to convey their particular views of the works.

The decision to hold a public meeting will be at the discretion of the Manager Parks and Gardens in accordance with Council's commitment to community consultation and engagement.

4.0 STREET TREES AND NEW VEHICULAR CROSSOVERS

Guiding principles

- *Application for the construction of a vehicular crossover must be in accordance with Council's Vehicular Crossover Policy for Individual Residential Property Titles.*
- *Street trees shall not be removed to accommodate a new or altered vehicular crossover unless they meet one of the criteria under **3.2 General guidelines for tree removal** in this policy.*

4.1 Investigation into potential impacts on street trees from new vehicle crossovers

In accordance with Council's Vehicular Crossover Policy for Individual Residential Property Titles, the minimum distance (separation) from the edge of a new proposed crossover to existing street trees is 2.0m.

In some instances, the minimum distance of 2.0m may be increased at the discretion of the Senior Arborist or delegated officer(s). Typically, this will occur where the subject tree is identified as a significant specimen (See section 1.4.2) or part of a significant treed avenue and tree health is likely to be compromised by the proposed crossover.

A non-destructive root investigation may be required to ascertain potential impacts to an established street tree as a result of a new vehicle crossover.

The aim of a non-destructive root investigation is to ascertain the extent of major roots in the vicinity of a proposed new vehicle crossover while minimising the damage to the root system. Non-destructive root investigations can be undertaken utilising hand digging, or hydraulic and/or pneumatic excavation equipment.

The recommendation to undertake such works will be made by the Senior Arborist or delegated officer(s).

The cost of a non-destructive root investigation will be borne by resident and/or developer requesting the new vehicle crossover.

If Council determines that the works have the potential to damage community owned assets, in this case street trees, Council will require that an Asset Protection Permit be obtained prior to the work commencing.

4.2 Transplant/Relocate existing street tree to accommodate new vehicle crossover

It may be possible to transplant/relocate an existing street tree to accommodate a new vehicular crossover. This will only be applicable to a tree that has been planted within the last two years.

The potential to transplant/relocate an existing street tree will be based on the opinion of the Senior Arborist or delegated officer(s).

The tree will be relocated to an agreed location on the naturestrip outside the subject property. If an appropriate site on the naturestrip outside the subject property is not feasible, the tree will be planted elsewhere in the same street or local neighbourhood.

Tree transplant/relocation will be subject to the following terms:

- All works associated with the tree relocation and tree establishment to be undertaken by Council. All costs incurred by Council for this work will be borne by the property owner/developer.
- Tree relocation can only be undertaken between June and September incl. If it is a requirement of the project to have the tree relocated outside this period, a refundable bond of \$1,000 incl GST is to be paid to Council. This bond is in addition to any other such bond or arrangement that the property owner/developer may have with Council regarding the project. If tree establishment is successful, the bond will be refunded at the conclusion of a minimum two-year tree establishment period.
- Should the tree not successfully establish during the two-year tree establishment period, an amount equal to that of the cost to Council for the removal of the existing tree, site reinstatement, purchase and planting of an advanced replacement tree and two-year maintenance period of the replacement tree will be withheld from the bond.
- The property owner/developer shall complete a Street Tree Relocation/Removal form and present with payment to Council's cashier prior to any works commencing.

5.0 TREE SELECTION, PLANTING AND ESTABLISHMENT

5.1 Tree Selection

Guiding principles

- *Select tree species for planting based on their suitability for the site, performance, and potential to contribute to landscape character meeting aesthetic and ecological requirements without onerous management implications.*
 - *Tree species selection in heritage gardens will be consistent with the style of each of these gardens;*
 - *Planting of exotic tree species will continue in areas of open space primarily dominated by exotic species;*
 - *Native and indigenous species will be used appropriately considering the pervading landscape context of a given open space;*
 - *In open space with a mix of exotic, native or indigenous tree species, this theme may be maintained or a particular theme reinforced; and*
 - *Indigenous species will be planted in nominated biodiversity corridors, appropriate areas of open space and adjacent to water courses.*
- *Consideration will be given to the appropriateness of continuing with the current practice of planting primarily exotic, deciduous street tree species. While the general landscape character throughout much of the city's streetscapes is currently dominated by this style of planting, future tree selection will consider the City's landscape character in-line with issues pertaining to water restrictions and climate change.*
- *Set and maintain high tree planting and establishment standards.*

5.1.1 Introduction

The issue is the right tree for the right place with due consideration given to aesthetic/design requirements, biological criteria (i.e. tolerances) and functional criteria (management issues). There is no one perfect tree. The most successful course is to match the planting site limitations with the right tree for that site.

If there is no one perfect urban tree, it is also important to understand that there is no one urban environment. The urban environment is a varied conglomeration of microclimates. Above ground or below ground site conditions can change dramatically within the space of a few metres. Consequently, a site analysis of each major planting site will allow more appropriate tree selections.

Appropriate site assessment and tree selection can have the following benefits:

- Mitigate conflicts between tree roots and adjacent infrastructure/buildings.
- Reduce the incidence of pest and disease outbreaks. This can be achieved through selecting resistant varieties of trees and increasing species diversity through the City.
- Increase plant performance by attributing species to particular soil conditions.
- Increased tree longevity so that tree benefits exceed the costs. The benefit of an urban tree is directly proportional to its crown size or volume and longevity in the landscape.

- Reduced maintenance costs, e.g. pruning requirements can be reduced by selecting smaller trees under powerlines or narrow canopy form for busy roads.
- Attractive streetscapes that reinforce the pervading landscape and architectural character.
- Reduced environmental demand - trees that have tolerance of drought and generally not require additional resource inputs, e.g. fertiliser or irrigation, in order to perform satisfactorily.

Tree selection will take into account relative plant tolerances and adaptability, and integration into surrounding planting themes.

Procedural solutions such as the detailed review of horticultural, arboricultural, planning and historical literature associated with the proposed planting site will also be considered.

5.1.2 Tree selection

The basic issues regarding tree selection are as follows:

- Biological requirements relate to a trees ability to tolerate urban conditions. The species selected should have high tolerance levels that will allow establishment and sustained growth while producing desired benefits with low management inputs. It also relates to available root space to sustain the potential tree size.
- Ecological issues include tree diversity, maintaining and enhancing existing significant areas of native and remnant indigenous vegetation. Selecting plants that do not have the potential to become woody weeds and impact on natural systems.
- Functional and spatial issues include the trees ability to be pruned so as to provide required clearances. It also relates to the trees root system and its limited impact on adjacent infrastructure. Certain species have been identified as more problematic than others in causing pavement damage.

The following species should not be used in narrow planting spaces and in paved pedestrian areas: Ash (*Fraxinus* spp.), Black Locust (*Robinia pseudoacacia*), Elm (*Ulmus* spp.), Eucalypt (*Eucalyptus* spp.), Paperbark (*Melaleuca* spp.), Plane (*Platanus* spp.), Pyramid Tree (*Lagunaria patersonia*), Sweet Gum (*Liquidambar styraciflua*), Poplar (*Populus* spp.) and Willow (*Salix* spp.).

- Aesthetic issues consider the ability for trees to enhance the visual amenity of a streetscape or area, without negative impact to surrounding infrastructure.
- Health considerations. Species selection will utilise trees that have no known or low levels of toxic or allergenic characteristics.
- Tree longevity should also be considered as the longer a tree is allowed to grow in a site the greater the benefits to the landscape and return on initial investment the trees will have.
- Availability. Street tree species selection in particular, will need to consider their commercial availability in order to provide the desired numbers and size for tree planting programs.

5.1.3 General guidelines for tree selection

The City of Boroondara is renowned for the rich diversity and maturity of trees within its streetscapes and open space and we are fortunate to have benefited from the foresight and vision of previous generations' tree plantings.

The pervading landscape character of the City's private and public land is comprised of primarily exotic, deciduous species throughout much of the municipality. Our predecessors planted these trees during a time that plants originating from the northern hemisphere formed the basis of most private and public landscapes.

Future tree selection will consider the importance of preserving and enhancing this character however, as a result of climate change, the appropriateness of continuing with this style of planting style will need to be considered.

The City is fortunate to have a number of heritage gardens and it is intended that future tree species selection will be consistent with the style of each of these gardens. Planting of exotic tree species will continue in areas of open space primarily dominated by exotic species.

Native and indigenous species will be used appropriately considering the pervading landscape context of open space and streets where the landscape is dominated by like vegetation or where there is strong community support.

A mix of exotic, native or indigenous tree species can be found in many areas of open space throughout the municipality. Future tree planting may continue to maintain this mixed theme or, based on community support, reinforce a particular tree species theme.

Throughout Boroondara, there are a number of important areas of remnant indigenous vegetation. Indigenous species will be planted in nominated biodiversity corridors (see Biodiversity Corridors Plan) open space and adjacent to water courses. If appropriate, planting of indigenous species shall be encouraged in streetscapes adjacent to nominated biodiversity corridors and water courses.

Species of tree will be selected that have moderate to high tolerance of stress with regard to general climatic suitability, soil oxygen levels, soil compaction, drought, pest and diseases, high wind and atmospheric pollution.

Species will be selected that do not require excessive resource input to maintain them in a safe and aesthetically pleasing manner. Tree species known to cause excessive damage to infrastructure will be avoided unless the species is already established as part of an existing avenue planting.

Species will be selected that can maintain spatial constraints within a street, e.g. pedestrian and vehicle clearances, overhead powerline clearances, root volume restraints, hard surfaces, and underground services. This may differ where cyclic crown modification works are undertaken to maintain the planting in line with design intent, such as regular clipping of topiary plantings in commercial areas.

Using tree species that are known to have low or manageable litter drop, such as leaves, flowers, fruit and bark.

Using tree species known for their structural integrity and planting of tree stock that have received appropriate formative treatment whilst in the nursery.

New nursery techniques and processes are providing new tree varieties into the market. These techniques are developing new native selections in particular that are generally more compact than the species and suitable for planting in a wide range of landscapes. These trees will be trialled and used appropriately.

A table of trees suitable for planting within Council's streets and parks and reserves can be seen in Appendix 1.

5.2 Tree Planting

Guiding principles

The City of Boroondara will proactively carry out tree planting in road reserves, open space and other Council managed land to meet the following objectives:

- *To preserve and enhance the local character of the distinct areas within the City;*
- *Where opportunities present, Council will endeavour to increase the number of trees within the City's streets and other Council managed land;*
- *To plant appropriate species that meet aesthetic and ecological requirements without onerous management implications; and*
- *Council will consult and inform the community about all major projects involving tree planting.*

5.2.1 Introduction

Trees are a dominant component in the landscape and one of the most effective ways to improve the image and landscape character of a city is to upgrade street tree and public open space planting.

The community's appreciation of trees and the environment is increasing and the overriding positive role of street trees in Boroondara is accepted. Trees provide a wide range of important benefits to the Boroondara community and visitors alike.

The introduction of new trees to a city's streets can be considered one of the simpler horticultural tasks for open space managers; however trees create a long-term impression in the landscape and can alter the identity of the landscape and impact on management practices and subsequent resource allocation.

There are different programs for tree planting within the City of Boroondara as set out below.

5.2.2 Infill Tree Planting Program

The objective of this program is to reinforce an existing consistent street tree theme within a street.

The City of Boroondara is fortunate to have benefited from the foresight and vision of previous generations' street tree plantings. These plantings are well established and the "theme" (streetscape character) of much of the municipality has been set.

Infill tree planting along the city's network of main roads will be undertaken in accordance with the 'Streetscape Planting Strategy – Main Roads'. This Strategy was initiated in August 2001 and provides a consistent and structured framework for enhancement of the City and defines appropriate street tree species for planting along identified main roads. The character of the area through which the road passes is enhanced and once planted, will provide a reference for species selection within nearby residential streets.

When determining the suitability of the existing street tree theme, consideration will be given to the site limitations that exist within the street and the appropriateness of continuing with this theme. If the existing theme is considered to be inappropriate and an alternative tree species can satisfactorily maintain the streets character, it shall be planted as the preferred street tree species.

Individual infill street tree plantings occur throughout the municipality for the following reasons.

- A replacement for a tree removed as part of normal maintenance.
- A resident request to have an individual tree planted outside their property where sufficient space permits.
- Council officer or resident request to plant available spaces within a street in order to complete the tree avenue/streetscape.

Trees are usually planted within a turfed naturestrip or within a sealed pedestrian area. All street trees that are removed shall be replaced unless site restrictions deem the planting of a tree to be inappropriate. See **5.2.6 Existing Street Features Restrictions**.

5.2.3 Street Tree Replacement Program

The objective of this program is to replace poor streetscapes and develop significant avenues throughout the municipality.

This program is efficient and effective in developing significant avenues by providing continuity of species type and size, focus of resource and standardisation of management practices. Resident perception of the finished product is high and the impact that the trees have upon the landscape once established, is pronounced.

The program can result in the sudden change of visual amenity of the streetscape and may create community discontent. Consequently, rigorous community consultation is required.

Streets are nominated for inclusion in this program following a request from a resident or group of residents or a Council officer.

This program gives priority to streets with trees that are:

- in decline;
- pose a high hazard potential;
- not performing (growing to expectations) and infill planting will not improve the streetscape; or
- impacting on adjacent infrastructure and potential for local community derision, statutory breach or litigation for damage or injury is high.

Nominated streets are assessed and rated against the following criteria.

Criteria	Scoring system	Score
1. Professional opinion of necessity of new street tree planting	A. High priority <i>(existing trees senescent/few existing trees and no limiting factors)</i>	10
	B. Medium priority <i>(opportunities for substantial planting)</i>	4
	C. Low priority <i>(existing streetscape reasonable but requires enhancement)</i>	1
	D. No opportunity to plant trees	0
2. Unity of residents to principle of removing existing trees & planting of new trees (<i>deemed from petition or group letter</i>)	A. Majority of residents included in petition/group letter	5
	B. No united approach from residents	0
Highest Possible Score		15

Streets that receive the highest score are included in the Street Tree Replacement Program for the current financial year.

As new streets are regularly added to the program and all listed streets are assessed and prioritised annually, no preference is given to the length of time a street is listed. There is no maximum period that a street can remain on the program.

The majority, if not all the existing trees within a street are removed and replaced with an appropriate species. Residents are given the opportunity to choose the preferred street tree from a selection of trees that are in keeping with the character of the area and appropriate to the size/available space of the planting site.

5.2.4 Main Road Tree Planting Program

The objective of this program is to develop significant tree lined avenues along the cities main roads.

The City of Boroondara has a 'Streetscape Planting Strategy – Main Roads', adopted in 2001. This Strategy provides a consistent and structured framework for enhancement of the city and defines appropriate street tree species for planting along identified main roads. The character of the area through which the road passes is enhanced and once planted, will provide a reference for specie selection within nearby residential streets.

This program is ongoing and undertaken in accordance with the recommendations of the Streetscape Planting Strategy – Main Roads.

5.2.5 Street Tree Planting

The aim is to plant trees at regular intervals and at a density that will provide a sense of continuity and scale to the streetscape.

Where reasonable, one tree will be planted in front of each property within the City. The growth characteristics of the tree and the capacity of the street will also determine spacing.

Other considerations include:

- private or other vegetation exists to the road reserve precluding the growth of a street tree; and,
- established planting theme or available space (long naturestrip or corner allotment) allow for more than one tree per property.

A common sense approach should be adopted at all times.

5.2.6 Existing Street Features Restrictions

Trees should be located as per the following criteria.

- Minimum of 2.5 metres from driveways, laneways, bus and tram stops/shelters.
- Minimum of 3.0 metres from electricity poles.
- Minimum of 15.0 metres from intersection in residential streets except in quieter residential streets where visibility may not be a problem.
- Minimum of 18.0 metres from streets intersecting with a main road.
- Minimum of 2.0 metres from hydrants or drainage pits.
- Minimum of 2.0 metres from beneath service wires.
- Minimum of 10.0 metres from a Stop or Give Way sign.
- Trees are not to be located over incoming gas and water services.
- Trees are not to be located where private overhanging trees will significantly reduce their health, vigour or shape or where foliage from the mature street tree will impinge upon traffic signals.

Where naturestrips do not exist, street trees can be planted within pedestrian areas where a minimum of 1.5m width can be maintained. No new tree planting shall be undertaken in streets with a pedestrian area less than 2.1m wide, i.e. the distance between the back of kerb and the property boundary.

Replacement planting will occur where street trees currently exist in a pedestrian area less than 2.1m wide.

No new tree planting shall be undertaken within the carriageway unless Council adopts a designed solution.

Species of tree will be commensurate with the width of the naturestrip. Large trees, e.g. *Platanus* spp. (Plane Trees), *Liquidambar styraciflua* (Sweet Gum) require a minimum 3.0m wide naturestrip to offset infrastructure impacts.

Species of trees planted in streets should be able to be pruned to a single trunk or have a clear trunk to minimum height of 1.5m for visibility.

5.2.7 Park Planting Program

The objective of this program is to establish or reinforce the presence of a tree canopy within a Council managed park.

Tree planting occurs for the following reasons.

- A replacement for a tree removed as part of normal maintenance.
- A resident request to have a tree planted.
- Council officer or resident request to plant trees.
- As part of a park upgrade or Master Plan of the individual park.

Using good design principles, the aim is to plant trees that will establish or reinforce the presence of a tree canopy within a Council managed park.

Tree selection will be based upon the requirements of the Council managed park and the required characteristics of the tree species as determined by Parks and Gardens, in consultation with the community.

Throughout Boroondara, there are a number of important areas of remnant indigenous vegetation. Indigenous species will be planted in nominated biodiversity corridors (see Biodiversity Corridors Plan) open space and adjacent to water courses.

A common sense approach should be adopted at all times.

5.2.8 Existing Council Managed Park or Features Restrictions

Tree location should consider the mature dimensions of the canopy height and width, trunk diameter and root development requirements to ensure that they do not have an eventual impact upon Council or privately owned infrastructure.

