The City of Waterford Urban Forest Plan

And
Urban Forest Resource Guide

Prepared by The
Waterford Planning Department

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Table of Contents

Executive Summary **6**
Chapter 1. Introduction **9**
Background and purpose-Waterford's Urban Forest 9
Expectation of Trees 10
Trees help save energy 10
Trees improve air quality 10
Trees provide other important urban services 11
Trees provide direct economic benefits 11
Social benefits related to trees 12
Specific environmental benefits of urban trees 12
Energy impacts
Air quality impacts
Water quality impacts
Benefits vs. Costs 14
Urban forest costs 14
Securing tree related benefits 14

Chapter 2 Urban Forest Policy Setting **15**
Existing regulations and plans 15
Open Space & Conservation 15
General Plan implementation 16
Title 12 Streets, Sidewalks and Public Places 16
Title 15 Buildings and Construction 16
Title 16 Subdivision 17
Title 17 Zoning 17

Chapter 3 Goals, Objectives and Implementation **18**
Recommendation for the management of Waterford's urban and Natural tree forest 18
Tree canopy cover 18
Tree and forest health 19
Management of the urban forest 19
Waterford Urban Forests Goals, Objective & Implementation 20

Chapter 4 Plan Physical Setting **27**
Setting 27
Location 27
Soils 27
Biological setting 32
Special status species
Fish species
Public Land and Urban Forests 35

Chapter 5 Native Oak Woodlands **37**
Native tree cover in the Waterford area 37

Existing Oak Woodlands 37
Historical impacts 37
Management of Native Oak Woodlands 38
Regeneration of Native Oak Forests 38
Management issues 39

Chapter 6 Urban Forest Management Principals 42
Introduction 44
General Management Concepts 44
Trees in parks 45
Management issues
Trees per acre
Tree condition and management concerns
Management approaches
City-maintained trees along streets and parkways 45
Management issues and approaches
Tree canopy cover over streets
Species composition
Privately-maintained trees along residential streets 46
Overview
Management issues and approaches
Trees in commercial parking lot 47
Management issues and approaches
Shading of parking spaces

Chapter 7 Panting Guidelines 49
General qualities desired for trees 49
General placement of trees 49
Locating and selecting trees to maximize Climate Benefits 51
Street trees 52
Planting patterns for street trees 52
In residential areas 53
In commercial/industrial areas and along walls 53
Trees for parks and other public places 53
General guidelines for locating and selecting trees 54
Locating Windbreaks for heating savings 55
Selecting yard trees 56

Chapter 8 Tree Maintenance Guide 60
Introduction 60
Responsibilities, duties and authority of the public works director 60
Service area maintenance
Mistletoe
Inspections
Tree inventory 61
Pests and disease 61
Tree roots 61

Overhead wires 62
Private Maintenance 62
Street and public space tree protection 62
Planting and maintenance 63
Removal and replacement 63
Tree trimming 64
Cooperation with other Departments and Agencies 64

Chapter 9 Tree Removal 66
Reasons for Tree Removal 66
Trees poses a potential safety problem
Tree is an undesirable species
Tree is creating a hardship
Construction necessitates removal

Chapter 10 Reforestation 68
Introduction 68
Replacement 68
Older trees reforestation plans 68

Chapter 11 Other Considerations 70
Determination of public trees 70
New development or subdivision street tree plans 70
Damage to trees by people 70
Business signs 70
Landscaped sound barriers 71

Chapter 12 Public Involvement 71
People play a major role in urban forest ecology 72
Planting, maintenance, and removal 72
Providers of tree care 72
Partnerships between community residents and the City 73
Community tree groups and volunteer projects 73
City-sponsored efforts 73

Chapter 13 Urban Forests Funding Resources 75
Internal funding sources 75
External funding sources 75
State and federally-funded grants
Non-governmental grants

Chapter 14 References & Resources 79

Chapter 15 Master Tree List 82

Appendix "A" Tree Descriptions 83
Appendix "B" Waterford Tree Management Descriptions 96

City of Waterford Urban Forest Plan & Resource Guide

Executive Summary

This document provides an overall framework for managing Waterford's urban and natural forest resources. It is based on the condition of the forest in 2003 and an analysis of trends that have shaped Waterford's urban forest to date and will continue to influence it in the future. The Chapters of this document are described below.

Chapter 1. Introduction This Chapter discusses the background and purpose for the development of the Waterford Urban Forest Plan. The focus of this section is on the benefits of urban trees with respect to adapting to variations in climatic condition in addition to the many other benefits of urban trees. This Chapter also addresses the overall Goals of the Waterford Urban Forest Plan and contains an overall cost/benefit summary of an urban forestry program.

Chapter 2. Urban Forest Policy Setting This Chapter examines the basis for the establishment of an urban forestry program in Waterford from the General Plan Open Space & Conservation Element through the various provisions in Waterford's Municipal Code that apply to the establishment and maintenance of Waterford's Urban Forests.

Chapter 3. Goals, Objectives and Implementation This contains a brief overview of some of the central issues of urban forestry in Waterford and identifies the Waterford Urban Forest Plan Goals, Objectives and proposed Implementation Actions.

Chapter 4 Plan Setting This Chapter includes and overview of the natural setting within which the Waterford Urban Forestry Plan is proposed. This Chapter describes the City's soil, biological and public land resources.

WATERFORD URBAN FOREST GOALS

1. Establish and maintain target levels of tree canopy throughout the City.
2. Promote conservation of existing tree resources.
3. Choose and locate new trees to maximize tree health and vigor
4. Maintain trees in a healthy and safe condition.
5. Develop an urban forest canopy that is stable over the long term.
6. Promote efficient and cost-effective management of publicly-owned urban and natural forest resources.
7. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.

Chapter 5 Native Oak Woodlands This Chapter addresses on of the more environmentally critical aspects of urban tree management, the areas native oak forests. This section contains special guidance on management practices that can be applied to the preservation/ conservation efforts necessary to preserve and protect this important natural resource.

Chapter 6 Urban Forest Management Principals This Chapter focuses on the general management issues of urban forests as they exist in Waterford. The Chapter looks at concerns over tree condition, general tree density, canopy cover, species composition, etc.

Chapter 7 Planting Guidelines. This Chapter addresses some of the unique challenges of planting trees in an urban setting. The topics of tree species selection (height, root system, water demand, etc.) in addition to picking the proper site for you tree.

Chapter 8 Tree Maintenance Guide
This Chapter addresses issues of maintaining the City's publicly owned trees. Also addressed is the need for development of an inventory program for the City's trees. Issues, such as pests, diseases, root system maintenance are addressed. This Chapter also addresses the authority vested in the Public Works Department regarding the care and maintenance of the City's publicly owned trees along streets and within public parklands.

Chapter 9, Tree Removal This Chapter contains standards, procedures and policies for the removal of publicly owned trees. The provisions are intended to provide guidance to City staff, and the public, regarding the preservation of the Cities important urban forest resources.

Chapter 10 Reforestation This Chapter addresses policies and standards for the replacement of trees within the City's urban forest.

Chapter 11, Other Considerations This Chapter discusses policies and standards for the urban forests developed as a result of City requirements for tree plantings on private development projects (parking lots, landscape plans, etc.).

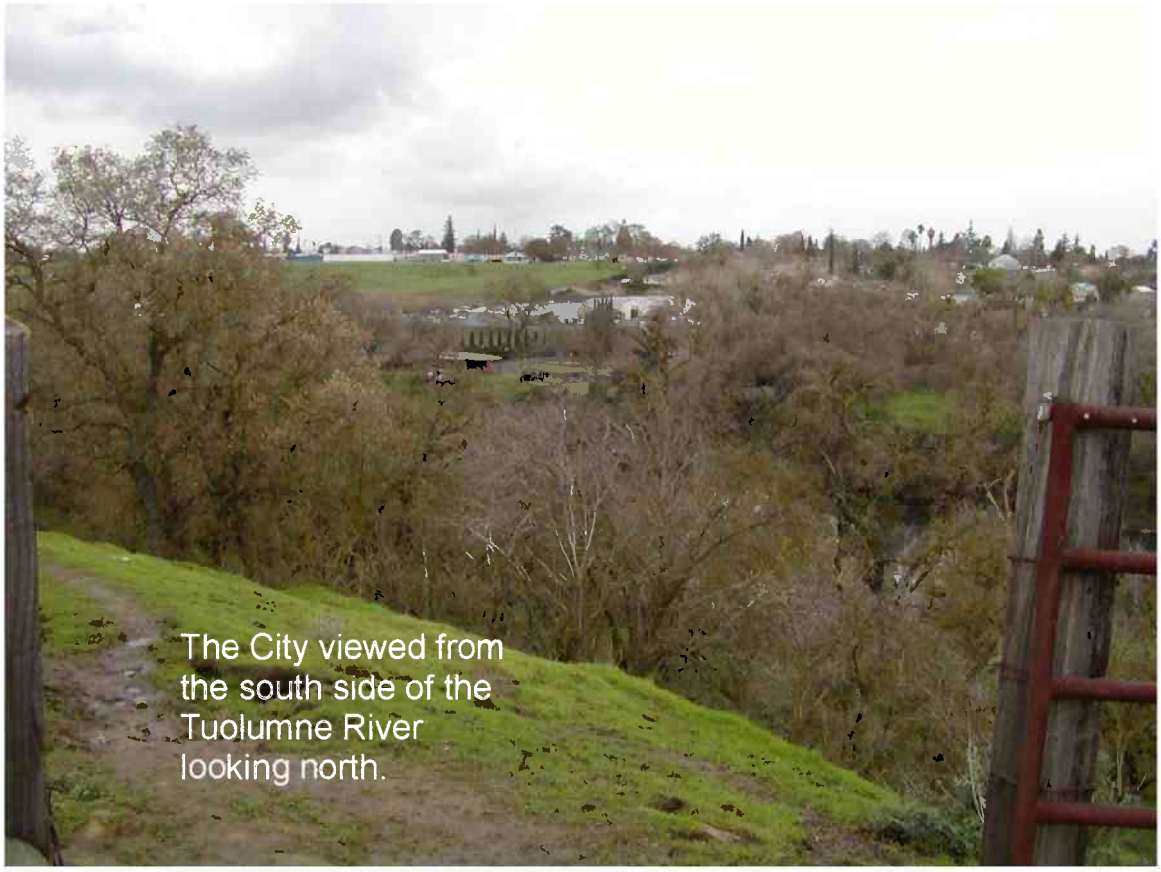
Chapter 12, Public Involvement This Chapter discusses approaches to promote public involvement in the development, care and maintenance of the Waterford's urban forests.

Chapter 13, Urban Forests Funding Resources This Chapter discusses both internal (City derived) and external funding resources that can be used to support Waterford's Urban Forest Program. The Chapter lists a number of external funding sources available to the City and to citizen groups to help fund urban forestry projects, including tree planting, environmental restoration, and community outreach and education. These sources of funding can help augment, but will not replace, the City's need to provide funding from internal sources, including assessment districts, development impact fees, etc.

Chapter 14 References & Resources This Chapter provide reference to various citations used in this document and resources for further reading on a specific topic discussed in this Plan.

Chapter 15 Master Tree List This Chapter contains a master tree list of suggested tree species that are climatically adapted for growing in the City of Waterford. This Chapter is supported by detailed tree descriptions contained in **Appendix "A".**

Management summaries of suggested tree species, for planting in Waterford's Urban Forests, are contained in **Appendix "B"** of this Plan.



The City viewed from the south side of the Tuolumne River looking north.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 1, Introduction

Background and Purpose-Waterford's Urban Forest

San Joaquin Valley Communities have been among the fastest growing areas in the State of California. The role of urban forests — trees in parks, yards, public spaces, and along streets — in the improvement of environmental quality, increased economic, physical and social health, and fostering of civic pride has taken on greater significance as these communities strived to preserve and improve their quality of life.

Urban and community forestry has been recognized as a cost effective means to address a variety of important community and national issues from improving air quality to combating global warming.

The City of Waterford has a long rich tree heritage. A dominant feature in older residential areas of our community is our tree lined streets, shaded yards, and canopied parks. The City is responsible for the care of trees that lie within the City's Incorporated Boundaries and has an interest in trees located outside its City Limits but within its Sphere of Influence. This includes trees located on the rights of way, easements, median strips, parks, and other City maintained areas.

Trees provide a variety of benefits, particularly in the urban environment. Trees in cities are widely appreciated for their aesthetic qualities. Trees play a large role in the identity of many cities. For example, a search of the internet shows that many cities throughout the world embrace the term "City of Trees" as part of their community identity.

Trees make cities more livable in a variety of ways. Some of these are difficult to quantify in economic terms. For example, trees and shrubs can help muffle urban noise, and trees provide important foraging and nesting opportunities for birds and other wildlife. However, it is possible to assign a dollar value to some of the benefits that trees provide, which emphasizes the importance of the urban forest as a key element of urban infrastructure. Researchers at various institutions have been working to quantify some of the benefits provided by the urban forest. In particular, scientists at the Center for Urban Forest Research (http://cufr.ucdavis.edu/) at the University of California, Davis, have been studying the economic benefits of trees in California communities since 1992. Their results are available online as both technical reports and short summary handouts.

Expectation of Trees

Street trees serve many purposes in an urban area. The most obvious contribution trees make is the general improvement in a city's appearance and quality of living. Tree lined streets are attractive to existing and prospective residents. Tourists are also attracted to a well-landscaped city. Visitors form first impressions of a city primarily on

its outward appearance. A city's outward visible aspect expresses the caliber and pride of its residents. One of the least expensive ways to improve a community's appearance is through a conscientious street tree planting and maintenance program.

Trees not only beautify the urban landscape but are also functional. Originally, the primary reason trees were planted in Waterford was to provide shade and cooling of the living areas. This benefit has been a major consideration in tree selection for practical and energy conservation reasons trough the years. In addition, trees improve the environment by screening undesirable views, reducing noise and wind, and providing food and shelter for wildlife. Above all, trees convert carbon dioxide into life-giving oxygen, while filtering dust and other harmful pollutants from the air. Trees give a community a feeling of permanence and dignity. They also play an important role in enhancing buildings and other structures by softening architectural lines and features.

Trees can add a monetary value to real property. Homes and building sites with trees usually sell more quickly and at higher prices than properties with no trees. Realty authorities have attributed increased valuation per home to neighborhoods beautified by a sound street tree program.

Street trees are an asset to any community, even though they require allocations for replacement, care, and maintenance. It should be noted that while many public expenditures involve capital investments in projects which deteriorate in value, investment in tree planting and maintenance is an investment in the community which increases in value.

Along with the benefits trees provide, some negative aspects are to be expected. Certain qualities of trees can lead to conflicts with people. Tree roots, leaves, insects, and low limbs can all impact residents and can sometimes cause a situation wherein the benefits of the trees are overlooked.

Realistically, conflicts will always be present to some degree. Toleration of conflicts is necessary to some degree if trees are to co-exist with us. Resolution of conflicts is a major purpose of our tree program. Corrective measures cannot be taken in every situation. This necessitates the establishment of some criteria which can be generally applied to our tree population to determine when conflicts overshadow the benefits and toleration may not be expected.

Trees help save energy

In hot climates, one of the principal economic benefits provided by trees is due to shade.

- Trees in residential yards that shade western and eastern facing windows, roofs, and walls can reduce energy needed for cooling by as much as 34% (Simpson and McPherson 1996).
- On hot summer days, temperatures within urbanized areas can be up to 10°F hotter than the surrounding countryside, a phenomenon known as the urban heat island effect (http://www.epa.gov/heatisland/).

- Buildings and pavement made of dark materials absorb the sun's rays, leading to an increase in the temperature of the surfaces and the air around them. Trees and other vegetation reduce summer temperatures through direct shading of surfaces and through the process of evapo-transpiration. Evapo-transpiration refers to the way that water is evaporated from within plant leaves, exiting through

tiny pores in the leaf. As the water evaporates, it cools the leaf and the air around it in much the same way that swamp coolers function. By combating the urban heat island effect, trees reduce the overall summer temperature within urban areas, helping to reduce energy use.

- Trees serve as windbreaks, which helps save energy by reducing the amount of outside air that infiltrates into heated or cooled building interiors (Heisler 1986).

Trees improve air quality

- Trees improve ambient air quality by removing gaseous air pollutants and particulates from the air (Scott et al, 1998).
- Although the majority of human-caused smog precursors come from moving vehicles, parked cars also emit volatile hydrocarbons and nitrogen oxides into the atmosphere that react to form smog. Cars parked in shade are much cooler and release fewer volatile hydrocarbons and nitrogen oxides into the atmosphere (Scott et al, 1999).
- As trees reduce the urban heat island effect, they also reduce the formation of photochemical smog because the chemical reactions that form smog are favored by higher temperatures (http://eetd.lbl.gov/HeatIsland/AirQuality/).

Trees provide other important urban services

- Tree canopies intercept rainfall, moderating stormwater runoff and reducing the amount of pollutants that wash off buildings and paved surfaces into creeks and storm drains (Xiao et al, 1998, Xiao and McPherson 2003, Geiger 2003).
- Tree shade over pavement slows down pavement deterioration (McPherson et al 1999).
- Trees planted along roadways can have a "traffic calming" effect which reduces driving speeds by visually narrowing the road (Otak, Inc. 2002)
- Tree roots help to hold soil in place, and tree canopies shield soil from the impact of rain drops, resulting in decreased soil erosion during storms, which improves stream water quality and reduces silt deposits in reservoirs and flood control basins.

Trees provide direct economic benefits

- A variety of studies show that trees increase residential property values. People pay more for homes with attractive trees, that are in neighborhoods with attractive trees, or that are near open space areas with trees. (Anderson and Cordell 1988, Wolf 1998b).
- A study by researchers in the State of Washington found that consumers perceive business districts with trees to be higher quality than those without trees. Consumers were willing to pay up to 10% more for goods bought in tree-lined business districts (Wolf 2003a, b).

Social benefits related to trees

A growing body of research has shown that the presence of trees in neighborhoods and views of trees and nature contribute to both physical and mental health of urban residents.

- Trees are associated with lower crime rates, and improved mental health, stronger ties between neighbors, and greater feelings of safety and well-being of City residents (Kuo 2003).
- Researchers have shown that office workers who can see nature from their desks have 23% less time off sick and report greater job satisfaction than those

who can not see any nature (Wolf 1998)
- Hospital patients with views of trees have been shown to recover significantly faster than those who can not see any natural features (Ulrich 1985).

Other Social Benefits from urban trees are:
- ♦ Abate noise, by absorbing high frequency noise which are most distressing to people,
- ♦ Create wildlife habitat, by providing homes for many types of wildlife,
- ♦ Reduce exposure to ultraviolet light, thereby lowering the risk of harmful health effects from skin cancer and cataracts,
- ♦ Provide pleasure, whether it be feelings of relaxation, or connection to nature,
- ♦ Provide important settings for recreation,
- ♦ Improve individual health by creating spaces that encourage walking,
- ♦ Create new bonds between people involved in tree planting activities,
- ♦ Provide jobs for both skilled and unskilled labor for planting and maintaining community trees,
- ♦ Provide educational opportunities for residents who want to learn about nature through first-hand experience, and
- ♦ Increase residential property values (studies indicate people are willing to pay 3-7% more for a house in a well-treed neighborhood versus in an area with few or no trees).

The answer provided by a number of studies of communities in California and elsewhere, is a definite "yes". Studies by Dr. Greg McPherson and colleagues at the Center for Urban Forest Research have consistently shown that the economically quantifiable benefits of urban trees are several times greater than their associated costs. Furthermore, their studies show that the benefit-to-cost ratio is higher for large trees than small trees (McPherson 2003). An urban forest composed primarily of trees that are small-statured at maturity provides a much lower total economic benefit to the community and has a lower benefit-to-cost ratio than an urban forest with a preponderance of large-canopied trees (Geiger et al 2004)

Specific Environmental Benefits of Urban Trees.

Energy Impacts

Rapid urbanization of cities during the past 50-years has been associated with a steady increase in downtown temperatures of about 1° F per decade. As temperature increases, energy demand for cooling increases as do carbon dioxide emissions from fossil fuel power plants, municipal water demand, unhealthy ozone levels, and human discomfort and disease.

Trees and other green-space may lower air temperatures 5-10° F. Because of the San Joaquin Valley's hot, dry summer weather, potential cooling savings from trees are among the highest in the nation. Computer simulations for an energy-efficient home in Fresno indicate that shade from two 25-foot tall trees on the west side and one on the east side are estimated to save $75 each year. Evapo-transpirational cooling from these three trees is estimated to increase savings by another $28.

Air Quality Impacts

Urban forests can reduce atmospheric carbon dioxide (CO_2) in two ways. Trees directly temporarily store CO_2 as woody and leafy biomass while they grow. Trees around buildings can also reduce the demand for heating and air conditioning, thereby reducing emissions associated with electric power production.

Urban trees provide direct air quality benefits by:

- Absorbing gaseous pollutants (ozone, nitrogen oxides) through leaf surfaces,
- Intercepting particulate matter (e.g., dust, ash, pollen, smoke),
- Releasing oxygen through photosynthesis, and
- Transpiring water and shading surfaces which lower local air temperatures, thereby reducing ozone levels.

Trees can emit various biogenic volatile organic compounds that can contribute to ozone formation.

Urban forests improve climate and conserve building energy use by:

- Shading, which reduces the amount of radiant energy absorbed and stored by built surfaces,
- Evapo-transpiration, which converts liquid water in leaves to vapor, thereby cooling the air, and
- Wind speed reduction, which reduces the infiltration of outside air into interior spaces.
- Sequestering Carbon in the atmosphere.

By shading asphalt surfaces and parked vehicles, trees reduce emission of hydrocarbons that come from leaky fuel tanks and worn hoses as gasoline evaporate. These evaporative emissions are a principal component of smog and parked vehicles are a primary source of this pollution.

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Water Quality Impacts

Urban stormwater runoff is a major source of pollution entering San Joaquin Valley Rivers and lakes. Trees improve water quality by:

- Intercepting and storing rainfall on leaves and branch surfaces, thereby reducing runoff volumes and delaying the onset of peak flows,
- Increasing the capacity of soils to infiltrate rainfall and reduce overland flow, and
- Reducing soil erosion by diminishing the impact of raindrops on barren surfaces.

Urban forests can provide other water benefits. Irrigated tree plantations can be a safe and productive means of wastewater disposal. Reused wastewater can recharge aquifers, reduce stormwater treatment loads, and create income through sales of wood products.

Benefits vs. Costs

Urban trees clearly provide a wide variety of benefits, although it is only possible to calculate an economic value for some of these. There are also obvious costs associated with planting, maintaining, and removing trees in cities. In addition, indirect costs associated with trees include the costs of clearing away fallen leaves, repairing damage to nearby structures that may be damaged by tree roots in certain planting situations (e.g., large trees planted too close to curbs and sidewalks), and the administrative costs associated with maintaining a community urban forest program. Do the economic benefits of urban trees exceed their cost?

Urban Forest Costs

Of course, there are costs associated with urban trees. Costs for planting and maintaining trees vary depending on the nature of tree programs and their participants. Generally, the single largest expenditure is for tree trimming, followed by tree removal/disposal, and tree planting. An initial analysis of data for Sacramento and other cities suggests that households typically spend about $5-10 annually per

tree for pruning, removal, pest/disease control, irrigation, and other tree care costs.

Other costs associated with urban trees include:

- Pavement damage caused by roots,
- Flooding caused by leaf litter clogging storm sewers,
- Green waste disposal and recycling (can be offset by avoiding dumping fees and purchases of mulch), and
- Irrigation costs.

Cost effective strategies to retain benefits from large street trees while reducing costs associated with root-sidewalk conflicts are needed.

Securing tree-related benefits

Many different City planning and management actions, especially those that occur during development, have a large impact on the character and condition of the urban forest. Waterford has expanded rapidly over the past decade. Urban forest planning and management actions taken over the past decade, as well as those made in the next decade, will shape the future of Waterford's urban forest for the next half century or more. To ensure the development of a thriving urban forest that will benefit the community, the City needs to develop a long term plan that accounts for the needs of trees in the urban environment. Both tree growth and tree decline are typically slow processes, so management actions related to these processes need to be initiated far in advance of the desired outcomes. This urban forest plan provides an overall strategy that will help the City maximize the benefits the urban forest will provide in the years to come

City of Waterford Urban Forest Plan & Resource Guide

Chapter 2
Urban Forests Policy Setting

Existing Regulations and Plans

The City of Waterford currently has some City regulations and plans that specifically address landscaping and urban trees. The basic guidance for the development of the City of Waterford's Urban Forest Plan and Resource Guide is grounded in the Open Space and Conservation Element of the Waterford Vision 2025 General Plan. This Element contains these specific Goals and Policies that support the development of this Plan:

Open Space & Conservation

Guiding Principal: A community that values, protects and conserves its valuable open space & other resources, with lands that benefit local residents and support and enhance the environment and economic base of the region

Goal Area A: Open Space for the Preservation of Natural Resources

GOALS

- **Maintain Waterford's Biological Resources**.
- **Maintain a High-Quality, Expanding Urban Forest**
- **Preserve Scenic Corridors and Resources**
- **Improve and Enhance Water Quality**

A.1 Identify and preserve wildlife habitats which support rare, endangered, or threatened species.
A.2 Preserve and enhance the Tuolumne River and Dry Creek in their natural state throughout the planning area.
A.3 Promote the protection and enhancement of designated scenic routes.
A.4. Improve and expand the City's urban forest.
A.5. Preserve and enhance water quality.

Goal Area OS-B: Open Space for the Managed Production of Resources

GOALS

- **Maintain and improve regional agricultural productivity**

B.1 Protect agricultural areas outside the City's urban growth area from urban impacts.
B.2 Relieve pressures on converting areas containing large concentrations of "prime" agricultural soils to urban uses by providing adequate urban development land within the Waterford City urban growth area.

Goal Area OS-C: Open Space for Outdoor Recreation
GOALS ■ **High Quality Recreational Open Space** ■ **Adequate Public Recreation Facilities** ■ **Comprehensive Urban Trail and Bike Path System**
POLICIES **C.1** Provide high-quality park and open space facilities to serve the needs of a growing population. **C.2** Maintain and expand the City's Bikeway and Trail System.
Goal Area OS-D: Open Space for Public Health and Safety
GOALS ■ **Safe Environment For Waterford's Citizens.**
POLICIES **D.1** Preserve open space areas which are necessary to maintaining public health and safety.
Goal Area OS-E: Conservation of Resources
GOALS ■ **Conserve Water Resources** ■ **Preserve and Protect Soil Resources** **E.1** Promote water conservation throughout the planning area. **E.2** Protect soil resources from the erosive forces of wind and water.

General Plan Implementation

The Waterford General Plan set forth Goals, Policies and Implementation Measures that have been implemented by means of various adopted Municipal Codes, Policies and Standards.

