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# WONDERWOOD PARK

## Forest Management Plan

September, 2011

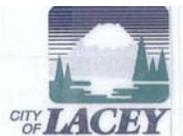
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*Prepared by*

**WASHINGTON FORESTRY CONSULTANTS, Inc.**  
**Olympia, WA**  
**360/943-1723**



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Washington State Department of Natural Resources Urban and Community Forestry Programs.  
The USDA is an equal opportunity provider and employer.

# **WONDERWOOD PARK Forest Management Plan**

*Prepared for the*  
**City of Lacey**  
**Parks and Recreation Department**  
**Lori Flemm, Director**



*Approved and Adopted by the*  
**City of Lacey Board of Park Commissioners**  
September, 2011

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- Forest Management Plan-

## WONDERWOOD PARK

Lacey, WA

### **Introduction**

The City of Lacey has requested that Washington Forestry Consultants, Inc. (WFCI) perform an inventory and assessment of trees, wildlife habitat, and other vegetation and prepare a 'Forest Management Plan' for Wonderwood Park. The purpose is to improve the overall health of the forest and enhance wildlife habitat in the park, while protecting the values that park patrons desire.

### **Wonderwood Park Location**

Located in the center of Lacey, Wonderwood Park provides approximately 40 acres of natural woodland combined with recreational facilities. Recreation amenities in the park include: paved pathways that thread through the woods, two picnic shelters, several picnic tables, two softball/soccer athletic fields, four tennis courts, a basketball court, and a playground at both the Stikes entrance and the Sunset entrance.

The park is situated in Lacey between Brentwood Drive SE and Impala Drive SE, north of 33<sup>rd</sup> Court SE (see Appendix VI). There are four separate pedestrian and vehicular entrances to Wonderwood Park, including Sunset Drive SE at the NW corner of the park,

Brentwood Drive SE on the east side, and Stikes Drive SE/32nd Avenue SE on the south side.

There are two legal tax parcels: #11828240200 and #11828240000 located in Section 28, Township 18 North, Range 1 west. Each parcel is approximately 20 acres (see Appendix VII).

The City of Lacey, and its Urban Growth Area, is divided into ten park planning areas. Wonderwood Park is centrally located within the Wonderwood Planning Area. In 2010, the population of the planning area was estimated at 15,819, with a density of 3,955 people per square mile.

### **Park Master and Management Plan**

Most parks in the City of Lacey’s park system have a master plan. A master plan is a ‘map’ (see Appendix V) drawn to show the existing and proposed uses and areas such as athletic fields, picnic areas, trails, restrooms, parking lots, play equipment, tennis and basketball courts, cultural resources, wildlife habitat, trails, open playfields, wetlands and buffers in a park.

The master plan for Wonderwood Park was adopted by the City Council on September 26, 1985. One of the goals in this plan is “To preserve existing mature woodlands”. Public meetings were held and a citizen task force convened to give input into the master plan for the park.

A Site Master Plan for Wonderwood Park was prepared on May 15, 1976 to guide development and estimate costs of development. In June of 1972, the Environmental Design class at the Evergreen State College prepared a ‘Design Proposal’ for a Lacey Community Park, which included some early management policy discussion.

A management plan identifies how each area will be managed and maintained, including the purpose or program for the park, any special rules in addition to adopted park rules, hours of park use, and best management practices for the man-made and natural features in the park. The management plan must be continually updated, may vary with the seasons, and usually does not address emergency repairs due to vandalism. Some of the parks in the City of Lacey’s park system have a management plan, while other have a partial management plan or no plan.

The Forest Management Plan is the first phase in the process to take a holistic approach to planning, both master and management planning, for Wonderwood Park. It may take years to address all natural resources in a management plan, but with each successive planning phase, we lay the groundwork for improved stewardship of our parks.

### **Park Acquisition and Development History**

In 1971, the City of Lacey purchased approximately twenty acres for what would be the first park in the city with \$14,500 of city funds, and a grant of \$58,000 from the Washington State Interagency Committee for Outdoor Recreation.

Two years later, the city purchased another approximately 20 acre parcel with a second grant from the Washington State Interagency Committee for Outdoor Recreation, in the amount of \$52,500, and a donation of \$17,500. This was followed by a third grant from the Washington State Interagency Committee for Outdoor Recreation in the amount of \$101,816. The city added \$25,454 and Wonderwood Park became our first developed park.

Phase 2 of the park's development was funded in 1977 with \$107,302 of city funds and a fourth grant of \$192,688 from the Washington State Interagency Committee for Outdoor Recreation.

In 2005, Wonderwood Park was redeveloped using \$1,010,000 in voter approved bonds and city funds, and a fifth grant in the amount of \$280,000 from the Washington State Interagency Committee for Outdoor Recreation.

In 2011, the City was awarded a \$10,000 Community Forestry Grant from the USDA Forest Service and the Washington State Department of Natural Resources Urban and Community Forestry Program to prepare a forest management plan. The City of Lacey retained the services of Washington Forestry Consultants, Inc. to prepare this plan.

### **Goals and Objectives - Supporting Plans**

The City of Lacey has recognized the need to protect and manage its valuable urban forest. Our vision for the city is to retain as much tree canopy as possible to preserve the forested Pacific Northwest character of the city. These goals and objectives will serve as the structure for park planning, acquisition and development, as well as management.

The need to design space for trees, encourage and enforce sound tree protection practices, facilitate tree planting, and create long-term tree planting plans is critical. A significant element of maintaining a livable city is to instill pride in its citizens. Citizens that take pride in their city and environment will get more involved and work even harder to preserve, protect, and enhance its beauty and livability.

The Comprehensive Plan for Outdoor Recreation was adopted by the City Council on July 22, 2010 and includes many goals and objectives that are relative to Wonderwood Park, and specifically to the Forest Management Plan. These specific goals and objectives in the comprehensive plan (listed below) support the purpose of our project:

1. GOAL: Develop a high quality, diversified parks and recreation system that provides amenities and activities for all ages, interests and abilities.

OBJECTIVE:

- ◆ Develop improvements and new opportunities within existing parks to accommodate population growth and increased demand within planning areas.

5. GOAL: Incorporate critical areas, ecological features and natural resources into the park system to protect and preserve habitat and retain migration corridors important to local wildlife.

OBJECTIVES:

- ◆ Identify, protect, and conserve wildlife habitat including nesting sites, foraging areas, and linkages within or adjacent to natural areas, open spaces, and the developing urban area.
- ◆ Acquire and provide appropriate public access to environmentally unique areas.
- ◆ Provide for public access to observe wildlife, enjoy nature, and develop an appreciation for our natural environment.
- ◆ Interpret and provide educational opportunities to instill an appreciation of critical areas and wildlife habitat in our citizens.
- ◆ Ensure minimal or passive development of some areas in parks in order to retain natural character.

6. GOAL: Develop a high quality system of multi-purpose trails and corridors that access significant environmental features, public facilities, neighborhoods and business districts and promote physical activity and a health conscious community.

OBJECTIVES:

- ◆ Extend appropriate types of trails through natural area corridors or greenways such as Woodland Creek and around natural features that will provide a high quality, diverse representation of area environmental resources.
- ◆ Actively promote the use of the developed trails systems in ways that encourage physical activity and a health conscious community.

8. GOAL: Continue to maintain parks and recreational facilities at a high standard of care.

OBJECTIVES:

- ◆ Ensure that adequate resources for maintenance accompany development.
- ◆ Work in cooperation with utility providers to extend municipal utilities, such as sewer service and drinking water, to all public parks whenever possible.
- ◆ Encourage and support local volunteer participation in park maintenance and security.

9. GOAL: Encourage public involvement when planning for park development and management, and for recreational opportunities.

OBJECTIVES:

- ◆ Encourage public participation in planning efforts through citizen surveys, public meetings and informal discussions.
- ◆ Minimize land use conflicts between parks and neighboring land by locating parks on public roads or adjacent to compatible land uses. Parks with less than 50% of a continuous park border along street frontage may experience misuse. Encourage citizen surveillance through a Park Watch Volunteer Program.
- ◆ Encourage volunteer stewardship of recreational and natural resources.

11. GOAL: Develop, staff, train and support a professional parks and recreation department that effectively serves the community in the realization of the identified goals and objectives.

The City of Lacey Urban Forest Management Plan was prepared and adopted in 2005. The technical review conducted during preparation of the Urban Forest Management Plan revealed 43% of our city is currently covered with native forest and planted ornamental tree canopy, compared to 48% tree canopy cover in 1966 when our city was incorporated.

Our goal is to insure no net loss of trees to reduce our carbon footprint in Wonderwood Park. The loss of forest canopy, individual trees, and the increase in urban development has ecological consequences. Loss of green infrastructure leads to declining ability to sustain ecosystem services for water, air and carbon.

The City of Lacey Urban Forest Management Plan provides a detailed Goal and Policy section, including the following goals that support this project:

SUMMARY GOAL: The goal of managing city trees is to improve canopy cover and the aesthetic and physical benefits of trees to a community, while protecting the infrastructure from tree damage. This can have positive environmental and economic benefits to the community. In short, the urban trees should be compatible and functional, while minimizing maintenance costs.

GOAL 4. Recognize the benefits of tree cover in consideration of drainage and watershed planning, habitat management, passive recreation opportunities, urban aesthetics, and maintain and improve Lacey’s overall tree canopy for these benefits and purposes.

GOAL 5. Provide significant habitat value in Lacey’s urban forest.

The Urban Forester’s Technical Review and Recommendations, include, “Solicit grant funding, corporate donations and other funds to expand tree planting.”

In pursuit of this goal, the \$10,000 Community Forestry Grant has made it possible for the City to move forward with the preparation of a forest management plan, and retain the services of a consulting forester, Washington Forestry Consultants, Inc.

### **Forest Management Plan Purpose and Objectives**

The City of Lacey would like to practice good forest management that will improve the general health and wildlife values of the forest stands while providing an active recreation area for the surrounding community.

The purpose of this effort is to generate a Forest Management Plan for Wonderwood Park that provides a sound approach to improving the health and sustainability of the forest, completes the inventory of existing trees, conducts an assessment of the health of the individual trees, the wildlife habitat in the forest, identifies trees that provide food and shelter, and develops an implementation plan that that prescribes the necessary current and future work and timelines to complete this work.

## Scope of Services

The following is a brief summary of the scope of services of WFCI for this project.

1. Perform an inventory and assessment of all trees 6 inches and larger in the park.
2. Perform an assessment of desirable understory plant cover, invasive plant cover and prescribe necessary management to improve desirable understory plant stocking, while eliminating undesirable or invasive plants.
3. Assess the available snags and downed logs, and other wildlife habitat values.
4. Provide a 'Forest Management Plan' that summarizes our findings and recommendations for short and long-term management of trees and vegetation in the park.

## Methods

A 100% inventory of all trees 6 inches and larger was performed. Information on species, size, crown class, tree health, and necessary cultural care was collected. Tree diameters were recorded in 2 inch DBH classes. Tree heights of high risk trees were measured with a TruePulse 360B when accurate tree height information was necessary.

Mitigation was prescribed for trees that were determined to be high risk trees. The assessment methodology used for high risk trees is detailed in Harvey and Hessburg's U.S. Forest Service publication<sup>1</sup>, specifically developed for parks and campgrounds. The locations of trees requiring work were determined using a Trimble Nomad GPS data collector. Individual trees were numbered in the field and a list is provided with the location map for the trees.

## Observations

### Site Description

The park has nearly flat topography with no prevailing aspect. There are no wetlands, lakes, streams or other sensitive areas that would be considered resources of the state. We did not see and are not aware of any threatened or endangered plant, animal, or bird species in the park. No raptor nest sites were found.

The park is predominantly forested with an older second-growth mixed deciduous-conifer forest stand. Some ornamental landscape plantings have been installed in the vicinity of the parking lots.

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<sup>1</sup> Harvey, R.D. and P. F. Hessburg. 1992. Long-Range Planning for Developed Sites and the Pacific Northwest: The Context of Hazard Tree Management. USDA Forest Service Publication FPM-TP039-92. Portland, Oregon.