Trees should be located as per the following criteria.

- Minimum of 2.5 metres from park furniture, paths, driveways and laneways.
- Specimen trees shall be planted a minimum 5.0 metres from adjoining properties and Council buildings.
- Minimum of 3.0 metres from electricity poles.
- Minimum of 2.0 metres from hydrants or drainage pits.
- Minimum of 2.0 metres from beneath service wires.
- Trees are not to be located over incoming gas and water services.
- Trees are not to be located where private overhanging trees will significantly reduce their health, vigour or shape.

5.2.9 Planting stock

Trees will be planted in line with best practice and an after-care maintenance program implemented so as to achieve a successful tree establishment rate of greater than 80%.

Appropriately sized planting stock will be selected for each site. It should be noted that the larger the size of the transplanted tree, the longer tree establishment takes in the new landscape. There is a compromise between super advanced stock and stock that is smaller in size yet is more vigorous and establishes quicker. Planting stock size will dictate the resources required for achieving successful establishment.

The height of planting stock is dependent upon stock availability but is usually between 1.5 metres and 2.8 metres tall.

Should a resident insist upon tree stock that is larger than that usually planted by Council, the resident shall pay all costs above those normally incurred by Council for the supply, planting and post planting establishment of the tree.

5.2.10 Tree Planting by Residents

Unless Council approval is obtained, residents are not permitted to plant trees and shrubs within the naturestrip or other sites within the road reserve. Council may remove such plantings and no compensation will be available to residents for the removal of these trees and large shrubs.

Residents are not permitted to plant trees and shrubs within a Council managed park without Council approval. Council may remove such plantings and no compensation will be available to residents for the removal of these trees and shrubs.

Where there is existing vegetation at a planting site that has obviously been planted by the resident, Council's Tree Planting Contractor shall make all attempts to notify the resident that the unauthorised vegetation will be removed in order to undertake planting of the Council nominated tree.

5.3 Tree Establishment

The importance of after-care tree maintenance requirements cannot be over stressed. If undertaken correctly, this facet of the tree planting process can greatly increase the success of the planting.

Mulching is particularly important for successful tree establishment. Mulching reduces weed competition, enhances root growth, prevents soil compaction (improved aeration) and maintains a more constant moisture gradient by reducing evaporation.

Mulch shall be maintained at the base of each tree for a minimum two years after planting. Mulch should be no more than 100mm in depth and should cover a circular area of 60cm for every 2.5cm of trunk diameter. Mulch shall be of a type with large particle size.

A regular watering program is required to ensure tree establishment. Monitoring of watering requirements is necessary to ascertain plant needs and watering frequency. This can be dependent on climatic and site conditions. Specific recommendations for watering are impractical due to the enormous variety of situations and tree requirements. A variation in watering requirements within the individual road sections of the City is expected.

Watering will continue for 26 weeks with three watering cycles per fortnight over the warmer months (October to March) and ongoing monitoring during the cooler months with supplementary watering when required.

During periods of water restrictions, recycled A class water will be used upon all recently planted trees for the duration of the two-year tree establishment period.

A program of tree establishment and after-care maintenance that includes watering, mulching and weed control will extend for a minimum two years after planting. The period of after-care maintenance may be extended, depending upon seasonal conditions and tree establishment.

All trees will be formative pruned two years after planting to provide good branch structure, direct growth to a desired shape to accommodate site constraints and reduce encroachment on utilities, buildings, pedestrian and vehicular clearance spaces as the tree matures.

Formative Pruning must be carried out in accordance with clause 7.2.5 of AS 4373 - 2007, *Pruning of amenity trees*.

5.4 Community Consultation

Guiding principles

Consultation with affected and interested members of the local community is paramount to ensuring the success of any tree planting works. A well-informed community who participates and has input into the process will ensure a successful outcome.

5.4.1 Infill Tree Planting Program

Affected residents are informed of the replacement process as part of the tree removal notification process as outlined in **3.8 Notification of removals / works to residents and committees** or as part of Councils Customer Request System procedure.

This program reinforces the existing street tree theme within a street by planting the same tree species that is dominant along the length of the street. There is no requirement for consultation about the selected replacement street tree species.

5.4.2 Street Tree Replacement Program

All residents and owners of properties within the affected street shall be included in the consultation process. All residents and owners of properties that abut the street shall also be included; i.e. corner properties. The ward Councillor shall receive a copy of information distributed.

The following components are deemed necessary in consulting adequately with affected property owners and residents:

- An introduction letter that provides a brief description defining the area to be planted and the reason for the planting.
- A list that indicates the existing trees nominated for removal and where proposed replacement trees will be located in relation to the front of properties.
 - Consistency along the length of a street is paramount for the success of this program. Usually, the majority, if not all the existing trees within a street are removed and replaced with the nominated tree species. Residents will have the opportunity to indicate a preference to retain an existing street tree outside their property.
 - Should a resident request the retention of a street tree that is located within the road reserve outside their property, Council will usually agree to this request unless the tree is hazardous or in poor health (useful life expectancy of < two years).
 - Should a resident request the retention of a street tree that is located within the road reserve outside another property, Council will not agree to this request.
- A survey will be distributed that includes an opportunity for affected residents and property owners to accept Council's proposal to undertake street tree replacement in their street.
 - The survey will include a selection of appropriate tree species; usually three, from which the preferred street tree species is to be selected. Survey details will include an indication of the trees' useful life expectancy and rationale for selection.
 - At least 14 days (including two weekends) shall be allowed for the return of surveys.
 - Included in the survey shall be cultural information, a photograph of each of the tree species and a site that an established specimen can be viewed. The tree selected by the majority of surveys returned to Council, shall be the nominated street tree for all future planting in the street.
 - Should the result of the survey be inconclusive (two or three tree species returning an equal number of votes), a second survey shall be distributed that includes the tree species that have received the highest number of equal votes.

- Should the second survey not return a conclusive result, Council officers will determine which tree species shall be planted.
- Residents will be advised of the results of the survey and the anticipated time-lines associated with the start and completion of works.
- In streets where infill planting has occurred over a number of years with a species that is different to the dominant mature street tree population and the new species is preferred due to cultural, biological or aesthetic preferences over the existing species, Council will recommend that this species continue to be planted.
 - An information letter shall be distributed to all residents and owners of properties within the affected street and all residents and owners of properties that abut the street; i.e. corner properties.
 - A survey will be distributed providing residents and property owners with an opportunity to support or not support Council's recommendation. Included in the survey shall be cultural information, a photograph of the tree species and a site that an established specimen can be viewed.
 - Should the majority of respondents not agree with Council's recommendation, a second survey will be distributed that includes a selection of appropriate species; usually three, from which the preferred street tree species is to be selected.
- Residents will be provided with a Council officers name and contact phone number where they can source additional information if required.

5.4.3 Park Planting Program

As this program establishes or reinforces the presence of a tree canopy within a Council managed park, good design principles are utilised in the selection of a suitable tree species.

Community consultation will be incorporated into the development of a Concept Plan or a tree planting project that will constitute a major percentage of the overall canopy of a Council managed park or reserve.

6.0 TREE PRUNING

Guiding Principles

- *Set and maintain high tree management standards.*
- *Undertake tree pruning in line with relevant legislative requirements, strategic policies and accepted tree care practices.*
- *All pruning undertaken on trees within the City of Boroondara will comply with AS 4373-2007: Pruning of Amenity Trees.*

6.1 Introduction

The City of Boroondara maintains trees on Council managed land to fulfil its legislative and management obligations to residents and visitors to the area. Maintenance works performed on the trees aim to manage tree health and reduce the inherent risks associated with trees in an urban area.

The City of Boroondara prunes Council managed trees to reduce the risk to public safety, decrease potential property damage, provide clearance around service and utility lines, and to shape young trees to promote structurally-sound branching for the future. Furthermore, pruning of trees will occur in response to unexpected events or emergencies, such as tree or branch failure resulting from severe storms.

Certain trees within the municipality may require specialist maintenance works, for example, topiary trees which require pruning to maintain shape and aesthetics. Some trees may require the installation of tree support systems to support branches or act as a failsafe in case of branch failure. Palms within the municipality also require specific maintenance works, which can include the collection of fronds for religious events.

This section of the Council Tree Management Guidelines addresses how the City of Boroondara approaches pruning and maintenance works on trees located on Council managed land.

6.2 Tree pruning – general requirements

The primary tree maintenance tasks within the City relate to pruning. Trees to be pruned within the scope of this document are those on nature strips and other Council managed land. Trees located on private property are not included in the scope of this policy.

The City of Boroondara will maintain high tree management standards at all times. All tree work will be performed to the highest arboricultural standard to reduce tree hazard and leave a healthy, well-balanced tree of good growth and aesthetically pleasing appearance. Any operation known to be detrimental to long-term tree health is not appropriate.

In order to maintain the safety and amenity of the City's street trees the City of Boroondara will employ staff and contractors who have appropriate arboricultural qualifications and expertise in relation to pruning of trees and will carry out the task to the highest level of safety.

All pruning undertaken on trees within the City of Boroondara will comply with AS 4373-2007 - Pruning of amenity trees.

The AS 4373-2007 - Pruning of amenity trees, describes methods for pruning of trees and encourages correct and uniform practices. It is intended for use on amenity trees and includes formative pruning, hazard reduction, selective pruning and thinning. It does not include practices related to timber, foliage, fruit and flower production, root pruning, and chemical pruning nor to sculptural forms of pruning such as topiary hedging and pleaching.

6.3 Programmed tree services

The City of Boroondara has implemented scheduled, proactive tree pruning programs based upon the location of the tree. Council programmes include:

- Block Street Tree Pruning– two-year cycle
- Shopping centre precincts (Topiary trees etc.) – five times per year
- Park trees
 - High-use parks – two-year cycle
 - General parks – three-year cycle
 - Playgrounds, buildings and picnic areas in parks – annual cycle
- Council managed child care centres – annual cycle
- Other Council managed properties – two-year cycle
- Council managed car parks – two-year cycle
- Reactive tree services

6.4 Programmed tree services – Street trees

The City of Boroondara programs maintenance pruning of street trees on a suburb by suburb basis. Scheduling the work in this manner produces efficiencies in labour and resource management and ensures that trees within a suburb meet the minimum standards of quality and utility.

The City of Boroondara will prune trees to maintain adequate clearances on a two-year cycle in line with the Block Street Tree Pruning specification. Pruning works on individual trees will comprise the following activities:

- clearance around powerlines, service lines, telephone lines and street lights;
- footpath, nature strip and roadway (crown lifting);
- dead wood, hanging and fallen branch removal;
- formative pruning; and
- tree stake and tie removal.

6.5 Powerline clearance requirements

Trees are cleared in accordance with Council's annual *Electric Line Clearance Management Plan* which fulfils Council's obligations as set out in the Electricity Safety (Electric Line Clearance) Regulations 2010.

Specified clearances are to be maintained free of vegetation. There is the additional requirement to maintain a regrowth space. This is measured as the average annual growth x Number of Years in a Vegetation Management Cycle.

Dimensions for clearance of vegetation from overhead powerlines are outlined in Appendix 2.

Other management options the City of Boroondara will investigate to minimise requirements to clear vegetation adjacent to powerlines are presented below:

- Optimum location of powerlines;
- Relocation of overhead powerlines to underground powerline in accordance with Council policy and in agreement with relevant service authorities. If boring or tunnelling is proposed beneath the Tree Protection Zone (TPZ), it shall be undertaken in accordance with the recommendations outlined in Appendix 4;
- Use of aerial bundle cables to reduce clearance space requirements in some areas of important vegetation;
- Investigation and development of innovative tree management and pruning methods to improve line clearance methods;
- Removal and replacement of inappropriate vegetation where possible; and
- Investigation and use of appropriate species in new and replacement planting.

6.6 Other clearance requirements

Council will prune trees within the City to provide the clearances for pedestrians, vehicles, streetlights, road signage, traffic control devices and to maintain sight lines. Clearance distances can be seen in Table 3 in Appendix 2.

6.7 Clearance of existing structural branches

In the case of some maturing trees, the structural form of the branches may have developed prior to current vehicle height capacity, the introduction of more contemporary infrastructure and legislative changes on clearance requirements other than for powerlines. Removal of structural branches may cause large wounds, provide entry points for pathogenic organisms and decay, and cause undue harm to the trees.

In pruning Council managed trees, the City of Boroondara will aim to meet the clearance requirements as best as possible with due regard for tree health.

Other options Council may consider:

- Installing reflective plates on low structural branches above the roadway;
- Using white lines to direct traffic away from curb; and
- Installing warning signs in streets known to have low clearance.



6.8 Programmed tree services – Park and other Council managed land

The City of Boroondara programs maintenance of trees in Council managed parks and other Council managed land based on a priority system with regard to the occupancy of the area surrounding the trees.

All parks and other Council managed land that contain trees are allocated into risk zones. The zones, categorised as Very High Risk, High Risk, Moderate Risk and Low Risk, designate how these areas are to be treated with regard to the type and timing of scheduled tree inspections. This schedule is outlined in more detail in Section 2 - Tree Risk Management.

6.9 Reactive tree services

Pruning in response to the customer requests shall be completed in the following time frames:

- imminent danger – immediate response;
- identified as hazardous – 2 working days; and
- requires pruning, but not hazardous – as soon as possible.

6.10 Formative tree pruning

Formative pruning is the pruning of a tree to provide good branch structure, direct growth to a desired shape and to accommodate site constraints and reduce encroachments on utilities, buildings, pedestrian and vehicular clearance spaces as the tree grows.

Where possible and having regard for the aesthetic amenity of the individual tree and streetscape, trees must have a single trunk, clear of branches to a height of 1500mm above ground level.

The City of Boroondara will formative prune young trees of up to 6m high and 4m crown width, in accordance with clause 7.2.5 of AS 4373-2007 – Pruning of Amenity Trees.

6.11 Topiary and high graft trees

The City of Boroondara uses topiary and high graft trees in locations where the available space precludes the planting of larger trees. Typically, these trees will be located in commercial areas.

Hills Fig (*Ficus microcarpa* var. *hillii*) is the most common topiary treatment within the City. The City of Boroondara Streetscape Planting Strategy – Main Roads (2001) also recommends the use of purpose built frames with climbers as an alternative treatment.

The City of Boroondara will maintain topiary and high graft trees in a safe and aesthetically acceptable condition and shaped to ensure that they do not impede or create a hazard for surrounding infrastructure, vehicular or pedestrian traffic.

Topiary trees are pruned to ensure a uniform, healthy and compact spherical shape. Unless space permits, the head shall not exceed 900 mm diameter.

High Graft Trees are pruned to ensure a uniform and healthy vase shape.

The trees will be pruned in February, April, August, October and December. The trees shall also be inspected monthly for vandalism and litter removal.



6.12 Unauthorised tree pruning

Residents have the legal right to prune off overhanging foliage into their property from a tree located on a neighbouring property, including one located on Council managed land. Council urges residents to utilise the service provided by Council and have pruning of trees on Council managed land undertaken by Council's Parks & Gardens Department.

If a resident or property owner damages a tree, makes the tree structurally unsound or reduces the aesthetics through inappropriate pruning, Council will seek reimbursement of the damage and the lost amenity value of the tree.

Cost of repair to the damaged tree will be based on commercial rates and will be derived from an approved tree valuation method. See Section **13 - Tree Valuation**.

6.13 Community consultation

Consultation with affected and interested members of the local community occurs as part of major tree pruning programs within a street or park.

6.13.1 Street trees

Affected residents are informed of the programmed pruning of street trees (Section 6.4) by way of an information postcard. The Street Tree Pruning Notification postcard is delivered to all residential and commercial properties a minimum of 28 days prior to the commencement of the pruning program.

Upon completion of the Block Street Tree Pruning Program within a given area, a second postcard is delivered to all residential and commercial properties. The Overhanging Tree and Shrub Notification postcard outlines the responsibilities of property owners regarding private vegetation overhanging the footpath.

6.13.2 Park trees

As part of the programmed maintenance of park trees (Section 6.8), a Park Tree Pruning Notification postcard is delivered to all abutting commercial and residential properties a minimum of fourteen (14) days prior to the commencement of the program.

To inform park users, appropriately placed information signs (A2 size) are installed a minimum fourteen (14) days prior to the commencement of the program.

7.0 WATERING MATURE TREES

Trees commonly grown in Boroondara originate from many different climate zones and have different water needs.

Mature trees can have large water requirements and may lose up to hundreds of litres of water daily through their leaves. Trees will experience stress if insufficient soil water is available to replace the water lost through the leaves.

Signs of water stress can include wilting foliage, marginal leaf scorch, lack of new growth in spring, and dieback of leaves, twigs and branches. The premature shedding of leaves without the appearance of the wilting or leaf scorch is another response to water stress.

These signs, whilst indicative of water stress may also be indicative of other tree health problems.

A number of park trees and street trees may show signs of water stress due to a reliance upon regular irrigation that may no longer be available as a result of water restrictions. Supplementary watering during extended dry periods can assist in maintaining tree health but Council does not have the capacity to water every drought stressed tree, relying generally upon the trees natural ability to survive.

A proactive inspection program of significant mature specimens occurs during the warmer months and extended periods of low rainfall. The identified trees are prioritised and attended to with either air-knifing (soil aeration), mulching, surface irrigation, deep root watering or a combination of these treatments. The treatments provide a cost effective, sustainable and long-term benefit to each tree resulting in a largely self-sufficient tree.

A Tree Contingency Plan has been developed to ensure survival of identified significant streetscapes and park trees in the event of ongoing extreme climatic conditions and water restrictions resulting in widespread tree decline or death. The plan is ongoing and trees are selected based upon; species rarity, outstanding form, size, maturity, regionally significant remnant specimen, contribution to amenity or integrity of a park or inclusion in Council's Significant Tree Register.

