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Improving our urban forest is no simple task, and requires the ideas, time, and expertise of many people. This project is the result of extensive collaboration and teamwork among those within and outside Alameda's urban forest. Special thanks go to the residents of the Alameda urban forest who enthusiastically attended meetings and provided feedback, so that this plan could reflect their vision for the forest in which they live. We would particularly like to thank Chris Buckley for his time, dedication and draft reviews.

THE CITY OF ALAMEDA'S MASTER STREET TREE PLAN
VOLUME 1

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CHAPTER 1

INTRODUCTION

1.0 / EXECUTIVE SUMMARY

The City of Alameda's Master Street Tree Plan (MSTP) is a community based Master Plan document covering all topics concerning the street trees of Alameda.

The MSTP provides detailed information about the status of the city's street trees and guidelines for its maintenance and expansion. This plan is intended for use by citizens, builders, City staff, and utility companies. This MSTP serves as an update and expansion to the previous Master Tree Plan written in 1989.

The goals of the MSTP are to:

- Improve the condition of the existing urban forest by adhering to the industry's best practices for maintenance;
- Increase public safety and decrease municipal liability by first mitigating safety concerns, then following a routine, proactive maintenance schedule;
- Expand canopy cover through strategic species selection using the devised tree matrix;
- Preserve protected trees that are significant to the city's identity;
- Reduce conflicts between trees and city infrastructure;
- Cultivate an attractive and functional street landscape design that uses scientifically researched, cost-effective technologies and strategies; and
- Enhance community involvement in the improvement of Alameda's urban forest.

1.1 / INTRODUCTION

We Californians may think of ourselves as outdoorsy nature-lovers, but about 98% of us live in urban areas. Even so, we are still forest dwellers, enjoying our lives among the trees that line our streets and spread their canopies in parks and gardens. But city life is not easy for forests. Rising pollution levels, climate change, construction, and urban sprawl are just some of the ways that cities threaten the health and existence of trees. Yet increasingly, we are realizing just how much we need the forest around us.

The ongoing construction so common to urban areas like Alameda can obliterate a city's sense of permanence and stability. The abundance of existing trees in Alameda makes it easy for residents to take them for granted; the "sense of place" a tree provides is usually not appreciated until the tree is taken down. This is not unlike the loss of a special building in a fire—however, there is a critical difference. To replace the visual impact of the tree takes a generation, while replacing that of the building often takes less than a year. An ongoing effort to cover the city with enduring trees is an effective solution to restore the feeling of security. This is one of the many reasons that cities throughout North America are becoming increasingly conscious of the importance of trees, and it is the incentive for the City of Alameda investing in its future by actively managing its urban forest with thoughtful foresight.

Unlike a natural forest, the urban forest does not have the opportunity to sustain itself. It exists in an environment that is constantly under the manipulation and influences of mankind. As a result, the amount and quality of human care an urban forest receives is vital to its longevity and health.

Sustainable urban forests result when naturally occurring and planted trees in cities are managed to provide the inhabitants with a constant level of economic, social, environmental, and ecological benefits today and into the future. Of course, healthy, well-managed trees provide greater amounts of these benefits than forests that are poorly maintained and less healthy.

ALL street trees are wiithin the public right-of-way and require specific city approvals and permits for the planting, pruning and removal of a street tree. Section 23-3 of the Alamaeda Municipal Code provides additional information regarding these requirements.

The City of Alameda is blessed with an abundance of trees. They are a major part of Alameda's heritage and define much of its character. In earlier days, Alameda was referred to as "Encinal de San Antonio"—later shortened to "The Encinal"—because of the large number of live oak trees in the city. Even the contemporary name "Alameda" translates into tree-related phrases; one of the Spanish translations is "a grove or lane of poplar trees," while another translation is "a public promenade bordered with trees." Although both of these phrases may be incorrect translations, they do accurately describe the city, whereby it is clear that the City of Alameda has always inspired thoughts of a lush, green, plant-filled environment. The maintenance and protection of fine old trees links the past with the present, binding this heritage to the future. The adoption of the Historical Tree designation

is evidence of the concern for Alameda's environmental heritage, refer to existing city ordinance for further information. This MSTP is dedicated to the principle that today's decisions and actions about trees are a part of tomorrow's environmental heritage. Therefore, the choice of trees to plant is an important one. New trees planted today affect the quality of the environmental heritage for years to come.

This Master Street Tree Plan (MSTP) provides information on the present status of Alameda's street trees, and suggests some effective means by which the city can safeguard and expand its urban forest through street tree management.

MSTP goals, such as increasing tree canopy, improving public safety, and providing native habitat, must be balanced with other goals such as accommodating growth and facilitating transportation. The MSTP is the City of Alameda's plan to integrate management of the many issues and opportunities posed by Alameda's tree resource. Additionally, all natural systems change over time. If the City and its residents want these changes to enhance the urban forest, they must be actively managed. Nationally-based studies repeatedly support the fact that the resource deteriorates when human intervention is not a proactive part of urban street trees' existence. This decline can be seen in many of Alameda's street tree corridors where it is evident that trees have been planted in places that either don't allow for growth or that conflict with sidewalks and power lines. Proactive management is needed to keep the city trees sustainable and in balance with other urban priorities.

WHO WILL USE THIS MASTER PLAN?

- City Managers: to unify the City's approach to street tree management
- City Council: to plan, implement, manage and maintain the council's street trees
- Landowners and Developers: to assist in the selection and planting of appropriate street tree species
- Contractors: to maintain and plant street trees.
- The General Public: to foster awareness of the benefits of street trees.

AREAS NOT COVERED BY THIS MSTP

A number of areas have been excluded from this version of the MSTP. With the exception of the naval grounds, which are under the control and management of separate authorities, all private developments are not included. These areas will hopefully be incorporated in future revisions of this MSTP. The City Parks have been excluded as they are the subject of separate studies. These studies will include consideration of the street trees in conjunction with other design elements. The major developments at the former Alameda Naval Base and Northpoint have been excluded, as they have separate master plans that control the planting of street trees within those developments, but will be equalized to use the Tree Matrix.

1.2 / MASTERPLAN GOALS AND ACTIONS

These following priorities for Alameda's urban forest were established through communication with city staff and residents during several information-gathering meetings early on in the project.

YES TO

- Tree protection
- More trees
- Long lived trees
- Healthier trees
- Dynamic urban forests
- Sustainable urban forests
- Protect healthy trees while providing for infrastructure stability and public safety
- Replant new trees species mix where existing trees cannot be safely retained
- Maintain successful tree species corridors by planting younger trees
- Proactively pre-plant trees before trees become high risk

NO TO

- Wholesale tree felling
- Short-term tree-less streets
- False eveness plantings
- High risk trees
- Sidewalk and utility conflicts

Based on these priorities, goals and action items were established by Alameda's city staff.

The goals and actions have been divided into two groups: long-term goals and short-term goals. Each goal statement is followed by the supporting rationale for the goal, which is then followed by short and long-term actions needed to achieve the goal. Implementation will require policy, program, and budget coordination, as well as long-term and stable funding. The timeline definitions for implementing the proposed actions are as follows:

- Short-term actions will be done within the next five years. Typically, these are actions that are either already partially implemented, that are budget-neutral, or that have already allocated new funding.
- Long-term actions will be accomplished in 25 years. These are actions that might require operational restructuring or reorganization, limited additional funding, or "tooling-up" on the part of internal or external partners.

SHORT-TERM GOALS AND ACTION ITEMS

Short-Term Goal 1: Encourage and maintain a balance between tree-lined streets and safe utility and transportation corridors.

Action A: Provide improved guidelines and standards for utility design, which will coexist with established and future tree plantings.
Action B: Trees shall be planted and maintained in locations where street trees do not conflict with standards for sight distance triangles and traffic sign placement.

Short-Term Goal 2: Maintain and update the public street tree inventory.

Action A: Update GIS tree inventory on an ongoing basis to reflect plantings, removals and maintenance.
Action B: Expand the current street tree inventory to include all city maintained street trees and plantable spaces.
Action C: Conduct a complete street tree inventory every 10 years.

Short-Term Goal 3: Train city maintenance employees in arborculture practices.

Action A: Create a position for, and hire, a City Arborist to coordinate and oversee all tree-related activities.
Action B: Hire and train a city tree crew to perform street tree maintenance in a manner that best follows the Best Management Practices as outlined in the MSTP.

Short-Term Goal 4: Create and maintain a comprehensive list of street trees to be recommended in future plantings.

Action A: Adopt and enforce an approved street tree list.
Action B: Revise the list of recommended street trees every five years to reflect the successes and failures of the existing street tree population.

Short-Term Goal 5: Coordinate street tree design and selection in the permits and review process.

Action A: Provide and encourage effective coordination and compliance with applicable design and development standards for each type of land use or street type associated with the establishment and maintenance of public trees.

Short-Term Goal 6: Develop a public tree ordinance that presents planting and maintenance standards for all street trees within public right of way.

Action A: Encourage continual input from the public and from City departments with regard to street tree standards and procedures associated with the planting, removal, and maintenance of public street trees.
Action B: Review and update procedures, and standards for establishing and maintaining the City's street trees.

LONG-TERM GOALS AND ACTION ITEMS

Long-Term Goal 1: Sustain and expand a healthy urban forest that benefits the community with improved safety, air quality, erosion control, storm water retention, temperature reduction, and aesthetics, while also enhancing wildlife resources.

> **Action A**: Fill in all available planting spaces for an increase in the street tree population within the next 25 years. Based on available funding plant tree species appropriate for the location by using the planting palettes and tree matrix in this MSTP. The city would need to aim to plant 200 street trees a year in order to meet this goal.
> **Action B**: Mitigate all hazardous street trees by following the tree maintenance and removal guidelines in this MSTP.

Long-Term Goal 2: Work toward no net loss of the overall community urban forest cover; in the long term, to work toward measurable gain.

> **Action A**: Mitigate the net loss of healthy forest canopy cover on publicly owned lands. In the long term, the City will achieve measurable gain with consideration of species performance, practicality, and maintenance requirements.

Long-Term Goal 3: Discourage the unnecessary removal of existing healthy trees in the design, construction, or reconstruction of street projects, and other property development.

> **Action A**: Develop tree planting, and removal standards.
> **Action B**: Removal of trees in unavoidable construction condition to be approved only by PW Director.

Long-Term Goal 4: Shift from a reactive, hazard-based maintenance program to a proactive, cyclic maintenance program.

> **Action A**: Continue to expand support for the street tree program and maintenance crew.
> **Action B**: Maintain city street trees on a five-year cycle, using the city's existing maintenance zones. New plantings should be addressed until established.

Long-Term Goal 5: Establish funding mechanisms for the expansion and sustainability of the City's street tree program.

> **Action A**: Allocate funds and research alternative funding sources to ensure the sustainability of the street tree maintenance program.
> **Action B**: Create incentives for property owners to share in the cost of planting street trees in front of their property.

1.3 / BACKGROUND TO ALAMEDA'S URBAN FOREST

CLIMATE

Alameda is part of the Bay Area coastal climate zone, experiencing a warm, moist summer/autumn and a cool, wet winter/spring. The city of Alameda has a mild climate during summer, when temperatures tend to be in the 60s, and a cool climate during winter, when temperatures are usually in the 50s. The warmest month of the year is September, with an average maximum temperature of 74.60 degrees Fahrenheit, while the coldest month of the year is January, with an average low temperature of 44.70 degrees Fahrenheit. Temperature variations between night and day tend to be fairly limited during both summer and winter, with differences around 15 and 13 degrees Fahrenheit, respectively.

The annual average precipitation in Alameda is 22.94 inches. Winter months tend to be wetter than summer months. The wettest month of the year is January, with an average rainfall of 4.85 inches. Alameda experiences more moderate rainfall than other coastal areas, and selected trees must tolerate a longer succession of drier days between rains. The predominant wind direction is from the Pacific throughout the year. Wind can have a significant impact on the health and form of a tree, particularly in exposed locations such as along the coast or where surrounding buildings and structures create wind tunnel effects.
Alameda is located in Zone 9 of the USDA Hardiness Zone Map, which identifies the climatic region where the average annual minimum temperature is between 40 and 50 degrees Fahrenheit. Tree species selected for planting in Alameda should be appropriate for this zone. In addition, species should be urban-tolerant, and rated as relatively free from insect pests and disease. According to Sunset's Western Garden Book, Alameda lies in Climate Zone 17, which is dominated by ocean influences about 98% of the time. The climate is mild without extreme high or low temperatures, characterized by cool, wet winters and cool summers with fog or wind. Certain interior sections of the city could be typified as Sunset Zone 16, with more heat than the maritime-dominated Sunset Zone 17. As part of northern and central California's chilly winter areas influenced by the coast, the main growing season is from March to December. Rain typically comes from fall through winter. Typical winter lows range from 28 degrees to 21 degrees Fahrenheit. Maritime air often influences the zone, giving it cooler, moister summers than Zone 14. In the Bay Area region, winter lows usually don't drop below 40, but temperatures in the 20s have been recorded. Snow is extremely rare. Nighttime temperatures during the summer usually fall no lower than the mid-50s. Precipitation averages 24 inches per year, while temperatures are moderate with a mean July high reading of 73 degrees F and a mean January high temperature of 57 degrees F. The potential growing season is long, with usually 360 days per year without a killing frost.

TREE SPECIES

In addition to considering site characteristics, such as availability of space, soil pH, and irrigation, species-specific features must also be scrutinized. A major consideration for street trees is the amount of litter dropped by mature trees. Species such as willow (*Salix* spp.) have weak wood and typically drop many small branches during a growing season. Others, such as American sweetgum

Photo of an Alameda street in 2007.

Same street as above after proposed urban forest unfill.

(*Liquidambar styraciflua*) drop high volumes of fruits. In certain species, such as Maidenhair (*Ginkgo biloba*) and Osage-orange (*Maclura pomifera*), female trees produce offensive or large fruit; male trees, however, produce no fruit. Furthermore, a few species of trees, including Hawthorn (*Crataegus* spp.), may have substantial thorns. These species should be avoided in high-traffic areas.

Seasonal color should also be considered when planning tree plantings. Flowering varieties are particularly welcome in the spring, and deciduous trees that display bright colors in autumn can add a great deal of interest to surrounding landscapes. Above all, tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site features as well as species characteristics. Matching a species to its favored climatic and soil conditions is the most important task when planning for a low-maintenance landscape, because plants that are well-matched to their environmental and site conditions are more likely to resist pathogens and insect pests, therefore requiring less maintenance overall. Refer to the Street Tree Matrix for additional tree species and cultivars suitable for planting in Alameda.

SOILS

The majority of Alameda is located on a sandy island. The rest of the soils are comprised of bay mud that was dredged up to provide additional land and open deep-water container ship passage in the water. These bay mud soils are clay-rich, fine textured, basic, and moderately infertile. They provide good structural support for trees but because the island soils have a high water level and the bay muds are saturated this often affects the depth of root growth.

Operations that filled marshland soil have had an immense environmental impact on Alameda, with the earliest ones beginning before 1870. Prior to these landfills, the city encompassed approximately 2,200 acres of high ground and 1,000 acres of marshland. According to Imelda Merlin in Alameda: Historical Geography of a California City, Alameda in 1964 comprised two and one-half times as much area as it had in 1850. The non-fill areas are typified by the Baywood soil series, according to the Soil Conservation Service's 1981 study of Alameda County. In the western part of Alameda, the Baywood series soils are composed of "deep, somewhat excessively drained soils that formed in sandy eolian deposits that derived from old beach deposits." In most cases, the soil becomes more acidic as depth increases. There is little variation in soil structure between soils taken at different depths; it is sand or loamy sand throughout.

The material that was used to fill the marshland consist of beach sands that were dredged from the outlying areas of Alameda Naval Air Station and Oakland Airport. In some of these fill areas there is a perched water table. The highly alkaline soil condition created by this high water table, combined with the addition of unknown materials during fill operations, compounds the problems of tree establishment in these areas.

Photo of an Alameda street in 2007

Same street as above after proposed urban forest infill

TOPOGRAPHY

The topography of the city of Alameda is mostly flat land along the San Francisco Bay floodplain, with most of the city only a couple of meters above sea level.

TREE POPULATION

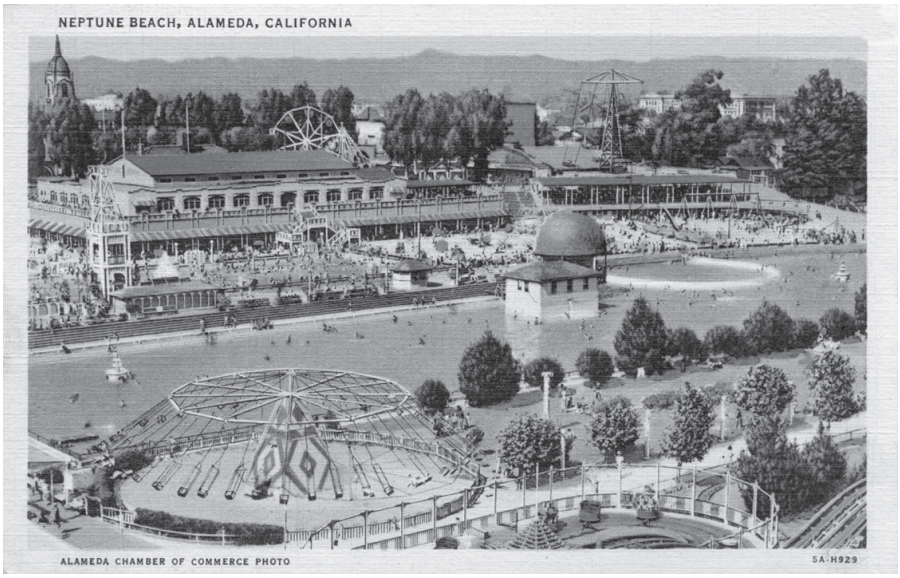
Most of today's large trees were planted during the first decade of the 20th century, and thanks to those who had such foresight, Alameda became known throughout the Bay Area as a city of trees. However, by the mid- to late 1970s, vehicular traffic had increased to the point that several street widening projects were proposed, requiring the removal of dozens of trees along the major arterials. These projects, together with the pruning of many trees that had matured enough to interfere with power lines, had a detrimental effect on Alameda's street trees.

In 1989, Thomas J. Pehrson of Urban Forestry Consultants and Barrie Coate was commissioned to conduct the first citywide street tree inventory and analysis. The resulting Master Tree Plan helped guide the revitalization of Alameda's street population for almost two decades. In 2008, Tanaka Design Group was commissioned to conduct a revised inventory and analysis of all street trees throughout the city. This recently completed tree inventory found over 12,000 street trees in the City of Alameda. Although a formal inventory of trees on public properties other than city streets has not been undertaken, it can be assumed there are two to three trees on these properties for each street tree, which would make the total public tree population somewhere between 36,000 and 48,000 trees.

The current tree inventory uses a GIS-based system that lists street trees by their own unique ID number, species, size, and health condition. The first non-computerized tree inventory was completed in 1989 and was not continually updated as work was done on Alameda's tree population. It is therefore desirable that the new inventory be continually maintained and included as a layer of the City's existing GIS maps.

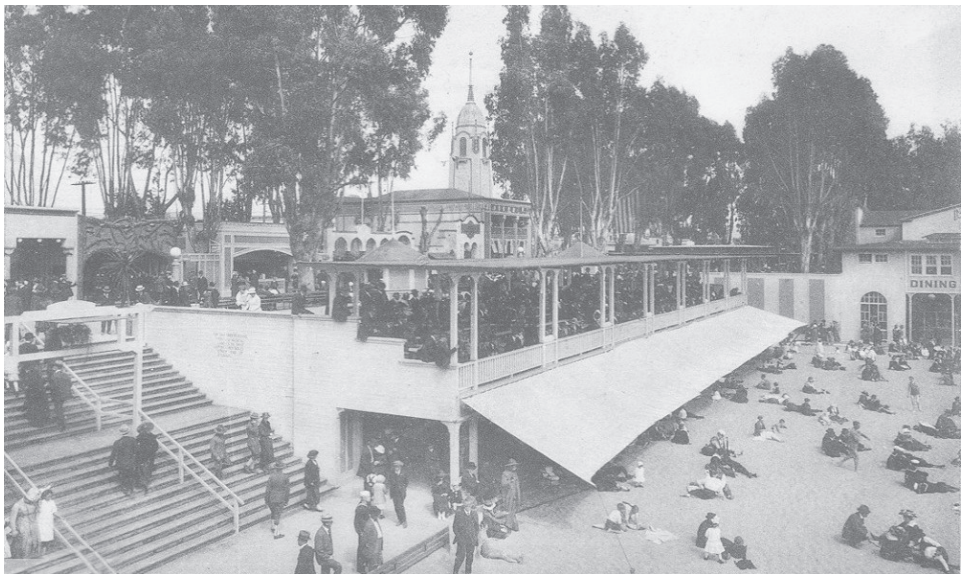
BENEFITS OF THE STREET TREES AND THE COMMUNITY FOREST

The many benefits of urban trees that were once considered qualitative and subjective are now being scientifically quantified. The environmental benefits trees provide, such as producing oxygen and removing air pollutants, may be the most obvious. Trees can also reduce air temperatures and consequently affect air quality, since the emissions of many pollutants are temperature-dependent. Planted in the right location around buildings, trees can reduce heating and cooling energy costs. Tree canopy can also reduce storm water runoff and contribute to substantial savings in the long-term construction costs for storm water facilities. The reduction in storm water volume can help improve the water quality of the San Francisco Bay by reducing pollutant runoff. Street trees contribute valuable wildlife habitat as well. Alameda's street trees provide significant economic benefits to the community. The environmental services the trees provide can be quantified and individual trees can be extremely valuable components of a city's landscape. The value of individual trees in the landscape can be appraised—many of the majestic, mature trees of Alameda's urban forest have an estimated appraised value in the tens of thousands



Plantings at Neptune Beach, Alameda, California (Circa 1912)

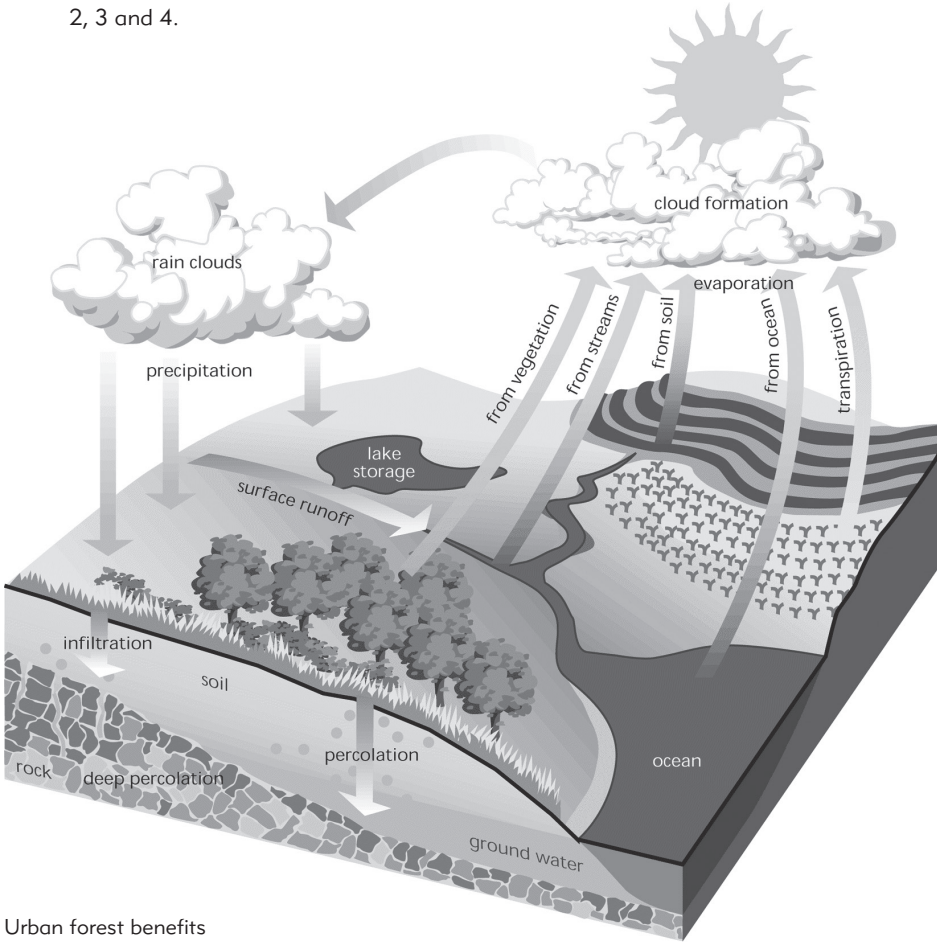
Plantings at Neptune Beach, Alameda, California (Circa 1912)



of dollars. Street trees are one of the key factors making Alameda a desirable place to shop, work, visit, and live. The following list gives several economic reasons why it makes sense to continue the stewardship of Alameda's street trees.

- The net cooling effect of a healthy mature tree is equivalent to 10 room-sized air conditioners operating 20 hours a day (U.S. Department of Agriculture).
- Trees properly placed around buildings can reduce air conditioning needs by 30 to 50%, and up to 65% in the case of mobile homes (USDA Forest Service).
- Shading an air conditioning unit can increase its efficiency by 10% (ASHREA The American Society of Heating, Refrigerating and Air-Conditioning Engineers).
- Trees can be a stimulus to economic development, attracting new business and tourism. Commercial retail areas are more attractive to shoppers, apartments rent more quickly, tenants stay longer, and space in a wooded setting is more valuable to sell or rent (The National Arbor Day Foundation).
- Healthy, mature trees add an average of 10% to a property's value (California Association of Realtors).
- The planting of trees means improved water quality, resulting in less runoff and erosion. This allows more recharging of the ground water supply. Wooded areas help prevent the transport of sediment and chemicals into streams (USDA Forest Service).
- In laboratory research, visual exposure to settings with trees has produced significant recovery from stress within five minutes, as indicated by changes in blood pressure and muscle tension (Texas A&M University).

Conclusion: The following appendices are results from the tree study: Appendix 2, 3 and 4.



CHAPTER 2

TREE INVENTORY

1.1 / INTRODUCTION

We Californians may think of ourselves as outdoorsy nature-lovers, but about 98% of us live in urban areas. Even so, we are still forest dwellers, enjoying our lives among the trees that line our streets and spread their canopies in parks and gardens. But city life is not easy for forests. Rising pollution levels, climate change, construction, and urban sprawl are just some of the ways that cities threaten the health and existence of trees. Yet increasingly, we are realizing just how much we need the forest around us.

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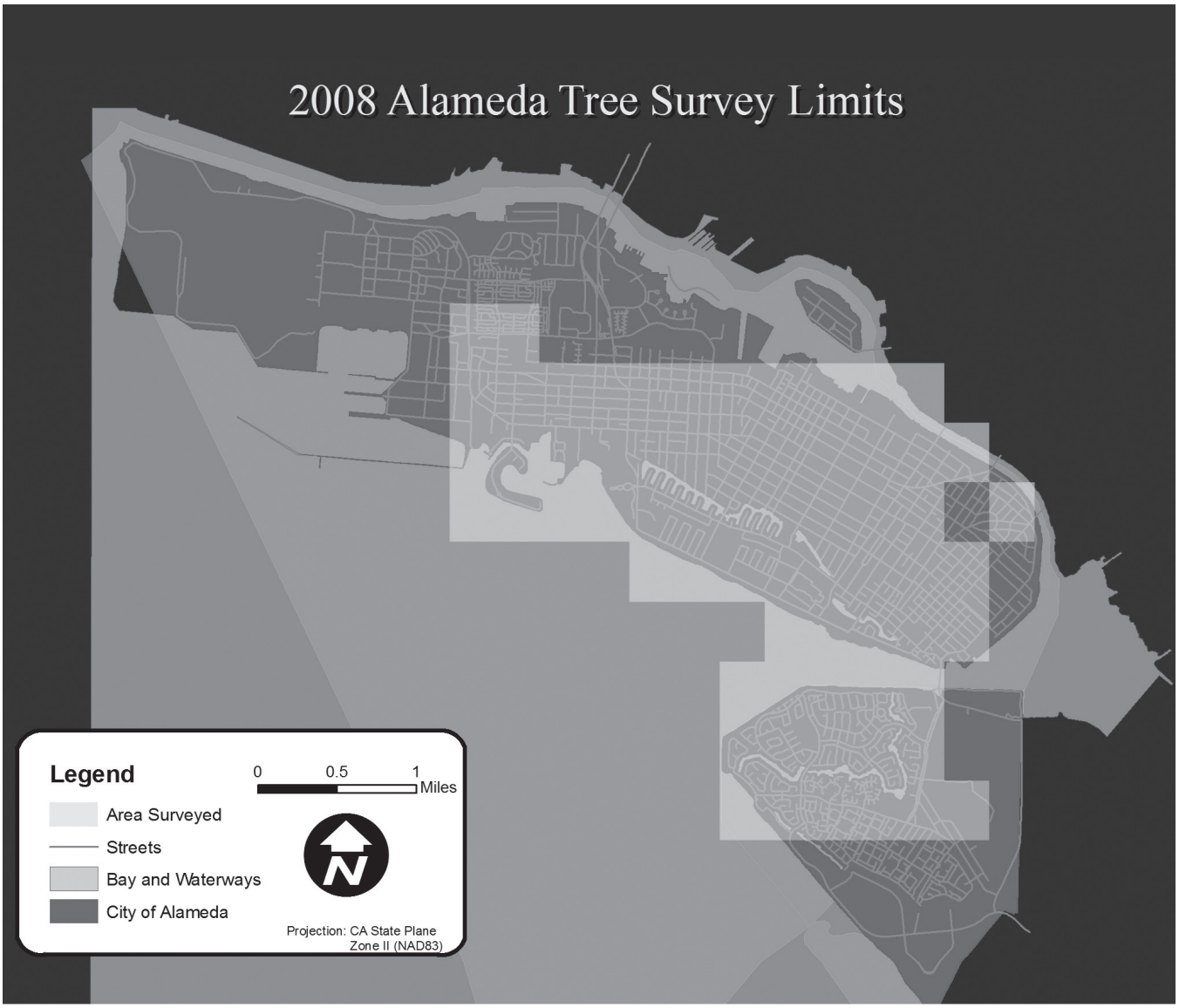
2008 Alameda Tree Survey Limits
Legend
0
0.5
1
Miles
Area Surveyed
Streets
Bay and Waterways
City of Alameda
N
Projection: CA State Plane
Zone II (NAD83)

Figure 2.1

to shop, work, visit, and live. The following list gives several economic reasons why it makes sense to continue the stewardship of Alameda's street trees.

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- Trees properly placed around buildings can reduce air conditioning needs by 30 to 50%, and up to 65% in the case of mobile homes (USDA Forest Service).
- Shading an air conditioning unit can increase its efficiency by 10% (ASHREA The American Society of Heating, Refrigerating and Air-Conditioning Engineers).

Table 2.0 / Components of the Neighbourwoods© tree inventory used in the 2008 tree inventory. * indicates characteristics that were analyzed only in Priority trees.

