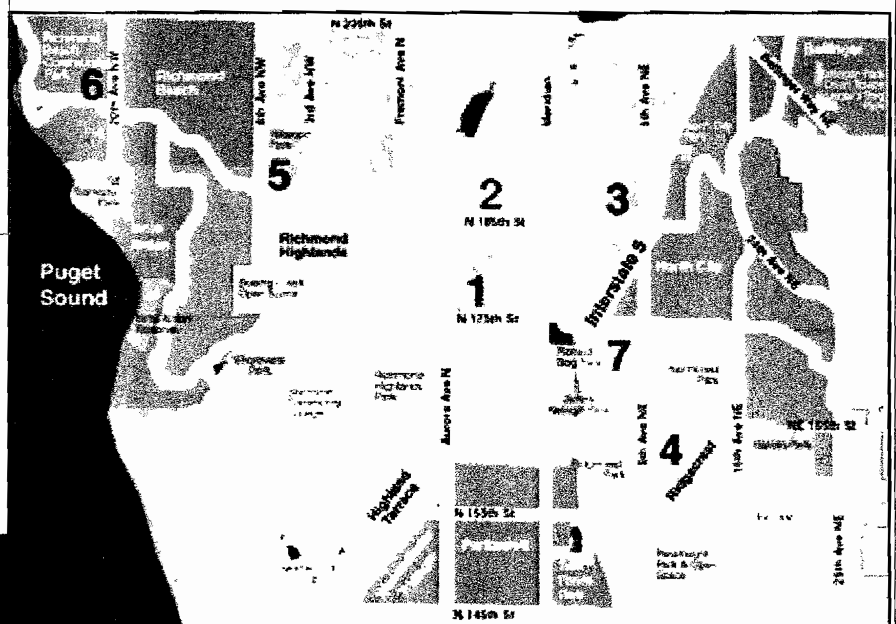
URBAN FOREST MANAGEMENT PLAN FINAL REPORT

The City of Shoreline, WA



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URBAN FOREST

MANAGEMENT PLAN

FINAL REPORT

SUBMITTED BY:

ACRT

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Presented to

City of Shoreline
Shoreline, WA 93065-1644

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Executive Summary

The City of Shoreline has recognized the benefits that trees provide to the quality of urban life. In order to manage this valuable resource the City contracted ACRT to conduct a street tree inventory and develop a management plan. This report will assist the City to make more informed choices.

ACRT conducted the inventory from February to October, 2003. City staff indicated that a that the Highlands and Innis Arden areas were not to be inventoried. They further indicated that only trees and planting sites presently occupying the City's boulevards should be inventoried and that trees and planting sites were not to be counted on the City's medians or in the City's parks.

The following is a summary of the inventory report.

1. ACRT inventoried a total of 14,226 trees and 1505 planting sites on the City's boulevards.

2. ACRT personnel recorded 170 species from 78 genera on the City's boulevards. The most plentiful species include Douglas-fir, *Pseudotsuga menziesii* (16%), American arborvitae (13%), Western red-cedar, *Thuja plicata,* (11%). The other species each composed less than 5% of the total number of trees.

3. The size class distribution indicates that 66.5% of the Shoreline tree population is composed of small trees less than 12 inches in diameter. Twenty three percent of the trees are medium sized trees with diameters between 13-30 inches and 2.3% of the trees are very large trees greater than 30 inches in diameter.

4. The majority of trees (64.5%) were estimated to be in good or better condition, 25.4% fair, 8.7% poor while a little over 1% were rated in critical condition or dead. These results are less favorable than other cities where ACRT has conducted tree inventories.

5. The vast majority of the trees (91.0%) require routine pruning. Of the remainder, just over 2% require priority pruning or re-inspection and 6.7% require removal. While the majority of trees presently require routine pruning, the lack of recent pruning is evident for many trees.

6. A preliminary estimate of the cost to systematically prune the 14,226 street trees based on a typical contract rate is $1,747,251.00 (Section 4.5). This figure is based on the City's current street tree population and does not include the costs to maintain the City's tree department, nor does it anticipate the costs of future development.