**Photo A. One of the larger grand firs in the park.**

Portions of the park are developed with ballfields, shelters, sport courts, playground equipment, and picnic tables. Both hard surfaced (asphalt) and unsurfaced (gravel and wood chip) trails traverse the park. Parking is provided in lots along the north, east and southerly edges of the park. Single-family residential homes surround the entire park.

Cleared areas with improvements cover approximately 7.8 acres. The remaining 31.3 acres is native forest with trails.

## Soils

There are two soil types (Figure 1) on the parcel according to the Thurston County Soil Survey.



**Figure 1. Soil types in Wonderwood Park. Types 1 and 2 are the Alderwood gravelly sandy loam and Type 38 is the Giles silt loam**

Soil types 1 and 2 are variants of the Alderwood gravelly sandy loam. All slopes are less than 3%, so there are really only Type I Alderwood soils in the park.

The Alderwood soil type is a moderately deep, moderately well drained soil found on glacial till plains. It is formed in ablation till overlying basal till. A weakly cemented hardpan occurs at a depth of 20 to 40 inches. Permeability is moderately rapid above the hardpan and very slow in the pan. The available water capacity for trees is low and the effective rooting depth for trees is 20-40 inches. A perched seasonal high water table is at a depth of 18-36 inches from November to March. The potential for 'windthrow' of trees is rated as 'moderate' under normal conditions.

The third type is the Giles silt loam. This is a deep, well drained soil that is found on terraces. It formed in glacial outwash and volcanic ash. Permeability is moderate and plant available water capacity is high. The effective rooting depth is 40 to 60 inches. The hazard of runoff and erosion is slight. The chance of windthrow is rated as 'slight' under normal conditions.

It appears that the Giles silt loam extends further north than shown on the above photos, but no additional soil mapping was done. The soils mapping depicted above was done on aerial photos with ground truthing by the Natural Resource Conservation Service in the 1970's.

### **Forest Cover**

The forest cover was stratified into four types (see aerial photo in Appendix I) for the purposes of description for the forest management plan. The following is a description of the types:

#### **Type I**

This 7.8 acre type includes the developed, non-forested area of the park including the baseball fields, sport courts, parking lots, access roads, and playgrounds. Some native trees occur in these areas, but are discussed in the surrounding Type II forest cover type description.

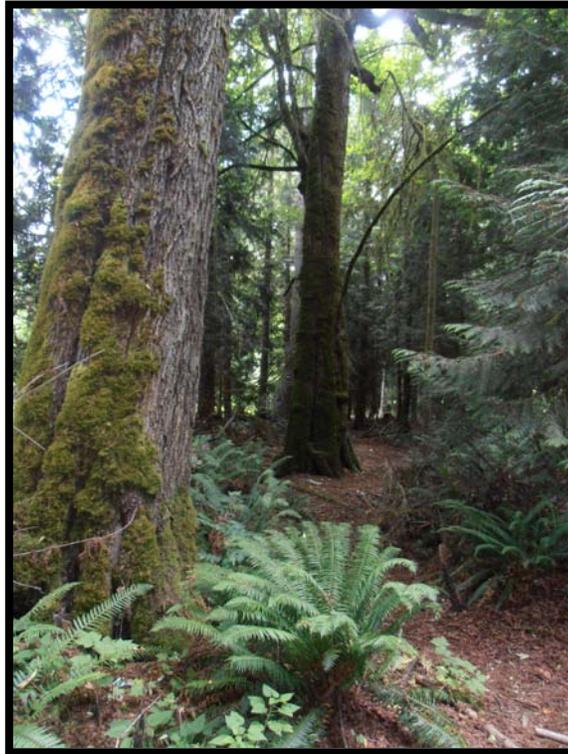


**Photo B. Photo of the developed ballfield in Type I. The forest behind is predominantly bigleaf maple with scattered conifers (WFCI 7-5-11).**

#### **Type II**

This is the largest forest type in the park. The predominant tree species include bigleaf maple (*Acer macrophyllum*) and western redcedar (*Thuja plicata*), with lesser numbers of Douglas-fir (*Pseudotsuga menziesii*), red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*), and grand fir (*Abies grandis*). Tree diameters range from the smaller

understory trees to the dominant and co-dominant trees up to 50 inches DBH. Douglas-fir is the tallest tree species in the park with specimens over 140 ft. tall.



**Photo C. View of large bigleaf maples  
in Type II (WFCI 8/10/11).**

Stand Condition. -- Tree condition varies by species. The following is a discussion of the condition of each of the dominant species in the type.

**Bigleaf Maple:** The dominant tree species in this type is bigleaf maple. Most of the larger trees exceed 80 years old and are considered to be over-mature. Many have old basal damage, perhaps by equipment or livestock injury when the trees were young and before it was a park. The decay is extensive in many trees.

The origin of some of these trees is sprouts from old stumps. The tight-V crotches formed where the stems come together are high risk points of structural failure. This same type of tight-V crotch occurs in the crowns of the maples and has resulted in many large scaffold branch failures. Once a co-dominant stem with a tight-V crotch or a large branch crotch fails, the remaining stem/branch is usually a very high risk to fail.

Some of the older trees are infected with *Ganaderma* spp., a fungus that infects both conifers and deciduous trees. This trunk rot fungi normally occurs in the lower stem causing severe internal decay. It is often called the varnish conk. The larger the conk, normally the more severe the decay. The more conks, the more severe the decay. If a

tree with conks occurs within reach of targets (buildings, trails, places where people congregate), then the tree is considered to be high risk and mitigation is usually required.



**Photo D. View of fungal conks on base of a large, double-stemmed bigleaf maple (WFCI 8/10/11).**

Many of the older bigleaf maples show signs of infection with Verticillium wilt (*Verticillium dahliae*), a vascular disease that clogs the vessels (xylem) that carry water and nutrients from the roots into the crown of the tree. Large sections, or individual scaffold branches yellow and die back. Over time, the entire upper crown of the tree can be killed by Verticillium wilt.

Western redcedar: Generally, the western redcedar in this type are in good condition. They are considered to be mature, however since the potential lifespan of a western redcedar can reach the age of 800 to 1,000 years the Wonderwood Park trees are young trees.



**Photo E. Photo of Type II showing redcedar and mix of other species in the park (WFCI 7-5-11).**

Most of the larger redcedar have internal decay. This is commonly caused by a fungus called Pencil rot (*Postia sericiomollis*). However, other types of trunk rot also occur in redcedar. It is important to note that western redcedar can have extensive internal decay, with a low risk of failure.

Once a western redcedar dies, the dead stem will often stand for decades with little more than some branch loss. These dead cedars will provide foraging and habitat for cavity nesting species of wildlife for years. If the tree is close to fixed targets (buildings, parking lots), then removal of the top to create a snag will protect much of the habitat value of the tree.

Few other insect or disease problems exist for western redcedar that cause significant damage or require control. Western redcedar is tolerant of shade and resistant to the laminated root disease in the park. This species is the preferred species for protection and replanting in the park.

Douglas-fir: The Douglas-fir trees generally are in good condition. They occur as small clusters and as scattered trees throughout the type. The Douglas-firs are the tallest trees in the park with many trees exceeding 140 feet tall and 36 inches DBH. We did not find laminated root rot in Type II, though some probably occurs.

Grand fir: Scattered grand fir occur with some trees exceeding 40 inches DBH. Most show evidence of infection with Grovesiella canker (*Grovesiella abieticola*) and infestation with Balsam woolly adelgid (*Adelges piceae*). Coupled with other environmental stresses, these insect and disease problems are causing decline in most of the grand firs. This species is a short-term component in the park, and little natural grand fir regeneration (seedlings) occur. Grand fir is a shade tolerant tree species and could be

interplanted in portions of the park away from the laminated root rot area (it is susceptible to laminated root rot).

**Western hemlock:** The western hemlock is an off-site species in the park. Trees over 30 inches DBH occur still, but none are considered to be healthy, or long-term trees. They will continue to decline with chronic mortality of remaining trees. This species should not be replanted in the park.



**Photo F. View of conks on dying western hemlock (WFCI 8/10/11).**

**Red alder:** Scattered red alders up to 22 inches DBH occur in the type, but are a very minor component. This is a short-lived (40 years +) species and requires full sun-light to thrive, so is occurring mostly on the edges of the ballfields.

Understory Shrubs. -- The understory shrub cover is dense throughout most of the park. Exceptions include patches of invasive plants that have overgrown the desirable native shrubs and areas disturbed by past encroachments and dumping.



**Photo G. View of sword fern dominated understory (WFCI 8/10/11).**

Sword fern (*Polystichum munitum*) is the dominant understory shrub species in the park, followed by Indian plum (*Oemleria cerasiformis*). Other significant species include western hazelnut (*Corylus cornuta* var. *californica*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*), Oregongrape (*Mahonia nervosa*) and salmonberry (*Rubus spectabilis*). Numerous areas of invasive plants occur.

### **Type III**

This small stand occurs in the southeasterly corner of the park. The dominant tree species is red alder with trees up to 14 inches DBH. Minor species include bigleaf maple and black cottonwood (*Populus trichocarpa*). This stand exists due to past (old) land management practices that cleared this area, coupled with the more moist Giles silt loam soils that helped red alder outcompete other tree species for growing space.

Stand Condition. -- The stand is moderately stocked with some tightly packed clusters. Most trees are in fair to good condition. No significant disease or insect problems were noted. The diameter of the trees ranges from 6 to 32 inches DBH.

We had considered potentially thinning some of the red alder trees to provide more growing space for the dominant trees. However, it does not appear that thinning is necessary, given the patchy nature of the stand. Over time, these more dense clusters will thin themselves through natural selection. This will cause the need for occasional tree removal in this small stand.



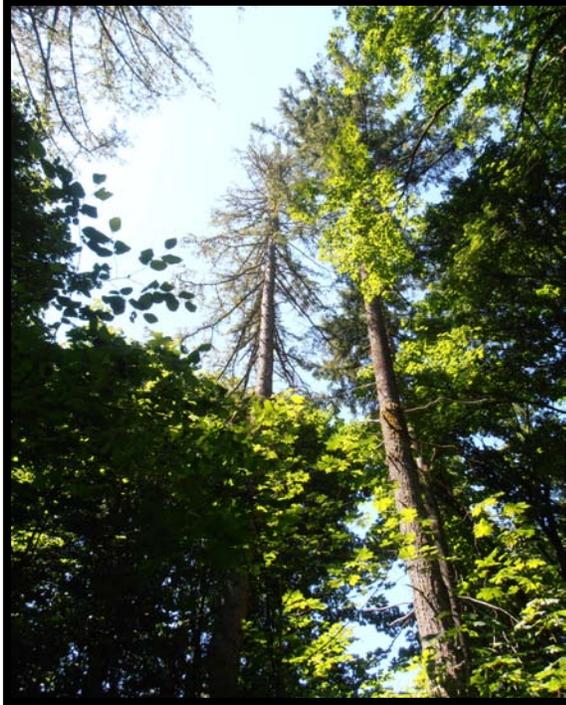
**Photo H. Photo of Type III in Wonderwood Park (WFCI 7-5-11).**

Understory Shrubs. -- The understory of the type is patchy with some spots densely stocked with bigleaf maple sprouts, smaller redcedar trees, Indian plum (*Oemleria cerasiformis*), thimbleberry (*Rubus parviflorus*) and red elderberry (*Sambucus racemosa* var. *pubens*). The sewer easement area is stocked with grass. There were some areas of invasive yellow archangel (*Lamium galeobdolon*) along the easterly edge.

#### **Type IV**

This forest type occurs in the southwest corner of the park. The tree stocking is variable due to tree loss to laminated root rot (*Phellinus sulphureus*). Parts of the type are fully stocked with healthy appearing Douglas-fir that is intermixed with bigleaf maple. Many gaps in the stand occur due to tree loss. These gaps have been colonized by bigleaf maple, western hazelnut and Indian plum. Scattered western redcedar and western hemlock occur. The trees in this type range from 6 to over 50 inches DBH.

Stand Condition. -- This type is a challenge to manage due to the disease. Up to 50% of the root system can be rotted on a Douglas-fir with no visible symptoms in the crown. When targets exist in the vicinity of the trees there is always an elevated risk.