	TREE CONDITION	**CONFLICTS**
TREE ID	Unbalanced crown*	Overhead Wires Structures
Unique tree ID number	Reduced height*	Sidewalks
Inventory date	Weak or yellow foliage*	Other trees
Genus	Defoliation*	Traffic Signs
Species	Dead or broken branches*	
Cultivar	Poor branch attachment*	**OTHER**
	Lean*	Plantable spots
MEASUREMENTS	Trunk scars*	
Diameter at breast height (DBH)	Branch or pruning scars*	
Percent of crown over hard surface	Conks*	
Number of stems	Rot/cavity – trunk*	
Height class	Rot/cavity - branch*	
Planting strip width	Crack*	
	Confined space*	
	Girdling roots*	
	Root trenching*	

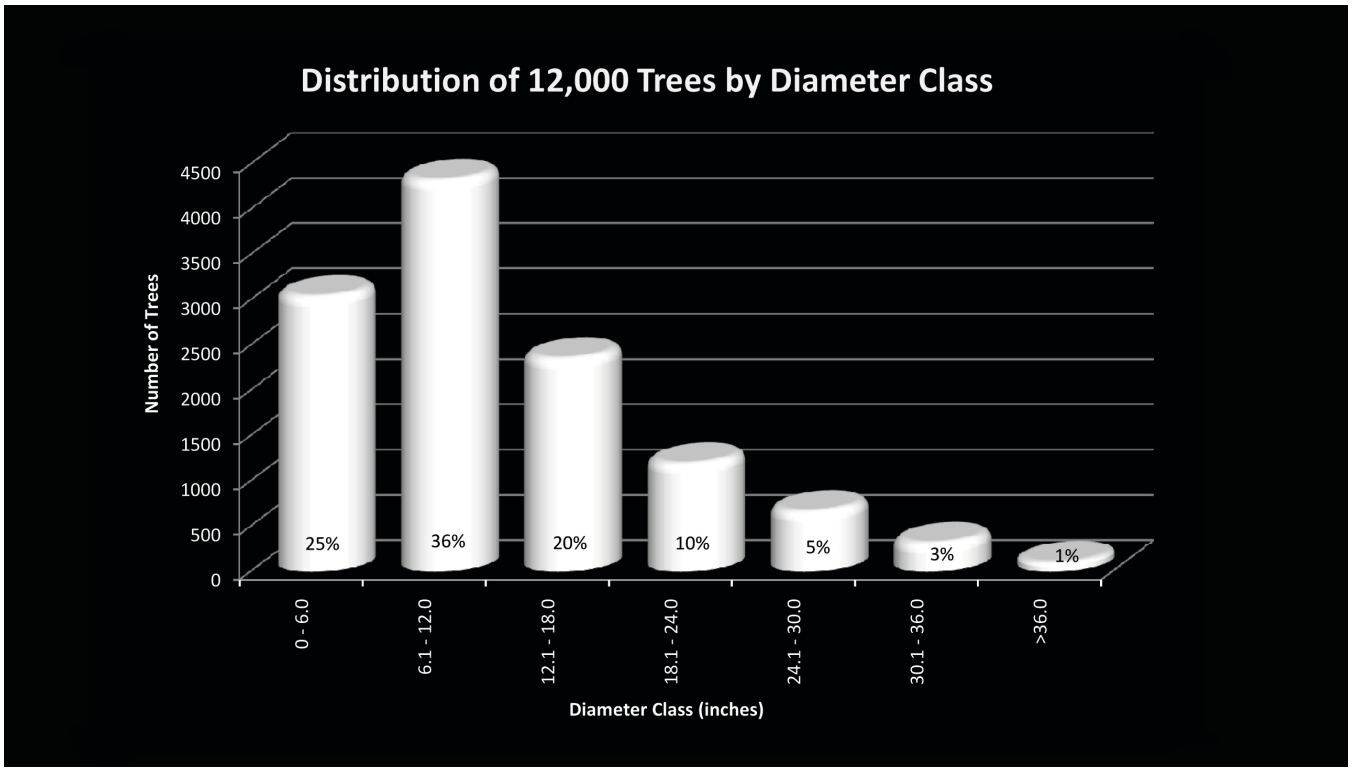
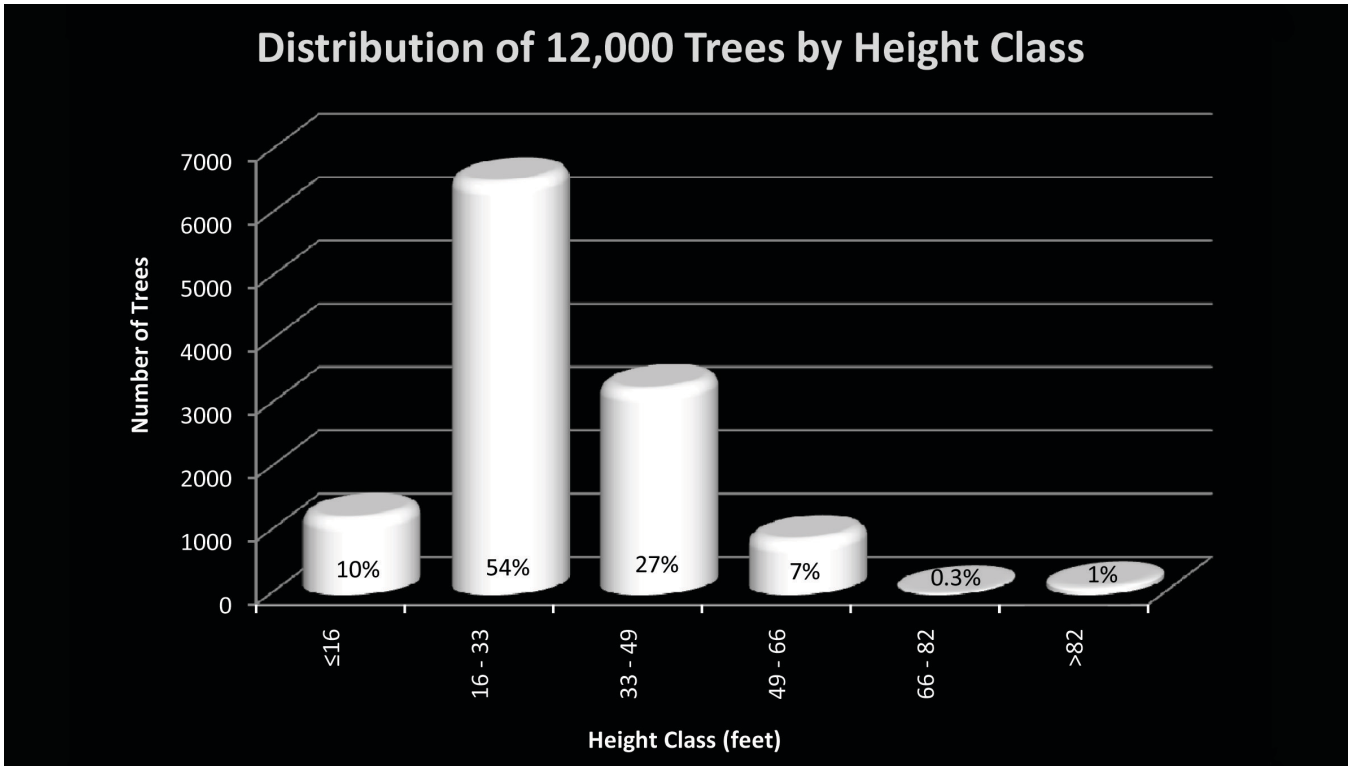
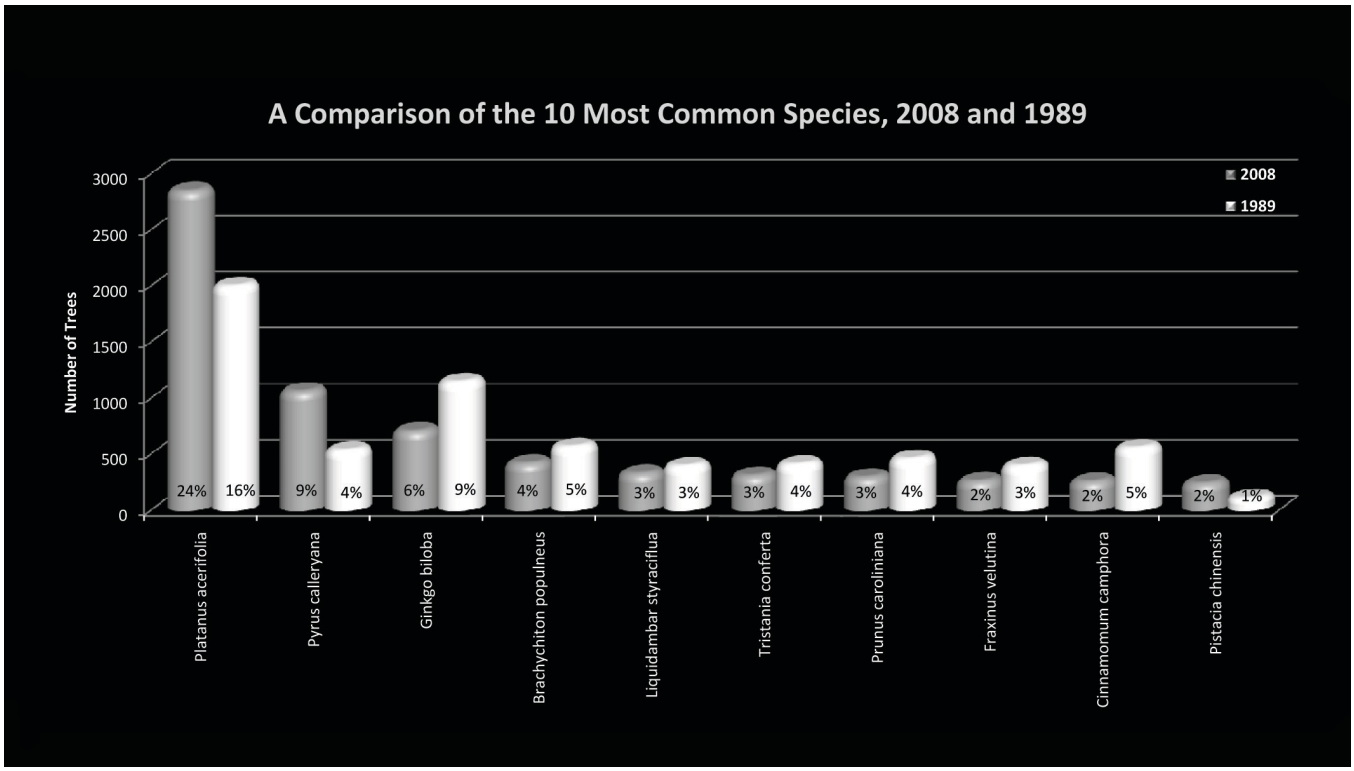


Figure 2.2

Figure 2.3





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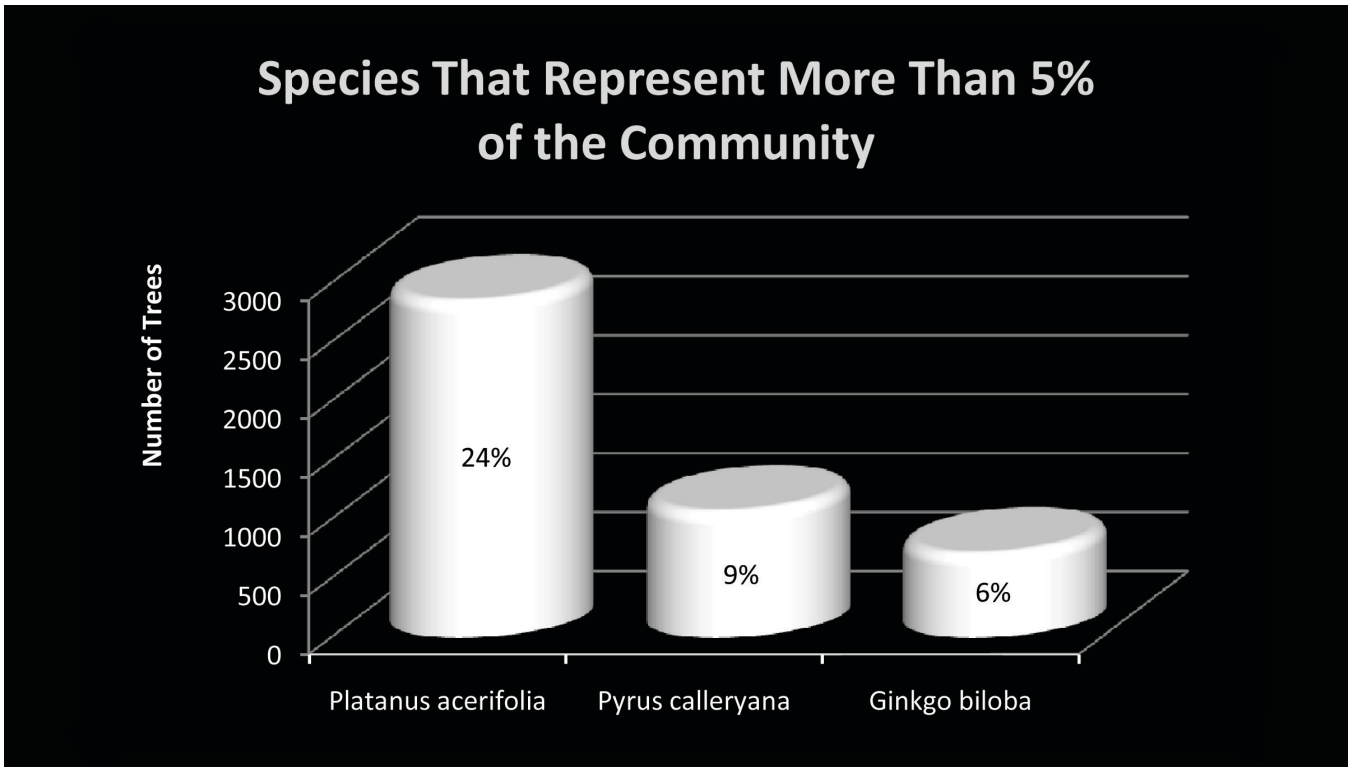


- Trees can be a stimulus to economic development, attracting new business and tourism. Commercial retail areas are more attractive to shoppers, apartments rent more quickly, tenants stay longer, and space in a wooded setting is more valuable to sell or rent (The National Arbor Day Foundation).
- Healthy, mature trees add an average of 10% to a property's value (California Association of Realtors).
- The planting of trees means improved water quality, resulting in less runoff and erosion. This allows more recharging of the ground water supply. Wooded areas help prevent the transport of sediment and chemicals into streams (USDA Forest Service).

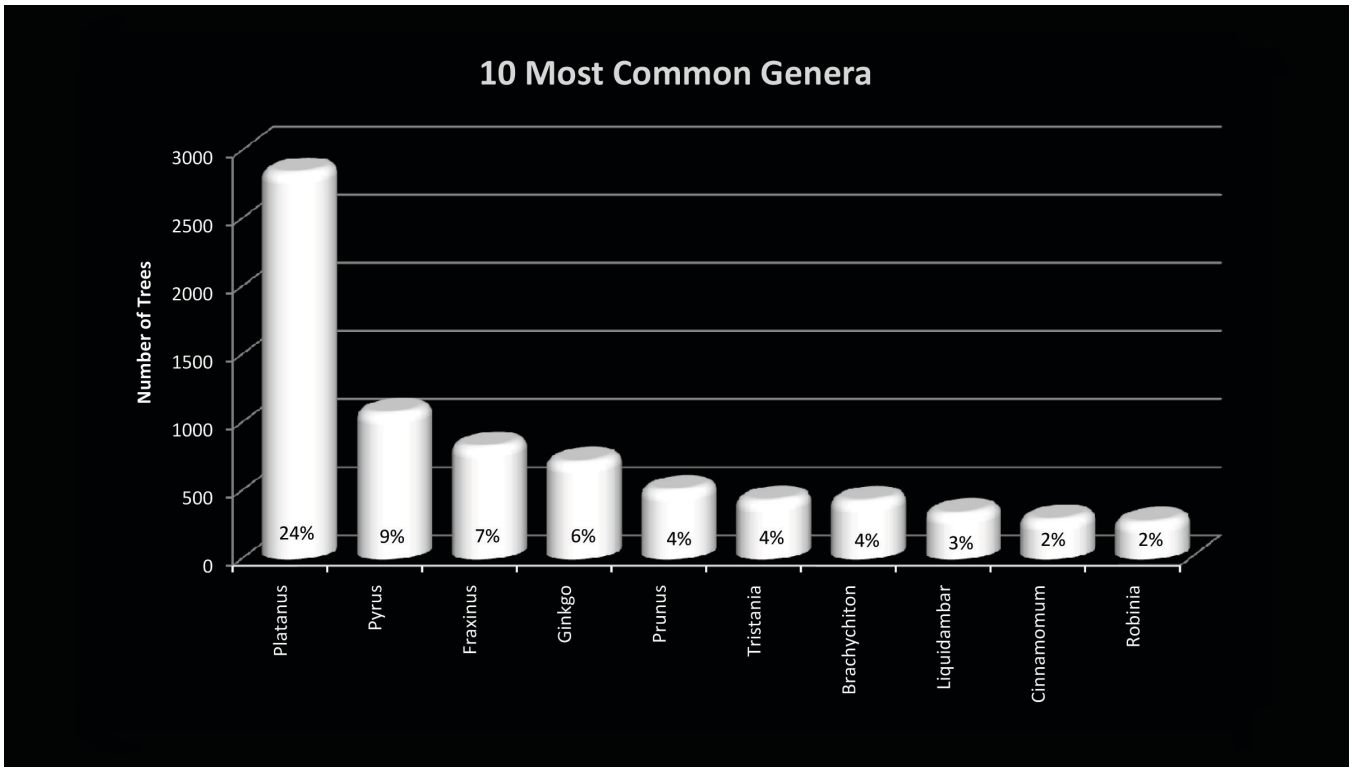
The City of Alameda is blessed with an abundance of trees. They are a major part of Alameda's heritage and define much of its character. In earlier days, Alameda was referred to as "Encinal de San Antonio"—later shortened to "The Encinal"—because of the large number of live oak trees in the city. Even the contemporary name "Alameda" translates into tree-related phrases; one of the Spanish translations is "a grove or lane of poplar trees," while another translation is "a public promenade bordered with trees." Although both of these phrases may be incorrect translations, they do accurately describe the city that has always inspired thoughts of lush, green, plant-filled neighborhoods. The maintenance and protection of fine old trees links the past with the present, binding this green heritage to the future. The adoption of the Historical Tree designation is evidence of the concern for Alameda's environmental heritage. (Refer to existing city ordinance for further information).

This MSTP is dedicated to the principle that today's decisions and actions about trees are a part of tomorrow's environmental heritage. Therefore, the choice of trees to plant is an important one. New trees planted today affect the quality of the environmental heritage for years to come.

This Master Street Tree Plan (MSTP) provides information on the present status of Alameda's street trees, and suggests some effective means by which the city can safeguard and expand its urban forest through street tree management.

MSTP goals, such as increasing tree canopy, improving public safety, and providing native habitat, must be balanced with other goals such as accommodating growth and facilitating transportation. The MSTP is the City of Alameda's plan to integrate management of the many issues and opportunities posed by Alameda's tree resource. Additionally, all natural systems change over time. If the City and its residents want these changes to enhance the urban forest, they must be actively managed. Nationally-based studies repeatedly support the fact that the urban tree resource deteriorates when human intervention is not a proactive part of urban street trees' existence. This decline can be seen in many of Alameda's street tree corridors where it is evident that trees have been planted in places that either don't allow for growth or that conflict with sidewalks and power lines. Proactive management is needed to keep the city trees sustainable and in balance with other urban priorities.

WHO WILL USE THIS MASTER PLAN?



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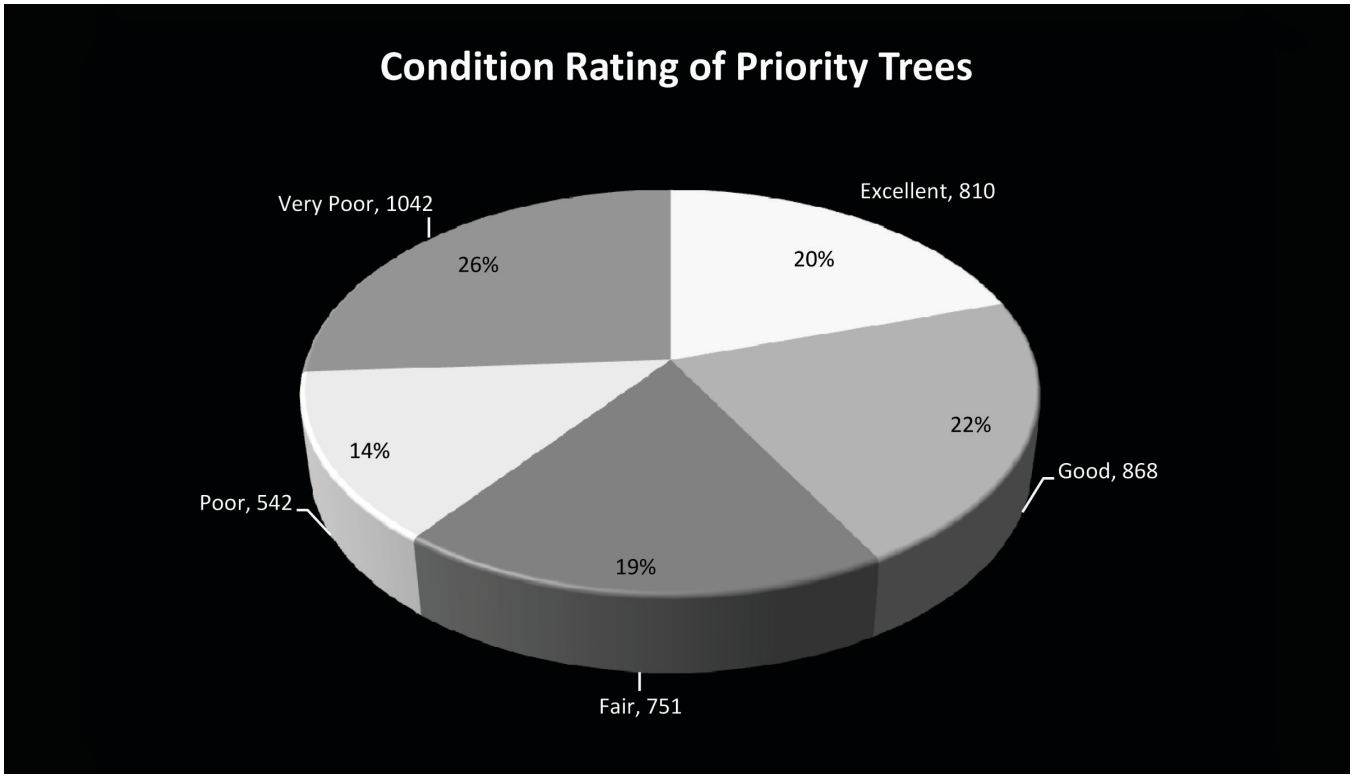

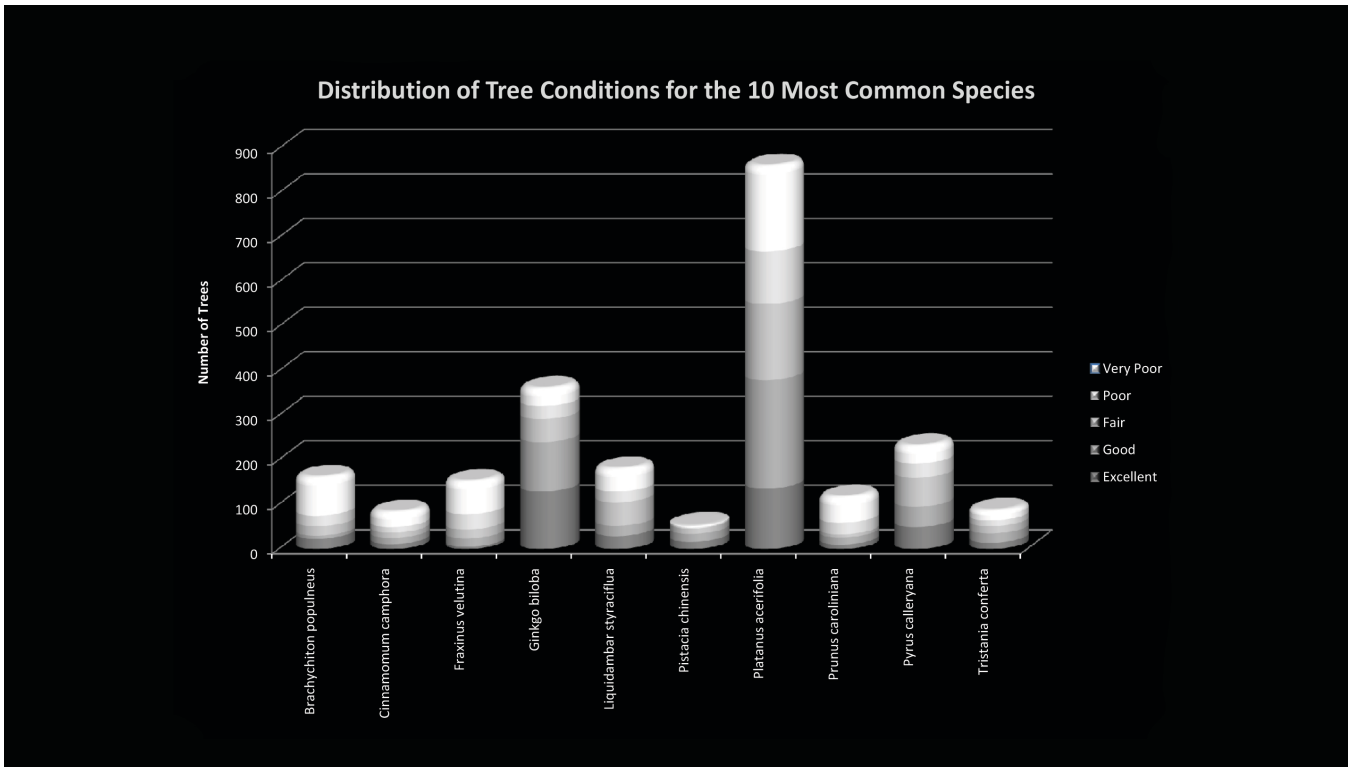

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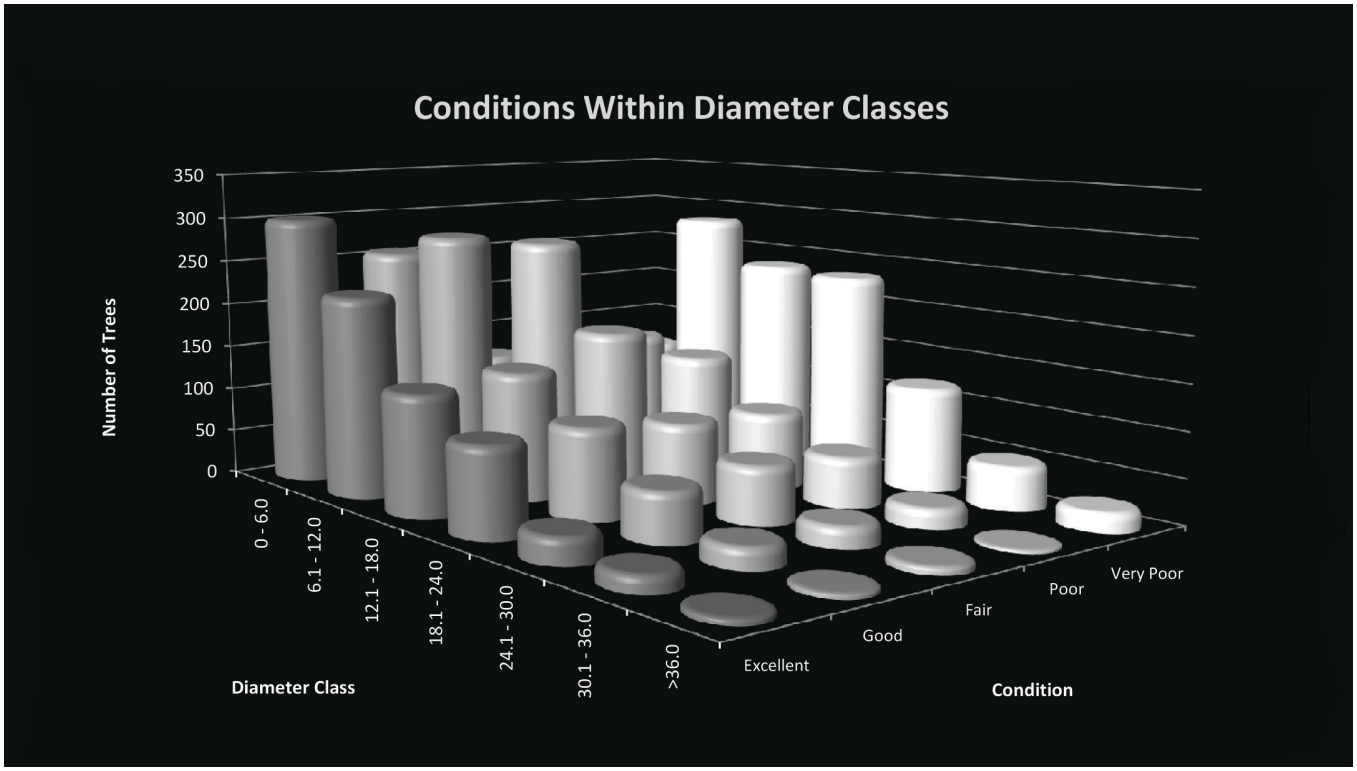


- City Managers: to unify the City's approach to street tree management
- City Council: to plan, implement, manage and maintain the council's street trees
- Landowners and Developers: to assist in the selection and planting of appropriate street tree species
- Contractors: to maintain and plant street trees.
- The General Public: to foster awareness of the benefits of street trees.

AREAS NOT COVERED BY THIS MSTP

A number of areas have been excluded from this version of the MSTP. All private developments are not included. These areas will hopefully be incorporated in future revisions of this MSTP. The City Parks have been excluded as they are the subject of separate studies. These studies will include consideration of the street trees in conjunction with other design elements. The major developments at the former Alameda Naval Base and Northpoint have been excluded, as they have separate master plans that control the planting of street trees within those developments, but will be equalized to use the Tree Matrix.

ALL street trees are wiithin the public right-of-way and require specific city approvals and permits for the planting, pruning and removal of a street tree. Section 23-3 of the Alamaeda Municipal Code provides additional information regarding these requirements.

1.2 / MASTERPLAN GOALS AND ACTIONS

These following priorities for Alameda's urban forest were established through communication with city staff and residents during several information-gathering meetings early on in the project.

YES TO

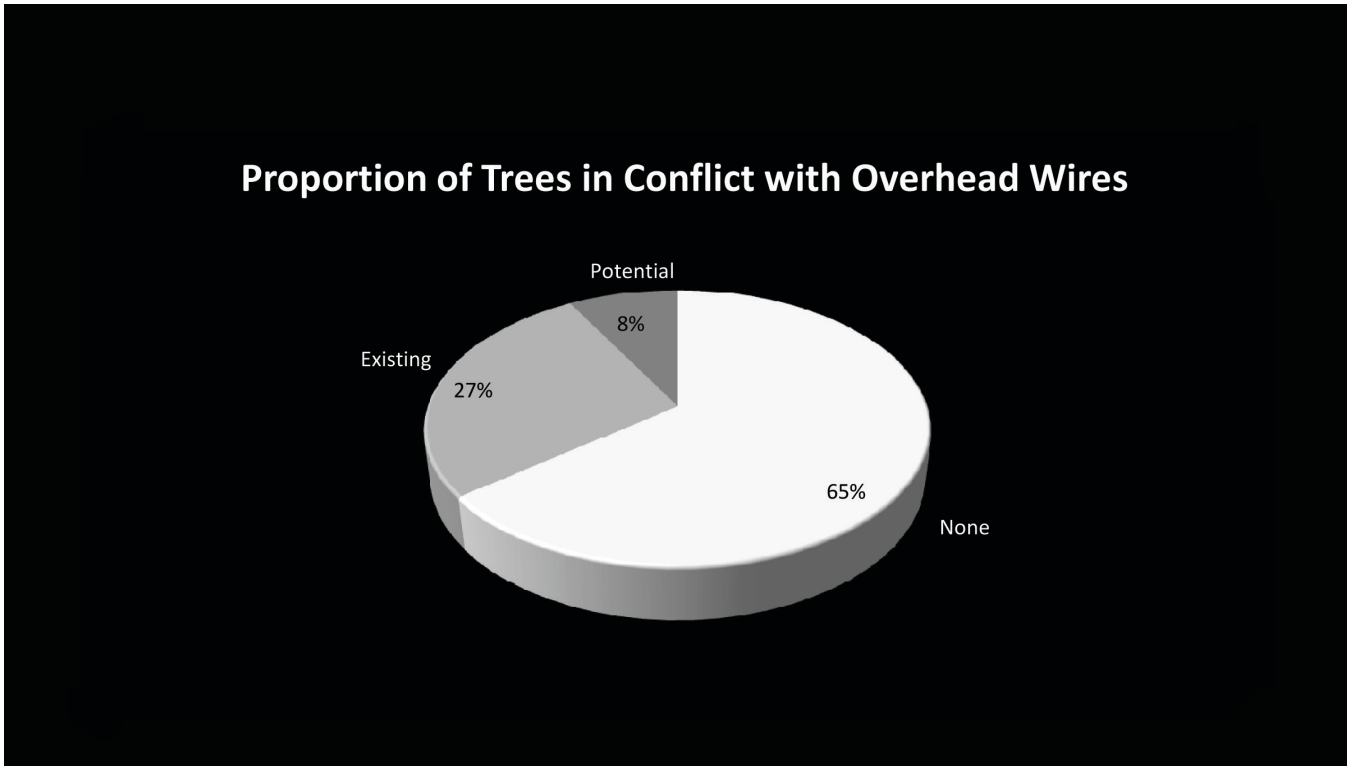
- Tree protection
- More trees
- Long lived trees
- Healthier trees
- Dynamic urban forests
- Sustainable urban forests
- Protect healthy trees while providing for infrastructure stability and public safety
- Replant new trees species mix where existing trees cannot be safely retained
- Maintain successful tree species corridors by planting younger trees
- Proactively pre-plant trees before trees become high risk

NO TO

- Wholesale tree felling
- Short-term tree-less streets
- False eveness plantings
- High risk trees
- Sidewalk and utility conflicts

Figure 2.10

Figure 2.11



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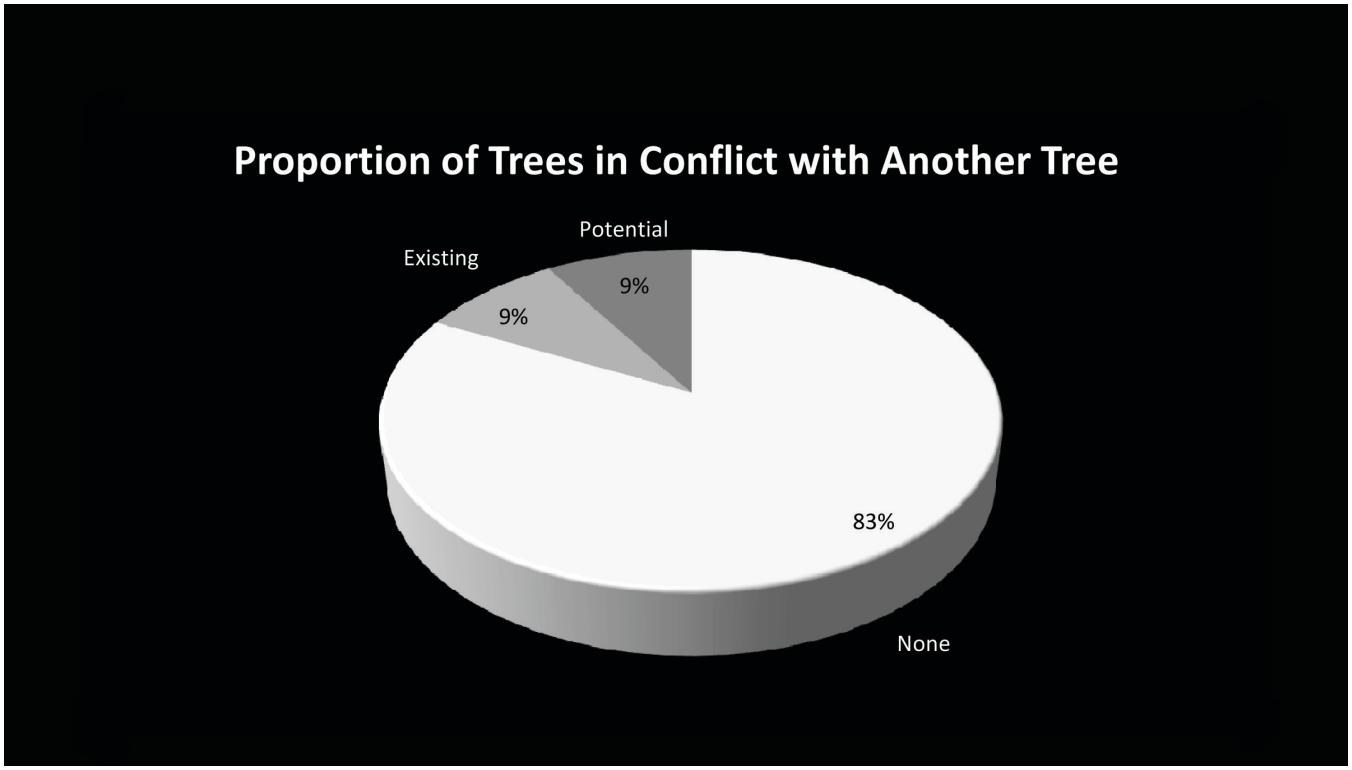