Specific Municipal Code provisions that have been adopted to implement and enforce the General Plan and Goals and Policies include, but are not limited to, the following:

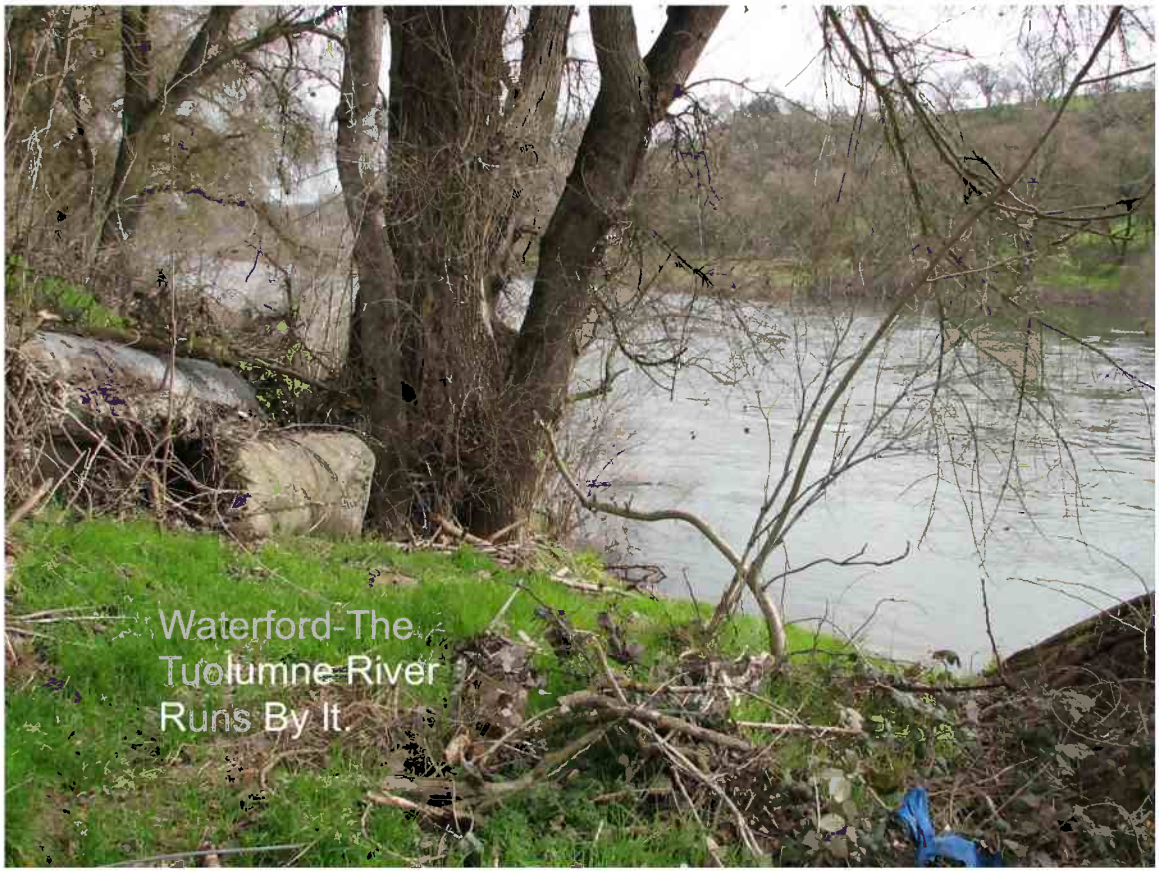
1. ***Title 12 Streets, Sidewalks and Public Places***, Chapters:
    - 12.20 Street Trees
    - 12.30 Tree and Sidewalk Maintenance
        - 05. Parks and Recreation Facilities
        - 06. Formation of Assessment or Maintenance District for Parks and Recreation Facilities
        - 07. Improvements-L Street Trees
        - 07. Establishment of Other Special Benefit Assessment, Improvement and Maintenance Districts

2. ***Title 15 Buildings and Construction***, Chapter 15.46 Water Efficient Landscaping Standards.

3. ***Title 16 Subdivision***, Chapters:
    - 16.11 Required and Supplemental Improvements
    - 16.13 Dedication, Site Reservation, Districts:

4. ***Title 17, Zoning***, Chapters:
    - 17.14 "OS" Open Space District
    - 17.18 "PS" Public and Semi-Public District
    - 17.40 General Regulations
    - 17.52 Architectural and Design Review Procedures
    - 17.54 Off-Street Parking
    - 17.62 Fencing, Walls and Hedges

The Waterford General Plan, including all its Elements, can be accessed on the Waterford Website at (http://cityofwaterford.org/departments/planning/general-plan/) Copies of various tree and urban forest related Municipal Code provisions, as they appear in Waterford Municipal Code, are available on The City of Waterford Website (http://qcode.us/codes/waterford/). The City of Waterford can be contacted directly for copies of other related standards and guidelines such as the City of Waterford Improvement Standards, Architectural Review Design Guidelines, etc.



City of Waterford Urban Forest Plan & Resource Guide

Chapter 3 Goals, Objectives and Implementation

Recommendations for the management of Waterford's urban and natural tree forest

This section summarizes some of the important issues and trends that are likely to affect Waterford's urban and natural tree forest over the next 25 to 50 years and beyond. Based on these issues, as well as local concerns and priorities, along with general urban forest management principles, the City has developed Urban Forest Goals. These Goals are used to help guide the overall management of Waterford's Urban and Natural Tree Forests. The objectives associated with these goals, and the recommendations for attaining these objectives, constitute an overall framework for the sustainable management of Waterford's Urban Forest resources.

These issues and related goals have been organized into three general topic areas. **Tree canopy cover** includes issues that are related to the overall amount of tree canopy in Waterford and its distribution within the City. **Tree and forest health** addresses the long-term health and sustainability of both individual trees and the forest as a whole. **Management of the urban forest** addresses issues that are specific to the care and maintenance of the urban forest by both the public and private sectors. These main topic areas, as well as the goals and objectives listed under them are highly interrelated. Hence, objectives listed under one goal may in fact support several other goals as well

Tree canopy cover

- Mean summer temperatures will tend to rise due to the urban heat island effect (localized heating of urban areas associated with pavement and other heat absorbing surfaces) and overall global warming trends. Increased tree canopy cover can help moderate these impacts.
- Regional air quality will continue to be an issue of concern. The Central Valley air basin in the vicinity of Modesto has historically exceeded national ambient air quality standards for ozone and, to a lesser degree, airborne particulate matter. Tree canopy intercepts and reduces both ozone and particulate pollutants.
- Many of Waterford's existing trees are young, and with proper care will continue to grow in size, increasing overall canopy cover.
- Many large commercial parking lots may never obtain even moderate levels of tree shading. Most parking lots achieve only low levels of tree shade within about 10 years and then begin to lose canopy as the result of both poor growth and trees loss.
- Due to tree placement and species selection, most existing residential tree plantings in front yards on private property are unlikely to provide significant shading of streets when trees mature.
- Native oak woodlands in Waterford are

generally in fair to poor condition, but low levels of natural regeneration in some areas may affect long-term sustainability of some native oak tree stands. Many of these trees have sustained high levels of root damage due to both construction-related activities and subsequent alteration of the root zone and are likely to decline and be removed over the next few decades.

Tree and forest health

- Greater genetic diversity within the urban forest reduces the risk of serious pest and disease epidemics. Genetic diversity can be increased by using multiple tree species and by using trees that are of seedling origin. Trees grown from seed are more genetically diverse than trees that are propagated clonally (grafted or grown from cuttings) and are consequently genetically identical. Most named tree varieties are genetically identical clones.
- A few tree species and varieties, such as flowering pear varieties, constitute a higher-than optimal percentage of all publicly-managed trees, but efforts are now being made to increase genetic diversity in both new and replacement public right-of-way streetscape plantings.
- Because much of Waterford has been developed recently over a fairly short time period, even-aged stands of trees make up large portions of Waterford's urban forest. Within these stands, trees with similar life spans will reach the end of their useful life as a group.
- Water conservation will continue to be a regional issue, especially during periods of drought. Currently, some of City-maintained trees along parkways are drought-tolerant.
- Some publicly-owned woodland along the Tuolumne River and Dry Creek has been invaded to varying degrees by aggressive non-native species that may displace native riparian vegetation.
- Native oak woodland stands are subject to "genetic pollution" from non-local oaks planted nearby. This may reduce the fitness of seedlings in the native stands and interfere with natural regeneration.
- Water management policies of the Modesto Irrigation District, along the MID Main Canal and Waterford Main Canals create vast strips of land without tree cover.

Management of the urban forest

- Most publicly-managed trees in Waterford are young and in relatively good condition. Tree care costs are likely to rise somewhat as trees become larger. The Department of Public Works maintains City owned trees.
- The majority of the trees in Waterford's urban forest are on privately-owned lands. Most property owners want to protect their trees, but many lack knowledge of currently-accepted tree care practices.
- Currently, City goals for tree planting and oak tree conservation on private land are addressed primarily through the actions of the Planning Department as part of the development review process. Through the City's development review process, the Planning Department implements Waterford's General Plan Goals and Policies that affect the urban forest.
- Once development is completed, responsibility for care and maintenance of planted trees and conserved oak woodlands shifts to other departments (Public Works Department), or to private individuals. Maintenance of

additional public trees will require additional maintenance staff (Public Works) and/or more contracted tree care services.

Within the context of the urban setting of Waterford, its organizational capacity and structure and the overall guidance and direction of the Waterford General Plan, the following Goals, Objectives and Implementation Actions have been developed.

Waterford Urban Forest Goals, Objectives and Implementation

Waterford Urban Forests
GOAL 1. Establish and maintain target levels of tree canopy throughout the City.
OBJECTIVES **1-a. Establish target levels of tree canopy cover citywide and for specific land use categories.** **1-b Maximize levels of successful tree establishment in new construction areas.** **1-c Maintain or increase tree canopy cover levels in existing developed areas.**
Objective 1-a **Establish target levels of tree canopy cover citywide and for specific land use categories.**
Implementing Actions: Adopt an appropriate goal and timetable for increasing overall canopy cover within the City of Waterford. Establish canopy cover goals for open space lands, residential areas, commercial parking lots, public facilities (including parks and schools), city-maintained parkways, and other major land use categories that will contribute to attainment of the overall canopy cover goal.
Objective 1-b **Maximize levels of successful tree establishment in new construction areas.**
Implementing Actions: Continue and expand policies and programs that require or encourage tree planting in new developments. Update existing planting standards to improve tree establishment and performance. Revisions should address improving planting site preparation (including modification of the planting hole standard), staking, tree species selection, and nursery stock quality. Increase levels of parking lot shading by adopting and implementing standards that improve design, site preparation, and short-and long-term maintenance practices.

Objective 1-c **Maintain or increase tree canopy cover levels in existing developed areas.**
Implementing Actions: Continue efforts to replant trees in publicly-maintained streetscapes and developed parks as needed to maintain appropriate levels of tree canopy. Promote appropriate tree planting on privately-owned properties by Waterford businesses and residents.

Waterford Urban Forests
GOAL 2. Promote conservation of existing tree resources.
POLICIES **2-a. Increase the level of protection provided to oaks before and during construction.** **2-b Improve the management of retained oaks.** **2-c Review and update Waterford's oak tree protection guidelines as needed to reduce tree damage during development and improve long term survival of retained trees.**
Policy 2-a **Increase the level of protection provided to oaks before and during construction.**
Implementing Actions: Promote good tree care practices by private tree owners by continuing to provide recommendations on oak tree care to interested citizens. Continue and expand tree care training / education opportunities for City staff involved in oak tree maintenance and landscape planning.
Objective 2-b **Improve the management of retained oaks.**
Implementing Actions: Increase tree cover in historically-forested open space lands by planting with locally native tree species where appropriate. Continue and expand recent efforts by Public Works Department to propagate and plant locally native trees in open space areas in collaboration with community volunteers. Continue to monitor establishment, survival, and growth of restoration plantings to help refine and optimize planting methods and identify potentially limiting factors.
Promote natural regeneration in City-owned oak woodlands by selectively protecting existing native seedlings and saplings in appropriate locations from mowing, herbicide application, or other potentially damaging maintenance practices.
Promote natural regeneration in heavily-used City-owned oak woodlands by maintaining adequate levels of organic matter on the soil surface beneath oak canopy.

Objective 2-c **Review and update Waterford's oak tree protection guidelines as needed to reduce tree damage during development and improve long term survival of retained trees.**
Implementing Actions:
Continue to implement tree protection measures and monitoring of trees designated to remain during development activities.
Continue City policies that attempt to maximize conservation of tree cover when developing in areas that contain existing tree resources. Use site planning to protect groups of trees and minimize the amount of disturbance to the roots of existing trees by expanding the protected area for root growth. Continue enforcement of Waterford's Oak Tree Ordinance.

Waterford Urban Forests
GOAL 3. Choose and locate new trees to maximize tree-related benefits
POLICIES **3-a. Match species to sites to the greatest degree possible.** **3-b Increase the use of large-canopy trees where practical to maximize tree benefits relative to costs.** **3-c. Locate new tree plantings in areas that will maximize energy conservation in buildings and shading of pavement.**
Policy 3-a **Match species to sites to the greatest degree possible.**
Implementing Actions: Provide guidelines on tree selection and placement to residents to promote planting the right tree in the right place and avoid tree/site combinations that will result in shortened tree life or excessive maintenance costs (e.g., redwoods on thin soils, big trees planted in small places, tall trees under electric distribution lines, etc.) Continue to select suitable species and place trees appropriately to minimize conflicts with infrastructure along streets (e.g., signs, traffic signals, streetlights).
Objective 3-b **Increase the use of large-canopy trees where practical to maximize tree benefits relative to costs.**
Implementing Actions: Include large-statured trees in planting plans for parks, streets, and other public lands where practical.
Objective 3-c. **Locate new tree plantings in areas that will maximize energy conservation in buildings and shading of pavement.**
Implementing Actions:
Provide homeowners with information on how to place trees to maximize energy conservation.
Use the planning and design review processes to encourage the use of parking lot and streetscape designs that provide greater amounts of pavement shading.

Waterford Urban Forests

GOAL4. Maintain trees in a healthy and safe condition.

OBJECTIVES

4-a. Follow best management practices for tree planting and care for trees on public land.

4-b Institute a program for identifying and correcting tree-related hazards on public properties.

4-c Encourage the use of best management practices (BMP) for tree planting and maintenance for trees planted on private lands.

Objective 4-a **Follow best management practices for tree planting and care for trees on public land.**

Implementing Actions:

Monitor tree health on public lands (parks, streets, open space areas, and public buildings) to identify developing pest and disease problems.

Develop a program for locating and evaluating potentially hazardous trees on public lands and public rights-of-way.

Objective 4-b **Institute a program for identifying and correcting tree-related hazards on public properties.**

Implementing Actions:

As needed, update the list of tree species potentially suitable for landscape uses in Waterford to reflect new pest problems that may render a tree unsuitable for continued planting.

Plant good-quality, preferably locally-grown, disease-free nursery stock to increase long-term survival. Implement the use of updated tree nursery stock standards to ensure the use of good quality stock. Continue existing pre-and post-planting inspections conducted by City staff, and implement new inspections where necessary for trees planted on public lands.

Continue use of current ANSI or other nationally-recognized pruning standards for pruning conducted by City staff and tree care contractors.

Develop and implement standards for assessing and improving (if necessary) soil conditions prior to planting to improve long term tree health and survival.

Assess and remediate site conditions prior to replanting trees which have died. Do not replant sites that are determined to be unsuitable for tree planting.

Objective 4-c **Encourage the use of best management practices (BMP) for tree planting and maintenance for trees planted on private lands.**

Implementing Actions:

Continue existing pre-and post-planting inspections conducted by City staff, and implement new inspections where necessary for trees planted on private lands as a condition of project approval.

Continue current City practice of accepting calls from private property owners about unusual tree pest or disease problems and, if warranted, inspecting affected trees as a way to identify new problems.
Make BMP guidelines for tree planting and maintenance available to permit applicants and the general public to encourage better tree selection, planting and care.

Waterford Urban Forests
GOAL 5. Develop an urban forest canopy that is stable over the long term.
OBJECTIVES **5-a. Avoid excessive use of individual tree species or varieties within large plantings and within the urban forest as a whole.** **5-b Increase the percentage of drought-tolerant trees in Waterford's urban forest.** **5-c Protect the long-term viability of conserved native oak woodlands in Waterford.** **5-d Maximize the effective age diversity of plantings to avoid even-aged stand problems.**
Objective5-a **Avoid excessive use of individual tree species or varieties within large plantings and within the urban forest as a whole.**
Implementing Actions: Establish upper limits for the percentage of the tree population that a single variety or species should comprise within planning areas or citywide. This will minimize the exposure of the urban forest to damage by new diseases, pests, or problems that affect only a single species or variety. Use these percentages to aid in species selection for new and replacement tree plantings. Reduce or eliminate the use of trees with high water use requirements in harsh sites such as street tree plantings and parking lots. Increase the use of locally-native oaks, especially blue oak, in new landscape plantings. Increase compliance with existing policies that emphasize the use of drought tolerant trees in new plantings. Increase the overall percentage of drought tolerant trees in City street tree plantings and in parks and private development by using more drought tolerant species in new and replacement plantings when feasible.
Objective 5-b **Increase the percentage of drought-tolerant trees in Waterford's urban forest.**
Implementing Actions: Use only trees of local genetic stock in and near native oak stands to conserve the genetic integrity of local oak populations.
Objective 5-c **Protect the long-term viability of conserved native oak woodlands in Waterford.**
Implementing Actions:
Where possible, substitute trees of different species or varieties for overused species/varieties when planting new or replacement trees.

Reduce cover of invasive exotic plant species in riparian woodlands.

Avoid using invasive exotic plant species in landscape situations to prevent escape of these plants into natural areas. Maintain a "do not plant" list for landscape plan review purposes.

Objective 5-d **Maximize the effective age diversity of plantings to avoid even-aged stand problems.**

Implementing Actions:

When planting replacement trees, avoid using trees that will reach the end of their useful life at the same time as existing trees in the planting.

In new plantings where even age plantings cannot be avoided, use a mix of species with different useful life spans. For example, oaks may live for well over 100-150 years whereas flowering pears may have a maximum useful life closer to 30-50 years.

Waterford Urban Forests

GOAL 6. Promote efficient and cost-effective management of publicly-owned urban and natural forest resources.

POLICIES

6-a. Develop a systematic approach to inspect and prune City-maintained trees in an efficient manner.

6-b Increase coordination and communication between City departments/divisions whose activities affect the urban forest.

6-c Develop basic budget information on costs associated with maintaining and caring for the community forest.

Policy 6-a **Develop a systematic approach to inspect and prune City-maintained trees in an efficient manner.**

Implementing Actions:

Develop appropriate criteria for inspecting and pruning trees of various species and size classes present in City-maintained landscapes.

Inspect and, as needed, prune young trees that will become medium to large-statured as needed (generally no more frequently than every 2 to 3 years) to establish good structure and avoid later remedial pruning.

Inspect and, as needed, prune mature trees on an appropriate schedule to maximize cost-efficiency (generally no more frequently than every 5 to 7 years).

When financially feasible, develop a tree inventory system to track tree care.

Objective 6-a **Increase coordination and communication between City departments/divisions whose activities affect the urban forest.**

Implementing Actions:

Foster communication and feedback between Planning, Public Works, and Parks and Facilities staff who deal with tree-related planning and maintenance issues.

Formally review the City tree list at least every two years and update as necessary.

Review the management plan, tree planting and maintenance guidelines, and public information brochure portions of this document every five years and update as necessary.
Develop management plans for maintaining specific sectors of the City's urban forest (e.g., parks, street segments, riparian corridors, open space areas). Formally review these management plans every 5 years and update as needed.
Continue and expand tree care training / education opportunities for City staff involved in tree maintenance and landscape planning.

Objective 6-a **Develop basic budget information on costs associated with maintaining and caring for the community forest.**

Implementing Actions:

Track costs associated with maintaining parkway and park trees to ensure assessment districts will provide adequate funding as trees mature.
As part of the City's annual budget process, prioritize necessary maintenance and preservation activities to be funded through sources other than the City funds. Where possible, use City funding to leverage for external grant funding.

Waterford Urban Forests

GOAL 7. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.

OBJECTIVE

7-a. Institute an ongoing program to educate the public about tree selection, placement and care.

Objective 1-ba **Institute an ongoing program to educate the public about tree selection, placement and care.**

Implementing Actions:

Periodically compare relative cost-efficiency of in-house versus contracted tree care for planting, young tree care, and mature tree care. Use these data to ensure that tree care tasks are allocated to contractors or City staff in a cost-efficient manner.

Provide locally-appropriate technical tree care information to residents through a variety of media to emphasize good tree selection and placement, optimal planting techniques, proper pruning of young and mature trees, and care of conserved native oaks.
Disseminate information about appropriate management of the residential/open space interface to landowners that are adjacent to public open space lands.

Encourage participation of local groups in public tree planting and tree care projects.

If local support exists, assist in the development of a tree-related non-profit / volunteer organization that can obtain grant funding for tree planting, tree care, and public education.

Provide funding, as feasible, for additional City staff time needed to carry out this objective. Alternatively, contract with a local tree non-profit to provide public outreach and volunteer coordination services.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 4, Plan Physical Setting

Setting

Like any planning effort, the location, setting and natural resources of the area within, and around, the City of Waterford shape the parameters of the "Plan" approach. Waterford, with climate, soils, and wild life characteristics, is in an excellent position to reap maximum benefit from an "Urban Forest" program effort.

This Chapter will examine two critical "setting" issues that significantly impact the "shape" or approach of the Waterford Urban Forest Plan, soil resources and biological setting.

The soils of the Waterford area are of excellent quality and provide very few limitations to tree growth and management. At the same time, the natural biological setting of the City creates constrains to Urban Forest management practices, particularly in the riparian corridors along the Tuolumne River and Dry Creek.

While the "biological" resources of the area create unique constrains, to the Waterford Urban Forest program, they also create unique opportunities and benefits that contribute to the unique quality of life enjoyed by Waterford residents.

Location

The City of Waterford is located on a bluff overlooking the Tuolumne River. The Waterford "urban area", which includes future urban expansion areas, is bounded on the north by Dry Creek and the South by the Tuolumne River. The area contains excellent agricultural land which predominately developed with various fruit and nut orchards. The City is well endowed with the natural resources necessary to support a vigorous Urban Forest program.

Soils

The Soil Conservation Service (now known as the Natural Resources Conservation Service (NRCS) has mapped 30 different soil associations in the eight physiographic provinces in the Stanislaus County. In the eastern portion of Stanislaus County, where the city of Waterford is located, there are six physiographic provinces and 16 soil associations. The physiographic provinces in this area are recent alluvial floodplains, basin lands, young alluvial fans, moderately old fans, low alluvial terraces, and high alluvial terraces. The following sections briefly describe the soil associations within each of the six physiographic provinces.

Recent Alluvial Floodplains
Soils in this physiographic province are typically level, deep, range from very well drained and productive to poorly drained and saline-alkaline. Erosion hazard is estimated to be low.

Basin Lands
Soils in this physiographic province are generally level, generally alluvial in origin, and poorly drained because of their high clay content. Some of these soils would be considered expansive under the Uniform Building Code. Erosion hazard is estimated to be low.

Young Alluvial Fans
Soils in this physiographic province are generally level, generally found adjacent to the floodplains and basin lands. Erosion hazard is estimated to be low.

Moderately Old Fans and Low Alluvial Terraces
Soils in these physiographic provinces are generally level with some variability in the rolling hills, generally older than the soils of the young alluvial fans, resulting in rock-like hardness at shallow depths. Erosion hazard is estimated to be low to moderate.

High Alluvial Terraces
Soils in this physiographic province are generally level with some variability in the rolling hills. Where the land surface is nearly level or only gently undulating, the soils have a subsoil of dense clay or a hardpan. The soils have lower clay content on the rolling hills. Erosion hazard is estimated to be low to moderate.

According to the *Soil survey for Eastern Stanislaus County* (1990) soils within the study area range from B-D, with Type C soils accounting for approximately 56 percent of the soils, Type B soils accounting for 42 percent of the soils and Type D soils accounting for approximately 4 percent of the soils.