**Photo I. View of dead and dying Douglas-firs in Type IV -they are infected with laminated root rot (WFCI 7/5/11).**

The disease is challenging to diagnose, since the fungus does not have a fruiting body like other fungi. The fungus produces an amorphous mass on the surface of the roots rather than a mushroom or conk. Often the mass is not apparent when roots are dug. The positive I.D. for this fungus is the red setal hyphae found under the root bark. If we find an infected tree, then we know trees within 15 ft. or so are also infected, and we suspect trees within 30-50 feet are also infected.



**Photo J. View of uprooted Douglas-fir from laminated root rot (WFCI 8/10/11).**

Douglas-fir bark beetles (*Dendroctonus pseudotsugae*) are often found in these laminated root rot infection centers. They are not a primary cause of Douglas-fir mortality, but rather secondary, infesting trees that are within a year or so of mortality from other, or cumulative causes. We manage this insect by keeping our forest stands healthy.



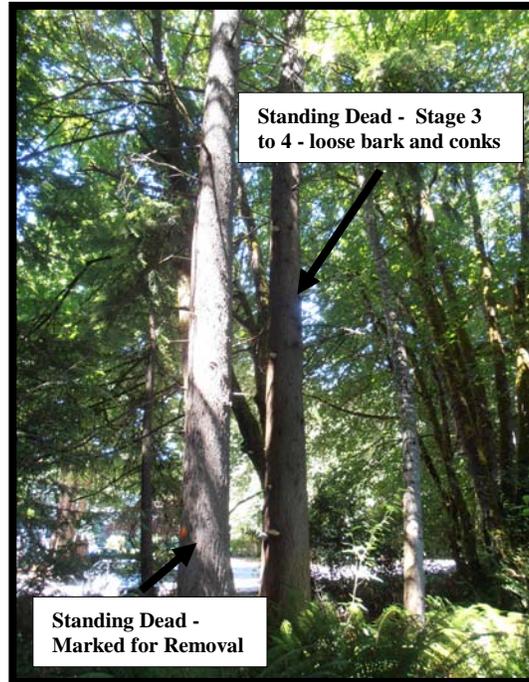
**Photo K. Photo of gap in stand in Type IV created by laminated root rot (WFCI 7-5-11).**

Understory Shrubs. -- The forest floor is heavily stocked with western hazelnut, Indian plum, Oregongrape, sword fern, and salal. The type has a very 'brushy' appearance to it.

### **Snags and Down Woody Debris**

Dead trees are an important component of a forest for wildlife foraging, nesting, loafing, and resting. The most valuable trees are those that are larger (greater than 12 inches DBH), since these trees will generally stand in a deteriorated condition longer. Once they fall, they are used by amphibians, small mammals, and birds as a source of insects, fungi, and seeds. New plants will also colonize the log as it decays. These are often called 'nurse logs'.

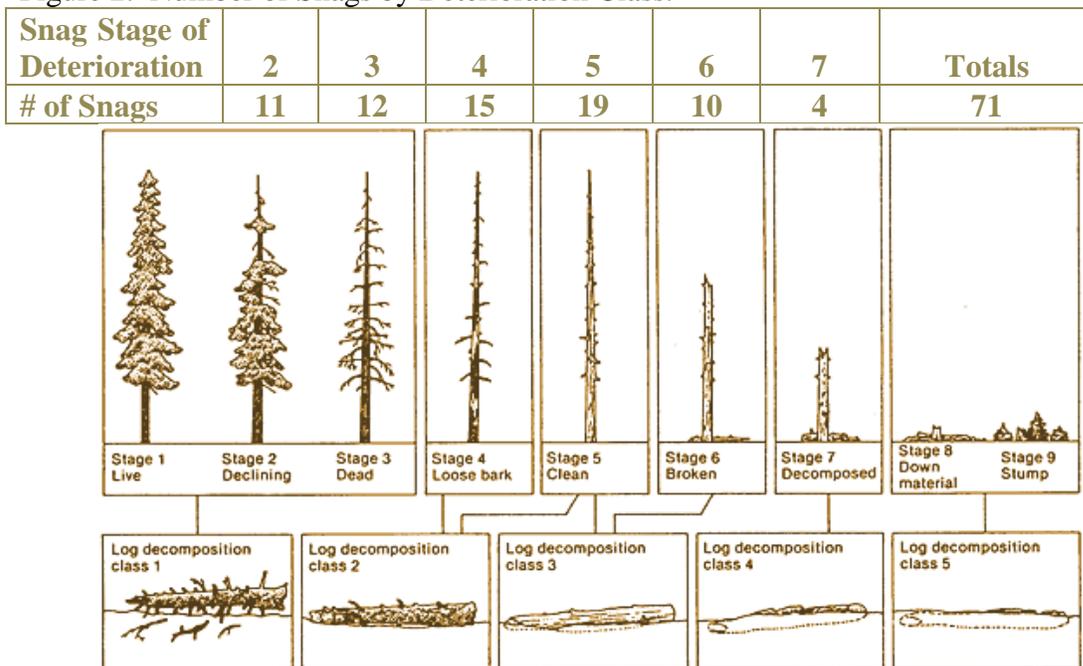
The Washington Department of Fish and Wildlife prescribes retention of at least 2 snags and 2 downed logs per acre for adequate wildlife habitat potential. To determine the adequacy of snags and downed logs, snags larger than 12 inches DBH and all downed logs with a small end diameter of at least 12 inches and at least 12 feet long were inventoried.



**Photo L. View of a recently dead western hemlock (left) and an older Stage 3 snag with conks on it.**

The figure 2 below illustrates what the deteriorating trees might look like and assigns a 'Deterioration Class' number to them. WFCI inventoried the snags. The numbers of snags found in Wonderwood Park shown above each snag class. We did not record Stage 1 - live trees, or Stage 8 or 9 - stumps.

**Figure 2. Number of Snags by Deterioration Class.**



*\*Illustration from WA Dept. of Fish and Wildlife.*

We found a total of seventy-one (71) snags in the various stages of decomposition. The majority of the snags are located in Types II and IV. This is equivalent to 2.3 snags per acre, just slightly above the minimum threshold.

One hundred twenty-two (122) downed logs were found in the park, nearly double (3.9 downed logs per acre) the recommended minimum of 2 per acre. We did not record the decomposition stage of the downed logs. This data reflects the City of Lacey's practice of removing most hazard trees and leaving the downed logs on the forest floor.



**Photo M. View Class 2 downed logs in the park.  
The origin was likely hazard tree removal.**



**Photo N. View of older downed Class 4 logs (WFCI 8/10/11).**

In the future, all suitable larger hazard trees that can be converted to 20-30 ft. tall snags will be beneficial for wildlife habitat.

### **Past Forest Management Practices**

Hazard tree assessments are conducted and trees removed in city parks as annual funding allows. These evaluations were conducted by consulting arborists in 2003, 2007 and 2009, with subsequent removal of 87 trees. No data was recorded by staff for trees that did not require removal.

Much of the past hazard tree management was pruning of branches, removing hanging branches, as well as removal of dead trees or trees with major structural defects.

Funding levels in the past ten years have not allowed for habitat and canopy analysis in conjunction with the hazard tree removal. However, tree seedlings have been planted in portions of the park.

### **Public Participation**

The City of Lacey Board of Park Commissioners held their regular monthly meeting on August 22, 2011 and invited neighboring residents to attend the meeting to discuss the draft management plan. Meeting notices were mailed directly to 186 residences and 42 other interested parties. A press release was issued on August 10, and information posted on the City of Lacey website, along with the draft plan.

Sixteen citizens, many neighbors of the park, but all frequent patrons of the park, attended the meeting. Suggestions included leaving snags and other improvements for bird and wildlife habitat, tree replanting areas and distance apart, management of vegetation overhanging property lines, control of invasive plants, and laminated root rot.

The people who attended the meeting love this park for its trees. Many offered to assist in various ways – planting seedlings, observing wildlife and birds, and removing invasive plant species. One of the citizens provided an extensive list of birds and wildlife observed in the park. Citizen volunteer efforts combined with city staff are critical to insuring the success of the action recommended in this plan.

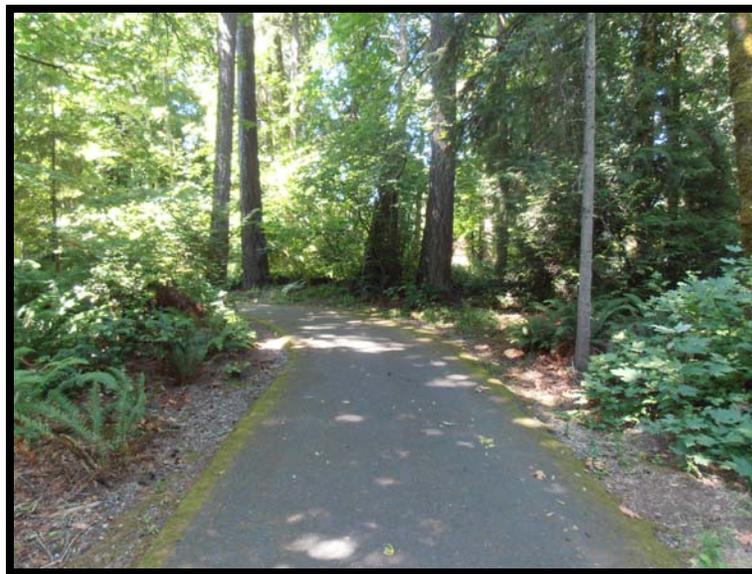
The draft plan was revised after hearing public comment and posted on the city website for review on September 19. The citizens who attended the August meeting were invited to the September 26 Board of Park Commissioners meeting for final comment. One citizen attended the meeting. The Board of Park Commissioners suggested minor revisions, and approved the plan as amended at the September 26, 2011 regular monthly meeting.

Members of the Black Hills Audubon Society have offered to assist with bird identification in the park, and recommend bird nesting box species and location. A field investigation led to the addition of a few species to the list in Appendix IV.

Many birds are cavity nesters and need snags and decaying trees in which to build their nests. The minimal number of snags suggests that construction and placement of bird nesting boxes may be beneficial. A boy scout, intent on earning his eagle advancement plans to build and place nesting boxes in the park. Many nesting boxes require annual maintenance, which is usually beyond the capacity of city staff to perform annually. Volunteers will perform this task to insure that these birds continue to make Wonderwood Park their home.

### **Potential for New Surfaced Trails**

Currently Wonderwood Park has a hard surface asphalt trail that loops around the park with a few shorter spurs. There are many other natural trails. Most of the natural trails were created by hikers. A few were created by the City of Lacey and maintained with wood chips.



**Photo O. View of existing asphalt tree in the park.**

During the Comprehensive Plan for Outdoor Recreation public input process, citizens requested that a asphalt or other hard surface loop trail be constructed in the western portion of the park, that trails be identified, and a trail map be drawn with distances identified.

WFCI was asked to comment on the potential for adding additional hard surface trails in the westerly one-third of the park (Forest cover Type II and IV). To determine the feasibility reconnaissance was performed in this area of the park with new trails in mind.

The forest stand in this area is lightly to heavily stocked with trees and heavy shrub cover. The southerly half of this area is the area of laminated root disease infection. Over the years many infected trees have failed, many have been removed, more will be removed this year, and additional trees will fail, die, and have to be removed in the future.

Given that we already have an extensive hard surfaced trail system, that construction potentially will cause damage to the root systems of trees, wounding of roots will create fresh entry points for infection by disease fungi, and the future risk from failing diseased trees - we do not recommend adding new hard surface trails to the westerly one-third of the park.

## Discussion and Recommendations

### Tree Inventory

A 100% inventory was done for trees six inches and larger. The inventory found a total of 2,334 trees in the park. The predominant tree species in the park is bigleaf maple (35%) with similar stocking of western redcedar (32%). Douglas-fir makes up 16% of the forest stands followed by red alder (11%) and western hemlock (4%). The following table provides a breakdown of the tree species in the park.

Table 1. Composition and size of trees in Wonderwood Park.