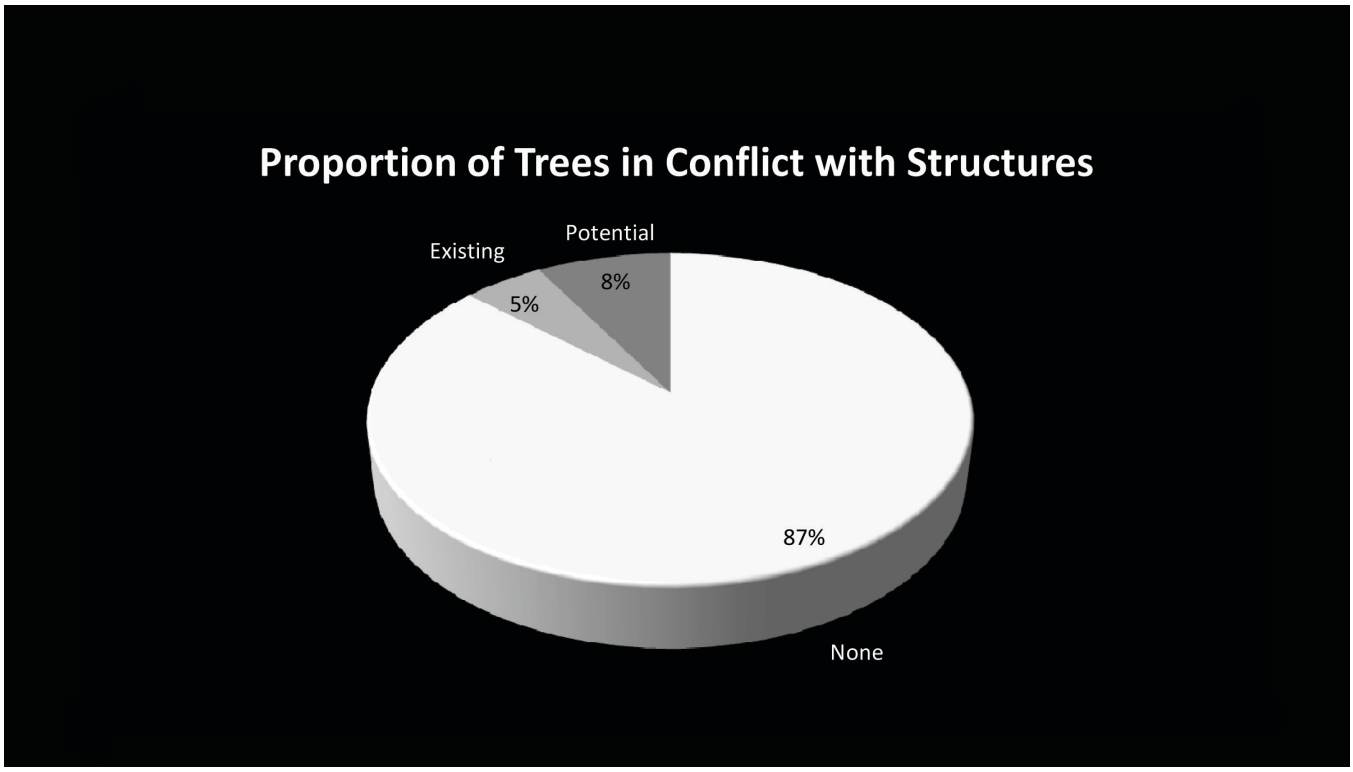

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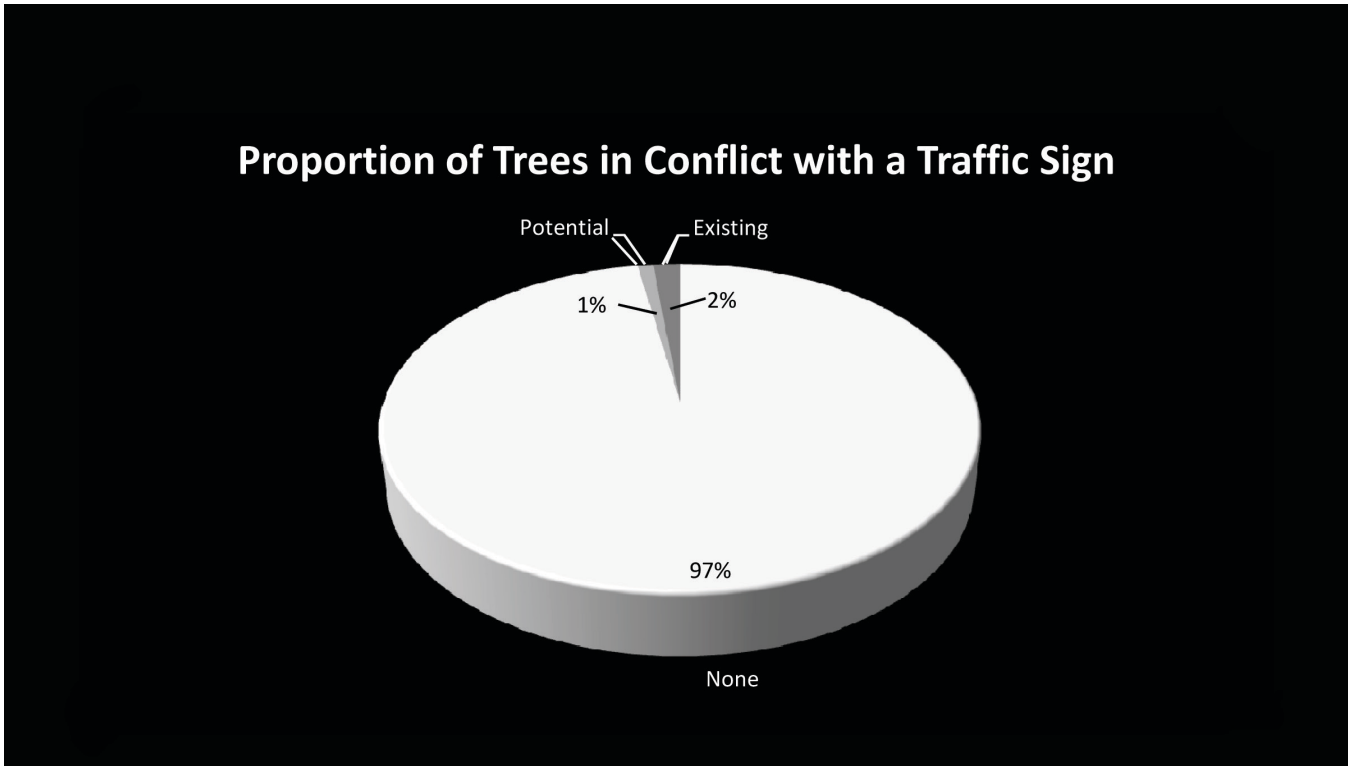


Based on these priorities, goals and action items were established by Alameda's city staff.

The goals and actions have been divided into two groups: long-term goals and short-term goals. Each goal statement is followed by the supporting rationale for the goal, which is then followed by short and long-term actions needed to achieve the goal. Implementation will require policy, program, and budget coordination, as well as long-term and stable funding. The timeline definitions for implementing the proposed actions are as follows:

- Short-term actions will be done within the next five years. Typically, these are actions that are either already partially implemented, that are budget-neutral, or that have already allocated new funding.
- Long-term actions will be accomplished in 25 years. These are actions that might require operational restructuring or reorganization, limited additional funding, or "tooling-up" on the part of internal or external partners.

SHORT-TERM GOALS AND ACTION ITEMS

Short-Term Goal 1: Encourage and maintain a balance between tree-lined streets and safe utility and transportation corridors.

Action A: Provide improved guidelines and standards for utility design, which will coexist with established and future tree plantings.
Action B: Trees shall be planted and maintained in locations where street trees do not conflict with standards for sight distance triangles and traffic sign placement.

Short-Term Goal 2: Maintain and update the public street tree inventory.

Action A: Update GIS tree inventory on an ongoing basis to reflect plantings, removals and maintenance.
Action B: Expand the current street tree inventory to include all city maintained street trees and plantable spaces.
Action C: Conduct a complete street tree inventory every 10 years.

Short-Term Goal 3: Train city maintenance employees in arborculture practices.

Action A: Create a position for, and hire, a City Arborist to coordinate and oversee all tree-related activities.
Action B: Hire and train a city tree crew to perform street tree maintenance in a manner that best follows the Best Management Practices as outlined in the MSTP.

Short-Term Goal 4: Create and maintain a comprehensive list of street trees to be recommended in future plantings.

Action A: Adopt and enforce an approved street tree list.
Action B: Revise the list of recommended street trees every five years to reflect the successes and failures of the existing street tree population.

Short-Term Goal 5: Coordinate street tree design and selection in the permits and review process.

Action A: Provide and encourage effective coordination and compliance with applicable design and development standards for each type of land use or street type associated with the establishment and maintenance of public trees.

Short-Term Goal 6: Develop a public tree ordinance that presents planting and maintenance standards for all street trees within public right of way.

Action A: Encourage continual input from the public and from City departments with regard to street tree standards and procedures associated with the planting, removal, and maintenance of public street trees.
Action B: Review and update procedures, and standards for establishing and maintaining the City's street trees.

LONG-TERM GOALS AND ACTION ITEMS

Long-Term Goal 1: Sustain and expand a healthy urban forest that benefits the community with improved safety, air quality, erosion control, storm water retention, temperature reduction, and aesthetics, while also enhancing wildlife resources.

Action A: Fill in all available planting spaces for an increase in the street tree population within the next 25 years. Based on available funding plant tree species appropriate for the location by using the planting palettes and tree matrix in this MSTP. The city would need to aim to plant 200 street trees a year in order to meet this goal.
Action B: Mitigate all hazardous street trees by following the tree maintenance and removal guidelines in this MSTP.

Long-Term Goal 2: Work toward no net loss of the overall community urban forest cover; in the long term, to work toward measurable gain.

Action A: Mitigate the net loss of healthy forest canopy cover on publicly owned lands. In the long term, the City will achieve measurable gain with consideration of species performance, practicality, and maintenance requirements.

Long-Term Goal 3: Discourage the unnecessary removal of existing healthy trees in the design, construction, or reconstruction of street projects, and other property development.

Action A: Develop tree planting, and removal standards.
Action B: Removal of trees in unavoidable construction condition to be approved only by PW Director.

Long-Term Goal 4: Shift from a reactive, hazard-based maintenance program to a proactive, cyclic maintenance program.

Action A: Continue to expand support for the street tree program and maintenance crew.
Action B: Maintain city street trees on a five-year cycle, using the city's existing maintenance zones. New plantings should be addressed until established.

Long-Term Goal 5: Establish funding mechanisms for the expansion and sustainability of the City's street tree program.

Action A: Allocate funds and research alternative funding sources to ensure the sustainability of the street tree maintenance program.
Action B: Create incentives for property owners to share in the cost of planting street trees in front of their property.

1.3 / BACKGROUND TO ALAMEDA'S URBAN FOREST

CLIMATE

Alameda is part of the Bay Area coastal climate zone, experiencing a warm, moist summer/autumn and a cool, wet winter/spring. The city of Alameda has a mild climate during summer, when temperatures tend to be in the 60s, and a cool climate during winter, when temperatures are usually in the 50s. The warmest month of the year is September, with an average maximum temperature of 74.60 degrees Fahrenheit, while the coldest month of the year is January, with an average low temperature of 44.70 degrees Fahrenheit. Temperature variations between night and day tend to be fairly limited during both summer and winter, with differences around 15 and 13 degrees Fahrenheit, respectively.

The annual average precipitation in Alameda is 22.94 inches. Winter months tend to be wetter than summer months. The wettest month of the year is January, with an average rainfall of 4.85 inches. Alameda experiences more moderate rainfall than other coastal areas, and selected trees must tolerate a longer succession of drier days between rains. The predominant wind direction is from the Pacific throughout the year. Wind can have a significant impact on the health and form of a tree, particularly in exposed locations such as along the coast or where surrounding buildings and structures create wind tunnel effects.
Alameda is located in Zone 9 of the USDA Hardiness Zone Map, which identifies the climatic region where the average annual minimum temperature is between 40 and 50 degrees Fahrenheit. Tree species selected for planting in Alameda should be appropriate for this zone. In addition, species should be urban-tolerant, and rated as relatively free from insect pests and disease. According to Sunset's Western Garden Book, Alameda lies in Climate Zone 17, which is dominated by ocean influences about 98% of the time. The climate is mild without extreme high or low temperatures, characterized by cool, wet winters and cool summers with fog or wind. Certain interior sections of the city could be typified as Sunset Zone 16, with more heat than the maritime-dominated Sunset Zone 17. As part of northern and central California's chilly winter areas influenced by the coast, the main growing season is from March to December. Rain typically comes from fall through winter. Maximum winter lows range from 28 degrees to 21 degrees Fahrenheit. Maritime air often influences the zone, giving it cooler, moister summers than Zone 14. In the Bay Area region, winter lows usually don't drop below 40, but temperatures in the 20s have been recorded. Snow is extremely rare. Nighttime temperatures

during the summer usually fall no lower than the mid-50s. Precipitation averages 24 inches per year, while temperatures are moderate with a mean July high reading of 73 degrees F and a mean January high temperature of 57 degrees F. The potential growing season is long, with usually 360 days per year without a killing frost.

SOILS

The majority of Alameda is located on a sandy island. The rest of the soils are comprised of bay mud that was dredged up to provide additional land and open deep-water container ship passage in the water. These bay mud soils are clay-rich, fine textured, alkaline, and moderately infertile. They provide good structural support for trees but because the island soils have a high water level and the bay muds are saturated this often affects the depth of root growth.

Operations that filled marshland soil have had an immense environmental impact on Alameda, with the earliest ones beginning before 1870. Prior to these landfills, the city encompassed approximately 2,200 acres of high ground and 1,000 acres of marshland. According to Imelda Merlin in Alameda: Historical Geography of a California City, Alameda in 1964 comprised two and one-half times as much area as it had in 1850. The non-fill areas are typified by the Baywood soil series, according to the Soil Conservation Service's 1981 study of Alameda County. In the western part of Alameda, the Baywood series soils are composed of "deep, somewhat excessively drained soils that formed in sandy eolian deposits that derived from old beach deposits." In most cases, the soil becomes more acidic as depth increases. There is little variation in soil structure between soils taken at different depths; it is sand or loamy sand throughout.

The material that was used to fill the marshland consist of beach sands that were dredged from the outlying areas of Alameda Naval Air Station and Oakland Airport. In some of these fill areas there is a perched water table. The highly alkaline soil condition created by this high water table, combined with the addition of unknown materials during fill operations, compounds the problems of tree establishment in these areas.

TOPOGRAPHY

The topography of the city of Alameda is mostly flat land along the San Francisco Bay floodplain, with most of the city only a couple of meters above sea level.

TREE POPULATION

Most of today's large trees were planted during the first decade of the 20th century, and thanks to those who had such foresight, Alameda became known throughout the Bay Area as a city of trees. However, by the mid- to late 1970s, vehicular traffic had increased to the point that several street widening projects were proposed, requiring the removal of dozens of trees along the major arterials. These projects, together with the pruning of many trees that had matured enough to interfere with power lines, had a detrimental effect on Alameda's street trees.

In 1989, Thomas J. Pehrson of Urban Forestry Consultants and Barrie Coate was commissioned to conduct the first citywide street tree inventory and analysis. The resulting Master Tree Plan helped guide the revitalization of Alameda's street population for almost two decades. In 2008, Tanaka Design Group was commissioned to conduct a revised inventory and analysis of all street trees throughout the city. This recently completed tree inventory found over 12,000 street trees in the City of Alameda. Although a formal inventory of trees on public properties other than city streets has not been undertaken, it can be assumed there are two to three trees on these properties for each street tree, which would make the total public tree population somewhere between 36,000 and 48,000 trees.

The current tree inventory uses a GIS-based system that lists street trees by their own unique ID number, species, size, and health condition. The first non-computerized tree inventory was completed in 1989 and was not continually updated as work was done on Alameda's tree population. It is therefore desirable that the new inventory be continually maintained and included as a layer of the City's existing GIS maps.

2.0 / METHODS

TREE INVENTORY

The 1989 tree inventory identified the location, composition and condition of City-maintained street trees on Alameda's main island. At that time, 12,222 street trees were identified and inspected. Data collected from each tree included: street address, species, height, trunk diameter at breast height (DBH), canopy spread, condition (infestations, diseases, manmade damages), maintenance needs (type of pruning), and physical constraints of each tree's growing space.

In 2008, 12,000 trees were surveyed across the main island and the newly developed Bay Farm Island. At the time of the current inventory, city funds did not allow for a complete inventory of all of the City's street trees, which is estimated at approximately 15,000 trees. A two-tiered tree assessment system was used to maximize the number of trees visited while collecting detailed information about the condition of some trees. Approximately 40% of the trees were surveyed using a 16-point health assessment. These trees are referred to as 'Priority' trees, and are scattered throughout the city. The health assessment followed the Neighbourwoods© protocol developed at the University of Toronto by Dr. Andrew Kenney and Dr. Danijela Puric-Mladenovic. Neighbourwoods© was designed to assist communities in conducting an inventory and evaluation of the state of their urban forest. It provides a standardized procedure for collecting information on tree location, species, size and condition, as well as site characteristics and potential conflicts with other urban infrastructure (Table 2.0, Appendix 2). The other 60% of the trees were also identified, measured, and assessed for conflicts with infrastructure, but were assigned a more general health rating (good, fair, poor) based on a visual scan of the tree's condition. Available spots for planting were also identified throughout the city.

Improved technology, such as advanced database programs and Geographical Information Systems (GIS), allowed for major improvements in methodology and

analysis between 1989 and 2008. Each tree's location was recorded using Global Positioning System (GPS). All information was collected using Trimble's Juno™ ST handheld computer with built-in GPS receiver, loaded with ArcPad 7.1 software (ESRI, 2006). The geodatabase and corresponding map was created and runs in ArcGIS 9.2 (ESRI, 2008). The City of Alameda had existing GIS data for the City streets, water features, building footprints, property boundaries, and street addresses. These were all used as layers in the map of the tree inventory. High resolution aerial photos form the background of the map, and were acquired from the California Spatial Information Library. Data analysis was done in ArcGIS 9.2 and Microsoft Excel 2007.

STAKEHOLDERS' MEETINGS

A crucial element in developing this MSTP was soliciting information from stakeholders of Alameda's urban forest. Stakeholder input was used to assist Tanaka Design Group in identifying opportunities, issues, actions, and goals for the MSTP. Three methods of gathering public input were used: conducting public meetings with City residents, interviewing City employees, and soliciting comments through an online questionnaire. Seven public forums were hosted by Tanaka Design Group and Alameda Public Works Department. At the first public forum,

CHAPTER 3

PLANTING GUIDELINES

INTRODUCTION

Tree planting is a major component of any city tree program. Tree species and planting location designations are significant components of a municipal tree planting program because of the long-term impact these decisions hold. It is important to develop an overall planting strategy, initially concentrating on streets and blocks with the greatest need for improvement. The success of a continuing tree planting program will be judged by the post-planting health of the trees and the amount of money spent on planting and maintaining the new trees. With a small amount of planning, healthy trees with greater life expectancies can be established with minimal initial investment and minor maintenance costs.

Tree planting fulfills two main purposes -
1) Tree planting should equal or exceed tree removals as funding allows; however, tree removals for health and safety reasons will not be deferred if this goal cannot be met.
2) As funding becomes available, increase the number of trees and the amount of canopy with a goal of improving climate and esthetics for the City's residents and businesses.

PLANTING STRATEGY-SHORT TERM

Immediately replanting trees, after dead and hazardous tree removal is considered replacement planting and is a top short-term priority. A second short-term goal is restorative planting - to fill in all immediately available plantable spots identified in this plan as funding becomes available. The objective is to accomplish this within a ten years timeframe. Streets and blocks with the greatest need for improvement and insuffcient canopy coverage should be a restorative planting priority.

PLANTING STRATEGY-LONG TERM

Once replacement and restorative plantings are completed, the City may actively search for and create additional locations for tree placement with Goal 2 in mind. At best, new tree planting in one year may exceed tree removals for all reasons in the same year by a ratio of (1.5:1), and at minimum, removals and new plantings may be equal in number. Tree planting may never lag behind tree removal in number, and budget and levels of service may be allocated accordingly. Trees planted by volunteer groups on city property with city knowledge and permission will count towards these numbers.

TREE SPECIES AND PLANTING LOCATION DESIGNATIONS

Tree species and planting location designations are significant components of a municipal tree planting program because of the long-term impact these decisions hold.

The 2008 Alameda street tree inventory documented 3,457 locations available for immediate street tree plantings. This Geographic Information Systems (GIS) dataset provides the exact location of each plantable space in the form of a city map, as well as the maximum tree height and canopy width that would be appropriate in each location. This dataset gives City managers a starting point for a city - wide

planting program. When selecting a tree species to be planted in a known location along a city street, one should consult with the Planting Palette for that location (Volume 2 Chapter 1), and the Tree Matrix located at the end of this document. The Planting Palette provides details of the built and planted landscape surrounding the planting location, as well as a list of tree species recommended for planting. A precise tree species (and in some cases, cultivar) should be selected from this recommended planting list with the help of the Tree Matrix. For each of the trees listed in the tree matrix, details are given about the trees characteristics and its preferred microsite conditions. The physical constraints of the available planting space, and/or the limited number of recommended tree species in the given Planting Palette may make the species selection process quite simple. However, several situations may arise when a City manager, contractor, landscape architect, planner, or resident must carefully consider several factors before deciding on a street tree planting. These factors are discussed in this chapter, and include:

- a desire for species diversity,
- esthetic criteria of the planting ,
- physical constraints of the available planting space, and,
- the type of urban development surrounding the planting location.
- Optimize tree canopy where there are physical constraints and limited planting space.

Beautiful home in Alameda, California (circa1912)

3.0 / TREE SPECIES DIVERSITY

Tree plantings in historic districts and new developments add greatly to the esthetic appeal of Alameda. However, species diversity in new plantings should be a primary concern. The dangers (such as disease and insect infestation) of planting monocultures have proven to be devastating throughout the United States. The goal should be to maintain species diversity throughout the city such that no one species represents more than 5%, and that no one genus comprises more than 10% of the total population. The frequency of the 10 most common street tree species in Alameda can be found in Volume 1 section 2.1 of this MSTP ("Results of the Tree Inventory").

The variety of trees available and suitable for planting in the urban environment far exceeds what is commonly seen in urban areas. The tendency is to only plant what is immediately available from nurseries. Yet with advanced notification, several nurseries would be willing to grow many of the less commonly produced trees found on the Tree Matrix. Of course, such advanced planning is not always possible, so both neighborhood and major street planting palettes incorporate commonly available tree species and those less commonly available.

A goal of this MSTP is to establish representatives of all species in the Tree Matrix. To ensure this:

1. A tree nursery order may be prepared in the year prior to planting, when possible.
2. At least 10 trees of each species or cultivar maybe planted along Alameda's streets, and monitored yearly for their success.
3. Experimental species may be tested in neighborhood locations throughout the city in sites appropriate to the species.

3.1 / ESTHETIC CRITERIA OF A STREET TREE PLANTING

The inclusion of living plants along city streetscapes to enhance both larger urban design and more detailed architectural design is one of the valuable reasons for designing with street trees. Some of the esthetic uses of trees in the landscape include softening line and mass, and unifying diverse architectural elements.

TREE SPECIES

In addition to considering site characteristics, such as availability of space, soil pH, and irrigation, species-specific features must also be scrutinized. A major consideration for street trees is the amount of litter dropped by mature trees. Species such as willow (*Salix* spp.) have weak wood and typically drop many small branches during a growing season. Others, such as American sweetgum (*Liquidambar styraciflua*) drop high volumes of fruits. In certain species, such as Maidenhair (*Ginkgo biloba*) and Osage-orange (*Maclura pomifera*), female trees produce offensive or large fruit; male trees, however, produce no fruit. Furthermore, a few species of trees, including Hawthorn (*Crataegus* spp.), may have substantial thorns. These species should be avoided in high-traffic areas.

Seasonal color should also be considered when planning tree plantings. Flowering varieties are particularly welcome in the spring, and deciduous trees that display bright colors in autumn can add a great deal of interest to surrounding landscapes. Above all, tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site features as well as species characteristics. Matching a species to its favored climatic and soil conditions is the most important task when planning for a low-maintenance landscape, because plants that are well-matched to their environmental and site conditions are more likely to resist pathogens and insect pests, therefore requiring less maintenance overall. Refer to the Street Tree Matrix for additional tree species and cultivars suitable for planting in Alameda.

Although diversity is important in a street tree population, a single-species planting of the same age provides esthetic unity to a neighborhood or street. A goal of this MSTP is to establish uniform plantings of large trees along identified major streets, while recommending a diverse mixture of species within neighborhood residential streets.

BLOCK-WIDE PLANTING PATTERNS

In situations where entire blocks are planted at once, there exists the opportunity for implementing tree planting patterns. Several schemes are possible, but an alternating planting pattern of two or three species is generally the most effective and practical pattern. Where alternative species are proposed, trees should be alternated whenever possible. In locations where several planting sites exist in a row, it is preferable that trees be used with equal frequency with a minimum ratio of 1:3. If possible, a maximum of four instances of the same species should be used consecutively before changing to an alternate species. Please refer to Volume 2 Section 1.1 of this MSTP ("Major Streets of Alameda") for further details on planting patterns to be used along Alameda's major streets.

When deciding on a block-wide planting pattern, one may want to consider the Formal, Informal, and Combined planting concepts:

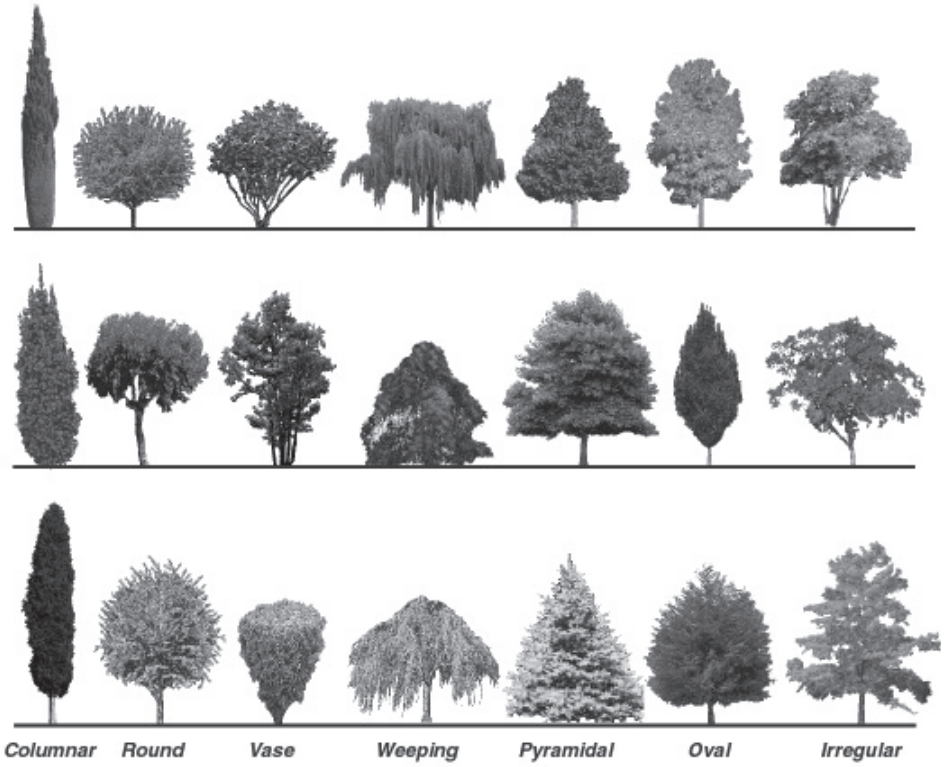
- Formal plantings generally utilize the same species of trees or species with similar form on both sides of the street for a distance of several blocks. A prominent example of this design style is the Central Avenue tree planting.
- Informal plantings emphasize randomness, a large number of species, and irregular spacing. An informal planting concept is most appropriate for large street planting areas such as boulevard medians. As a general rule, informal plantings in strips adjacent to streets are applicable only if the area for planting is large (20 feet wide or more). Without sufficient width in the planting strip, the desired informal effect cannot be achieved. The medians along Island Drive are examples of this.
- Combined plantings include elements of both formal and informal planting concepts. Generally, one species of tree is used on both sides of the streets for the majority of the planting, with a different species (of different size, form, color, or texture) used to accent some particular feature such as an intersection, building, or entryway. The early streetscape plantings in Alameda shown on historic postcards are examples of a combined planting, where one species was established along the block with a smaller, more ornamental tree used to highlight each intersection.

There are opportunities to employ all three of these planting concepts in the City of Alameda. However, formal and combined concepts are the most appropriate for the majority of the City's plantings.

Central Avenue at Park St., Alameda (circa 1912)

Beautiful residence in Alameda, California (circa 1912)

Figure 3.0 / Examples of various tree forms to consider when selecting a species for planting.



VISUAL CHARACTERISTICS OF A TREE SPECIES

Trees are design elements, with each tree bearing its own inherent visual characteristics. These include form, natural color, and texture as well as seasonal changes such as fall color and spring flowers. Some trees are bright and lively, such as a sugar maple, while others are statelier, darker, and more somber, like many of the native oaks.

Street trees need to have a form that allows traffic and pedestrian movements around the tree and that is appropriate to physical constraints such as power lines. Adjacent buildings should also be given consideration in the selection of species. In general, columnar or pyramidal trees should be favored in front of multistory or commercial buildings, especially those with shallow setbacks. Conversely, broad-spreading trees could be favored in front of single-story buildings with deep setbacks, especially low-slung buildings such as bungalows. Figure 3.0 gives examples of tree forms that should be considered when selecting a tree to reflect its surroundings.

Deciduous trees provide shade in the summer and then offer sunlight in the winter when they lose their leaves. They give a sense of the seasons and can produce spectacular autumn displays. Evergreen trees maintain their foliage throughout the year, providing year-round screening, greenery, and shelter from winds. An advantage of deciduous trees is that they renew their leaves annually, allowing them to shed foliage that has become affected by disease and pollution. Where appropriate, deciduous trees should be selected to provide solar access to properties on the south-facing, northern side of the street.

3.2 / PHYSICAL CONSTRAINTS OF THE AVAILABLE PLANTING SPACE

In addition to the ecological and esthetic criteria, it is important to consider the constraints of the tree's physical surrounding. The physical limitations of an available planting space are perhaps the most obvious determinants of tree species to be planted. Street trees will typically be planted on a planting strip, but they can also be located in medians, islands, tree pits, and bump-outs.

PLANTING STRIPS

A planting strip helps separate pedestrians from traffic lanes. The wider the planting strip the larger a tree can be, and the greater the buffering capacity for pedestrians. When planted in a strip large enough to accommodate the mature growth of the trees, planting strips are the ideal planting location for street trees.

TREE PITS

Planting street trees in pits with tree grates is a common planting option in areas with confined planting spaces and high pedestrian traffic, like downtown Alameda. Alameda has successfully planted many trees with this planting option, though it generally has a higher installation cost and a slightly higher cost for long-term maintenance. Cast-iron tree grates cost approximately $300 - $400 each, and they have to be cleaned out every year and widened every couple years as the trees grow. Once the trees grow large enough, the grate has to be removed completely.

ISLANDS OR BUMP-OUTS

This planting option is often preferred over planting in tree pits when there is adequate space for the islands. This option eliminates the tree grates and their future maintenance, while gaining valuable soil volume for the tree's roots. The problem with this option is that it impedes drainage, sometimes eliminates parking spaces, and it makes it difficult to clean leaves off the streets with a mechanical street sweeper.

SIDEWALK

When the curb, sidewalk, and other street improvements are already installed, or if the planting strip is too narrow, the only place to plant a street tree is behind the sidewalk. Planted behind the sidewalk, the tree no longer buffers the pedestrians from the traffic lane, and it becomes more difficult to obtain the canopy effect of street trees over the roadway. However, placing the tree behind the sidewalk can potentially make more soil volume available to the roots of the tree.

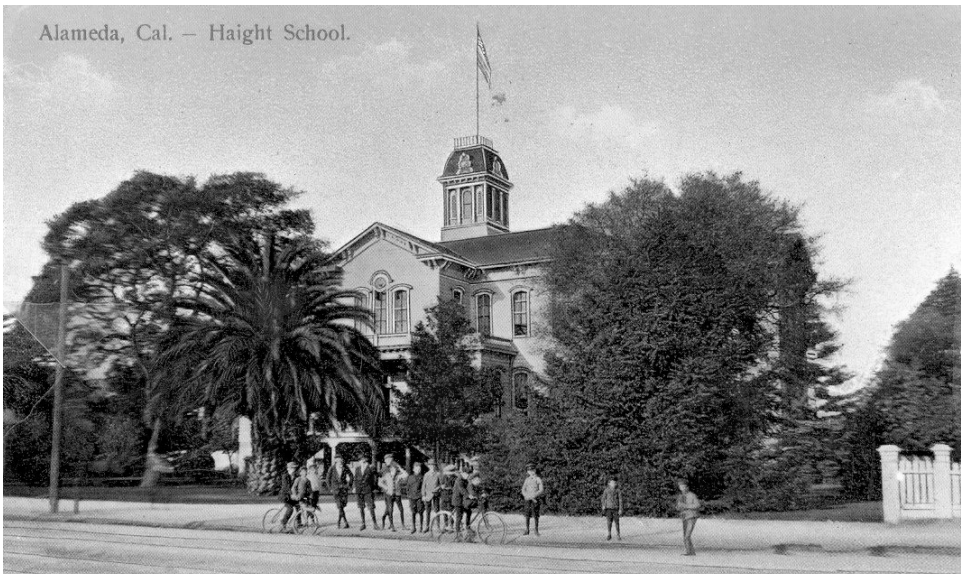
MEDIANS

This planting option is particularly effective at making a very wide street much more pedestrian-scaled. Unfortunately, Alameda often lacks sufficient right-of-way width to be able to incorporate medians into the city's streetscape. The most prominent existing medians in Alameda are on Encinal and Bay Farm Island.

Future reconfiguration of streets to reduce the road and parking width and increase landscape and pedestrian areas may lead to opportunities for tree planting in locations other than the existing planting strip, subject to traffic safety and parking considerations. This would result in substantial benefits to the streetscape. In particular, expanded planting strips enable tree planting away from overhead power lines, thereby reducing the substantial negative impacts of power line and tree interference.

The majority of Alameda has overhead power lines on one side of the road, which has a major impact on the performance of the trees. When trees are overpruned the overall form and health of the tree is impacted. New trees under high voltage power lines need to be selected so that their mature height does not encroach on high voltage utility lines or they can be pruned using CPUC standards. Except for major streets, species and cultivars that at mature height do not exceed 25 feet are recommended especially on streets where the width is less than 36'.

Tree selection should also take into account the impact on street lighting, as trees can significantly impact the level of lighting—and therefore safety—in the street. The presence of underground services restricts the space available for tree roots, which is a particular consideration when the tree is planted.



Alameda, California. Haight School (circa 1911)

3.3 / TYPES OF DEVELOPED LANDSCAPE SURROUNDING STREET TREES

The compositional elements of the developed landscape are buildings, pavement, and introduced plants. Trees serve as landmarks, pinpointing or emphasizing locations. The plane trees of Central Avenue are an example of such landmarks, demonstrating how street trees bring harmony to a street of varied uses and architectural forms. Trees can also reinforce the importance of streets relative to their size and scale; other trees can humanize the scale of parking lots and shopping centers, as with the west end of the Alameda Towne Centre.