Figure 4.1
Waterford Area Soils Map

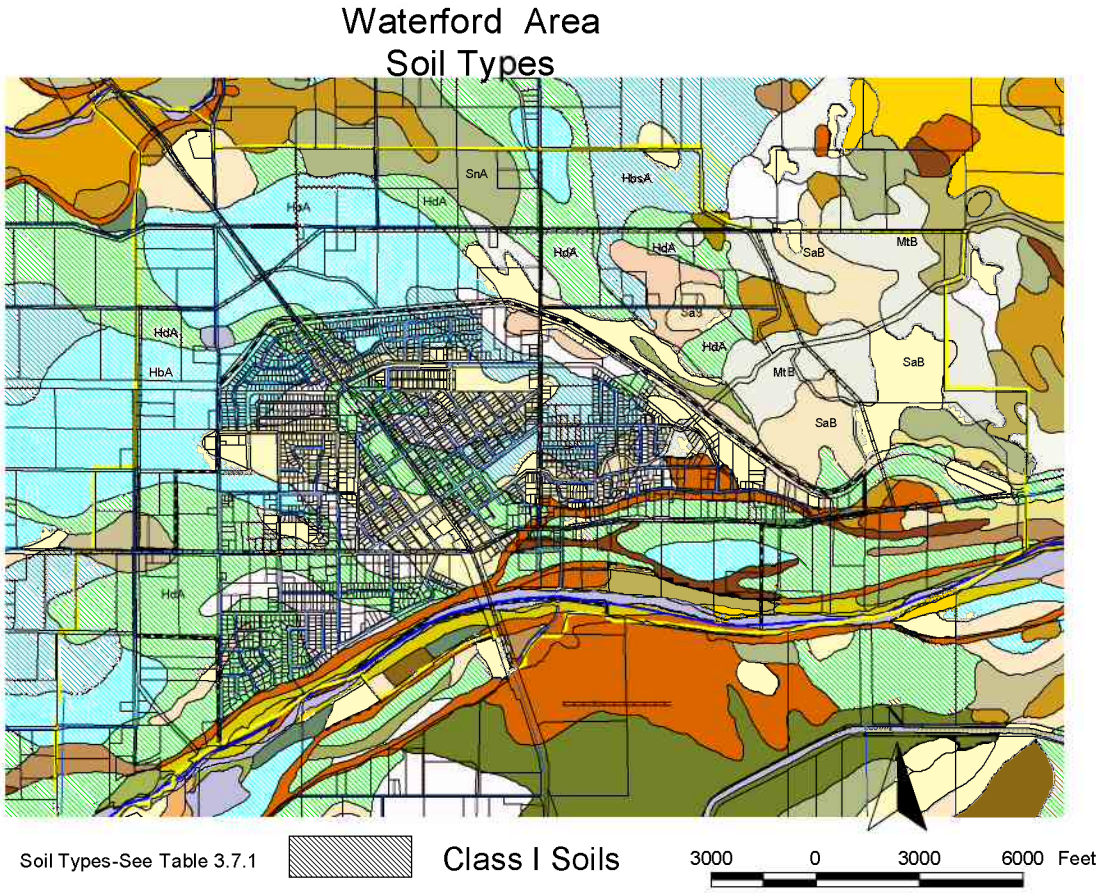


Table 4.1

Major Soil Types in the Waterford Area
Eastern Stanislaus Area, California
Soil Survey Series 1957, No. 20

Map Symbol	Name	Position & Slope	Drainage	Permeability	Runoff	Erosion	Fertility	Capability Unit
GsA	Greenfield sandy loam, 0 to 3 percent slopes	Nearly level to very gently sloping alluvial terraces	Good	Moderately Rapid	Very Slow	Slight	High	IIw-2
GvA	Greenfield sandy loam, deep over hardpan, 0 to3 percent slopes	Nearly level to very gently sloping alluvial fans	Good	Moderately Rapid	Very slow	Slight	Moderate to High	IIs-3
HbA	Hanford fine sandy loam, 0 to 3 percent slopes	Nearly level to very gently sloping alluvial fans	Good	Moderately rapid	Very slow	Slight	High	I-1
HbsA	Hanford fine sandy loam deep over silt, 0 to 1 percent slopes	Nearly level to very gently sloping alluvial fans	Good	Moderately rapid	Very slow	Slight	High	I-1
HaA	Hanford sandy loam	Nearly level to very gently sloping alluvial fans	Good	Rapid	Very slow	Slight	Moderate to High	I-1
HdB	Hanford sandy loam, 0 to 8 percent slopes	Gently sloping terrace edge	Good	Rapid	Slow	Slight	Moderate to High	IIe-1
MoA	Modesto loam, 0 to 1 percent slopes	Nearly level valley floor	Moderately Good	Slow	Very slow	Slight	Moderate	IIs-7
MtA	Montpellier coarse sandy loam, 0 to 3 percent slopes	Gently undulating high old fans	Good	Slow	Very slow	Slight	Low	IIIs-3
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes	Undulating, high old fans	Good	Slow	Slow	Slight	Low	IVe-3
PtC	Peters clay, 8 to 15 percent slopes	Smooth or concave slopes	Good	Slow	Slow to medium	Slight	Moderate	IVe-5
RaA	Raynor clay, 0 to 3 percent slopes	Very gentle slopes; smooth or slightly concave	Good	Slow	Very slow	Slight	High	IIIs-5

Table 4.1 ***Continued***
Major Soil Types in the Waterford Area
Eastern Stanislaus Area, California
Soil Survey Series 1957, No. 20

Map Symbol	Name	Position & Slope	Drainage	Permeability	Runoff	Erosion	Fertility	Capability Unit
SaB	San Joaquin sandy loams, 3 to 8 percent slopes	Undulating old alluvial fans	Good	Very slow	Slow to medium	Slight	Low	IVe-3
SnA	Snelling sandy loam, 0 to 3 percent slopes	Smooth, nearly level alluvial terraces	Good	Moderately slow	Slow	Slight	Moderate	IIs7
WmB	Whitney sandy loams, 3 to 8 percent slopes	Ridge tops and undulating areas	Good	Moderate	Slow	Slight	Moderate	IIIe-1

In general, the high quality of the soils in, and around, the City of Waterford account for the highly productive orchard and field crops grown in the vicinity of the City and forms the base for it's agricultural driven economy.

Biological Setting
The area, with its two major water courses (Dry Creek and the Tuolumne River) also contains a rich and diverse wildlife setting.

Past and Current Biological Context:
The area, in general, ranges from relatively flat to the west and gently rolling as it rises to the east. The majority of the area, surrounding the City of Waterford, consists of agricultural lands that support non-native annual grasses and forbes when they are not being cultivated for annual crops, orchard or irrigated pasture. The biological communities and special-status species located in the project area are described below.

Biological Communities
Six biological communities were documented in the project area; non-native annual grassland, artificially-created seasonal wetland, drainage, mixed riparian woodland, agricultural field, orchard and vineyard, irrigated pasture, and developed. Dry Creek and the Tuolumne River and associated riparian communities are major components of the natural "urban forest" elements of the City of Waterford.

Non-native Annual Grassland.
Non-native annual grassland is the dominant community type in the north-eastern portion of the area. Non-native annual grasslands consist of dense to sparse covers of annual grasses that often grow with a variety of showy annual forbs (both native and non-native). Common plant species are wild oats, bromes, fescue, barbed goat-grass, Italian ryegrass, mustards, filarees, yellow star-thistle, rancher's fireweed, and chickweed.

Grasslands support insects amphibians, reptiles, and small birds and animals that are preyed on by other wildlife, including Red-tailed Hawks, Red-shouldered Hawks, American Kestrels, Great-horned Owls, California Voles, deer mice, California ground squirrels, and coyotes. Grasslands near open water and riparian habitats are used by the most wildlife species because they provide places for resting, breeding and escape cover. Much of the non-native grassland in the project area is heavily disturbed from roadside activities, which reduces the quality of the habitat for wildlife and decreases the number of species expected to occur there.

Agricultural Field. Agricultural fields and their adjacent unimproved roads are habitat for a wide variety of weedy plant species. Most of these species are non-native, and potential for the occurrence of special-status plant species is very low. Common weedy plants occurring in the agricultural fields and along the unimproved roads were ripgut brome, red-root amaranth, and common knotweed. During periods when the field is fallow, non-native species of annual grasses and forbes become established

Orchard. Orchards, mostly almond and walnut, are found on much of the land immediately adjacent to the City. The orchards include mature trees that provide nearly complete canopy cover and minimal undergrowth is present between the rows of trees. Non-native annual grassland form the under-story of the orchard habitat.

Representative wildlife of orchard lands in the Central Valley includes Yellow-billed Magpie, American Crow, Western Scrub Jay and the California ground squirrel.

Irrigated Pasture
Irrigated pasture is typically grazed intensively and is low in species diversity and has low potential for the occurrence of special-status species. Common plant species of pasture includes, primarily, annual and perennial grasses and forbes such as tall fescue, Italian ryegrass, soft chess, and curly dock.

Developed Areas
Most of the project area components extend through developed areas and do not support sensitive biological resources. These areas include roads, residential neighborhoods, commercial and industrial development and public facilities. They provide minimal habitat values for local wildlife species except where "urban" tree (forests) have been developed along city streets, parklands and within portions of the Tuolumne River pass through the City.

Natural Waterways and Canals
Dry Creek and the Tuolumne River, natural drainage channels into these waterways, along with several irrigation canals, occur in the project area. Dry Creek and the Tuolumne River are perennial drainage corridors and contain mixed riparian woodland vegetation along their banks. The canal system is artificially created and constructed dirt and, some cases, concrete-lined to reduce seepage. These irrigation canals are typically groomed to reduce vegetation and, as a result, do not contain any wetland or riparian value.

Both Dry Creek and the Tuolumne River provide important habitat for a variety of wildlife. Vegetation growing along the edges of the water course provides nesting habitat for several bird species and foraging and refuge habitat for amphibians, reptiles and mammals occupying the open water and adjacent grassland habitats.

Birds such as Herons and Belted Kingfishers forage in these communities, primarily along the water's edge. Many species of insectivorous birds, including White-throated Swift, Barn Swallow, Cliff Swallow, Black Phoebe, and Ash-throated Flycatcher, catch their prey over open water.

Riparian Woodland
As stated above, riparian woodland occurs along the banks of Dry Creek and the Tuolumne River. This woodland area contains a mix of mature trees (valley oak, Fremont's cottonwood, and willows) and shrubs. Elderberry shrubs frequently occur just outside this riparian corridor.

Despite local disturbances from urbanization in the project area, the riparian forest provides an important wildlife resource. Riparian trees and shrubs in the study area provide nesting habitat for numerous bird species that forage in the multi-layered vegetation of the riparian forest and in adjacent non-naïve annual grassland areas and open water habitats. Birds typically found these riparian forests include Red-tailed Hawk, Red-shouldered Hawk, American Robin and Acorn Woodpeckers.

Special-Status Species

Special-Status Plants
Based on a review of existing information, species list obtained from the USFWS, and species distribution and habitat requirements data, there is a low potential for special-status plans in the City's proposed Sphere of Influence. Most of the project area is developed or heavily disturbed and does not support suitable habitat conditions for special-status plans known to occur in the region.

Special-Status Wildlife
Based on a review of existing information, species lists and species distribution and habitat requirements, 19 special-status wildlife species were determined to have potential to occur in the project region, mostly along the riparian corridors surrounding the Tuolumne River and Dry Creek.

Valley Elderberry Longhorn Beetle. Elderberry shrubs are found along the banks of the Tuolumne River and Dry Creek. These shrubs provide suitable habitat for this species.

Special-Status Raptors. Annual grasslands and agricultural habitats to the north and east of the City's proposed Sphere of Influence provide suitable habitat for four special-status birds including Swainson's Hawks, White-tailed Kites, Northern Harriers, and Loggerhead Shrieks. The riparian woodland habitat along Dry Creek and the Tuolumne River provides suitable nesting habitat for Swainson's Hawks.

Western Pond Turtle. Dry Creek provides suitable aquatic habitat for the western pond turtle.

Fish Species
Fisheries Resources
In general, resident fish communities of the Sacramento and San Joaquin Valley floor are dominated by introduced warm-water species. Based on their known geographic distribution and general habitat requirements, resident warm-water species such as sunfish, catfish, carp, and mosquito-fish are likely to occur in the project area.

Chinook Salmon
La Grange Dam (built in 1893) is the upstream barrier to Chinook salmon (*Oncorhynchus tshawytscha*) migration. Spawning now takes place in the 25-mile reach below the dam, and juvenile rearing takes place throughout the lower Tuolumne River. The quantity of habitat for salmon in the Tuolumne River has been degraded over the years by many factors. Efforts are underway to improve the segments of the Tuolumne River and enhance the quality of designated spawning areas.

Currently, the entire Chinook salmon population in the San Joaquin River is made up of fall-run Chinook that spawn between October and December. Small numbers of spawners have been observed in the Tuolumne River as late as February. Recent spawning escapement of Chinook salmon in the Merced, Tuolumne and Stanislaus rivers is highly variable. Higher returns are strongly correlated with above normal and wet water year types. Similarly, lower spawning escapements are correlated with normal, dry, and critically dry water years. Very low spawning escapements since 1990 are related to drought conditions between 1987 and 1992.

Steelhead
Steelhead is the anadromous form of *O. mykiss* that is listed by NOAA Fisheries as threatened, but recent court decision forced

the NOAA Fisheries to propose a re-listing of both anadromous and resident populations of *O. mykiss* as threatened. The species can be either anadromous or resident in freshwater streams or rivers. Individuals that do emigrate to the sea are call steelhead and individuals that remain resident in freshwater are termed rainbow trout. Both adult steelhead and rainbow trout typically survive after spawning, though it is rare that adults will spawn more than twice.

Steelheads have a life history similar to salmon. The primary difference is that juvenile steelhead remains in the tributaries for at least one year before smolting. The majority of the spawning for winter-run steelhead generally occurs in December. Steelhead eggs are deposited in gravels and hatch in 30-60 days. Fry generally emerge during April and May, and juvenile steelhead generally spend 1-3 years in freshwater before emigrating to the ocean, where they generally spend 2-4 years before returning to freshwater to spawn. Adults that survive spawning return to the ocean from April through June. Juveniles usually emigrate from November through May. They require silt-free streams with rocky/gravel substrates for spawning with cool, fast-moving water near riffles to keep eggs oxygenated.

Historically, winter-run steelhead are native to the Sacramento and San Joaquin river Basins and are the only race found in the Central Valley and frequent the Tuolumne River in the along the City of Waterford's river frontage.

Public Land and Urban Forests.
Public land holdings within the City of Waterford contain a significant part of the City's urban forest tree inventory.

Schools

The Waterford Unified School District is comprised of the Richard M. Moon Elementary School, the Lucille Whitehead Intermediate School, the Waterford Middle School, and Waterford High School. Waterford High School is located at 121 S. Reinway Ave. in the city. Richard M. Moon Elementary provides K-3, 4 services and is located at 219 N. Reinway. Lucille Whitehead Intermediate School provides 4-6 grades and is located at 119 N. Reinway Ave. Waterford Middle School which serves grades 5-8 students, is located at 12916 Bentley. Due to the nature of how these school lands are used, tree densities are very low in these open areas dedicated to school use.

Parks
The Waterford park system consists of both active and passive recreational areas, including a variety of park types. The city of Waterford has approximately 60 acres of parkland, including river park trails along the Tuolumne River corridor.

The City of Waterford has acquired and is attempting to acquire property and/or easements along its southern boundary abutting the Tuolumne River. The goal of the Tuolumne River Parkland Acquisition Program is to protect an important environmental resource along the river. The river provides habitat corridors for fish and wildlife. It also serves the functional purpose of carrying off storm water runoff during the rainy season. An additional goal of the Tuolumne River Parkland Project is to preserve and enhance existing passive recreational uses along the riverfront area and provide for development of new public recreational uses.

Along with the Tuolumne River Park areas, the City owns and maintains several community parks.

Beard Park is the city's largest and most heavily used park. This 11.61 acre park serves as Waterford's community park. It is the core of Waterford's park and recreation system providing both open space and recreational opportunities.

Skyline Park This Park is currently owned by the City of Modesto; and contains a municipal water well. The well is fenced and the rest of the site is landscaped with grass and newly planted trees. The property is approximately 1.16 acres in size.

Basin Park Basin Park is a shallow detention basin located within a newly developed single-family residential area. The site was dedicated for park use as part of the development agreement between the city and the subdivision. The 1.97acre park contains a turf area within the rectangular depression that takes up most of the park.

River Park This 2.50-acre site includes a pavilion and restroom facilities and has a large grass area and many mature trees. Given these conditions and its location adjacent to the Tuolumne River it has the potential to be a very popular neighborhood park. A master plan is being considered to guide the future development of this park and the whole Tuolumne River Parkland system.

River-walk Trail This linear park is also part of the Tuolumne River Parkland area. It is located between the Riverpointe development of single-family residential houses to the north and the Tuolumne River to the south. Its width varies between 75 and 125 feet. This narrow corridor is heavily wooded and has an existing dirt trail that runs approximately 2000 feet.

River Park (Phase II, former Lambert parcel) The city has acquired this 7.51-acre parcel and plans to integrate it into River Park as part of the Tuolumne River-Walk and River Park trail system. This property is located along the Tuolumne River and will link over 3000 feet of riverfront parklands along the Tuolumne River.

Tuolumne River Parkway Several adjacent parcels connect from S. Reinway to the eastern edge of the Riverpointe subdivision and Riverwalk Trail. These parcels include a 19.6 acre parcel and other parcels (totaling nearly 15-acres) purchased by the City to connect individual City parkland and providing riverfront access along the entire length of the Tuolumne River along the entire Waterford city limits as it borders the River.

Brethren Park This site is developed with landscaping, a pavilion and playground facilities. Although the park is small, 0.38 acres or 16,600 square feet, it provides recreational value to this multi-family area, which mainly consists of apartments with limited outdoor space.

Strip Parks The city of Waterford currently has four neighborhood strip parks. These linear parks are 50 feet wide greenway corridors containing a paved path. They include the three Welch Street strip parks and the Bonnie Brae strip park. The Welch Street strip parks were constructed in three phases and occupy portions of the old Waterford Irrigation Canal system. The Welch Street strip parks will be approximately 2,580 feet in length.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 5
Native Oak Woodlands

Native tree cover in the Waterford area

In Waterford, as in much of California, the state of the native vegetation that existed prior to settlement is clouded by the lack of records from early explorers and settlers. However, based on our knowledge of oak woodland ecology, existing vegetation, historical information, and some early photographs of the area, it is possible to draw some conclusions about past conditions and possible future potential of Waterford's native oak woodlands.

Existing Oak Woodlands

Existing native Oak Woodlands, in the Waterford area, are typically located along the riparian corridors of the Tuolumne River and Dry Creek. Most of these riparian woodlands consist of relatively narrow bands of trees, typically about 110 to 160 feet wide. Approximately 80 to 100% of the land area within these riparian corridors is covered by tree canopy. Most riparian woodlands in Waterford would be expected to have complete (100%) or nearly complete canopy cover at maturity.

The health and condition of trees, within stands, are important indicators of the health and sustainability of the stand as a whole. Many of Waterford's native trees are long-lived species that tend to decline slowly in response to stressful conditions and diseases. Evaluating tree condition provides clues to unfavorable stand conditions, such as competition due to overcrowding or lack of young trees. Tree condition ratings can also help identify trends that will change the stand in the future. For example, if older canopy trees are in decline, tree death and canopy cover loss are likely over the short term, increasing the importance of natural regeneration to refill gaps created in the canopy.

Waterford's riparian woodlands are generally much denser than its upland woodlands, a pattern that is typical throughout most surrounding area. Various non-native tree species, including fig, mulberry, silk tree, privet, Chinese tallow tree, and plum cherry are found in some of the riparian woodlands. The California Invasive Plant Council (Cal-IPC), at (http://www.cal-ipc.org/) maintains an inventory of exotic plants that are invasive in natural areas. Invasive plant species, such as Chinese tallow tree and fig can proliferate in riparian areas, displacing native vegetation and disrupting native ecosystems.

Historical Impacts

Waterford's current oak woodlands have been greatly altered by past human activities. Virtually all of these oak

woodlands were at least partially logged at various times over the past 100 or more years or cleared to accommodate agricultural management practices. Many of the existing trees in the area are second- or third-growth trees; that is, trees that arose after the first or second round of tree cutting and clearing, respectively.

Because the locally native oak species all have potential life spans in excess of 300 years, most of the second and third-growth oaks in these areas are still in their prime.

Management of Native Oak Woodlands

Because most tree roots are relatively shallow, compaction of the soil surface can directly damage or kill fine roots. Soil compaction also reduces water infiltration and diffusion of oxygen into the soil. These changes also negatively affect root growth and health. Because the soil typically lacks an organic mulch layer, tree roots are also subjected to greater extremes of soil temperature and moisture stress. Natural oak woodlands typically have a well-developed mulch layer that not only moderates soil conditions but provides a source of nutrients needed for roots and their associated soil microorganisms and provides a favorable seedbed for oak seedling establishment.

Regeneration of Native Oak Forests

Although the shaded environment under the tree canopy helps oak seedlings establish, the seedlings are subsequently suppressed by the overhead trees. Consequently, understory oak seedlings persist in reserve for many years and normally do not grow into trees until a canopy opening develops through the death of an over story tree. At that point, the established seedlings grow rapidly to fill the gap. Many of the existing second- and third-growth stands that developed after cutting followed this pattern of regeneration.

In species such as willows and cottonwoods, seedlings establish best on bare mineral soil in open sites after some sort of disturbance, such as a flood. In contrast, in locally native oak species, seedlings typically become established in the natural mulch layer beneath existing tree canopy.

Oaks can also become established from seed in pre-existing openings in favorable sites that have adequate amounts of mulch cover and soil moisture. This is why oak seedlings often become established in openings close to existing oak canopy and in irrigated landscape beds.

Regeneration refers to the process by which new trees are established in forests and woodlands to maintain the stand as existing trees die or are removed. Seedlings and saplings in the understory are also commonly referred to collectively as regeneration. Regeneration patterns vary between species. In addition, a given species may exhibit different regeneration patterns on different sites. For example, regeneration may be much more widespread in moist sites compared to dry sites.

To maintain woodland over the long term, regeneration is needed to replace mature oaks that decline and die. Only a relatively small percentage of the seedlings present in the understory will survive to become trees when a gap in

the canopy is created by tree death. Hence, low numbers of seedlings (less than about 10-15 healthy seedlings and saplings per over story tree) may indicate that regeneration is inadequate to maintain the stand if mature trees die.

Management issues

Change, either for better or worse, typically occurs slowly in native oak woodlands. Even if corrective actions are undertaken immediately, it may require many years before the impacts of these activities are obvious. Both tree growth and tree decline can proceed slowly, especially for blue oak.

Some of the recommended practices can be implemented with little or no additional cost to the City. For instance, changing mowing height and the timing of mowing to help conserve seedlings does not increase the cost of mowing operations. Similarly, where well-placed natural oak seedlings exist, the only cost associated with tree establishment may be placing a stake next to the seedling to mark its position and prevent its destruction. Locally native oaks can be restored in many areas by directly out-planting locally-collected acorns in the fall. Community volunteers organized by staff from Public Works Department have already accomplished projects of this type in some areas and could be involved in efforts to locate and mark existing natural seedlings as well.

Planting projects are especially important in old clearings that contain no or very few trees. Because natural oak seedlings establish most readily under or near existing oak canopy, natural re-colonization of large openings by oaks may take centuries if it occurs at all. Direct planting into large openings is often the only practical way to ensure that oak woodlands become reestablished in these areas.

Native oaks directly seeded as acorns can often be established without irrigation and with little or no maintenance. Methods for direct planting of oaks are available online at (http://phytosphere.com/oakplanting/oakplanting.htm) and are also discussed in detail in UC ANR Publication 21601 (McCreary 2001). The California Native Plant Society's website includes a listing of nurseries that can grow native materials on a contract basis (http://www.cnps.org/links/native_plant_nurseries.htm).

Table 5.1
Natural Oak Woodland Management

Objectives	Priority	Management activities	Woodland types
Maintain layer of organic mulch on soil surface to encourage oak seedling establishment and promote root health of existing trees	High	- Change mowing practices (mower height, timing) to conserve organic matter on soil surface (e.g., leave at least 4-6 inches of residue where possible, especially within and near tree drip lines; attempt to time final mowing before annual plants are completely dry to avoid excessive loss of residue) - In critical areas (e.g., heavily used sites, root zones of trees showing evidence of decline) apply 3-4 inches of clean wood chips as mulch within root zone.	Upland (primarily)
Promote natural regeneration and restocking of native tree cover, especially in low-canopy areas and areas where existing trees are in decline.	High	- Selectively protect appropriately located existing native seedlings / saplings from destruction caused by mowing, herbicide application, etc.	Riparian Upland
Reduce cover of non-native species to promote health and regeneration of native trees and shrubs.	High	- Eliminate small localized infestations (a few individuals to about 0.25-0.5 acre) of invasive species before they spread further. - Minimize the amount of disturbance during eradication efforts.	Riparian Upland
	Medium	- Suppress and/or remove large infestations (0.5 acre or more) of invasive exotic trees (e.g., privet) and shrubs (e.g., Himalayan blackberry).	Riparian (primarily)
Avoid contamination and possible degradation of local tree gene pools.	High	Use only locally-collected native oak species in restoration/planting projects and in park landscape plantings that adjoin native stands.	Riparian Upland
Reduce chance of injury or property damage from tree failures.	High	Identify trees with high hazard potential and mitigate by minimizing target exposure (e.g., by closing off likely failure zone) or failure potential (e.g., corrective pruning, tree removal)	Upland (primarily)
Assess woodland resources to allow for adaptive management.	Medium	Monitor woodland areas at least every 3-5 years to assess status and identify management needs.	Riparian Upland
Restore native tree canopy cover in previously cleared areas and areas previously occupied by exotics.	Medium	Plant native oaks and other native trees and understory species using locally-collected seed or cuttings.	Riparian Upland

The success of an individual planting project depends on a number of factors that interact over time. Information on past planting projects can serve as the basis for refining and optimizing restoration techniques for local conditions. Useful information includes records on the methods and materials used in planting projects, including follow-up maintenance; seedling survival and growth over time; and factors that have damaged or killed seedlings. Records should be sufficient to determine what has worked, what hasn't, and why. Volunteers could be used to help collect data. City staff would be responsible for periodically compiling and analyzing the data.

Where efforts are being made to protect and enhance woodlands, interpretive signage that explains the project goals may be useful for educating the public and gaining public support for the project. By involving the public in various restoration activities, the City can help reduce overall costs of management activities. Projects involving monitoring, invasive plant removal, tree planting, tree protection, and other activities can be conducted by trained and supervised community volunteers to keep program costs low. These volunteer activities also help to educate the community about the importance of managing public woodlands and provide a greater sense of community ownership and pride in these natural areas.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 6
Urban Forest Management Principals

Introduction

Efforts to encourage tree planting in new developments is central to the City's development regulations. Other efforts, especially in areas lacking significant tree cover, should be continued and bolstered to promote expansion of Waterford's Urban Forests. Commercial developments, in particular, tend to have very low tree cover. Additional strategies to allow for tree planting in these areas could be considered. This situation is not unique to Waterford.

McPherson and Simpson (2003) found that only 6% of the trees in 21 California cities were found on commercial/industrial land uses. In contrast, 77% of the trees in these cities occurred in residential land uses. Furthermore, average tree cover in commercial/industrial areas averaged 7% compared with 24% tree cover in residential areas among cities in previously forested areas (Western Center for Urban Forest Research and Education 1997). Although the percentage of land area covered by pavement and structures in commercial sites tends to be high, increased use of trees with moderate to wide canopy spread (a minimum of 30 to 35 feet) could increase the canopy cover.

The following discussion focuses on the unique Tree Management approaches that might be applied in the development and expansion of Waterford's Urban Forests.

General Management Concepts

In many California cities, established trees are often subjected to poor pruning practices, particularly topping (cutting back large limbs to stubs). Topping can destroy tree structure and make trees more hazardous. In some areas of Waterford, that have overhead utility lines along streets, some trees have been topped to maintain utility line clearance. Although PG&E and other utilities are changing from topping to directional pruning (also known as "V" trimming) to maintain clearance, the best solution for planting under utility lines is to use species that will not grow tall enough to require clearance pruning.

Because most front yards contain at least some irrigated turf, the wide use of trees that tolerate lawn irrigation schedules, such as coast redwood and birch, is understandable. However, these and other high water use species tend to fare badly during drought periods, especially when they become large. Given Waterford's soil and climate, and the increasingly tight water supplies in the state, greater use of drought tolerant species should be encouraged.

In order to develop good branch structure that will reduce later maintenance needs, most young trees should be inspected, and pruned as needed, on a two to three year cycle until the permanent branch structure is developed. This is most important for

hardwood trees (i.e., trees other than conifers) that will be medium to large-statured at maturity. Early training of conifers that have a typical excurrent growth pattern (like a Christmas tree) is much less critical and mainly consists of eventually removing low branches to develop clearance.

Irrigation is also a critical maintenance issue. As noted above, street tree plantings tend to be especially stressful because soil conditions are typically poor (high compaction, restricted soil volume) and summer water demand is high due to heat radiated off paved surfaces. In these sites, trees with moderate to high moisture requirements can easily become critically stressed if irrigation is inadequate. Improperly adjusted timers or malfunctioning equipment can result in water deficits that can severely damage established trees and can kill young trees.

Maintenance needs in street tree plantings could be reduced by phasing out high water-use species in favor of more drought tolerant species. In many sites, drought tolerant tree species, including locally native oaks, may be able to grow with little or no irrigation. For example, in relatively wide beds that have adequate amounts of soil that is suitable for root growth, species such as blue oak should be capable of surviving without irrigation once established. Because blue oak would grow relatively slowly in these sites, its pruning requirements would also be low. In many sites, it may be possible to establish locally native oaks from seed among existing plantings. Eventually, such oaks could replace shorter-lived, higher maintenance species that were originally present in the plantings.