Species	DBH Range	# of Trees	% Composition
Bigleaf Maple	6-44	807	34.6%
Western Redcedar	6-50	755	32.3%
Douglas-fir	6-42	379	16.2%
Red Alder	6-30	259	11.1%
Western Hemlock	6-36	95	4.1%
Grand Fir	8-38	20	1.0%
Cherry	6-20	15	<1.0%
Pacific Madrone	14-16	2	<1.0%
Scouler's Willow	12	1	<1.0%
Black Cottonwood	40	1	<1.0%
<b>Summary</b>	<b>6-50</b>	<b>2,334</b>	<b>100%</b>

The inventory found that the park is heavily stocked with large, older trees. A more detailed breakdown of the tree species by diameter class is provided in Appendix III.

Figure 3. Illustration of the diameter (DBH) classes of trees at Wonderwood Park.

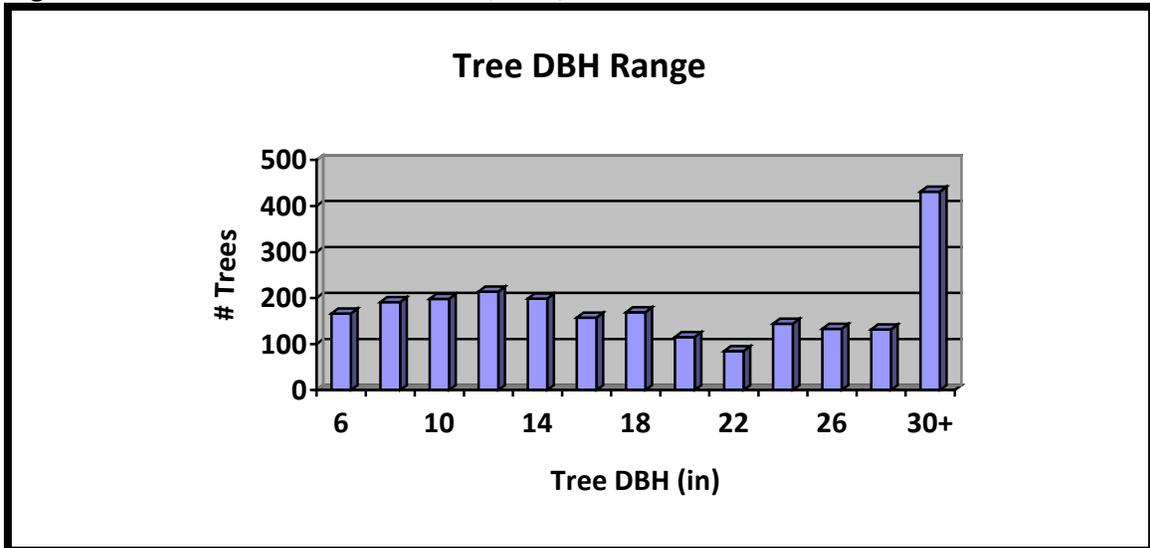
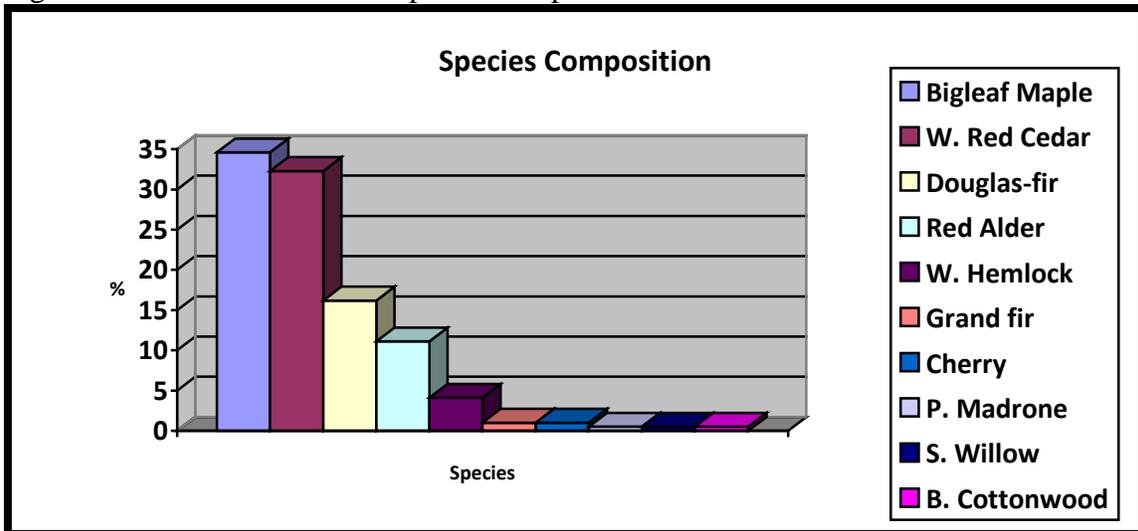


Figure 4. Illustration of the % species composition.



Many of the bigleaf maples are mature or over mature. A significant percentage of the natural reproduction is bigleaf maple. These data suggest that tree replanting should focus on species other than bigleaf maple.

In addition to species and diameter, the crown class was determined for each tree in the park to provide an overview of the crown structure of the stands. Table 2 illustrates the number and composition of trees in each crown class. Definitions of the crown classes is provided in Appendix VIII.

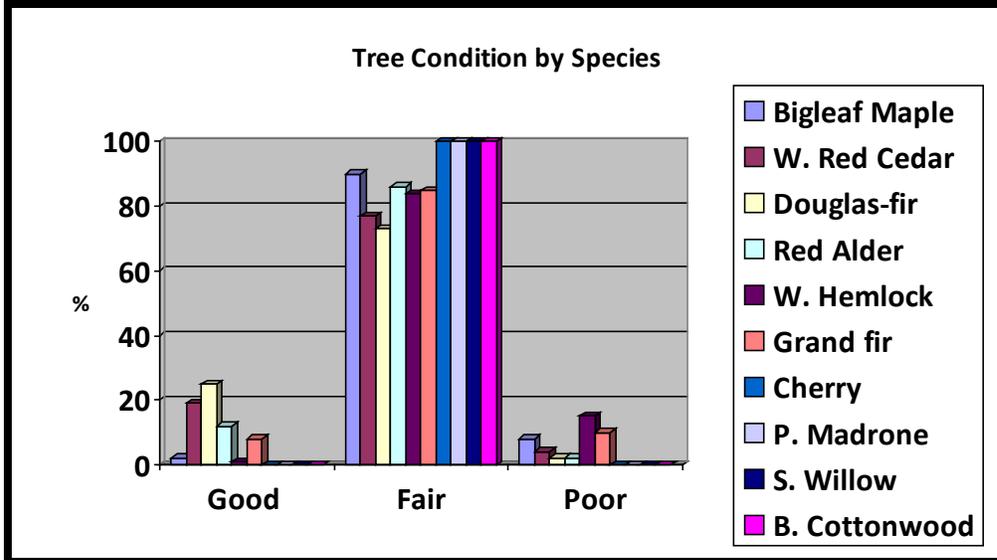
Table 2. Summary by crown.

Crown Class	# of Trees	% Composition
Dominant	168	7%
Co-dominant	1,486	64%
Intermediate	364	16%
Suppressed	316	13%
	<b>2,334</b>	<b>100%</b>

The majority of the intermediate and suppressed trees were western red cedar and bigleaf maple, both of which are tolerant of shade. As it stands now these shade tolerant tree species will be the replacement trees as the larger dominant and co-dominant trees die.

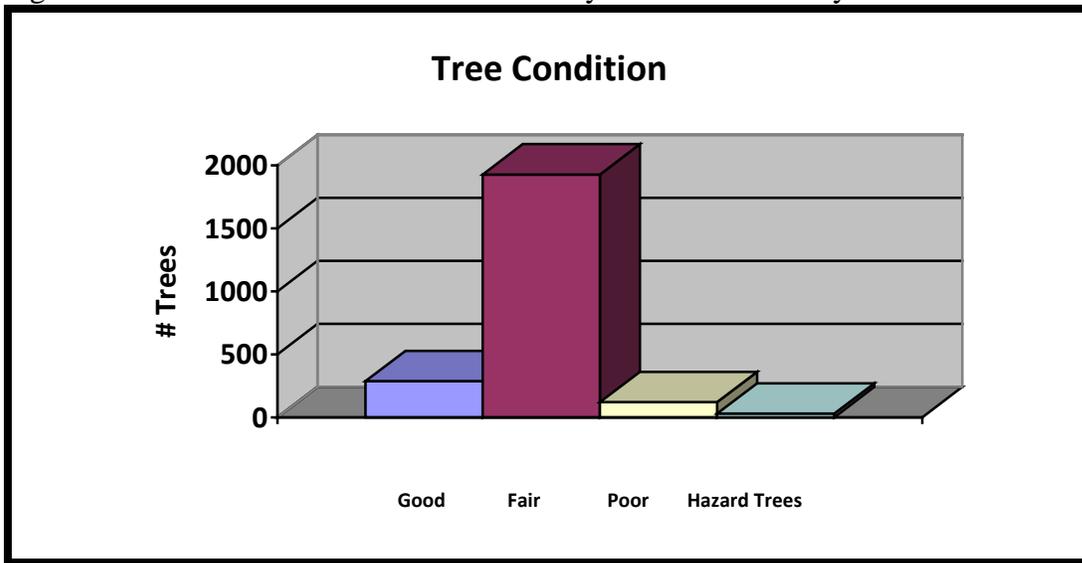
The condition of the trees was classified as Good, Fair and Poor condition. Dead trees and nearly dead trees were classified and inventoried as snags. Hazard trees were excluded from this summary.

Figure 5. Illustration of the condition of trees in Wonderwood Park.



The majority of the trees in Wonderwood Park were classified as being in fair condition. The factors assessed included foliage color, bark vigor, lateral and terminal branch growth, and tree structure.

Figure 6. Illustration of the number of trees by tree condition only.



The predominant structural defect for trees in Wonderwood Park is the multi-stemmed bigleaf maple, tight-V crotches in the branch structure of bigleaf maple, and internal decay in the butts of both bigleaf maple and western redcedar. These defects have been the most common causes of tree removal in the past years.

Over time, these defects will continue with the loss of many more trees or parts of trees. Most of these types of defects cannot be repaired by pruning or other cultural practices.

### Summary of the Significant Insect and Disease Problems Found

Older second-growth forests support many insects and diseases. Many are just part of the process of aging and are secondary pathogens. There are many other species of fungi present in the park, however these are the most prevalent and can be the primary cause of tree failure. The diseases of concern in Wonderwood Park included:

Laminated Root Disease	<i>Phellinus sulphureescens</i>
Shoestring Root Disease	<i>Armillaria ostoyae</i>
Annosus Root Disease	<i>Heterobasidion annosum</i>
Red Ring Rot	<i>Phellinus pini</i>
Brown Cubical Butt Rot	<i>Phaeolus schweinitzii</i>
Pencil Rot	<i>Postia sericiomollis</i>
Ganaderma Trunk Rot	<i>Ganaderma tsugae</i>
Brown Trunk Rot	<i>Fomitopsis officinalis</i>
Brown Crumbly Rot	<i>Fomitopsis pinicola</i>
Grovesiella Canker	<i>Grovesiella abieticola</i>
Verticillium wilt	<i>Verticillium dahliae</i>
Balsam woolly adelgid	<i>Adelges piceae</i>

Laminated root disease (LRR) is the most damaging disease, causing the mortality or failure of many of the Douglas-fir trees in the southwest quadrant of the park.

LRR is considered to be the most damaging root disease in the Pacific Northwest. The fungus spreads by root to root contact and can remain viable in cut stumps for up to 50 years. Management includes removing all susceptible species of trees within 50 feet of an infected tree to break the root to root spreading to surrounding uninfected trees. Trees planted back on the site should be of a species that is resistant to the disease to break the infection cycle. These LRR resistant species include western redcedar, western white pine, and deciduous trees.

Verticillium wilt causes the dieback in the crowns of the bigleaf maples. A few branches, to a major branch, to entire sections of the crown dying back can occur in the same year. This disease is present in many of the older maples in the park and is a major cause of tree loss. There is no practical control for this disease, other than sanitation of infected branches or trees.

Most of the insect problems are secondary, that is, insects attacking trees stressed by other organisms, physical damage, or weather. One insect that is contributing directly to the loss of the grand firs is the Balsam Woolly Adelgid (*Adelges piceae*). This insect injects a toxin in the twig ends, causing the tree to respond with growth that results in a swelling of the branch tips. The distorted growth often dies back. This stress coupled with Grovesiella canker are major stresses to the Grand and other true firs.