The question of what trees to plant in this developed landscape becomes an issue of design. Because the relationship to natural woodlands is diminished, the selection of trees must relate to the visual and functional roles to be served. The following design guidelines are divided into four types of developed landscape: the commercial zone, residential areas, industrial property and institutional property.

COMMERCIAL ZONES

The hub of Alameda's central business district is Park Street, with retail and office buildings radiating primarily north and south. In addition to Park Street, other major business venues are on Webster, Lincoln and Encinal Avenue. These and other streets provide an opportunity for further streetscape connections. Carefully developed tree planting schemes should become an integral part of any expansion plans. When selecting trees for commercial zones, several general considerations are important:

- The form and size of the tree should allow freedom of movement for both cars and pedestrians
- The lowest permanent branches eventually must be able to clear eight feet over sidewalks and 13.5" or more feet over streets, depending upon the proximity of truck traffic
- Multi-trunked and small, low-branching trees should be avoided
- Trees that have deep root systems should be used. Trees that create excessive litter should be avoided

Tree planting situations in the commercial zone of Alameda fall into four broad categories:

a. Street trees for the major boulevards and primary access roads
b. Street trees for secondary commercial streets
c. Street trees for pocket parks and walkways
d. Trees for parking areas

Each situation has its own design determinants from which criteria for tree selection can be developed.

a. Street Trees for the Major Boulevards and Primary Access Roads
The principal design requirements for street trees relate to scale, reinforcement of street unity, and shade. On wide streets, trees should be large in scale so

that they will occupy a large volume and balance the scale of the street. Small-scaled trees would not make a sufficient visual impact on such a street. Trees placed closely together (25 to 35 feet) also unify the streetscape by giving it reinforced form and character.

Each major street might be treated a little differently, but schemes adopted should echo the historic planting character of Alameda, including both mixed and unified plantings.

A commercial street is a linear composite of many architectural forms and styles. The resulting visual diversity can border on chaos, as there is no single unifying element or theme to give harmony to the whole. Tree plantings can effectively counterbalance this chaotic diversity and provide a pleasingly harmonious character to the street.

To minimize distractions and provide the proper landscape environment for these key gateway streets, Alameda should prioritize work to place all utility lines on these streets underground.

b. Street Trees for Secondary Commercial Streets

Most of these streets (for example, parts of Santa Clara Avenue, San Jose Avenue, San Antonio Avenue, and Oak Street) are narrow and less important as access streets to Park Street. At their current state, they should have a greater focus on pedestrian orientation than street tree canopy coverage. While serving various businesses is obviously a necessity, streets that also handle pedestrian traffic need more attention to this important use. The design criteria for such streets include small-scale, narrow planting spaces that provide shade over pedestrian walks. Each street can be planted with a variety of species of a small- to medium- sized canopy tree, thereby providing a unique character to these specific streets. When space permits, both sides of the street could be planted with erect, oval-shaped trees, which are best suited for the narrowest spaces. Uniform planting on both sides of these streets is of less importance because street width is already scaled down. For effective shading, planting should be concentrated on south- and west-facing building facades and walks; north-facing buildings need little extra shade protection.

c. Street Trees for Pocket Parks and Walkways

These spaces are small in scale and are related to the slow pace of walking. Close observation of detail is important in small spaces. Interesting shadow patterns on pavement, seasonal color, and sculptural form are desirable elements in tree selection here. Trees should generally be planted closely together, but the apparent size of a small space can be manipulated through varied tree spacing. Trees for these spaces need not branch at the height required for automobiles, and multi-trunked species can be used. Clearly defined pedestrian ways and linkages should become integrated into the central portion of the business district; they are especially important to include in future development.

d. Trees for Parking Areas

Parking lots can be significant sources of heat, air pollutants, water pollutants, and visual blight. As a result, many communities have enacted ordinances that

not only specify general landscape requirements (for example, one tree for every four parking spaces), but also require parking lots to have up to a 50% canopy cover after 15 years. Detailed studies have shown how effective such provisions are and the benefits that they provide the communities.

Unshaded parking lots can be characterized as miniature heat islands and sources of motor vehicle pollutants. Tree canopies can cool these "hot-spots" by direct shading of the ground surface and indirectly by the transpiration of water through leaves.

Not only do canopy cover provisions reduce pollution and surface temperatures, they also make the lot more inviting, thereby improving the business climate. It is often observed that in hot weather, shaded parking spaces will generally be filled first, even if one must walk further.

Generally, Alameda's parking lots are void of large canopy trees. Lots that have been landscaped almost exclusively rely on crape myrtles or other small trees that provide little shade.
Modifying Alameda's city ordinance to specify 40 to 50% canopy coverage over parking lots would make a dramatic improvement in future parking lots. Provisions to ensure this coverage is maintained should also be included.

Trees for parking areas fall into three basic use categories: trees for shade, definition, and screening.

- Shade trees should have a rounded, high-branched form and grow relatively quickly to cast a broad shadow. Low-branching, conical trees, particularly conifers, should be avoided in the active parking area.
- Definition, or delineator, trees are used to guide traffic, highlight entrances, terminate vistas, and indicate ends of parking bays. As such, they should be taller and more erect (pyramidal or ovoid forms) than the shade trees used.
- Screening trees may be smaller in size than shade or delineator trees. Both round and erect forms are appropriate. Low branching is important if sufficient planting space is available. Evergreen trees afford year-round screening; however, higher-branching trees can be effectively used if they are combined with low shrubs.

RESIDENTIAL AREAS

In the residential streets of Alameda, the functional uses of trees are less important considerations than in the commercial area. The harmonious character or theme that tree plantings can achieve becomes their dominant role. The repetition of tree types helps unify a street of varying architectural styles and garden plantings. A street with too many small, dissimilar, unrelated tree forms tends to appear disorderly. The most pleasing streets and neighborhoods in Alameda are those with strength of unity deriving from a consistent street tree theme.

Perhaps the best examples are the few blocks of Haight Avenue and Santa Clark Avenue, where the grand trees that were planted decades ago achieve a fine strength of character with younger, more recently planted trees that do not impinge on the overall texture of the streets. Additionally, the residential private gardens

bordering the streets usually reinforce this character. Other neighborhoods have a fine visual harmony, not necessarily because of regular street plantings, but because of the repetition of similar trees in a consistent fashion—for instance, portions of Willow Street. The decision of what trees to plant and how to plant them along residential streets is based upon qualitative questions relating to the desired street character:

- Should it be open and sunny or closed and canopied?
- Should the tree canopy give dense shadows or dappled light?
- Are formality and regularity, or informal consistency, important?
- Is seasonal color, or a varied green, more desirable?

In a residential landscape with various existing trees, a more cohesive appearance can be achieved with an apparent random planting of two or more distinct species. Planting can be used to screen views of utility lines and poles, shade driveways and south- or west-facing building walls, and separate open front yards from the street. A narrower street in an older neighborhood may have many large trees in the private gardens; here, a smaller tree might be used to give the street harmony without destroying its openness.

Utility poles and overhead wires are visually distracting elements in most Alameda neighborhoods. Of course, the best solution for eliminating this distraction is underground wiring—a very costly undertaking. However, trees planted along a street can significantly mask the prominence of power lines. Rights-of-way with randomly spaced trees planted forward on lots offset the regularity of utility pole spacing. The canopy of small- to medium-sized trees planted beneath wires can block the direct view of overhead lines.

The recommendation of specific trees for residential neighborhoods is more difficult than for commercial areas, which tend to have more definitive design criteria. Factors such as topography, soil, existing trees, and proximity to the coast and inland waterways all add to the more personal nature of residential areas and form a complexity of design determinants.

The following sections outline zoning-specific street tree planting considerations.

Single-Family Residential

The percentage of street tree canopy cover within Alameda's single-family neighborhoods varies widely. Some neighborhoods are characterized by large tree species while other neighborhoods have canopy cover characteristic of smaller tree species.

Single-family residential property areas hold the greatest opportunity for street tree canopy cover enhancement. Homeowners should be encouraged, perhaps through incentive programs, to care for their street trees and plant additional trees on their property for their own enjoyment and to benefit the overall community. Too many street trees in front of single-family properties are harmed by poor maintenance practices such as tree topping, girdling, volcano mulching, changing the soil grade, and lack of water. Information on tree maintenance practices should be made available to residents through printed material, classes, and the city web site.

Multi-Family Residential

Multi-family residential properties tend to be located along major transportation corridors and adjacent to the downtown core. Typically, much fewer street trees are planted in multi-family developments than in single-family ones. The greatest opportunity for trees begins with the designer and the developer. Planning for more street trees at the conceptive design level should be encouraged.

INDUSTRIAL PROPERTY

The street tree planting opportunities within the city's industrial areas vary widely but are generally fairly limited. A high percentage of property in industrial areas is needed for access, egress, and circulation space for large trucks and parking. These requirements significantly impact the opportunity for street tree plantings. In Alameda's industrial zones, the greatest opportunity to maximize street tree plantings is in expanded tree trenches. In this environment, even a few additional trees would have significant visual impact.

INSTITUTIONAL PROPERTY

The naval grounds and the college campus comprise Alameda's main institutional properties. The streetscapes found on these properties vary widely in design and use, often containing many park-like street tree plantings. Some of these trees are of significant size and character and highly valued by students, staff, and visitors. Additionally they provide nesting sites and habitats for birds. Institutional streets are highly designed landscapes, so the selection of tree species and their location in this landscape must reflect not just the streetscape, but the rest of the landscape as well. Significant planting opportunities exist throughout the range of institutional properties in Alameda. However it is outside the scope of this MSTP to provide a planting strategy for this zone.

CHAPTER 4

MANAGEMENT PLAN

This chapter of the Master Street Tree Plan presents goals, policies, standards and actions that may be adopted by the Alameda City Council, for management of Alameda's street trees for the foreseeable future. The intent of these goals is to maximize the net benefits of the existing street trees and extend Alameda's living canopy. Management priorities and recommendations required to work toward these goals are presented. The goals, policies, standards and actions herein have been adapted from the City of Davis Community Forest Management Plan (2002), a successful working document for a California municipality of similar size to the City of Alameda.

4.0 / MANAGEMENT POLICIES, STANDARDS AND ACTIONS

GOAL 1

To improve the quality of the Alameda's street trees over time in ways that will optimize environmental, economic, habitat, food and social benefits to the City and its neighborhoods.

Policy 1.1 Increase the existing tree canopy cover through implementation of the Tree Matrix for tree selection, and the Best Management Practices (BMPs) for tree placement, and care.

Policy 1.2 Ensure that the street tree population has a diverse mix of tree species and ages.

Actions

A. Work with the public and City staff to educate and encourage public awareness of the importance of tree species and age diversity within the Urban Forest.

GOAL 2

Promote planting and protection of the existing street tree resource.

Actions

A. Where funding permits, implement practices to reduce tree removals, such as systematic tree inspection and pruning.

B. Explore new methods of repairing sidewalks using alternative materials to provide safe and shady walkways while retaining large, healthy trees.

Policy 2.1 Expand existing comprehensive street tree inventory to include all street trees.

Actions

A. Complete identification, measurement, and comprehensive health assessment of all street trees for the City's GIS database. Continuously update inventory to develop work history of street trees.

B. Use the inventory as the basis for tree-related work scheduling.

Policy 2.2 Maintain clear criteria for tree removal, and implement practices to retain healthy and safe trees.

Actions

A. Street tree removal requests may be approved if one or more of the following conditions exist: **1)** tree is dead or in declining health that will result in its death within a year, **2)** tree is a safety concern because of its high potential for failure due to considerable dead or dying foliage, branches, roots, or trunk, **3)** tree is structurally unsound due to root pruning or crown damage, **4)** tree has reached an over-mature condition, is in declining health, and limits planting/growth of a replacement tree, **5)** tree is infected with a disease that cannot be treated successfully and/or there is strong potential that the pathogen could spread to other trees in the area, **6)** tree location is stated for the construction of public or private improvements, **7)** tree is causing damage to public or private

property, utilities, or drainage that cannot be mitigated by crown pruning, root pruning, irrigation, or other maintenance, **8)** uplifting roots create inmitigable ADA safety concern, **9)** sidewalk width surrounding tree needs to be reduced beyond ADA mandates.

(Note: When dealing with cracked curbs and sidewalks in the vicinity of street trees, the public works director is strongly encouraged to consider alternatives such as bumping out curbs and sidewalks away from trees: reducing sidewalk width near trees: and using interlocking sidewalk pavers. Tree removal is permissible only after all practical and reasonable alternatives have been considered.)

B. When a tree has been identified as high risk remove tree by decision of the PW Director if determined to be a safety hazard.

C. The City Council has discretion to identify special situations where a comprehensive tree removal and replacement program may be desirable.

At the time comprehensive program goes to council for approval, recommendations are to be guided by the MSTP.

D. Where new species are to replace currently planted species, a phasing plan is to be implemented if the site allows whereby no more than 10% of non high risk tree removal is allowed per year unless by City Council action.

E. Replace trees removed or lost to damage on site whenever practical or in a nearby available site with no net loss to the street tree population.

GOAL 3

Continue to maintain the City's street trees in a safe and healthy condition as cost-effectively as possible.

Policy 3.1 Follow the Best Management Practices (BMPs) for tree planting and care (Volume 2 Chapter 2), and make available to the public.

Actions

A. Review BMPs periodically to ensure they employ the most current industry standards.

Policy 3.2 Implement routine inspection for large street trees to reduce long-term tree care costs.

Actions

A. Record annual maintenance procedures in the GIS street tree inventory.

GOAL 4

Facilitate collaboration among City departments related to issues and projects involving trees.

Policy 4.1 Review existing Maintenance Division staffing levels. If budget allows, create City Arborist (and/or professional Urban Forester) job description and continue to maintain the position with a highly qualified urban forester.

Actions

A. Use the Tree Management Planning Tool/Level of Service (LOS) Matrix, Appendix 5, as a tool for establishing priorities, by the following recommended process, as allowed by city budget:

i. Establish minimum to optimum tree management budget range for the planning period (i.e. annual, 5-year, etc.).
ii. Review inventory data and existing street tree conditions. Establish number of street trees being managed.
iii. Prioritize program areas for planning period and rank importance in LOS matrix. Establish special management projects and prioritize.
iv. Modify generic LOS definitions as necessary for conditions (i.e. delete minimal LOS 1 and/or upgrade LOS 2,3,4 with additional special projects if adequate budget exists.
v. Evaluate budget demands for special projects.
vi. Evaluate best funding options, including capabilities of community based partners, grant availability, and comparative costs for private service contracts compared to staff costs.

B. In preparation for each new fiscal year, it is recommended if budget allows that the City Arborist will prepare an annual tree management plan for the street trees, including annual goals for new tree plantings, routine maintenance and pruning, tree removals and replacement program, task scheduling, public education programs, funding and resources, inspections, etc.

GOAL 5

Provide awareness of the importance of the Urban Forest; educate the community on proper tree planting and care; and encourage greater participation in tree planting and stewardship activities.

Policy 5.1 Promote awareness of the standards in the Master Street Tree Plan (MSTP).

Actions

A. Distribute MSTP to City Council, all City departments, public agencies and private partners. Make the plan available to the general public.
B. Develop educational material aimed at preventing the unwarranted and illegal pruning and removal of street trees.

Policy 5.2 Disseminate information and educate the public on the care and value of trees.

Actions

A. Develop and make available a general brochure to for residents in the City of Alameda on the City's tree care policies.
B. Organize and publicize annual Arbor Day activities.

Policy5.3 Amend existing City plans and ordinances to accept the provisions of this MSTP.

Actions

A. Identify current codes, statutes, and ordinances that require updating.
B. Implement amendments following adoption or updating of this MSTP.

4.1 / DETAILED MANAGEMENT PRIORITIES

There are five tree program management elements that must be addressed every year: High Risk Tree Abatement, Mature Tree Care, Young Tree Care, Tree Planting, and Program Administration. Although each of these programs is essential to the maintenance of Alameda's street trees, an annual and/or five-year plan for management priorities should be established to determine where available budget dollars will be spent.

PRIORITY 1: HIGH RISK TREE ABATEMENT

High Risk tree abatement, or removal of dead or dying street trees, is the highest budget priority due to potential public safety concerns. Dead and dying trees can be in danger of falling or losing major branches, with resultant property and/or personal injury concerns.

- **Recommendation:** Eliminate any backlog of high risk street trees. Maintain the City's ability to remove all dead/dying trees in a timely manner.

PRIORITY 2: MATURE TREE CARE

Mature tree care is a high priority for the tree management budget over the next five years. Large trees are the most significant component of Alameda's urban forest. They form the umbrella over streets, and create the backbone of the urban form. Although care of mature trees is the most costly management element, it is a priority because of the importance of safety and tree health issues; the consequences of lack of care are more immediate for large trees than smaller trees.

- **Recommendation:** Continue the current 5-year pruning cycle for larger trees.

PRIORITIES 3 AND 4: YOUNG STREET TREE CARE AND PLANTING

Young tree care and new tree planting are essential parts of street tree management. The health and stability of Alameda's future street tree population depends in large part on judicious tree selection today, as well as ongoing maintenance of young trees. These recommendations assume that City staff may be assisted in young tree care and planting activities by community based partners who can train volunteers and apply for outside grants, thereby producing a substantial cost savings to the City.

- **Recommendation:** Establish a young tree care program that inspects/prunes young trees once a year for the first five years after planting. Eliminate the backlog of any young street trees that are not receiving early training/pruning.
- **Recommendation:** Use city-funded tree planting for replacement trees, and seek outside grant money with the help of community based partners (such as Master Gardeners) for additional planting to reach the City's ultimate goal to have a tree planted at every identified site within the next twenty years.

PRIORITY 5: ADMINISTRATION

Administration refers to activities such as supervision, scheduling, coordination, planning and education overseen by the City's Maintenance Services Division. Current tasks performed by the maintenance supervisors are numerous and varied. They respond to public contact, including comments, work orders and special requests related to trees, and coordinate with other City departments such as Planning

& Building, Housing, and Alameda Municipal Power. Part of this coordination responsibility is to review proposed development and construction plans to ensure that adequate existing tree protection and ion measures are taken and that tree planting follows City guidelines.

- **Recommendation:** Expand the current level of Program Administration to include a position for a City arborist, if budget allows.

4.2 / LEVEL OF SERVICE MATRIX

The following Tree Management Planning Tool/Level of Service (LOS) Matrix, Appendix 5, has been developed to direct the prioritizing and budgeting of the annual tree management plan.

The purpose of the LOS Matrix is to identify priorities for care of City street trees along with identifying annual and long-term projected management costs. The LOS Matrix is designed to respond to budget levels from optimal (in adequate budget years) down to minimal service (to be used rarely and only for extremely lean budget years). When funding exceeds the optimal service levels for annual maintenance and administration needs, the five year plan may address additional long-term goals of the MSTP, such as promoting public awareness, updating the Best Management Practices with current industry standards, or other goals, priorities and actions contained in the recommendations above.

TREE MANAGEMENT PLANNING TOOL[1]

Levels of Service (L.O.S.) and Budget Determination for City-funded Tree Management

Program Area	Rank for Fiscal Year*	Potential Level of Service 1 (minimal)	Potential Level of Service 2	Potential Level of Service 3	Potential Level of Service 4 (optimal)	Staff Recommendation for Fiscal Year*
Planting		No new city-funded tree planting	Replace street tree removals only	Replace removals and plant on request; increase street tree population by 1/2 % per year	Replace removals and plant on request; increase street tree population by 1% per year; provide for special planting projects	
Young Tree Care		No young tree care	± 5-year cycle inspection/ pruning	± 3-year cycle inspection/ pruning	± 1-year cycle inspection/ pruning	
Mature Tree Care		± 12-year cycle inspection/ pruning	± 9-year cycle inspection/ pruning	± 7-year cycle inspection/ pruning	± 5-year cycle inspection/ pruning	
HIgh Risk Tree Abatement		Removals on property owner request only	Removals on request; maintain <5% 'dead of dying' backlog	Removals on request; maintain <2% backlog; fund special projects	Removals on request; maintain <1% backlog; fund removal/replacement programs; inventory and other special projects	
Administration (2008 dollars)		$2.50/tree admin budget or 0.25 supervisory arborists/ 10,000 trees	$3.50/tree admin budget or 0.40 supervisory arborists/ 10,000 trees	$4.25/tree admin budget or 0.50 supervisory arborists/ 10,000 trees	$5.00/tree admin budget or 0.65 supervisory arborists/ 10,000 trees	

1 developed by the City of Davis, 2002

* Column to be filled in annually when planning budget and proposed Level of Service.

4.3 / ANNUAL OPERATING PLAN FOR FY 2009

This FY 2009 Level of Service (LOS) matrix and resulting budget are based on the FY 2008 budget. The LOS matrix, with accompanying text, explains the issues and processes involved in developing recommendation for this time frame. It is included in this plan for its value at the present time and for reference as a model for future years' planning and budgeting.

The LOS Matrix compares current levels of service with four possible levels/budgetary demands for 2009: minimal care (LOS 1) through optimal care (LOS 4). The matrix includes five annual ongoing maintenance/program management areas: Tree Planting, Young Tree Care, Mature Tree Care, High Risk Tree Abatement, and Program Administration/Management.

Although each of these annual ongoing program areas is essential to the maintenance of the City's street tree population, they have been prioritized for budget consideration. Concern for public safety and responsible management of the existing street trees has been placed as the highest priority. The final column of the matrix proposes the recommended implementation strategy and budget for FY 2009.

The issues inherent in the management of each program area and related implementation standards are addressed in the text below, organized by budget priority.

1. HIGH RISK TREE ABATEMENT

High risk tree abatement, or removal of dead or dying street trees, has been given the highest budget priority for FY 2009.

During a typical year in Alameda, about 150 street trees require removal. These trees are removed on request by homeowners and City staff as well as in emergency removal situations such as following a storm.

Assuming current mortality rates in Alameda continue during the next year, 150 street trees will need to be removed due to normal aging of the population.

Therefore, to summarize the matrix, levels of service identified for high risk tree abatement are as follows:

Level of Service 1 (minimal): High risk tree removals on property owner's or City's request only; no backlog high risk tree removal.

Level of Service 2: High risk tree removals on property owner's or City's request; eliminate backlog of high risk trees in ten (10) years.

Level of Service 3: High risk tree removals on property owner's or City's request; eliminate backlog of high risk trees in five (5) years

Recommended level

Level of Service 4 (optimal): High risk tree removals on property owner's or City's request; eliminate any backlog of high risk trees with one-time capital expense in one (1) year.

2. MATURE TREE CARE

Mature street tree care is identified as the second highest priority for the tree management budget in FY 2009. Mature trees include all trees over four-inches diameter at breast height (4" DBH).

The Society of Municipal Arborists (SMA), the leading professional organization in the field of municipal urban forestry, established a minimum standard for pruning street trees at least once every eight years, with recommended pruning every five years for older trees.

The current Level of Service for mature trees in Alameda is about a five-year cycle. Approximately 2,500 trees are inspected and/or pruned each year. This equates to LOS 4. The recommended Level of Service for mature tree care is to maintain the current five-year pruning cycle.

Therefore, to summarize the matrix, the levels of service identified for mature tree care are as follows:

Level of Service 1 (minimal): Inspection/pruning of 1,250 trees/year; this equates to a ten (10) year cycle.

Level of Service 2: Inspection/pruning of 1,500 trees/year; this equates to an eight (8) year cycle.

Level of Service 3: Inspection/pruning of 2,000 trees/year; this equates to a six (6) year cycle.

Recommended level
Level of Service 4 (optimal): Five-year inspection/pruning cycle: 2,500 trees/year.

3. YOUNG TREE CARE

Conscientious care of young trees is a prudent and cost-saving measure in the long run, because trees that are frequently inspected and pruned in the first six years of growth need much less attention and costly maintenance when mature. Young trees are defined as trees newly planted to about four-inch (4") DBH, assuming the time frame encompassing planting through three years after planting. Regular watering and basin adjustment, mulching, stake adjustment and removal, pruning to remove broken and dead wood, establish central leader, select lowest permanent branch, establish scaffold branches, and other maintenance is provided to young trees.

London plane, flowering pears, elms and Red maple should probably be pruned when 2, 3 and possibly 4 years old before reverting to a less frequent cycle. Young trees in intense commercial areas (eg. Park and Webster Streets) probably need pruning

every year for the first 3-5 years and probably at 2-3 year intervals thereafter until all temporary lower branches are removed.

The Society of Municipal Arborists (SMA) established a minimum standard for pruning young trees once every three years, or two prunes during the first six years. In practice, a more optimal goal is to create a two-year prune cycle, or four prunes in the first six years, which will more readily establish healthy, long-lived mature trees. The pruning sequence recommended by Dr. Larry Costello (UC Cooperative Extension) in his publication "Training Young Trees for Structure and Form" is to properly train young trees by inspecting/pruning at the time of planting, one year later, then three and five years after planting. To meet this goal will require starting newly planted trees on this program, as well as increasing pruning of existing young trees over the next five years to bring all trees to the same level of care.

Alameda currently has about 2,300 trees sized 0-4" DBH. Many of these are smaller tree species or slower growing trees (eg. Gingkos) that could be pruned less often than every two years. To reach the optimal two-year cycle, approximately 1,150 trees will need to be inspected/pruned annually. Alameda does not have a young tree care program established, and records are sparse on the level of service provided to young trees.

The recommended Level of Service for young tree care is LOS 3, representing a two-year cycle of 1,150 trees/year, with no elimination of backlog.

Therefore, to summarize the matrix, the levels of service identified for young tree care are as follows:

Level of Service 1 (minimal): No young tree care.

Level of Service 2: Four-year cycle, 575 trees/year.

Recommended level
Level of Service 3: Two year cycle, 1,150 trees/year.

Level of Service 4 (optimal): Two year cycle with backlog elimination in first year. One year cycle for very fast growing species, e.g. London plane, elms etc. and trees in high intensity commercial area.

4. TREE PLANTING

New tree planting on an annual basis is an important element of perpetuating the street tree population. Failure to plant trees on a regular basis will reduce age diversity and leave gaps in canopy cover. Replacement of removed trees and filling in vacant street tree sites are the major goals of new tree planting.

The 2008 street tree inventory identified 3,457 vacant planting sites. In addition to vacant tree locations, approximately 150 trees/year are removed due to damage or health concerns. Therefore, to achieve full stocking over the next 20 years, approximately 150 replacement trees and 175 trees in vacant sites must be planted each year (325 trees/year) for 20 years.

The optimal LOS 4 plants 500 trees/year to reach full stocking in 10 years, at an average cost of $253 to $351/tree. In the short-term due to higher priority of high risk tree removal and mature tree care, it is acceptable to reduce tree planting funds as necessary if budgetary constraints demand. Therefore, Level of Service 2 is recommended, provided that each site is in accordance with MTP spacing criteria.

Therefore, to summarize the matrix, the levels of service identified for tree planting are as follows:

Level of Service 1 (minimal): No new plantings.

Recommended level
Level of Service 2: Replace removals only. 150 trees/year.

Level of Service 3: Replace removals (150 trees/year) and plant 175 trees/year in vacant sites to reach full stocking in 20 years. 325 trees/year.
Level of Service 4 (optimal): Replace removals (150 trees/year) and plant 350 trees/year in vacant sites to reach full stocking in 10 years. 500 trees/year.

5. ADMINISTRATION

Administration refers to activities overseen by the City's Maintenance Division, such as supervision, coordination, planning and education. Currently there is one full time maintenance supervisor, and no arborist on staff. It is recommended that the City create a position for a full-time City Arborist, whose duties would include selecting contractors to fulfill tree maintenance and planting needs, filling job orders, and supervising pest management and staff training. Additionally, the City Arborist's role is to educate developers, contractors, designers and residents concerning tree-related policies and benefits of healthy trees. As part of his/her interactions with the public, the City Arborist is responsible for replying to phone requests, inspections, monitoring projects and diagnosing tree problems.

There is no national standard for this service, however, these activities are fundamental to effective implementation of street tree programs. Based on other municipal street tree programs in California, 1 full-time supervisory arborist for every 20,000 street trees is recommended and corresponds to LOS 4. LOS 4 is recommended, which will provide the desired level of oversight needed to enforce ordinances, educate stakeholders, and guide a model program. However, for the next five years the goal is to continue to contract out registered consulting Arborist services while gathering support and funding for a full-time City arborist in 2014.

Recommended level
Level of Service 1: One Maintenance Supervisor per 20,000 trees
Level of Service 2: 0.5 City Arborist and 0.5 Maintenance Supervisor per 20,000 trees
Level of Service 3: One City Arborist per 20,000 trees
Level of Service 4: One City arborist and one Maintenance Supervisor per 20,000 trees

PROPOSED LEVEL OF SERVICE MATRIX FOR STREET TREE MAINTENANCE, FY 2009

Program Area:	Current (2007) Level of Service for Alameda Street Trees		Potential Level of Service 1 (minimal)		Potential Level of Service 2		Potential Level of Service 3		Potential Level of Service 4 (optimal)		Recommended for FY 2009	
Tree Planting	LOS: 1-2 (35 trees planted in 2007)	Budget Impact: unknown	No new plantings	Budget Impact: TBD	Replace removals only (150 trees/yr)	Budget Impact: TBD	Replace removals and plant 175 vacant spaces (325 trees/yr)	Budget Impact: TBD	Replace removals and plant 350 vacant spaces (500 trees/yr)	Budget Impact: TBD	LOS: 2 Replace removals only	Budget Impact: TBD
Young Tree Care	LOS: 3 (estimated 2-year cycle, 1,250 trees/yr @ $40/tree)	Budget Impact: unknown	No young tree care	Budget Impact: TBD	Prune 575 trees/yr (4-year cycle)	Budget Impact: TBD	Prune 1,150 trees/yr (2-year cycle)	Budget Impact: TBD	Prune 2,300 trees (2-year cycle and eliminate backlog in 1 yr.)	Budget Impact: TBD	LOS: 3 Prune 1,150 trees/year	Budget Impact: TBD
Mature Tree Care	LOS: 4 (5-year cycle, 2,500 trees/yr @ $69/tree)	Budget Impact: unknown	Prune 1,250 trees/yr (10-year cycle)	Budget Impact: TBD	Prune 1,500 trees/yr (8-year cycle)	Budget Impact: TBD	Prune 2,000 trees/yr (6-year cycle)	Budget Impact: TBD	Prune 2,500 trees/year (5-year cycle)	Budget Impact: TBD	LOS: 4 5-year cycle, 2,500 trees/year	Budget Impact: TBD
Hazard Tree Abatement	LOS: 1 (150 trees/yr)	Budget Impact: unknown	Remove on request only (150 trees/year)	Budget Impact: TBD	Remove on request (150/yr) and eliminate backlog of hazard trees in 10 yrs (35/yr). Total 185 trees @ $300/tree	Budget Impact: TBD	Remove on request (150/year) and eliminate backlog in 5 yrs (70/yr). Total 220 trees @ $300/tree	Budget Impact: TBD	Remove on request (150/yr) and eliminate backlog in 1 yr (350 trees). Total 500 trees @ $300/tree	Budget Impact: TBD	LOS: 4 (150/yr @ $300/tree and one-time removal of 350 trees to eliminate backlog)	Budget Impact: TBD
Admin-istration	LOS: 1 (1 maint. supervisor/ 20,000 trees, contract arborist as needed)	Budget Impact: unknown	1 maint. supervisor/ 20,000 trees, contract arborist as needed	Budget Impact: TBD	0.5 City Arborist, 0.5 maint. supervisor/ 20,000 trees	Budget Impact: TBD	1 City Arborist/ 20,000 trees	Budget Impact: TBD	1 City Arborist, 1 Maint. Supervisor/ 20,000 trees	Budget Impact: TBD	LOS: 1 1 maint. supervisor/ 20,000 trees, contract arborist as needed	Budget Impact: TBD
Misc. Tree Maintenance	unknown		TBD		TBD		TBD		TBD		TBD	
Total Budget Impact	unknown (sum of all budget impacts for 2007 LOS)		TBD (sum of all budget impacts using LOS 1)		TBD (sum of all budget impacts using LOS 2)		TBD (sum of all budget impacts using LOS 3)		TBD (sum of all budget impacts using LOS 4)		TBD (sum of all budget impacts using recommended LOS)	

CHAPTER 5

BUDGET

5.0 / FUNDING A STREET TREE PROGRAM

Based on recent research by the Society of Municipal Arborists (McGannon, "Urban Forestry Programs Across America," City Trees, July/August, 2001), there is a $5.00 per capita standard budget required to support staffing levels for a comprehensive street tree program that performs tree planting, maintenance, emergency services, public relations, and supervision. Alameda's 2000 census population was near 72,000, and it is projected to be 80,000 in less than 10 years. Given these population figures and the national standard, Alameda's general funding level should be between $360,000 and $400,000 annually. Specific budgetary recommendations are made on a yearly basis using the Tree Management Planning Tool (Appendix 5). The 2008 FY budget was approximately $350,000, and is detailed in the table below.

STREET TREE EXPENDITURES FOR FISCAL YEAR 2008

Street Tree Expenditures	**$Total**
Mature Tree Care	171 842
Young Tree Care	50 000
Arborists' Services (diagnosis, reports, etc.)	2 500
Bay Street Homeowners' Assoc. (Elm Tree Care)	3 000
Bee Hive Removal	1 000
Misc. Tree Care	32 000
Tree Plantings and Removals	75 000
Insect Pest Treatment	4 000
Grand Total	339 342
Average $ / tree / year	22.62
Average $ / capita (population 72,000)	4.71

The budget for the street tree program varies from year to year. Resources available are often inadequate to create a comprehensive street tree program and accomplish the goals that the MSTP aims to achieve. With greater and more secure funding, the City could move from a reactive to a proactive management approach, provide greater services, and increase street tree canopy coverage.

There are various funding mechanisms and sources the City can consider to support increasing staff levels, public education efforts, tree protection, maintenance, planting activities, and other components of a truly progressive, comprehensive street tree management program.

5.1 / POTENTIAL FUNDING SOURCES

Expanding funding for a comprehensive street tree program makes it possible to increase the number of projects accomplished and reduce reliance on limited municipal funds. Leveraging municipal funds through partnerships with other sources of funding from state, federal, and local organizations will increase the number of partners with a vested interest in sustaining a healthy street tree population. Potential sources of additional funding have been identified as follows:

A. ESTABLISH AN ALAMEDA STREET TREE TRUST FUND

A special account could be created to deposit all street tree funds, which would be restricted to use by the street tree program. The funds in this account would be managed by the City, subject to the annual budget process, and would follow normal purchasing policies and procedures. This innovative funding mechanism does not rely on City general funds but rather on the collection and deposit of monies from various sources.