A moderate percentage of the tree species in the current plantings will be small-statured at maturity. Small tree size is necessary and desirable in tight planting situations, including plantings under utility lines. However, a number of relatively large beds with dense plantings of small- statured trees such as purple leaf plum could alternatively accommodate a smaller number of large-statured trees. One consequence of the small-statured tree planting pattern is that little or no tree canopy is actually directly over pavement, so street surfaces will not receive substantial amounts of shade during the hottest periods. Many of the benefits that street trees provide are directly related to canopy size, and researchers have shown that the benefit-to-cost ratio generally increases with tree size (McPherson 2003). Overuse of small-statured trees greatly reduces many of the benefits that are associated with street tree plantings.

Age diversity within plantings is also an important factor that affects the long-term sustainability of the street tree population (Maco and McPherson 2003). Especially when genetically uniform clonal varieties are used, trees of a given species planted at a site at one time will also tend to reach the end of their useful life at the same time. In plantings that have a diversity of species and tree ages represented, only a small percentage of the trees will need to be replaced in any given year. Phased replacement of dead trees in the existing plantings following the replacement protocol outlined above will help produce a more stable mix of species and tree ages. This will also allow the City to gradually replace short lived species used in the original plantings with longer-lived, better adapted species.

Trees in parks

The City of Waterford maintains many improved parks with many acres of developed parkland to serve its resident population and visitors alike. These

parklands include both planted trees and conserved native trees. These parks are a key contributor to the quality of life in Waterford. The trees in these parks increase the desirability and usability of the parks by providing critical shading and visual interest. They also provide habitat for wildlife species and enhance opportunities for wildlife viewing within the City. Trees in parks also provide a variety of other benefits, such as controlling soil erosion, intercepting particulate and gaseous air pollution (carbon sequestering), and reducing urban noise. Trees are a long-term asset of City parks that need to be managed in a way that maintains their utility and safety for as long as possible. Heavy human use of park lands and maintenance of turf and other park assets can also impact tree health.

Management issues

- If native oaks are planted in parks adjacent to natural oak stands, seed sources of planted material should be from the Waterford area.
- Site assessments should be conducted before replanting empty planting spaces so that corrective actions can be taken if necessary to improve the planting site and/or species selection.
- Waterford parks contain many young trees which need to be inspected and pruned to develop good structure. Timely pruning of young trees reduces later maintenance needs.
- Many older trees are developing problems associated with poor structure or decline that will require more expensive pruning of large branches to mitigate hazardous conditions.

Trees per acre

The overall density goal of trees in city parks should ranged from about 15 to 50 trees per acre depending on park size an purpose For example, parks used for active recreation purposes (ball fields, swimming, court games, etc.) would typically have lower density of tree plantings.

Tree condition and management concerns

Although tree structure and pruning concerns were common in all types of parks older parks generally have older trees, which are prone to certain problems not seen in young trees. In addition, some older parks have problems associated with certain design elements (e.g., inadequate root zone protection and irrigation near conserved oaks) and plant materials that are no longer used (e.g., Lombardy poplar).

Parks typically represent sites with sufficient space to grow trees that have large canopies at maturity. Researchers at the Forest Service Center for Urban Forest Research at UC Davis have shown that a mature large-statured tree provides an annual net benefit two to six times that of a mature small-statured tree . A number of large-statured trees, including the various oak species, are common in Waterford parks. (http://cufr.ucdavis.edu/products/cufr_419.pdf).

Management approaches

In recently-constructed parks with uniformly young trees, the major tree maintenance issue is early structural pruning to develop good permanent branch structure. Other issues include avoiding wounding trees and replacing young trees that have died. Older parks are more likely to have trees of mature size, including both fast-growing non-native species and conserved oaks. These older and larger trees tend to have more problems related to pests and diseases and potential hazards related to poor structure and dead or declining branches.

City-maintained trees along streets and parkways

The City of Waterford Public Works Department maintains trees in its right-of-way along City streets and parkways throughout the City. These include plantings in street medians and along street shoulders. Well-designed and properly maintained street tree plantings not only enhance the aesthetics of City streets and the community as a whole, but can provide a variety of other benefits. Shading and evaporative cooling provided by trees are obvious benefits, but street trees can also help intercept particulate and gaseous air pollutants; moderate stormwater runoff; increase traffic safety through "traffic calming" effects that tend to reduce vehicle speed; extend the life of asphalt paving through shading; and have positive economic impacts on businesses located along streets.

Management issues and approaches

- Irrigation is critical for maintaining the condition of most of Waterford's street trees. Increased use of more drought-tolerant species would reduce street tree maintenance costs.
- Phased replanting of empty sites could be used to increase the percentage of drought tolerant species among City street trees and increase age diversity within the plantings.
- Soil problems have been a common cause of poor tree performance (compaction/limited surface area exposure) in street tree plantings. When dead trees are removed, the planting site should be assessed to determine whether adverse conditions need to be corrected before the site is replanted.
- If street shading and other benefits of tree canopy are a goal of street tree plantings, greater use of large-statured trees will be needed in future plantings.
- By monitoring species composition of new plantings, the City can avoid overuse of the most common tree species.
- Because soil conditions and planter arrangements can vary widely between different roadway segments, long-term management plans should be developed for specific street segments to guide tree replacement.

Canopy cover along residential streets should be an important goal along residential streets as opposed to tree plantings along commercial and industrial street and major roadways that accommodate high traffic volumes.

Much of the variation must be considered in the number of trees per street mile depending on type of street section, street level of service and neighborhood. Density can range from one (e.g., center median only) to three (median plus both shoulders). If the number of planting beds is taken into account, the average number of trees per street mile per planting bed is 160, with a range of 58 to 264. This corresponds to an average of one tree for every 40 feet of roadway per landscaped bed.

Many of the species in these City-maintained street tree plantings do not have a very wide canopy spread at maturity. Assuming an overall average canopy spread of 25 to 30 feet at maturity for each tree, an average of one tree per 40 feet of roadway will generally not provide a continuous tree canopy if all trees reach mature size. Canopy spread in residential neighborhoods is of greater importance in residential neighborhoods than in some commercial and industrial districts.

Tree canopy cover over streets

The shading of paved surfaces by trees provides several important benefits. The amount of shading over streets can be

quantified by evaluating Canopy Cover at the Edge of Pavement (CCEP). CCEP is reported as the percentage of pavement edge (the line defined by the junction of the street and curb) that has tree canopy directly over it. (http://www.isa-arbor.com/publications/tree-ord/ccep.aspx).

Trees that provide any substantial shading at the pavement edge typically extend over the street as well.

The low level of CCEP was due to three factors:

- trees are commonly placed well back from the sidewalk, and commonly well beyond the public utility easement along the street;
- relatively few large-canopied trees are planted in residential front yards
- most trees are still far below their mature canopy spread.

To account for the effect of the third factor (tree maturity), Based on these data, the number of trees with CCEP could triple to about 16% if all trees currently present attain their typical mature spread. When expressed on the basis of trees per street mile (counting both sides of the street), the number of trees providing CCEP is expected to increase from 19 trees/street mile to 62 trees/street mile as the current tree population grows to mature size. Most of these trees will only provide a few feet of CCEP at maturity. Assuming an optimistic average 8 feet of CCEP per tree on average, the 62 trees per mile will provide about 500 feet of CCEP, or about 5% CCEP on each side of the street. By comparison, a well-canopied street would typically have at least 50% CCEP.

Actual planting density within beds is typically somewhat higher than one tree per 40 feet because many beds are interrupted by areas such as intersections that do not contain trees.

Species composition

In general, a high level of tree species diversity is desirable to reduce the chance that a major problem that develops in one species will impact a high percentage of the total tree population. A commonly-used guideline is that a single cultivated species should not make up more than 10% of the urban street tree population.

The number of tree species present within a given street segment tends to increase as the age of the development increases. Some of the most recently constructed neighborhoods had as few as six front-yard species, whereas older neighborhoods typically had 15 or more species. The increased diversity is the result of both tree replacement and additional plantings by homeowners. High species diversity is generally desirable for reducing risks associated with pests and diseases.

Privately-maintained trees along residential streets

These and most of the other trees in Waterford's urban forest are owned and maintained by Waterford residents. Hence, it is important to consider the status of this resource, which provides a wide variety of benefits to the City as a whole. In particular, the "traffic calming" effect produced by having rows of trees along roads can reduce vehicle speeds and make residential neighborhoods safer. Studies also show that trees in neighborhoods are associated with stronger ties between neighbors and lower crime rates (Kuo 2003).

Overview

- Most Waterford neighborhoods have at least a moderate numbers of trees in front yards.

• Most residential front yard trees are relatively young and well below mature size.

Management issues and approaches

• A few commonly used tree species may not be sustainable over the long term. Providing more information on tree species to tree planters (both homeowners and developers who plant trees in new residential developments) may help them make better species selections.

• Increased use of drought-tolerant tree species, including locally native oak species, should be encouraged where appropriate.

• Residents with conserved native oaks may need more guidance on how to effectively maintain these trees in residential landscapes.

• Educational efforts should be undertaken to ensure that residents are aware of proper tree pruning practices to keep topping and other destructive practices from gaining a foothold in Waterford.

Trees in commercial parking lots

Parking lots can occupy a substantial amount of a city's land area. Trees in parking lots help mitigate some of the negative environmental impacts of parking lots while improving their appearance. Adequate numbers of appropriately placed trees can mitigate stormwater runoff and reduce the temperatures of both pavement and vehicles, thereby improving both water quality and air quality. However, parking lots can be harsh sites for tree growth, so good site design and proper tree maintenance are needed to achieve the benefits that parking lot trees can provide.

Management issues and approaches

- Changes in parking lot planning and tree maintenance practices have been made to increase levels of parking lot shading in Waterford.
- Lower ratios of parking spaces per tree can help increase shading, but only if coupled with proper tree placement and tree size.
- Soil conditions need to be improved in many existing parking lot tree planting sites to improve tree growth, condition, and survival. Soil problems should be avoided or corrected before the original planting and corrected as needed before replanting empty sites.
- Tree species used in parking lots should only include those that are adapted to the relatively harsh site conditions.
- Native oaks retained in parking lots can sometimes provide many years of substantial canopy cover even if the root-zone has been excessively encroached upon by construction activity. Greater levels of root-zone protection would improve the long-term health and survival prospects of most retained trees.
- Follow-up monitoring of parking lots is needed to ensure that trees are properly maintained and replacements are planted as needed.

Shading of parking spaces

Tree size, planter size, and the placement of trees in planters all influence whether trees actually shade parking spaces. Small-statured and young trees are less likely to extend over parking spaces, especially if they are in large planters, such as those that border parking lots. As a result of forecasted changes in summer temperatures, due to climate change, some older Waterford parking lots will become uninhabitable during mid-day summer months. This will have an adverse impact on retail and service activity for businesses that rely on these customer parking areas. The City should work with the owners of these parking facilities to improve long-term tree shading patterns and improve the parking environment.

Tree health and maintenance are factors that influence levels of shade that develop in parking lots. If growing conditions are poor, both new and older trees will remain stunted and will not attain the size anticipated in the approved landscape plan. Tree canopy size can also be restricted by improper pruning practices, such as topping.

Parking lot canopy cover is also adversely affected by premature tree decline and death. This is particularly critical along south (mid-day) and west (afternoon) facing street parameters. Tree death and removal causes an immediate loss of tree canopy. If trees are not replaced, the ratio of parking spaces per tree is increased over the long term. Even if trees are replaced, the new trees are small and typically do not provide significant shade for a number of years. Any program to develop better-shaded parking lots has to include provisions to replace lost trees and monitor the health and maintenance of existing trees.

As currently designed and constructed, parking lots are typically not good sites for tree growth. This is a recognized problem throughout the United States and ameliorating these harsh growing conditions is the focus of much urban forest research. Soils under pavement are normally compacted to levels that inhibit root growth. Compacted soils may also drain poorly, leading to long periods of soil flooding in the winter or after irrigation. Impervious pavement reduces the amount of water and oxygen in the soil, further restricting root growth. Un-shaded pavement absorbs and re-radiates heat, making summer growing conditions especially hot. Due to all of these factors, small cutouts in paved areas are very difficult environments for tree growth. Berms, mounds, and slopes, which are common in planters around the edges of parking lots, can be excessively dry sites because much of the applied irrigation runs off from the sloped areas.

These negative features can be mitigated to some degree through design and construction techniques. Increasing planter size and using linear planters can provide greater amounts of rootable soil, but only if the soil is deeply tilled to reduce soil compaction and improve drainage. Irrigation systems must be designed and operated to ensure that applied water does not simply run off. Some areas of impervious pavement can be replaced by pavers or other pervious materials within the root-zone. Structural soil mixes, which provide adequate levels of aeration and pore space when compacted to engineering specifications, can be also be used to increase the root-able area beneath pavement. Tree species that are more tolerant of heat and drought can be used in preference to species that do not perform well under such conditions. Some of these improvements, such as de-compacting planting beds and making use of permeable paving materials may require some additional costs at the construction phase, but these modest investments will pay off in terms of reduced maintenance, superior tree performance, and more shade-related benefits over the long term. In older lots, efforts to ensure that missing trees are replaced will be more successful if they include soil modifications to improve growing conditions.

City of Waterford Urban Forest Plan & Resource Guide

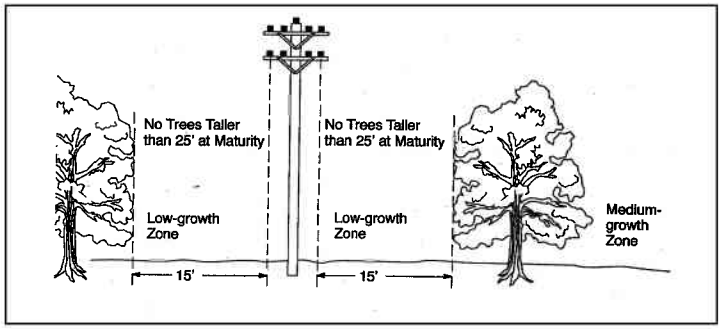
Chapter 7
Planting Guidelines

General Qualities Desired for Trees

How an urban forest prospers, and the impact it has on a community, depends on the types and location of the trees being planted. Over the years a variety of trees have been planted in Waterford. Most of the trees present have done as well as can be expected in an urban setting. Certain trees have undesirable traits in an urban setting, which can overshadow their benefits. While each tree has limitations and there is no completely ideal tree, certain characteristics are important in the selection of trees, particularly trees to be planted in public spaces. Trees with the following characteristics are preferred:

- Trees that adapted to this area.
- Trees that have a longer life span than 25 years.
- Trees that do not have a history of brittleness or anchorage problems.
- Trees that are not known to have serious pest, disease, or fruiting problems.
- Trees that will not require a high level of maintenance.
- Trees that have an attractive appearance, especially with some fall color.
- Trees with root systems that are not overly aggressive.

While efforts are made to find trees with these characteristics, at times unknown problems later develop. Therefore, it is important to anticipate any possible problems that may occur later when determining the selection and placement of trees and all other issues related to planting. A list of trees found to be most compatible in the urban environment of Waterford is found in the City's Master Tree List found in Appendix "A". Other trees may be added to this list from time to tome as they are found to meet the objectives of the City's Urban Forest Program.



General Placement of Trees

The local utility company should be contacted, before planting, to locate underground water, sewer, gas, and telecommunication lines. Note the

location of power lines, streetlights, and traffic signs, and select tree species that will not conflict with these aspects of the city's infrastructure. Keep trees at least 30 feet (10 m) away from street intersections to ensure visibility. Avoid planting shallow rooting species near sidewalks, curbs, and paving.

General guidelines for placement of tree in and around overhead utility lines, particularly with respect to overhead power lines, are as follows:

- Establish a 15-foot "low-growth" zone on both sides of all electric lines. The zone under the electric power lines should be a low-growth tree planting zone as well as a shrub and flower-planting zone on public and private landscape plans.

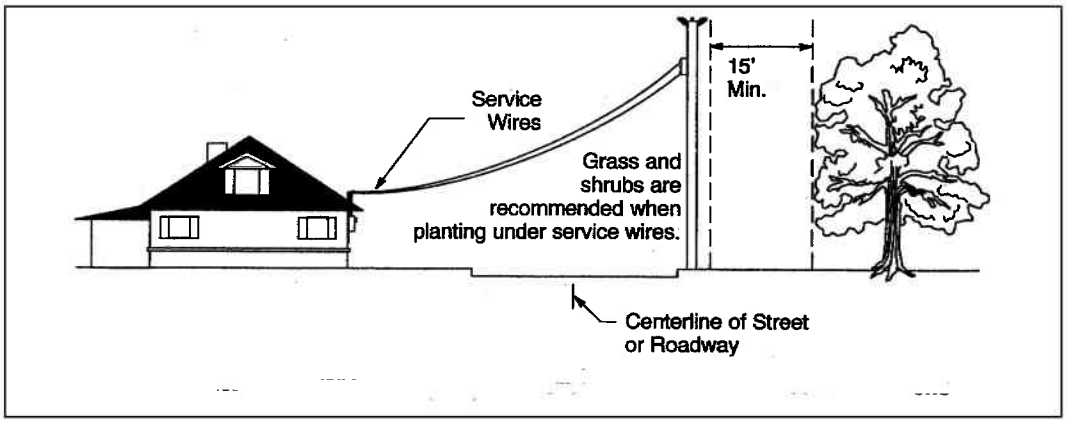
- Keep in mind that when planting under power service drops; a flower and shrub-planting zone is best.

- Do not plant tall trees (trees that are or will exceed 25-feet at maturity) under or within 15-feet of the side of overhead electric lines. In general, do not plant threes near power poles.

- Do not plant trees and shrubs near power poles. Consider safety and access for repairs.

Tree roots can heave pavement if planted too close to sidewalks and patios. Generally, avoid planting within 3 feet (1 m) of pavement, and remember that trunk flare at the base of large trees can displace soil and paving for a considerable distance. Select only small growing trees (<25 feet tall) for locations under overhead power lines, and do not plant directly above underground water and sewer lines. Avoid locating trees where they will block illumination from streetlights or views of street signs in parking lots, commercial areas, and along streets.

Maintenance requirements and public safety issues influence the type of trees selected for public places. The ideal public tree is not susceptible to wind damage and branch drop, does not require frequent pruning, produces little litter, is deep-rooted, has few serious pest and disease problems, and tolerates a wide range of soil conditions, irrigation regimes, and air pollutants. Because relatively few trees have all these traits, it is important to match the tree species to planting site by determining what issues are most important on a case-by-case basis. For example, parking lot trees should be tolerant of hot, dry conditions, have strong branch attachments, and be



resistant to attacks by pests that leave vehicles covered with sticky exudate. Consult the City's Master Tree List in Appendix "A", the Descriptions and Management information in Appendixes "B" and "C" and a local landscape professional for horticultural more information on tree traits.

Locating and Selecting Trees to Maximize Climate Benefits

Locate trees in common areas, along streets, in parking lots, and commercial areas to maximize shade on paving and parked vehicles. Shade trees reduce heat that is stored or reflected by paved surfaces. By cooling streets and parking areas, they reduce emissions of evaporative hydrocarbons from parked cars that are involved in smog formation. Large trees can shade more area than smaller trees, but should be used only where space permits.

Because trees in common areas and other public places may not shelter buildings from sun and wind, CO_2 reductions are primarily due to sequestration. Fast-growing trees sequester more CO_2 initially than slow-growing trees, but this advantage can be lost if the fast-growing trees die at younger ages. Large growing trees have the capacity to store more CO 2 than do smaller growing trees. To maximize CO_2 sequestration, select tree species that are well suited to the site where they will be planted. Use information in Appendix "A" and "B" and consult with your local landscape professional to select the right tree for your site. Trees that are not well adapted will grow slowly, show symptoms of stress, or die at an early age. Unhealthy trees do little to reduce atmospheric CO_2, and can be unsightly liabilities in the landscape.

Some of the following guidelines may help you maximize their ability to serve as CO_2 sinks:

- Provide as much pervious surface as possible because soil and woody plants store CO_2.
- Maximize use of woody plants, especially trees, as they store more CO_2 than do herbaceous plants and grass.
- Increase tree-stocking levels where feasible, and immediately replace dead trees to compensate for CO_2 lost through tree and stump removal.
- Create a diverse assemblage of habitats, with trees of different ages and species, to promote a continuous canopy cover.
- Select species that are adapted to local climate, soils, and other growing conditions. Adapted plants should thrive in the long
- Group species with similar landscape maintenance requirements together and consider how irrigation, pruning, fertilization, weed, pest, and disease control can be minimized.
- Compost litter fall, and apply it as mulch to reduce CO_2 release associated with irrigation and fertilization.
- Where feasible, reduce CO_2 released through landscape management by using push mowers (not gas or electric), hand saws (not chain saws), pruners (not gas/electric shears), rakes (not leaf blowers), and employing local landscape professionals who do not have to travel far to your site.
- Consider the project's life span when making species selection. Fast-growing species will sequester more

CO_2 initially than slow-growing species, but may not live as long.

- Provide a suitable soil environment for the trees in plazas, parking lots, and other difficult sites to maximize initial CO_2 sequestration and longevity.
-

Street Trees

Street trees are planted on public rights of way or easements. This portion of the property extends inward from the street curb. Except in locations where cut outs in the concrete are present, or where planter strips exist, trees have historically been planted to within 10'' to 12'' of the edge of the right of way and/or easement that extends into the property. Today a more practical approach to planting trees is practiced. The following are standards for tree placement.

Planting Patterns for Street Trees.

There are several ways to arrange trees in an urban area. Trees can be planted in:

a. Diverse species plantings.
b. Uniform species plantings (mono-culture).
c. Semi uniform plantings.

All of the methods have been used within the city. However, this plan goal is to eliminate the uniform species plantings (mono-culture).

Diverse Planting Culture

Planting a variety of species in an urban area is very beneficial from a disease prevention standpoint. Having many different kinds of trees assures that if a disease is introduced, only portions of the urban forest will be affected. Diverse species planting also prevents the problem of a general decline of all trees if only a single species is used. It is generally agreed that a city should not have more than 10% of its tree population planted to a single species. A shortcoming of this type of planting is that additional maintenance is required compared to uniform grouping because each tree species can differ greatly. In addition, diverse population does not provide the harmony that uniform planting does. However, there is some assurance that no single disease will wipe out your urban forest, and this is the recommended strategy for planting street trees in Waterford.

Uniform Planting Culture

At the other extreme, a uniform or mono-culture planting allows for easier maintenance, unifies the neighborhood with a common species, and provides consistency to a planting program. For example, in older portions of the City, mono-culture plantings have resulted in trees reaching maturity at the same time and may need to be replaced all at once or over a short period of time. As another example, the Modesto Ash is susceptible to a disease called Anthracnose, which can kill the tree. In a mono-culture one disease species can kill all of the street trees in a neighborhood.

Semi-Uniform Planting Culture

The Semi-uniform planting programs are a viable option for larger cities. The City of Waterford has implemented a small version of this type of planting program by establishing uniform standards within blocks, streets and some neighborhoods.

In residential areas.

a. One tree per lot or two trees per corner lot, unless an extremely large lot exists.
b. Trees are to be placed where they will have the most energy benefit to residents. This usually means centering them according to the living portions of the structure.
c. Trees are not planted within 6' of driveways or sewer lines.
d. Trees are not planted within the clear vision triangle on corner lots (usually 25' to 30' from corners).
e. Trees are planted no closer than 35', nor further than 90', to one another.
f. In some situations, such as streets that end in cul-de-sac (court), trees may not be planted at every residence due to the lack of space. Trees may not be placed at each residence in subdivisions with small lots where two lots jointly have a landscaped area of less than 60'. At these locations only one tree may be planted in a location which will provide the greatest benefit for both residents.
g. Trees are not normally planted within 12' of street light poles. In some cases this will not allow the planting of trees at a residence.
h. Trees should not be planted within 6' of a fire hydrant.

In commercial/industrial areas and along walls.

The planting standards are*:*

a. Trees are spread 35' to 40' on center unless obstacles exist, such as power poles.
b. Trees are kept out of clear vision zone at corner intersections and near driveways.
c. Watering systems must be provided to the area by the developer.
d. Trees should not be located within 5' of business signs or within 6' of sewer lines.
e. Trees should not be planted within 6' of a fire hydrant.

Trees for Parks and Other Public Places

Trees are used in parks as design elements. These elements are complex, living, growing things, changing with each season. They're used for their esthetic and functional qualities. Trees used in parks fall into five general categories. The categories are perimeter, accent, transitional, specimen, and screen trees.

Perimeter trees match the physical characteristics of the city street trees adjacent to the park site. These characteristics would include size, texture, density, form, and color. Perimeter trees signal the user that he/she is entering a new environment. Accent trees are those which have an outstanding showy feature. Accent trees will typically have a seasonal show, be it flowers or a bright fall leaf color. This tree will draw the user's attention to entry points or a special park feature.

Transitional trees are larger in scale than both perimeter or accent trees. Transitional trees are used to define the park as a large public open space. They are literally and physically the ceiling of the park space.

Specimen trees are unique or unusual trees not commonly seen in residential landscapes. Specimen trees introduce the park user to a broader spectrum of trees that grow in our climate zone.

Screen trees are evergreen, fine textured, and medium in size. Screen trees are used to conceal objectionable views, block nuisance lighting from playing fields and game courts, and at times, focus a park users eyes on a particular vista or park feature. While the transitional trees are the ceiling of the park, screen trees represent the wall of a park.

Tree placement in a park doesn't always fit into one of the five categories defined. Sometimes overlap occurs because of existing physical conditions that exist at the park site. These conditions would include wind direction, sun angles, soil conditions, topography, adjacent property uses, building types, and types of parks (active or passive).

General Guidelines for locating and Selecting Trees

Residential Yard Trees Maximizing Energy Savings from shading, the right tree in the right spot saves energy. In midsummer, the sun shines on the northeast and east sides of buildings in the morning, passes over the roof near midday, then shines on the west and northwest sides in the after-noon. Air conditioners work hardest during the afternoon when temperatures are highest and incoming sunshine is greatest. Therefore, the west and northwest sides of a home are the most important sides to shade. Sun shining through windows heats the home quickly. Locate trees to shade windows so that they block incoming solar radiation, but do not block views. In San Joaquin Valley communities, the East Side is the second most important side to shade.

Trees located to shade south walls can block winter sunshine and increase heating costs, because during winter the sun is lower in the sky and shines on the south side of homes. The warmth the sun provides is an asset, so do not plant evergreen trees that will block southern exposures and solar collectors.

Use solar friendly trees to the south because the bare branches of these deciduous trees allow most sunlight to strike the building (some solar unfriendly deciduous trees can reduce sunlight striking the south side of buildings by 50%). To maximize summer shade and minimize winter shade, locate trees about 10-20 feet (3-6 m) south of the home. As trees grow taller, prune lower branches to allow more sun to reach the building if this will not weaken the tree's structure.