8.0 TREE SUPPORT SYSTEMS

The installation of cables as supporting systems for trees with structural defects is a contemporary arboricultural practice but may infer a potential liability to Council and should only be undertaken with caution.

Tree support systems are used to provide supplemental support to leaders, individual limbs, and/or the whole plant. The objectives for support systems should be clearly defined prior to installation.

The following points are to be considered before recommending a tree support system for a tree:

- Support systems will only reduce the hazard potential and will not permanently remedy structural weaknesses or provide a guarantee against failure.
- A tree support system will require annual inspections and maintenance. Future modifications will be necessary, as the distribution of weight changes throughout the trees' crown.
- Appropriate pruning to reduce extension and weight of supported branches and to decrease the leverage on the structural defect will be required prior to the installation of a support system.
- The installation of a bolt or rod brace through a bifurcation may also be required. A brace would be expected to reduce or prevent further splitting within the union. Rod systems must always be supported by a cable.
- Cabling systems should only be installed by an appropriately qualified and experienced arborist. Hardware specifications should follow a recognised standard such as ANSI A300 (2000).

Adapted from Harris, Clark and Matheny (2004)

The decision as to whether a tree support system is to be installed into a tree on Council managed land is undertaken by the Senior Arborist or nominated officer(s).

Tree support systems are not recommended for use in street trees.

A record of trees with tree support systems will be maintained on Council's Asset Management System.

9.0 MANAGEMENT OF CANARY ISLAND DATE PALMS

There are some good examples of Canary Island Date Palm (CIDP) both within private and public gardens across the City. The management of CIDP within the City requires unique consideration due to the demand for fronds for religious events.

9.1 CIDP audit

In order to manage CIDP throughout the City an inventory needs to be maintained. Details of Palm location, tree dimensions, condition and pruning history are to be included in the inventory.

9.2 Pruning of CIDP

Palms are pruned to remove dead or chlorotic lower fronds, or remove flower and fruit stalks.

Palms are often over pruned however, with the removal of green fronds rarely necessary. Removing green fronds from a palm can slow growth rate and cause a narrowing of the trunk and potential root problems. Over pruning of CIDP can cause trees to become susceptible to Fusarium wilt. Refer to Section 12.4.3.

Excessive pruning, particularly the older fronds low down the canopy, can also cause potassium (K) deficiency. Potassium deficiency can cause crowns to become greatly reduced in size, fronds appear 'frizzled' and trunk taper is reduced resulting in 'pencil pointing'. Without treatment, palms affected by severe K deficiency will die.

If there is a need to undertake pruning, only remove those fronds drooping below an imaginary horizontal line drawn through the bottom of the canopy (see Diagram 1).

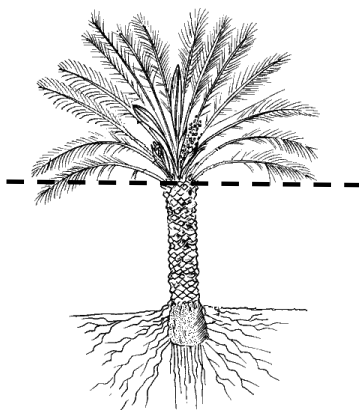


Diagram 1. Dashed line indicates acceptable pruning height. Fronds drooping below line could be pruned.

9.3 Pest and diseases

A significant threat to palm species and in particular the Canary Island Date Palm, is Fusarium wilt. Details on Fusarium wilt of CIDP can be seen in section 12.4.3.

Details on the management of CIDP can be seen in Appendix 3.

10.0 PROTECTION OF TREES ON COUNCIL MANAGED LAND DURING CONSTRUCTION

Guiding principles

- *Council managed trees will be protected from construction works and other activities that threaten tree condition, safety or amenity.*
- *The conflicting requirements of trees and infrastructure maintenance or enhancements will be minimised where possible.*

10.1 Introduction

Trees on Council managed land are to be protected at all times with the objective to reduce the negative impacts of development, construction and temporary works on Council managed trees.

No damage, pruning or removal of any tree will be permitted without the approval of the Senior Arborist or delegated officer(s). The contractor, relevant responsible authority or property owner shall be responsible for the protection of trees on Council managed land that are likely to be affected by development, construction and temporary works.

Trees vary in their ability to adapt to altered growing conditions. Mature trees have established stable biological systems in the pre-existing physical environment. Disruption of this environment by construction activities interrupts the tree's physiological processes, causing depletion of energy reserves and a decline in vigour, often resulting in the tree's death. Typically, this reaction may develop from one to twelve years or more, post-construction.

The tree protection requirements are intended to guide a construction project to ensure that appropriate practices will be implemented in the field in order to preserve both trees and property values while eliminating undesirable consequences that may result from uninformed or careless acts.

Typical negative impacts that may occur during construction include:

- mechanical injury to roots, trunk or branches;
- compaction of soil, which degrades the functioning roots and inhibits the development of new roots and restricts drainage, which desiccates roots;
- changes in existing grade which can cut or suffocate roots;
- alteration of the water table - either raising or lowering;
- microclimate change, exposing sheltered trees to sun or wind;
- sterile soil conditions, associated with stripping off topsoil; and
- chemical damage due to leaking or spilling of fuels, lubricants, hydraulic oils or other toxic substances.

Construction projects within the Tree Protection Zone (TPZ) of a Significant Tree (as defined in Section 1.4.2) are required to implement the protective practices described in Section 10.2 and Appendix 4.

Trees on Council managed land shall be protected from potential damage caused by demolition, building and landscaping works on private property and Council managed land. The tree protection measures are outlined in Council's Asset Protection Permit.

Notification of potential damage to street trees, naturestrip or other Parks and Gardens managed asset will be forwarded from the Asset Protection Department to Parks and Gardens.

The hierarchy of principles for tree protection are:

- **Avoid damage to trees, or**
- **Minimise damage to trees, or**
- **Replace trees and improve the landscape (as a last resort)**

All trees on Council managed land shall be protected in accordance with AS 4970 - 2009 Protection of trees on development sites. ***To maintain consistency across Council, the calculation of a TPZ has been altered from 12 x trunk diameter to 10 x trunk diameter throughout this policy.***

Removal of trees is subject to the procedures outlined in Sections 3.0.

10.2 Guidelines for tree protection

- Establish a TPZ around the tree (10 x trunk diameter measured as a radius from edge of the trunk). Protection fencing may also be required.
- No persons, vehicles or machinery to enter the Tree Preservation Zone without Council permission.
- No stockpiling of building materials, debris or soil within the allocated TPZ (10 x trunk diameter) without Council permission.
- No fuel, oil dumps or chemicals shall be allowed in or stored within the allocated TPZ (10 x trunk diameter) and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- Soil levels must not be altered within the allocated TPZ (10 x trunk diameter) without Council permission.
- Any tree root from a Council tree, greater than 50mm in diameter is not to be severed without Council permission.
- No Council tree is to be pruned or branches removed without Council permission. All pruning shall be undertaken by a Council approved contractor and in accordance with AS 4373 – 2007 Pruning of Amenity Trees.
- A Council tree shall not be used to attach anything including, temporary services wires, nails, screws or any other fixing device. The use of tree trunks as a winch support or anchorage is prohibited.
- Care is to be taken to ensure that no damage is caused to Council tree trunks, roots and structural branches.
- Supplementary watering should be provided to all trees through any dry periods during and after the construction process.
- Any other statutory requirements.

The Tree Protection Zone will be the major factor in determining techniques for protecting each tree.

If the TPZ is designated (Appendix 4) and protected by fencing and there is no infringement into that zone, no further preservation techniques would need to be employed.

If boring or tunnelling is proposed beneath the TPZ and the depth of the boring meets or exceeds recommendations (Appendix 4), no further preservation techniques would need to be employed.

If the TPZ is threatened or must be encroached, the tree or trees must be further investigated on a case by case basis. Exploratory root investigations may be required to ascertain the presence of roots within the TPZ, the probable extent of damage and strategies to avoid damage (Appendix 4).

Guidelines for the establishment of tree protection zones can be seen in Appendix 4.

10.3 Gantry scaffolding and hoardings

Where a gantry, scaffold or hoarding is to be constructed over a footpath the contractor, developer or relevant authority must ensure that the placement of the footings and gantry structure do not impact on Council trees.

- The gantry, scaffold or hoarding should be a minimum 0.5m from the trunk of the tree.
- If a tree trunk is enclosed in the gantry structure, protective material should be wrapped around the trunk to prevent damage. This includes main branches arising from the trunk.
- Orientate footings away from the base of the tree.

All scaffolds are to comply with the requirements of AS 1576 and AS 4576. Additional operational guidelines may be obtained from the WorkCover Authority.

If Council trees are affected by gantry, scaffold or hoardings, the contractor, developer or relevant authority is responsible for implementing a tree maintenance program.

10.4 Service installation guidelines

For the installation or maintenance of services in the vicinity of trees, the service should be diverted or re-aligned to run beyond the Tree Protection Zone (TPZ). Where this is not practical, trenchless excavation or root sympathetic hand excavation is recommended. A combination of these methods may be used where necessary.

Acceptable techniques in order of preference:

1. diversion of service around the TPZ;
2. trenchless thrusting and directional boring at an appropriate depth beneath the TPZ; and
3. root sympathetic trench excavation within the TPZ.

Trench excavation by machinery should not be permitted within the TPZ.

10.5 Diversion or re-alignment of the service

Diversion or re-alignment of the service is the most appropriate method to minimise damage to the root system of a tree and potential future damage to the service by developing tree roots.

Prior to installation or maintenance activities, the TPZ should be determined according to the method outlined in Section 10.2 - Guidelines for tree protection and Appendix 4.

10.6 Trenchless thrusting and directional boring

The action of 'trenchless thrusting' or 'directional boring' is the preferred method for service establishment within the TPZ. When these methods are used, the overall impact to the tree is minimised.

All machinery associated with the action of thrusting or directional boring must remain outside the TPZ. Entry and exit points should be located at a safe distance outside the TPZ to ensure that machinery, slurry and work activities are kept clear of the TPZ. This will minimise any root loss or ground compaction that may arise.

If the thrusting rod or directional drill-head becomes stuck within the TPZ, the arborist responsible for the trees on the site should be contacted prior to the retrieval process. Any retrieval of a thrusting rod or directional drill-head from within the TPZ should be undertaken with hand tools unless otherwise stated by the responsible arborist (CA, 1999).

Techniques involving external lubrication of the mole with materials other than water (e.g. Oil or bentonite) should be avoided unless precautions are taken to ensure that there is no contamination of the soil within 800-1100mm of the surface within the TPZ (NJUG, 1995).

Summary:

1. Entrance and exit pits must be outside TPZ.
2. Verification of the bore depth and offset readings must be undertaken outside the TPZ.
3. Where possible, align the bore or trench to pass directly under the trunk of the tree.
4. Where excavation within the TPZ cannot be avoided, then this should be done by hand or using other root sympathetic excavation techniques. Machinery should not be permitted within the TPZ.

Details of depth and alignment of boring is outlined in Appendix 4.

10.7 Hand and root sympathetic excavation

Where trenchless techniques cannot be used, hand, pneumatic and other root sympathetic excavation methods may be used within the TPZ.

The objective of root sympathetic excavation should be to retain as many roots as possible while creating sufficient space for the installation of the service. Hand or other root sympathetic excavation will require greater supervision to ensure that the tree protection measures are maintained.

All work should proceed with hand tools with care taken not to damage roots as they are exposed. All roots greater than 50mm in diameter should be retained and worked around. Clumps or masses of small fibrous roots collectively greater than 50mm in diameter should also be retained.

Where there is no option but to sever roots that are greater than 50mm in diameter, the roots must be inspected by the Senior Arborist or delegated officer(s). Where root removal is approved, they should be cut using a sharp axe, pruning saw or chainsaw while creating the smallest possible wound (Adapted from: NJUG, 1995).

Emergency utility repairs shall be exempt from the above restriction zones within the TPZ. The Senior Arborist or delegated officer(s) shall be contacted after any such repairs as they may result in significant tree damage or removal.

Summary:

1. When using hand or other root sympathetic excavation methods, carefully work around roots, retaining as many as possible.
2. Any root greater in diameter than 50mm should not be severed without the approval from the Senior Arborist or delegated officer(s).
3. Prune roots which have to be removed using a sharp tool (e.g. secateurs or handsaw). Make a clean cut and leave as small a wound as possible.
4. Pipes should be carefully threaded between the undamaged roots.
5. Frost and heat can damage exposed roots. If trenches are to be left open for more than 24 hours, cover the roots with damp hessian. Hessian is to be removed before backfilling.
6. When backfilling a trench within a TPZ, consolidating the earth below and around the service pipe to 95% compaction will inhibit the growth of roots around the service. Clean, uncompacted backfill should be used above the consolidated region to allow roots to recolonise the soil above the service

10.8 Damage to trees

10.8.1 Reporting

Any damage or injury to trees shall be reported within 6-hours to the Senior Arborist or delegated officer(s) in order to undertake any required mitigation work.

10.8.2 Penalty for damage to street trees

All costs incurred by Council for reinstating, rectifying or replacing a Council managed tree including any maintenance and establishment costs for a defined period following the completion of works, will be reimbursed in full by the contractor, relevant authority or property owner.

Cost of repair or replacement of the damaged tree will be based on commercial rates and will be derived from an approved tree valuation method. See Section 13 – **Tree Valuation**.

Council can order a cease work where it is identified that work in the vicinity of a tree or group of trees has or is likely to cause damage to a tree or group of trees located on Council managed land. Council's Senior Arborist or delegated officer(s) may request an independent arborist's report prior to the recommencement of work. All costs associated with the independent arborist's report will be reimbursed in full by the contractor, relevant authority or property owner.

Council's Senior Arborist or delegated officer(s) may refer an incidence of damage or removal of a tree on Council managed land to Council's Local Laws department. In accordance with Local Law 1B, Section 8 Actions Affecting Council - controlled land & assets, a person must not, without a permit or licence:

- a) cause any change to Council controlled land or anything on it; or
- b) remove anything from Council controlled land.

Penalty for first offence: ten (10) penalty units.

10.8.3 Pruning damaged trees

Council's trees are regularly pruned to maintain health and to achieve appropriate clearances. Construction and temporary works may require trees to be pruned to clear structures and building activities that would not normally be required as part of Council's scheduled tree management programs.

All pruning is to be undertaken by Council's in-house Tree Services team, or approved contractors and undertaken in accordance with AS 4373 - 2007 Pruning of Amenity Trees.

It must be recognised that trees are individual in form and structure, and that pruning needs may not always fit strict rules. No more than 25 percent of the functioning leaf and stem area may be removed from a given tree within one calendar year, or removal of excessive foliage that may contribute to unbalancing of the tree.

The Senior Arborist or delegated officer(s) shall assume all responsibility for special pruning practices that vary from the standards outlined in **Section 6 - Tree Pruning**.

All costs incurred in pruning Council's trees shall be reimbursed in full by the contractor, relevant authority or property owner.

11.0 TREE ROOT MANAGEMENT

Guiding principles

- *Damage to tree root systems is to be avoided to ensure ongoing tree health. It is understood however, that certain tree root treatment works, including root pruning and root barrier / deflector installation, are required to be performed on Council managed trees from time to time. This work is required for risk management, to maintain public safety and contain tree root growth where necessary to prevent damage to property, roads and pavements.*
- *The pruning of a trees root system can have detrimental effects on tree health and stability. Root pruning of trees on Council managed land will not be permitted without the approval of the Senior Arborist or delegated officer(s).*

11.1 Root pruning

Root Pruning is the practice of removing a portion of a tree's root system. The circumstances necessitating root pruning vary, but the objective of tree root pruning is always to ensure the health, stability, and longevity of the tree.

Major root pruning will not be permitted without the approval of the Senior Arborist or delegated officer(s).

11.2 Tree root barrier / Deflector installation

By guiding roots away from infrastructure, the damage potential can be reduced. Guidance methods include the use of root barriers.

Root barriers are used to prevent or delay conflicts between tree roots and infrastructure. The placement of a physical or chemical barrier, deflects lateral growing roots down below the depth of the barrier or constricts them within a defined space.

Research has shown that there are variable effects of root barriers on root distribution. The effectiveness of root barriers is dependant on a number of factors including soil type, type of barrier, tree species, tree age, planting situation and the distance of the tree to infrastructure.

The most common type of barrier used on Council trees is a deflector. These barriers attempt to change normal root orientation to exclude root growth from a given area, or to reposition roots to prevent potential future damage.

Details on root pruning and barrier installation guidelines can be seen in Appendix 5.

11.3 Root pruning procedures

11.3.1 Root pruning requests

Requests for root pruning and barrier installation are generated through resident requests.

Residents may request a tree be inspected for root pruning and barrier installation by contacting Parks and Gardens. All requests for root pruning and barrier installation shall be inspected and assessed by a suitably qualified person.

At all sites that root growth from a tree growing on Council managed land is alleged to have caused damage to private property, a standard report including photographs of the alleged damage and the subject tree in relation to the alleged damage, is to be submitted to Council's Risk Management Department.

In order to reasonably assess whether Council managed trees are contributing to structural damage of privately owned buildings, the following data is required of the property owner (plaintiff):

- Plan of all existing on-site and surrounding vegetation within past 10 years (preferable);
- Investigation of soil at the base of the buildings to determine the presence, size, depth, and amount of roots present;
- Identification to genus level of any roots found as a result of the root investigation;
- Structural engineers investigation of the building to determine:
 - Recent history of patterns of movement in the affected building/s;
 - age and condition of building; and
 - depth and condition of building footings.
- A geotechnical investigation of the site to determine:
 - soil moisture levels around the site and the building;
 - soil moisture tension, soil bulk density, and soil load bearing capacity; and
 - conditions and discharge points of stormwater from site.