These were the most significant insect or disease problems found in the park.

### **Invasive Plant Control**

We found at least 8 species of invasive herbaceous or woody plants within the park. All require control due to the aggressive nature and potential to cause significant damage to the park.

Invasive species identified include English ivy (*Hedera helix*), bamboo (*Phyllostachys* spp.), field bindweed (*Convolvulus arvensis*), yellow archangel (*Lamiastrum galeobdolon*), Himalayan blackberry (*Rubus armeniacus*), morning glory (Family-*Convolvulaceae*), English laurel (*Prunus laurocerasus*), and American holly (*Ilex opaca*).

Locations of many of the major infestations are noted on the attached map in Appendix II (Hazard tree map). However, there are likely other smaller infestations that are not mapped.



**Photo P. Photo of yellow archangel in north-central portion of the park.**

The yellow archangel spreads from cuttings dumped in the park edges by neighbors. This plant will smother all native understory shrubs and forbs. Much of the dumping was addressed many years ago, however some is still occurring.

Evergreen blackberry and morning glory appear to have been introduced into the park unintentionally and should be removed. There are also two species of woody plants, holly and laurel, within the park, that should be considered “invasive” and removed wherever encountered.

English ivy is the most extensive occurring in the northerly and easterly portions of the park. Some removal cutting of ivy on trees has occurred in the past, however many new vines are climbing trees.



**Photo Q. View of English ivy mat on ground and growing up the tree.**

An unknown species of bamboo has moved into the westerly edge of the park. One infestation has spread from a neighbors clump, and another small clump occurs north of this.

We found field bindweed growing in several locations around the edges of the park. This is a pioneer species that colonizes disturbed soils, or areas created by dumping of grass clippings or other debris.

All these species (except bamboo, American holly, and morning glory), are considered Class C noxious weeds (WAC Chapter 16-750) by the state of Washington. The plants in these areas should be controlled to prevent more loss of native plants in the park.

The preferred method of treatment for English ivy, yellow archangel, blackberry, and field bindweed is treatment with 2% solution of Garlon 4 Ultra with 1/2% Superspread MSO. This will control many of the plants, though spot retreatment will be required annually to control new sprouts from roots and seed. Once these areas of noxious weeds have been controlled, new trees can be planted into the dead mats of vegetation.

To control American holly and English laurel, cut the plant stem to the groundline and immediately treat the stump with a 50% solution of Garlon 4 Ultra with water.

Table 3. List of noxious weeds found in the park.

<b>Common Name</b>	<b>Scientific Name</b>	<b>Noxious Weed Class</b>
English Ivy	<i>Hedera helix</i>	C
Bamboo	<i>Phyllostachys</i> spp.	--
Field Bindweed	<i>Convolvulus arvensis</i>	C
Yellow Archangel	<i>Lamium galeobdolon</i>	C
Morning Glory	<i>Convolvulaceae</i>	--
American holly	<i>Ilex opaca</i>	--
Evergreen blackberry	<i>Rubus armeniacus</i>	C
English laurel	<i>Prunus laurocerasus</i>	--

Control of the bamboo is more challenging. The bamboo that has spread through the fence should be grubbed out, followed by covering the rooting area with 4 mil black plastic. The edges should be held firmly down with small logs. Inspect this annually. Treat any growth from around the edges in early June with a 5% solution of Chopper Gen2 with 1% Superspread MSO. Apply to the foliage and all stems. Notify the adjacent landowner that he may see some damage to his bamboo. Encourage him to eradicate his as well. The isolated clump to the north can be treated directly with the Chopper Gen2 solution. Retreatment will be required.

If any of these plants are pulled or excavated with mechanical equipment, they must be destroyed to prevent spread onto other sites. They **cannot** be composted. All pieces of the plant need to be placed in plastic garbage bags and taken to the landfill or other

suitable place. Multiple treatments will be necessary to control the plants. If any excavation is done, all disturbed soils must be reseeded with a shade tolerant grass seed mix to slow invasion by other pioneer weed species such as Scotchbroom and blackberry.

**Hazard Trees**

A hazard tree is defined as: 1) a tree that is dead, dying, diseased, damaged, or structurally defective and 2) the tree or parts of the tree are at risk to fail, and 3) there is a target within reach of the tree or tree parts.

Wonderwood Park has many old trees with significant structural defect and disease. It is not possible nor desirable to try to sanitize the park of all potential tree problems.

Our evaluation attempted to identify the higher risk trees near targets, while leaving some trees with defect in less frequently used areas of the park.

Thirty (30) higher risk trees (hazard trees) were found in the park that are near frequent or permanent targets. Most require removal to mitigate the risk. These trees were marked with orange painted numbers and orange paint dots at eye level. This recommended work should be done immediately. The park should be re-inspected for hazard trees at least every two years.

The majority of the marked trees were dead or in severe decline, or had substantial decay in the stem or butt. In all cases targets such as trails, fences, homes, parking lots, or buildings were within reach of the trees. Many other trees with defects occur, but the target is forest or a little used trail. These types of trees were not marked.

Bigleaf maples that are designated to be turned into 10-20 ft. tall wildlife snags should be injected with undiluted Chopper Gen2 by making overlapping axe frill at the root collar and placing the herbicide into the cuts immediately. This will control the root system of the tree, preventing regrowth of what will become future hazardous branches. Table 4 provides a complete list of hazard trees. The location of these trees was determined using our Trimble Nomad GPS, and are shown on the map in Appendix II.

Table 4. High risk hazard tree list. Trees should be removed unless otherwise indicated.

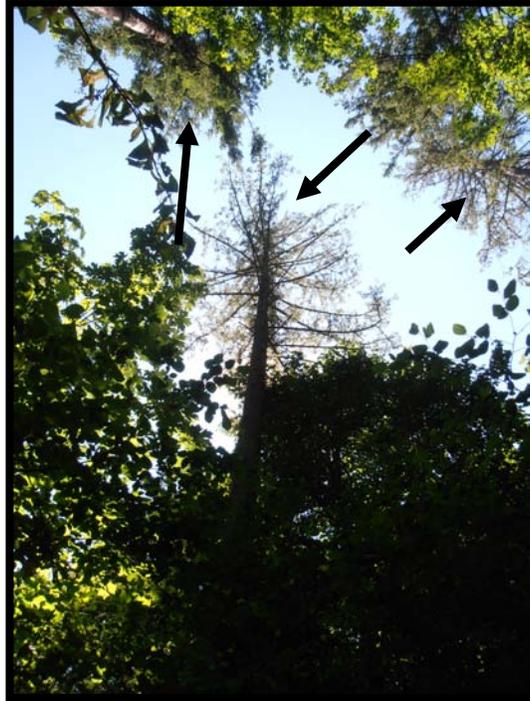
<b>Tree #</b>	<b>Species</b>	<b>DBH (in.)</b>	<b>Condition</b>	<b>Notes</b>
1	Western Redcedar	16	Very Poor	Severe decay in lower stem - Make wildlife tree by cutting to a 20 ft. tall stump and killing stump and roots;
2	Western Hemlock	28	Poor	Severe decay in lower stem and roots;
3	Western Hemlock	15	Very Poor	Severe decay in lower stem
4	Bigleaf Maple	50+	Poor	Large co-dominant stem on east side of tree

Tree #	Species	DBH (in.)	Condition	Notes
				is severely decay; Remove east decayed stem at about 10 ft. above the ground line; Do not damage remaining dominant stem;
5	Bigleaf Maple	9,14	Poor	Large wound in stem - future problem to parking lot;
6	Bigleaf Maple	26	Very Poor	Severe decay and seam;
7	Bigleaf Maple	42	Very Poor	Severe decay in lower stem - next to ballfield;
8	Bigleaf Maple	28,32	Poor	Severe decay in lower stem and many large conks; Make 20 tall wildlife snag and kill snag;
9	Bigleaf Maple	28	Very Poor	Severe decay in lower stem; Make 20 tall wildlife snag and kill snag;
10	Red Alder	8	Very Poor	Stem defects;
11	Western Redcedar	34	Very Poor	Severe decay in stem;
12	Bigleaf Maple	14	Very Poor	Severe decay in lower stem;
13	Red Alder	6	Dead	At entrance to park;
14	Douglas-fir	24	Poor	LRR+
15	Douglas-fir	19	Poor	LRR+
16	Bigleaf Maple	25	Very Poor	Hollow lower stem;
17	Douglas-fir	30	Poor	LRR+
18	Douglas-fir	20	Poor	LRR+
19	Douglas-fir	8	Poor	LRR+
20	Douglas-fir	19	Poor	10' from LRR+ tree
21	Douglas-fir	15	Poor	LRR+
22	Douglas-fir	30	Very Poor	LRR+
23	Douglas-fir	30	Very Poor	in LRR area
24	Douglas-fir	32	Very Poor	LRR+
25	Douglas-fir	26	Very Poor	LRR+
26	Douglas-fir	19	Poor	25' from LRR+ tree
27	Western Hemlock	18	Dead	Dead snag that could fail into homes
28	Bigleaf Maple	15	Dead	Dead tree that could fail into back yard
29	Red Alder	15	Very Poor	Decayed stem that could fail onto trail
30	Douglas-fir	21	Poor	Hollow lower stem and LRR+

*\*Locations were mapped and illustrated on the maps in Appendix II.*

We observed numerous trees in the park with an aluminum numbered tag and a spot of orange hardware paint. This appears to be hazard tree marking by another party. In all cases we evaluated the tree. Of the trees evaluated, only one tree requires work.

In future cases, the mitigation of trees determined to be high risk should occur within a reasonable time period of the report to the City of Lacey. Reasonable is defined as the time to put together and put out a bid document for mitigation, followed by completion of the work shortly thereafter.



**Photo R. View of 3 laminated root rot infected trees in the southwest quad of the park.**



**Photo S. View of uprooted laminated root rot infected tree. Note marked, infected standing tree to upper left.**

## Encroachments

Despite past efforts to limit encroachments into the park from the surrounding lots, we noted several areas of dumping, tree damage, understory shrub and tree removal, or encroachment with structures.



**Photo T. View of grass clippings and debris dumped in the park from the neighboring property.**

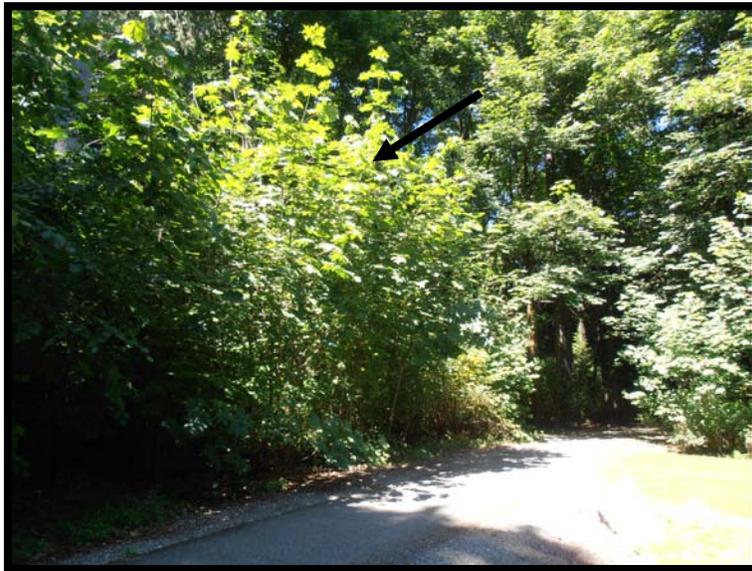
The dumping occurred at 4 locations and was predominantly grass clippings and landscape debris. Some tree pruning had occurred on one site, and most understory shrubs and small trees had been cleared. Playground equipment, tarps, and old car parts also occur at two locations.



**Photo U. View of tarp over compost, and play structures. Also pruning and shrub removal on this site.**

### **Bigleaf Maple Brush Management**

The understory of the park is heavily stocked with bigleaf maple stump sprouts. In some cases they are encroaching on pathways or other facilities. These multi-stemmed clusters will create new trees with high risk stems. Most of these sprout clumps should be cut and treated (Garlon 4 Ultra 25% with Superspread MSO) to prevent resprouting. Single-stem form trees from seed, can be left to grow.