Although the closer a tree is to the home the more shade it provides, the roots of trees that are too close can damage the foundation. Branches that impinge on the building can make it difficult to maintain exterior walls and windows. Keep trees at least 5-10 feet (1.5-3 m) from the home to avoid these conflicts but within 30-50 feet (9-15 m) to effectively shade windows and walls. Paved patios and driveways can become heat sinks that warm the home during the day. Shade trees can make them cooler and more comfortable spaces.

Shading your air conditioner can reduce its energy use, but do not plant vegetation so close that it will obstruct the flow of air around the unit. Keep trees away from overhead power lines and do not plant directly above underground water and sewer lines. Contact your local utility company before planting to determine where underground lines are located and which

tree species will not grow into power lines.

Locating Windbreaks for Heating Savings The winter heating season is not too long in the San Joaquin Valley, but heating costs can still be several hundred dollars per year. Because of their size and porosity, trees are ideal wind filters. Even leafless trees in the city can reduce wind speeds and heating costs. In situations where lot sizes are large enough to plant windbreaks, additional savings can be obtained. Locate rows of trees perpendicular to the primary wind direction — usually along the north and west sides of the property in the San Joaquin Valley. Design the windbreak row to be longer than the building being sheltered because the wind speed increases at the edge of the windbreak. Ideally, the windbreak is planted upwind about 25-50 feet (7-15 m) from the building and consists of dense evergreens that will grow to twice the height of the building they shelter (Heisler 1986, Sand 1991).

Avoid locating windbreaks that will block sunlight to south and east walls. Trees should be spaced close enough to form a dense screen, but not so close that they will block sunlight to each other, causing lower branches to self-prune. Most conifers can be spaced about 6 feet (2 m) on center. If there is room for two or more rows, then space rows 10-12 feet (3-4 m) apart.

Selecting Yard Trees The ideal shade tree has a fairly dense, round crown with limbs broad enough to partially shade the roof. Given the same placement, a large tree will provide more building shade than a small tree. Deciduous trees allow sun to shine through leafless branches in winter. Plant small trees where nearby buildings or power lines limit aboveground space. Columnar or upright trees are appropriate in narrow side yards. Because the best location for shade trees is relatively close to the west and east sides of buildings, the most suitable trees will be strong, resisting storm damage, disease, and pests (Sand 1994). Examples of trees not to select for placement near buildings include cottonwood (Populus fremontii) because of their invasive roots, weak wood, and large size, ginkgo (Ginkgo biloba) because of their narrow form, sparse shade, and slow growth, and pine trees (Pinus spp.) because of their evergreen foliage.

When selecting trees, match the tree's water requirements with those of surrounding plants. For instance, select low water-use species for planting in areas that receive little irrigation. Also, match the tree's maintenance requirements with the amount of care different areas in the landscape receive. Tree species that drop leaves and fruit may be more easily maintained in areas where litter disappears in coarse groundcovers or in a lawn where it can be easily raked up than in areas that are more difficult to clean. Check with your local landscape professional before selecting trees, to make sure that they are well suited to the site's soil and climatic conditions.

Conifers are preferred over deciduous trees for windbreaks because they provide better wind protection. The ideal windbreak tree is fast growing, visually dense, and has stiff branches that do not self-prune. Species in the pine (Pinus spp.), cypress (Cupressus spp.) genera, and evergreen oak species (Quercus spp.) are among the best windbreak trees for San Joaquin Valley communities.

Waterford-Ten Years of Growth (1998-2009)

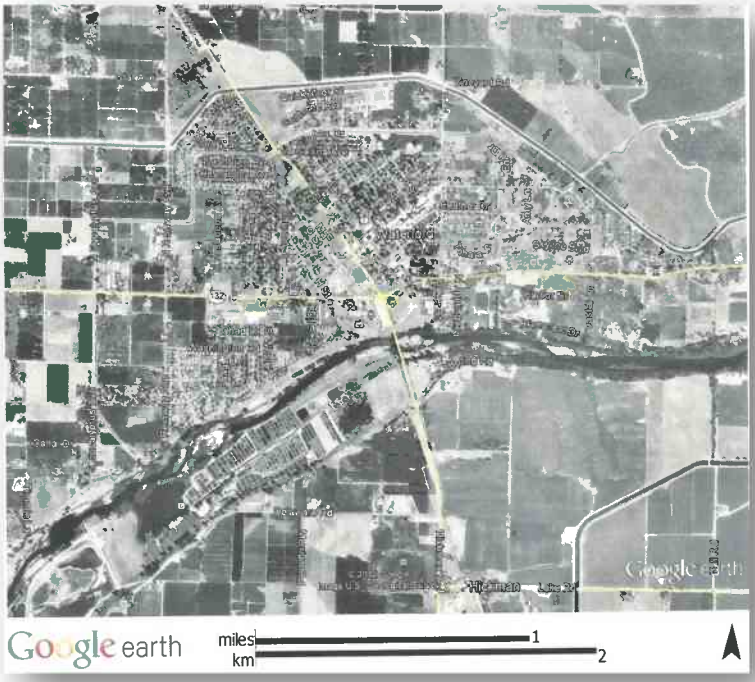


Figure 1 Waterford Urban Area (9/98)

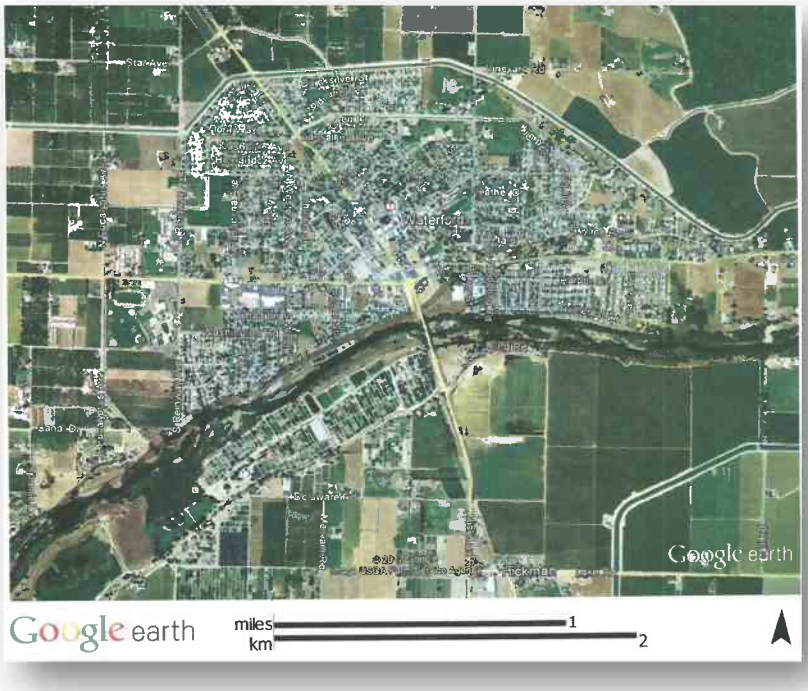


Figure 2 Waterford Urban Area (9/2009)

Mature v. Young Residential Tree Cover

Figure 3 Older Neighborhood Tree Canopy Cover

Figure 4 Newer Neighborhood Tree Canopy Cover

Industrial/Commercial Canopy Cover

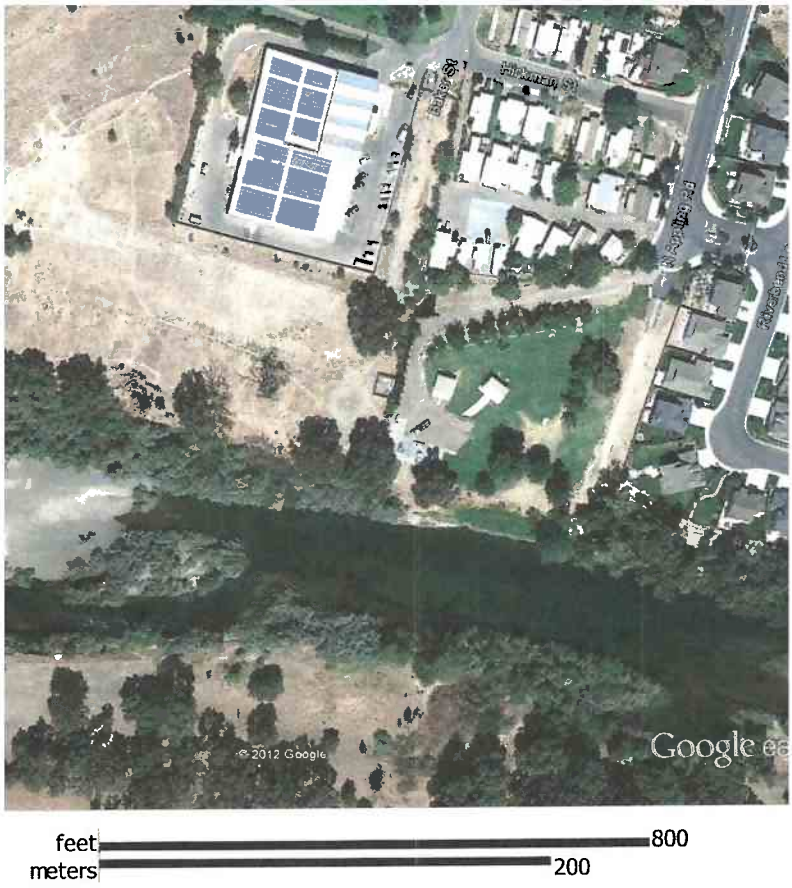


Figure 5 Acosta Cabinet Factory (Note Solar Panels on Roof

Figure 6 Commercial and residential Tree Canopy Comparison

And "A River Runs By It"

The Tuolumne River Parkway and the City of Waterford

Figure 7 The Waterford River Parkway on the West End of the City

Figure 8 The Waterford River Parkway on the West End of the City

City of Waterford Urban Forest Plan & Resource Guide

Chapter 8
Tree Maintenance Guide

Introduction

The general purpose of the City of Waterford's tree maintenance program is to:

- To keep trees in a safe condition.
- To care for the horticultural needs of the trees.
- To preserve the trees so that maximum benefits can be realized during their life cycle.

The City of Waterford has been responsible for routine and emergency public tree maintenance. Full-time City employees have performed such tree maintenance activities as pruning, spraying, staking and cabling. If the City can not meet these duties on routine or emergency tree maintenance, then private contractors can be utilized.

Responsibilities, Duties and Authority of the Public Works Director

The Public Works Director, under the general supervision of the City Manager, has the authority and responsibility to maintain Waterford's public (street and park) trees in accordance with this Plan and Waterford Municipal Code.

Service Area Maintenance

Private Citizens can call to report street trees needing service. If the request is compelling, needed, and approved either by the street tree service personnel, or from a member of the Public Works Department, then the tree shall be maintained to the best of the service personnel's ability. At times when requests are high due to storm damage, the public should be made aware of possible lengthy delays in storm damage repair to trees.

Mistletoe

Uncontrolled mistletoe can become a serious threat to many of our shade trees in Waterford. Control of this parasite can be difficult due to the fact that primarily birds spread mistletoe. Birds eat the seeds of the mistletoe plant, whereupon the seed is passed through the bird's digestive tract. The parasite is then spread by the bird's excrement onto other trees.

The only way to control mistletoe is to interrupt its life cycle and remove the plant before seeds are produced. Since seeds are produced three to four years after the mistletoe plants emerge, effective control through plant removal must occur more often than three years.

Inspections

To determine the conditions of public trees and their future needs, inspections are an ongoing part of tree maintenance. All personnel working on trees are trained to look for potential or immediate problems. In addition, certain portions of the City are targeted for special inspections annually. These inspections are usually where older trees exist, where unusual problems have occurred, such as a particular disease, or at the request of individual residents. Based on

these inspections, changes in schedule maintenance may be necessary.

Tree Inventory

The City has been seeking funding to pursue an inventory of the City's street and parkland trees. This inventory is expected to lead to the development of an accurate record keeping system of maintenance for the City's street and parkland trees. The inventory program can also provide the capability of monitoring the urban forest composition an estimate the carbon sequestering characteristics of the City's urban forest. This information allows the tracking of trees for liability and planning purposes and calculating the "carbon off-set value of the City's trees in meeting state standards for reducing greenhouse gases. Maintaining current public site tree inventory records is critical in assessing the needs of the entire urban forest.

Pests and Disease

In an urban area, pest and disease have a more direct impact on trees than in a natural environment. Pests and disease cannot only harm or alter the appearance of trees, but can become a nuisance to nearby residents. This being said, in the search for new street trees the Public Works Department and the Planning Department took this factor into account. One of the characteristics of street trees chosen was the resistance, or pest free characteristics of the tree. While no tree is completely immune to pests, fungi or disease, none of the trees on our improved list is overly susceptible to pests or disease. In the event of an oversight on our part, we will address any pests or disease associated with the new trees when the problem arises.

Tree Roots

To have a healthy tree, a root system is necessary to provide support, water, and nutrients. While necessary, tree roots in an urban area are the source of many conflicts. This places roots in areas where lawns, sidewalks, curbs, sewers, and driveways are also present. As most of a tree's root system is not visible, prevention of conflicts and monitoring of root growth is not an easy task.

Citizens frequently contact the City about tree root conflicts. Under certain conditions, tree roots can be removed or severed without seriously damaging the tree. On a request basis, a representative from the Public Works Department will respond to these situations. If tree roots can be safely severed or removed, some recommendations are given. In some cases, however, tree roots cannot be safely cut, and an explanation is given to the citizen.

If roots can be safely cut, several options exist. An authorization can be given for a private party to cut or hire someone to do the cutting. Actual removal of tree roots is left up to the individual residents. A final alternative to severe root problems is tree removal. However, this alternative is not considered until all other alternatives mentioned above have been either tried or considered.

Upon discovery of the issue, action may be taken to repair public walks or curbs damaged by tree roots. The action could include removal and replacement of the damaged walks or curbs, patching the sidewalks, or planing of the curbs. The property owner coordinates these efforts with the Public Works Department; certain criteria for repair are used, and are available through the Public Works Department.

A common root problem that occurs often is between tree roots and sewer lines. While the City maintains the main lines, the lateral lines are the responsibility of the property

owner. Tree roots can enter these lines through small cracks or openings caused by normal deterioration. Once inside, the line blockage can quickly occur. Some root cutting may be possible to minimize sewer problems; however, replacement of the damaged sections is often necessary by the property owner.

Overhead Wires

There are trees throughout the City that grow into electrical or communication lines. The City personnel can work low voltage lines such as house type and communication lines around when proper training is given. Trees will be pruned according to good horticultural practices. The City cannot perform work on City trees within 10-feet of high-voltage electrical wires unless approved by the City Manager or Director of Public Works. If approved, only employees who have been trained in the clearance of high-voltage overhead wires may do the necessary work.

Private Maintenance Approval

At times property owners may want to prune, spray, or provide other maintenance to public street trees as a supplement to, or in place, of City crews. Any work done to the aboveground portion of a public tree by a private party requires approval by the Director of Public Works prior to carrying out such work. If approved, the work performed must be agreed upon in advance and all conditions of approval, such as insurance, must be followed. All costs for works performed are borne by the property owner or other party requesting the approval.

Street and Public Space Tree Protection

The following provisions will be enforced with respect to the protection of trees located on public sites including street trees:

a. No person shall remove, trim, prune, spray, or cut any above or below ground portions of any street tree in right-of-way or easement without first obtaining permission from the Public Works Director.
b. No person shall interfere or cause any person to interfere with any work being done under the provisions of this Plan and the provisions of Waterford Municipal Code or by any employee of the City, or by any person or firm doing work for the City.
c. No person shall interfere or cause anyone to interfere with or damage any overhead wires or underground pipes or conduits while removing, trimming, pruning, spraying, or cutting any street trees in a right-of-way or easement. The owner of such facilities shall be notified when such work may interfere with or cause damage to the facilities. The cost of repair of the damage to overhead wires, underground pipes or conduits shall be the responsibility of the person, firm or corporation doing or causing the work to be done. The City of Waterford and it officers and employees shall be exempt from the provisions of this subsection.
d. In accordance with this Plan and Waterford Municipal Code it is unlawful for any person to injure or destroy by any means any tree planted or maintained by the City in rights-of-way or easements, including, but not limited to, the following:

    1. Constructing a concrete sidewalk or driveway or otherwise filling up the ground around any street tree so as to shut off air or water from its roots.
    2. Piling building materials, equipment, or other substances around any tree.

3. Pouring any deleterious material on any tree or on the ground near any tree.
4. Posting any sign, poster, notice, or other object on any tree, tree stake or guard, or fastening any guide wire, cable, rope, nails, screws, or other device to any tree, tree stake or guard, except as carried out or recommended by a registered arborist.
5. Causing or encouraging any fire or burning near of around a tree.
6. Using any mechanical weeding device against a tree.
7. Constructing retaining walls, fences, or other similar improvements, which prohibit the planting or maintaining of street trees or otherwise affect their growth.
8. Operating construction equipment in such a manner to cause it to contact the tree or the root system of any tree.
9. Disrupt the anchorage of the tree or change the grade around the tree.

e. No person shall plant a tree or other plant material in a planting strip or easement other than lawn or other similar planting materials, unless approved by the Public Works Director.

Planting and Maintenance

a. Except as otherwise provided in this section, within the limits of funds provided by the City budget, the City will supply, replace or plant approximately one public street tree per lot, excepting corner lots. On corner lots 2-3 street trees will be planted, and maintain public street trees in all rights-of-way and planting easements within the city.
b. Fees shall be charged to provide for the cost of furnishing, locating, planting and public street trees.
c. The property owner or occupant, as the case may be, shall be responsible for watering street trees located in planting strips or easements abutting said property.
d. This section shall not prevent any person, firm or public utility from installing and maintaining any overhead wires or underground pipes or conduits lawfully on, over or under public streets or public rights-of-way subject to the provisions and requirements of this Plan and Waterford Municipal Code. The Public Works Director, when reviewing plans for planting, maintenance or removal of street trees shall consider the effect upon existing overhead wires or underground pipes or conduits and shall avoid unnecessary disturbance to or relocation of said facilities.

Removal and Replacement

a. The Public Works Director shall be responsible for inspection, maintenance, removal and replacement of street trees planted within rights-of-ways or easements. The Public Works Director may cause street trees or other plant material planted in a right-of-way or easement to be removed by the City if they are deemed by the Public Works Director to be unhealthy, hazardous, undesirable or causing excessive damage to existing public improvements, or street trees.
b. The Public Works Director shall have the authority to require property owners to take such action as is necessary to control insects, scales, parasites, fungus, and other injurious pests or plant material that would cause serious injury to street trees and other plant material within the City. The City shall notify the

property owner in writing, describing the conditions and stating the control necessary to correct the condition, and establishing a reasonable time within which the corrective steps shall be taken.

c. The Public Works Director shall have the authority to require property owners to remove or prune any privately planted tree, shrub, vine, or other plant material if it is determined by the Public Works Director to be seriously interfering with the growth and health of any street tree.
d. In the event a property owner desires to remove a tree from the right-of-way or easement abutting his/her property, his/her authorized agent shall make application to the Public Works Department. The Public Works Director shall determine whether or not such tree is required to be retained in order to preserve the intent and purpose of the Street Tree Plan. In making his/her determination, the Public Works Director shall consider the inconvenience or hardship which retention of the tree would cause the property owner, and consider also the condition, age, and desirability of variety and location of the tree. If the Director finds that the tree may be moved without violating the intent and spirit of the Street Tree Plan, he/she may authorize the property owner to remove such tree at his/her own expense and liability. If a permit is granted for removal of a street tree, all removal work shall be completed within sixty (60) days from the date of issuance of the permit, and shall be under general supervision of, and in accordance with, rules established by the Public Works Director. All tree stumps shall be removed to a depth specified by the Public Works Director. All removal permits shall be void after the expiration of sixty (60) days from the date of issuance, unless extended by the Public Works Director.

Trees Trimming

Notwithstanding other provisions of this Plan, it is the duty of every person owning or occupying any land or lots of land within the City to keep all private trees extending over any street or alley trimmed up to a height of not less than twelve feet (12') except that a height or not less than eight feet (8') shall be permitted over the sidewalk area, and also to keep said space clear of debris.

Cooperation with other Departments and Agencies

a. The Public Works Department shall review and approve all applications for new curb, gutter, sidewalk or driveway installation, or other improvement which might require the removal of or cause injury to any street tree, or interfere with the fulfillment of the Street Tree Plan.
b. Any public utility maintaining any overhead wires or underground pipes or conduits shall obtain permission from the Public Works Director before performing any maintenance to said wires, pipes, or conduits, which would cause injury to street trees. Said public utility shall in no way injure, deface, prune, or scar any street tree until the Public Works Director has approved their plans and procedures.
c. The Public Works Director shall be permitted to inspect any and all maintenance or operational work performed by public utilities, which might affect a street tree or street trees. During the performance of said work, if in the opinion of the Director, it would cause excessive or unnecessary injury to any street tree, the Director shall have the authority to stop said maintenance and operational work and arrange with

said public utility another method of maintenance or operational work satisfactory to the City.

d. The provisions of subsection (b) and (c) of this section shall not apply to emergency public utility maintenance work, which is performed during non-working hours for City personnel.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 9
Tree Removal

Reasons for Tree Removal

Trees continually move through their life cycle in an urban area, just as they do in a natural forest. If the life cycle were allowed to go to completion in an urban area, ending in tree collapse and decomposition, numerous problems would arise. At some point in the life cycle, a decision must be made to remove a tree. A preservation approach exists in the City so those trees are not removed unnecessarily. When trees are removed, replacement generally occurs. Certain criteria are used to make the judgment of when a tree is removed. Five general categories are used:

A. Tree is dead, dying, or diseased
B. Tree poses a potential safety problem.
C. Tree is an undesirable species.
D. Tree is creating a hardship
E. Construction necessitates removal.
F. Tree is Dead, Dying, or Diseased
G. Conflicts with utilities

Being a living organism, trees at some point die or become diseased, unless their life cycle is interrupted at an earlier stage.

When this occurs, the trees must be removed before the final decay processes set in and a safety problem occurs. Inspections will usually identify these trees on an annual basis.

Tree Poses a Potential Safety Problem

Trees can pose a potential safety problem, even with a good maintenance program. Growth habits and strengths of limbs and trunks are variable. It is also difficult to know what is occurring below the ground. Certain signs of decay or weakening can be detected during inspections. These signs can be such things as fungal growth, included bark, split trunks, cavities, or a poor general appearance. Even though the tree may still be functioning and producing benefits, inspections could show that a potential problem is present which poses a high risk to public safety.

If corrective steps are not feasible, removal of the tree is necessary. At times certain work, which is necessary around the root system of trees, could leave the tree with poor anchorage. Assessments are made of whether the tree must be removed. For example, if a tree is located near a sewer line and the property owner must gain access to repair the line, the tree may have to be removed because of severe root loss necessary to clear the area of roots for repair. Some trees can produce a fruit that could cause slipping problems for pedestrians, or other traffic, near it. If the fruiting habits cannot be stopped, removal of the tree may be necessary.

Tree is an Undesirable Species

Certain trees which have undesirable traits are present on rights of way or easements.

Thorns, brittleness, heavy fruiting and extremely invasive root systems are some of the reasons a tree may be undesirable. Birds or citizens plant most of these trees. Occasionally a major problem may occur with an established street tree, which would make it undesirable. Some examples of undesirable trees are Willows, Poplars, and Mulberry. When an undesirable species is found, its condition and value are reviewed and removal may be necessary.

Tree is Creating a Hardship

Conflicts of some type occur with every tree. What is considered by some to be a hardship may not be to most people. For example, certain people consider leaf raking a hardship; others may feel that insect damage creates a hardship. Certain criteria have been developed to allow for consistent interpretation of a hardship.

Hardship is interpreted to mean structural problems, such as cracking or raising of a garage floor, which could possibly be associated to tree roots. When alternatives have been attempted and the problem reappears or continues, removal may be considered.

Hardship is not extended to situations in the landscape, or with other non-structural improvements. Removal of trees due to hardship has been considered in the case of a handicapped person under special circumstances involving vehicle access.

Construction Necessitates Removal

Use of property can change, with the interest in new development. When existing trees are in conflict with improvements such as new building construction, removal is considered under permit procedures. However, if at all possible, the tree(s) will be preserved in new construction projects. If removal is the only alternative, the property owner is responsible for removal and replacement of trees. Replacement trees must be of a size as near to the size of the tree removed as possible, within practical limits, and in accordance to the Street Tree Plan.

Occasionally, in residential areas a property owner will want to widen a driveway where a tree exists. If the tree is less than six-inches (6”) in diameter at a distance of four and a half feet (4 ½’) above the ground, removal may be allowed under permit procedures. The property owner is again responsible for all costs and tasks necessary for removal and replacement of the tree. If a replacement is not possible, a charge equivalent to the current planting cost of a 24-inch boxed tree is assessed to the property owner.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 10 Reforestation

Introduction

A visitor driving through Waterford cannot help but noticing our beautiful tree lined streets and forested parkland. These trees did not spring up overnight. It was the vision of City officials many years ago to line our streets with a variety of trees and it is the aim of this document to continue that tradition well into the 21st century. To keep our streets lined with beautiful trees. This will promote unity and community, as well as attracting visitors and prospective residents.

Replacement

When a tree is removed, a gap in our forest occurs. To replace these trees, a plan consistent with the total affected area must be considered. To do this, a map indicating what trees will be planted in existing neighborhoods is maintained by the Planning Department. This map designates in general the species to be replanted on each street. Some deviation is necessary based on how the specific site fits into the standard categories.

It is the City's practice to replace trees when they are removed. However, in some cases the trees removed may not be replaced. This occurs when there is not adequate room for replacement due to poor site selection originally or because adjacent trees exist which will fill the void quickly.

The older areas of the city that were constructed in the 1950's or 1960's have a high number of trees that have reached maturity or are declining. These neighborhoods have become accustomed to tree lined streets. In most cases, these older trees are removed on a gradual basis so that a minimal impact in the neighborhood can be felt.

Occasionally, a high number of trees may be declining at the same time in a limited area. This could result from years of severe drought, pest/disease infestation, damage caused by storms, or failure of the tree due to age. When this occurs special attention is given to minimize the impact on the neighborhood. This generally occurs when more than 50% of the trees in a neighborhood have been, or will be, removed within a five-year period. In this situation, a reforestation plan is drawn up which indicates:

1. Which trees will be removed
2. Over what time period the removal will be necessary
3. What impact the removals will have on the neighborhood
4. What type of tree will be used as a replacement, what size tree will be planted, and when planting will occur
5. What type of citizen contact will be necessary
6. The objective of this special attention is to minimize the transition problems

associated with converting a tree lined street to a street with a mixed age population.

Reforestation plans may also be developed when a certain tree species develops multiple or specific problems and no practical solution to the problems are available.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 11 Other Considerations

Determination of Public Trees

The care of all trees on City owned properties such as parks and recreational areas are the responsibility of the City. Trees along the street that have at least the centerline of the tree at ground level within the right of way or easements are also considered to be a City responsibility.