Upon receiving the aforementioned report(s) and structural damage is suspected to be as a result of soil subsidence in conjunction with Council trees or other matters, Council will consider a structural engineers investigation in order to clarify the cause and prescribe the best remedy.

All reports associated with Council managed trees allegedly contributing to structural damage to privately owned buildings is to be submitted to Council's Risk Management Department.

11.3.2 Root pruning approvals

All approvals for tree root treatment of trees on Council managed land, shall be authorised by the Senior Arborist or delegated officer(s) after relevant investigations.

The type and configuration of tree root treatment to be used at a particular site will be at the discretion of the Senior Arborist or delegated officer(s) after investigation of the site, alleged damage to private or public property and the tree.

Where root pruning and barrier installation is not justifiable because a tree does not meet one of the criteria in this policy and a member of the community insists on such action, a standard format letter of refusal is to be sent by the Senior Arborist.

11.4 Documentation of tree root management events

All root pruning and root barrier installations are to be recorded.

Details are to include:

- address;
- location of tree;
- tree species, age, dimensions and condition;
- reason for root prune and/or barrier installation;
- type, configuration and location of barrier; and
- date of installation.

12.0 MANAGEMENT OF PEST, DISEASE, ANIMAL, AND WEED SPECIES

Guiding principles

- *Pest and diseases are a component of the urban landscape and Council recognises that control measures will be required at times to maintain healthy and aesthetically pleasing landscapes.*
- *Council will adopt the principles of Plant Health Care to address pest and disease management with a focus on problem prevention through appropriate tree selection, planting and tree maintenance.*
- *Constant monitoring of the urban forest will allow timely and appropriate responses.*
- *If problems do occur, multiple management options will be used to remedy them.*

12.1 Introduction and principles of pest and disease management

Pest and disease are a component of the urban landscape and Council recognises that control measures will be required from time to time in order to maintain healthy and aesthetically pleasing landscapes. A range of methods will be utilised in the management of pest and disease outbreaks and the identification of damage thresholds will initiate the implementation of a pest and disease control program.

Specifically Council will approach pest and disease management as follows:

- Council officers will have a thorough understanding of the biology of the plants and key pests in relation to the ecosystems they are managing. On-going training and education will occur for Council officers to maintain current best practice approach to pest management;
- Council will support research into biological controls for pests and diseases that pose a threat;
- If a pest outbreak is identified and damage thresholds exceed accepted levels and other trees are at risk, all possible action will be taken to effectively decrease the risk to other trees from the pest outbreak;
- An integrated approach to pest management will be adopted that employs methods and materials that preserve and augment the ecosystem while facilitating permanent control of the pest;
- Advice and management programs will be sought from other agencies or pest control regulator, for example Department of Primary Industries, to ensure the best approach is adopted for any pest outbreak;
- Trees will be removed when they are infected with an epidemic insect or disease where the recommended control is not applicable and removal is the recommended practice to prevent transmission;
- Species of tree will be selected that are known to be pest and disease resistant;
- Monitoring systems will be developed to check pests and tree health regularly; and
- Trees that are recognised woody weed species will be removed when opportunities are presented through the normal management of the City's tree population.

12.2 Major animal pests

The City of Boroondara recognises that possums, flying foxes and other native animals are protected species under the Wildlife Act 1975.

12.2.1 Brushtail & Ringtail Possums

In the event that a Council managed tree is showing signs of excessive damage from possum grazing, Council shall inspect the tree and determine a suitable course of action to reduce further grazing.

Further details regarding management of Brushtail and Ringtail possums can be seen in Appendix 6.

12.2.2 Grey-headed Flying Fox

The Grey-headed Flying-fox is a state and nationally listed threatened species. In 2004, as part of the Department of Natural Resources flying-fox trial relocation from the Royal Botanic Gardens, the flying-fox began roosting at Yarra Bend Park, Kew. As this site has been identified as one of the most suitable sites in Melbourne for a flying-fox campsite, the State Government decided to consolidate the colony at this site.

Flying-fox roost together during the day in large camps and usually travel 5 to 15 km and up to 50 km from the campsite at night to feed. The species predominantly feeds on Eucalypt nectar and blossoms as well as native fruit.

Flying-fox benefit forest ecosystem regeneration by pollinating plants and dispersing seed. Their movement through the campsite may also cause various levels of defoliation and some tree death. The impact on vegetation is localised and is generally offset by their valuable role in regeneration.

Managing the flying-fox is a challenge facing the land managers and the broader community. Yarra Bend Park and the Grey-headed Flying-fox are managed by Parks Victoria, the Department of Sustainability and Environment (DSE) and the Yarra Bend Trust. In 2004, DSE developed a Flying-fox Management Plan in order to formalise management responsibilities, plan revegetation and programme ongoing monitoring of the colony to ensure a sustainable campsite at Yarra Bend Park.

Council will continue to monitor the Management Plan and its implementation. If the flying-fox colony creates unacceptable impacts on City of Boroondara residents, officers will work with DSE to ensure community needs are responded to in a reasonable manner.

12.3 Insect Pests

12.3.1 Elm leaf beetle (ELB) management

Elm Leaf Beetle (ELB) (*Pyrrhalta luteola*) can be a serious pest for Melbourne's Elm tree population. Repeated defoliation over successive seasons can weaken elms, increasing their susceptibility to other stresses and may therefore contribute to their death.

In accordance with best industry practice, the City of Boroondara will endeavour to control ELB infested Council managed trees using integrated pest management (IPM) practices. Chemical, cultural and biological procedures shall be used to minimise the impact of the pest on the municipality's elm populations.

Survey and Monitoring of ELB populations

Council will maintain a register of elms growing on Council managed land. Damage predictions and treatment decisions will be based on survey data and the continual monitoring of trees and elm thickets in the affected areas. The Senior Arborist or delegated officer(s) will undertake damage prediction sampling in affected areas.

The Senior Arborist or delegated officer(s) will carry out the collation of survey results and the information used in conjunction with the degree-day method to determine the timing and focus of the proposed control methods.

Council has an elm leaf beetle brochure available for residents to provide information ELB identification and control methods.

12.3.2 Psyllid damage on eucalypts

Sap-sucking psyllids can cause significant damage to eucalypts. Psyllids feed on a wide variety of eucalypts. Some of these psyllids are restricted to a single eucalypt host species or to a group of closely related species. Psyllid damage to eucalypts is common although may not significantly affect trees in terms of long-term health and aesthetics.

Council Officers will decide if it is appropriate to treat a tree infested with psyllid.

12.4 Diseases of trees

12.4.1 Dutch Elm Disease (DED)

Dutch Elm Disease (DED) (*Ophiostoma ulmi* (Buism.) Nannf., *Ophiostoma novo-ulmi*) is a devastating vascular wilt disease that has wiped out most of the elms of Britain and North America, and over half the elms of continental Europe. The discovery of this disease in New Zealand has dramatically increased the likelihood of it reaching Australia.

The European elm bark beetle (*Scolytus multistriatus*), another introduced pest, is now widespread in Victoria and has the potential to spread the Dutch elm disease pathogen rapidly should an outbreak occur.

Melbourne's elms are considered highly susceptible to DED for several reasons:

- the majority of Melbourne's elms are European species and are more vulnerable than Asiatic species;
- the vector of DED, the Elm Bark Beetle is well established in Melbourne;
- many of Melbourne's elms are planted in avenues and likely to be root-grafted;
- many of Melbourne's elms are in senescence and more vulnerable to disease; and
- it is likely that many of Melbourne's elms originate from only a few imported plants and therefore are of low genetic variability.

12.4.2 The DED contingency plan

In 1993 Mr P.T. Jenkins was engaged by the Elm Leaf Beetle Liaison Committee to prepare a Dutch Elm Disease Contingency Plan for Australia. The draft (2001) DED Contingency Plan should be used as the major reference document in conjunction with the Tree Management Guidelines, in the event of a suspected or confirmed DED outbreak.

The aim of the DED contingency plan is to give background and provide detailed information for City of Boroondara staff and service providers, regarding required action in the event of a suspected or confirmed outbreak of Dutch Elm Disease (DED), in the City of Boroondara, Greater Melbourne or elsewhere in Australia.

The DED contingency plan is outlined in Appendix 6 and outlines the action to be taken in the event of a suspected or confirmed outbreak of Dutch Elm Disease.

12.4.3 Fusarium Wilt (*Fusarium oxysporum* f.sp. *canariensis*) of Canary Island Date Palms.

A significant threat to palm species, in particular the Canary Island Date Palm, is Fusarium wilt, (*Fusarium oxysporum* f.sp. *canariensis*). Fusarium wilt is a true wilt disease where plant decline and death is as a direct result of the loss of function of the water conducting cells within the plant. The general decline symptoms are similar to those caused by other root and stem diseases and include:

- progressive frond death from oldest to newest canopy;
- one-sided leaflet death on a declining frond;
- a prominent brown strip on the rachis base starting at the trunk and extending out a variable distance towards the frond tip; or
- discoloured vascular bundles in the 'striped' fronds.

Disease Management

To date there is no control for the fungus. Management strategies are the only option available to limit the spread of the disease and include:

- Properly sample symptomatic palms and seek lab verification of this pathogen;
- Avoid scattering infested soil within or among rows of palms. Clean tools used in palm removal with bleach or rubbing alcohol;
- Avoid severe lower frond pruning on *P. canariensis* to achieve greater height of cleared trunk. This can result in effective, rapid spread of the wilt fungus;
- Fusarium wilt-affected palms should be carefully removed from the landscape;
- Do not transplant palms from known Fusarium sites, e.g. Sydney, Geelong, South Melbourne. All palms should be inspected and tested prior to planting (or transplanting) into a healthy site;
- Maintain palms in optimum growing conditions. Ensure adequate moisture and appropriate applications of fertiliser; and
- Maintenance personnel should be alert to the key symptoms of Fusarium wilt. Suspect palms should be sampled and submitted for wilt determination.

Details of Fusarium wilt symptoms, diagnosis and control measures can be seen in Appendix 6.

12.5 Woody weed management

Some tree species are so successful at growing in a certain region that their benefits are outweighed by the competition they provide to more desirable species in the area, including those which are native. Weeds are therefore plants that are growing in the 'wrong' place. Weeds may be causing damage to natural ecosystems or loss in agricultural systems, or they could have the potential to escape from their current environment into other environments.

There are two types of listed weeds:

1. Declared noxious weeds are those proclaimed under the Catchment and Land Protection Act 1994 are listed as state prohibited, regionally prohibited, regionally controlled and controlled; and
2. Environmental weeds are those that threaten the values of natural ecosystems and often out-compete them.

The City of Boroondara will remove woody weed species when opportunities are presented through the normal management of the City's tree population. Council Officers will decide if it is appropriate to plant a replacement tree in the location where the woody weed was removed.

Other areas within the municipality may be designated as high priority for the control of woody weeds. These include vegetation corridors, along waterways and areas with natural or revegetated native vegetation.

A list of woody weed species can be seen in Appendix 6.

12.6 Mistletoe

Throughout Boroondara, mistletoe is most noticeably found on trees such as Pin Oak (*Quercus palustris*), Plane tree (*Platanus spp.*) and Prunus (*Prunus spp.*). Mistletoes are partial parasites, taking up water and mineral salts from the host tree. The vast majority of mistletoe species have green leaves, and carry out photosynthesis normally.

The mistletoe has a highly modified root system and forms one or more primary roots (haustoria) which functions both for attachment to the host and for nutrient absorption. The haustorium penetrates the bark of the host and grows to the host's cambial layer where new xylem (water-conducting) cells are generated. The haustorium's secretions usually cause the host's xylem cells to proliferate and form a continuous connection with the xylem of the parasite's haustorium. The mistletoe becomes a parasite utilising the host's water supply with its dissolved nutrients.

While the effect upon tree health is often minor, mistletoe growth can proliferate within an individual tree or group of trees. Unchecked, mistletoe can eventually contribute to an individual trees decline and contribute to widespread dispersal among trees on private and Council managed land.

Clumps of mistletoe are often regarded as aesthetically poor as they are very noticeable upon the majority of the host trees in Boroondara during the autumn and winter seasons.

Accordingly, it is recommended that a systematic pruning program to remove mistletoe from host trees occur during the late autumn to early spring season. Locating mistletoe clumps is easier at this time of the year due to the majority of the host trees being defoliated.

13.0 TREE VALUATION

13.1 Replacement tree costs for the City of Boroondara

When a tree located on Council managed land is required to be removed and its condition does not satisfy the criteria for removal as outlined in the Tree Management Guidelines, in the majority of instances, Council will assign a monetary value based on cost of repairs and/or removal and replacement.

Assigning a monetary value to a tree based on cost of repairs and/or removal and replacement are based on real economic costs, i.e. the actual costs incurred to rectify or repair a tree.

The costs to be calculated in determining the value of a tree are shown below:

- Costs of any report or opinion given on a subject tree. Includes consulting arborist's fees or other professional opinions, tests and investigations needed to establish the condition of the tree and recommend appropriate remedial works.
- Costs incurred to repair any damage to the tree. This would include pruning, tree surgery, soil amelioration, and cultural maintenance programs, for example watering programs, fertilising, or de-compaction works.
- Costs to remove a tree and dispose of debris including the stump.
- Costs of any associated works to undertake remedial tree works, for example community consultation, traffic control, power shutdowns, or underground utility identification.
- Costs for tree replacement with largest available specimen (advanced tree) of same or mutually agreed similar species to the removed tree. Costs to include all transport costs and any associated works to undertake planting of tree, for example community consultation, traffic control, or underground utility identification.
- Cost to establish tree for 2-5 years. Council's Senior Arborist or delegated officer(s) will determine the duration of the tree establishment period based upon the size of the advanced tree. Includes watering programs, formative pruning, pest and disease control, re-mulching and fertilising. Also includes associated costs for re-assessment and monitoring of newly planted tree.

The costs assigned to the value of a tree will be established by Council, based on current suppliers of such goods and services.

13.2 Determining a Monetary Value

Prior to determining monetary values for trees, the condition of the tree(s) must be established. Trees that are dead, dying or in such poor condition that their useful life expectancy is limited, shall not be assigned a tree replacement cost as they should probably be removed under normal tree management practices.

1. Example of tree valuation based on cost of repair.

Damaged crown of a maturing, large street tree as a result of house demolition:

Arboricultural inspection and report	\$550.00
Remedial pruning works	\$850.00
TOTAL	<u>\$1,400.00</u>

2. Example of tree valuation based on cost of removal and replacement.

Maturing, large street tree:

Arboricultural inspection and report	\$550.00
Tree removal	\$1,680.00
Tree replacement (Advanced tree)	\$1,700.00 (Includes delivery)
Planting cost	\$150.00
Establishment costs (5 years)	\$525.00 (35 visits/yr based on \$3.00 per visit)
Follow up assessments	\$240.00
<u>TOTAL \$4,845.00</u>	

13.3 City of Boroondara – Tree Amenity Value Formula

Trees are essential components of our environment and have an intrinsic amenity value. It is the intrinsic amenity value that often needs to be translated into a universally meaningful monetary value.

Council may elect to calculate the trees amenity value if a tree is particularly significant due to its size, prominence in the landscape, rarity, or other highly esteemed social value and it requires removal, has been removed as a result of an unauthorised tree removal or damaged structurally or aesthetically beyond that which the tree can no longer be retained.

The City of Boroondara has adopted the City of Melbourne – Amenity Value Formula Calculating a Tree's Amenity Value (2001), originally developed in 1990 based upon the Maurer-Hoffman Formula. This formula has been successfully used by the City of Melbourne for the past 15 years.

Application of the Amenity Value Formula will only be considered in exceptional circumstances. The City of Boroondara Amenity Value Formula can be seen in Appendix 7.

13.4 Quantifying Environmental Benefits of Trees on Council Managed Land

Trees provide many environmental services:

- Air pollutants reduction
- Nitrogen, phosphorus and sediment interception
- Carbon emissions reduction and sequestration
- Urban heat-island cooling
- Storm water runoff reduction
- Wildlife habitat

Quantifying the environmental benefits of trees could have impacts on the social (particularly health) and economic policies regarding the urban forest.

The methods of calculating monetary environmental benefits of trees on Council managed land will continue to be explored.

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APPENDIX 1: TREE SPECIES FOR VARYING SIZED PLANTING SITES

Recommended tree species list is not definitive.

Small trees suitable for small sites or naturestrips between 1.0m to 1.5m in width or wider.