7. ACRT proposes that to effectively manage the street tree population that the City should adopt a five-year pruning cycle. The estimated annual tree maintenance cost for a five-year pruning cycle is $349,450.00 (Section 4.5).

8. To maintain the City's urban forest we recommend that the City replant trees slated for removal and fill the existing vacancies in the coming year. Afterwards the City should budget to plant 100 trees annually to fill existing tree vacancies plus an estimated 1% tree replacement or 100 trees annually for the next five years. With an average tree planting costs of $264.00 per tree the tree planting costs are estimated at $118,800.00 annually.
9. We believe that an annual budget of $468,250.00 should be adequate to maintain the City's trees. Note: the simplified costs presented in this report may not reflect the true costs to run this program as suggested and may require additional funds after a more thorough review to reflect accurate local costs.
10. ACRT believes that maintaining the City's trees at this level will provide the citizens of Shoreline with a pleasing urban environment.

Implementing the proposed programs will provide the City with the maximum economic, aesthetic, and environmental benefits from its urban forest. The level of economic appreciation achieved by the urban forest can be maximized through necessary maintenance. As the overall condition of the street tree population improves, survival rates will increase and publicly owned trees will appreciate in value as they grow and develop.

1.0 Introduction

The City of Shoreline is a pleasant community located in Snohomish County just north of Seattle. Native Douglas fir and Western red cedars grow rampant, giving the community an appearance of a city within a forest. Thus the trees that make up Shoreline urban forest are an essential component of the City's landscape and a defining element of its character.

Trees provide benefits, which supercede the traditional amenities of aesthetics and shade. In urban environment, healthy trees provide substantial benefits including:

1. Temperature moderation,
2. Mitigation of urban heat islands,
3. Stormwater runoff reduction,
4. Carbon sequestration,
5. Improved air quality
6. Noise reduction, and
7. Visual screening.

However, a healthy and well-maintained urban forest does not come about by accident. The health and stability of a city's urban forest can only be achieved by proactive management. The street tree inventory conducted by ACRT will help document the existing condition publicly owned trees in the City of Shoreline.

Interest in urban trees is increasing from the federal and state level to the local level as their benefits are quantified and better understood. Federal funding for urban forestry assistance has increased tenfold with emphasis toward educating people on the benefits provided by trees. Despite the fact that federal funding for urban forestry has grown dramatically, the competition for these funds has outpaced availability. Global Releaf, a program of American Forests, is promoting tree planting on a worldwide basis in an effort to slow the buildup of carbon dioxide and thereby slowing the effects of global warming. The National Arbor Day Foundation administers the "Tree City USA" program to acknowledge local communities tree care and planting efforts. This emphasis on the health and proliferation of the urban forest is a key factor in increasing the quality of life in urban and suburban communities

Improving tree vigor and survival will result in long-term benefits and reduce public liability by eliminating hazardous conditions. Recent research has demonstrated that residential and commercial property values rise as the number and size of trees increase and as overall tree condition improves. Research has also shown that urban trees are more effective at reducing air pollution than the same tree in a wooded setting. In addition, shading by trees can improve air conditioner efficiency by up to 40%.

The City of Shoreline has taken a proactive approach by contracting ACRT, Inc. to conduct an inventory of the City's trees and provide an overview of the condition of its urban forest. The tree inventory forms the basis of a tree management plan that can be used to address tree inventory maintenance and associated concerns of public safety, and liability on a systematic and proactive basis. A street tree maintenance program that is based on the results of this inventory will allow priorities, scheduling and budgeting to be based on documented field conditions. Implementing this program will ensure that the residents of Shoreline enjoy the benefits of their urban forest for many years to come.