Establishing a Street Tree Trust Fund can facilitate the compliance of tree mitigation requirements by encouraging equitable contributions for replacement trees. Expenditures from this trust fund would require authorization by the city manager or designee. Not less than 80% of the Trust Fund shall be expended on tree replacement and restoration during each fiscal year. However, if the city manager or designee determines that there are insufficient reserves in the Trust Fund to implement a viable tree replacement program, funds may be carried over to the next fiscal year. The Trust Fund would serve as the City's primary funding source for city-sponsored street tree restoration efforts. The Trust Fund monies could also be leveraged when applying for grants.

Potential sources of money for the Street Tree Trust Fund include, but are not limited to, the following:

- **Cost Sharing**

The issue of how to pay for street tree planting should be presented to the City Council for possible solutions. For example, establishing a cost share policy could prompt neighborhoods to do infill plantings that cannot be accomplished with existing resources. Additionally, sharing the cost of tree planting gives the property owner a sense of "ownership" that will likely encourage the follow-up care (e.g., watering and mulching) that is essential for tree survival in the first few years following planting. The drawback is that some citizens will not pay to plant trees, resulting in gaps in the street tree canopy. Because of the irregularity of cost share plantings, diverse species planting plans are the best method for maintaining thematic regularity along streets with tree gaps.

- **Damage Compensation**

When a resident illegally removes or vandalizes a street tree, an automobile damages a street tree, or construction equipment destroys a group of public trees, the City of Alameda can seek compensation for the damages, or landscape value of the trees. Generally, the compensation is collected from the insurance company of the person responsible for the damage or directly from the business that caused

the damage to public trees. The compensation funds can be used to remedy the specific damage or to fund replacement plantings when the damages are too great.

• Permit and Plan Review and Inspection Fees
(to the extent permitted under California Code)
Municipalities commonly require private developers and businesses to support the administrative time needed for proper and professional plan review and site inspection tasks. In light of the city's goal to protect and enhance the urban forest, charging specifically for the time and arboricultural expertise needed to approve permit applications, review plans, and make site inspections might be a viable option to support the salary and benefits of additional full- or part-time urban forestry positions. The city should perform a job analysis to determine the time spent performing review and inspection tasks, and investigate what other nearby or similarly sized cities are charging for such a task.

• Developers' Fees (to the extent permitted under A California Code)
Developers could be required to pay a set amount per project to support Alameda's overall street tree program. The fee could be a percentage of the total project cost, based on the number of housing units built or based on the area of land being developed. It is suggested that this fee would be paid and deposited in the Street Tree Trust Fund before the project is approved. Large development could be conditioned to set up private maintenance service district to manage operating and construction cost to tree maintenance without development on public right of way.

• Private Donations/Corporate Sponsorships
Alameda is fortunate to have generous citizens who care about the quality of life in their city. The Recreation and Parks Department, for example, has received sizable private donations to improve park facilities. The Street Tree Trust Fund could also solicit citizens for private donations to support tree planting, tree care, and public education activities. A major source of donations could be from businesses and corporations who wish to sponsor non-profit environmental activities. All potential contributors should be reminded that any donations might be tax-deductible.

• Fund-Raising Activities
With the support of volunteers, the City can hold various fund-raising events throughout the year. Popular large events include competitive and social runs and walks. Tree-related and Alameda-related merchandise could be commissioned and sold both at City events and online. Restaurants can have special Tree Nights where a small percentage of the patrons' bills is donated back to the City for tree planting. Even small efforts, such as school and church bake sales and yard sales, can be encouraged to raise funds for trees in the community.

• Public awareness and volunteer training
California ReLeaf and California Department of Forestry and Fire protection award grants to grassroots groups across California for education, public awareness, tree planting and care, and volunteer development.

B. OTHER FUNDING TOOLS

The following sources of revenue are appropriate for inclusion in Alameda's Street Tree Bank, but are viable sources of funding for the comprehensive street tree program:

1. Landscape Assessment District
Property owners vote to assess themselves the extra tax to maintain a specific landscape feature.

2. Public/Private Partnerships
It is important that the City recognizes that its ability to single-handedly spearhead new tree planting efforts is constrained based on routine citywide Public Works obligations. As a result, the City should vigorously pursue public/private partnerships with local, private, not-for-profit entities offering expertise in horticulture, such as tropical botanical gardens, tree and plant societies, and garden clubs.

3. Adopt a Tree Program
Residents may participate in the Adopt-A-Tree Program by making a tax-deductible contribution to the Public Works department which will go toward planting a new tree or trees. Additionally, participants agree to water the tree for the first two years.

APPENDICES

APPENDIX 1 / STREET TREE PLANTING AND STAKING SPECIFICATIONS

1. ALL WORK SHALL BE PERFORMED BY PERSONS FAMILIAR WITH THIS TYPE OF WORK AND UNDER THE SUPERVISION OF A QUALIFIED PLANTING FOREMAN.
2. CONTRACTOR SHALL VERIFY THAT ADEQUATE DRAINAGE EXISTS PRIOR TO PLANTING.
3. CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO PLANTING.
4. TREES SHALL BE 7 TO 10 FEET HIGH SUPPLIED IN FIFTEEN GALLON CONTAINERS. TREES SHALL HAVE A MINIMUM OF 1.5 INCH TRUNK DIAMETER AT BREAST HEIGHT.
5. ALL TREES SHALL CONFORM TO THE STANDARDS SET FORTH IN THE MOST RECENT *AMERICAN STANDARDS FOR NURSERY STOCK* PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN (A.A.N.).
6. TREES SHALL HAVE A STRAIGHT STRONG TERMINAL LEADER, UNCUT AND UNBROKEN. THE MAIN TRUNK SHALL HAVE ACCEPTABLE LATERAL GROWTH ALONG ITS LENGTH SHORTER AND SMALLER IN DIAMETER THAN THE MAIN TRUNK.
7. ALL TREES THAT, IN THE OPINION OF THE CITY ENGINEER, ARE DISEASED, INSECT INFECTED, OR HAVE GIRDLING ROOTS, WILL BE REJECTED.
8. TREES WITH ROOT FLARE COVERED BY MORE THAN 1.5 INCHES OF SOIL WILL BE REJECTED PRIOR TO INSTALLATION.
9. PLANTING MIXTURE FOR THE BACKFILL SHALL HAVE NO SOIL AMENDMENTS.
10. IN PARKWAY STRIPS SET PLANTER TOP 1.5 INCHES BELOW SIDEWALK GRADE. IN LAWNS OR GROUNDCOVER AREAS SET PLANTER TOP FLUSH WITH FINISHED GRADE. IN LAWN AREAS THERE SHALL BE A 2 FOOT MULCH RING CLEARANCE BETWEEN EDGE OF LAWN AND TREE.
11. STAKING OF TREE IS NOT RECOMMENDED, EXCEPT ON WINDY SITES, FOR LARGE EVERGREEN TREES, OR IN AREAS WITH HEAVY TRAFFIC. IF STAKING IS DONE, FLEXIBLE HOSE - NOT TIES AND WIRES - SHOULD BE USED. NAIL FLEXIBLE TREE STRAP TO EACH SIDE OF THE STAKE IN TEARDROP FIGURE WITH 1 INCH MAX GALVANIZED ROOFING NAIL.
12. TREE STAKES TO BE REMOVED AFTER TWO YEARS.
13. AT PLANTING PRUNE ONLY CROSSING LIMBS, CO-DOMINANT LEADER, BROKEN, DISEASED OR DEAD BRANCHES, AND ANY BRANCHES THAT POSE A HAZARD TO PEDESTRIANS WHILE PRESERVING FORM AND CHARACTER OF TREE. DO NOT CUT LEADER. DO NOT PRUNE IN ORDER TO REDUCE CANOPY SIZE.
14. DO NOT WRAP TRUNK OF TREE.
15. A ROOT COLLAR EXCAVATION FOR ALL TREES SPECIFIED WILL BE DONE BY THE CITY ENGINEER TO ENSURE THAT TREES WERE NOT PLANTED OR GROWN TOO DEEPLY AT THE NURSERY. LANDSCAPE CONTRACTORS SHALL HAVE SUPPLIERS MARK GROUND LEVEL LINE ABOVE ROOT BALL. IF CITY ENGINEER DETERMINES THAT THERE IS EXCESSIVE SOIL OVER THE ROOT CROWN, THE TREES WILL BE REJECTED.
16. MULCH SHALL BE 3" DEEP UNLESS OTHERWISE NOTED.
17. TREES SHALL BE WATERED TWICE WEEKLY. ALL TREES NOT MEETING WITH THE APPROVAL OF THE CITY ENGINEER AT THE END OF THAT PERIOD SHALL BE REPLACED BY THE CONTRACTOR.
18. DEEP WATERING TUBES.

1 TREE PLANTING NOTES

NO.	REVISED	BY	APP.

DATE: AUGUST 24, 2008

SCALE: NOT TO SCALE

CITY OF ALAMEDA
CALIFORNIA
ENGINEERING DEPARTMENT

Tree Planting Details

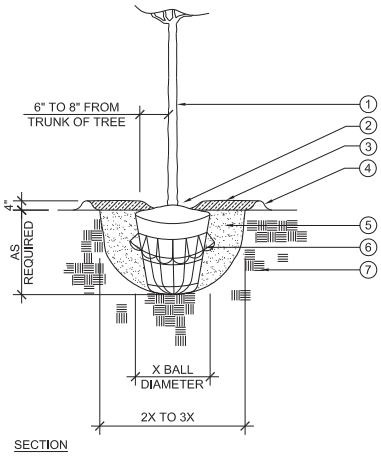
APPROVED BY:

CITY ENGINEER

REG. C.E. NO.

DATE

Exhibit 1



SECTION

LEGEND

1. TREE TRUNK. (OPTIONAL)
2. ROOTBALL CROWN TO BE 2" ABOVE SURROUNDING FINISH GRADE.
3. 3" MULCH RING DIRECTLY OVER PLANTING HOLE (KEEP CLEAR FROM TRUNK - DO NOT MOUND BASE OF TREE)
4. PLANTER SAUCER EDGE.
5. PLANTING MIX OR BACKFILL.
6. WIRE BASKET OPTIONAL.
7. EXISTING SOIL.

NOTES

A. CUT AND REMOVE TOP ½ OF WIRE BASKET, TURN DOWN TOP ½ OF BURLAP: REMOVE ALL CORD & TWINE FROM BASE OF TRUNK: IF NONDEGRADEABLE WRAP IS USED, REMOVE TOTALLY.

B. LOOSEN EXTERIOR OF THE ROOT BALL AND THE ROOT MATT AT THE BOTTOM OF THE BALL, CUT ALL MAJOR CIRCLING ROOTS.

2 GENERAL TREE PLANTING

NO.	REVISED	BY	APP.

DATE: AUGUST 24, 2008

SCALE: NOT TO SCALE

CITY OF ALAMEDA
CALIFORNIA
ENGINEERING DEPARTMENT

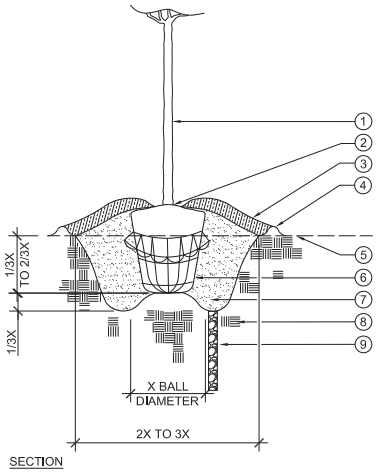
Tree Planting Details

APPROVED BY:

CITY ENGINEER

REG. C.E. NO. _____

DATE _____



LEGEND

1. TREE TRUNK.
2. ROOTBALL CROWN TO BE 2" ABOVE SURROUNDING FINISH GRADE.
3. 3" MULCH RING DIRECTLY OVER PLATING HOLE.
4. PLANTER SAUCER EDGE.
5. EXISTING GROUND LINE.
6. WIRE BASKET OPTIONAL.
7. PLANTING MIX BACKFILL.
8. EXISTING SOIL.
9. CHIMNEY DRAIN, 8" DIA. HOLE X 5' DEEP. BACK FILLED WITH DRAIN ROCK. DRILL ON DOWNHILL SLOPE OF ROOTBALL FOR DRAINAGE.

3 TREE PLANTING IN WET / HEAVY SOILS

NO.	REVISED	BY	APP.

DATE: AUGUST 24, 2008

SCALE: NOT TO SCALE

CITY OF ALAMEDA
CALIFORNIA
ENGINEERING DEPARTMENT

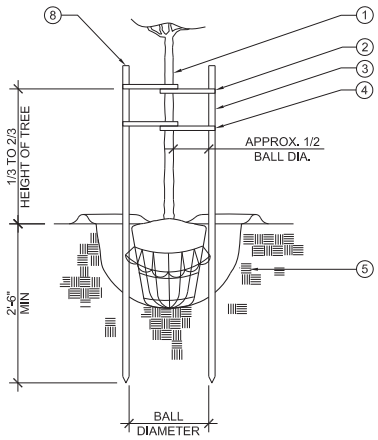
Tree Planting Details

APPROVED BY:

CITY ENGINEER

REG. C.E. NO.

DATE



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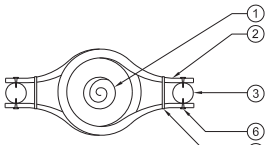


PLAN

LEGEND

1. TREE TRUNK.
2. CUT SEMI-RIGID GARDEN HOSE. UPON INSTALLATION.
3. 2" DIAMETER LODGEPOLE TREE STAKE.
4. ONLY USE SECOND TIE IF TREE SIZE IS 24" BOX OR LARGER OR AS REQUIRED.
5. EXISTING SOIL.
6. 1" GALVANIZED ROOFING NAIL.
7. PLASTIC ZIP TIE.
8. CUT TOP OF STAKE AS REQUIRED TO CLEAR LOWEST BRANCH BY 6".

NOTES

TREE STAKES FOR ALL STREET TREES SHALL BE PARALLEL TO STREET.

4 TREE STAKING

NO.	REVISED	BY	APP.

DATE: AUGUST 24, 2008

SCALE: NOT TO SCALE

CITY OF ALAMEDA
CALIFORNIA
ENGINEERING DEPARTMENT

Tree Planting Details

APPROVED BY:

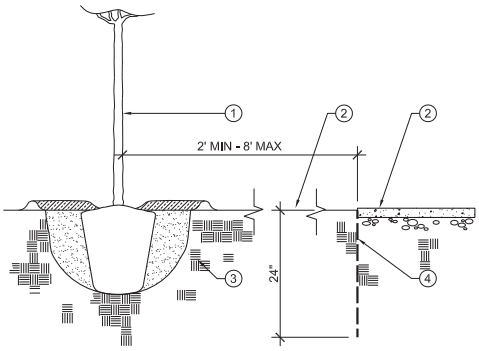
CITY ENGINEER

REG. C.E. NO. _____

DATE _____

LEGEND

1. TREE TRUNK.
2. ADJACENT PAVING, CURB, CURB AND GUTTER, OR PATH.
3. EXISTING SOIL.
4. ROOT BARRIER: CONTRACTOR SHALL USE DEEP ROOT LINEAR ROOT BARRIER #22-29-18-P / HIGH DENSITY POLYETHYLENE, MANUFACTURED BY DEEP ROOT CORP. (7354 BOLSA AVE. WESTMINSTER CA 92683) OR EQUAL. SET TOP FLUSH WITH FINISHED GRADE.
5. CENTER LINE OF TREE.
6. 2' MINIMUM FOR NEW PLANTER STRIP.



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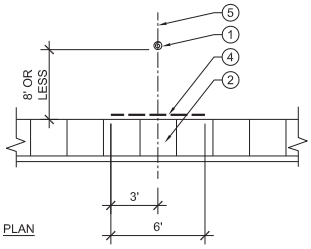


PLAN

5 ROOT CONTROL BARRIER

NO.	REVISED	BY	APP.

DATE: AUGUST 24, 2008

SCALE: NOT TO SCALE

CITY OF ALAMEDA
CALIFORNIA
ENGINEERING DEPARTMENT

Tree Planting Details

APPROVED BY:

CITY ENGINEER

REG. C.E. NO.

DATE

APPENDIX 2 / COMPONENTS OF THE NEIGHBOURWOODS© TREE INVENTORY

UNBALANCED CROWN

The growth of trees in forest conditions usually results in them having long, straight, trunks. However, open grown urban trees develop wider crowns with lower branching. They often have irregular or unbalanced crowns because of past damage, management practices, restricted growing space, conflict with buildings, or a lack of light. This can result in structural weakness and high risk problems.

If the tree crown were unbalanced, lopsided, or developed as a flag, the tree would get points for unbalanced crown. A tree might have an unbalanced crown but straight trunk or it can have both an unbalanced crown and a leaning stem. In the latter case, both of these problems should be recorded separately.

Three classes are established for unbalanced crown.

0 here are no signs that the crown is unbalanced or lopsided; crown normally developed.
1 Crown slightly asymmetrical due to restricted growing space or lack of light.
2 Crown is asymmetrical, unbalanced or lopsided.
3 Crown is severely asymmetrical to the point where it clearly places damaging stress on the main stem or root system.

REDUCED HEIGHT

Reduced height refers to topping, pollarding, or similar damage caused by windstorms, snow, or vandalism. Topping, or any maintenance practices that result in removing a large portion of the crown, may weaken tissues from the trunk to the roots. The loss of parts of the live crown can be expected to be followed by dying-back of the root system (and vice versa). Topping also stimulates excessive sprouting. Sprouts are poorly attached to the main branch. As sprouts increase in size, they may become high risk. Topping is often done to reduce conflicts between the tree's crown and utilities. In many cases though, topping may exacerbate conflicts between a tree and utilities.

Dramatic reduction of the crown volume results also in large stubs that are points for disease and pest entrance and the development of epicormic shoots.

The degree of reduced height is ranked in three classes relative to the amount of crown removed. These three classes are recorded using the following rating:

0 There are no signs that tree height has been reduced. Crown has not been topped or pollarded.

1 Less than 1/4 of the crown volume removed.

2 1/4 to 1/2 of the crown volume removed.

3 More than 1/2 of the crown volume removed leaving behind only a few stubs.

WEAK OR YELLOWING FOLIAGE

The presence of pest, diseases, or physiological problems can reflect on leaf colour or size. A tree is considered to have weak foliage/yellowing leaves if it has thin foliage, is off-colour, or has smaller leaves than what is normal. Looking from the side, the overall crown can be more transparent or lighter green to yellow. However, keep in mind that some tree species such as Honey Locust, Black Locust, and Ashes normally have more transparent crowns than species such as Maples, Elms, Beeches, etc. (As a rule of thumb, species with compound leaves have more transparent crowns.). Similarly, some cultivars have different leaf colour or shape than what is typical for the species. For example, the youngest foliage of Honey Locust 'Sunburst' has lighter green (almost yellow) leaves compared to the older leaves or those typical for other Honey Locust.

Weak or yellowing foliage may be a symptom of a number of problems. It may be caused by pests or disease in parts of the tree other than the leaves. In addition, drought, confined root spaces, soil compaction, girdling roots, poor nutrition, etc., might be the cause of weak foliage. In such cases, maintenance measures such as soil aeration, fertilizing, and watering might help the tree to recover.

When examining a tree for weak foliage or yellowing leaves, you should be considering the portions of the crown not affected by dieback, topping, or pollarding. In other words, a tree may have lost a large portion of its crown, but the remaining parts appear to be healthy. In such situations, you would not record anything in this category. On the other hand, a tree may have a full crown with no history of topping, pollarding, or storm damage, but the leaves on the crown tend to be either small or chlorotic (yellow). In this case, you should record the degree of defect. Remember, it would also be possible for a tree to have both weak/yellowing foliage as well as reduced height. In such cases, record both in the appropriate columns. The reason the Neighbourwoods program differentiates between crown loss and symptoms ofa weak crown is that a tree may recover from the latter. However, crown dieback, topping, and pollarding, while perhaps compensated by regrowth in other parts of the crown, represent a long-term loss of photosynthetic area.

The degree of weak/yellowing leaves is grouped in three classes relative to normal foliage for the species in question. These three classes are recorded using the following rating:

0 Leaves normal size, colour, and texture
1 Leaves appear to be somewhat smaller than normal; pale in colour
2 Leaves are significantly smaller than what is normal; pale foliage; thinning of foliage; the crown is significantly more "transparent" than typical for the species.
3 Leaves are dramatically smaller than normal and/or leaf colour is dramatically different; the crown is very transparent; the tree appears to be in a serious state of decline.

DEFOLIATION

Crown defoliation is one of the main indices monitored for tree condition of both forest and urban trees. It usually indicates serious problems with trees of either a physiological or pathological nature. Defoliation is the term used to describe a situation where part of the leaf mass is missing and bare branches and twigs remain. Dieback (death of shoot and branches, generally from the tip to base) falls into this category as well.
During the tree inventory, only the amount of crown that has lost foliage should be recorded. It should be noted that bare twigs or dead branches in the inner crown are not considered for the ratings of crown defoliation. If the tree has a full complement of foliage or the tree exhibits no visible crown damage, there is no need to record anything on the inventory sheet. Similarly, if a large tree has one or two small branches without leaves nothing is entered in the space.

Three classes of crown defoliation are recorded using the following rating:

0 Tree crown not defoliated (healthy). Allow for minor twig defoliation, which is normal in a healthy tree.
1 Between trace amounts of defoliation and less than 1/4 of the crown having lost its leaves - crown slightly defoliated.

2 1/4 to 1/2 of the crown had lost its leaves - crown moderately defoliated.

3 More than 1/2 of the crown without leaves - crown severely defoliated

LARGE DEAD OR BROKEN BRANCHES OR STUBS

Dead or broken branches can be the points where rot begins and can constitute a safety concern in themselves. Dead branches or stubs greater than 7 cm in diameter (about the size of a pop can) should be considered. (A stub is a short piece of a branch still attached to a tree after a branch has broken off or after improper pruning).

The evaluation of dead or broken branches is based on the approximate size and number of dead branches, limbs, or stubs. Three classes of dead or broken branches are defined using the following rating:

0 Tree does not have major dead branches; small branches within the inner crown should not be considered. The tree may have one or more minor dead or broken branches or stubs.
1 At least one dead or broken branch, or stub greater than 7cm in diameter is present. Its diameter is less than 1/4 of the diameter of the next order branch or main stem at the point of attachment.
2 The tree has one or more dead or broken branches or stubs BUT its diameter is 1/4 to 1/2 of the diameter of the next order branch or main stem at the point of attachment.
3 The tree has one or more dead or broken branches or stubs which is (or was) a main branch (a scaffold branch. i.e. the diameter is more than 1/2 of the diameter of the main stem at the point of attachment).

POOR BRANCH ATTACHMENT (V- SHAPED FORK)

Poor branch attachment can be recognized as a sharp angle where major branches join to the main trunk of the tree. If the angle where they join is more like a narrow V than a U, then the union should be examined for included bark. Included bark occurs where two stems or main branches grow at such an acute angle that the bark from both stems becomes imbedded making an extremely weak branch union. When branches or co-dominant stems (two or more stems growing at the same rate, from more or less the same position) with included bark increase in size, they may split from the trunk. Poor branch attachment also includes situations when a number of branches are attached to the main stem at the same position. This could occur as a result of pollarding, topping or a failure to properly prune the tree when it was young. Epicormic shoots following topping, pruning or storm damage have poor attachment as well.

Three classes for poor attachment can be recognized:

0 Branches properly attached, there are no signs of poor attachment

1 A V-shaped union between a minor branch and the main stem (the diameter of the branch is 1/2 of the diameter, or less, than the branch or main stem where it is attached). There is no evidence of included bark, but the angle of the fork is such that there is a potential for this to appear as the tree grows. This category also includes epicormic shoots following topping, pruning or storm damage, etc.

2 As in 1, but the branch is more than 1/2 of the diameter of the branch or main stem where it is attached, and there is evidence of included bark but no breakage. This category also includes trees with epicormic shoots resulting from poor pruning or breakage, and multiple trunks or co-dominant stems. Multiple stems are trunks of equal size and/or relative importance arising from the base of the tree, co-dominant stems are major branches of similar diameter arising in the crown of the tree.

3 As in 2, but with evidence of a crack between the stems.

LEAN

The trunk is a physiological and structural connection between the crown and root system. Serious trunk lean can cause structural problems and may cause the tree to fail. This is especially apparent if some soil cracking and/or uprooting is also observed. Some species that are on the border between being either small trees or tall shrubs have a tendency to exhibit lean. This can be the case with Russian Olive, Serviceberry, French Lilac, Hawthorns, Japanese Maple, Staghorn Sumac, etc. However, the leaning trunk of such species is usually not serious.

Three classes of leaning can be recognized using the following rating:

0 The tree is virtually vertically positioned over the base of the stem (Figure 1).
1 Slight or minor lean (< 15° from vertical) but no apparent danger (Figure 2).

2 Slight or minor lean (< 15° from vertical) with some evidence of root mounding or soil cracking on the side of the tree away from the lean (Figure 3).

3 Serious lean (>15° from vertical) with some evidence of root mounding or soil cracking on the side of the tree away from the lean.

Tree pruning is an old practice for regulating tree size and the shape of a tree's crown and for removing dead or damaged branches. It is an essential part of tree maintenance in an urban environment. Excessive pruning and flush cuts (a poor pruning practice in which both the branch and stem tissue are removed) can weaken the defense system of a tree.
Any process of removing dead or live branches and limbs will leave a scar. Proper pruning scars will form circular wound-wood around the cut and old pruning scars may eventually heal over leaving a distinct knob. When pruning cuts are made improperly, wound-wood may form only to the sides of the wound, or partly about the wound. These scars may also form a point of entry for wood rotting organisms.

The amount and quality of pruning has been classified using the following rating:

0 Tree has not been pruned.
1 One or more pruned minor branches or stubs. Diameter of the pruning scar is less than 1/4 of the diameter of the next order branch or main stem at the point of attachment. Proper pruning.
2 Diameter of the scar is 1/4 to 1/2 of the diameter of the next order branch or main stem at the point of attachment.
3 One or more pruned main (scaffold) branches. Diameter is more than 1/2 of the diameter of the main stem at the point of attachment. One or more flush cuts.

BASAL/TRUNK SCAR(S)

A scar is formed when the bark of a tree is damaged to such an extent that the wood underneath is exposed. As such, they can form the point where decay begins. Scars may be old and show some signs of healing over or they may be relatively new. Damaged bark alone does not necessarily constitute a risk to the tree. Damage to the bark that exposed the wood at some time should be considered a scar.

The most frequent cause of scars on urban trees is vandalism. Other causes include: the girdling of trunks by lawnmower damage; the bark of trees growing near driveways and parking lots have been repeatedly injured by vehicles, bicycles, etc; lightning; frost cracks; or sunscald. The size of the scar relative to the size of the tree is important. For example, a 5 cm scar on a tree with a diameter of 10 cm is more serious than a 5 cm scar on a tree of 50 cm "diameter breast height" (dbh). As a rule-of-thumb, scars that have widths greater than 1/8 of the circumference of the stem on small trees (less than 30 cm dbh) and any scars greater than 10 cm wide on larger trees (more than 30 cm dbh) should be recorded.

Stems may also become cracked due to frost. These cracks may heal over and the scar tissue will form a long ridge along the stem. These cracks are classified the same way as scars. In this category, we are most interested in damage appearing near the base of the tree, below the crown. Other similar damage higher up are covered under other categories.

The presence of scars has been grouped in three classes using the following rating:

0 The tree does not have any scars.
1 One or more scars with a width totaling 1/8 to 1/4 of the circumference, OR a scar less than 1/8 but more than 50 cm in length.
2 One or more scars with a width totaling 1/4 to 1/2 of circumference, OR 1/8 to1/4 the circumference but more than 50 cm in height.
3 One or more scars with a width totaling more than 1/2 of circumference of the stem, OR it is between 1/4 to1/2 the circumference but more than 50 cm in height.

CONKS

A conk is the external sign of wood rotting fungus. These may appear as crusts or flat "hoof-shaped" brackets on stems and branches. Conks are a sign of rot and an indication that the tree may have some serious internal defects that will affect its longevity and could result in the tree becoming a safety concern. (Note: While the presence of conks indicates the presence of rot, it is possible that a tree will have serious rot without conks being visible.)

Conks are recorded either as presence or absence:

0 The absence of conks
1 The presence of conks

ROT/CAVITY

In the advanced stages of decay, wood is consumed by fungi and insects resulting in rot and/or cavities. Rot might develop from bark wounds, breakage, and pruning wounds. Cavities often form after flush cuts or stub cuts. Older trees occasionally have large cavities or rot in their trunks and main branches. Either way, rot and/or cavities indicate serious decay and structural problems.

The rotten wood may be soft enough that it can be crumbled between your fingers. It may be wet and spongy or dry and powdery. Trees may have a scar, but the wood is still gray and hard. In such cases, a scar should be recorded, but not rot. Any large cavities or holes in the main stem or main branches should be recorded as well. Three classes of rot/cavity can be recorded using the following rating:

0 Tree does not have any sign of rot or cavity
1 Rot/cavity is 1/8 to 1/4 of the diameter of the trunk or major branch.
2 Rot or cavity is 1/4 to 1/2 of diameter of the trunk or major branch.
3 Rot or cavity is more than 1/2 of diameter of the trunk or major branch.

CRACKS

A crack is deep split through the bark, extending into the wood of the tree. Cracks are physical separations of the wood. They can occur in stems and branches and they may even extend up from the roots into the lower stem. Cracks are considered to be the number one high risk defect because they indicate the structural weakness of a tree. For example, when a tree has two cracks in the same segment of the stem, the stem can be separated into two sections of wood, which move independently from each other. One section slides over the other creating tension and the crack elongates.

One of the most common reasons for cracks and splits on tree trunks is frost cracking. Frost cracks originate at a point where the trunk was physically injured in the past. Trees growing on poorly drained soils are particularly prone to frost cracks. Frost cracks often close during summer, only to re-open in succeeding winters. If cracks are only in the bark, they will not seriously damage it, although they do provide openings where certain disease organisms may enter the tree, particularly if the tree is in a weakened condition. Maples and sycamores are very prone to frost cracks while apples, ornamental crabapples, ash, beech, horse chestnut and tulip tree are susceptible. Isolated trees are more subject to frost cracks than trees in groups or in forest settings.

In some cases when a scar or cavity forms, the wound will not heal properly at the edges. The wound tissue may roll inward as it grows, failing to close. This process will continue and outward pressure will be exerted on the stem, causing a crack to form.

The evaluation of cracks is based on the number of cracks (splits), where they occur and if they are in contact with another defects such as, rot or a cavity. Three classes of cracks are defined using the following rating:

0 Tree does not have major cracks either on trunk or major branches.
1 One minor crack extends into the stem, major stubs or a branch of significant size. A minor crack is one that enters the wood (not just in the bark) but does not extend more than _ of the distance to the centre of the stem. No "Ram's Horn" (Figure 1)
2 Two or more minor cracks occur in the same general area of the stem, but there are no other defects in contact with the cracks; The crack condition is more serious than class 1, but less than class 3.
3 A crack(s) is in contact with another defect (e.g. rot, poor branch attachment, lean); Tree has one deep crack where one-half or more of the tree diameter is structurally compromised; A crack has "Ram's Horn" (Figure 3) appearance; Crack(s) in the tangential (horizontal) plane.

CONFINED SPACE FOR ROOT SYSTEMS

The root system of a tree is often depicted as the mirror image of the crown but it can extend beyond the drip line as much as two to three times the diameter of the crown. (The drip line is an imaginary line on the ground under the outer edge of the crown of the tree). The major portion of the absorbing root system of a mature tree

is within the top 90 cm of soil, and most of the fine roots that are active in water and nutrient absorption are in the top 30 cm.

Trees growing on urban spaces such as streets, parking lots, commercial and other areas usually do not have enough space for their roots. They exist in the space that is left over after the other infrastructure is in place, or they may be planted in containers and median strips. Trees growing in such spaces are more subject to girdling roots, drought effect, and other secondary problems such us pests and disease.

If a building foundation, or other structure (curbs, retention walls, containers, paving etc.) is presently restricting the full growth of the tree's roots, this should be indicated using the following criteria:

0 No obstruction or conflicts are apparent in the area within the drip line of the tree.
1 An obstruction exists which would eliminate root development in an area less than 1/4 of the area within the dripline of the tree.
2 An obstruction exists which would eliminate root development in an area between 1/4 and 1/2 of the area within the drip line of the tree.
3 An obstruction exists which would eliminate root development in an area more than 1/2 of the area within the drip line of the tree.

EXPOSED/SURFACE ROOTS

Exposed or surface roots are often seen on urban trees. Often this problem is related to compacted soil condition or soil erosion or is a result of heavy use of the space close to the tree.

Roots under the drip-line of the tree that are exposed to the surface can be grouped as following:

0 There are no exposed roots.
1 1/4 of roots close are surfaced or exposed.
2 1/4 to 1/2 of roots are surfaced or exposed.
3 More than 1/2 of roots below the entire canopy (drip line) are surfaced or exposed.

ROOT TRENCHING/CUTTING

Roots may be lost directly when the soil surface near trees is lowered, or when trenches are dug for underground utilities, or for the construction of curbs, sidewalks, foundations, etc. The roots that are left after trenching may be insufficient to supply the crown with nutrients and water. A tree so affected will be more subject to drought, have poor growth (shoot extension) and leaves may be smaller than usual and may be chlorotic. Eventually, the loss of root mass may be balanced by crown dieback and the tree may die prematurely. The loss of a substantial proportion of the root system may also affect the stability of the tree. Remember that there may be only between five and 10 major roots attached to the tree at the root collar. If one of these is severed, all roots beyond that point will be lost representing 10 to 20% of the root system.

Any signs of trench digging or root cutting associated with other excavation should be noted. As mentioned above, the extent of a tree's root system may exceed two to three times the width of the crown. Such unobstructed conditions are seldom achieved in the urban environment, so we can use the extent of the perimeter of the crown (the drip-line) as a conservative estimate of the extent of the root system. For the purposes of this classification, consider the area delineated by the drip-line as the rooting area.

0 There are no signs of root trenching or cutting within the rooting area.
1 Up to 1/4 of the root system has been cut during trenching or excavation.
2 Between 1/4 and 1/2 of the root system has been cut during trenching or excavation.
3 More than 1/2 of the root system has been cut during trenching or excavation.

GIRDLING ROOTS

The normal pattern of tree root growth is horizontal to the ground surface and radially away from the trunk. The pattern of girdling roots is to grow tangentially to the trunk, and in many cases, upwardly. This abnormal root growth causes physiological stress on the expanding tissues as the trunk and roots grow in diameter. Eventually the root collar and roots may become constricted causing decline in the condition of the tree and even resulting in the death of the tree.

Girdling root symptoms are found more often on park, street, yard, and trees in nursery trees than on forest trees. Some tree species such as transplanted Norway Maples seem more prone to the problem than others. Sugar Maples, Oaks, Elms and Pines are also prone to girdling roots.