Small Evergreen (5 to 8m)		Small Deciduous (5 to 8m)	
Botanical Name	Comment	Botanical Name	Comment
<i>Acacia implexa</i> (Lightwood)	Indigenous species. Use in natural groupings & adjacent to open space.	<i>Catalpa bignonioides</i> 'Nana' (Dwarf Indian Bean)	Could be used in commercial areas or formal gardens.
<i>Acacia podalyriifolia</i> (Qld. Silver Wattle)	Good foliage contrast. Useful under powerlines.	<i>Fraxinus ornus</i> 'Meczek' (Moptop Ash)	Could be used in commercial areas or formal gardens.
<i>Acacia pycnantha</i> (Golden Wattle)	Indigenous species.	<i>Gleditsia triacanthos</i> var. <i>inermis</i> 'Elegantissima' (Compact Honey Locust)	Could be used in commercial areas or formal gardens.
<i>Callistemon</i> 'Harkness' (Harkness Bottlebrush) OR <i>Callistemon</i> 'Kings Park Special'	Useful under powerlines & narrow planting sites.	<i>Lagerstroemia indica</i> x <i>L. fauriei</i> 'Natchez' (Natchez Crepe Myrtle)	Very good small tree. White flowers. Useful under powerlines. Could replace <i>Prunus</i> spp.
<i>Eucalyptus curtisii</i> (Plunkett Mallee)	Useful under powerlines & narrow planting sites. Attractive cream/white flowers.	<i>Lagerstroemia indica</i> x <i>L. fauriei</i> 'Sioux' (Sioux Crepe Myrtle)	Very good small tree. Medium pink flowers. Useful under powerlines. Upright branching.
<i>Eucalyptus leucoxylon</i> 'Eukie Dwarf' (Dwarf Yellow Gum)	Good selection for small urban sites	<i>Lagerstroemia indica</i> x <i>L. fauriei</i> 'Tuscarora' (Tuscarora Crepe Myrtle)	Very good small tree. Cerise flowers. Useful under powerlines. Could replace <i>Prunus</i> spp.
<i>Eucalyptus gregsoniana</i> (Wolgan Snow Gum)	Smaller species than <i>E. pauciflora</i> .	<i>Malus ioensis</i> 'Plena' (Bechtel Crab)	Very attractive small tree. Good spring flower display & autumn colour. Useful under powerlines.
<i>Eucalyptus platypus</i> (Round-leaf Moort)	Dense glossy foliage. Good under powerlines. Underutilised.	<i>Prunus cerasifera</i> 'Nigra' (Purple-leaf Cherry Plum)	Useful small tree where dark foliage provides textural contrast.
<i>Ficus microcarpa</i> var. <i>hillii</i> (Hill's Fig)	Only to be used as topiary specimens in commercial areas		
<i>Hakea multilineata</i> (Pink Spike Hakea)	Only use grafted stock (<i>H. salicifolia</i>), more suitable to the heavier soils.		
<i>Leptospermum petersonii</i> (Lemon-scented Tea-tree)	Adaptable to a range of conditions.		
<i>Melaleuca bracteata</i> (Black Tea-tree)	Useful small tree, tolerant of a wide range of conditions with attractive flowers		
<i>Tristaniopsis laurina</i> (Kanooka, Water Gum)	Useful, small tree. Long-lived with attractive features		

Medium trees suitable for open space areas and naturestrips between 2.0m to 3.0m in width or wider.

Medium Evergreen (8 to 15m)

Botanical Name	Comment
<i>Acacia melanoxylon</i> (Blackwood)	Indigenous species. Could be used as signature species.
<i>Acacia pendula</i> (Weeping Myall)	Attractive pendulous form with silver/grey fine foliage. Longer lived than most Wattles.
<i>Allocasuarina littoralis</i> (Black She-oak)	Useful urban tree. Can vary. Upright growth useful for narrow sites.
<i>Brachychiton populneus</i> (Kurrajong)	Useful urban tree with good drought tolerance. Could also consider B. x roseus
<i>Corymbia eximia</i> (Yellow Bloodwood)	Attractive species that could be used extensively in the north of the City.
<i>Eucalyptus cinerea</i> (Argyle Apple)	Provides good foliage contrast
<i>Eucalyptus leucoxylon subsp. megalocarpa</i> (Yellow Gum)	Good urban tree. Smaller stature than species may be suitable under powerlines.
<i>Eucalyptus pauciflora</i> (Snow Gum)	Attractive foliage & bark. Can vary in form from seed grown stock.
<i>Eucalyptus polyanthemus</i> (Red Box)	Adaptable to a range of conditions. Blue-grey foliage contrast.
<i>Eucalyptus risdonii</i> (Risdon Peppermint)	Drought tolerance, small size, excellent foliage and showy bark
<i>Eucalyptus scoparia</i> (Wallangara White Gum)	Attractive foliage & bark.
<i>Geijera parviflora</i> (Wilga, Australian Willow)	Attractive, albeit slow growing, tree. Good replacement for Peppercorns
<i>Olea europea</i> 'Swan Hill' & 'Tolleys Upright' seedless varieties of European Olive	Upright forms. Good drought tolerance
<i>Phoenix canariensis</i> (Canary Island Date Palm)	Signature palm within the City. Could be used as a highlight tree
<i>Syzygium paniculatum</i> (Magenta Brush Cherry)	Useful urban tree. Fruit can cause litter concern.
<i>Waterhousea floribunda</i> (Weeping Lilly Pilly)	Attractive foliage. Useful urban tree.

Medium Deciduous (8 to 15m)

Botanical Name	Comment
<i>Acer campestre</i> 'Evelyn' (Queen Elizabeth Maple)	Good urban tree that is underutilised. Drought tolerant.
<i>Acer campestre</i> 'Elsrijk' (Elsrijk Maple)	Good urban tree that is underutilised. Narrower form than 'Evelyn'
<i>Acer truncatum</i> x <i>A. platanoides</i> 'Keithsform' (Norwegian Sunset)	Good urban tree. Could replace Liquidambar within the City.
<i>Fraxinus pennsylvanica</i> 'Aerial' (Aerial Green Ash)	Narrow form useful where above ground space is limited.
<i>Gleditsia triacanthos</i> 'Sunburst' (Golden Honeylocust)	Attractive foliage & pendulous form.
<i>Koelreuteria paniculata</i> (Golden Rain Tree)	Attractive tree. Is slow to establish.
<i>Malus tschonoskii</i> (Tschonoski Crabapple)	Pyramidal form. Recently released species. Could trial species in streets
<i>Melia azedarach</i> (White Cedar)	Useful tree for urban areas. Fruit can cause litter problem. Can also develop wide trunk so do not use in narrow sites.
<i>Pistacia chinensis</i> (Chinese Pistachio)	Attractive tree with good drought tolerance. Can vary when grown from seed.
<i>Pyrus calleryana</i> 'Aristocrat' (Aristocrat Callery Pear)	Good urban tree.
<i>Pyrus calleryana</i> 'Capital' (Capital Callery Pear)	Good urban tree. Narrow form useful where above ground space is limited & in commercial areas.
<i>Pyrus calleryana</i> 'Glensform' Chanticleer® (Chanticleer Callery Pear)	Good urban tree. Narrow form useful where above ground space is limited & in commercial areas.
<i>Tilia cordata</i> 'Greenspire' (Upright Small Leafed Linden)	Narrow-domed tree that will adapt to a range of soil conditions. Good substitute for elms.

Large trees suitable for large open space areas and naturestrips > 2.5m in width.

Large Evergreen (>15m)

Botanical Name	Comment
<i>Angophora costata</i> (Smooth-Barked Apple)	Good urban tree. Makes attractive avenue tree. Could be a signature species within the City.
<i>Casuarina cunninghamiana</i> (River She-oak)	Good urban tree
<i>Corymbia citriodora</i> (Lemon-Scented Gum)	Attractive, broad domed tree.
<i>Corymbia maculata</i> (Spotted Gum)	Good urban tree. Makes attractive avenue tree. Could be a signature species within the City.
<i>Eucalyptus camaldulensis</i> (River Red Gum)	Indigenous to area. Use in large areas away from high target areas.
<i>Eucalyptus elata</i> (River Peppermint)	Attractive semi-pendulous form. Requires large site. Also dwarf variety 'Dry White' available from Austraflo.
<i>Eucalyptus leucoxylon</i> (Yellow Gum)	Useful urban tree. Could be a signature species within the City.
<i>Eucalyptus melliodora</i> (Yellow Box)	Indigenous species. Could be a signature species within the City.
<i>Eucalyptus sideroxylon</i> (Red Ironbark)	Attractive tree with good bark contrast.
<i>Lophostemon confertus</i> (Queensland Brush Box)	Good urban tree. Commonly used in street planting across Melbourne.
<i>Syncarpia glomulifera</i> (Turpentine)	Good alternative to eucalypts.

Large Deciduous (>15m)

Botanical Name	Comment
<i>Acer x freemanii</i> 'Jeffersred' (Autumn Blaze Freeman's Maple)	Good urban tree. Use in wide planting sites.
<i>Fraxinus pennsylvanica</i> 'Urbanite' (Urbanite Green Ash)	Good urban tree. Could also use <i>Fraxinus pennsylvanica</i> 'Cimmzam' Cimmamon™
<i>Ginkgo biloba</i> 'Princeton Sentry' (Upright Maidenhair Tree)	Good urban tree. May be slow to establish after transplanting. Use this form where above ground space is limiting.
<i>Liquidambar styraciflua</i> 'Rotundiloba' (Rotundiloba Sweetgum)	Better selection of Sweet Gum. Assured autumn colour. Use in wide sites.
<i>Platanus orientalis</i> (Oriental Plane Tree)	Good urban tree.
<i>Platanus orientalis</i> 'Digitata' (Oriental Plane Tree)	Good urban tree.
<i>Platanus x acerifolia</i> 'Yarwood' (London Plane Tree)	This variety is not prone to anthracnose.
<i>Quercus palustris</i> (Pin Oak)	Good urban tree.
<i>Quercus robur</i> (English Oak)	Good urban tree. Other options could include <i>Q. macrocarpa</i> (Bur Oak)
<i>Quercus robur</i> 'Fastigiata' (Fastigate English Oak)	Good urban tree. Narrow form
<i>Quercus rubra</i> (Red Oak)	Good urban tree.
<i>Tilia tomentosa</i> 'Sterling' (Silver Linden)	Attractive large tree. Requires large planting site.
<i>Ulmus parvifolia</i> 'Todd' (Todd Japanese Elm)	This form of the Japanese Elm has better structure than the species. Use in wide planting sites.
<i>Washingtonia robusta</i> (Washington Palm)	Attractive palm that could be used as a highlight tree
<i>Zelkova serrata</i> 'Green Vase' (Green Vase Japanese Zelkova)	Attractive large tree. This form of the Japanese Zelkova has better structure & vigour than the species. Use in wide planting sites.

APPENDIX 2: TREE CLEARANCE REQUIREMENTS

i) Electrical

Table 1. All areas. Dimensions of Clearance Space for Aerial Bundled Cable and Insulated Service Cable.

Type of powerline	<i>Near Pole</i>	<i>Away from pole</i>		
	All spans	Span of up to 40 meters	Span of 40-70 meters	Span of over 70 meters
	<i>In all directions</i>			
Aerial Bundled Cable	0.3 m	0.3 m	0.6 m	0.9 m
Insulated service cable	0.6 m	0.6 m	1.0 m	1.0 m

The requirement for clearance space surrounding an aerial bundled cable or insulated cable does not apply to small tree branches with a diameter of less than 10 millimetres and leaves if, at least once a year, the branches and leaves are removed from the clearance space as indicated in Table 1.

Branches and leaves are not required to be annually removed in accordance with above clause if the branches and leaves are not likely to abrade the cable before they are next removed in accordance with the Code.

Table 2. Minimum clearance spaces surrounding a powerline – Low bushfire risk areas other than Aerial Bundled Cable (ABC) or insulated cable.

Type of Powerline Nominal voltage	<i>Clearance Spaces</i>		
	<i>Near Pole</i>	<i>Away from pole</i>	
	<i>1</i>	<i>2</i>	<i>3</i>
	<i>Section of all spans near the pole</i>	<i>Spans up to and including 40 metres</i>	<i>Spans exceeding 40 metres</i>
Bare and Covered Low Voltage	1000 mm	1000 mm	1500 mm
6.6 kV, 11 kV and 22 kV	1500 mm	1500 mm	2000 mm
66 kV	2250 mm	2250 mm	3000 mm
<p>For 66 kV—The space vertically above the powerline must be kept clear of vegetation.</p> <p>An additional distance must be added to the clearance space to allow for the sag and sway of the conductors and for vegetation regrowth during the period between pruning times.</p>			

The above clearances are to be maintained free of vegetation. There is the additional requirement to maintain a regrowth space. This is measured as the average annual growth x number of years in a vegetation management or tree clearance cycle.

ii) Other clearance requirements

Where possible and having due regard for the aesthetic amenity of the individual tree and streetscape, Council will prune trees within the City in an attempt to achieve the clearances listed in Table 3.

Table 3.

Access Type & Clearance Location	Clearance
Pedestrian Over footpaths, driveways, walkways, nature strips	Height of 3m
Vehicular Over roadways	Height of 4.3m
Motorist/pedestrian visibility Along road user sightlines	Height of 1.5m
Street lighting Above and either side of the street light. <i>In addition, the tree will be sufficiently pruned to allow triangulated illumination of the road below the tree.</i> Streetlight cables/from cable	Distance of 1m Distance of 600mm
Road signage From signs	Maintain visibility
Traffic control devices From control devices	Maintain visibility

APPENDIX 3: MANAGEMENT OF CANARY ISLAND DATE PALMS

The Canary Island Date Palm (CIDP) is one of the most widely cultivated ornamental palms in the world. The species has enjoyed a reputation as an adaptable tree that will tolerate a wide range of soil types and climactic conditions and as such it is highly suitable for the Australian landscape (Jones 1989). There are some good examples of Canary Island Date Palm (CIDP) both within private and public gardens across the municipality.

CIDP audit

In order to manage CIDP throughout the City an inventory needs to be maintained. Details of location, tree dimensions, condition and pruning history are to be included in the inventory.

Pruning of CIDP

Palms are pruned to remove dead or chlorotic lower fronds, or remove flower and fruit stalks.

Palms are often over pruned however, with the removal of green fronds rarely necessary. Removing green fronds from a palm can slow growth rate and cause a narrowing of the trunk and potential root problems. Over pruning of CIDP can cause trees to become susceptible to Fusarium wilt. Refer to Section 12.4.3.

Excessive pruning, particularly of the older fronds low down the canopy, can also cause potassium (K) deficiency. Potassium is required by plants in the control of water movement between cells, stomatal activity, chemical reactions and growth extension. Potassium is also required for the thickening of cell walls which aids in the protection of plants against disease.

Potassium is translocated from the older leaves to the newer leaves as required by the plant and in cases of deficiency, crowns become greatly reduced in size, fronds appear 'frizzled' and trunk taper is reduced resulting in 'pencil pointing'. Without treatment, palms affected by severe K deficiency will die.

If there is a need to undertake pruning, only remove those fronds drooping below an imaginary horizontal line drawn through the bottom of the canopy (See Diagram 1).

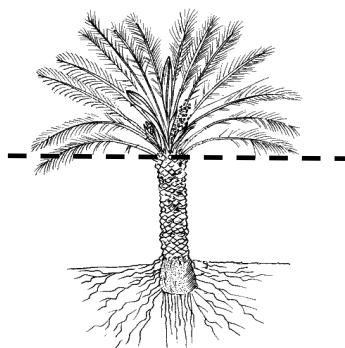


Diagram 1. Dashed line indicates acceptable pruning height. Fronds drooping below

Pest and diseases

A significant threat to palm species in particular the Canary Island Date Palm is Fusarium wilt (*Fusarium oxysporum* f.sp. *canariensis*). Fusarium Wilt is a true wilt disease where plant decline and death is as a direct result of the loss of function of the water conducting cells within the plant. The general decline symptoms are similar to those caused by other root and stem diseases and include:

- Progressive frond death from oldest to newest canopy;
- One-sided leaflet death on a declining frond;
- A prominent brown strip on the rhachis base starting at the trunk and extending out a variable distance towards the frond tip; and
- Discoloured vascular bundles in the 'striped' fronds.

Symptoms will become pronounced during periods of drought and may vary from those mentioned above and as a result, identification through nucleic acid finger printing is necessary to clearly classify the pathogen.

The disease is generally spread through infected plant material, soil and pruning tools. Control usually involves removal and destruction of infected plant material (Simone & Cashion).

There are a number of other diseases that may also be agents of decline including *Ganoderma* root and butt rots which are identified by the appearance of a perennial basidiocarp around the base of the plant. There are also leaf blights that can cause decline in the crown health of CIDP (Sinclair, Lyon & Johnson 1996).

Aside from the obvious effects on aesthetic appeal, dead or dying fronds in areas of high traffic movement falling from height can cause damage to property and/or injury to persons. The spine like pinnae at the base of the rhachis can also inflict serious stick injury to unwary individuals who attempt to handle fallen fronds. In addition, the fronds can provide shelter to vermin such as rats, sparrows, starlings and mynahs (Jones 1989).

Fertiliser Requirements

Fertilising CIDP is an important cultural requirement for sustained, healthy growth. Regularly fertilising CIDP will greatly improve the vigour and health of palms.

The fertiliser ratio for palms should be two parts nitrogen (N) to one part phosphorous (P) to three parts potassium (K) to one part magnesium (Mg) and must include all micronutrients. 100% of N, P, K, and Mg should be in controlled release form.

Apply 500 grams of fertilizer for every 10 square meters of crown projection (1,200 grams per tree in this case) every 3 to 4 months following establishment. Broadcast fertiliser evenly under the canopy to the drip line of the palm but not close to the base of the palm. Avoid applying fertiliser close to the trunk (within 30cm) as this is where the root initiation zone is located and fertiliser can burn emerging roots.

APPENDIX 4: GUIDELINES FOR TREE PROTECTION ZONES

The protection of all trees located on Council managed land shall be in accordance with AS 4970 - 2009 Protection of trees on development sites. ***To maintain consistency across Council, the calculation of a TPZ has been altered from 12 x trunk diameter to 10 x trunk diameter throughout this policy.***

A tree protection zone (TPZ) should be established around the base of each tree within the construction/development area. The TPZ is based on the standards established by NJUG (1995) and Harris *et al.*, (2004).

To calculate the TPZ, the diameter of the tree is measured in centimetres (cm) at 1.5 metres above grade (Diagram 1). Where a tree branches below 1.5 metres (m), measure the smallest trunk diameter below the lowest branch (Diagram 2).