2.0 Objectives

The objectives of the survey were to determine the following:

1. To inventory the trees on the City of Shoreline street boulevards.
2. To determine the tree species composition and diversity on the City's boulevards.
3. To provide an average tree size and range of tree sizes.
4. To determine an estimate of tree maintenance needs.
5. To provide an estimation of tree condition.
6. To predict tree planting needs.
7. To report other needs while conducting the survey.
8. To contribute to a comprehensive Urban Forest Management Plan

3.0 Tree Inventory Methodology

ACRT personnel conducted a partial inventory of the City of Shoreline's street trees from February to October 2003. City of Shoreline staff indicated that only trees and planting sites presently occupying the City's boulevards should be inventoried and that trees and planting sites were not to be counted on the City's medians or in the City's parks. No trees under five feet in height were included in the inventory.

The data collectors included:

Irvin Penner: Mr. Penner has an Associates degree in Horticulture from the University of Guelph, a Bachelor of Science degree in Forestry from the Laval University and is an ISA Certified Arborist.

Dave Fulton: Mr. Fulton has completed courses in Biology and Botany at several universities in the Los Angeles area and has worked on numerous urban forest inventories in the Los Angeles area.

Bruce Franklin: Mr. Franklin has Bachelor of Science degrees in Forest Management and Natural Resource Management from Colorado State University and is an ISA Certified Arborist.

3.1 Location Information

Trees were located by street address along street rights-of-way. Addresses were recorded on the field from a list provided by the City. If the tree was located on a parcel without a known address, an address was assigned based on the numbering series of the address of the adjacent properties. Tree numbers distinguish between multiple series on a single property (Fig. 1), and all sites are located by block side information (Fig. 2). In most cases, the street right-of-way corresponds to the parcel of land between the curb and the sidewalk. All naturally growing trees 1 ½ inches in diameter or greater were included in the inventory.

Trees were mapped using a Global Positioning System (GPS). This allowed for accurate mapping of all trees in these areas. The location of the trees was then positioned on a geodetically correct street map of the City. These maps are to scale and the position of each tree is accurate to a margin or error of four feet. The GPS maps were supplied electronically to the city on April 15, 2003.

Only the street "Theme" category in the listings generated by Tree Manager™ for Windows® was used in this inventory. The Streets theme includes those trees on the street right-of-way between the curb and sidewalk; or those trees on city property 30 ft from the centerline of the road.

3.2 Tree Cell Number Methodology

The individual number for each tree or planting site is numbered sequentially in the order of "traffic flow". A separate series of numbers exist for each side of the property. Multiple trees and planting sites can exist at each location.