Many symptoms can indicate girdling roots. These include weak foliage and defoliation. However, the focus here will be on symptoms such as abnormal swelling of the trunk (expanding trunk restricted by a girdling root), and the lack of normal butt flare at least part way around the base of the tree. Trees with a root that girdles the lower trunk usually have little or no flare on one side of the tree at the ground line. You should keep in mind that if soil is spread around a tree, the butt flare may also be buried. In this case, the effect will be the same all around the tree. In some cases, girdling roots can be easily seen on the surface (girdling roots below the root collar).

Girdling root problems on the tree should be recorded using the following criteria:

0 There are no signs of girdling roots on the surface or on the trunk
1 Girdling roots on the surface but there is no trunk-swelling yet
2 Between 1 and 3.
3 Atypical butt swelling either with girdling roots seen at the soil surface or not.

CONFLICTS

While forest trees compete for growing space with each other, urban trees compete directly with each other, buildings, above-ground and below-ground infrastructure and indirectly with people. These conflicts illustrate the growing condition of a tree but they may also indicate remedial action that could help the tree. In this case, conflicts are considered "existing" or "potential". An existing conflict means that part of the tree is currently in contact with the obstruction to the point that either

the tree or obstruction may be damaged. Potential conflict means that the tree and the obstruction will be touching within 3-5 years (within the next inspection cycle).

In each of these cases, a P in the appropriate column should be entered if there is potential for the tree to come into conflict (contact) with the particular item. If a conflict already exists, an E in the appropriate column needs to be written. If there is no conflict, the appropriate cell on the Data Collection Form is left empty. The computer program will consider this as a default value N (no conflict) that will be automatically entered into the cell. Otherwise, P or E should be typed in or picked up from drop-down list.

Conflict with Overhead Wires

Conflicts with overhead power and telephone wires can be common along some streets. Yet, this is not uncommon for other urban spaces such as yards, parking lots, or commercial areas. Conflict with overhead wires can cause many problems for both trees and wires and it can create maintenance problems and high risk situations.

N There are no conflicts.
E The branches of a tree are currently within 0.5 meters of electrical, telephone, or other wires. **P** At some point (within the inspection cycle), as the tree grows, such a conflict could occur.

Conflict with Structure

Trees are often planted close to buildings without taking into consideration their biological needs and actual size. Consequently, when they become large enough, they are often blamed for causing damage to the structure. However, the damage to trees caused by close growth to buildings is often neglected. Conflict between trees and structures can cause maintenance and high risk problems. Conflicts with structure include buildings, fences, etc.

Conflicts with structures can be grouped as follows:

N There are no conflicts
E Tree is already touching the structure.
P There is potential for the tree to come into contact with the structure within the next inspection cycle.

Conflict with Sidewalk

N There are no conflicts.
E The sidewalk already shows signs of being lifted by stem or root growth.
P A tree's stem, at some point in its life, would be within 0.5 m of a sidewalk.

Conflict with Other Tree

Urban trees are usually solitary initially having no competition with other trees. This results in the development of broad crowns. At some point however, conflict may occur when tree crowns start to touch each other and compete for space and light.

Conflicts with other tree(s) should be recorded as:

N There are no conflicts.
E The tree in question is currently touching the crown of another tree.
P There is potential for existing conflict (E) to occur within the inspection cycle.

Conflict with Traffic Signs

Street trees sometimes screen traffic signs and as such create an unsafe situation for motorists. If the tree is screening the sign or if there is a chance that this will happen in the near future, this conflict should be recorded.

Conflicts with traffic signs should be recorded as:

N There are no conflicts
E The tree in question is currently screening or touching the sign
P There is potential for existing conflict (E) to occur within the inspection cycle.

APPENDIX 3 / 40 LARGEST STREET TREES OUT OF THE 12,000 SURVEYED, BASED ON DIAMETER

Tree ID	Scientific Name	DBH (Inches)	Height Class
5218	Eucalyptus nicholii	41.0	4
5849	Platanus acerifolia	41.1	4
9873	Platanus acerifolia	41.1	4
10596	Eucalyptus nicholii	41.1	4
2621	Phoenix canariensis	41.4	3
122	Liquidambar styraciflua	41.5	4
2615	Phoenix canariensis	41.5	5
11596	Liquidambar styraciflua	41.5	3
11996	Robinia pseudoacacia	41.5	3
2268	Liquidambar styraciflua	41.6	4
11985	Robinia pseudoacacia	41.6	3
4437	Pinus pinea	41.7	3
9992	Platanus acerifolia	41.7	3
41	Platanus acerifolia	41.9	4
2616	Phoenix canariensis	41.9	4
5195	Platanus acerifolia	41.9	4
11129	Liquidambar styraciflua	41.9	5
9827	Platanus acerifolia	42.4	4
2614	Phoenix canariensis	42.7	4
8683	Tilia tomentosa	43.0	4
5191	Platanus acerifolia	43.1	4
4345	Cordyline australis	43.2	2
8486	Pinus pinea	43.3	2
11101	Liquidambar styraciflua	43.3	5
8483	Pinus pinea	43.4	2
10122	Cinnamomum camphora	43.7	3
7323	Sequoia sempervirens	43.9	4
10926	Pinus pinea	44.0	2
5208	Platanus acerifolia	44.1	4
10893	Pinus pinea	44.1	2
9454	Platanus acerifolia	44.2	4
5017	Pinus pinea	44.4	2
4463	Phoenix canariensis	46.3	4
6	Schinus molle	46.5	2
7941	Pinus canariensis	46.6	4
6118	Platanus acerifolia	46.7	4
9810	Robinia pseudoacacia	47.3	3
7822	Pinus pinea	48.3	2
2471	Liquidambar styraciflua	50.2	4
5213	Eucalyptus nicholii	52.2	3

APPENDIX 4 / GENERA PRESENT ALONG PUBLIC STREETS IN ALAMEDA, 2008

Genus	# of Trees
Acaci	102
Acer	264
Acmena	1
Acrocomia	1
Aesculus	69
Albizia	6
Alnus	230
Arbutus	1
Betula	2
Brachychiton	429
Callistemon	19
Calocedrus	5
Carpinus	9
Castanea	1
Cedrus	6
Celtis	41
Ceratonia	196
Cercis	4
Cinnamomum	291
Cordyline	39
Cornus	2
Crataegus	176
Cupaniopsis	1
Cupressus	1
Eriobotrya	14
Eucalyptus	101
Fagus	2
Ficus	14
Fraxinus	828
Geijera	194
Ginkgo	715
Gleditsia	24
Grevillea	9
Gymnocladus	1
Jacaranda	67
Juglans	1
Juniperus	3
Koelreuteria	205
Lagerstroemia	124
Ligustrum	222
Liquidambar	337
Liriodendron	120

Genus	# of Trees
Lithocarpus	1
Lophostemon	1
Lyonothamnus	3
Magnolia	126
Maytenus	14
Melaleuca	48
Metrosideros	241
Michelia	1
Morus	4
Myoporum	118
Nerium	3
Nyss	2
Olea	1
Persea	4
Phoenix	12
Photinia	6
Pinus	188
Pistacia	249
Pittosporum	169
Platanus	2815
Podocarpus	2
Populus	12
Prunus	506
Pseudotsuga	1
Pyrus	1076
Quercus	233
Rhus	3
Robinia	272
Sapium	140
Schinus	19
Sequoia	54
Sophora	30
Syagrus	1
Thuja	5
Tilia	97
Trachycarpus	3
Tristania	430
Ulmus	94
Washingtonia	120
Yucca	1
Zelkova	18

APPENDIX 5 / SPECIES PRESENT ALONG PUBLIC STREETS IN ALAMEDA, 2008

Genus	# of Trees
Acacia longifolia	3
Acacia melanoxylon	99
Acer buergeranum	20
Acer japonica	6
Acer macrophyllum	13
Acer negundo	6
Acer nigrum	9
Acer palmatum	54
Acer platanoides	38
Acer pseudoplatanus	6
Acer rubrum	102
Acer saccharinum	2
Acer saccharum	8
Acmena smithii	1
Acrocomia rubrum	1
Aesculus carnea	44
Aesculus hippocastanum	25
Albizia julibrissin	6
Alnus cordata	66
Alnus rhombifolia	164
Arbutus unedo	1
Betula pendula	2
Brachychiton populneus	429
Callistemon citrinus	17
Callistemon viminalis	2
Calocedrus decurrens	5
Carpinus betulus	9
Castanea dentata	1
Cedrus deodara	6
Celtis occidentalis	1
Celtis sinensis	40
Ceratonia siliqua	196
Cercis occidentalis	4
Cinnamomum camphora	267
Cinnamomum glanduliferum	24
Cordyline australis	39
Cornus florida	2
Crataegus laevigata	121
Crataegus lavallei	33
Crataegus phaenopyrum	22
Cupaniopsis anacardioides	1
Cupressus sempervirens	1

Genus	# of Trees
Eriobotrya deflexa	4
Eriobotrya japonica	10
Eucalyptus camaldulensis	12
Eucalyptus citriodora	1
Eucalyptus cladocalyx	2
Eucalyptus ficifolia	24
Eucalyptus nicholii	49
Eucalyptus polyanthemos	2
Eucalyptus rudis	8
Eucalyptus sideroxylon	3
Fagus sylvatica	2
Ficus macrophylla	3
Ficus nitida	11
Fraxinus americana	6
Fraxinus angustifolia	192
Fraxinus glabra	1
Fraxinus holotricha	133
Fraxinus latifolia	1
Fraxinus ornus	11
Fraxinus oxycarpa	120
Fraxinus palmatum	1
Fraxinus uhdei	91
Fraxinus undulatum	1
Fraxinus velutina	271
Geijera parviflora	194
Ginkgo biloba	715
Gleditsia triacanthos	24
Grevillea robusta	9
Gymnocladus dioica	1
Jacaranda mimosifolia	67
Juglans regia	1
Juniperus chinensis	3
Koelreuteria bipinnata	152
Koelreuteria paniculata	53
Lagerstroemia indica	124
Ligustrum lucidum	222
Liquidambar styraciflua	337
Liriodendron tulipifera	120
Lithocarpus densiflorus	1
Lophostemon confertus	1
Lyonothamnus floribundus	3
Magnolia grandiflora	125

Genus	# of Trees
Magnolia soulangiana	1
Maytenus boaria	14
Melaleuca linariifolia	1
Melaleuca quinquenervia	47
Metrosideros excelsus	241
Michelia doltsopa	1
Morus alba	4
Myoporum laetum	118
Nerium oleander	3
Nyssa sylvatica	2
Olea europaea	1
Persea americana	1
Persea borbonia	3
Phoenix canariensis	12
Photinia fraseri	6
Pinus canariensis	73
Pinus pinea	105
Pinus radiata	10
Pistacia chinensis	249
Pittosporum acerifolia	1
Pittosporum undulatum	168
Platanus acerifolia	2301
Platanus occidentalis	513
Platanus racemosa	1
Podocarpus gracilior	2
Populus fremontii	2
Populus nigra	10
Prunus blireiana	1
Prunus caroliniana	302
Prunus cerasifera	198
Prunus serrulata	3
Prunus yedoensis	2
Pseudotsuga caroliniana	1
Pyrus calleryana	1073
Pyrus kawakamii	3
Quercus agrifolia	79
Quercus coccinea	1
Quercus ilex	1
Quercus laurifolia	3
Quercus palustris	55
Quercus robur	3
Quercus rubra	78

Genus	# of Trees
Quercus saponaria	3
Quercus shumardii	1
Quercus suber	7
Quercus virginiana	2
Rhus lancea	3
Robinia ambigua	44
Robinia pseudoacacia	228
Sapium sebiferum	140
Schinus molle	4
Schinus terebinthifolius	15
Sequoia sempervirens	54
Sophora japonica	30
Syagrus romanzoffianum	1
Thuja occidentalis	3
Thuja plicata	2
Tilia cordata	60
Tilia tomentosa	37
Trachycarpus fortunei	3
Tristania conferta	318
Tristania laurina	112
Ulmus americana	78
Ulmus parvifolia	11
Ulmus wilsoniana	5
Washingtonia robusta	120
Yucca australis	1
Zelkova serrata	18

APPENDIX 6 / TREE MANAGEMENT PLANNING TOOL[1]

Levels of Service (L.O.S.) and Budget Determination for City-funded Tree Management

Program Area	Rank for Fiscal Year*	Potential Level of Service 1 (minimal)	Potential Level of Service 2
Planting		No new city-funded tree planting	Replace street tree removals only
Young Tree Care		No young tree care	± 5-year cycle inspection/ pruning
Mature Tree Care		± 12-year cycle inspection/ pruning	± 9-year cycle inspection/ pruning
HIgh Risk Tree Abatement		Removals on property owner request only	Removals on request; maintain <5% 'dead of dying' backlog
Administration (2008 dollars)		$2.50/tree admin budget or 0.25 supervisory arborists/ 10,000 trees	$3.50/tree admin budget or 0.40 supervisory arborists/ 10,000 trees

1 developed by the City of Davis, 2002

* Column to be filled in annually when planning budget and proposed Level of Service.

Potential Level of Service 3	**Potential Level of Service 4 (optimal)**	**Staff/Tree Commission Recommendation for Fiscal Year***
Replace removals and plant on request; increase street tree population by 1/2 % per year	Replace removals and plant on request; increase street tree population by 1% per year; provide for special planting projects	
± 3-year cycle inspection/ pruning	± 1-year cycle inspection/ pruning for fast growing species	
± 7-year cycle inspection/ pruning	± 5-year cycle inspection/ pruning	
Removals on request; maintain <2% backlog; fund special projects	Removals on request; maintain <1% backlog; fund removal/replacement programs; inventory and other special projects	
$4.25/tree admin budget or 0.50 supervisory arborists/ 10,000 trees	$5.00/tree admin budget or 0.65 supervisory arborists/ 10,000 trees	

APPENDIX 7 / TREE BENEFITS CALCULATION

The equation to determine the value of all annual benefits (B) of a tree is:

B = E + AQ + CO2 + H + A, where:

E = value of net annual energy savings (cooling and heating)
AQ = value of annual air quality improvement (pollutant uptake, avoided power plant emissions, and BVOC emissions)
CO2 = value of annual CO2 reductions (sequestration, avoided emissions, release due to tree care and decomposition)
H = value of annual stormwater runoff reductions (water quality and flood control)
A = value of annual aesthetics and other benefits

THE SUM OF COSTS CALCULATIONS

On the other side of the cost-benefit equation are costs for tree planting and management. Expenditures that are borne by property owners (irrigation, pruning, and removal) and the community (pollen and other health care costs).

For the purposes of this Master Street Tree Plan, the estimated average tree for Alameda
was a medium-sized tree, based upon the professional review and opinion of the consulting arborists. Average net benefits were set at $22 per tree.

APPENDIX 8 / BEST RANKED TREES FOR IMPROVING AIR QUALITY

(Source: Local Governments for Sustainability: **www.iclei.org**)

Ozone

English Elm
Ulmus procera

European Linden
Tilia europea American

Beech
Fagus grandifolia

Yellow Birch
Betula alleghaniensis

Tulip Tree
Liriodendron tulipifera

American Linden
Tilia americana

European Beech
Fagus sylvatica

Dawn Redwood
Metasequoia glyptostrobides

Paper Birch
Betula papyrifera

Carbon Monoxide

American Linden
Tilia americana

American Beech
Fagus grandifolia

Silver Linden
Tilia tomentosa

Yellow Birch
Betula alleghaniensis

Redmond Lindontil
Tilia eucjlora

English Elm
Ulmus procera

Gingko
Ginko biloba

Tulip Tree
Liriodendron tulipifera

Overall

English Elm
Ulmus procera

European Linden
Tilia europea American

Tulip Tree
Liriodendron tulipifera

Dawn Redwood
Metasequoia glyptostrobides

American Beech
Fagus grandifolia

Yellow Birch
Betula alleghaniensis

European Beech
Fagus sylvatica

American Linden
Tilia americana

American Elm
Ulmus americana

APPENDIX 9 / MAJOR STREETS - AND NEIGHBOURHOOD TREE SPECIES RECOMMENDATIONS

MAIOR STREET	2009 EXISTING TREES	2009 MSTP
Atlantic Avenue & Clement Avenue	Eucalyptus nicholi-wilow-leaved peppermint, ceratonia silqua-carob, Liquidambar Styraciflua-sweetgum.	Tristannia conferta-brisbane box, Platanus x acerifolia columbia and yarwood - London plane tree.
Broadway	Fraxinus velutina var. glabra- Modesto ash.	Gymnocladus dioica 'Espresso' - seedless Kentucky coffee tree. Acer rubrum - red maple. 'October Glory', 'Brandywine', and possibly other varieties (but not 'Red Sunset' or 'Morgan'). Do not use 'Brandywine' under high voltage lines. Ulmus 'Frontier' and 'Princeton' - frontier hybrid elm and Princeton American elm.
Buena Vista	Fraxinus holotricha 'Moraine' - Moraine ash; Liriodendron tulipifera - tuliptree.	Tilia tomentosa - silver linden. Ulmus 'Frontier' and 'Princeton' - frontier hybrid elm and Princeton American elm. Ulmus - various American and hybrid elms. 'Accolade', 'Commendation', 'Jefferson', 'New Harmony', 'Patriot', 'Triumph', 'Washington', 'Frontier' and 'Princeton'.
Central Avenue	Platanus x acerlflla 'Columbia' and 'Yarwood' - London plane tree.	Platanus x acerifolia 'Columbia' and 'Yarwood' - London plane tree.
Doolittle Drive	Platanus x acerifolia 'Yarwood' - London plane tree; Acacia melanoxylon - black acacia; Populus nigra 'Italica' - Lombardy poplar.	Platanus x acerifolia 'Columbia' and 'Yarwood' -London plane tree.Tilia tomentosa - silver linden. Metrosideros excelsus - New Zealand Christmas tree.
Encinal Avenue	Fraxinus velutina var. glabra - Modesto ash; Fraxinus oxycarpa 'Raywood' - Raywood ash; Fraxinus holotricha 'Moraine' - Moraine ash.	Acer rubrum - red maple. 'October Glory', 'Brandywine', and possibly other varieties Gymnocladus dioica 'Espresso' - seedless Kentucky coffee tree.
Fernside Boulevard	Tilden Way to High Street: Ginkgo biloba -maidenhair tree; Fraxinus holotricha 'Moraine' -Moraine ash. High Street to Encinal Avenue: Platanus x acerifolia - London plane tree Encinal Avenue to Otis Drive: Fraxinus holotricha 'Moraine' - Moraine ash.	Platanus x acerifolia 'Columbia' and 'Yarwood' - London plane tree. *Gymnocladus dioica - seedless Kentucky coffee tree. 'Espresso' variety. Tilia tomentosa - silver linden (especially good for small planting areas).
Gibbons Drive	Liquidambar styraciflua - Sweetgum.	Acer rubrum - red maple. 'Brandywine' and possibly other varieties Quercus coccinea - scarlet oak. *Quercus falcata - southern red oak.
Grand Street	North of Otis Drive: Acer platanoides - Norway maple; Pyrus calleryana 'Bradford' - Bradford pear;Robinia pseudoacacia - black locust. South of Otis Drive: Eucalyptus rudis - swamp gum; Corymbia ficifolia - red-flowering gum; Eucalyptus nicholii - wilow-leaved peppermint.	North of Lagoon: Acer rubrum - red maple. 'October Glory', 'Brandywine', and possibly other varieties , Acer nigrum- black maple, Acer saccharum-sugar maple, 'Commemoration' and possibly other varieties (but not 'Greem mountain'), Quercus coccinea-scarlet oak, Quercus falcata - southern red oak South of Lagoon: Corymbia ficifolia - red-flowering gum.

MAIOR STREET	2009 EXISTING TREES	2009 MSTP
Harbour Bay Parkway	Doolittle Avenue to Maitland Avenue: - Populus nigra 'Italica' - Lombardy poplar; Eucalyptus rudis - swamp gum; Myoporum laetum - Myoporum. Maitland Avenue to South Loop Road: Alnus rhombifolia . white alder; Pinus pinea - stone pine. South Loop Road to End: Phoenix canariensis -Canary Island date palm.	Retain existing planting scheme, but consider substituting. Fagus sylvatica (European beech) for the existing Alnus rhombifolia (white alder).
High Street	Fraxinus velutina var. glabra - Modesto ash; Fraxinus holotricha 'Moraine' - Moraine ash; Fraxinus oxycarpa 'Raywood' - Raywood ash.	Gymnocladus dioica 'Espresso' - seedless Kentucky coffee tree. Koelreoteria bipinnata-Chinese flame tree, Pistachia chinesis 'Keith Dave'- Chinese pistache.
Island Drive	Doolittle to Mecartney Road medians: Pinus radiata Monterey pine; Alnus rhombifolia - white alder; Pinus pinea - stone pine; Platanus x acerifolia - London plane tree; Prunus cerasifera - purple leaf plum. Streetscape: Pinus contorta - lodgepole pine; Pinus pinea - stone pine; Prunus cerasifera - purple leaf plum; Populus nigra 'Italica' - Lombardy poplar. Mecartney Road to Fir Avenue: Ginkgo biloba -maid-enhair tree. Fir Avenue to Catalina: Eucalyptus polyanthemos - silver dollar gum; Quercus ilex - holly oak; Ginkgo biloba - maidenhair tree.	North of Mecartney Road: Retain existing Populus nigra 'Italica' (Lombardy poplars) and substitute Fagus sylvatica (European beech) for the existing Alnus rhombifolia (white alders). South of Mecartney Road: Quercus coccinea - scarlet oak. Tilia tomentosa - silver linden. Corymbia ficifolia - red-flowering gum. Ginkgo biloba 'Fairmount', 'Saratoga' and possibly other varieties, but not 'Autumn Gold' - maidenhair tree.
Lincoln Avenue Marshall Way Pacific Avenue Tilden Way	Brachychiton populneus - boUle tree; Cinnamomum camphora - cam-phor; Prunus caroliniana - Carolina cherry laureL. St. Charles Avenue to Sherman Avenue: Chinese pistache trees have been planted to replace laurel figs killed by the 1990 frost. The low-branching and initially awkward structure of this species will have to be monitored carefully in order for these trees to function properly in this small commercial district. Marshall Way/ Pacific Avenue: Cinnamomum cam-phora - camphor; Tristania conferta - Brisbane box.	Tilia tomentosa - silver linden. Ulmus 'Accolade', 'Commendation', 'Jefferson', 'New Harmony', 'Patriot', 'Triumph', 'Washington', and possibly other varieties - various American and hybrid elms. Metrosideros excelsus - New Zealand Christmas tree. Pistacia chinensis 'Keith Davey' - Chinese pistache. Quercus coccinea - scarlet oak.
Main Street	Prunus caroliniana-Carolina laurel cherry, Alnus rhombifolia-white alder, Koelreuteria bipinnata-chinese flame tree.	To be deferred and coordinated with Alameda Point development.

MAIOR STREET	2009 EXISTING TREES	2009 MSTP
Marina Village Parkway	Acacia baileyana - Bailey acacia; Alnus cordata -Italian alder; Platanus x acerifolia - London plane tree; Myoporum laetum - Myoporum; Pinus eldarica - Afghan pine; Populus nigra 'Italica' . Lombardy poplar.	Platanus x acerifolia 'Yarwood' - London plane tree. Fagus sylvatica - European beech.
Mecartney Road	Eucalyptus rudis - swamp gum; Ceratonia siliqua - carob; Cinnamomum camphora - camphor. Island Drive to Aughinbaugh Way: Platanus x acerifolia - London plane tree; Acacia baileyana -Bailey acacia; Prunus cerasifera - purple leaf plum; Pinus pinea - stone pine; Pinus radiata -Monterey pine; Populus nigra 'Italica' - Lombardy poplar.	Gymnocladus dioica 'Espresso' - seedless Kentucky coffee tree. Platanus x acerifolia 'Columbia' and 'Yarwood' - London plane tree. Corymbia ficifolia - red-flowering gum.
Otis Drive	Bay Farm Island Bridge to Park Street: Myoporum laetum - Myoporum; Crataegus laevigata - English hawthorn; Ligustrum lucidum - glossy privet. Park Street to Westline Drive: Tristania conferta -Brisbane box; Eucalyptus rudis - swamp gum.	Corymbia ficifolia - red-flowering gum. Metrosideros excelsus - New Zealand Christmas tree. Pyrus calleryana 'Aristocrat', and possibly other varieties Tilia tomentosa - silver linden. For use where bay mud soils are not present.
Park Street	The frost in the winter of 1990 damaged and kiled nearly all the laurel figs in the business district of Park Street; they have recently been replaced with swamp myrtle. There are stil several cherry laurels and glossy privets throughout the business district. The large parkways between Otis Drive and San Jose Avenue are perfect sites for large-stature trees.	North of Clinton Avenue (in commercial district): Ginkgo biloba ' Fairmount' - maidenhair tree. Lagerstroemia indica x L. fauriei 'Tuscarora' and possibly other varieties - crape myrtle. South of Clinton Avenue: Ginkgo biloba 'Fairmount' or 'Saratoga' - maidenhair tree. Do not plant 'Fairmount' under high voltage lines. Quercus coccinea - scarlet oak. Quercus falcata - southern red oak. Do not plant under high voltage lines.
Robert Davey, Jr. Drive (formerly Brideway Road)	Platanus x acerifolia - London plane tree; Alnus rhombifolia - white alder; Acacia baileyana - Bailey acacia; Prunus cerasifera - purple leaf plum; Pinus pinea - stone pine; Pinus radiata - Monterey pine,	Platanus x acerifolia - London plane tree, 'yarwood' or 'Columbia'. Fagus sylvatica (European beech) to replace the existing Alnus rhombifolia (white alder).
Santa Clara Avenue	Cinnamomum camphora - camphor; Ceratonia siliqua - carob; Prunus caroliniana - Carolina cherry laurel. Recently planted coast live oak and Brisbane box.	Keep the all-evergreen look established by the surviving camphor trees by planting the following: Tristania conferta - Brisbane box (not under high voltage lines). Corymbia ficifolia - red-flowering gum. Metrosideros excelsus - New Zealand Christmas tree. Quercus virginiana – southern live oak.

MAJOR STREET	EXISTING TREES	2009 MSTP
Shoreline Drive	Pittosporum undulatum - mock orange; Myoporum laetum - Myoporum; Metrosideros excelsus - New Zealand Christmas tree.	Washington robusta-Maxican fan Plam, Italian Cypress
Webster Street	Pyrus calleryana 'Aristocrat' - flowering pear. Lagerstroemia indica	Pyrus calleryana 'Aristocrat' - flowering pear. Lagerstroemia indica x L. fauriei 'Tuscarora' - crape myrtle. Use as an accent tree.
Constitution Way Eighth Street West Line Drive	Eighth Street: Washingtonia robusta - Mexican fan palm; Robinia pseudoacacia - black locust; Fraxinus holotricha 'Moraine' - Moraine ash. Constitution Way: Magnolia grandiflora - southern magnolia; Alnus rhombifolia - white alder; Prunus x blireiana - flowering plum; Jacaranda mimosifolia - Jacaranda. Westline Drive: Eucalyptus rudis -swamp gum; Pittosporum undulatum - mock orange.	Constitution Way and Eighth Street north of Central: Tristania conferta - Brisbane box. Platanus x acerifolia 'Columbia' and 'Yarwood' - London plane tree. Magnolia grandiflora 'Russett' and possibly other varieties - southern magnolia. Eighth Street between Central and Portola: Washingtonia robusta - Mexican fan palm. West Line Drive: Corymbia ficifolia - red-flowering gum. Tristania conferta - Brisbane box. Platanus x acerifolia 'Columbia' and 'Yarwood' - London plane tree.

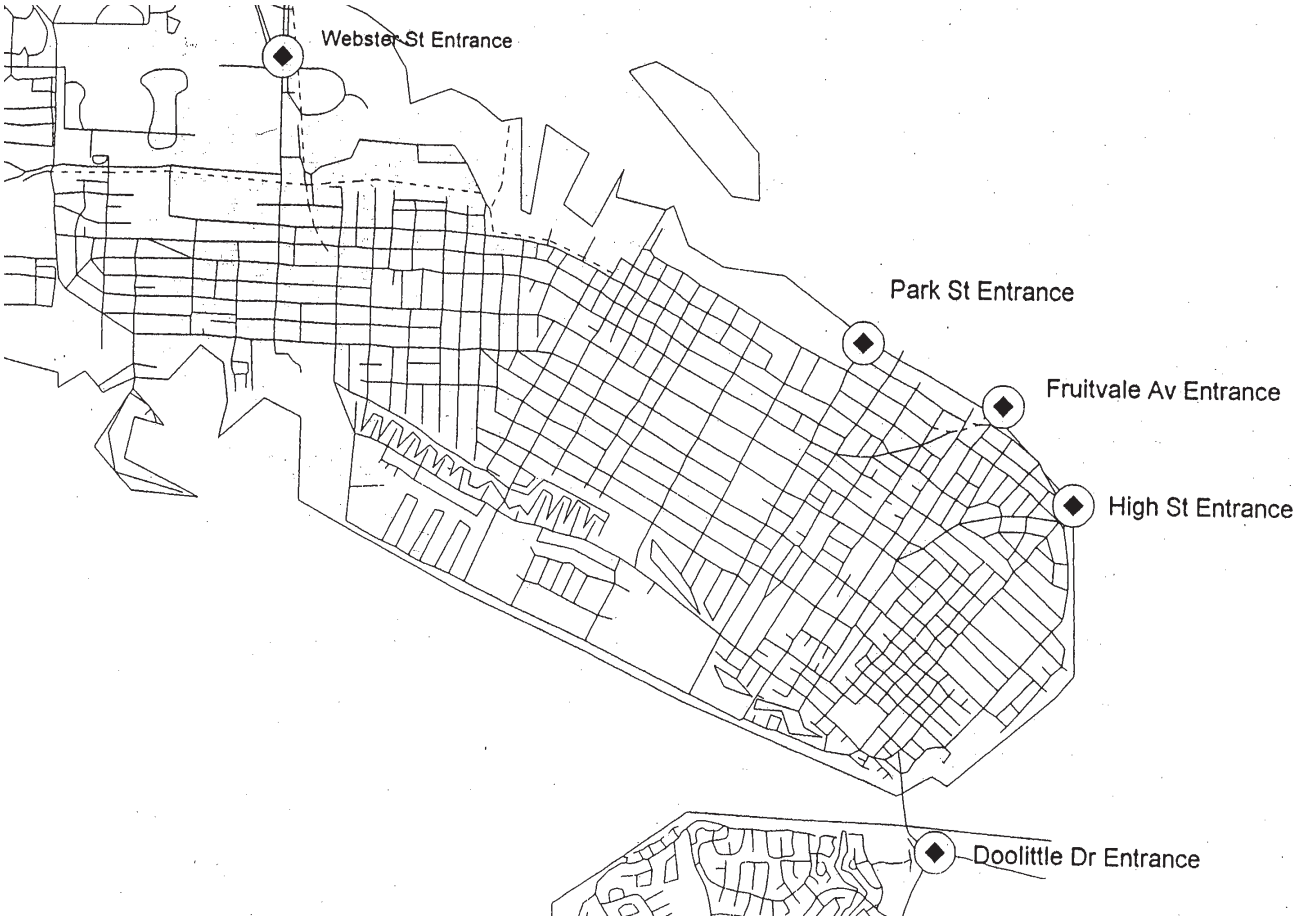
NEIGHBORHOOD	PLANTING STRIP	1989 MSTP	2009 MSTP
Ballena Bay		Alnus cordata, Eucalyptus rudis, Metrosideros excelsus	Carpinus betulus 'Fastigiata' - fastigiate hornbeam. Metrosideros excelsus - New Zealand Christmas tree.
Bay Farm Island	2-7 feet	Alnus rhombifolia, Fraxinus angustifolia, Platanus x acerifolia*, Prunus cerasifera, Pyrus calleryana, Tristania conferta.	Acer campestre - hedge maple; Tristania laurina - swamp myrtle; Metrosideros excelsus - New Zealand Christmas tree; Aesculus hippocastanum 'Baumannii' - Baumann's horsechestnut; Corymbia ficifolia – red-flowering gum; Jacaranda mimosifolia - Jacaranda; Quercus coccinea,- scarlet oak; Quercus palustris - pin oak; Quercus suber - cork oak.
Bay Mound	2-7 feet	Cinnamomum camphora, Crataegus laevigata, Fraxinus oxycarpa, Fraxinus uhdei, Fraxinus velutina, Geijera parviflora, Ginkgo biloba, Metrosideros excelsus*, Myoporum laetum, Platanus x acerifolia, Prunus caroliniana, Pyrus calleryana, Sapium sebiferum.	Acer buergeranum - Trident maple; Acer campestre - hedge maple; Aesculus x carnea - red horsechestnut; Corymbia ficifolia - red-flowering gum; Metrosideros excelsus - New Zealand Christmas tree; Acer saccharum 'Commemoration' - sugar maple; Carpinus betulus 'Fastigiata' and 'Frans Fontaine' - hornbeam; Jacaranda mimosifolia - Jacaranda; Quercus palustris – pin oak; Ulmus americana 'Princeton' - elm.
Bay View	3-7 feet	Fraxinus oxycarpa, Myoporum laetum*Brachychiton populneus, Cinnamomum camphora, Liquidambar styraciflua, Platanus x acerifolia*, Pyrus calleryana.	
Central East	2-6 feet	Ceratonia siliqua, Ginkgo biloba, Platanus x acerifolia*	Tristania conferta -Brisbane box; Acer nigrum - black maple; Acer buergeranum - Trident maple; Aesculus x carnea - red horsechestnut; Carpinus betulus 'Frans Fontaine' - hornbeam; Nyssa sylvatica - black tupelo; Tilia tomentosa 'Green Mountain' and 'Sterling' - silver linden.
Crown Beach	3-5 feet	Platanus x acerifolia , Washingtonia robusta*	Missing
East Central	2-6 feet	Fraxinus velutina, Ginkgo biloba, Ligustrum lucidum, Platanus x acerifolia*	Commercial areas: Carpinus betulus 'Frans Fontaine' - hornbeam; Acer nigrum 'Greencolumn' - black maple. Residential areas: Metrosideros excelsus - New Zealand Christmas tree, Jacaranda mimosifolia - Jacarand; Pistacia chinensis 'Keith Davey' - Chinese pistache; Quercus suber - cork oak; Ulmus 'Frontier' - elm.
East End	2-5 feet	Brachychiton populneus, Ginkgo biloba, Liquidambar styraciflua, Platanus x acerifolia*, Prunus caroliniana, Pyrus calleryana	Metrosideros excelsus - New Zealand Christmas tree; Acer saccharum 'Commemoration' - sugar maple; Pistacia chinensis 'Keith Davey' - Chinese pistache; Tristaniopsis laurina (formerly Tristania laurina) - swamp myrtle; Lagerstroemia indica x L. fauriei 'Tuscarora' - crape myrtle; Prunus x blireiana 'Natchez' - flowering plum.Quercus coccininea, Acer rubrum 'october glory' &brandy wine.