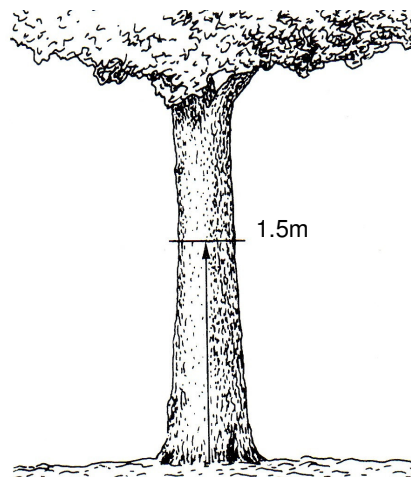


Diagram 1: Measurement of DBH on tree with single trunk

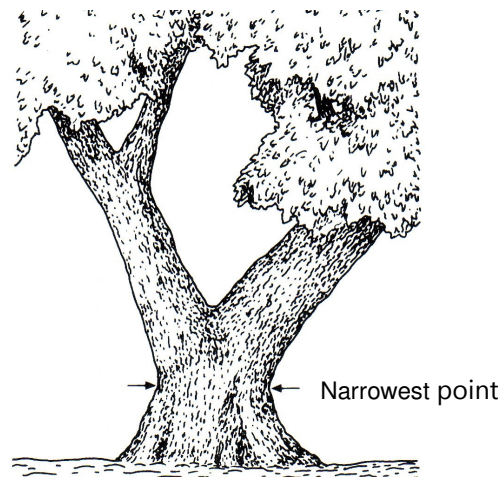


Diagram 2: Measurement of basal diameter at narrowest point above the basal flare

For multiple stemmed trees measure the circumference of each trunk stem 1.5m above ground (Diagram 3). The cross-sectional square centimetre area of each trunk stem is determined and then added together to obtain a total trunk area. A diameter can be ascertained from the total area calculation (based on a circle).

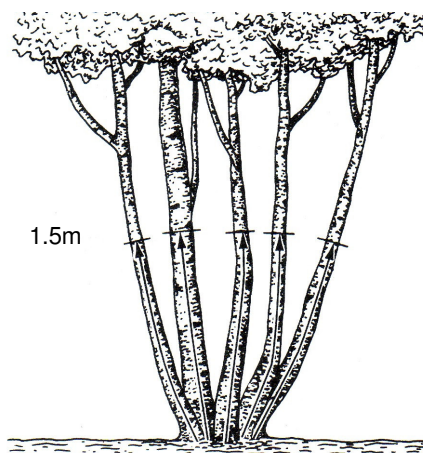


Diagram 3. Measurement of DBH on tree with multiple trunks

Diagrams 1-3 adapted from Gooding *et al.* (2000)

To establish the radial TPZ distance, multiply the diameter by ten (10). This distance should then be measured from the edge of the trunk of the tree to provide the circular protection area in all directions.

In the case of street trees the existing infrastructure around the tree will inhibit the establishment of a symmetric TPZ. It will be the nature strip area that requires the emphasis for protection of the root system.

Reference:

Gooding, R.F., Ingram, J.B., Urban, J.R., Bloch, L.B., Steigerwaldt, W.M, Harris, R.W. and Allen, E.N. (2000) Guide for plant appraisal, 9th edition, International society of Arboriculture, USA

Australian Standard 4373:2007 – Pruning of Amenity Trees

Table 1. Tree protection zone distances

Tree protection zone. (Diameter X 10)	
Diameter (cm)	Distance (m)
5	0.5
7.5	0.75
15	1.5
30	3.0
45	4.5
60	6.0
75	7.5
90	9.0
105	10.5

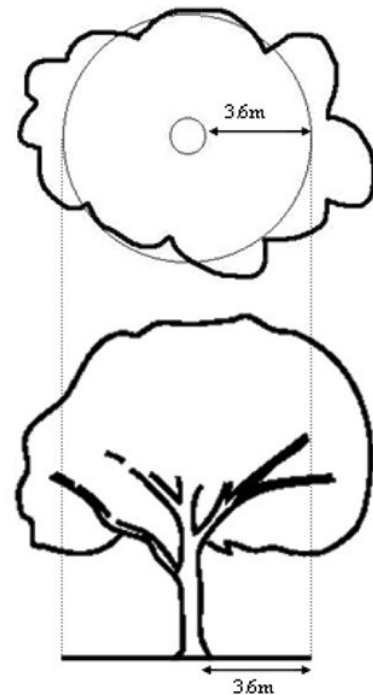
Diagram 1: Determining the tree protection zone

1. Measure the diameter (cm) of the tree at 1.5m above grade.
2. Calculate the TPZ using the table above or, by multiplying the diameter by 10. (This is measured from the edge of the trunk).

Example:

A mature Brush Box (*Lophostemon confertus*) street tree with a diameter of 36cm.

$36\text{cm} \times 10 = 360\text{ cm}$ or, 3.6m radius TPZ



Fencing for Protected Trees, Street Trees or Designated Trees

A fenced Tree Protection Zone (TPZ) is required around all trees, including street trees within or adjacent to a construction site on Council managed land.

A fenced TPZ is required around all street trees adjacent to a construction site on private property.

The requirement for fenced enclosures around designated street and park trees will be at the discretion of the Senior Arborist or delegated officer(s).

Temporary protective fencing shall be erected to establish a Tree Protection Zone (TPZ) around all Canopy Trees (with a total trunk circumference of 110cm or more measured at 1.5 metres from the ground) abutting a construction site, including street trees. Fencing shall be in accordance with AS 4687, secured to restrict access and will enclose an area that encompasses all of the area below the trees dripline or all of the available naturestrip, whichever is the greater. The fence shall not impede pedestrian or vehicular traffic flow and erected before any machinery or materials are brought onto the site and before the commencement of works, including demolition. The protective fencing shall remain until the completion of works and must not be removed or altered without the approval of the Senior Arborist or delegated officer(s).

Mulching the TPZ may be an alternative to the erection of tree protection fencing. Prior to construction, wood chips may be spread within the TPZ to 100mm depth, leaving the trunk clear of mulch. Mulching can also act as a temporary root buffer left in place until completion of construction. The mulched area is to be reinstated to its original condition upon completion of works. The decision to mulch the TPZ in preference to fencing shall be at the discretion of the Senior Arborist or delegated officer(s).

Supplemental irrigation, soil aeration, fertilizing or other beneficial practices may be approved by for use within the TPZ.

Erection and maintenance of any fencing, installation and cleaning up of mulch and any other tree maintenance requirement is the responsibility of the developer, contractor, relevant authority or property owner.

Prohibited activities must remain outside the allocated TPZ – **Section 10 Protection of Trees on Council Managed Land During Construction**. Regular inspections of development sites will be undertaken by Senior Arborist or delegated officer(s).

Modifications to the tree protection method

Owing to the complexity of some developments, it may be necessary to encroach the allocated TPZ of a retained tree. The TPZ assigned for a particular tree should be used as a guide for planning purposes. There will be times when it is not possible to implement the allocated TPZ around each tree to be preserved (Matheny & Clark, 1998).

Existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system. Existing infrastructure around some trees may be within the TPZ or structural root zone, as is the case with street trees. The roots of some trees may have grown in response to the site conditions and therefore, if existing hard surfaces and building alignments are utilised in new designs, the impacts on the trees should be minimal. In instances where it is known that the root system is not

symmetrical, the tree protection zone should be established independently, but with guidance from the method.

Encroachment of a TPZ will be authorised by the Senior Arborist or delegated officer(s).

The Structural Root Zone (SRZ)

There is a threshold to how much encroachment into a root zone that can occur in order to maintain a safe and healthy tree.

The closer the excavation or trenching is to the trunk of the tree, the greater the potential for root damage resulting in an increased risk of tree failure. On this basis, all proposed construction works within the allocated TPZ should be approved by the Senior Arborist or delegated officer(s). Exploratory excavation can also be used to ascertain extent of root system within the area of proposed development. Refer to **Section 10.7 – Hand and root sympathetic excavation**.

The stability of a tree can be affected if large roots are severed or damaged near the trunk. Root damage or severance reduces the trees ability to withstand typical wind loads which can lead to windthrow (root plate failure). Mattheck & Breloer (1997) have undertaken investigations to assist with determining the minimum distance from the tree trunk where these roots may be more fundamental to tree stability.

The minimum clearance distance required to simply provide confidence about a tree's stability is determined by the radius of the trees stem (measured on the lower trunk, immediately above any root buttressing) and comparing this with a failure boundary curve. This provides a minimum clearance distance from the centre of the tree's trunk to preserve stability. Table 2 indicates the Structural Root Zone (SRZ) for a number of tree sizes.

Table 2: Structural Root Zone

Trunk diameter(cm) <i>measured immediately above the root buttress</i>	Structural Root Zone (m)
10	0.9
20	1.5
30	2.0
40	2.4
50	2.6
60	2.8
70	2.9
80	3.1
90	3.2
100	3.4

Adapted from Mattheck and Breloer (1997)

The clearance distances indicated above should never be used as a minimum clearance distance to maintain tree health. If used in this manner, most trees would probably decline or even die. The SRZ distance provides a guide to assess the stability of trees, if disturbance occurs near to them. Clearance distances required to preserve long term tree health are maintained by using the Tree Protection Zone.

Assessment of root damage will be undertaken by the Senior Arborist or delegated officer(s).

Depth of boring

Depth specifications for boring in contemporary literature are variable but consistently state that a tunnel under the root plate of a tree should be at least 600mm deep (Harris *et. al.*, 2004). Boring according to the Multinet directional boring standard EP-DD-4136 (2003) at a depth of 800-1100mm to the top of the pipe (TOP) will ensure that the excavation is below the major zone of absorbing roots. A minimum boring depth of 800mm from natural grade to the TOP should apply under all TPZ's

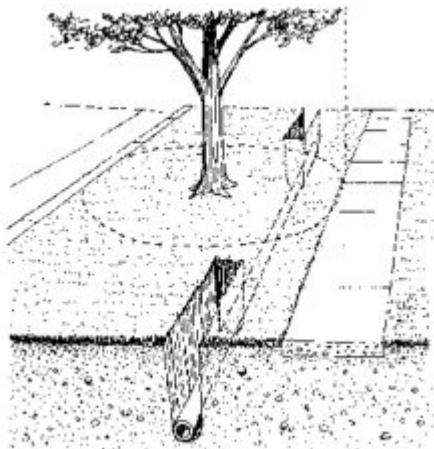
Boring depth should also consider soil topography. Boring within the A soil horizon (topsoil) will impact on the root system of the tree as this area is the most conducive soil environment for root growth. Boring below this area in the B Horizon or sub-soil layer will reduce the impact on the root system of the tree by avoiding most of the absorbing roots as well as avoiding root damage to services. (Harris, Matheny & Clark 1999).

To avoid damage to pipes by tree roots, Mattheck and Breloer (1997) recommended that pipes should not pass within the root plate of the tree. Where the pipe must be within the root plate, it should be laid at a minimum depth of 800mm and be placed within a duct which can resist root penetration.

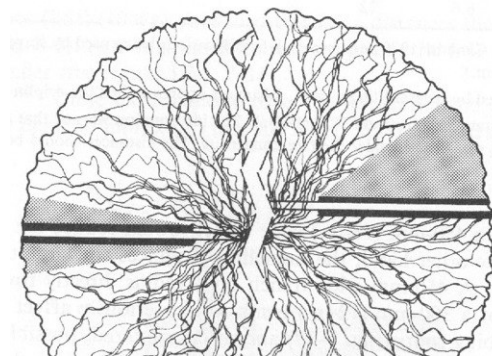
Alignment of boring

Ideally, the line of boring or excavation should lie directly under the trunk of the tree. The diagram below (right) illustrates the comparative root loss of boring directly under the trunk as opposed to boring at an offset distance. Mattheck and Breloer (1997) suggested that placing pipes directly beneath trees would effectively minimise the wind loading damage by the fact that the root lies in the neutral pivot of the swaying motion. Where it is not possible to bore directly under the trunk of a tree, the bore should be as deep as possible to minimise the loss of absorbing roots.

Diagram 2



*Boring within the protection zone.
(From: CFSF, 1999)*



*The comparative impact of boring within the protection zone. Left, about 15% of the absorbing roots would be jeopardised when boring directly under the trunk. Whereas, right, 20% would be lost from the offset boring
(From: Harris, 1992)*

APPENDIX 5: ROOT PRUNING AND ROOT BARRIER / DEFLECTOR INSTALLATION GUIDELINES

Root Pruning Guidelines

The following general root pruning guidelines are provided:

1. A tree should be root pruned only if the problem can be solved by removing less than 33 percent of the tree's roots, with no more than 25 percent from one side.
2. The minimum clearance distance required to simply provide confidence about a tree's stability is determined by the radius of the tree's stem (measured on the lower trunk, immediately above any buttressing) and comparing this with a failure boundary curve. This provides a minimum clearance distance from the centre of the tree's trunk to preserve stability.

Table 1 indicates the Structural Root Zone (SRZ) and provides a guideline for root pruning for a number of tree sizes. The clearance distances indicated should never be used as a minimum clearance distance to maintain tree health. If used in this manner, most trees could decline or even die.

Table 1 Structural Root Zone

Trunk diameter(cm)	Structural Root Zone (m)
10	0.9
20	1.5
30	2.0
40	2.4
50	2.6
60	2.8
70	2.9
80	3.1
90	3.2
100	3.4

Adapted from Mattheck and Breloer (1997)

3. Cut roots cleanly after excavation with clean, sharp tools.
4. Backfill the excavation as soon as possible and water the soil around the roots to avoid leaving air pockets.
5. Surface roots which interfere with other elements in the street/landscape can be removed under the supervision of the Senior Arborist or delegated officer(s). Each tree has a different root system and requires individual analysis and treatment.
6. Where root pruning is absolutely necessary, trees should only be pruned that are not in decline or stressed.
7. To reduce the threat of failure, only one side of the tree should be pruned at a time, with subsequent sides pruned after 3-4 years.
8. The top of the tree should be thinned before the roots are cut, preferably one year before root pruning occurs. Crown reduction pruning may be advisable (Harris, Clark and Matheny 1999).

Barrier types

The most common type of barrier used on Council trees is a deflector. These barriers attempt to change normal root orientation to exclude root growth from a given area, or to reposition roots to prevent potential future damage.

Deflectors can be solid, interlocking thermoplastic panels, sheets, rolls or preformed planters. Plastic deflectors (high-density polyethylene) and geotextile fabric products are also used. Some geotextile fabric products can be impregnated with chemical compounds that inhibit root development.

Circular (or square) preformed barriers used on new tree plantings should only be installed after investigation of the site, soil type and species to be planted. Root buttress development can be compromised which may affect the structural stability of the tree. Restrictive soils (compacted) may restrict root development.

Barrier configuration

Linear, deflector barriers are the most common installed in the City of Boroondara. Linear barriers can be placed alongside hardscape elements, such as footpaths, kerb and channels, and fences after root pruning.

Typically root barrier installations will be adjacent to street trees situated:

- in a grassed nature strip;
- under an asphalt or concrete footpath or road;
- in a asphalt or concrete cut-out in the road or footpath; and
- in Council managed land.

Root barriers are to be placed at the minimum distances from the tree(s) as outlined in Table 1.

The depth of the barrier will be dependent on the soil type, tree species, distances to infrastructure and alleged damage and are usually installed at 1.0m depth.

Linear barriers must also be appropriately sealed around any underground services running perpendicular to the barrier.

The top edge of a root barrier is to be maintained at least 2.5cm above soil level or mulch. If root barrier is placed within a hard surface the top of the barrier is imbedded into the hard surface upon reinstatement.

Specification detail can be seen in Arboricultural Services Tree Root Treatment Contract.

Assessment of tree suitable for root pruning and barrier installation

Senior Arborist or delegated officer(s) will determine the suitability for root pruning and/or barrier installation based on the factors listed below:

- Tree species;
- Tree age;
- Tree condition;
- Relative tolerance of tree to root severance;
- Significance in the landscape/street;
- Distance available for root pruning;
- Extent of or potential of tree root conflict;
- Distance from tree to infrastructure;
- Soil type;
- Surrounding infrastructure; and
- Placement of barrier (feasibility).

Soil type

Barriers are most effective in areas of well-drained soil where the roots grow back to the surface more slowly than in soils that are not as free draining.

Root barriers appear to be ineffective in compacted and poorly drained soils that are typical in many urban areas. The roots quickly return to the soil surface after they grow under the barrier (Figure 1), often in the loosened soil filled in around the barrier during installation. Although the barrier stops some roots, the roots that reach the surface are large in diameter and can cause damage to the footpath (Gilman, 1997; Gilman, 1995).

Biddle (1998) recognised that although root pruning and barriers works theoretically, there are usually overwhelming practical objections. For a root barrier to be effective, it must be deeper than all root activity at the time of construction. Unless a barrier can be fully effective, it merely provides a false sense of security.

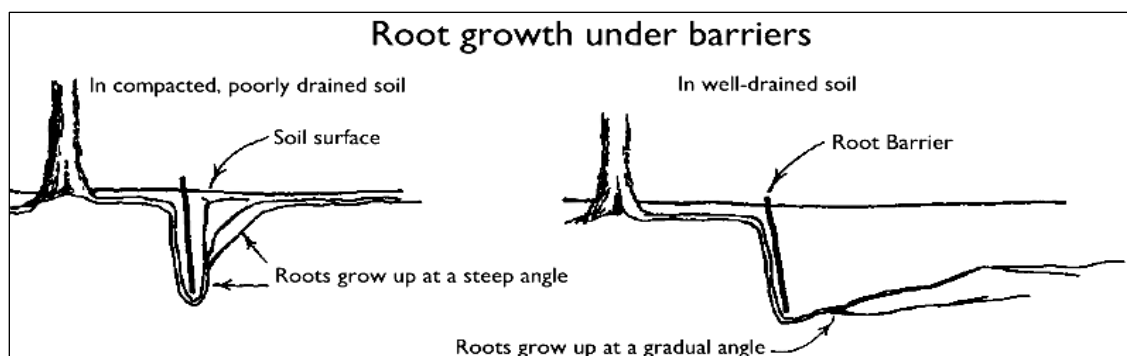


Figure1: Root growth under barriers (Gilman, 1997)

Procedure – How roots damage structures

Tree roots have several mechanisms whereby they are capable of displacing or damaging structures. Lightweight structures in close proximity to trunks are able to be displaced through the expansion of heavy lateral roots as they increase in size. This can be easily observed with displacement or lifting of concrete bays, cracking and raised sections in bitumen or movement or cracking in fencing.