New Development or Subdivision Street Tree Plans

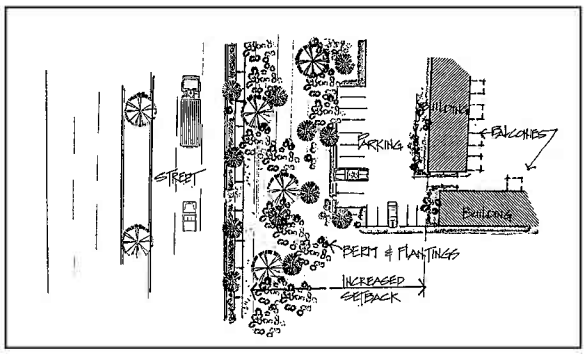
In accordance with the development regulations of the City of Waterford, subdivision proposals and other types of new development are, or may be, required to prepare a street tree plan. These plans are considered an amendment to the City of Waterford's Street Tree Plan and must be submitted to the Public Works Department and the Planning Department for review and comment. Such plan, when approved by the Planning Director, shall be submitted to the Planning Commission, which shall review said plan and submit its recommendations to the Council. After making any revisions thereto which it may deem advisable, the Council shall adopt such plan by resolution.

Other amendments to this plan shall be made in the same manner as the original adoption.

Damage to Trees by People

At times people damage trees intentionally or unintentionally. When the Public Works Department or Planning Department becomes aware of these situations, an evaluation is made and billing for damages is prepared if the responsible party can be located. Should damage be intentional, police action may be necessary.

The most common cause of tree damage is from vehicle accidents. Cars occasionally strike trees and other public property. Public trees are considered to have a value and an accurate assessment of tree value and/or damages to the trees can be determined.



Business Signs

Trees can cause visibility conflicts with the business signs. It is our practice not to prune trees for better visibility of signs. Some pruning may be done when scheduled maintenance is required on the tree. However, special arrangements are not made to alter the normal growth habit.

Landscaped Sound Barriers

As part of the urban development process, large public and private landscape areas are typically set aside to buffer traffic and other noise sources from residential and commercial use areas. These buffer areas are ideal open areas for planting trees and adding other landscape elements.

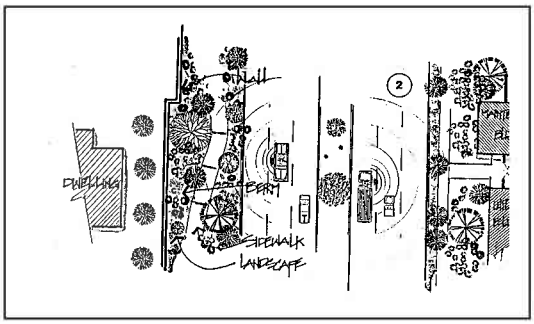
Cars and trucks, and trains are the most pervasive outdoor noise sources. Several approaches can be taken to lower the impact of noise. Barriers are typically used to provide some noise attenuation. The amount of noise reduction depends upon the material and design of the barrier. Solid structures provide the most attenuation; vegetation will only abate noise a little, but psychologically can provide a more relaxed environment.

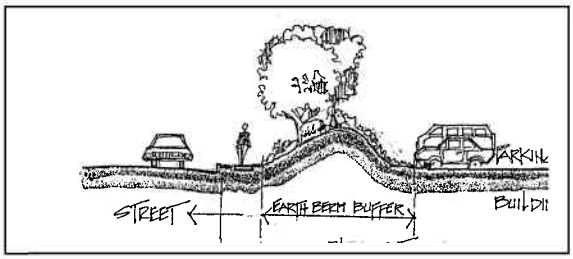
Site planning can also be used as a tool for noise reduction. Many site-planning techniques can be employed to protect sensitive uses from excessive noise. These are among others:

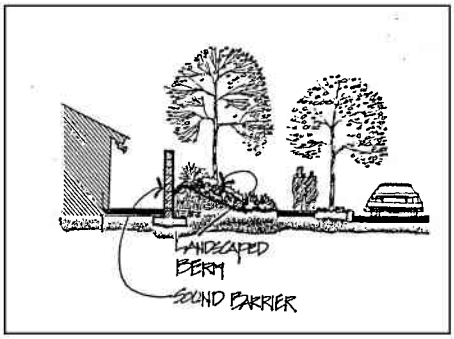
(1) Increasing the distance between the noise source and the receiver;
(2) Placing noise compatible land uses (parking, utility rooms, maintenance buildings, etc.) between the source and the receiver;
(3) Locating the barrier-type facility or building parallel to the noise source; and,
(4) Orienting the noise-sensitive use away from the source of noise.

All these techniques can be used to attenuate the actual noise reaching a noise-sensitive land use, without adding an excessive burden or cost to a specific proposal.

At the same time, landscape, landscaped berms, and sound walls have varying degrees of effectiveness with respect to noise attenuation. Landscaping, however, is an important element in any noise attenuation plan. Trees, vines and bushes add texture to sound walls and help reduce graffiti and other vandalism.







City of Waterford Urban Forest Plan & Resource Guide

Chapter 12 Public Involvement

People play a major role in urban forest ecology

In Waterford, as in most urban areas, people are essential to the functioning of the urban forest. Urban environments can severely limit the ability of trees to become established and grow. Soil compaction, paved surfaces, buildings, and utilities can limit both below-ground rooting space and above-ground space for canopy spread. If people did not make space available, plant trees, and maintain them, trees would simply not exist in many urban areas.

Planting, maintenance, and removal

Unlike the "natural" forest setting, trees in "urban forests" require human "management" to be successful. In a natural forest, trees replace themselves and eventually die, fail, and decay, recycling their nutrients into the soil. These processes generally aren't allowed to proceed in the urban forest for obvious reasons.

Tree seedlings can sometimes establish in urban areas naturally from seeds dropped from existing trees or buried by animals in favorable sites such as landscape beds. However, generally trees must be planted if they are going to become established in sites where they can grow to maturity. To obtain a healthy, long-lived tree, people need to select the appropriate species for the site, adequately prepare the planting site, and select good quality planting material. Most trees in urban areas need some irrigation, at least during the establishment phase, applied in the right place, at the right times, in the right amounts. Inadequate and excessive irrigation are two common causes of tree death in urban areas, especially in new plantings

As trees become established, pruning is typically needed to ensure that trees develop a strong structure that will minimize later problems. Large, established trees need to be inspected and pruned as needed to ensure that dead or structurally weak branches do not pose a hazard to people or property within the tree's target zone. Large trees that are declining and hazardous trees typically need to be removed before they can fall, and the resulting waste typically must be disposed of actively, rather than passively decaying on the landscape.

Providers of tree care

A variety of people are necessarily involved in managing the various phases of trees' life cycles in the urban forest. Informed and trained residents can manage many of the basic aspects of tree care on their own, including planting, irrigation, and basic pruning of young trees. Even if these tasks are delegated to landscape maintenance contractors, property owners need to have enough basic knowledge about tree care to ensure the quality of tree care they are purchasing.

Because of the specialized skills and

knowledge needed, trained tree care professionals are needed for most work on large mature trees. Again, property owners need to know enough to ensure that they hire a qualified professional that will protect their investment in their trees.

Waterford staff and their contractors, manage the urban forest on City owned lands. In addition, City staff and their consultants can provide expertise needed to help manage the urban forest as a cohesive unit. The City can play a leadership role by looking at processes that extend beyond individual properties and providing strategies and technical information that will help further the community's urban forest goals. By providing locally appropriate information on tree planting and care, the City can help residents make good decisions on tree selection, planting, and care.

Partnerships between community residents and the City

The majority of Waterford's urban forest is, and will continue to be, managed by individual landowners. If the City has an overall goal of maintaining and improving its urban forest, it will play a role in helping residents understand the importance of the urban forest and how to successfully manage trees on their properties. Because of limited resources, the City's support roles will be limited to providing information to individuals, groups and private land-owners, on Best Management Practices of preserving and maintaining the City's urban forests.

City-sponsored efforts

This document, the City of Waterford's Urban Forest and Resource Guide contains many important Urban Forest management concepts that would be a valuable resource to private property owners and "urban foresters" in the City. Future efforts in public information will include the preparation and distribution of "hand-outs", brochures, and other miscellaneous information on Urban Forestry, to Waterford's residents.

City newsletters (such as the "City Hall Insider") and utility bill inserts can also be used in the outreach effort. These avenues can be used to disseminate information directly (e.g., the handouts or excerpts from them, City tree regulations and guidelines, tree pest updates, etc.) or can be used to point residents to where the information can be accessed.

Community tree groups and volunteer projects

In the absence of a dedicated community tree group, the City can continue to partner with existing community organizations to coordinate tree planting and care projects by community volunteers. In addition to local schools, including Modesto Junior College, CSU-Stanislaus, local members of the UC Master Gardeners Program, the local California Native Plant Society chapter, and similar groups could be approached to help in projects that may involve longer-term involvement than the typical one-day planting event.

A significant amount of effort is needed to establish and run a community tree group either on a fully volunteer basis or as a registered nonprofit organization. At least one highly motivated leader/organizer is needed as well as a contingent of active volunteers. Such groups also benefit from in-house expertise, such as from local tree professionals. Although the City can promote and facilitate the establishment of a community tree group, the availability and interest of community members is ultimately needed to develop a successful group.

Careful planning and concerted efforts are necessary to coordinate successful community volunteer projects. Projects need to be well-organized so that participants can feel like their time is being put to good use. Planting projects need to be followed up by necessary tree care, either by the City or by additional volunteer work; so that volunteers can see that their efforts are valued and result in a lasting legacy. Despite the effort required, successful volunteer projects provide a wide variety of long-lasting benefits. Besides the trees that are planted and cared for, community volunteer tree projects provide opportunities for residents to work together for the betterment of Waterford, as a community.

City of Waterford Urban Forest Plan & Resource Guide

Chapter 13
Urban Forests Funding Resources

Internal funding sources

Currently, funding for the planting and care of trees on City of Waterford lands comes from several sources. Developers are required to plant landscaping, including trees, in new City parks and public parkways constructed as part of a development plan. Subsequent maintenance of trees in these new public landscaping areas is funded through local assessment districts. In older areas that do not have assessment districts, the ongoing maintenance and eventual replacement of public trees along streets and in parks is derived from the City's General Fund, as part of the overall budget for the Public Works Department.

Grants provided by other agencies and organizations can serve to augment the City's existing sources of funding. However, many grant programs require that some matching funding be provided by the applicant.

External funding sources

Various grant programs administered by state and federal agencies or private foundations and organizations provide funding for a variety of projects related to urban forestry. Some grants are available directly to local governments, whereas others are only available to other entities, such as schools or non-profit community tree groups. By partnering with other groups, the City can expand its options for obtaining urban forestry grant funding.

External funding programs may change over time. Due to the current (2012) fiscal limitations experienced by the Federal and State agencies, funding for Urban Forest program efforts is extremely limited and highly competitive. Some state programs are funded by specific ballot propositions and have a limited lifespan. New programs also become available over time. The listing below includes grant programs that were in existence as of Spring 2012. Individual granting agencies and organizations should be checked for the current availability, guidelines, and deadlines for the grants listed. In addition, the website http://www.grants.gov/ provides information on competitive grant opportunities from all Federal grant-making agencies and should be monitored for new federal grant programs. The Foundation Center website (http://www.fdncenter.org/) provides a variety of information related to grants provided by private foundations.

State and federally-funded grants

Environmental Protection Agency Environmental Education Grants

The Grant Program sponsored by EPA's Office of Environmental Education supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality. EPA awards grants each year based on

funding appropriated by Congress. Annual funding for the program ranges between $2 and $3 million. More than 75 percent of the grants awarded by this program are for less than $15,000.
http://www.epa.gov/enviroed/grants.html

The California Resources Agency Environmental Enhancement and Mitigation Program

The Environmental Enhancement and Mitigation Program (EEMP) were established by the Legislature in 1989. It offers a total of $10 million each year for grants to local, state, and federal governmental agencies and to nonprofit organizations for projects to mitigate the environmental impacts caused by new or modified state transportation facilities. State gasoline tax monies fund the EEMP. Grants are awarded in three categories:

Highway Landscape and Urban Forestry-- Projects designed to improve air quality through the planting of trees and other suitable plants.

Resource Lands -- Projects for the acquisition, restoration, or enhancement of watersheds, wildlife habitat, wetlands, forests, or other natural areas.

Roadside Recreational -- Projects for the acquisition and/or development of roadside recreational opportunities.

http://resources.ca.gov/eem/

California Department of Water Resources

The Department's Urban Streams Restoration Program (USRP) provides grants for local projects that reduce flooding and erosion of urban streams, improve environmental values and promote community stewardship. Past grants have funded a variety of activities: creek cleanups; eradication of exotic or invasive plants; re-vegetation and bioengineering bank stabilization projects; channel reconfiguration to improve stream geomorphology and aquatic habitat functions; and acquisition of property critical for flood management.

A project may be eligible for a USRP grant if most of the questions below can be answered with "yes":

1. Does the proposed project address a stream-related problem?
2. Are flooding and/or erosion from the stream affecting an urban area?

http://www.watershedrestoration.water.ca.gov/urbanstreams/

Green Trees for the Golden State

These grants provide funds to help cities, counties, districts and non-profit 501c (3) organizations plant trees in public urban settings and provide three years of care for those trees. The goals of the grant program are to improve urban environments and to promote increased awareness in the proper planting and care needed to foster healthy community forests while incorporating community involvement, participation, education and stewardship. The original grant funding was provided by Proposition 12 in the year 2000.
http://www.ufei.org/grantinfo.lasso

Non-governmental grants

American Forests/Global ReLeaf Urban Forests Program

American Forests is looking for quality tree-planting projects to be funded by their ReLeaf Forests
http://www.americanforests.org/what-we-do/what-we-do-urban-forests/

The Great Valley Center

The Great Valley Center serves the Central Valley's 19 counties by supporting innovative proposals for nonprofit work in the areas of Land Use, Economic Development, Growth, Agriculture, and Community Investment. During the past six

years, grant sizes have ranged from $500 to more than $20,000, the average being $10,000. To date, about one in three applicants have received awards
http://www.greatvalley.org/legaci/index.aspx

The Conservation Fund/Kodak American Greenways Awards Program
The Conservation Fund supports an ecosystem restoration program. They are particularly interested in partnering with private and public sector organizations and agencies to plant trees and improve the environment in projects that would otherwise not be feasible. They support projects that plant the right trees in the right places for the right reasons.
http://www.conservationfund.org/?article=2106

National Fish and Wildlife Foundation
The National Fish and Wildlife Foundation provide funding on a competitive basis to projects that sustain, restore, and enhance our Nation's fish, wildlife, and plants and their habitats. Their strategic plan organizes grant-making efforts into three broad areas: Keystones and Charters. All Foundation grants are awarded through one of these three areas.
http://www.nfwf.org/programs.cfm

ESRI-Sponsored Grants
ESRI, a leading geographic information systems (GIS) software developer, continues to seek relationships with organizations by partnering in common task initiatives. ESRI has found the best way to forge relationships is through education and grant programs. Free software, hardware, and training bundles are available under several ESRI-sponsored grant programs.
http://www.esri.com/grants/esri/conservation.html
http://www.aiacc.org

Wal-Mart/Sam's Club Community Matching Grant Program
The Community Matching Grant Program is the largest program funded by Wal-Mart and Sam's Club. The Matching Grant program allows local nonprofit organizations to hold fundraisers at their local Wal-Mart or Sam's Club. Wal-Mart and Sam's can elect to match a portion of the funds raised up to $1,000. Events held off the premises of a Wal-Mart store or Sam's Club are also eligible for funding when a Wal-Mart or Sam's Club associate is actively involved in the event. Additionally, once the Wal-Mart or Sam's Club has met certain criteria in the Matching Grant Program each year, a second source of funding is awarded to the store / club to use in the community. These funds do not require a fundraiser to be held, instead the funds can be awarded directly to a deserving organization general matching grant and small grant programs, and the Foundation administers a number of special grant programs with specific guidelines and time-lines.
http://www.walmartfoundation.org/

National Tree Trust Roots and Seeds Programs
The National Tree Trust believes strong organizations are a key to healthy urban and community forests. Through the Seeds Program grant, established urban and community forestry organizations use funding for organizational needs, which include rent, staff salary and purchase of upgraded technology.
http://www.nationaltreetrust.org

The Home Depot Grants for the Environment
The Home Depot Foundation considers requests for grants to: 1) conserve forestlands and/or promote responsible forestry management, 2) encourage green

building and sustainable design in affordable housing, 3) identify and help alleviate the causes of lead poisoning in children in at-risk communities, and 4) promote community recycling and clean-up.
http://www.homedepotfoundation.org

William Turnbull Jr. Environmental Education Grant

Ten years ago, after the passing of renowned architect William Turnbull Jr., FAIA, the Foundation Regents initiated a special environmental education grant, as a tribute to his legacy. The William Turnbull, Jr., FAIA Environmental Education Grant program, fosters the public's awareness of the relationship between the built and natural environments. This program has supported a number of community programs including the San Diego Zoological Society, the California Preservation Foundation, and the Greenspace Cambria Land Trust. In addition, they supported the Great Valley Center's efforts to help our communities think about building a livable future by sponsoring publication of Our Valley…Our Choice.
http://aiacc.org/environmental-grants-program/

City of Waterford Urban Forest Plan & Resource Guide

Chapter 14
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The Waterford General Plan, including all its Elements, can be accessed on the Waterford Website at (http://cityofwaterford.org/departments/planning/general-plan/) Copies of various tree and urban forest related Municipal Code provisions, they appear in Waterford Municipal Code are available on The City of Waterford Website (http://qcode.us/codes/waterford/). The City of Waterford can be contacted directly for copies of other related standards and guidelines such as the City of Waterford Improvement Standards, Architectural Review Design Guidelines, etc.

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City of Waterford Urban Forest Plan & Resource Guide
Chapter 15
Master Tree List

Chinese Pistache ***Pistacia chinensis (Budded Sterile Male Trees Only)***
Raywood Ash ***Fraxinus oxycarpa***
Moraine Ash ***Fraxinus moranous***
White Ash ***Fraxinus americana***
Green Ash ***Fraxinus pennsylvanica***
Tulip Tree ***Liriodenoron tulipifera***
Autumn Gold (Maidenhair Tree) ***Ginkgo biloba***
Red Oak ***Quercus rubra***
Live Oak ***Quercus agriflia***
Holly Oak ***Quercus ilex***
Bradford Pear ***Pyrus calleryana***
Chinese Tallow ***Sapium sebiferum***
Japanese Privet ***Ligustrum japonica***
Chinese Hackberry ***Celtis occidentalis, sineisis***
Australian Willow, Wilga ***Geijera parviflora. Rutaceae***
Greenshire Little Leaf Linden ***Tilia cordata***
American Linden ***Tilia Americana***
Japanese Zelkova ***Zelkova serrata***
Black or Sun Burst Locust ***Robinia pseudoacacia***
Eastern Redbud ***Cercis candensis***
Plane Tree, Sycamore. ***Platanus. platanaceae***
London Plane Tree ***Platanus acerifolia***
African Sumac ***Rhus*** **(Male Only)**
Chinese Elm, Chinese Evergreen Elm ***Ulmus Ulmaceae parvifolia*** **(often sold a** ***U. p.*** **'Sempervirens')**
Liquidambar ***Hamamelidiaceae***
Kentucky Coffee Tree ***Gymnocladus dioica.***
Japanese Tree Lilac. ***S. reticulata (s. japanica, S. amurensis japonica).***
Crape Myrtle ***Lagerstroemia indica Lythraceae.***
Tident Maple ***A. buergeranum***
Japanese Maple ***A. palmatum***

City of Waterford Urban Forest Plan & Resource Guide

Appendix A Tree Descriptions

Waterford Urban Forest Tree Species Resource Guide
Sunset Western Garden Book
Climate Zone 8

Pistache
Pistacia anacardianceae
Deciduous or semi-evergreen trees. Divided leaves on all species. Flowers are now showy. Female trees bear fruit after several years if male trees are nearby. O species described, only P. *vera* bears edible fruit (nuts). Others are ornamental trees. Verticillium wilt may strike established trees. Minimize susceptibility by planting in well-drained soil, watering deeply and infrequently.

Chinese Pistache *Pistacia chinensis*
Moderate growth to 60 feet tall, 50 feet wide. Young trees often gawky and lopsided, but older trees become dense and shapely with reasonable care. Leaves with 10-16 paired leaflets 2-4 inches long by ¾ inches wide. Foliage colors beautifully in fall-scarlet, crimson, orange, sometimes yellow tones. Fruit on female trees bright red, turning dark blue. Not fussy as to soil or water; accepts moderately alkaline conditions, lawn watering though verticillium wilt is a danger or no summer watering at all (this only in deep soils). Resistant to oak root fungus. Stake young trees and prune for first few years to develop head high enough to walk under. Reliable tree for street or lawn, patio or garden corner planting.

Ash *Fraxinus oleaceae*
Deciduous trees, one almost evergreen. Trees grow fairly fast and most tolerate hot summers, cold winters and many kinds of soil (including alkaline soil). Chiefly used as street trees, shade trees, lawn trees, patio shelter trees. Fairly pest free.

In most cases leaves are divided into leaflets. Male and female flowers generally inconspicuous, in clusters) grow on separate trees in some species, on same tree in others. In latter case, flowers are often flowed by clusters of single-seeded, winged fruit, often in such abundance that they can be a litter problem. When flowers are on separate trees, you'll get fruit on female tree only if it grows near a male tree.

White Ash *F. americana*. Native to eastern U. S. and grows to 80-feet in height with straight trunk and oval-shaped crown. Leaves 8-15 inches long with 5-9 dark green, oval leaflets, paler beneath; turn purplish in fall. Needs some watering. Edges show burning in hot, windy areas. Male and female flowers on separate trees, but plants

sold are generally seedlings, so you don't know what you're getting. With both male and female trees, you will get a heavy crop of seed; letter and seedlings a problem. Seedless selections include "Autumn Applause" and Autumn Purple", both with exceptionally good, long-lasting purple fall color; Champaign County" a dense upright oval with brown and purple fall color.

Green Ash, Red Ash *F. Pennsylvania (F. lanceolata)*. Deciduous, native to eastern U.S. Moderate grower to 30-40 feet in height forming compact oval crown. Gray brown bark; dense twiggy structure. Leaves 10-12 inches long, divided into 5-9 bright green, rather narrow, 4-6 inch long leaflets. Male and female flowers on separate trees. Takes wet soil and severe cold but foliage burns in hot dry winds. Seedless varieties include; "Marshall", "Summit", "Bergeson", "Emerald" "Patmore" and "Urbanite".

F. oxycarpa. Compact, small-leafed, fine-textured ash with delicate, lacy look. The species is not known in the West; the following selection from Australia is choice.

Raywood Ash, Claret Ash *Fraxinus oxycarpa*
Compact, round-headed, fast-growing tree to 25-35 feet. Produces no seeds. Purple red fall color.

F. holotricha.
Deciduous tree. Native of eastern Balkan Peninsula. Upright, rather narrow tree to 40 feet in height. Leaves of 9-13 dull green, 2-3 inches long leaflets with toothed edges. Casts light, filtered shade. Leaves turn yellow in fall, dry up and sift down into lawn or ground cover, thus lessening litter problem.

***F.h.* 'Morain' Ash**.
Selected variety; more round headed than species, produces few seeds. Good lawn tree-neat, symmetrical, uniform bright yellow in fall.

***F. velutina* (Arizona Ash)**
Deciduous tree. Native to Arizona. Tree withstands hot, dry conditions and cold to about –10 F. Pyramidal when young; spreading, more open when mature. Leaves divided into 3-5 narrow to oval, 3 inch long leaflets. Male and female flowers on separate streets.

***F.v.* 'Modesto" Ash** Selection from tree in Westside Park, Modesto, California. Vigorous form of Arizona ash. Grows to about 50 feet, with a 30-foot spread. Medium green leaflets, glossier than those of the species, turns bright yellow in fall. In many area, Modesto Ash leaves get scorched look following a wet spring. This is caused by fungus disease called anthracnose. Control by spraying with benomyl. Prune out and dispose of infected wood; it can re-infect. Veticillium wilt is prevalent in agricultural areas; there is no control once it's started in young trees, but established trees often survive. Keep trees vigorous; if any are lost, replace with Raywood Ash. Control aphids, psyllids, and spier mites with contact spray. Resistant to oak root fungus.

Tulip Tree *Liriodenoron tulipifera*
Deciduous tree. Fast Growth to 60-80 ft., with eventual spread to 40 ft. Straight columnar trunk, with spreading, rising branches that form tall pyramidal crown. Lyre-shaped leaves, 5-6 inches long and wide, Turn from bright yellow green to bright yellow (or yellow brown) in fall. Tulip-shaped flowers in late spring are 2 inches wide, greenish yellow, orange at base. Handsome at close range, thy are not showing on the tree being high up and well-concealed by leaves. They are not usually produced until tree is 10-12 years old.

Tree needs room, deep, rich, swell-drained neutral or slightly acid soil; plenty of summer water. Best where constant wind from one direction won't strike it. Control scale insects and aphids as necessary. Not bothered by oak rot fungus.

Good large shade, lawn, or roadside tree. Spreading root system makes it hard to garden under. Columnar variety 'Arnold' is useful in narrow planting areas; it will bloom 2-3 years after planing. 'Majestic Beauty' (L. t. 'Aureo-marginatum') has leaves edged with yellow. Moderate growth rate, size.

Autumn Gold (Maidenhair Tree) ***Ginkgo biloba***

Deciduous tree. Graceful, hardy tree, attractive in any season, especially in fall when leathery, light green leaves of spring and summer suddenly turn gold. Fall leaves linger, then drop quickly and cleanly to make golden carpet where they fall. Related to conifers but differs in having broad (1-4 inch wide), fan-shaped leaves rather than needlelike foliage. In shape and veining, leaves resemble leaflets of maidenhair fern, hence name. Can grow to 70-80 feet, but most mature trees are 35-50 feet . May be gawky in youth, but becomes well-proportioned with age. Narrow to spreading or even umbrella shaped at maturity. Usually grows slowly, about 1-foot per year but under ideal conditions can grow up to 3-feet per year.

Plant only male trees (grafted or grown from cuttings of male plants); female trees produce messy, fleshy, ill-smelling fruit in quantity. Named varieties listed below are reliably male. Use as street tree, lawn tree. Plant in deep, loose, well-drained soil. Be sure plant is not root-bound in can. Stake young trees to keep them straight; young growth may be brittle, but wood becomes strong with age. Water through dry seasons until 10-20 feet high, then let tree become self-sufficient. In general, ginkgos are not bothered by insects or diseases. They are resistant to oak root fungus.

G. b. **'Autumn Gold'**. Upright, eventually rather broad.

G. b. **'Fairmount'** Fast-growing, pyramidal form. Straighter main stem than; Autumn Gold', requires less staking and tying.

Oak ***Quercus fagceae***

Deciduous or evergreen trees. Western homeowners acquire oak trees in either of 2 ways. They may plant the trees themselves, starting from a nursery plant or an acorn or they may simply have a native oak tree, left from the days when the land was wild, on their property.