NEIGHBORHOOD	PLANTING STRIP	1989 MSTP	2009 MSTP
Fernside	2-6 feet	Ginkgo biloba*, Liquidambar styraciflua	Acer x freemanii 'Autumn Blaze' - Freeman maple; Acer nigrum 'Green Column' - black maple; Acer rubrum 'October Glory' and 'Brandywine' - red maple; Tristania conferta - Brisbane box; Carpinus betulus 'Fastigata' and 'Frans Fontaine' - hornbeam. Platnus to planter strip > 5' , silver linden
Gold Coast	2-6 feet	Ginkgo biloba, Liquidambar styraciflua, Platanus x acerifolia , Prunus caroliniana, Pyrus calleryana, Robinia pseudoacacia*, Ulmus procera, Washingtonia robusta	Ginkgo biloba 'Saratoga' - Saratoga maidenhair tree; Magnolia grandiflora 'Russet' - southern magnolia; Magnolia grandiflora 'St. Mary'- southern magnolia; Prunus x yedoensis - Yoshino cherry; Quercus palustrus - pin oak; Quercus shumardii - Shumard oak; Tilia tomentosa 'Greenmountain' or 'Sterling' - silver linden; Acer rubrum 'October Glory' and 'Brandywine' - red maple; Ulmus 'Frontier' - elm.
Jackson Park	3-7 feet	Fraxinus velutina, Platanus x acerifolia *	Acer x freemanii 'Autumn Blaze' - Freeman maple; Acer buergeranum - Trident maple; Acer campestre - hedge maple; Acer nigrum 'Green Column' - black maple; Carpinus betulus 'Fastigiata' - fastigiate hornbeam; Koelreuteria bipinnata - Chinese flame tree. Jacaranda mimosifolia- Jacaranda, Podocarpus gracilior-fern pine
Lagunaria	2-5 feet	Alnus cordata*, Ginkgo biloba*, Platanus x acerifolia , Pyrus calleryana,Tristania conferta	Corymbia ficifolia - red-flowering gum; Podocarpus gracilior - African fern pine; Quercus coccinea - scarlet oak; Quercus palustris - pin oak; Quercus suber - cork oak
Northside East	2-5 feet	Brachychiton populneus, Liriodendron tulipifera, Pittosporum undulatum, Platanus x acerifolia , Pyrus calleryana*	Tilia tomentosa 'Green Mountain' & 'Sterling' - silver linden; Acer rubrum 'October Glory' & randywine' - red maple; Aesculus hippocastanum 'Baumannii' – Baumann's horsechestnut; Prunus x yedoensis - Yoshino cherry; Quercus palustris - pin oak; Tristaniopsis laurina - swamp myrtle; Ulmus 'Princeton' - elm.
Northside West	2-13 feet	Brachychiton populneus, Liquidambar styraciflua, Magnolia grandiflora, Pistacia chinensis, Platanus x acerifolia, Pyrus calleryana*	"Carpinus betulus 'Fastigiata' - fastigiate hornbeam; Cercis canadensis - eastern redbud; Nyssa sylvatica - black tupelo; Pistacia chinensis - Chinese pistache;Jacaranda mimosifolia - Jacaranda; Podocarpus gracilior - African fern pine; Ulmus 'Frontier' - elm; Lagerstroemia indica x L. fauriei 'Natchez' & 'Tuscarora'- crape myrtle"
Park Street North	2-5 feet	Platanus occidentalis, Pyrus calleryana	Acer nigrum 'Green Column' - black maple; Aesculus x carnea - red horsechestnut; Carpinus betulus 'Fastigiata' - fastigiate hornbeam; Ginkgo biloba 'Fairmount' - maidenhair tree; Lagerstroemia indica x L. fauriei 'Tuscarora' and 'Natchez' - crape myrtle; Prunus sargentii'Columnaris' sargent cherry, Prunus yedoensis-Yoshino flowering cherry

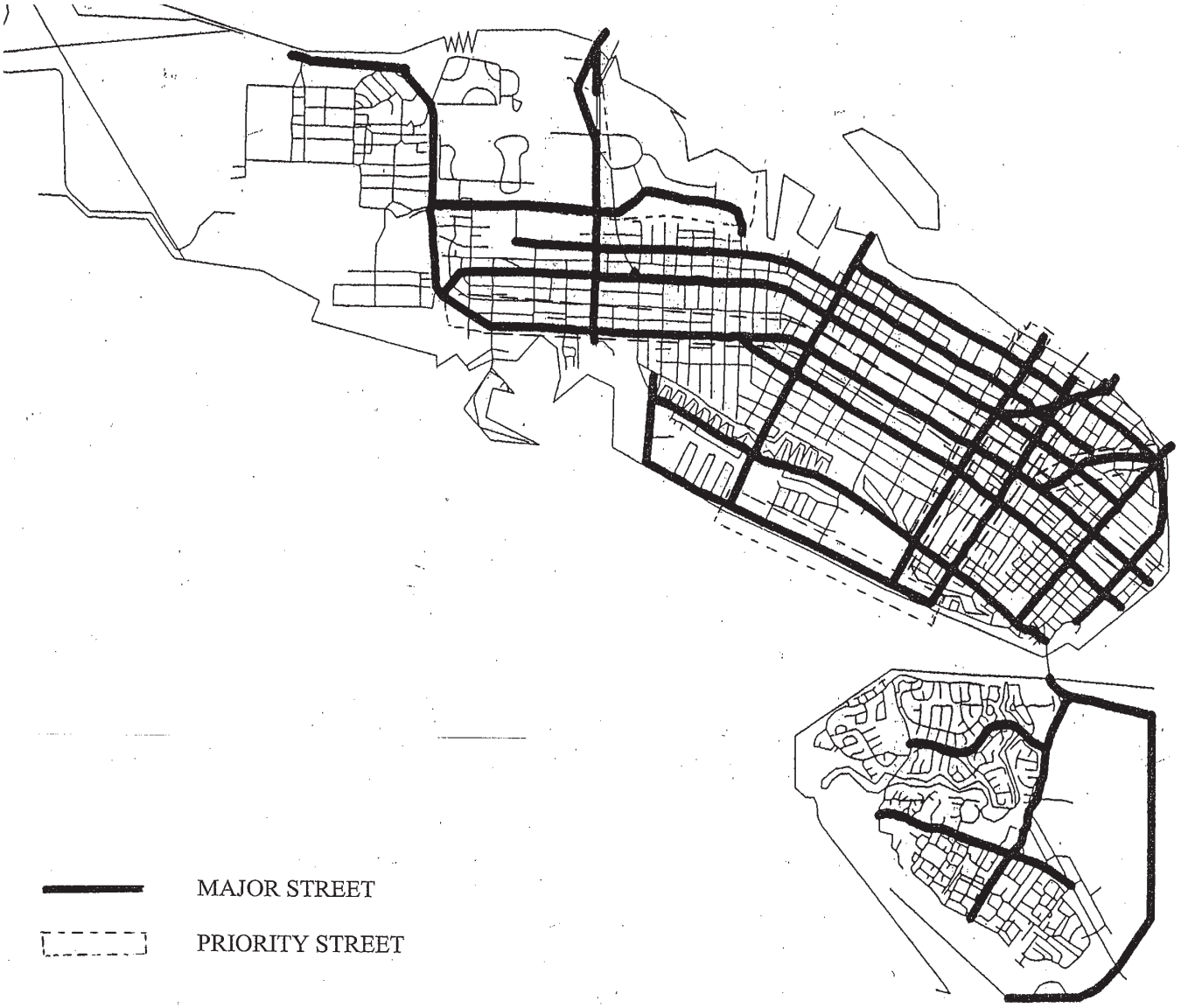
NEIGHBORHOOD	PLANTING STRIP	1989 MSTP	2009 MSTP
South Central	2-6 feet	Brachychiton populneus, Ceratonia siliqua, Geijera parviflora, Ginkgo biloba, Jacaranda mimosifolia, Ligustrum lucidum, Platanus x acerifolia*, Pyrus calleryana, Quercus rubra.	Koelreuteria bipinnata - Chinese flame tree; Nyssa sylvatica - black tupelo; Pistacia chinensis - Chinese pistache; Quercus shumardii - Shumard oak; Acer rubrum 'October Glory' and 'Brandywine' - red maple; Acer saccharum 'Commemoration' - sugar maple; Jacaranda mimosifolia - Jacaranda; Prunus x yedoensis - Yoshino cherry; Quercus suber - cork oak.
South Shore			Metrosideros excelsus - New Zealand Christmas tree; Tristania conferta - Brisbane box; Tilia tomentosa 'Green Mountain' & 'Sterling' - silver linden; Lagerstroemia indica x L. fauriei 'Natchez' & 'Tuscarora' - crape myrtle
West Central	2-6 feet	Brachychiton populneus, Pistacia chinensis, Platanus x acerifolia*, Pyrus calleryana	Acer buergeranum - Trident maple; Acer campestre - hedge maple; Aesculus x carnea - red horsechestnut; Koelreuteria bipinnata - Chinese flame tree; Magnolia grandiflora 'Russet' - southern magnolia; Magnolia grandiflora 'St. Mary' - southern magnolia; Ginkgo biloba 'Saratoga' & 'Fairmount' - maidenhair tree; Podocarpus gracilior - African fern pine; Tilia tomentosa 'Green Mountain' & 'Sterling' - silver linden.
West End	2-6 feet	Brachychiton populneus, Cinnamomum camphora, Koelreuteria bipinnata*, Pyrus calleryana	Carpinus betulus 'Fastigiata' - fastigiate hornbeam; Cercis canadensis - eastern redbud; Koelreuteria bipinnata - Chinese flame tree; Tristaniopsis laurina - swamp myrtle; Acer nigrum 'Greencolumn' - black maple; Acer rubrum 'October Glory' & 'Brandywine' - red maple; Aesculus hippocastanum 'Baumannii' - Baumann's horsechestnut; Ulmus 'Princeton' - elm.
West End Central	3-6 feet	Brachychiton populneus*, Pyrus calleryana	Acer x freemanii 'Autumn Blaze' - Freeman maple; Acer saccharum 'Commemoration' - sugar maple; Jacaranda mimosifolia - Jacaranda; Podocarpus gracilior - African Fern pine; Quercus coccinea - scarlet oak; Quercus suber - cork oak; Lagerstroemia indica x L. fauriei 'Natchez' & 'Tuscarora' - crape myrtle.
West End North			
Woodstock		Acacia melanoxylon*, Platanus x acerifolia	For sites four feet or larger, use: Aesculus hippocastanum 'Baumannii' - Baumann's horsechestnut; Podocarpus gracilior - African Fern pine. For small, constrained planting sites use: Tilia tomentosa 'Green Mountain' & 'Sterling' - silver linden; Pistacia chinensis 'Keith Davey' - Chinese pistache.
Bisness District of Alameda			Acer nigrum 'Green Column' - black maple; Ginkgo biloba 'Fairmount' - maidenhair tree; Metrosideros excelsus - New Zealand Christmas tree; Quercus palustris - pin oak; Acer rubrum 'Armstrong' - red maple; Pyrus calleryana 'Aristocrat' and 'Chanticlear' - Bradford pear; Lagerstroemia indica x L. fauriei 'Natchez' and 'Tuscarora' - crape myrtle.

APPENDIX 10 / CITY OF ALAMEDA NEIGHBORHOODS MAP

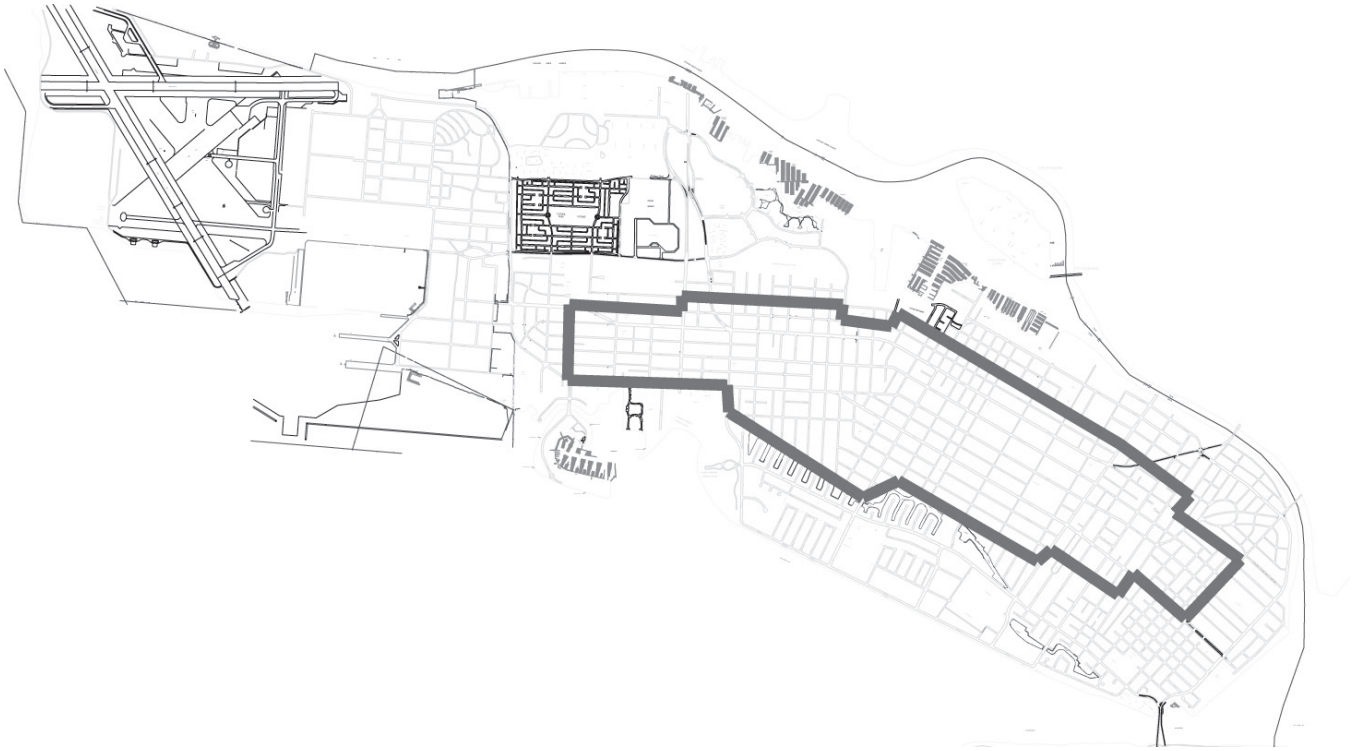
APPENDIX 11 / CITY OF ALAMEDA ENTRY GATEWAYS MAP



APPENDIX 12 / CITY OF ALAMEDA - MAJOR STREETS OVERALL MAP



APPENDIX 13 / CITY OF ALAMEDA - SPECIAL PLANTING ZONE MAP



• Species American Elm, London Plane, Scarlet Oak, Southern Red Oak and Shumard Oak can be planted in less than 5' planter strip but not less than 3'. If located within marked area.

GLOSSARY

When the following words and phrases are used in this MSTP, they shall have the following meanings unless a different meaning is clearly required by the context:

Associated Vegetation shall mean native or non-native shrubs and ground covers within city parks, rights-of-ways, and open spaces.

City shall mean the government of Alameda.

Arborist shall mean the contracted or City employee who is a current certified arborist by the International Society of Arboriculture and is responsible for administering and enforcing the provisions of this chapter.

High Risk Tree shall mean any public tree rated as such by the City according to the tree high risk evaluation standards established by the International Society of Arboriculture.

Maintain or maintenance shall mean the entire care of trees within City rights-of-ways and open spaces, as well as the preparation of ground, fertilizing, mulching, planting, disease and insect control, trimming, pruning, staking, root control, watering, leaf litter, weed removal, and removal of dead and dying trees.

Master Street Tree Plan shall mean a document adopted by council that presents street tree inventories, maintenance recommendations, recommended street tree lists, a master design plan for street tree plantings, and urban forestry program goals.

Street Trees shall mean all trees and woody plants within public rights-of-ways.

Planting shall mean to install public trees permanently in the ground.

Planting Strip shall mean the area available for planting including tree pits between the street curbs, the edge of the traveled portion of roadway, and the property line.

Property Owner shall mean the person owning such property as shown by the records of the Assessor's Office of Alameda County, California.

Pruning shall mean cutting or removing any part of the branching structure of a plant in either the crown, trunk, and/or root areas.

Removal shall mean removal of a tree within City rights-of-ways and open spaces.

Street Tree Standards and Specifications Manual shall mean a document adopted by council that presents required standards and specifications for public tree planting, maintenance, and removal. Currently, such a document does not exist. If funding is available this may be available in the future.

BIBLIOGRAPHY

American National Standards Institute. "Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (pruning)." ANSI A300 (Part 1) –Pruning.

American National Standards Institute. "American Standard for Nursery Stock." ANSI Z60.1.

American National Standards Institute. "Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements." ANSI Z133.1.

Bratton, N.J & K.L.Wolf. "Trees and Roadside Safety in U.S. Urban Settings, Paper 05-0946." In "Proceedings of the 84th Annual Meeting of the Transportation Research Board (January 9-13, 2005)." Transportation Research Board of the National Academies of Science. Washington, DC.

Burden, D. 2006. Urban Street Trees. 22 Benefits. Specific Applications. [online] Glatting Jackson and Walkable Communities Inc. Available from: www.ufei.org/files/pubs/22Benefits ofUrbanStreetTrees.pdf [cited June 2008]

Centre for Urban Forest Research. 2007. Why Shade Streets? The unexpected benefit. Davis: USDA Forest Service (Published 2007). Available from: http://www.fs.fed.us/psw/programs/cufr/products/cufr_673_WhyShadeStreets_10-06.pdf [cited June 2008]

City and County of San Francisco. Street Tree Planting Permitting Process. 2007: San Francisco, Department of Public Works. Available from: www.sfgov.org/site/sfdpw_index.asp?id=33090 [cited June 2008]

City of Davis. 2002. Community Forest Management Plan. Available from: http://cityofdavis.or/pgs/trees/pdfs/CFMP-Final-Sept2002-toc.pdf [cited June 2008].

City of Portland. 1995. "Portland's Urban Forestry Management Plan, public review draft." Portland Parks and Recreation and the Urban Forestry Management Plan Technical Advisory Committee. Portland, OR.

Clark, J. R., N. P. Matheny, G. Cross & V. Wake. 1997. A Model of Urban Forest Sustainability. Journal of Arboriculture, 23 (1), 17-30.

Council of Tree and Landscape Appraisers. 2000. "Guide for Plant Appraisal." 9th Edition. 143pp.

Dwyer, John F., Gregory E. McPherson, Herbert W. Schroeder, and Rowan A. Rowntree. 1992. Assessing the Benefits and Costs of the Urban Forest. Journal of Arboriculture 18(5).

Gilman, Edward & Sharon Lilly. 2002. Best Management Practices: Tree Pruning. International Society of Arboriculture. Champaign, IL. 35p.

Keating, Janice. 2002. Trees: The Oldest New Thing in Stormwater Treatment Stormwater. Vol. 3 (2).

McPherson, G., S. Maco, J. Simpson, P. Peper, Q. Xiao, AM. VanDerZanden, N. Bell. 2002. Western Community Tree Guide: Benefits, Costs and Strategy Planning.

Miller, R.W. 1997. Urban Forestry: Planning and Managing Urban Green Spaces. Prentice Hall. Upper Saddle River, NJ. 188p.

Moll, G. 1989. Improving the health of the urban forest. In Moll, G. and S. Ebenreck (eds.). Shading Our Cities, pp. 119-130. A Resources Guide for Urban and Community Forests. Island Press. Washington.

Nowak, David J. 2004. The Effects of Urban Trees on Air Quality. USDA Forest Service, Syracuse , NY. Available from: http://www.fs.fed.us/ne/syracuse/TREE%20Air%20Qual.pdf. [Cited June 2008].

Richards, N.A. 1983. Diversity and stability in street tree populations. Urban Ecology 7: 159-171.

Ulrich, Roger S. and Robert F. Simons. 1986. Recovery from Stress During Exposure to Everyday Outdoor Environments. In The Costs of Not Knowing. Edited by Wineman et. al.

Wolf, K. 1998. Enterprising landscapes: Business districts and the urban forest. In C. Kollin, Engineering Green: Proceedings of the 11th National Urban Forest Conference. Washington, DC: American Forests.

Wolf, K. 1998. Trees in Business Districts: Positive Effects on Consumer Behavior! - Fact Sheet 5. Available from: http://www.cfr.washington.edu/research.envmind/consumer.html [Cited June 2008].

Wolf, K. 2003. Youth and Mental Health: Work Projects in Urban Green Space. In C. Kollin (ed.), Engineering Green: Proceedings of the 11th National Urban Forest Conference. Washington, DC: American Forests.

Wolf, K. 2005a. Business District Streetscapes, Trees and Consumer Response. Journal of Forestry, 103 (8) 396-400.

Wolf, K. 2005b. Civic Nature: Valuation: Assessments of Human Functioning and Well-Being in Cities. In: Forging Solutions: Applying Ecological Economics to Current Problems, Proceedings of the 3rd Biennial Conference of the U.S. Society for Ecological Economics (July 20-23,2005). Tacoma, WA: Earth Economics.

WEB SITES:

International Society of Arboriculture:
http://www.isa-arbor.com/home.aspx

Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service: http://cufr.ucdavis.edu/

Human – Environment Research Laboratory, University of Illinois at Urbana Champaign: http://www.herl.uiuc.edu/

National Arbor Day Foundation:
http://www.arborday.org/

Urban Forestry South. USDA Forest Service, Western Region: http://www.urbanforestrywest.usda.gov/

i. ALAMEDA STREET TREE MATRIX

Tree Species	Common Name	Foliage		Flower/Fruit									
		Deciduous/Evergreen	Fall Color	Flower Color	Flower Period	Fruit	Fruiting Period	Shape	Growth Rate Per Year (once established)	Height at Maturity (feet)	Spread at Maturity (feet)	Trunk Diameter at Breast Height at Maturity (inches)	Longevity (years)
Acer buergeranum	Trident Maple	D	Red or orange	Yellow	Spring	Brown winged seed, 0.5-1.5"	Summer	Rounded, spreading with a low canopy	24-36"	25	25	20	50-100
Acer campestre 'Queen Elizabeth'*	Hedge Maple	D	Gold	Inconspicuous	Spring	Brown winged seed, 0.5-1.5"	Summer or Fall	Upright	12-36"	35	35	25	50-100
Acer x freemanii 'Autumn Blaze'	Autumn Blaze Hybrid Maple	D	Red	Inconspicuous	Spring	Brown winged seed, 1.5-3"	Fall	Conical or oval, erect of spreading with a high canopy	36"	50	40	30	50-100
Acer nigrum 'Green Column'	Black Maple	D	Gold	Inconspicuous	Spring	Brown winged seed, 0.5-1.5"	Fall	Oval or rounded	24"	65	50	25	50-100
*Acer palmatum**	Japanese Maple	D	Red, gold, orange, bronze, purple or multicolor	Inconspicuous	Spring	Brown winged seed, 0.5-1.5"	Summer	Rounded, umbrella or vase	12-24"	25	25	15	50-100
*Acer paxii**	Evergreen Maple	E	N/A	Inconspicuous	Spring	Brown winged seed, 0.5-1.5"	Summer	Rounded, erect or spreading with a low canopy	12"	35	35	20	50-100
Acer rubrum 'Armstrong'*	Scarlet Maple	D	Yellow or red	Red	Spring	Brown winged seed, 1.5-3"	Summer	Columnar, erect	36"	45	15	25	50-100
Acer rubrum 'Bowhall'*	Bowhall Maple	D	Red, gold or orange	Red	Spring	Red winged seed, 1.5-3"	Summer	Upright, narrow	36"	40	15	25	50-100
Acer rubrum 'Brandywine'	Brandywine Maple	D	Deep red	Red	Spring	Seedless	N/A	Oval	36"	40	30	25	50-100
Acer rubrum 'Frank Jr.'*	Redpointe Maple	D	Red	Red	Spring	Brown winged seed, 1.5-3"	Summer	Broadly pyramidal	36"	45	30	25	50-100
Acer rubrum 'October Glory'	October Glory Maple	D	Deep red	Red	Spring	Red winged seed, 1.5-3"	Summer	Oval or rounded	36"	40	35	25	50-100
Acer rubrum 'Somerset'*	Somerset Maple	D	Red	Red	Spring	Seedless	N/A	Oval or rounded	36"	45	35	25	50-100
Acer rubrum 'Sun Valley'*	Sun Valley Maple	D	Red	Red	Spring	Seedless	N/A	Oval, densely branched	36"	40	35	25	50-100
Acer saccharum 'Autumn Splendor'* *Acer saccharum* 'Bonfire' *Acer saccharum* 'Commemoration' *Acer saccharum* 'Crescendo'* *Acer saccharum* 'Fall Fiesta'*	Sugar Maple	D	Orange or yellow	Inconspicuous	Spring	Brown winged seed, 1.5-3"	Summer	Oval or rounded, erect or spreading	8-18"	65	40	30	>100
Aesculus carnea 'Briotti'	Red Horsechestnut	D	No change in leaf color	Showy, fragrant, red or rose	Spring	Brown capsule, 0.5-1.5"	Summer or Fall	Rounded or Umbrella, erect or spreading with a low canopy	12-18"	35	30	20	50-100
Aesculus hippocastanum 'Baumannii'	European Horsechestnut	D	Gold	White	Spring	Seedless	N/A	Oval or rounded	12-24"	65	40	25	50-100

* trees to be considered on an experimental basis, as they have yet to be proven as successful street trees in Alameda (see discussion in sec. 3.2)
** minimum planter width may be less if tree is located within area marked in Appendix 13

Microsite Conditions									Root Zone Mgt.		Nursery Status			Litter Issue	Pests & Diseases	Comments
Tolerates Full Sun	Tolerates Shade	Requires Good Drainage	Tolerates Poor Drainage	Tolerates Moist Soil	Drought Tolerant	Tolerates Sprinklers	Seaside Tolerance	Tolerates Alkaline Soil	Minimum Planter Width (feet)	Hardscape Damage Potential	Nursery Availability	Nursery Origin	Stock Type			
✓	✓			✓			✓	✓	3	Moderate	Good	California	Container		Susceptible to aphids, root rot and verticillium wilt.	A good Japanese Maple substitute. Does not get good fall color in Alameda.
✓	✓	✓			✓	✓		✓	3	Low	Poor	Oregon	B&B and bareroot		Susceptible to verticillium wilt and tar spot.	Suitable for use in parking lot islands and sidewalk tree pits.
✓	✓	✓		✓		✓			4	Moderate	Good	California	Container		Susceptible to aphids, beetle borers and scales, oak root rot, root rot, sooty mold and verticillium wilt.	A fast growing hybrid of Red and Silver maple. Fall color in Alameda has been variable. Develops chlorosis in alkaline soils.
✓	✓	✓			✓	✓			3	Moderate	Good	Oregon	Container		Susceptible to anthracnose, oak root rot, phytophthora, powdery mildew, root rot and verticillium wilt.	Reputed to be one of the toughest maples for street tree use. Tolerant of severe heat and drought once established.
	✓	✓		✓		✓	✓		3	Low	Good	California and Oregon	B&B and container		Resistant to oak root fungus. Susceptible to root rot, verticillium wilt and sun scorch.	Use as understory with larger trees. Green-leaf varieties can tolerate more sun.
	✓			✓			✓	✓	3	Low	Poor				Susceptible to aphids, root rot and verticillium wilt.	
✓	✓		✓	✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	Not to be planted under high voltage lines.
✓	✓		✓	✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	Not to be planted under high voltage lines.
✓	✓		✓	✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	Very good fall color and a possible *Liquidambar* substitute. Colors ten day later than most *A. rubrum* cultivars.
✓	✓		✓	✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	
✓	✓		✓	✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	Very good fall color and a possible *Liquidambar* substitute. The last of the *A. rubrum* cultivars to color in the fall.
✓	✓	✓		✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	
✓	✓	✓		✓	✓	✓	✓		3	Moderate	Good	California and Oregon	Bareroot and container		Susceptible to beetle borers and scales, oak root rot, phytophthora, root rot and verticillium wilt.	
✓	✓		✓				✓	✓	3	Moderate	Good	Oregon	Bareroot		Susceptible to beetle borers and scales, anthracnose, oak root rot, powdery mildew, root rot and verticillium wilt.	
✓	✓		✓	✓		✓	✓	✓	3	Moderate	Good	California and Oregon	Container	Flowers, dry fruit, leaves	Susceptible to beetle borers, chlorosis, powdery mildew and rust.	Horizontal branching required pruning in early years.
✓		✓		✓		✓		✓	4	Moderate	Poor			Flowers, leaves	Susceptible to white-marked tussock moth and japanese beetle, leaf blotch, scorch, powdery mildew and leaf spot.	

Tree Species	Common Name	Foliage		Flower/Fruit									
		Deciduous/Evergreen	Fall Color	Flower Color	Flower Period	Fruit	Fruiting Period	Shape	Growth Rate Per Year (once established)	Height at Maturity (feet)	Spread at Maturity (feet)	Trunk Diameter at Breast Height at Maturity (inches)	Longevity (years)
*Alsophila australis**	Australian Tree Fern	E	N/A	N/A	N/A	N/A	N/A	Rounded or vase, erect or spreading with a low canopy	35"	25	25	15	<50
*Angophora costata**	Gum Myrtle	E	N/A	Showy, white	Summer	Brown capsule, 0.25-0.5"	Fall	Conical or rounded, erect or spreading with high canopy	24"	50	40	25	50-100
Betula nigra 'Heritage'*	Heritage River Birch	D	Gold	Inconspicuous	Spring	Catkins	Spring	Pyramidal	24-36"	45	30	30	50-100
Carpinus betulus 'Fastigata'	European Hornbeam	D	Red, gold or multicolor	Inconspicuous	Spring	Brown winged seed, 0.25-0.5"	Winter or Summer	Columnar or conical, erect with low canopy	12-24"	35	40	15	50-100
Carpinus betulus 'Frans Fontaine'	European Hornbeam	D	Red, gold or multicolor	Inconspicuous	Spring	Brown winged seed, 0.25-0.5"	Winter or Summer	Columnar or conical, erect with low canopy	12-24"	35	15	15	50-100
*Carpinus caroliniana**	American Hornbeam	D	Red, gold, orange or multicolor	Inconspicuous	Spring	Small winged seed, 0.25-0.5"	Winter or Summer	Rounded or umbrella, erect with a low canopy	12-24"	35	30	20	50-100
*Cercis canadensis**	Eastern Redbud	D	Gold	Pink	Spring	Brown pods, 1.5-3"	Summer	Rounded or Umbrella, erect or spreading with a low canopy	36"	25	25	10	<50
*Chionanthus retusus**	Chinese Fringe Tree	D	Gold	White	Summer	Purple drupe, 0.5-1.5"	Fall or Winter	Rounded or umbrella, spreading	24"	20	15	15	<50
*Corylus colurna**	Turkish Hazel	D	Yellow	Green or yellow	Winter	Small brown nut enclosed in leafy bracts, edible, 0.25-0.5"	Fall	Oval or umbrella, erect or spreading and covers an extensive area	12-24"	60	35	25	50-100
Corymbia ficifolia	Red Flowering Gum	E	N/A	Showy, orange, pink, red or rose	Spring, Summer, Fall or Winter	Brown capsule, 0.5-1.5"	Spring, Summer or Fall	Rounded, erect or spreading with a low canopy	24"	35	30	30	50-100
Crataegus x 'Vaughn'*	Vaughn Hawthorn	D	Red or orange	White	Spring	Red pome, 0.25", persisting through winter	Fall	Oval, erect or spreading with a low canopy	24-36"	25	20	15	50-100
*Cupressus sempervirens**	Italian Cypress	E	N/A	Inconspicuous	Spring	Brown cone, 0.5-1.5"	Fall	Columnar, erect	36"	50	30	25	50-150
Fagus sylvatica	European Beech	D	Bronze	Inconspicuous	Spring	Brown nut in spiny husk, 0.5-1.5", edible	Fall	Broadly pyramidal to broadly oval	24"	60	50	35	50-100
Ginkgo biloba 'Fairmont'	Fairmont Maidenhair Tree	D	Gold	Inconspicuous	Winter	Fruitless	N/A	Pyramidal with dominant leader	12-24"	50	25	40	>100
Ginkgo biloba 'Golden Colonnade'*	Golden Colonnade Maidenhair Tree	D	Gold	Inconspicuous	Winter	Fruitless	N/A	Narrow, conical	12-18"	45	25	25	>100
Ginkgo biloba 'Magyar'*	Magyar Maidenhair Tree	D	Gold	Inconspicuous	Winter	Fruitless	N/A	Narrow, pyramidal	12-18"	50	25	25	>100

* trees to be considered on an experimental basis, as they have yet to be proven as successful street trees in Alameda (see discussion in sec. 3.2)
** minimum planter width may be less if tree is located within area marked in Appendix 13

Microsite Conditions									Root Zone Mgt.		Nursery Status			Litter Issue	Pests & Diseases	Comments
Tolerates Full Sun	Tolerates Shade	Requires Good Drainage	Tolerates Poor Drainage	Tolerates Moist Soil	Drought Tolerant	Tolerates Sprinklers	Seaside Tolerance	Tolerates Alkaline Soil	Minimum Planter Width (feet)	Hardscape Damage Potential	Nursery Availability	Nursery Origin	Stock Type			
✓	✓	✓		✓			✓	✓	2	Low	Poor			Leaves	Susceptible to spider mites and root rot.	Grows best in partial shade. Also know as *Cyathea australis* , *C. cooperi* , *Alsophila cooperi* and *Sphaeropteris cooperi.*
✓			✓	✓	✓	✓	✓	✓	3	Moderate	Poor			Exfoliating bark	Resistant to oak root fungus.	Tolerates smog.
✓	✓	✓		✓		✓			3	Low	Good	California	Container		Susceptible to leaf miner, leaf spot and scorch.	Heritage Birch requires an acid to neutral soil, and will turn chlorotic in alkaline soil. Prefers moist soil. Reportedly resistant to Bronze Birch Borer.
✓	✓			✓	✓	✓	✓		3	Low	Good	California and Oregon	Bareroot and container	Dry fruit	Resistant to verticillium wilt. Susceptible to aphids, scales, oak root rot and root rot.	Needs very little pruning to maintain good form. 2" leaves produce a handsome texture, and the winter twig pattern is attractive.
✓	✓			✓	✓	✓	✓		3	Low	Good	California and Oregon	Bareroot and container	Dry fruit	Resistant to verticillium wilt. Susceptible to aphids, scales, oak root rot and root rot.	Needs very little pruning to maintain good form. 2" leaves produce a handsome texture, and the winter twig pattern is attractive. 'Frans Fontaine' is more slender than 'Fastigata'.
✓	✓	✓		✓			✓		3	Low	Good	California and Oregon	Bareroot and container	Dry fruit	Resistant to verticillium wilt. Susceptible to oak root rot and root rot.	Often multi-stemmed. Requires a moderate amount of water.
✓	✓			✓			✓	✓	3	Low	Good	California and Oregon	Container	Dry fruit	Susceptible to caterpillars and scales, anthracnose, crown rot, oak root rot, phytophthora, root rot and verticillium wilt.	Showy pink flowers bloom best in full sun, and with moderate moisture. It may require light top pruning (not topping) of vigorous top shoots to maintain its height below 25'.
✓	✓			✓			✓	✓	3	Low	Good	California and Oregon	Container	Wet fruit		Its fragrant spring flowering is quite impressive, and is attractive in fall, when the reddish berries are seen amongst the yellow fall foliage. This is a very clean looking tree. It is easily maintained below 25' in height.
✓	✓	✓		✓			✓		3	Moderate	Good	Oregon	Bareroot	Dry fruit	Susceptible to chlorosis, powdery mildew and sooty mold.	
✓	✓	✓		✓	✓	✓	✓	✓	3	Moderate	Good	California	Container	Dry fruit	Resistant to Texas root rot and verticillium. Susceptible to beetle borers and thrips, oak root rot, phytophthora and root rot.	Red flowering gum is very desirable as a flowering accent tree, with its profusion of bright flower clusters in late summer, and sporadically throughout the year. Has fragrant leaves.
✓				✓	✓			✓	2	Low	Poor			Wet fruit	Resistant to verticillium. Susceptible to aphids, beetle borers, scales and spider mites, fire blight, oak root rot, powdery mildew, root rot, rust and sooty mold.	Branches with thorns. The foliage is reddish purple when unfolding, changing to lustrous dark green at maturity and turning to orange, scarlet and purple in autumn. The white flower clusters in early June are effective for 7 to 10 days. The fruit persists all winter.
✓	✓		✓	✓	✓	✓		✓	3	Moderate	Good	California	Container	Dry fruit	Resistant to Texas root rot. Susceptible to spider mites, gummosis, phytophthora and root rot.	
✓			✓	✓		✓	✓	✓	4	Moderate	Good	Oregon	Container and B&B	Dry fruit	Resistant to verticillium. Susceptible to aphids and spider mites, canker, oak root rot, phytophthora, root rot and sooty mold.	Limit plantings to wide medians.
✓	✓	✓		✓		✓	✓	✓	3	Moderate	Good	California and Oregon	Bareroot and container		Resistant to oak root fungus. Susceptible to anthracnose.	Ginkgo is a smog tolerant and hardy tree. Not to be planted in East end of city due to large existing Gingko population. 'Fairmont' is faster growing than other Ginkgo varieties.
✓	✓		✓	✓		✓	✓	✓	4	Moderate	Good	California and Oregon	Bareroot and container		Resistant to oak root fungus. Susceptible to anthracnose.	Ginkgo is a smog tolerant and hardy tree. Not to be planted in East end of city due to large existing Gingko population.
✓	✓		✓	✓		✓	✓	✓	4	Moderate	Good	California and Oregon	Bareroot and container		Resistant to oak root fungus. Susceptible to anthracnose.	Ginkgo is a smog tolerant and hardy tree. Not to be planted in East end of city due to large existing Gingko population.