Apportioning blame to tree roots that are alleged to be causing direct damage to lightweight structures and hard surfaces can be a relatively simple process requiring visual confirmation of the presence, identification and size of roots below the area of damage then formulating a conclusion and recommending remedial treatment as recommended by the Senior Arborist or delegated officer(s).

Indirect damage to structures can be caused by roots absorbing soil moisture and influencing differential soil water deficits. Clay soils in particular are considered reactive, that is they respond to fluctuations in soil moisture and will expand and contract accordingly.

When rigid structures such as footings supporting brick wall are built on reactive soils that experience differential drying or wetting, there is the potential for structural movement to occur through soil heaving or shrinking around the footings upon which the rigid structures are built.

To be able to reasonably apportion blame for structural damage caused by the influence of tree roots on soil moisture deficits, numerous facts must first be established and other potentially contributory factors omitted. Factors other than root influence on soil moisture levels that can influence structural movement include:

- soil properties (soil reactivity);
- site vegetation history (removal of vegetation influencing soil moisture re-hydration levels);
- footing construction techniques (inadequate size, too shallow, quality of concrete footing);
- building age (deterioration of materials over time); and
- climatic history (changes in weather patterns influencing patterns of soil drying).

Other management considerations to reduce conflicts between tree roots and hard surfaces and structures:

Long-term species selection

Tree selection is often one of the most effective tools in managing tree roots. The aim is to select those tree species that will cause the least damage to adjacent infrastructure with their root systems.

The issue is the right tree for the right place with due consideration given to aesthetic/design requirements, biological criteria (i.e. tolerances) and functional criteria (management issues). There is no one perfect tree. The most successful course is to match the planting site limitations with the right tree for that spot.

If there is no one perfect urban tree, it is also important to understand that there is no one urban environment. The urban environment is a varied conglomeration of microclimates. Above ground or below ground site conditions can change dramatically within the space of a few metres. Consequently a site analysis of each major planting site will allow more appropriate tree selections.

Tree selection is not just a case of recommending a particular plant but must also consider its root physiology and a thorough assessment of the site conditions. Also the soil conditions of the site frequently limit planting success.

Tree species suitable for planting within certain size planting sites for the City of Boroondara can be seen in Appendix 1.

Providing Adequate Space for Trees

The further a tree is away from hard surfaces the less likely damage will occur. Combined with this is the understanding that the smaller the size of the mature tree the narrower the planting site can be, within reason.

One way to estimate this is to consider the 'Zone of Upheaval' (Clark, 2000) which uses the mature size of the tree to estimate the root plate of the tree (combination of buttress flare and heavy lateral roots). By keeping hard surfaces away from the stem and zone of upheaval, damage to hard surfaces could be substantially mitigated or eliminated.

To use this method one has to estimate the trunk diameter (DBH) of the mature tree. Clark (2000) estimates the DBH to be typically 4% of mature tree height and up to 5% of heavy stemmed trees like *Ficus macrophylla* (Moreton Bay Fig) or *Schinus areira* (Peppercorn Tree).

This area to offset potential damage (zone of upheaval) is estimated as 4 to 5 x DBH (of the mature tree) in diameter.

Table 2: Zone of Upheaval.

Est. Mature Height (m)	Est. DBH (cm)		Zone of Upheaval (Diameter m.)			
	Type 1 (DBH 4% of height)	Type 2 (DBH 5% of height)	Type 1		Type 2	
			4xDBH	5xDBH	4xDBH	5xDBH
5	0.20	0.25	0.80	1.00	1.00	1.25
6	0.24	0.30	0.96	1.20	1.20	1.50
7	0.28	0.35	1.12	1.40	1.40	1.75
8	0.32	0.40	1.28	1.60	1.60	2.00
9	0.36	0.45	1.44	1.80	1.80	2.25
10	0.40	0.50	1.60	2.00	2.00	2.50
11	0.44	0.55	1.76	2.20	2.20	2.75
12	0.48	0.60	1.92	2.40	2.40	3.00
13	0.52	0.65	2.08	2.60	2.60	3.25
14	0.56	0.70	2.24	2.80	2.80	3.50
15	0.60	0.75	2.40	3.00	3.00	3.75
16	0.64	0.80	2.56	3.20	3.20	4.00
17	0.68	0.85	2.72	3.40	3.40	4.25
18	0.72	0.90	2.88	3.60	3.60	4.50
19	0.76	0.95	3.04	3.80	3.80	4.75
20	0.80	1.00	3.20	4.00	4.00	5.00
21	0.84	1.05	3.36	4.20	4.20	5.25
22	0.88	1.10	3.52	4.40	4.40	5.50
23	0.92	1.15	3.68	4.60	4.60	5.75
24	0.96	1.20	3.84	4.80	4.80	6.00
25	1.00	1.25	4.00	5.00	5.00	6.25

APPENDIX 6: MANAGEMENT OF PEST & DISEASES

Animal management

The City of Boroondara recognises that possums, flying foxes and other native animals are protected species under the Wildlife Act 1975.

Brushtail & Ringtail Possums

In the event that a Council managed tree is showing signs of excessive damage from possum grazing, Council officers shall inspect the tree and determine a suitable course of action to reduce further grazing. Listed below are appropriate actions to limit possum access to trees:

- Installation of possum guards or bands around the trunks or major branches of the tree. These guards are typically constructed from sheet metal or clear polycarbonate and should be a minimum of 60cm wide. Where possible the guard will be placed above the first fork of the tree to provide refuge for possums if pursued by other animals, provided that it is not possible for the possum to access the remainder of the tree. Possum guards may also be placed on surrounding trees to restrict access to a combined tree canopy.
- The effected tree and surrounding trees may be pruned to reduce the crown away from structures or other trees, to prevent the development of 'possum highways'. A clear distance of 2m should be created between the tree/s and surrounding structures.
- The ability to limit den sites in buildings and trees will be investigated. Tree hollows will not be filled as this can cause more damage to the tree.
- Strategies could be investigated for limiting possum movement along utility lines.

Within a site with fixed boundaries, such as a public park, a specific possum management strategy could be developed to manage the possum population on the particular site. In addition to the possum control strategies outlined above, the following could also be implemented:

- Surveys could be conducted to determine the size of the possum population, the number of dens, whether the possums are local or live in properties surrounding the park, and access to artificial food sources, such as unsecured rubbish bins, food scraps or deliberate feeding by the public.
- Seasonal use of organic repellents in garden beds to protect specific vegetation.
- Modifying public rubbish bins to restrict access by possums.
- Public education campaigns to discourage deliberate feeding and dumping of possums in parks.
- In exceptional circumstances and in accordance with a documented possum control strategy, the number of common Brushtail Possums could be directly reduced in a park through trapping and humanely destroying the possums.

Insect management

Elm leaf beetle (ELB) management

Elm Leaf Beetle (ELB) (*Pyrrhalta luteola*) can be a serious pest for Melbourne's Elm populations. Repeated defoliation over successive seasons can weaken elms, increasing their susceptibility to other stresses and may therefore contribute to tree death.

In accordance with best industry practice, the City of Boroondara will endeavour to combat ELB within the municipality using integrated pest management (IPM) practices. Chemical, cultural and biological procedures shall be used to minimise the impact of the pest on the municipality's elm populations.

Survey and Monitoring of ELB populations

Council will maintain a register of elms growing on Council managed land. Damage predictions and treatment decisions will be based on survey data and the continual monitoring of trees and elm thickets in the affected areas. The Senior Arborist or delegated officer(s) will undertake damage prediction sampling in affected areas.

The Senior Arborist or delegated officer(s) will carry out the collation of survey results and the information used in conjunction with the degree-day method to determine the timing and focus of the proposed control methods.

Council has an elm leaf beetle brochure available for residents that provides information identification and control of the pest.

Methods of Control

Chemical Control

Imidacloprid

The chemical Imidacloprid, sold commercially as Confidor[®], is a systemic insecticide registered for ELB control. The chemical is either applied via a soil drench or trunk injection, and moves through the tree via the internal transport system.

Adult beetles or larvae are killed after eating a leaf that contains the chemical. Typically, effective ELB control is achieved for 2-3 years when Confidor[®] is applied in this manner.

Imidacloprid Root Drench

The use of Imidacloprid as a root drench is the most efficient and cost effective method of control in large trees. This treatment is available in August - October. Uptake of the chemical will take between 2 to 8 weeks.

This treatment is employed where sufficient area of soil exists beneath the tree. The application technique being used involves the injection of the insecticide into the soil, to a depth of 40 to 60 cm, along the drip line of the tree. The insecticide is absorbed by the roots and is transported up into the leaves in the sap stream.

Imidacloprid Stem Injection

Like the root drench, this is a most efficient and cost effective method of control in large trees, in particular, where there is little available soil area under the tree to administer the root drench. Uptake of the product is much faster than the root drench. This treatment will be available between September and December. The stem injection does cause some damage to the tree's vascular system.

What is Imidacloprid and how hazardous is it?

The active constituent, **Imidacloprid**, is from a new insecticidal chemical group, which has a relatively low hazard to the applicators and the soil environment.

The method of application, i.e.: soil injection or stem injection means that there is a very low risk of exposure for the general public using the treated areas which, coupled with the chemical's low hazard, amounts to an extremely low risk of adverse effects.

Imidacloprid is available in a home garden ready-to-use pack for general insect control in the garden and is sold as 'CONFIDOR PLANT INSECTICIDE'. Another product has just been released for termite control and is called 'PREMISE'.

Carbaryl

Carbaryl is the active constituent in a number of products. It is a contact insecticide, and is applied either as a foliar spray or as a band around the trunk. When mature larvae move down the tree to pupate they are killed on contact with the chemical band.

Bark banding, is a population control measure and may not significantly reduce the level of damage to the tree. The Carbaryl bands may be effective for up to six weeks depending on rain events.

Carbaryl Canopy Spray

The use of Carbaryl as a canopy spray is a cheaper alternative to Imidacloprid and will provide approximately 6 weeks protection against ELB. If employed at the right time (October to December) this treatment will keep the tree relatively free of damage until the following spring. This treatment involves the spraying of all the leaves in the canopy with a dilute solution of the insecticide. Specialised ground based equipment is used.

What is carbaryl and how hazardous is it?

Carbaryl is a carbamate insecticide of relatively low hazard to the applicators and the general environment. The application of a dilute spray to the bark or the canopy of the tree markedly reduces any hazard to people from direct exposure. Once the spray deposit is dry, direct exposure is almost impossible. The treated band is also placed as high above the ground as is practicable.

Entrust

Entrust[®] Naturalyte[®] insect control is an organic insecticide for the control of various insect pests on fruit, vegetable and ornamental plants. Spinosad, the active ingredient in Entrust[®] Naturalyte[®] insect control, is a revolutionary compound for insect control that provides the efficacy of a synthetic insecticide with environmental benefits of most biological insecticides. It offers excellent control of targeted pests and low toxicity to non-target organisms, including most beneficial insects.

Entrust[®] Naturalyte[®] is applied as a foliar spray and has two modes of entry, contact and ingestion, which increases the level of control. Movement of the chemical within the leaf helps reach pests out of the direct line of spray.

Entrust[®] Naturalyte[®] should form part of an effective insect resistance management programme, ideally suited for use in IPM programmes.

The Senior Arborist or delegated officer(s) will determine which Council trees are to receive chemical treatment for ELB. The program may cycle treatment of the trees over

two or three years, to achieve a balance between the annual expense and effective control.

Biological Control

In its native area, the elm leaf beetle has several natural enemies that keep the populations in check, including species of birds, toads, diseases, and predacious and parasitic insects. None of the known ELB predators exist in Melbourne, and the Department of Primary Industries through Primary Industries Research Victoria have experimented with using the elm leaf beetle parasitic fly (*Erynniopsis antennata*) as a potential biological control agent.

The City of Boroondara supports efforts to find an effective biological control agent, and would support a test release of the fly within the municipality.

Cultural Control

Removal of potential habitat is an integral component of Council's ELB management strategy. Wild elm thickets or elm suckers provide additional habitat for the pest. The location and condition of these trees/thickets often means that chemical control of ELB is not feasible, and therefore removing these trees/thickets will assist in achieving control within the greater municipal area.

Similarly, by removing elms in areas of lower significance and replacing them with alternative species, potential food for the beetles will be reduced and resources can be targeted at maintaining elms in significant areas.

Removal of a Tree

This course of action is recommended when the Senior Arborist or delegated officer(s) believes the amenity value of the tree is too low to warrant the expense of alternative treatments.

Tree removal includes the removal of the tree to ground level, the disposal of all debris including leaves, branches and log wood, the treatment of the stump with an appropriate herbicide to prevent suckering and the grinding of the stump two weeks after the herbicide treatment.

Council will also aim to reduce debris and potential over-wintering sites from around the base of trees.

Disease Management

Dutch Elm Disease

The DED contingency plan

In 1993 Mr P.T. Jenkins was engaged by the Elm Leaf Beetle Liaison Committee to prepare a Dutch Elm Disease Contingency Plan for Australia. The draft (2001) DED Contingency Plan should be used as the major reference document in conjunction with the Tree Management Guidelines, in the event of a suspected or confirmed DED outbreak.

The aim of the DED contingency plan is to give background and provide detailed information for City of Boroondara staff and service providers, regarding required action in the event of a suspected or confirmed outbreak of Dutch Elm Disease (DED), in the City of Boroondara, Greater Melbourne or elsewhere in Australia.

Symptoms of Dutch Elm Disease

The most common symptom of DED is the yellowing, curling and eventual death of leaves (see plate 1 & 2). As the disease progresses, this dieback spreads over the entire affected branch and back towards the main trunk of the tree.

The second symptom, typical of DED is the formation of brown, longitudinal streaks in the sapwood of infected branches, (see plate 3 & 4). By peeling back the bark on infected wood, this streaking can generally be easily seen.



Plates 1 & 2



Plates 3 & 4

Transmission of Dutch Elm Disease

The fungal spores are primarily carried from diseased elms into healthy elms on the body of the Elm Bark Beetle (*Scolytus multistriatus*). The Elm Bark Beetle, pictured below is the only known vector of DED and is generally most active during the spring and summer months. It is now well established in Victoria.



DED can also spread from diseased trees to healthy trees via root grafts in closely planted elms. Root grafts commonly form in closely planted elms, and unless these grafts are severed, a 'domino' effect can cause the loss of an entire avenue in a short period of time (Lefoe, 1997). This is particularly relevant to the City of Boroondara as the majority of elms are planted in rows in avenue plantings or within the parks and gardens.

Detection of Dutch Elm Disease

Surveying for DED in the City can only be carried out during spring and summer. Beyond this period the ability to detect symptoms can be confounded by autumn yellowing of foliage. This period is also the peak period for Elm Bark Beetle activity.

Action	Responsible Officer
Continue regular surveying of elms	Senior Arborist / Contract officer
Ensure all contractors are trained in the detection of DED symptoms	Senior Arborist / Contract officer

Prevention of Dutch Elm Disease

Removal of deadwood in elms is the best method of preventing DED, as it reduces the habitat of Elm Bark Beetle. Avoid the pruning of elms during spring and summer when Elm Bark Beetles are active.

Action	Responsible officer
Ensure all elms are kept deadwood free	Senior Arborist / Contract officer

Privately Owned Elms

Elms on private land within the City of Boroondara have the potential to obstruct the control of DED in the case of an outbreak. For this reason it is imperative that all trees are recorded on a database. The Friends of the Elms currently maintain a database of elms across Victoria, however this is not a comprehensive list.

Actions	Responsible Officer
Continue updating elm population of the FOTE Database	Senior Arborist / Contract officer
Liaise with DNRE regarding survey of these trees	Senior Arborist / Contract officer

Procedural Guidelines

The following pages contain procedural guidelines, which should be followed by City of Boroondara staff or service providers according to the appropriate scenario, in any suspected occurrence of DED.

If DED occurrence is suspected within the City of Boroondara

1. Contact the City of Boroondara's Senior Arborist or nominated Officer for diagnosis immediately.
2. Take photographs of affected tree(s), mark location of tree(s) on a plan.
3. Collect a specimen of the affected tree(s) and submit it immediately (by courier) along with a Specimen Submission Form to: Crop Health Services, Agriculture Victoria. Private Bag 15, South Eastern Mail Centre, Victoria 3176.
4. Immediately cease works and proclaim the site and surrounds as a quarantine area, ensuring no elm material, (including leaf litter) is removed until further notice.
5. Contact Mr Greg LeFoe of Keith Turnbull Research Institute to advise that testing is occurring.

If DED is suspected or found to be present outside of City

1. Confirm diagnosis.
2. Contact Mr Greg LeFoe of Keith Turnbull Research Institute ((03) 9785-0158) to advise that outbreak has occurred so that the Australian Dutch Elm Disease Contingency Plan can be activated.
3. Facilitate immediate survey of City of Boroondara elms.
4. Liaise with Council's Communications Manager and *Progress Press and Boroondara Bulletin* to implement appropriate items from DED Media Contingency Plan.
5. Advise appropriate stakeholders.
6. Arrange for regular status reports from the authority in the infected area.

If DED is found not to be present

1. Liaise with Council's Communications Manager and *Progress Press and Boroondara Bulletin*.
2. Arrange briefing for Director Environment and Infrastructure and Chief Executive Officer.