The method of acquisition is quite significant. An oak tree planted in a garden will vigorously and fast (1 ½ - 4 feet per year). It probably will not experience poor health or any unusual pest attacks, whether it's a western native or not. Old wild tree, on the other hand, quite frequently cannot handle the surfeit of water and nutrients that they receive in a garden and must be given special treatment.

Special treatment for existing native oaks. If possible, do not raise or lower grade level between trunk and drip line. If you must alter grade, put a well around the base of trunk so that grade level there is not changed. Never water within 4-feet of trunk or allow water to stand within that area. Any of a number of sucking and chewing insects and mites feed upon existing native oaks. Most of the time these creatures are kept in check by other insects and mites, birds, and by insect-and-mite troubles that we don't even know about.

Occasionally, though, an outbreak of some organism-usually oak moth larvae- gets bad enough to required artificial control. When that happens, call a commercial arborist or pest control firm to diagnose and treat the problems; oak trees are too big for home owners to reach with their limited spray equipment.

Oak root fungus (Armilliaria) is often present in many California neighborhoods that once were oak forests or walnut groves. Get an arborist's advise on how to sustain infected trees. All old oaks, infected or not, can benefit from feeding and deep watering (fertilize and irrigate only out near drip line).

Old native oaks also benefit from periodic grooming to remove dead wood. However, arborists should not cut thick branches unless they have good reasons for doing so, since excessive pruning may stimulate succulent new growth that will be subject to mildew.

Q. rubra, Q. rubra maxima, Q. Borealis **Red Oak, Northern Red Oak.** Deciduous. Fast growth to 90 feet. Broad, spreading branches and round-topped crown. Leaves 5 – 8 inches long by 3 – 5 inches wide, with 3 – 7 pairs of sharp-pointed lobes. New leaves and leaf stalks are red in spring, turning to dark red, ruddy brown, or orange in fall. Needs fertile soil and plenty of water. Stake young plants. High-branching habit and reasonably open shade make it a good tree for big lawns, parks, broad avenues. It deep roots make it good to garden under.

Q. agriflia **Coast Live Oak** Evergreen tree. Native to Coast Ranges. Round-headed, wide-spreading tree to 20 – 70 feet high, often with greater spread. Smooth, dark gray bark. Dense foliage of rounded, holly-like, 1 –3 inch long leaves, slightly glossy n upper surface. As planted tree from nursery or acorn, it can grow as high as 25 feet in ten years, 50 feet in 25-years. Attractive green all year unless hit by oak moth larvae. Has greedy roots and drops almost all its old leaves in early spring just when gardening time is most malleable. Regardless of these faults, it's a handsome and quite worthwhile shade tree or street tree. Can be sheared into a handsome 10-20 foot hedge.

Q. ilex **Holly Oak Holm Oak.** Evergreen. Native to Mediterranean region. Grows at a moderate rate to 40-70 feet high, with equal spread. Leaves vary in shape and size, but are usually 1 ½ - 3 inches long ½ -1 inches wide, either toothed or smooth edged, dark, rich green on upper surface, yellowish or silvery below. Tolerates wind and salt air; will grow in constant sea wind, but tends to be shrubby there. Inland, growth rate can be moderately fast but varies with soil and water conditions. Good evergreen street or lawn tree where coast live oak is difficult to maintain, but lacks open grace of coast live oak. Can take hard clipping into formal shapes or hedges.

Ornamental Pear *Pyrus rosaceae*
Deciduous or evergreen trees. Most ornamental species are subject to fireblight. All are best in full sun, will get along with no more than moderate summer watering once established.

P. calleryana **Bradford Pear** Grows to 25-50 feet. Strong horizontal branching pattern. Leaves 1 ½ -3 inches long., broadly oval, scalloped, dark green, very glossy and leathery, Flowers clustered, pure white, ¾ -1 inch wide; very early bloom. In coldest areas, flower crop may be destroyed by late freezes in some years. Fruit very small, round, inedible. Fairly resistant to fireblight; rich purplish red fall color.

'Bradford', original introduction, has strongly horizontal limbs, has reached 50-feet in height, 30-feet in width. 'Aristocrat' is more pyramidal, with up-curving branches. 'Redspire' is similar, with yellow to red fall color. 'Capital' and 'Whitehouse' are narrowly columnar. 'Chanti-cleer' is narrow but not columnar, about 40 feet tall by 15 feet wide. 'Trinity' is round-head form.

Chinese Tallow *Sapium sebiferum Euphorbiaceae.*
Deciduous tree. To 35-feet with dense round or conical crown of equal width. Outstanding fall color. Tends toward shrubbiness, multiple trunks, suckering, but easily trained to single trunk. In colder areas, un-ripened branch tips freeze back each winter; new growth quickly covers damage, but may require thinning. Leaves are poplar-like, roundish, tapering to slender point, light green. Foliage is dense, but general effect is airy; leaves flutter in lightest breeze. If tree is in full sun and has moderate autumn chill, its foliage turns brilliant, translucent, neon red. Some trees color plum purple, yellow, orange, or mixture of colors. If possible, select your tree while it is in fall color; a few specimens have shown nondescript yellow instead of flaming red. Tiny yellowish flowers in spikes at branch tips; fruit small, clustered, grayish white; they are covered by a waxy coating.

Hardy to 10* - 15* F. Grows in most soils, but does somewhat better in mildly acid conditions. Give it ample water for fast growth and prune only to correct shape. Stake young plants securely. Good lawn or street tree, patio or terrace shade tree. Resistant to oak root fungus. Good screening against low summer sun or objectionable view. Gives light to moderate shade.

Privet *Ligustrum. Oleaceae*
Deciduous or evergreen shrubs or small trees. Most widely used in hedges. Can also be clipped into formal shapes and featured n tubs or large pots. One type is a common street tree. All have abundant, showy clusters of white to creamy white flowers in late spring or early summer. (Clipped hedges bear fewer flowers because most of the flower-bearing branches get trimmed off.) Fragrance is described as "pleasant" to "unpleasant". Flowers draw bees. Small, blue black, berry-like fruit follows blossoms. Birds eat fruit, thus distributing seeds resulting in multitudes of seedlings.

Most privets are easily grown in sun or some shade, and in any soil. Give them lots of water. In some areas they are subject to lilac leaf miner, which disfigures leaves.

Confusion exists concerning identity of certain privets in nurseries. The plant sold as *L. japonicum* usually turns out to be the small tree *L. lucidum*. The true *L. Japonicum* is available in 2 (or more) forms. The tall, shrubby kind is the true species; the lower-growing, more densely foliaged form is typically sold as *L. texanum*, and probably should be called *L. japonicum* 'Texanum'. In a similar fashion, the smaller-leafed hardy privets used for hedging are often confused; *L. amurense*, *L. ovalifolium*, and *L. vulgare* look much alike and any is likely to be sold as common privet, a name that belongs *to L vulgare.*

***L. japonicm* Japanese Privet** Evergreen shrub. Dense, compact growth habit to 20 – 12 feet, but can be kept lower by trimming. Roundish oval leaves 2 – 4 inches long, dark to medium green and glossy above, distinctly paler to almost whitish beneath; have thick, slightly spongy feeling. Excellent plants for hedges or screens, or for

shaping into globes, pyramids, other shapes, or small standard trees. Sunburns in hot spells. In areas of caliche soil, or where Texas root rot prevails, grow it in containers.

Hackberry *Celtis Ulmaceae*
Deciduous trees. Related to elms and similar to them in most details, but smaller. All have virtue of deep rooting; old trees in narrow planting strips expand in trunk diameter and nearly fill strips; but without a surface rood or any sign of heaving the sidewalk or curb. Bare-root plants, especially in larger sizes, sometimes fail to leaf out. Safer to buy in containers. Or try for small bare-root trees with big root systems. Especially good in windy locations. Though young trees should be staked until well established. When established, trees will take wind, desert heat, much drought, and alkaline soil.

Street or lawn trees, even near buildings or paving; will take overhead shade. All have inconspicuous flowers. Only pest problems of note seems to be occasional aphid attack. Trees are attractive to birds.

***C. occidentalis* Common Hackberry** Native to eastern U. S. Grows to form rounded crown 50 feet high or more and nearly as wide. Branches are spreading and sometimes pendulous. Leaves oval, bright green, 2 – 5 inches long, finely toothed on edges. Tree does not leaf out until April or later. Resistant to oak root fungus. Tolerates high-plains heat, wind, alkaline soil, urban pollution.

***C. sineisis* Chinese Hackberry, Yunnan Hackberry** Similar in growth habit to common hackberry, but smaller. Leaves to 4 inches long, smoother and glossier than those of other hackberries, with scallop-toothed edges.

Australian Willow, Wilga *Geijera parviflora. Rutaceae*
Graceful, fine textured, to 25 30 feet high, 20 foot wide. Main branches sweep up and out, little branches hang down, Distant citrus relative; called Australian willow because its 3 – 6 inch long, narrow, medium green, drooping leaves give a kind of weeping willow effect. With age, produces loose clusters of unimportant small, creamy white flowers in early spring, early fall. Well-drained soil and full sun; plant tolerates light shade but tends to be thin in foliage. Established three resists drought but responds to ample water with faster growth. Needs pruning only to correct from (much less pruning than willow). Quite pest free.

Has much of the willow's grace and the eucalyptus's toughness. Moderate growth rate; deep, noninvasive roots. Casts light shade. Plant singly as patio or street tree. Or in colonies for attractive grove effect.

Linden *Tilia. Tiliaceae*
Deciduous trees. Dense, compact crowns. Much used for street and park planting in Europe. All have small, quite fragrant, yellowish white flowers in drooping clusters. All respond well to deep rich soil and plenty of water. All grow at slow to moderate rate. Young trees need staking and shaping. Older trees need only corrective pruning. Under certain circumstances, aphids cause disagreeable drip of honeydew and accompanying sooty mildew.

***T. americana* American Linden** To 40-60 feet with 20 – 25 foot spread. Straight trunk; dense, compact narrow crown Heart-shaped, dull dark green leaves to 4-6 inches long, 3-4 inches wide (some times longer). Lose clusters of fragrant, yellowish white flowers in June-July. "Redmond" is a pyramidal form with glossy foliage.

***T. cordata* Little-Leaf Linden** To 30-50 feet with 15 – 30 foot spread. Form densely pyramidal. Leaves 1 ½ - 3 inches long, equally broad or broader, dark green above, silvery beneath. Flowers in July. Excellent medium-sized lawn or street tree. Given space to develop its symmetrical crown, it can be a fine patio shade tree (but expect bees in flowering season). It is the hardiest linden. 'Chancellor', Glenleven', 'Greenspire', 'June Bride', and 'Olympic' are selected forms. 'June Bride' has an especially heavy show of flowers.

Japanese or Sawleaf Zelkova *Zelkova serrata Ulmaceae*
Deciduous tree. A good shade tree, it grows at moderate to fast rate, eventually to 60 feet or higher and equally wide. Smooth, gray bark like that of beech. Leaves similar to those of elm (2 – 3 ½ inches long by 1 ½ inches wide) but rougher textured, with saw-tooth margins. Carefully train young trees to develop strong framework – head back excessively long pendulous branches to force side growth, thin competing branches to permit full development of the strongest. Water deeply to encourage deep rooting. Pest resistant, but elm leaf beetles are a problem in local elms died.

Fall foliage color varies from yellow to dark red to dull reddish brown. Three grafted selections are sold; 'Halka', the fastest growing , resembles American elm more than do 'Green Vase' and 'Village Green. All are good substitutes for elm.

Locust *Robinia Leguminosae*
Deciduous trees or shrubs. Leaves divided like feathers into many roundish leaflets; clusters of sweet pea-shaped, white or pink flowers mid-spring to early summer. They are hardy everywhere, fairly fast growing, and sell adapted to dry hot regions. Will take poor soil, much drought when established. Drawbacks: wood is brittle, roots aggressive, plants often spread by suckers.

***R. pseudoacacia* Black or Sun Burst Locust Tree**; fast growth to 75 feet, with rather open, sparse-branching habit. Deeply furrowed brown bark. Thorny branchlets. Leaves divided into 7 – 19 leaflets 1 – 2 inches long. Flowers are white, fragrant, ½ - ¾ inches long, in dense, hanging clusters 4 –8 inches long. Bean-like, 4-inch long pods turn brown and hang on tree all winter.

Emigrants brought seeds with tem from eastern U. S., and black locust is now common everywhere in West. In California's Gold Country it has gone native. Very drought tolerant. With pruning and training in its early years, it is a truly handsome flowering tree – but it is so common, and so commonly neglected, that it's often overlooked.

Has been used as street tree, but not good in narrow parking strips or under power lines. Wood is extremely hard, tough; trees difficult to prune out where not wanted. Varieties include:

'Frisia'. Leaves yellow; new growth nearly orange. Thorns; new wood red.
'Pyramidalis'.('Fastigiata'). Very narrow, columnar tree.
'Tortuosa'. Slow growing, with twisted branches. Few-flowered blossom clusters.
'Umbraculifera'. Dense, round headed. Usually grafted 6 – 8 feet high on another locust. Very few flowers.

Redbud *Cercis. Leguminosae*
Deciduous shrubs or trees. Five redbuds are grown in the West; 2 western natives, one eastern native, one from Europe, one from China. Early spring flowers are sweet pea-shaped, small, in clusters; where tree is

adapted, blossoms are borne in great profusion on bare twigs, branches, sometimes even on main trunk. Flowers are followed by clusters of flat pods. Attractive broad, rounded leaves are heart shaped at base. All give fall color with first frosts. Average water needs (except for drought-tolerant *C. occidentalis*)

***C. candensis* Eastern Redbud** Native of eastern U. S. Largest and fastest growing of available species where adapted. To 25 – 35 feet tall. Most apt to take tree form. Round headed but with horizontally tiered branches in age. Rich green, 3 – 6 inches long leaves have pointed tips. Small (1/2 inch long), rosy pink flowers clothe bare brown branches in early spring. Valuable for filling the gap between the early-flowering fruit trees (flowering peach, flowering plum), and the crabapples and late-flowering cherries. Varieties are 'Alba' (white flowers), 'Forest Pansy' (purple foliage, needs some shade in hot climates), 'Oklahoma' (wine red flowers, thick, glossy, heat resistant leaves), 'Plena' (double flowers), and 'Rubye Atkinson' (pure pink flowers).

Plane Tree, Sycamore. *Platanus. platanaceae*

Deciduous trees. All grow large, have lobed, maple-like leaves. Older bark sheds in patches to reveal pale, smooth, new park beneath. Brown, ball-like seed clusters hang from branches on long stalks through winter; prized for winter arrangements. Somewhat drought tolerant but better with some deep watering in summer. Subject to blight (anthracnose) which causes early, continued leave fall; *p. racemosa* especially susceptible. Rake up and dispose of dead leaves, since fungus spores can over-winter on them.

***P. acerifolia (P. orientalis)* London Plane Tree** Fast growth to 40 – 80 feet, with 30 – 40 foot spread. Smooth, cream-colored upper trunk and limbs. Leaves are 3 – 5- lobed, 4- 5 inches wide. Tolerates most soils, stands up beautifully under city smog, soot, dust, reflected heat. Can be pollarded to create dense, low canopy.

Watch for spider mites and scale. Boot street, park, or lawn tree. Used on lines and blocks for formal plantings; avenues, screens masses. Powdery mildew can cause premature leave drop in some seasons. The scarce variety 'Yarwood' is somewhat resistant. 'Bloodgood' has some resistance to anthracnose.

Sumac *Rhus. Anacardianceae*

Evergreen or deciduous shrubs or trees. Of the ornamental sumacs, deciduous kinds are hardy anywhere and thrive in poor soils. They tend to produce suckers, especially if their roots are disturbed by soil cultivation. They need some water. Evergreen sumacs are not as hardy as the deciduous kinds, but they will grow in almost any soil as long as it is well drained (soggy soils may kill them). They are fire retardant if fairly well watered.

***R. lancea* African Sumac** Evergreen tree. Slow growing to 25-feet. Open, spreading habit; graceful weeping outer branchlets. Leaves divided into 3-willow-like, dark green leaflets 4-5 inches long. Pea-sized, berry-like, yellow or red fruit grows in clusters on female tree, can be messy on pavement.

African Sumac can tolerate high summer heat. Established plants are drought resistant, but will also thrive in lawns. Hardy to 12* F. Stake and prune to establish form you want. Makes attractive, airy tree with interesting branch pattern

and effective dark red, rough bark. You can train it to a single trunk or let it grow as multi-trunked tree that looks somewhat like olive. Also useful as screens, clipped hedges, or background plantings. Old plants easy to transplant if grown under dry conditions.

Elm *Ulmus Ulmaceae*

Deciduous or partially evergreen trees. Easy to grow in any fairly good soil; will survive in most poor ones. Best with normal watering, but will tolerate low moisture conditions at expense of good growth, plant health. Root systems are aggressive and close to surface; you will have trouble growing other plants under these trees. Branch crotches often narrow, easily split. Many of the larger elms are tasty to leaf beetles, bark beetles, leafhoppers, aphids, and scale, making them either time-consuming to care for or messy (or both). Dutch elm disease, formerly a problem in the East and Midwest, has reached western states.

***U. parvifolia* (often sold a *U. p.* 'Sempervirens') Chinese Elm, Chinese Evergreen Elm.** Evergreen or deciduous according to winter temperatures and tree's individual heredity. So-called evergreen elm usually sold as 'Sempervirens'; this may be evergreen most winters, lose its leaves in unusual cold snap (new leaves come on fast). Very fast growth to 40- 60 feet, with 50 – 70 foot spread. Often reaches 30 feet in 5 years. Extremely variable in form, but generally spreading, with long, arching, eventually weeping branchlets. Trunks of older trees have bark, which sheds in patches somewhat like sycamore. Leaves leathery, ¾ - 2 ½ inches long, 1/3 – 1 1/3 inches wide, oval, evenly toothed. Round fruit forms in fall while leaves are still on tree.

Stake young trees until trunks can carry weight of branches. Stake and head leading shoot higher than other shade trees to compensate for weeping. Rub or cut out small branches along trunk for first few years. Shorten overlong branches or strongly weeping branches to strengthen tree scaffolding. Older trees may need thinning to lessen chance of storm damage. Bothered very little by pests or diseases.

Good for patio shade in milder portions of West. Useful for sun screening. With careful pruning, useful as a street tree.

Varieties are 'Brea', with larger leaves, more upright habit; and 'Drake', with small leaves, weeping habit. Both are more or less evergreen. 'True Green' has small deep green leaves, is round headed, more evergreen than others.

Sweet Gum

Liquidambar *Hamamelidiaceae*

Deciduous trees. Valuable for form, foliage, and fall color, easy culture. Moderate growth rate; young and middle-aged trees generally upright, somewhat cone shaped, spreading in age. Lobed, apple-like leaves. Flowers inconspicuous; fruits are spiny balls which ornament trees in winter, need raking in spring.

Requires neutral or slightly acid soils; cholorosis is strongly alkaline soils is hard to correct. Prune only to shape. Trees branch from ground up and look most natural that way; can be pruned high for easier foot traffic.

Good street trees. Form surface roots which can be nuisance in lawns or parking strips. Effective in tall screens or groves, planted 6-10 ft. apart. Brilliant fall foliage. Leaves

color best when trees are in full sun and well-drained soil; fall color less effective in mildest climates or in mild, late autumns. For best appearance, should be watered deeply once a month in heavy soils, twice a month in sandy soils through dry season.

L. formosana. (Chinese Sweet Gum) To 40-60 ft. tall, 24ft. wide. Free-form outline; sometimes pyramidal, especially when young. Leaves 3-5 lobed, 3-4 ½ inches across, violet red when expanding, then deep green.

L. orientalis (Oriental Sweet Gum). Native to Turkey. To 20-30 feet; spreading or round headed. Leaves 2-3 inches wide, deeply lobed, each lobe again lobed in lacy effect. Resistant to oak root fungus.

L. styraciflua (American Sweet Gum) Grows to 6- feet. Narrow and erect in youth, with lower limbs eventually spreading to 20-25 feet. Tolerates damp soil; resistant to oak root fungus. In winter, branching pattern, furrowed bark, corky wings on twigs, and hanging fruit give interest; in spring and summer, leaves are deep green; in fall, leaves turn purple, yellow or red. Even seedling trees give good color (which may vary somewhat from year to year), but for uniformity, match trees while they are in fall color or buy budded trees of a named variety, which as the following:

'Burgundy'. Leaves turn deep purple red, hang late into winter or even early spring if storms are not heavy.
'Festival' Narrow, columnar. Light green foliage turns to yellow, peach, pink, orange, and red.
'Palo Alto' Turns orange red to bright red in fall.

Kentucky Coffee Tree *Gymnocladus dioica* Deciduous tree, native to eastern U. S. Saplings grow very fast, but slow down at 8-10 feet. Trees ultimately reach 50 feet in height. Narrowish habit in youth. Older trees broader, with fairly few heavy, contorted branches. These, together with stout winter twigs, make bare tree picturesque. Leaves (1 ½ - 3 feet long) come out late in spring; they are pinkish when expanding, deep green in summer, yellow in autumn. Inconspicuous flowers are followed by 6-10 inch long flat reddish brown pods containing hard black seeds. Average soil and routine watering. Established trees will take some drought, much heat and cold, poor soil. Effective for form in any cold-winter garden.

Lilac *Syringa Oleaceae* Deciduous shrubs, rarely small trees. Best where winter brings pronounced chill, but some bloom well with light chilling. Sun, light shade in hottest areas. All like alkaline soil.

Japanese Tree Lilac. *S. reticulata (s. japanica, S. amurensis japonica).* Large shrub easily trained as single-stemmed 30-ft. tree. Bark is smooth, something like cherry in its gloss. Large leaves (to 5 inches long). White flower clusters to 1 ft. appear in late spring, early summer. Flowers showy, but not fragrant; they smell like privet flowers. Useful small shade or street tree in difficult climates.

Crape Myrtle *Lagerstroemia indica Lythraceae*. Deciduous shrub or tree. Root hardy and sometimes treated as perennial. Flower freely. Native of China. Dwarf shrubby forms and shrub-tree forms, 6-30 feet tall. Slow growing as shrub, spreads as wide as high; trained as tree, becomes vase shaped with very attractive trunk and branch pattern. Spring foliage is light green tinged bronze red; mature leaves 1-2 inches long, oval deep glossy green. Fall foliage is yellow, more rarely orange to red. Crinkled, crepe-like, 1 ½ inch flowers in rounded,

slightly conical clusters, 6-12 inches long, at ends of branches. Colors in shapes of red, rose, deep or soft pink, rosy orchid, purple, white. Long flowering period from July to September.

Subject to mildew. Selections called Indian Tribes have heavy foliage with considerable resistance to mildew. (Catawba, Cherokee, Potomac, Seminole, Powhata). Hybrids between *L. indica* and the species *L. fauriei* have even greater resistance to mildew than Indian Tribes.

Maple ***Acer Aceraceae*** Deciduous or evergreen trees or large shrubs. Larger maples have extensive fibrous root systems that take water and nutrients form the topsoil. The great canopy of leaves calls for a steady, constant supply of water not necessarily frequent watering, but constantly available water throughout the root zone. Ample deep watering and periodic feeding will help keep roots down.

Tident Maple ***A. buergeranum*** Native of China and Japan. Grows 20-25 feet high. Lobed leaves that are pale beneath. Fall color usually red, varies to orange or yellow. Low, spreading growth; A decorative, useful patio tree and favorite bonsai subject.

Japanese Maple ***A. palmatum*** Native to Japan and Korea. Slow rowing to 20-feet; normally many stemmed. Most airy and delicate of all maples. Leaves 2-4 inches long, deeply cut into 5-9 toothed lobes. All-year interest; young spring growth is flowing red; summer's leaves are soft green; fall foliage scarlet, orange, or yellow. Slender leafless branches in greens and reds provide winter pattern. Resistant to oak root fungus.

Date Palm ***Phoenix Palmae***
Mostly large feather palms, but one a dwarf. Trunks patterned with bases of old leaf stalks. Small yellowish flowers in large, hanging sprays followed by clusters of often edible fruit (*P. dactylifera* bears dates of commerce). These palms hybridize freely, so buy from reliable nurseryman who knows his seed or plant source.

P. canariensis **Canary Island Date Palm**
Big, heavy-trunked plant to 60-feet tall with 50-foot spread composed of a great many gracefully arching fronds. Grows slowly until it forms trunk, then speeds up a little. Young plants do well in pots for many years, looking something like pineapples. Grow on slopes, in parks, big spaces along wide streets; not for small city lots. Hardy to 20* F. Slow to develop new head of foliage after hard-frost damage.