Tree Species	Common Name	Foliage		Flower/Fruit									
		Deciduous/Evergreen	Fall Color	Flower Color	Flower Period	Fruit	Fruiting Period	Shape	Growth Rate Per Year (once established)	Height at Maturity (feet)	Spread at Maturity (feet)	Trunk Diameter at Breast Height at Maturity (inches)	Longevity (years)
Ginkgo biloba 'Princeton Sentry'*	Princeton Sentry Maidenhair Tree	D	Gold	Inconspicuous	Winter	Fruitless	N/A	Narrow, columnar, erect	12-18"	50	20	25	>100
Ginkgo biloba 'Saratoga'	Saratoga Maidenhair Tree	D	Gold	Inconspicuous	Winter	Fruitless	N/A	Conical or oval, erect or spreading and covers an extensive area	12-18"	50	30	25	>100
Gymnocladus dioecia 'Espresso'*	Kentucky Coffee Tree	D	Gold	Inconspicuous	Summer	Fruitless	N/A	Oval to vase shaped with upright arching branches	24-36"	50	35	30	50-100
Jacaranda mimosifolia	Jacaranda	E	N/A	Showy blue or lavender	Spring, Summer or Fall	Brown capsule, 1.5-3"	Summer or Fall	Oval, rounded, umbrella or vase, spreading with a high canopy	24"	40	60	25	<50-100
Koelreuteria bipinnata	Chinese Flame Tree	D	Bronze or gold	Yellow	Summer or Fall	Prolific red-pink capsules, 1.5-3""	Fall	Rounded, umbrella or vase	18-24"	35	35	20	50-100
Lagerstromia x 'Natchez' *Lagerstromia* x 'Tuscarora'	Hybrid Crape Myrtle	D	Red, gold, orange or multicolor	'Natchez' has white flowers. 'Tuscarora' has pink flowers.	Summer	Brown capsule, 0.25-0.5"	Fall	Oval, rounded, umbrella or vase, erect or spreading with a low canopy	12-24"	25	15	15	50-100
Laurus nobilis 'Saratoga'	Sweet Bay	E	N/A	Yellow-green	Spring	Black berry, 0.5"	Summer	Conical or oval	12-24"	35	20	25	50-150
*Livistona australis**	Australia Palm	E	N/A	Cream	Spring	Black or brown drupe, 0.5-1.5"	Summer or Fall	Fan palm, erect with a high canopy	12"	50	30	20	50-100
Lophostemon confertus	Brisbane Box	E	N/A	Showy, white	Spring	Brown capsule, 0.25-0.5"	Summer	Oval or rounded, erect or spreading and covers and extensive area	24-36"	50	30	25	50-100
Magnolia grandiflora 'Russet' *Magnolia grandiflora* 'St. Mary'	Southern Magnolia	E	N/A	Showy, fragrant, white	Spring, Summer or Fall	Purple or red follicle, 3" long	Summer or Fall	Oval, rounded or umbrella, erect or spreading	24"	65	60	50	>100
Metrosideros excelsus	New Zealand Christmas Tree	E	N/A	Showy, red	Spring or Summer	Brown capsule, 0.25-0.5"	Summer or Fall	Oval or rounded, erect or spreading with a low canopy	18-24"	35	35	30	50-100
Nyssa sylvatica 'Red Rage'* *Nyssa sylvatica* 'Forum'*	Sour Gum	D	Red, orange or multicolor	Inconspicuous	Spring	Black drupe, 0.5-1.5"	Fall or Winter	Conical or oval, erect or spreading with a high canopy	12-18"	65	25	30	>100
*Persea americana**	Avocado	E	N/A	Showy green	Spring	Medium-large fruits, edible	Fall	Rounded, spreading	12-36"	50	40	15	50-100
*Persea borbonia**	Redbay	E	N/A	Inconspicuous	Spring	Persistent, blue, 0.25-0.5"	Fall	Rounded, spreading	12-36"	50	50	20	50-100
*Persea indica**	Avocado	E	N/A	Inconspicuous	Spring	Black, 0.5-1"	Fall	Rounded, spreading	12-36"	30	40	15	50-100

* trees to be considered on an experimental basis, as they have yet to be proven as successful street trees in Alameda (see discussion in sec. 3.2)
** minimum planter width may be less if tree is located within area marked in Appendix 13

Microsite Conditions									Root Zone Mgt.		Nursery Status			Litter Issue	Pests & Diseases	Comments
Tolerates Full Sun	Tolerates Shade	Requires Good Drainage	Tolerates Poor Drainage	Tolerates Moist Soil	Drought Tolerant	Tolerates Sprinklers	Seaside Tolerance	Tolerates Alkaline Soil	Minimum Planter Width (feet)	Hardscape Damage Potential	Nursery Availability	Nursery Origin	Stock Type			
✓	✓		✓	✓		✓	✓	✓	4	Moderate	Good	California and Oregon	Bareroot and container		Resistant to oak root fungus. Susceptible to anthracnose.	'Princeton Sentry' has fragrant flowers in Spring. Ginkgo is a smog tolerant and hardy tree. Not to be planted in East end of city due to large existing Gingko population.
✓	✓		✓	✓		✓	✓	✓	4	Moderate	Good	California and Oregon	Bareroot and container		Resistant to oak root fungus. Susceptible to anthracnose.	Ginkgo is a smog tolerant and hardy tree. Not to be planted in East end of city due to large existing Gingko population.
✓	✓		✓	✓	✓	✓		✓	3	Moderate	Good	Oregon	Bareroot		Resistant to oak root fungus.	
✓		✓		✓			✓	✓	3	Low	Good	California	Container	Flower and dry fruit	Resistant to oak root fungus. Susceptible to aphids, phytophthora and root rot.	Well-adapted to Alameda's sandy soils. Place where it will get frequent watering. Neighborhood specific. Reported to have weak branch strength.
✓	✓	✓		✓	✓	✓	✓	✓	4	Moderate	Good	California	Container	Dry fruit	Susceptible to beetle borers and scales.	Becomes a round-headed tree requiring little pruning at maturity, but needs training when young, as it tends to form multiple leaders.
✓	✓			✓	✓	✓	✓	✓	3	Low	Good	California	Container	Flowers, dry fruit	Resistant to powdery mildew. Susceptible to aphids and sooty mold.	'Tuscarora' has multiple stems.
✓	✓	✓		✓	✓		✓	✓	4	Moderate	Good	California	Container	Dry fruit	Susceptible to psyllids and scales, phytophthora and root rot.	Dense canopy of fragrant leaves. Early pruning needed to train a good shape; pruning needed less frequently with age. Requires removal of suckers.
✓	✓			✓	✓	✓	✓	✓	4	Moderate	Poor			Dry fruit	Resistant to Texas root rot. Susceptible to pigeons.	Fan palm with dark, shiny leaves. Needs moderate watering.
✓	✓		✓	✓	✓	✓	✓	✓	3	Low	Good	California	Container	Dry fruit	Susceptible to scales, phytophthora and root rot.	Previously known at *Tristanis conferta* . Drought resistant once established. Smog tolerant. The red peeling bark and foliage are reminiscent of native Arbutus. Use like a small Eucalyptus tree with few structural problems. Extensive fruit drop from mature trees sometimes causes complaints.
✓	✓			✓	✓		✓	✓	5	High	Good	California	Container	Leaves	Resistant to oak root fungus. Susceptible to aphids, scales and spider mites, root rot and verticillium wilt.	Not to be planted near drain inlets, as leaves may obstruct drainage. Only to be planted in wide planter strips or medians.
✓	✓	✓		✓	✓	✓	✓	✓	4	Moderate	Good	California	Container	Dry fruit	Susceptible to phytophthora and root rot.	Smog tolerant. Leave low trunk twigs to encourage strong structure. Not to be planted in small planter strips.
✓	✓		✓	✓	✓	✓	✓		4	Low	Good	Oregon	B&B and container	Dry fruit	Susceptible to fusarium, phytophthora, root rot, rust and verticillium wilt. Also susceptible to lime-induced chlorosis in alkaline soils.	Should use only suggested varieties to ensure good form and color.
✓	✓	✓		✓		✓	✓	✓	2	Low	Poor			Leaves	Susceptible to phytophthora root rot, mites, scales and leaf spot.	Drainage is a concern with this species. Amending soil with mulch and gypsum may suppress root rot.
✓	✓	✓		✓	✓	✓	✓	✓	5	Low	Poor			Fruit and leaves	Susceptible to borer, scales and sooty mold.	Redbay is a rugged and adaptable plant suitable to many landscape applications. Unfortunately, the wood is reportedly brittle and subject to wind damage. Pruning to keep lateral branches less than half the diameter of the trunk will increase the tree's longevity and help prevent branches from separating from the trunk.
✓		✓		✓		✓	✓		2	Low	Poor			Leaves	Susceptible to phytophthora root rot.	Might be a good substitute for Camphor if fruiting can be limited, perhaps by using Guatemalan varieties, and/or limiting selections to varieties with Type A or Type B flowers. Potential for sidewalk damage needs to be assessed. Seems to thrive in Alameda as a yard tree. Does not do well with high water table and winds. Only to be planted inland. Amending soil with mulch and gypsum may suppress root rot.

Tree Species	Common Name	Foliage		Flower/Fruit									
		Deciduous/Evergreen	Fall Color	Flower Color	Flower Period	Fruit	Fruiting Period	Shape	Growth Rate Per Year (once established)	Height at Maturity (feet)	Spread at Maturity (feet)	Trunk Diameter at Breast Height at Maturity (inches)	Longevity (years)
Phoenix canariensis	Canary Island Palm	E	N/A	Yellow	Spring	Orange or yellow drupe, 0.5-1.5"	Fall	Feather palm, erect and covers an extensive area	12"	65	25	35	50-100
Pistachia chinensis 'Keith Davey'	Chinese Pistache	D	Red, orange, gold or multicolor	Inconspicuous	Spring	Prolific red or blue drupe, 0.5"	Summer or Fall	Oval, rounded or umbrella, erect or spreading with a high canopy	12-18"	65	50	25	>100
Platanus acerifolia 'Bloodgood'** *Platanus acerifolia* 'Columbia'** *Platanus acerifolia* 'Yarwood'**	London Planetree	D	Bronze or gold	Inconspicuous	Spring or Winter	Brown seed balls, 0.5-1.5"	Summer	Oval , rounded or umbrella, erect or spreading and covers an extensive area	36"	70	50	35	>100
Podocarpus gracilior	Fern Pine	E	N/A	Inconspicuous	Spring	Purple drupe, 0.25-0.5"	Fall	Oval or rounded, erect and covers an extensive area	12-24"	50	35	30	>100
Prunus sargentii 'Columnaris'*	Columnar Sargent Cherry	D	Red, gold or bronze	Showy pink	Spring	Purple, red or black drupe, 0.25-0.5"	Fall, Winter or Summer	Columnar or vase, erect	12-36"	35	20	20	40
*Prunus yedoensis**	Yoshino Flowering Cherry	D	Bronze or gold	Showy, fragrant pink or white	Spring or Winter	Black drupe, 0.25-0.5"	Winter or Summer	Oval, rounded or umbrella, erect or spreading with a low canopy	36"	35	30	20	<50-100
Pyrus calleryana 'Aristocrat' *Pyrus calleryana* 'Chanticleer'	Callery Pear	D	Red, gold, purple or multicolor	Showy, fragrant, white	Spring	Brown pome, 0.25-0.5"	Summer	Oval or rounded, erect or spreading, low or high canopy	24"	35-50	45	20	50-100
*Quercus coccinea***	Scarlet Oak	D	Red	Inconspicuous	Spring	Acorns, 0.5-1.5"	Fall or Winter	Oval, rounded or umbrella, erect or spreading and covers an extensive area	24"	60	60	40	>100
Quercus falcata, **	Southern Red Oak	D	Bronze	Inconspicuous	Spring	Acorns	Fall	Oval or rounded	24"	65	60	40	>100
Quercus palustris *	Pin Oak	D	Bronze, red gold or multicolor	Inconspicuous	Spring	Acorns, 0.5-1.5"	Fall or Winter	Conical, rounded	24"	65	35	30	>100
*Quercus shumardii***	Shumard Oak	D	Red, gold, orange or multicolor	Inconspicuous	Spring	Acorns, 0.5-1.5"	Fall	Oval, rounded or umbrella, erect or spreading and covers an extensive area	24-36"	65	45	30	>100
Quercus suber	Cork Oak	E	N/A	Inconspicuous	Spring	Prolific acorns, 0.5-1.5"	Fall or Winter	Oval, rounded or umbrella, erect or spreading and covers an extensive area	24"	70	45	50	>100
*Quercus virginiana**	Southern Live Oak	E	N/A	Inconspicuous	Spring	Acorn, 0.5-1.5"	Fall or Winter	Oval, rounded or umbrella, erect or spreading with a high canopy	24-36"	60	60	50	>100

* trees to be considered on an experimental basis, as they have yet to be proven as successful street trees in Alameda (see discussion in sec. 3.2)
** minimum planter width may be less if tree is located within area marked in Appendix 13

Microsite Conditions									Root Zone Mgt.		Nursery Status			Litter Issue	Pests & Diseases	Comments
Tolerates Full Sun	Tolerates Shade	Requires Good Drainage	Tolerates Poor Drainage	Tolerates Moist Soil	Drought Tolerant	Tolerates Sprinklers	Seaside Tolerance	Tolerates Alkaline Soil	Minimum Planter Width (feet)	Hardscape Damage Potential	Nursery Availability	Nursery Origin	Stock Type			
✓		✓		✓	✓	✓	✓	✓	4	Low	Good	California	Container	Dry fruit and leaves	Resistant to Texas root rot. Susceptible to pigeons, *Fusarium* and root rot.	This is probably the most useful of available palms for street side uses. It should be used in areas broad enough to not only prevent the lateral expansion of the trunk from breaking pavement, but also to prevent the fruit from making a mess on the sidewalk areas.
✓	✓	✓		✓	✓	✓		✓	3	Low	Good	California and Oregon	Container	Dry fruit	Resistant to oak root fungus. Susceptible to root rot and verticillim wilt.	Requires pruning in the first 2-4 years to prevent clearance problems caused by horizontal branch growth. One of the best fall coloring trees for this climate. Not for use in heavily watered lawns. 'Keith Davey' has a more uniform structure and is easier to maintain than other varieties.
✓	✓			✓	✓	✓		✓	5	Moderate	Good	California and Oregon	Bareroot and container		'Yarwood' resistant to powdery mildew. 'Bloodgood' resistant to anthracnose. 'Columbia' resistant to both.	Will grow in almost any soil. Needs very little pruning to achieve semi-open habit and good form.
✓	✓	✓		✓	✓	✓	✓	✓	4	Moderate	Good	California	Container	Dry fruit	Susceptible to black scale.	Produces a round or oval, upright form covered with narrow blue-green foliage and a fairly dense canopy. The excellent branching is easily shaped into well structured crowns. Hardscape damage has been noted in the few mature trees in CA. Can be messy when leaves drop.
✓		✓		✓		✓			3	Low	Good	Oregon	Container		Susceptible to caterpillars, aphids, borer and scales. Trees in heavy soil sometimes subject to root rot.	This species of cherry is far better adapted to urban tree use than the more commonly used cultivars. It will tolerate poor soil. Branches don't droop, and are susceptible to breakage. First planted in Alameda in 2005.
✓		✓		✓			✓	✓	3	Low	Good	California and Oregon	Bareroot and container	Flower and dry fruit	Susceptible to caterpillars, canker, crown rot, oak root rot, phytophthora, root rot, rust and verticillium wilt.	On clay soils, plant on slopes or in raised beds.
✓	✓	✓		✓	✓	✓	✓	✓	3	Moderate	Good	Californiaa nd Oregon	Bareroot and container	Dry fruit	Fairly resistant to fire blight, oak root fungus and verticillium wilt. Susceptible to whiteflies.	'Aristocrat' only to be planted in business districts of Park St. and Webster. Requires annual pruning at the beginning to establish good structure and prevent splitting later on. Very good fall color.
✓	✓			✓	✓	✓	✓	✓	4	Moderate	Good	California and Oregon	Bareroot and container	Acorns	Resistant to verticillium wilt. Susceptible to caterpillars and scales.	This is the most colorful of the Eastern Oaks, with a reliable brilliant red color in the fall. Many specimens hold most brown leaves all winter. Possible Liquidambar substitute. Best in deep, rich soil.
✓		✓		✓	✓	✓			5	Low	Good	Oregon	Bareroot		Susceptible to caterpillars.	Appears to produce reliable red fall color with consistent upright growth habit. Does not appear subject to aphids. Possible alternative to Q. coccinea where a taller and less spreading tree is desired. Possible Liquidambar substitute.
✓	✓		✓	✓	✓	✓	✓		3	Low	Good	California and Oregon	Bareroot and container	Acorns	Resistant to verticillium wilt. Susceptible to scales, anthracnose, and occasional chlorosis, especially in clay soils.	Some branches hang very low, and may cause clearance problems unless kept pruned. Highly variable growth forms may be problematic. Brown leaves tend to hang on the tree of some specimens in winter. May become chlorotic in alkaline soil.
✓	✓			✓	✓	✓	✓	✓	5	Moderate	Good	California and Oregon	Bareroot and container	Acorns	Resistant to verticillium wilt. Susceptible to beetle borers, beetle leaves, caterpillars, insect galls, leaf miner and scales.	More easily transplanted than Scarlet Oak. Not as prone to iron deficiency as Pin Oak.
✓	✓	✓		✓	✓		✓	✓	8	Moderate	Good	California	Container		Resistant to verticillium wilt. Susceptible to phytophthora and root rot.	Does not like having persistently wet roots, therefore, cannot be planted in grass, or near irrigation. Leaf drop in spring may seem abnormal, but is typical pattern for the tree. Bark is the source of commercial cork.
✓	✓		✓	✓		✓	✓	✓	6	Moderate	Good	California	Container	Acorns	Resistant to verticillium wilt. Susceptible to insect galls, oak root rot, phytophthora and root rot.	Best in deep, rich soil, but widely adapted to a variety of soil types.

Tree Species	Common Name	Foliage		Flower/Fruit									
		Deciduous/Evergreen	Fall Color	Flower Color	Flower Period	Fruit	Fruiting Period	Shape	Growth Rate Per Year (once established)	Height at Maturity (feet)	Spread at Maturity (feet)	Trunk Diameter at Breast Height at Maturity (inches)	Longevity (years)
*Rhus lancea**	African Sumac	E	N/A	Inconspicuous	Summer	Red or yellow drupe, 0.25-0.5"	Fall	Rounded or umbrella, spreading or weeping with a low canopy	24"	25	25	30	50-100
*Taxodium distichum**	Bald Cypress	D	Bronze or orange	Inconspicuous	Summer or Fall	Fragrant, Brown cone, 0.5-1.5"	Summer or Fall	Conical, erect or spreading and covers an extensive area	24-36"	65	40	35	50-100
*Taxodium mucronatum**	Montezuma Cypress	E	N/A	Inconspicuous	Summer or Fall	Fragrant, Brown cone, 0.5-1.5"	Summer or Fall	Conical, erect or weeping and covers an extensive area	36"	65	50	50	50-100
Tilia tomentosa 'Green Mountain' *Tilia tomentosa* 'Sterling'	Silver Linden	D	Gold	Showy, fragrant, yellow or white	Summer	Gray capsule, 0.25-0.5"	Fall	Conical, oval or umbrella, erect or spreading with high canopy and extensive area	18-48"	50	40	25	50-100
Tristania laurina 'Elegans'	Swamp Myrtle	E	N/A	Showy, yellow	Spring or Summer	Brown capsule, 0.25-0.5"	Summer or Fall	Oval or rounded, erect or spreading with a low canopy	12"	25	20	15	<50-100
Ulmus americana 'Jefferson'*,** *Ulmus americana* 'New Harmony'*,** *Ulmus americana* 'Princeton'** *Ulmus americana* 'Valley Forge'*,**	American Elm cultivars	D	Yellow	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Upright or spreading, vase shape	36"	70	60	80	>100
Ulmus 'Frontier'	Frontier Elm	D	Burgundy	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Broadly oval	36"	40	30	25	unknown
Ulmus 'Morton'*	Accolade Elm	D	Yellow	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Upright, vase-shaped with arching limbs	36"	70	60	unknown	unknown
Ulmus 'Morton Glossy'*	Triumph Elm	D	Yellow	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Upright oval to vase	36"	55	45	unknown	unknown
Ulmus 'Morton Stalwart'*	Commendation Elm	D	Yellow	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Upright oval	36"	60	50	unknown	unknown
Ulmus 'Patriot'*	Patriot Elm	D	Yellow	Inconspicuous	Spring	Green, wafer-like seedpods, 0.25-0.5"	Spring	Stiffly upright, narrow vase shape	36"	50	40	unknown	unknown
Washingtonia robusta	Mexican Fan Palm	E	N/A	Inconspicuous	Summer	Edible black drup, 0.25-0.5"	Fall or Winter	Fan palm, erect and covers an extensive area	18-24"	>65	15	20	50-100

* trees to be considered on an experimental basis, as they have yet to be proven as successful street trees in Alameda (see discussion in sec. 3.2)
** minimum planter width may be less if tree is located within area marked in Appendix 13

Microsite Conditions									Root Zone Mgt.		Nursery Status			Litter Issue	Pests & Diseases	Comments
Tolerates Full Sun	Tolerates Shade	Requires Good Drainage	Tolerates Poor Drainage	Tolerates Moist Soil	Drought Tolerant	Tolerates Sprinklers	Seaside Tolerance	Tolerates Alkaline Soil	Minimum Planter Width (feet)	Hardscape Damage Potential	Nursery Availability	Nursery Origin	Stock Type			
✓	✓			✓	✓		✓	✓	4	Low	Good	California	Container	Dry fruit	Susceptible to root rot and verticillium wilt.	A dense shade tree, rather graceful with its arching branches and weeping foliage. It is tough and reliable in dry conditions, though it looks best with regular deep watering. It may require regularly scheduled light pruning (but not topping) of vigorous top shoots to maintain its height below 25 feet.
✓	✓		✓	✓		✓	✓	✓	4	Moderate	Good	Oregon	Bareroot and container	Dry fruit	Resistant to oak root fungus. Susceptible to beetle borers and beetle leaves, phytophthora and root rot.	Plant only in wide medians.
✓	✓			✓	✓			✓	5	Moderate	Poor			Dry fruit	Susceptible to beetle borers and beetle leaves.	Fairly drought tolerant, but needs ample water when young. Plant only in wide medians.
✓	✓	✓		✓	✓	✓	✓	✓	3	Low	Good	Oregon	Bareroot and container	Dry fruit	Susceptible to root rot, sooty mold and verticillium wilt.	Light green leaves with silver undersides move in any breeze. Faster growing than most Lindens, with good yellow fall color in Alameda. Unlike other Lindens, does not appear subject to aphids.
✓	✓			✓				✓	2	Low	Good	California	Container	Dry fruit and flowers	Susceptible to scales.	It is useful where only small planter spaces are available. Easily pruned to any form.
✓	✓		✓	✓	✓	✓	✓	✓	6	High	Good	Oregon	Bareroot	Dry seeds	Resistant to Dutch elm disease and elm leaf beetle.	
✓	✓			✓		✓		✓	3	Low	Good	California and Oregon	Bareroot and container	Dry seeds	Resistant to Dutch elm disease and elm yellows.	This is a hybrid between *U. carpinifolia* and *U. parvifolia* .
✓	✓			✓	✓	✓	✓	✓	6	Moderate	Good	Oregon	Bareroot and container	Dry seeds	Resistant to elm yellows, elm leaf beetle, elm leaf miner and Dutch elm disease.	This is a hybrid between *U. japonica* and *U. wilsoniana.*
✓	✓			✓		✓		✓	4	Moderate	Good	Oregon	Bareroot	Dry seeds	Resistant to Dutch elm disease.	This is a hybrid between *U. wilsoniana* , *U. japonica* and *U. pumila* .
✓	✓			✓		✓		✓	5	Moderate	Good	Oregon	Bareroot	Dry seeds	Resistant to Dutch elm disease.	This is a hybrid between *U. wilsoniana* , *U. pumila* and *U. carpinifolia* .
✓	✓			✓		✓		✓	4	Moderate	Good	Oregon	Bareroot	Dry seeds	Resistant to Dutch elm disease.	This is a hybrid between *U. wilsoniana, U. carpinifolia* , *U. glabra* and *U. pumila* .
✓	✓	✓		✓	✓	✓	✓	✓	3	Low	Good	California	Container	Dry fruit and leaves	Resistant to Texas root rot. Susceptible to beetle borers and pigeons.	A moderately invasive species. Use for special situations, such as on Burbank Street and to preserve views on Shoreline Drive. Planting at each of these locations should be at the same time to establish uniformity.

ii. DEFINITION OF TERMS IN THE TREE MATRIX

TREE SPECIES

Botanical names (Genus and species) are the Latin nomenclature for a plant, by which it is identified in nurseries. Using botanical names insures the acquisition of the exact plant desired, because common names of plants are not consistent from place to place. The botanical name used in this category consists of two parts, genus and species. Cultivars are horticulturally or agriculturally derived varieties of a plant, and they are usually cultivated for specific characteristics such as color, lack of or production of fruit, or unique foliage characteristics.

COMMON NAME

Common names of plants vary tremendously from place to place, and are not a reliable identifying feature. Common names are usually of local value, because they derive from laymen gardeners who create names based on some visible characteristic, or reference to a local individual.

FOLIAGE

Deciduous: The tree loses its leaves once a year, usually in the fall.

Evergreen: The tree loses its 2-3 year old leaves, usually over a protracted time, most often in spring.
Fall Color: The tree produces attractive fall foliage color.

FLOWER/FRUIT

Flower Color: If the tree has ornamental flowers, its colors are listed.

Flowering Period: Flowering period by season.

Fruit: If the tree produces fruit, it will be described here.

Fruiting Period: Fruiting period by season.

GROWTH/STATURE

Suitable for Planting Under Power Lines: Trees that are suitable to plant under high voltage power lines must be able to withstand puc pruning requirements without jeopardizing health or structural integrity of tree.

Shape: This category identifies the generally definable shape tree canopies take as they mature. As with height, care and urban environments will provide many influencing variables. Tree shapes are defined as follows in this database:

- Columnar = erect and almost parallel, resembling a column
- Conical = oval at the base, elongated and tapering to a narrower width at the top

- Fan Palm = fan shaped leaves with venation of the leaves extending like the ribs of a fan
- Oval = appearing elliptical, resembling an egg
- Rounded = ball-like or circular
- Umbrella = branches extending outward and down, as an umbrella does
- Vase = a narrow base, widening and arching outward towards the top

Growth Rate per Year (Once Established): Growth Rate (in inches) identifies the maximum relative rate a tree will grow. As with height, urban environments will provide many influencing variables.

Height at Maturity: The maximum height (in feet) to which the species or cultivar may potentially grow in an urban setting. Urban environments may inhibit the potential of a tree to reach the maximum height it would in a natural setting. It is important, though, to consider overhead restrictions before planting a tree.

Spread at Maturity: The maximum canopy width (in feet) to which the species or cultivar may potentially grow in an urban setting.

Trunk Diameter at Breast Height at Maturity: The maximum diameter of the trunk (in inches) when measured at breast height (4.5 feet above ground level) to which the species may potentially grow in an urban setting.

Longevity: The typical lifespan of the species in an urban setting is given in years. Longevity is an important consideration for long-term shading, screening, beauty and value of a property. Short-lived trees may also be wonderful shade trees, and can be useful where permanence is not the ultimate goal. Longevity may vary depending on proper selection of adapted species, care the tree receives, risk of mechanical damage, and the presence or lack of diseases and pests.

MICROSITE CONDITIONS

Tolerates Full Sun: The tree tolerates 6 or more hours of direct sunlight per day.

Tolerates Shade: The tree tolerates exposure to high light, but less than 2 hours of direct sunlight per day.

Requires Good Drainage: The tree requires good drainage. A soil which drains at the rate of 0.05 inches per hour or more will provide the preferred balance of air, water, and solids ideal for root growth. The very sandy or sandy loam top soils generally found in Alameda are ideal for a broad range of species.

Tolerates Poor Drainage: These trees can grow in soils that drain at a rate less than 0.05 inches per hour, such as the clay soils found throughout the fill areas of Alameda.
Tolerates Moist Soil: These trees can tolerate damp soil most of the year.

Drought Tolerant: These trees are not adversely affected by prolonged periods with little or no rainfall, once established.

Tolerates Sprinklers: These are trees that do not react adversely to sprinkler irrigation. Sprinkler watering can favor diseases such as Phytophthora or Armillaria, especially in soils with poor drainage. Some of the native Oak species are particularly susceptible to these diseases. Other species have a natural tendency to grow shallow roots. If they are sprinkler watered, their roots tend to remain even nearer to the surface (where the water is), increasing the likelihood that they will blow over in string winds.

Seaside Tolerance: Trees with a checkmark in this column do well when planted along the seaside in this climatic zone.

Tolerates Alkaline Soil: These are species that will not be significantly inhibited by growing in soils with pH levels of 7.5-8.7, assuming the high pH levels are caused by high calcium, magnesium, and slightly elevated levels of boron and sodium.

ROOT ZONE MANAGEMENT

Minimum Planter Width: This is the minimum planter space, in feet, in which the species should be used without a root barrier if pavement damage is to be avoided. Even trees listed as tolerant of very small spaces can, in very shallow soils or with sprinkler watering, cause pavement damage.

Hardscape Damage Potential: Hardscape Damage Potential attempts to qualify the tendency trees have of causing damage with their roots. Root damage is usually caused when tree roots remain close to the surface of the soil. Tree roots can cause costly damage to paving, structures and even underground utilities. Because roots nearer the tree trunk will enlarge earlier and grow more rapidly, care should be taken to space trees appropriately from structures. Local environmental and tree care conditions, such as soil type or watering habits, can affect a tree's root development. Long, deep waterings can encourage downward root growth. Shallow soils will force roots to grow horizontally rather than vertically.

NURSERY STATUS

Nursery Availability: If the species is grown in California or Oregon, it is listed as having Good availability. If the species was not found to be grown by any major nurseries in California or Oregon, it is listed as having Poor availability. This fact should not deter use of the species or cultivar, only warn the municipal personnel that they may need to source smaller suppliers, or order the tree six months or more in advance.

Nursery Origin: This indicates the state that the tree grower's operation is likely to be located. Again, this should not deter the use of the species or cultivar.

Stock Type: This notes the method by which this species is commonly sold by growers.

LITTER ISSUE

Fruits, flowers, leaves, twigs and bark can be considered litter if they tend to fall with frequency, long duration and abundance. These plant droppings create maintenance hassles when the trees are located over drives, walkways, patios or planting areas which are meant to be kept relatively clean. Problems can include hazardous slippery or bumpy surfaces, staining of surfaces, and smothering of small plants to the point of preventing their growth. However, except for fruits that are sizable and/or wet, most litter is tolerable. Some litter may be left as mulch and contribute to the improvement of the soil. If the tree drops excessive amounts of any of the mentioned plant parts, it is noted here. The fruit type, wet or dry, is also identified.

PESTS AND DISEASES

These notes identify pests and diseases by which this species might by threatened or resistant. Different plants attract different pests, and some pests will require special and regular treatments to prevent damage to the tree or its fruit. Disease resistance is a genetic characteristic that determines the tree's ability to resist disease. Trees that are resistant to a disease either do not contract the disease or show little or few symptoms of the disease. Possessing low-level disease symptoms does not significantly affect the health of the tree nor its aesthetic qualities. Because not all trees have been tested for all pests or diseases, much data is not known or documented. This field makes no claim of listing all pests and diseases of any particular tree.

COMMENTS

These are special notes as to how this particular species or cultivar will perform as a street tree.