**Photo V. View of bigleaf maple sprouts overhanging asphalt trail.**

The area south of the tennis courts is an example where the bigleaf maples have been cut in the past and have created a dense thicket of new sprouts. In this area it is recommended that the bigleaf maple be removed and treated, and a more compatible tree species be interplanted among the residual conifers. Candidate species to plant include serviceberry, red osier dogwood, and chokecherry.

These small trees have a mature height of 15 feet or less, will recreate the buffering between the tennis courts and homes, while nearly eliminating shading and debris on the tennis courts. The wildlife forage values will be improved with any of these species. In addition, all 3 species are native, flower and have excellent fall color.



**Photo W. View of bigleaf maple sprouts south of tennis courts.**

### **Tree Replanting**

There are some smaller gaps in the canopy within the park that are stocked only with deciduous shrub cover, or are overgrown with yellow archangel or English ivy. These areas are candidates for replanting. The gaps smaller than 100 ft. across must be planted with shade tolerant species such as grand fir or western redcedar.

The laminated root rot area in the southwest quadrant of the park is more open with more light reaching the forest floor. Only two native tree species can be planted in this area: western white pine and western redcedar. Other native conifer species are susceptible to infection by laminated root rot.



**Photo X. View of small gap overgrown with English ivy.  
Good area to control ivy and replant new trees.**

In all cases, the trees to plant should be seedlings or transplant stock. These trees are available from the Washington Department of Natural Resources Webster Nursery, Weyerhaeuser Nursery, or the Industrial Forestry Association (IFA) Nursery. Depending on species and availability, use 1+1, plug+1, 2-1, or 1-2 tree seedlings or transplants. Avoid 1-0 and 2-0 seedlings. Use trees from the 232 seed zone if possible. Other acceptable zones include 231, 241, or 242. Western redcedar normally does not have a published seed zone. An alternative is planting containerized trees from the city's greenhouse.

In most cases we plant areas such as the gaps in Wonderwood Park on a tighter spacing with the plan to thin out extra trees if too many are successful. The recommended tree planting spacing is 15 ft. x 15 ft., utilizing any desirable, existing tree seedlings/trees in the spacing. Trees should be ordered in September of the year prior to planting. All tree planting (containerized trees) should be done between October 31 and November 30 with spring planting (bare-root or containerized trees) done between March 1st and March 15th.

If possible, a small amount of bark or other composted mulch should be placed in an 18 inch radius around each newly planted tree. No watering will be necessary, however spot weed control should be done around each tree in early March of each year for the first 3 growing seasons.

### **Laminated Root Disease Management**

The City of Lacey has been selectively removing laminated root rot killed trees in the park for many years. Trees are cut and left on the forest floor. Mortality will continue as trees on the perimeter of the infection center become infected.

The City of Lacey should consider a more aggressive approach to limiting the spread of the disease. This is done by cutting all known infected trees, then cutting adjacent trees until they show no signs of infection. The infected trees will be predominantly Douglas-fir, but may include western hemlock or grand fir. This will provide a buffer between the infection center and healthy trees. The sparse stand in the southwest quad, will become more of an open patch.

The infection center is brushy and is predominantly stocked with western hazelnut. It is recommended that the western hazelnut be cut also, but not treated. It will resprout and create new trees. This will provide more light to establish new trees. Western white pine and western redcedar can then be replanted. New shrubs and forbs will naturally establish in this area, creating forage for species of wildlife that may not exist in Wonderwood Park today. Some selective weed control will need to be done over the years until the tree canopies close.

Salvage of the logs should be considered. The root rot area is very close to the southwest park entrance. The log salvage could be done using horses, as was done after the 1996

ice storm, when 3 loads of damaged trees were removed. If horses are not available, then a small machine could be used to remove the logs.

**Park Perimeter Maintenance**

The perimeter of the park is partially cleared in some areas for the sewer lines, access streets, and parking lots. There are areas where the forest extends to the property lines and in many cases trees and brush overhang the property lines. City staff should inspect the perimeter of the park at least 4 times a year.

To facilitate patrol of the parks perimeter, the brush along the remaining uncleared property lines could be cut back to provide walking access for security and patrol purposes. Simply cutting back shrubs (western hazelnut, Indian plum, etc.) will provide this recommended access. Western hazelnut is an important food source for squirrels, and should be pruned to allow access, yet remain a food source wherever possible.

**Conclusions**

**Recommended Management Practices - the Action Plan**

The following Table 5 provides an action plan for the necessary management activities in the park. These activities are designed to control invasive plants, eliminate encroachments on park boundaries, maintain safety for park users, improve the stocking levels of desirable tree and shrub species, increase the numbers of snags and downed logs, maintain the layers of trees and shrubs used by different species of wildlife, and maintain forest health and diversity.

Table 5. Recommended action plan for forest management activity.

<b>YEAR*</b>	<b>MONTH</b>	<b>TYPE</b>	<b>ACTIVITY</b>	<b>PRODUCT/TECHNIQUE</b>
<b>Annually</b>	<b>March, June, September, and December</b>	<b>All</b>	Inspection 4x per year	Maintain property lines and inspect for encroachments. Inspect stands for invasive weeds and schedule treatment. Provide weed control for all planted trees for the 1st 3 growing seasons.
<b>Annually</b>	<b>June</b>	<b>All</b>	Noxious Weed - Spot Treatment	Spot treat all noxious weeds with appropriate herbicide.
<b>Bi-Annually</b>		<b>All</b>	Hazard Tree Evaluation	Conduct a hazard tree evaluation every 2 years - the next will be in 2013.
<b>2011</b>	<b>Sept.-Oct</b>	<b>All</b>	Hazard tree removal	Removal all 30 hazard trees identified in Table 4.
<b>2011</b>	<b>Sept.</b>	<b>All</b>	Eliminate	Notify homeowners that are dumping

<b>YEAR*</b>	<b>MONTH</b>	<b>TYPE</b>	<b>ACTIVITY</b>	<b>PRODUCT/TECHNIQUE</b>
			Encroachments	or encroaching on the park to remove all grass clippings, debris, junk and structures. Addresses provided under separate cover.
<b>2011</b>	<b>Sept.-Oct</b>	<b>All</b>	Extra Paint	Remove all unnecessary paint and tags from trees.
<b>2011</b>	<b>Sept.-Oct.</b>	<b>IV</b>	Laminated Root Rot Mgt.	Remove all infected trees and edge trees. Clean up brush in infection center. Salvage logs.
<b>2011</b>	<b>Sept.</b>	<b>All</b>	Noxious Weed Control	Control all noxious weeds including English ivy, yellow archangel, bamboo and field bindweed.
<b>2011</b>	<b>Oct.-Nov.</b>	<b>II</b>	Bigleaf Maple sprout removal	Cut all bigleaf maple sprouts along the southern edge of tennis courts and treat stumps with Garlon 4 Ultra as labeled.
<b>2011</b>	<b>Sept.</b>	<b>All</b>	Order Tree Seedlings	Seedlings to be planted in root rot area and in gaps.
<b>2011</b>	<b>October 31 to November 30</b>	<b>All</b>	Plant Trees	Remove any invasive plants in proposed tree planting areas. Plant trees in gaps after invasive plants are removed
<b>2012</b>	<b>March 1 to the 15</b>	<b>All</b>	Plant trees	Plant trees in gaps and the root rot infection center.
<b>2012</b>	<b>June</b>	<b>All</b>	Spot weed control	Conduct spot weed control around all planted tree seedlings with 1% RoundupPro - keep product off trees.
<b>2012 and beyond</b>	<b>June</b>	<b>All</b>	Invasive Spot weed control	Spot treat all invasive plants in park - use Garlon 4 Ultra for English ivy, yellow archangel, and field bindweed, and Chopper Gen2 for the bamboo.
<b>2013</b>	<b>June</b>	<b>All</b>	Hazard Tree Evaluation	Complete hazard tree evaluation every 2 years.
<b>2016</b>	<b>January</b>	<b>All</b>	Revise Mgt. Plan	Contact WFCI to revise forest management plan.

*\* Adjust schedule if activity is delayed/accelerated.*

The City of Lacey staff includes two Certified Arborists<sup>®</sup> who are qualified to lead the implementation of the proposed management recommendations. Staff receives training in the most current arboricultural practices annually. When necessary, staff may require input from WFCI as special disease, weed, or other unusual conditions arise.

Based on review of the above recommendations, citizen input, and assessment of staff time, in cooperation with volunteers, Table 6 is a summary of what city staff plans to accomplish in the fall of 2011 and the spring of 2012.

Table 6. Summary of the planned management activities for 2011-20122.

<b>Timing</b>	<b>Activity</b>
August 2011	Order herbicides for invasive plants
	Prepare Nursery order for bare root White Pine and Western Red Cedar
September 2011	Treat entire park for invasive plants and noxious weeds
	Order White Pine and Western Redcedar seedlings
	Identify which hazardous trees can be removed by Lacey staff and which will be contracted to a private tree service
	Obtain 3 bids for trees to be contracted
	Remove and treat bigleaf maple stump sprouts near tennis courts
October 2011	Spot treat invasive plants that were missed
	Tree removals - in house and contracted
	Plant containerized trees and shrubs and apply mulch for weed prevention; (100 Western Red Cedar, 25 Vine Maple, 25 Saskatoon serviceberry, 40 Red Osier Dogwood); Work with Boy Scout volunteer group;
November 2011	Plant containerized trees and shrubs - Boy Scout volunteer group(100 Western Red Cedar, 25 Vine Maple, 25 Saskatoon serviceberry, 35 Red Osier Dogwood); Plant bare root White Pine (50)
January-February 2012	Removal and treatment of bigleaf maple sprouts throughout park
	Pruning vegetation along perimeter of park to create access for patrol - May be contracted
March 2012	Plant bare root trees, Western Red Cedar and White Pine
April 2012	Spot treat invasive plants
May 2012	Weed control around seedlings
Fall, 2012	Park Maintenance staff arborists will assess survival of the trees planted, the extent to which invasive plant treatment has been successful, and plan the course of action; A follow-up assessment may be requested from WFCI to refine recommendations based on the success of the implemented practices;

Detailed records will be kept on the work activity so that the success of the treatments can be evaluated, and future work prescriptions can be refined.

## Summary

An assessment of the trees and vegetation in the entire park was completed. There are 2,334 trees ranging from 6 to 50 inches DBH on approximately 31 acres of forested area. We found 30 trees that are dead, dying, decayed, or defective and require removal or conversion to wildlife snags.

There are numerous infestations of 7 different noxious weeds/tree species that require control to prevent further damage to the parks native plants. The noxious weeds include English ivy, yellow archangel, bamboo, field bindweed, morning glory, American holly, and Himalayan blackberry.

The species composition of the understory is heavy to bigleaf maple stump sprouts. Selective control of some of these sprout clumps, coupled with replanting of noxious weed areas and gaps in the canopy will greatly improve the future species composition, diversity, and layering of vegetation for wildlife in the park.

Creation of additional snags and improving the diversity of plants through planting the gaps will greatly improve foraging habitat for wildlife, layering of vegetation for songbirds, and browse for ungulates.

Expansion of the asphalt trail system into the westerly one-third of the park is not recommended due to the presence of the disease problems and potential of root damage to healthy trees.

Access needs to be improved around the park perimeter to facilitate patrol to identify encroachments on a quarterly basis. Overall, the forest health and wildlife habitat will be improved in the long-term if this plan is implemented.