City of Waterford Urban Forest Plan & Resource Guide

Appendix "B"

Waterford Tree Management Descriptions

Name	Habit	Positive	Negative	Best Application
Chinese Pistache *Pistacia chinensis*	Moderate growth to 60 feet tall, 50 feet wide. Young trees often gawky and lopsided, but older trees become dense and shapely with reasonable care. Leaves with 10-16 paired leaflets 2-4 inches long by ¾ inches wide. Foliage colors beautifully in fall-scarlet, crimson, orange, sometimes yellow tones. Fruit on female trees bright red, turning dark blue. Not fussy as to soil or water; accepts moderately alkaline conditions, lawn watering though verticillium wilt is a danger or no summer watering at all (this only in deep soils). Resistant to oak root fungus. Stake young trees and prune for first few years to develop head high enough to walk under.	One of the best all-around street tree species; relatively pest free; excellent fall color; relatively drought-tolerant.	Spindly growth when young, so must be properly trained; sometimes attacked by Verticillium wilt, a soil-borne fungus disease; female trees bear large crops of nuisance fruits, so budded male sterile trees should be planted – these are not always easy to find in the trade.	Reliable tree for street or lawn, patio or garden corner planting
Raywood Ash *Fraxinus oxycarpa*	Deciduous trees, one almost evergreen. Trees grow fairly fast and most tolerate hot summers, cold winters and many kinds of soil (including alkaline soil). Fairly pest free. In most cases leaves are divided into leaflets. Male and female flowers generally inconspicuous, in clusters) grow on separate trees in some species, on same tree in others. In latter case, flowers are often flowed by clusters of single-seeded, winged fruit, often in such abundance that they can be a litter problem. When flowers are on separate trees, you'll get fruit on female tree only if it grows near a male tree. Compact, round-headed, fast-growing tree to 25-35	Relatively good street tree; fast growing.	Attacked by woolly ash aphids which produce large amounts of honeydew; suffers from an unknown branch dieback disorder (examples of this problem can be found in Waterford).	Chiefly used as street trees, shade trees, lawn trees, patio shelter trees.

	feet. Produces no seeds. Purple red fall color.			
Name	**Habit**	**Positive**	**Negative**	**Best Application**
Moraine Ash ***Fraxinus moranous***	Deciduous tree. Native of eastern Balkan Peninsula. Upright, rather narrow tree to 40 feet in height. Leaves of 9-13 dull green, 2-3 inches long leaflets with toothed edges. Casts light, filtered shade. Leaves turn yellow in fall, dry up and sift down into lawn or ground cover, thus lessening litter problem. More round headed than species, produces few seeds.	Fast growth; grows relatively well under lawn irrigation.	Becomes very seedy with age – large numbers of brown, winged seeds may become as numerous as the leaves; susceptible to mistletoe.	Good lawn tree-neat, symmetrical, uniform bright yellow in fall.
White Ash ***F. americana***.	Grows to 80-feet in height with straight trunk and oval-shaped crown. Leaves 8-15 inches long with 5-9 dark green, oval leaflets, paler beneath; turn purplish in fall. Needs some watering. Seedless selections include "Autumn Applause" and Autumn Purple", both with exceptionally good, long-lasting purple fall color; Champaign County" a dense upright oval with brown and purple fall color.	Trees grow fairly fast and most tolerate hot summers, cold winters and many kinds of soil (including alkaline soil). Fairly pest free.	With both male and female trees, you will get a heavy crop of seed; letter and seedlings a problem. Leaf edges show burning in hot, windy areas.	Chiefly used as street trees, shade trees, lawn trees, patio shelter trees.
Green Ash, Red Ash ***F. pennsylvanica (F. lanceolata)***.	Deciduous, native to eastern U.S. Moderate grower to 30-40 feet in height forming compact oval crown. Gray brown bark; dense twiggy structure. Leaves 10-12 inches long, divided into 5-9 bright green, rather narrow, 4-6 inch long leaflets.	Takes wet soil and severe cold but foliage burns in hot dry winds	Male and female flowers on separate trees. Seedless varieties include; "Marshall", "Summit", "Bergeson", "Emerald" "Patmore" and "Urbanite".	Chiefly used as shade trees, lawn trees, patio shelter trees. Little growth experience in Waterford
Tulip Tree ***Liriodenoron tulipifera***	Deciduous tree. Fast Growth to 60-80 ft., with eventual spread to 40 ft. Straight columnar trunk, with spreading, rising branches that form tall pyramidal crown. Lyre-shaped leaves, 5-6 inches long and wide, Turn from bright yellow green to bright yellow (or yellow brown) in fall. Tulip-shaped flowers in late spring are 2 inches wide, greenish yellow, orange at base. Handsome at close range, thy are not showing on the tree being high up and well-concealed by leaves. They are not usually produced until tree is 10-12 years old. Tree needs room, deep, rich, swell-drained neutral or slightly acid soil; plenty of summer water. Control scale insects and aphids as necessary. Not bothered by oak rot fungus.		Not recommend for Waterford. It develops iron chlorosis in alkaline soils, which Waterford has. It is also consistently and heavily attacked by the tulip tree aphid.	Good large shade, lawn, or roadside tree. Spreading root system makes it hard to garden under. Best where constant wind from one direction won't strike it.

Name	Habit	Positive	Negative	Best Application
Autumn Gold (Maidenhair Tree) ***Ginkgo biloba***	Deciduous tree. Graceful, hardy tree, attractive in any season, especially in fall when leathery, light green leaves of spring and summer suddenly turn gold. Fall leaves linger, then drop quickly and cleanly to make golden carpet where they fall. Related to conifers but differs in having broad (1-4 inch wide), fan-shaped leaves rather than needlelike foliage. In shape and veining, leaves resemble leaflets of maindenhair fern, hence name. Can grow to 70-80 feet, but most mature trees are 35-50 feet. May be gawky in youth, but becomes well-proportioned with age. Narrow to spreading or even umbrella shaped at maturity. Usually grows slowly, about 1-foot per year but under ideal conditions can grow up to 3-feet per year. Plant only male trees (grafted or grown from cuttings of male plants); female trees produce messy, fleshy, ill-smelling fruit in quantity. Named varieties listed below are reliably male. Plant in deep, loose, well-drained soil. Be sure plant is not root-bound in can. Stake young trees to keep tem straight; young growth may be brittle, but wood becomes strong with age. Water through dry seasons until 10-20 feet high, then let tree become self-sufficient. In general, ginkgos are not bothered by insects or diseases. They are resistant to oak root fungus.	A very good street tree; almost pest free; relatively easy to train; excellent fall color.	Very slow growing; female trees produce very objectionable nuisance fruits – only guaranteed male sterile trees should be planted.	Use as street tree, lawn tree.
Red Oak ***Quercus rubra***	Deciduous. Fast growth to 90 feet. Broad, spreading branches and round-topped crown. Leaves 5 – 8 inches long by 3 – 5 inches wide, with 3 – 7 pairs of sharp-pointed lobes. New leaves and leaf stalks are red in spring, turning to dark red, ruddy brown, or orange in fall. Needs fertile soil and plenty of water. Stake young plants.	Good fall color.	Develops iron chlorosis in alkaline soil; has a serious aphid pest problem; probably best to keep the numbers of this species low in Waterford.	High-branching habit and reasonably open shade make it a good tree for big lawns, parks, broad avenues. It deep roots make it good to garden under.

Name	Habit	Positive	Negative	Best Application
Live Oak ***Quercus agriflia***	Evergreen tree. Native to Coast Ranges. Round-headed, wide-spreading tree to 20 – 70 feet high, often with greater spread. Smooth, dark gray bark. Dense foliage of rounded, holly-like, 1 –3 inch long leaves, slightly glossy n upper surface. As planted tree from nursery or acorn, it can grow as high as 25 feet in ten years, 50 feet in 25-years. Attractive green all year unless hit by oak moth larvae. Has greedy roots and drops almost all its old leaves in early spring just when gardening time is most malleable.	In time a very large tree; best in a park where there is plenty of room.	Because of its ultimate size, not a good choice for a street tree; produces acorns, which may become a nuisance and slipping hazard when they fall to the sidewalk.	A handsome and quite worthwhile shade tree or street tree. Can be sheared into a handsome 10-20 foot hedge.
Holly Oak ***Quercus ilex***	Evergreen. Native to Mediterranean region. Grows at a moderate rate to 40-70 feet high, with equal spread. Leaves vary in shape and size, but are usually 1 ½ - 3 inches long ½ -1 inches wide, either toothed or smooth edged, dark, rich green on upper surface, yellowish or silvery below. Tolerates wind and salt air; will grow in constant sea wind, but tends to be shrubby there. Inland, growth rate can be moderately fast but varies with soil and water conditions.	Medium size; naturally well-shaped.	Often produces large crops of acorns; evergreen, so winter sun is blocked.	Good evergreen street or lawn tree where coast live oak is difficult to maintain, but lacks open grace of coast live oak. Can take hard clipping into formal shapes or hedges.
Bradford Pear ***Pyrus calleryana***	Deciduous or evergreen trees. All are best in full sun, will get along with no more than moderate summer watering once established. Grows to 25-50 feet. Strong horizontal branching pattern. Leaves 1 ½ -3 inches long, broadly oval, scalloped, dark green, very glossy and leathery, Flowers clustered, pure white, ¾ -1 inch wide; very early bloom. In coldest areas, flower crop may be destroyed by late freezes in some years. Fruit very small, round, inedible. Fairly resistant to fireblight; rich purplish red fall color. 'Bradford', original introduction, has strongly horizontal limbs, has reached 50-feet in height, 30-feet in width. 'Aristocrat' is more pyramidal, with up-curving branches. 'Redspire' is similar, with yellow to red fall color. 'Capital' and 'Whitehouse' are narrowly columnar. 'Chanti-cleer' is narrow but not columnar, about 40 feet tall by 15 feet wide. 'Trinity' is round-head form.	The best of the Callery flowering pears; good, medium size; used throughout downtown Waterford; attractive spring bloom and fall color; fast growth.	Vigorous, upright growth habit; needs careful early training to develop strong framework; susceptible to iron chlorosis in wet, poorly-drained soils; nuisance fruits (small, brown fleshy berries) are often a problem.	A handsome and quite worthwhile street tree with bright fall colors.
				Best Application

Name	Habit	Positive	Negative	
Chinese Tallow ***Sapium sebiferum***	Deciduous tree. To 35-feet with dense round or conical crown of equal width. Outstanding fall color. Tends toward shrubbiness, multiple trunks, suckering, but easily trained to single trunk. In colder areas, un-ripened branch tips freeze back each winter; new growth quickly covers damage, but may require thinning. Leaves are poplar-like, roundish, tapering to slender point, light green. Foliage is dense, but general effect is airy; leaves flutter in lightest breeze. If tree is in full sun and has moderate autumn chill, its foliage turns brilliant, translucent, neon red. Some trees color plum purple, yellow, orange, or mixture of colors. If possible, select your tree while it is in fall color; a few specimens have shown nondescript yellow instead of flaming red. Tiny yellowish flowers in spikes at branch tips; fruit small, clustered, grayish white; they are covered by a waxy coating. Hardy to 10* - 15* F. Grows in most soils, but does somewhat better in mildly acid conditions. Give it ample water for fast growth and prune only to correct shape. Stake young plants securely.	Medium size; fast growth; beautiful fall color; good lawn tree.	Produces small nuisance fruits (small, gray-white berries in clusters); small twigs throughout tree freeze and die back.	Good lawn or street tree, patio or terrace shade tree. Resistant to oak root fungus. Good screening against low summer sun or objectionable view. Gives light to moderate shade.
Japanese Privet ***Ligustrum japonica***	Evergreen shrub. Dense, compact growth habit to 20 – 12 feet, but can be kept lower by trimming. Roundish oval leaves 2 – 4 inches long, dark to medium green and glossy above, distinctly paler to almost whitish beneath; have thick, slightly spongy feeling. Sunburns in hot spells. In areas of caliche soil, or where Texas root rot prevails, grow it in containers.		Not recommend as a street tree. It produces heavy crops of nuisance fruits (small, black berries); the City of Waterford pulled out several dozen privets in the downtown area several years ago, and replaced them with Bradford pears.	Excellent plants for hedges or screens, or for shaping into globes, pyramids, other shapes, or small standard trees.

Name	Habit	Positive	Negative	Best Application
Chinese Hackberry, Yunnan Hackberry ***Celtis occidentalis, sineisis***	Deciduous trees. Related to elms and similar to them in most details, but smaller (to 50–feet). All have virtue of deep rooting; old trees in narrow planting strips expand in trunk diameter and nearly fill strips; but without a surface rood or any sign of heaving the sidewalk or curb. Bare-root plants, especially in larger sizes, sometimes fail to leaf out. Safer to buy in containers. Or try for small bare-root trees with big root systems. Especially good in windy locations. Though young trees should be staked until well established. When established, trees will take wind, desert heat, much drought, and alkaline soil. Similar in growth habit to common hackberry, but smaller. Leaves to 4 inches long, smoother and glossier than those of other hackberries, with scallop-toothed edges.	Relatively large tree; tolerates drought; fast growth; strong branches.	Produces nuisance fruits (small, purple berries).	Street or lawn trees, even near buildings or paving; will take overhead shade. All have inconspicuous flowers. Only pest problems of note seems to be occasional aphid attack. Trees are attractive to birds.
Australian Willow, Wilga ***Geijera parviflora. Rutaceae***	Graceful, fine textured, to 25 30 feet high, 20 foot wide. Main branches sweep up and out, little branches hang down, Distant citrus relative; called Australian willow because its 3 – 6 inch long, narrow, medium green, drooping leaves give a kind of weeping willow effect. With age, produces loose clusters of unimportant small, creamy white flowers in early spring, early fall. Well-drained soil and full sun; plant tolerates light shade but tends to be thin in foliage. Established three resists drought but responds to ample water with faster growth. Needs pruning only to correct from (much less pruning than willow). Quite pest free.	Very attractive, weeping habit.	Frost sensitive – will be seriously injured at temperatures below 32 degrees F; evergreen, so winter sun is blocked; often sheds many leaves in spring.	Has much of the willow's grace and the eucalyptus's toughness. Moderate growth rate; deep, noninvasive roots. Casts light shade. Plant singly as patio or street tree. Or in colonies for attractive grove effect.
American Linden ***Tilia americana***	To 40-60 feet with 20 – 25 foot spread. Straight trunk; dense, compact narrow crown Heart-shaped, dull dark green leaves to 4-6 inches long, 3-4 inches wide (some times longer). Lose clusters of fragrant, yellowish white flowers in June-July. "Redmond" is a pyramidal form with glossy foliage.	Respond well to deep rich soil and plenty of water. All grow at slow to moderate rate. Young trees need staking and shaping. Older trees need only corrective pruning	Like all Linden, under certain circumstances, aphids cause disagreeable drip of honeydew and accompanying sooty mildew.	Potential Street Tree. Little experience with this tree in Waterford.

Name	Habit	Positive	Negative	Best Application
Greenshire Little Leaf Linden *Tilia cordata*	Deciduous trees. Dense, compact crowns. Much used for street and park planting in Europe. All have small, quite fragrant, yellowish white flowers in drooping clusters. All respond well to deep rich soil and plenty of water. All grow at slow to moderate rate. Young trees need staking and shaping. Older trees need only corrective pruning. Under certain circumstances, aphids cause disagreeable drip of honeydew and accompanying sooty mildew. To 30-50 feet with 15 – 30 foot spread. Form densely pyramidal. Leaves 1 ½ - 3 inches long, equally broad or broader, dark green above, silvery beneath. Flowers in July. It is the hardiest linden. 'Chancellor', Glenleven', 'Greenspire', 'June Bride', and 'Olympic' are selected forms. 'June Bride' has an especially heavy show of flowers.	Relatively good lawn tree.	Attacked by aphids; upright form does not provide as much shade as spreading species.	Excellent medium-sized lawn or street tree. Given space to develop its symmetrical crown, it can be a fine patio shade tree (but expect bees in flowering season).
Japanese Zelkova *Zelkova serrata*	Deciduous tree. A good shade tree, it grows at moderate to fast rate, eventually to 60 feet or higher and equally wide. Smooth, gray bark like that of beech. Leaves similar to those of elm (2 – 3 ½ inches long by 1 ½ inches wide) but rougher textured, with saw-tooth margins. Carefully train young trees to develop strong framework – head back excessively long pendulous branches to force side growth, thin competing branches to permit full development of the strongest. Water deeply to encourage deep rooting. Pest resistant, but elm leaf beetles are a problem in local elms died. Fall foliage color varies from yellow to dark red to dull reddish brown.	Relatively good street tree species, but needs lots of space; large, spreading tree; tolerates drought; fast growth.	Susceptible to elm leaf beetle; gangly and somewhat unattractive when young.	Three grafted selections are sold; 'Halka', the fastest growing , resembles American elm more than do 'Green Vase' and 'Village Green. All are good substitutes for elm.

Name	Habit	Positive	Negative	Best Application
Black or Sun Burst Locust ***Robinia pseudoacacia***	Deciduous trees or shrubs. Leaves divided like feathers into many roundish leaflets; clusters of sweet pea-shaped, white or pink flowers mid-spring to early summer. They are hardy everywhere, fairly fast growing, and sell adapted to dry hot regions. Will take poor soil, much drought when established. Drawbacks: wood is brittle, roots aggressive, plants often spread by suckers. Fast growth to 75 feet, with rather open, sparse-branching habit. Deeply furrowed brown bark. Thorny branchlets. Leaves divided into 7 – 19 leaflets 1 – 2 inches long. Flowers are white, fragrant, ½ - ¾ inches long, in dense, hanging clusters 4 –8 inches long. Bean-like, 4-inch long pods turn brown and hang on tree all winter. .	Very drought tolerant. With pruning and training in its early years, it is a truly handsome flowering tree – but it is so common, and so commonly neglected, that it's often overlooked	Not recommend; either black or honey locusts as street trees; root systems are very invasive, and sprout freely; foliage is thin and unattractive; black locust is very susceptible to aphids. (The City of Modesto is systematically removing all of their honey locust street trees, mainly because of sidewalk damage problems).	Can be used as a park or garden tree.
Eastern Redbud ***Cercis candensis***	Deciduous shrubs or trees. Early spring flowers are sweet pea-shaped, small, in clusters; where tree is adapted, blossoms are borne in great profusion on bare twigs, branches, sometimes even on main trunk. Flowers are followed by clusters of flat pods. Attractive broad, rounded leaves are heart shaped at base. All give fall color with first frosts. Average water needs (except for drought-tolerant *C. occidentalis*) Native of eastern U. S. Largest and fastest growing of available species where adapted. To 25 – 35 feet tall. Most apt to take tree form. Round headed but with horizontally tiered branches in age. Rich green, 3 – 6 inches long leaves have pointed tips. Small (1/2 inch long), rosy pink flowers clothe bare brown branches in early spring. Varieties are 'Alba' (white flowers), 'Forest Pansy' (purple foliage, needs some shade in hot climates), 'Oklahoma' (wine red flowers, thick, glossy, heat resistant leaves), 'Plena' (double flowers), and 'Rubye Atkinson' (pure pink flowers).	Very nice small tree; mostly planted for its blossoms and attractive fruit.	Small size does not make it a very effective street tree.	Valuable for filling the gap between the early-flowering fruit trees (flowering peach, flowering plum), and the crabapples and late-flowering cherries.

Name	Habit	Positive	Negative	Best Application
London Plane Tree, Sycamore. *Platanus acerifolia*	Deciduous trees. All grow large, have lobed, maple-like leaves. Older park sheds in patches to reveal pale, smooth, new park beneath. Brown, ball-like seed clusters hang from branches on long stalks through winter; prized for winter arrangements. Somewhat drought tolerant but better with some deep watering in summer. Subject to blight (anthracnose) which causes early, continued leave fall; *p. racemosa* especially susceptible. Rake up and dispose of dead leaves, since fungus spores can over-winter on them. Fast growth to 40 – 80 feet, with 30 – 40 foot spread. Smooth, cream-colored upper trunk and limbs. Leaves are 3 – 5- lobed, 4- 5 inches wide. Watch for spider mites and scale. Boot street, park, or lawn tree. Used on lines and blocks for formal plantings; avenues, screens masses. Powdery mildew can cause premature leave drop in some seasons. The scarce variety 'Yarwood' is somewhat resistant. 'Bloodgood' has some resistance to anthracnose.	Still one of the best, hardiest, problem-free large street trees; good near sidewalks; tolerates lawn water; excellent branch structure with little pruning.	Some people have allergic reactions to the hairs on the bottom of the leaves.	Tolerates most soils, stands up beautifully under city smog, soot, dust, reflected heat. Can be pollarded to create dense, low canopy.
African Sumac *Rhus* (Male Only)	Evergreen or deciduous shrubs or trees. Of the ornamental sumacs, deciduous kinds are hardy anywhere and thrive in poor soils. They tend to produce suckers, especially if their roots are disturbed by soil cultivation. They need some water. Evergreen sumacs are not as hardy as the deciduous kinds, but they will grow in almost any soil as long as it is well drained (soggy soils may kill them). They are fire retardant if fairly well watered. Evergreen tree. Slow growing to 25-feet. Open, spreading habit; graceful weeping outer branchlets. Leaves divided into 3-willow-like, dark green leaflets 4-5 inches long. Pea-sized, berry-like, yellow or red fruit grows in clusters on female tree, can be messy on pavement. African Sumac can tolerate high summer heat. Established plants are drought resistant, but will also thrive in lawns. Hardy to 12* F. Stake and prune to establish form you want.	Tough tree; tolerates heat and drought; good lawn tree.	Evergreen, so blocks winter sun; very messy leaf drop in spring and summer; produces nuisance fruits (red berries); requires careful training when young to prevent blowing over, especially in shallow or poorly-drained soils; frost sensitive.	Makes attractive, airy tree with interesting branch pattern and effective dark red, rough bark. You can train it to a single trunk or let it grow as multi-trunked tree that looks somewhat like olive. Also useful as screens, clipped hedges, or background plantings. Old plants easy to transplant if grown under dry

				conditions.
Name	**Habit**	**Positive**	**Negative**	**Best Application**
Chinese Elm, Chinese Evergreen Elm ***Ulmus Ulmaceae parvifolia*** **(often sold a *U. p.* 'Sempervirens')**	Deciduous or partially evergreen trees. Best with normal watering, but will tolerate low moisture conditions at expense of good growth, plant health. Branch crotches often narrow, easily split. Evergreen or deciduous according to winter temperatures and tree's individual heredity. So-called evergreen elm usually sold as 'Sempervirens'; this may be evergreen most winters, lose its leaves in unusual cold snap (new leaves come on fast). Very fast growth to 40- 60 feet, with 50 – 70 foot spread. Often reaches 30 feet in 5 years. Extremely variable in form, but generally spreading, with long, arching, eventually weeping branchlets. Trunks of older trees have bark which sheds in patches somewhat like sycamore. Leaves leathery, ¾ - 2 ½ inches long, 1/3 – 1 1/3 inches wide, oval, evenly toothed. Round fruit forms in fall while leaves are still on tree. Stake young trees until trunks can carry weight of branches. Stake and head leading shoot higher than other shade trees to compensate for weeping. Rub or cut out small branches along trunk for first few years. Shorten overlong branches or strongly weeping branches to strengthen tree scaffolding. Older trees may need thinning to lessen chance of storm damage. Very little bothered by pests or diseases. Varieties are 'Brea', with larger leaves, more upright habit; and 'Drake', with small leaves, weeping habit. Both are more or less evergreen. 'True Green' has small deep green leaves, is round headed, more evergreen than others.	Very beautiful spreading tree; attractive bark; tolerates drought; fast growth. Easy to grow in any fairly good soil; will survive in most poor ones.	Partially evergreen – drops more leaves in cold weather; susceptible to European elm scale.	Good for patio shade in milder portions of West. Useful for sun screening. With careful pruning, useful as a street tree. Root systems are aggressive and close to surface; you will have trouble growing other plants under these trees. Many of the larger elms are tasty to leaf beetles, bark beetles, leafhoppers, aphids, and scale, making them either time-consuming to care for or messy (or both). Dutch elm disease, formerly a problem in the East and Midwest, has reached western states.

Name	Habit	Positive	Negative	Best Application
Liquidambar ***Hamamelidiaceae***	Deciduous trees to 60 feet in height; some low growth ornamental species to 30-feet. Valuable for form, foliage, and fall color, easy culture. Moderate growth rate; young and middle-aged trees generally upright, somewhat cone shaped, spreading in age. Lobed, apple-like leaves. Flowers inconspicuous; fruits are spiny balls which ornament trees in winter, need raking in spring. Requires neutral or slightly acid soils; cholorosis is strongly alkaline soils is hard to correct. Prune only to shape. Trees branch from ground up and look most natural that way; can be pruned high for easier foot traffic. Brilliant fall foliage. Leaves color best when trees are in full sun and well-drained soil; fall color less effective in mildest climates or in mild, late autumns. For best appearance, should be watered deeply once a month in heavy soils, twice a month in sandy soils through dry season	Fast, upright growth that needs little or no pruning; beautiful fall colors.	Bears large crops of nuisance fruits (large, spiny balls); subject to limb breakage; shallow, invasive roots in lawns.	Good street trees along parkways and parking lots. Form surface roots which can be nuisance in lawns or parking strips. Effective in tall screens or groves, planted 6-10 ft. apart.
Kentucky Coffee Tree ***Gymnocladus dioica***	Deciduous tree, native to eastern U. S. Saplings grow very fast, but slow down at 8-10 feet. Trees ultimately reach 50 feet in height. Narrowish habit in youth. Older trees broader, with fairly few heavy, contorted branches. These, together with stout winter twigs, make bare tree picturesque. Leaves (1 ½ - 3 feet long) come out late in spring; they are pinkish when expanding, deep green in summer, yellow in autumn. Inconspicuous flowers are followed by 6-10 inch long flat reddish brown pods containing hard black seeds. Average soil and routine watering. Established trees will take some drought, much heat and cold, poor soil. Effective for form in any cold-winter garden.	Colorful and hardy.	Nuisance seed pods	No experience with this tree in Waterford.
Japanese Tree Lilac. ***S. reticulata (s. japanica, S. amurensis japonica).***	Large shrub easily trained as single-stemmed 30-ft. tree. Bark is smooth, something like cherry in its gloss. Large leaves (to 5 inches long). White flower clusters to 1 ft. appear in late spring, early summer. Flowers showy, but not fragrant; they smell like privet flowers. Useful small shade or street tree in difficult climates.	Colorful flowers; like alkaline soil.		Can be used as a street tree under power lines or in areas requiring low shrubbery.

Name	Habit	Positive	Negative	Best Application
Crape Myrtle ***Lagerstroemia indica Lythraceae***.	Deciduous shrub or tree. Native of China. Dwarf shrubby forms and shrub-tree forms, 6-30 feet tall. Slow growing as shrub, spreads as wide as high; trained as tree, becomes vase shaped with very attractive trunk and branch pattern. Spring foliage is light green tinged bronze red; mature leaves 1-2 inches long, oval deep glossy green. Fall foliage is yellow, more rarely orange to red. Crinkled, crepe-like, 1 ½ inch flowers in rounded, slightly conical clusters, 6-12 inches long, at ends of branches. Colors in shapes of red, rose, deep or soft pink, rosy orchid, purple, white. Long flowering period from July to September.	Root hardy and sometimes treated as perennial. Flower freely.	Subject to mildew. Selections called Indian Tribes have heavy foliage with considerable resistance to mildew. (Catawba, Cherokee, Potomac, Seminole, Powhata). Hybrids between *L. indica* and the species *L. fauriei* have even greater resistance to mildew than Indian Tribes.	Small yard or street tree.
Tident Maple *A. buergeranum*	Native of China and Japan. Grows 20-25 feet high. Lobed leaves that are pale beneath. Fall color usually red, varies to orange or yellow. Low, spreading growth;	Attractive small leaves and colorful.	Extensive fibrous root systems that take water and nutrients form the topsoil.	Small yard or street tree A decorative, useful patio tree and favorite bonsai subject.
Japanese Maple *A. palmatum*	Native to Japan and Korea. Slow rowing to 20-feet; normally many stemmed. Most airy and delicate of all maples. Leaves 2-4 inches long, deeply cut into 5-9 toothed lobes. All-year interest; young spring growth is flowing red; summer's leaves are soft green; fall foliage scarlet, orange, or yellow. Slender leafless branches in greens and reds provide winter pattern.	Attractive all year. Resistant to oak root fungus.	Extensive fibrous root systems that take water and nutrients form the topsoil. Ample deep watering and periodic feeding will help keep roots down.	Small yard or street tree
Canary Island Date Palm ***Phoenix canariensis***	Mostly large feather palms, but one a dwarf. Trunks patterned with bases of old leafstalks. Small yellowish flowers in large, hanging sprays followed by clusters of often-edible fruit (*P. dactylifera* bears dates of commerce). Big, heavy-trunked plant to 60-feet tall with 50-foot spread composed of a great many gracefully arching fronds. Grows slowly until it forms trunk, then speeds up a little. Hardy to 20* F. Slow to develop new head of foliage after hard-frost damage.		Not a good street tree in residential areas, as it does not produce shade; should be planted along wide avenues (like Las Palmas), or in parks to be enjoyed at a distance.	Young plants do well in pots for many years, looking something like pineapples. Grow on slopes, in parks, big spaces along wide streets; not for small city lots