If DED is found to be present

1. Arrange formation of Project team containing representatives from Parks & Gardens, Contractors, Council's Communications Manager and *Progress Press*, relevant Council departments.
2. Notify Tree Maintenance Contractor to prepare staff and necessary equipment.
3. Arrange for briefing of Director Environment and Infrastructure, and Chief Executive Officer.
4. Facilitate immediate survey of all City of Boroondara elms, working outwards from quarantine area.
5. Liaise with Council's Communications Manager and *Progress Press and Boroondara Bulletin* to implement DED Media Contingency Plan.
6. Consult stakeholders.
7. Implement Tree Removal Plan as appropriate.
8. Arrange burial site for infected material and preferred route to site. (Location to be determined).
9. Arrange for provision of FOTE database of private elm trees in Melbourne to relevant authorities.

Tree Removal Plan

This plan is designed for use by Council's tree maintenance contractor as directed by the Senior Arborist or nominated Officer for any tree required to be removed as part of the DED Action Plan. It should be regularly reviewed to conform to the Australian DED Contingency Plan.

Disposal of Timber

1. Cut tree down
2. Disinfect tools i.e.: Chainsaws, handsaws, rakes, with methylated spirits or sodium hypochloride
3. Feed branches through chipper into truck 1, seal and spray with *Pestigas*
4. Place logs into truck 2.
5. Seal truck 2 and spray internally with *Pestigas*.
6. Drive directly to burial site (to be determined by Project team).
7. First dump logs and then woodchip into prepared disposal hole.

Disposal of Fallen Elm Branches Elsewhere

1. No elm pruning to occur within City of Boroondara between November to March.
2. Disinfect tools i.e.: Chainsaws, handsaws, rakes with methylated spirits or sodium hypochloride.
3. Contractor to arrange for dedicated (fully sealed) log truck specifically to collect fallen elm branches.
4. Fallen branches within infected area to be sprayed with *methoxychlor* or *chlorpyrifos*.
5. When truck is full drive directly to burial site.
6. Dump logs into prepared disposal hole.
7. Spray truck internally with *Pestigas*.

Sample Collection

1. Identify affected trees within quarantine area and collect samples using Elevated Platform Vehicle (EPV).
2. Check samples for brown streaking.
3. Locate sampled trees on plan and discreetly mark tree for future reference.
4. Place samples in a heavy duty, sealed paper bag and label accordingly with a waterproof marker.
5. Deliver sealed samples between the hours of 8:30am and 4:30pm Monday to Friday to Crop Health Services, Agriculture Victoria, 621 Burwood Highway, Knoxfield (Ph: 9210 9222).
6. Excess material to be disposed of as above.
7. Inspect Elms for brown streaking under bark at all other locations within the City of Boroondara.
8. Locate any affected trees on a plan and discreetly mark tree for future reference.
9. Place samples in a heavy duty, sealed paper bag and label accordingly.
10. Deliver sealed samples to Crop Health Services, Agriculture Victoria.
11. Excess material to be disposed of as above.

Public Consultation

Public consultation/information should be coordinated by the Manager, Parks & Gardens in conjunction with the Council's Communications Manager. Media releases and any other public notification should be coordinated by the Council's Communications Manager.

Fusarium Wilt (*Fusarium oxysporum* f.sp. *canariensis*) of Canary Island Date Palms.

Fusarium wilt (*Fusarium oxysporum* f.sp. *canariensis*) is a vigorous fungal disease capable of decimating ornamental plantings of Canary Island Date Palms. The disease was first observed in Australia within palms located at Centennial Park Sydney in the 1980's.

Symptoms

Palms affected by Fusarium wilt exhibit general decline symptoms as caused by other root or stem diseases. Affected palms exhibit reduced vigour during early disease onset. Primary symptoms are foliar, with lower, older fronds desiccating and dying from the lower trunk toward the bud. Occasionally, the first symptomatic leaf may be in the mid-canopy and the following decline may seem one-sided on the tree.

Affected fronds die in a one-sided manner, from the lower leaflets (pinnae) and spines out to the frond tip. Dieback continues from the tip to the frond base on the other side of the rachis. Some leaves may die from the frond tip back to the base on both sides of the rachis simultaneously.

A linear brown stripe develops on the lower surface of the frond rachis, extending a variable distance out from the frond base. Some pinnae and spines may exhibit necrotic streaking as well. Vascular discoloration is evident in both cross and longitudinal sections of the rachis. Discrete pockets of salmon-pink to brown tissue can be observed in cross sections. In longitudinal sections, similarly coloured streaks of tissue will be apparent.

Some variation in symptom appearance and development is to be expected. Symptoms will be most pronounced as plants enter a period of higher temperature and greater water demand.

There are also several rachis blight diseases that can cause frond death in a manner similar to Fusarium wilt, but do not lead to plant death. These other fungi often cause solid zones of necrotic tissue in the rachis that will be obvious in cross section. Clear symptoms of Fusarium wilt can be masked by the occurrence of two different diseases on the same plant.

Where palm weevils exist in the locality with Fusarium wilt, these insects can invade the wilt stressed trees and cause more rapid palm death and obscure the symptoms of Fusarium wilt.

Fusarium wilt is able to survive and multiply in soils and can lay dormant within the soil for up to 50 years.

Disease Spread

Spread is aided by:

- Transplanting infected palms to healthy sites;
- Transporting infected soil to healthy sites. Soil in root balls or operational equipment; and
- Using pruning implements that have not been sanitised

Introduction of this disease into new areas is primarily dependent upon the movement of infected trees or infested soil. The *Fusarium* pathogen does not have a widely disseminated, airborne spore stage. An infected plant and/or infested soil must be introduced into a landscape or nursery for subsequent infection.

If a disease-free Canary Island date palm is planted, future development of *Fusarium* wilt is highly unlikely without the direct introduction of the pathogen.

Local spread in an area where the fungus is known to exist can be directly tied to maintenance activities. The *Fusarium* fungus is easily distributed through the tree especially through the water conducting cells. Pruning can introduce the fungus or fungus-infested saw dust between pruning saw teeth or lopper blades. Pruning activities can spread the fungus among trees within a landscape or nursery or between landscapes.

The ability of *F. oxysporum* f.sp. *canariensis* to infect seed is unknown at this time.

Disease Management

To date there is no control for the fungus. Management strategies are the only option available to limit the spread of the disease.

- Properly sample symptomatic palms and seek lab verification of this pathogen. The potential management of *Fusarium* wilt on Canary Island date palms is dependent upon rapid and accurate diagnosis in both the nursery and landscape. Failure to properly identify this disease will result in subtle but effective spread of this fungus in the immediate environment. Misidentification of a palm dysfunction such as *Fusarium* wilt will result in the unnecessary destruction of an expensive palm.
- Avoid scattering infested soil within or among rows of palms. Clean tools used in palm removal with bleach or rubbing alcohol. Leave the infested site fallow or replant with a non-palm species. Since the host range of the *Fusarium* wilt pathogen is undefined in Australia, replanting with a palm is a risk where infested soil exists. Restricted use of soil fumigants like methyl bromide/chloropicrin or metam sodium (Vapam') can provide an added measure of fungus control in infested sites. Use of these fumigants, however, is not likely to eradicate this fungus from the site.
- Avoid severe lower frond pruning on *P. canariensis* to achieve greater height of cleared trunk. This can result in effective, rapid spread of the wilt fungus. Where this disease is known to exist, limit pruning cycles to once a year and remove only dead lower fronds. Avoid multiple pruning cycles of palms over different areas. Use several pruning saws or loppers in the pruning cycle. Use one tool on each tree. Disinfect this tool in either a 1:1 ratio of bleach in water or undiluted rubbing alcohol. Choose the next pruning saw from the disinfectant solution to prune the next palm.
- *Fusarium* wilt-affected palms should be carefully removed from the landscape. These trees should be taken to the landfill rather than committed to a municipality's green waste recycling program. It is unlikely that this fungus will be destroyed by the chipping and piling process normally used for green wastes.
- Do not transplant palms from known *Fusarium* sites, e.g. Sydney, Geelong, South Melbourne. All palms should be inspected and tested prior to planting (or transplanting) into healthy site.
- Maintain palms in optimum growing conditions. Ensure adequate moisture and appropriate applications of fertiliser.

- Maintenance personnel should be alert to the key symptoms of Fusarium wilt. Suspect palms should be sampled and submitted for wilt determination.

Fusarium Wilt Diagnosis

There appear to be four key symptoms necessary for a field diagnosis of Fusarium wilt disease.

1. Progressive frond death from oldest to newest canopy.
2. One-sided leaflet death on a declining frond.
3. A prominent brown stripe on the rachis base starting at the trunk and extending out a variable distance toward the frond tip.
4. Discoloured vascular bundles in the “striped” fronds.

If these symptoms are present, a diagnosis of Fusarium wilt is likely but not absolute due to the presence of other rachis blights or possible insect damage. Seek laboratory verification prior to destruction of a Fusarium wilt-suspect palm.

For proper laboratory verification of Fusarium wilt of Canary Island date palm, collect 3-4 petiole bases from fronds exhibiting either one-sided leaflet death or tip dieback and the lower brown striping of the rachis. If only 1-2 fronds have clear symptoms, remove a symptomless lower and upper frond as well.

Remove the lower 30-45 centimetres of each frond and remove the spines before packaging. If several trees are symptomatic, disinfect loppers or pruning saws between trees. Complete any other diagnostic requirements as outlined by relevant laboratory undertaking the diagnosis.

Verification of Fusarium-wilt suspect samples is very important. There are several species of the fungus *Fusarium* that can be isolated from roots, leaves and buds of palms that are not causing Fusarium wilt disease. Similarly there are strains of *Fusarium oxysporum* recovered from palm tissues that do not cause Fusarium wilt. Do not destroy suspect palms needlessly. When you can, obtain a precise diagnosis on this plant disease.

The Department of Sustainability and Environment is the first contact for plant pathological testing. They can test for the presence of Fusarium fungus, further detailed testing would be required to identify to variety level, i.e. *F. oxysporum* f.sp. *canariensis*. This additional testing can be undertaken by Dr. Summerall at Sydney Botanic Gardens or Dr Ian Smith Senior Forest Pathologist University of Melbourne, School of Forest and Ecosystem Science.

Woody Weed Species

The following list contains species that are listed as noxious or environmental woody weeds or those that have the potential to require increased management inputs over time. Some tree species listed have a greater potential to create an environmental weed problem in some areas than others.

List 1: Woody weed species

Acacia baileyana (Cootamundra Wattle)
Acacia elata (Cedar Wattle)
Acacia floribunda (White Sallow Wattle/Gossamer Wattle)
Acacia longifolia (Sallow Wattle)
Acacia saligna (Golden Wreath Wattle)
Acer negundo (Box Elder)
Acer pseudoplatanus (Sycamore Maple)
Ailanthus altissima (Tree-of-heaven)
Chamaecytisus proliferus (Tree Lucerne)
Coprosma repens (Mirror Bush)
Cotoneaster franchetii (Grey Cotoneaster)
Cotoneaster glaucophyllus (Large-leaf Cotoneaster)
Cotoneaster pannosus (Grey-leaved Cotoneaster)
Crataegus monogyna (Hawthorn)
Fraxinus angustifolia ssp. *angustifolia* (Desert Ash)
Hakea salicifolia (Willow-leaved Hakea)
Ilex aquifolium (Holly)
Leptospermum laevigatum (Coastal Tea-tree)
Ligustrum lucidum (Glossy-leaved Privet)
Ligustrum vulgare (Common Privet)
Paraserianthes lophantha (Cape Leeuwin Wattle) (syn. *Albizia lophanta*)
Pinus radiata (Monterey Pine)
Pittosporum undulatum (Sweet Pittosporum)
Prunus cerasifera (Cherry Plum)
Prunus laurocerasus (Cherry Laurel)
Pyracantha angustifolia (Orange Firethorn)
Pyracantha fortuneana (Broad-leaved Firethorn)
Robinia pseudoacacia (Black Locust)
Salix spp. (Willow) (except *S. babylonica* (Weeping Willow) & *S. X reichardtii* (Pussy Willow))
Solanum mauritianum (Wild Tobacco Tree)

APPENDIX 7: CITY OF BOROONDARA – AMENITY VALUE FORMULA

Calculating A Tree's Amenity Value

The following formula has been prepared to assist with calculating the monetary amenity value of a City of Boroondara tree. In most cases this value will be charged to the developer by the City of Boroondara when a tree is removed. A charge of tree and stump removal, tree replacement, planting, 24 months maintenance and where applicable, paving over of tree plot costs will also occur in most cases.

When young trees with a 5cm trunk diameter or less will be replaced by another tree, there will be no amenity value charge. The removal of trees with a trunk diameter greater than 5cm however, if replaced with another tree, will be calculated and charged, the average amenity value of a young replacement tree.

Tree amenity value formula:

Value (V) = Basic Value (\$) x Species (S) x Aesthetics (A) x Locality (L) x Condition (C)

Read through the following formula definitions to calculate the tree amenity value.

Basic Monetary Value (\$) 2006

The basic monetary value of a tree is determined by matching the trunk diameter at breast height (DBH) with its corresponding value.

DBH cm	\$	DBH cm	\$	DBH cm	\$
6	\$263.00	45	\$14815.00	85	\$52,860.00
10	\$732.00	50	\$18290.00	90	\$59,261.00
15	\$1646.00	55	\$22132.00	95	\$66,029.00
20	\$2926.00	60	\$26338.00	100	\$73,162.00
25	\$4573.00	65	\$30911.00	105	\$80,661.00
30	\$6585.00	70	\$35849.00	110	\$88,526.00
35	\$8962.00	75	\$41154.00	115	\$96,757.00
40	\$11706.00	80	\$46824.00	120	\$10,5353.00
				Basic Value (\$)	

Species Factor (S)

A tree is assessed according to its known natural life span and its rate of growth in a particular environment. For example, a long-lived tree will be scored higher than a short-lived tree. Significant features to the tree will also modify how the tree is scored. Judgement regarding species factor must be made by a qualified Arborist.

Species Group	Characteristics	Score
1	trees of short life span (less than 50 years) fast growth rate <i>example: Prunus, Acacia, Virgillia, Laburnum</i>	0.5
2	trees of short life span (less than 50 years) slow growth rate <i>example: Malus, Crataegus, Eugenia, Waterhousia, Pyrus</i>	0.6
3	trees of medium life span (50 -150 years) fast growth rate <i>example: Populus, Liquidambar, Eucalyptus, Angophora, Grevillea, Melaleuca, Michelia, Salix, Casaurina, Hakea, Celtis, Acmena</i>	0.7
4	trees of medium life span (50 - 150 years) slow growth rate <i>example: Brachychiton, Fraxinus, Gleditsia, Lagunaria, Jacaranda, Shinus, Phoenix, Melia, Robinia, Lophostemon, Liriodendron, Agonis, Metrosideros, Syzygium</i>	0.8
5	trees of long life span (more than 150 years) fast growth rate <i>example: Cupressus, Platanus, Ficus, Pinus</i>	0.9
6	trees of long life span (more than 150 years) slow growth rate <i>example: Ulmus, Quercus, Sequoia, Ginkgo, Araucaria</i>	1.0
Modifiers	an ubiquitous species (grows like a weed) <i>example: Salix, Fraxinus rotundifolia, Pittosporum undulatum</i> dangerous (poor branch attachment) <i>example: Ulmus fastigiata, Eucalyptus nicholii</i> has undesirable characteristics (eg allergenic) <i>example: Lagunaria patersonii</i>	-0.1
	a rare species in the locality a special precious cultivated variety a 'significant tree' registered by the National Trust has special historical or other significance	+0.1
Species Factor (S)		

Trees named are only supplied as examples in Melbourne conditions.

Aesthetics (A)

The aesthetic value of a tree is determined by the impact on the landscape if the tree were removed. This category is closely tied to the locality factor (L).

contributes little to the landscape	0.5
one of a group of close plantings	0.6
wide plantings	0.7
irregular spacing between trees; regular spacing one side	0.8
street or pathway plantings, regular spacing both sides	0.9
solitary feature specimen tree	1.0
Aesthetics (A)	

Locality (L)

The locality factor is determined by the tree's geographical situation. Trees in a bushland area or important tree lined avenue score highest because of the importance of the tree to the growing environment in which the tree is located.

insignificant tree of non preferred species	1.0
in outer suburb areas and residential streets	1.5
in Park or Reserve; significant street	2.0
in main tree lined stands of trees or avenues	2.25
in undeveloped bushland or open forest; indigenous tree	2.5
Locality (L)	

Tree Condition (C)

The tree condition value is determined by the corresponding total score of the assessment criteria.

Assessment Criteria	Criteria Condition	Score
Trunk	solid and sound	5
	sections of bark damaged/missing	3
	extensive decay, hollow trunk	1
Growth	>15cm twig elongation this season	3
	5-15cm twig elongation	2
	<5cm twig elongation	1
Structure	healthy, stable and sound	5
	some deadwood and dead limbs	3
	extensive dieback and deadwood	1
Pests and Diseases	no pest/disease infestation	3
	minor symptoms of infestation	2
	advanced symptoms of infestation	1
Canopy Development	full balance canopy	5
	full but unbalanced, lop-sided	3
	unbalanced and lacking full canopy	1
Life Expectancy	>50 years	5
	10-50 years	3
	<10 years	1
Total Score		

6-9	very poor	0.2
10-13	poor	0.4
14-18	fair	0.6
19-22	good	0.8
23-26	excellent	1.0

Tree Condition (C)

Amenity value	
Less costs for replacement tree (if applicable)	
Cost of tree removal incl GST	
Total cost	

*Note: The Amenity Value Formula used by the City of Boroondara was developed from the formula used by the City of Melbourne. The City of Melbourne formula was developed by Dr. Peter Yau in 1990 based upon the Maurer-Hoffman Formula.

The basic monetary value of the tree was taken from the internationally accepted table of values devised by the American Council of Tree and Landscape Appraisers and the International Society of Arboriculture, which in the base year 1988 was \$US 27 per square inch trunk basal area. When converted to a value corresponding to centimetres in trunk diameter at breast height (DBH) the Basic Monetary Value table, updated in 2006 to reflect more current monetary values, should be relevant.