Respectfully submitted,

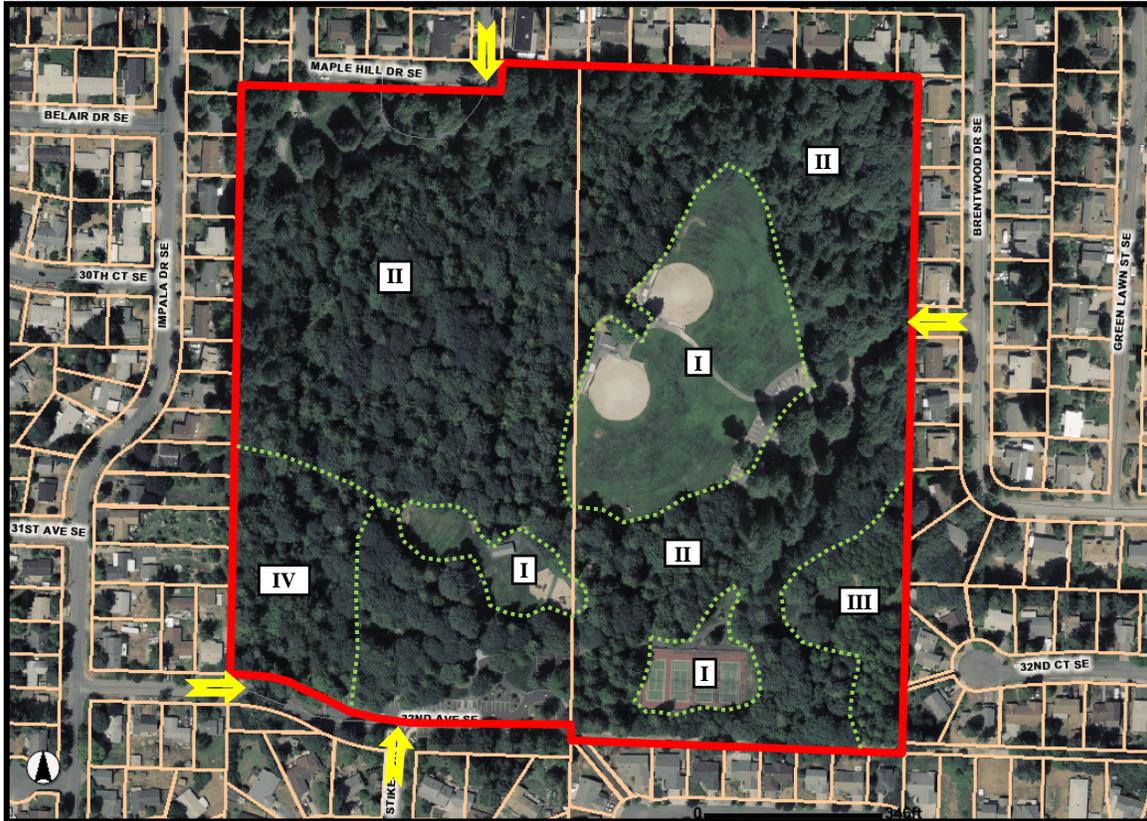
Washington Forestry Consultants, Inc.



Galen M. Wright, ACF, ASCA  
Certified Forester No. 44  
ISA Board Certified Master Arborist #PN-129BU

## APPENDIX I

### Aerial Photo of Wonderwood Park with Forest Cover Types (Thurston County Geodata 2009)



#### Forest Cover Types:

- Type I: Ballfields, picnic area, sport courts - Non-forest
- Type II: Bigleaf maple, Redcedar, Douglas-fir - 6 to 50 inches DBH
- Type III: Red alder, Bigleaf maple - 6 to 14 inches DBH
- Type IV: Douglas-fir, Bigleaf maple-6 to 40 inches DBH - Laminated Root Disease Area

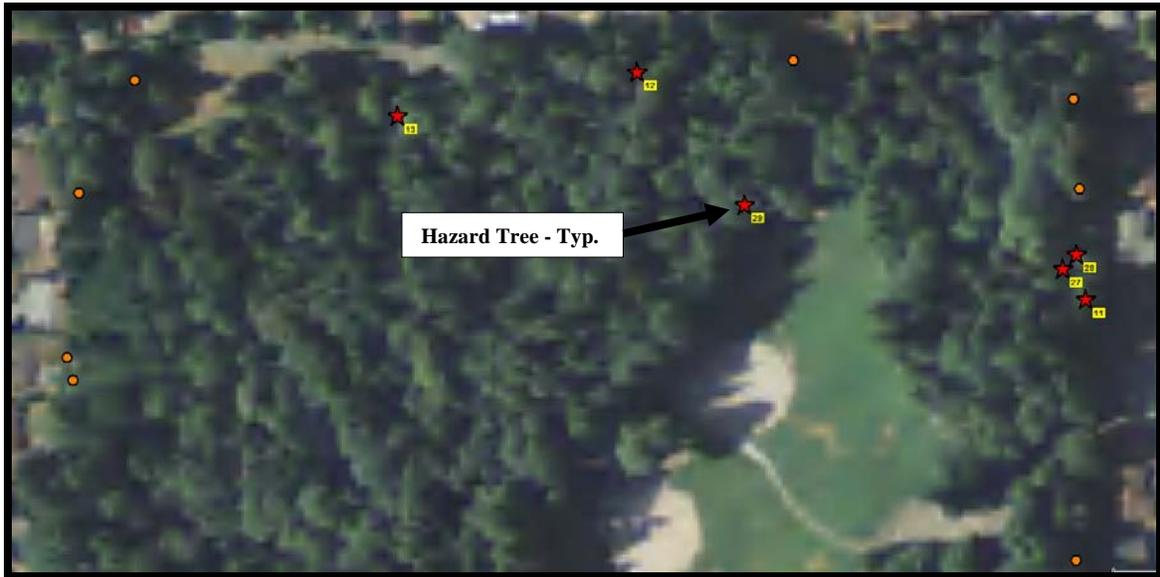
#### Legend:

-  Park Boundary
-  Forest Cover Type Line
-  Access Point to Park

## APPENDIX II

### Locations of Marked Hazard Trees and Noxious Weed Infestations

#### North Half of Park



#### South Half of Park



*\*Tree #'s 18-20 are between #'s 17,21 and 30. Bees flagged between #21 and 30..*

**APPENDIX III****Detailed Tree Inventory Summary**

Species	Condition	DBH (inches)													Totals
		6	8	10	12	14	16	18	20	22	24	26	28	30+	
Douglas-fir	Good		1	3	2	3	1	6	3	8	13	17	13	24	<b>94</b>
	Fair	13	18	16	24	14	12	23	19	15	27	24	17	54	<b>276</b>
	Poor	3	2	1		2				1					<b>9</b>
Western Redcedar	Good	12	12	10	9	12	6	5	7	2	10	7	8	43	<b>143</b>
	Fair	50	67	61	59	43	36	30	29	15	33	27	32	102	<b>584</b>
	Poor	1	3	1	2	2	3	2	2	2	2		2	6	<b>28</b>
Bigleaf Maple	Good	1		2		1	1	3	1		3		2	3	<b>17</b>
	Fair	45	43	53	58	71	45	61	36	33	41	47	44	152	<b>729</b>
	Poor	3	3	3	3	1	2	3	2	1	2	3	5	30	<b>61</b>
Red Alder	Good		2		3	5	11	6	2					1	<b>30</b>
	Fair	29	25	38	42	31	31	18	4	3		2			<b>223</b>
	Poor		1			2	1	1	1						<b>6</b>
Western Hemlock	Good								1						<b>1</b>
	Fair	5	6	6	8	7	5	8	5	4	10	3	6	7	<b>80</b>
	Poor			1	1		1	2	1	1	1	3	1	2	<b>14</b>
Grand Fir	Good													1	<b>1</b>
	Fair		1	1	2	2		1	1		2		2	5	<b>17</b>
	Poor		1			1									<b>2</b>
Cottonwood	Fair												1	<b>1</b>	
Scouler Willow	Fair				1									<b>1</b>	
Pacific Madrone	Fair					1	1							<b>2</b>	
Cherry	Fair	4	6	2		1	1		1					<b>15</b>	
<b>Summary</b>		<b>166</b>	<b>191</b>	<b>198</b>	<b>214</b>	<b>199</b>	<b>157</b>	<b>169</b>	<b>115</b>	<b>85</b>	<b>144</b>	<b>133</b>	<b>132</b>	<b>431</b>	<b>2,334</b>

## APPENDIX IV

### Observed Wonderwood Park Wildlife

#### Cavity Nesting Species

#### MAMMALS

Douglas' Squirrel	Shrew spp.
Eastern Gray Squirrel	Eastern Cottontail spp.
Raccoon	Coast Mole
Common Deer Mouse	Opossum

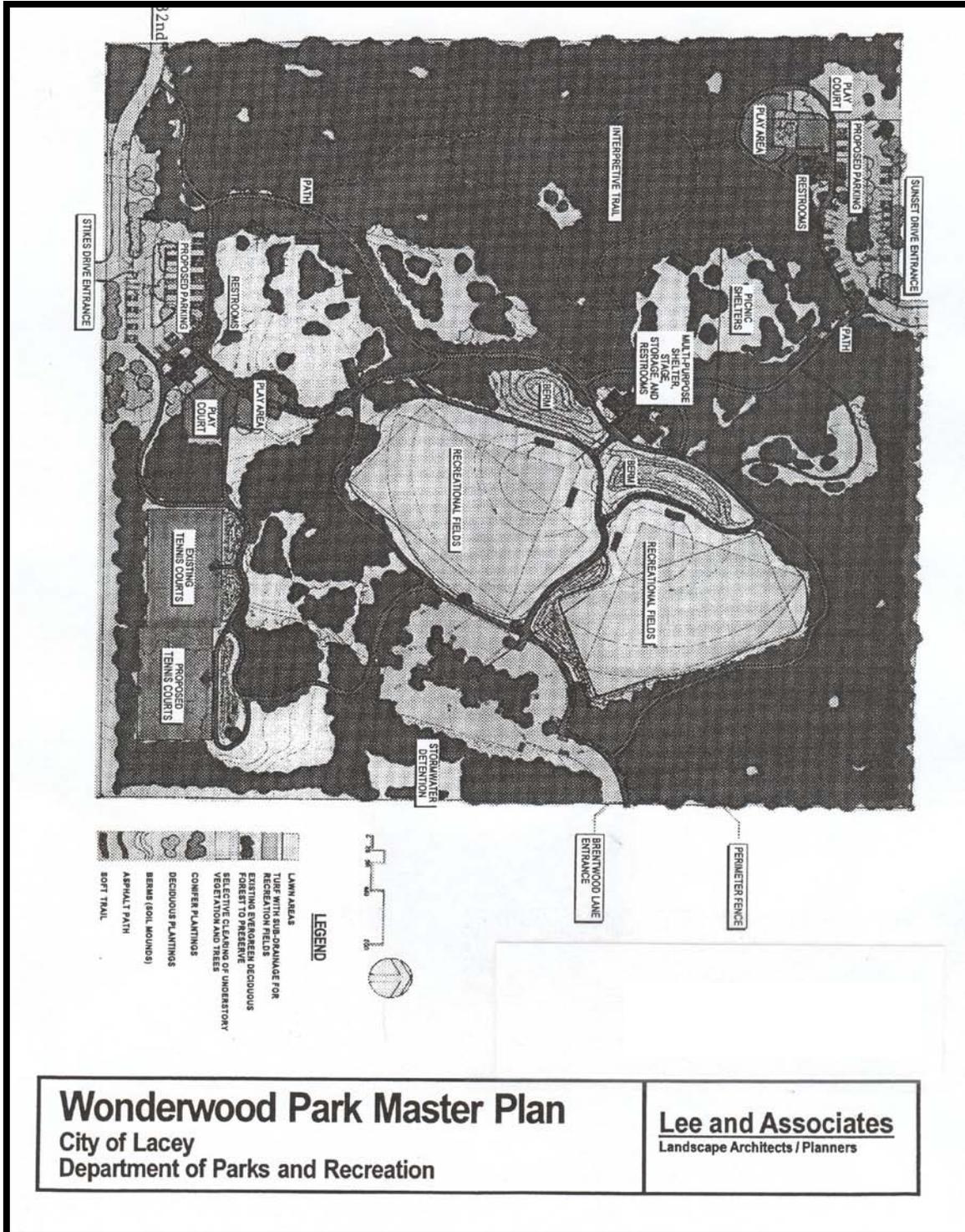
#### BIRDS

American Crow	Olive-sided Flycatcher
American Robin	Yellow-Rumped Warbler
Spotted Towhee	Song Sparrow
Mallard	White-Crowned Sparrow
Barred Owl	Golden-Crowned Sparrow
Northern Flicker	Dark-eyed Junco
Red-Breasted Sapsucker	House Finch
Pileated Woodpecker	Winter Wren
Hairy Woodpecker	Bewick's Wren
Downy Woodpecker	House Wren
Steller's Jay	Golden-Crowned Kinglet
Western Scrub-Jay	Pine Siskin
Blacked-Capped Chickadee	House Sparrow
Brown Creeper	Rufous Hummingbird
Red-Breasted Nuthatch	Anna's Hummingbird
White-Breasted Nuthatch	Ruby-Crowned Kinglet
Starling	Bushtit
Cedar Waxwing	Swainson's Thrush
Hutton's Vireos	Varied Thrush

*\*List contributed by Greg Fisher and the Black Hills Audubon Society*

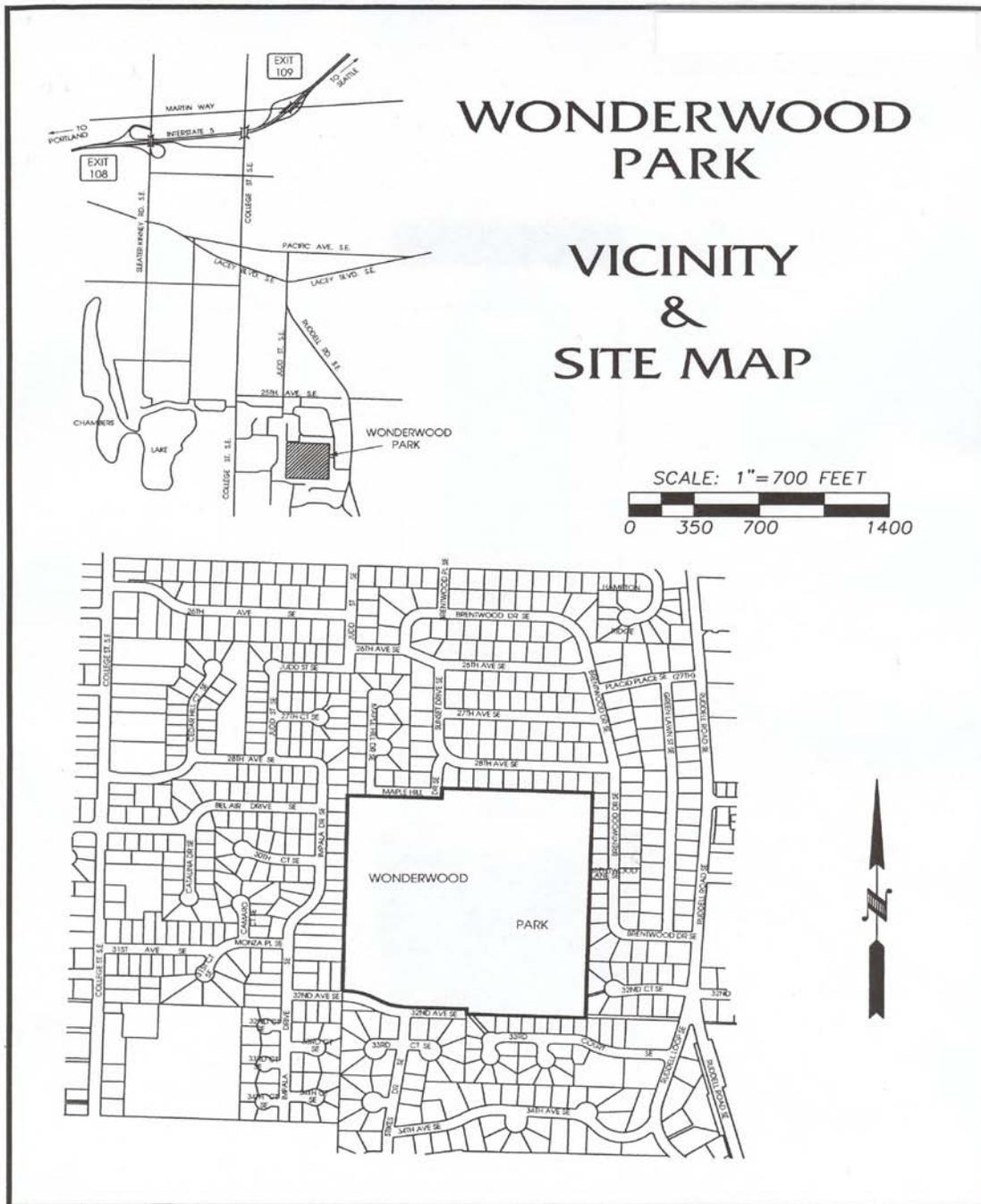
## APPENDIX V

### Wonderwood Park Master Plan Map



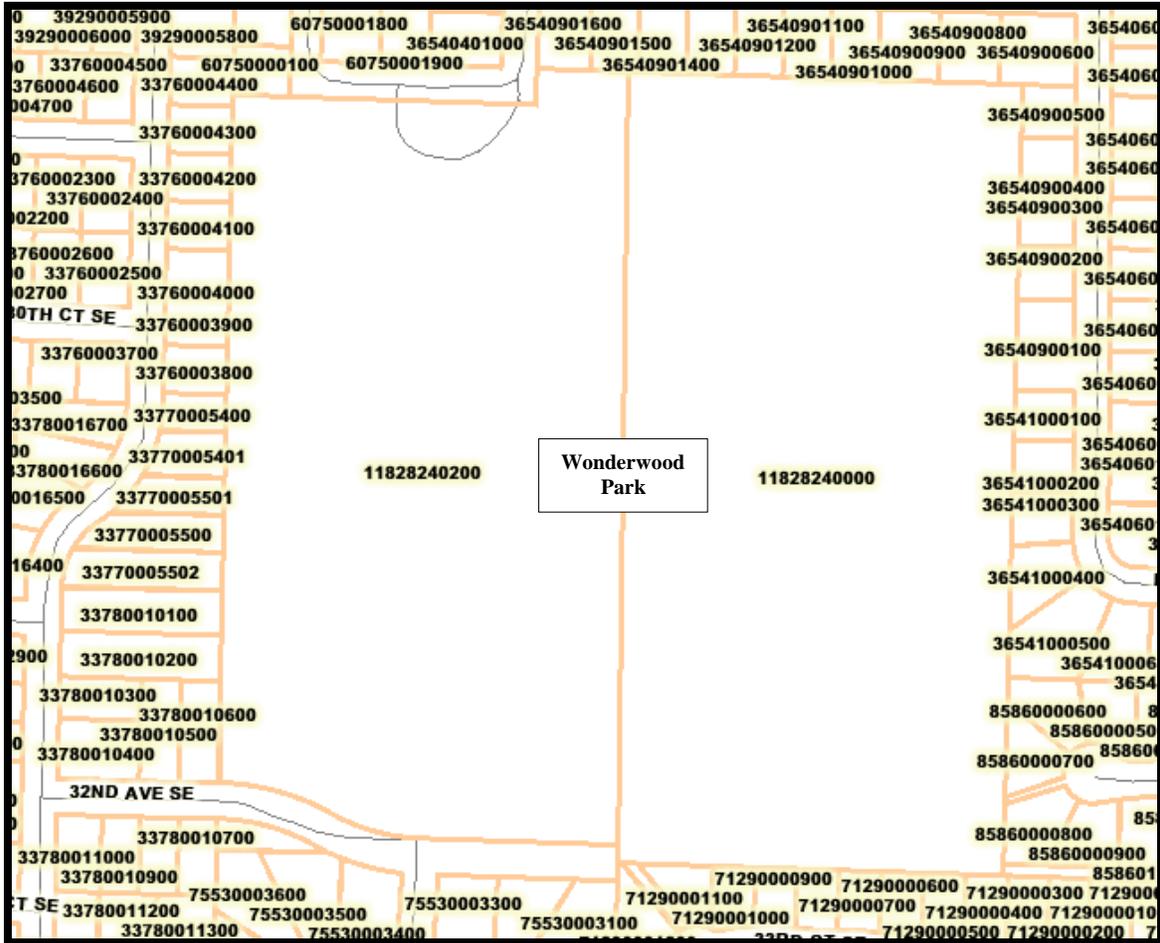
## APPENDIX VI

### Wonderwood Park - Vicinity Map



## APPENDIX VII

### Wonderwood Park Parcel Map Thurston County Geodata - September 2011



## APPENDIX VIII

### Glossary of Forestry and Arboricultural Terminology

**DBH:** Diameter at Breast Height (measured 4.5 ft. above the ground line on the high side of the tree).

**Hazard tree:** Tree that is dead, dying, diseased, insect infested, or structurally defective with an unacceptable risk of failure of the entire tree or tree parts onto targets.

**Live Crown Ratio:** Ratio of live foliage on the stem of the tree. Example: A 100' tall tree with 40 feet of live crown would have a 40% live crown ratio. Conifers with less than 30% live crown ratio are generally not considered to be long-term trees in forestry.

**Canopy:** The foliage in total, of a tree or stand of trees.

**Crown:** Portion of a trees stem covered by live foliage.

**Crown Position:** Position of the crown with respect to other trees in the stand.

**Dominant Crown Position:** Receives light from above and from the sides.

**Codominant Crown Position:** Receives light from above and some from the sides.

**Intermediate Crown Position:** Receives little light from above and none from the sides. Trees tend to be slender with poor live crown ratios.

**Suppressed Crown Position:** Receives no light from above and none from the sides. Trees tend to be slender with poor live crown ratios.

**Cultural Care Needs:**

<b>ABBRV.</b>	<b>ACTIVITY</b>	<b>DESCRIPTION</b>
<b>CC</b>	<b>Crown Cleaning</b>	Pruning of dead, dying, diseased, damaged, or defective branches over 1/2 inch in diameter –includes removal of dead tops
<b>CT</b>	<b>Crown Thinning</b>	Pruning of branches described in crown cleaning, plus thinning of up to 20% of the live branches over 1/2 inch diameter. Branch should be 1/3 to 1/2 the diameter of the lateral branch. Thinning should be well distributed throughout crown of tree, and should release healthy, long-term branches.
<b>RC</b>	<b>Crown Reduction</b>	Reduction of the crown of a tree by pruning to lateral branches. Generally used to remove declining branches or to lighten end weight on long branches.
<b>CR</b>	<b>Crown Raising</b>	Pruning of lower branches to remove deadwood or to provide ground or building clearances.
<b>RMV</b>	<b>Remove</b>	Remove tree due to decline or hazardous conditions that cannot be mitigated by pruning.
<b>RS</b>	<b>Remove Sprouts</b>	Remove basal sprouts from stem of tree.
<b>Rep</b>	<b>Replace</b>	Tree is small – is in decline or dead. Replace with suitable tree species.
<b>HT</b>	<b>Hazard Tree</b>	Tree is hazardous and cannot be mitigated by pruning. Recommendation is to remove tree.
<b>None</b>	<b>No Work</b>	No work necessary at this time.

## APPENDIX IX

### Assumptions and Limiting Conditions

- 1) Any legal description provided to the Washington Forestry Consultants, Inc. is assumed to be correct. Any titles and ownership's to any property are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is appraised or evaluated as though free and clear, under responsible ownership and competent management.
- 2) It is assumed that any property is not in violation of any applicable codes, ordinances, statutes, or other governmental regulations, unless otherwise stated.
- 3) Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, Washington Forestry Consultants, Inc. can neither guarantee nor be responsible for the accuracy of information.
- 4) Washington Forestry Consultants, Inc. shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.
- 5) Loss or alteration of any part of this report invalidated the entire report.
- 6) Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior expressed written or verbal consent of Washington Forestry Consultants, Inc..
- 7) Neither all or any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent of Washington Forestry Consultants, Inc. -- particularly as to value conclusions, identity of Washington Forestry Consultants, Inc., or any reference to any professional society or to any initialed designation conferred upon Washington Forestry Consultants, Inc. as stated in its qualifications.
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- 9) Sketches, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.
- 10) Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree or other plant or property in question may not arise in the future.

*Note: Even healthy trees can fail under normal or storm conditions. The only way to eliminate all risk is to remove all trees within reach of all targets. Annual monitoring by an ISA Certified Arborist or Certified Forester will reduce the potential of tree failures. It is impossible to predict with certainty that a tree will stand or fail, or the timing of the failure. It is considered an 'Act of God' when a tree fails, unless it is directly felled or pushed over by man's actions.*