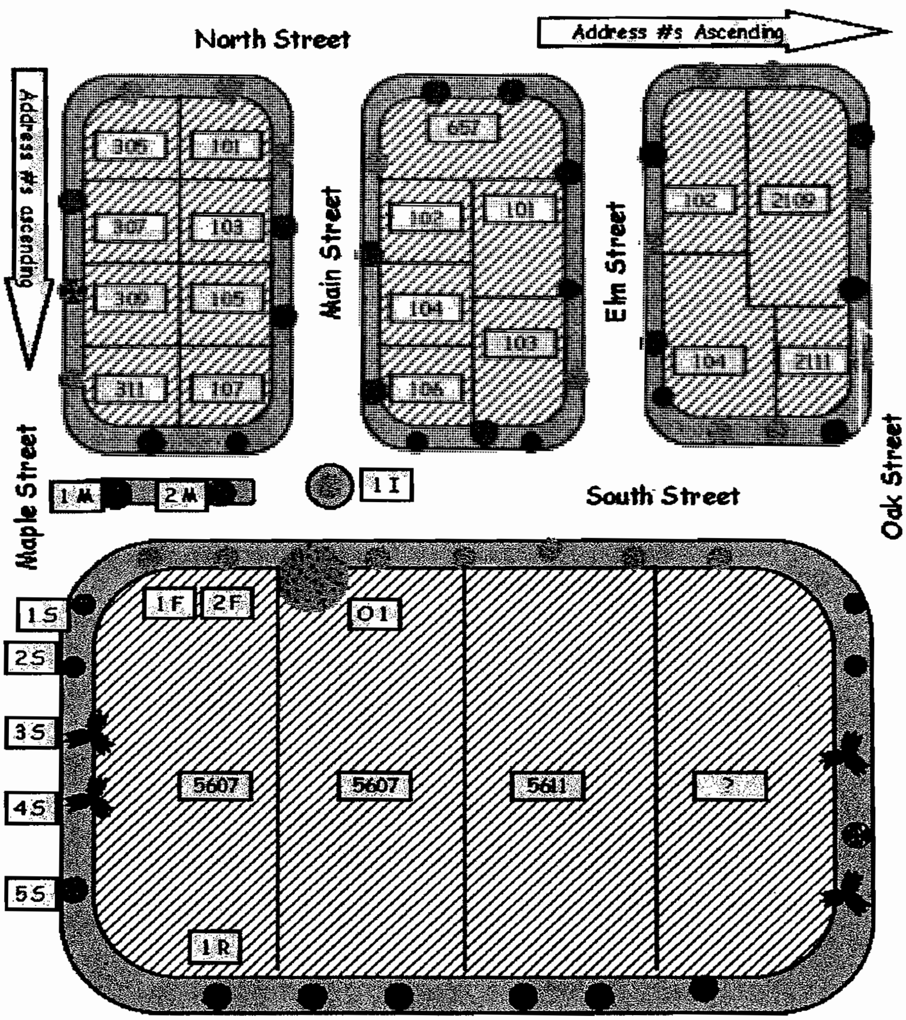


Fig. 1. Tree numbering methodology

As trees are numbered sequentially in the order of "traffic flow" there is a separate series of numbers for each side of a property.

4.0 Results.

Overall, attribute data was collected for a total of 14,226 trees and 1505 planting sites. Tree and planting site data were collected in all areas except for "The Highlands" and most of the "Innis Arden" areas (Fig 2).

Fig. 2 City map detailing the areas where trees were inventoried by ACRT, February to October 2003.

A breakdown of the number trees and planting sites examined in each zone and the number of trees for which data was collected is included in Table 1.

SITE TYPE	AREA													Total
	Balinger	Briarcrest	Crista Ministries	Echo Lake	Fircrest	Hillwood	Innis Arden	Meridian Park	North City	Park wood	Richmond Beach	Richmond Highlands	Ridge Crest	
PLANTING SITE	12	52	2	56	0	82	0	49	290	352	59	158	393	1505
TREES	719	279	53	1565	18	1690	32	1453	2323	512	1134	3234	1254	14266
TOTAL	731	331	55	1621	18	1772	32	1502	2613	864	1193	3392	1647	15771

**Note: no planting sites were collected on open streets with no curb.*

Table 1. Number of trees and planting sites inventoried by City management zone.

Because the City of Shoreline is a new City (incorporated since 1994) many of the typical amenities such as curbs and sidewalks are lacking. Our data collectors noted that without curbs or sidewalks many property owners have taken the initiative to plant trees more densely on the City's boulevards than would be expected under more controlled conditions. In other instances, it appeared that nature was allowed free reign and native species, especially western red cedar, were seeding themselves on the boulevards.

4.1 Species Composition and Diversity

Trees were identified by common name, genus, species, and by cultivar when appropriate. Both the common name and scientific (Latin) name were recorded. Altogether, there were 9,504 trees and 503 planting sites.

As tree species vary considerably in life expectancy and maintenance requirements, it is essential to know the species composition and proportion of the urban forest. The total number and condition of each species group influence maintenance and planting activities. Species diversity is a major objective of urban forest management as it reduces the proportion of trees that may be lost to or are affected by a species-specific pest or disease. A diverse tree population is also more appealing to the public and with proper planning can exhibit flowering trees in spring, shade trees of differing density in summer, vibrantly colored trees in fall and interesting texture in winter.

From the results of the inventory it is evident that Shoreline tree population is adequately diverse. ACRT personnel recorded over 190 species from 115 genera on the City's boulevards (Fig. 4). The most plentiful species include Douglas fir, *Pseudotsuga menziessii* (16%), American arborvitae, *Thuja occidentalis* (13%), and Western red-cedar *Thuja plicata* (11.%). The other species each composed less than 5% of the total number of trees.

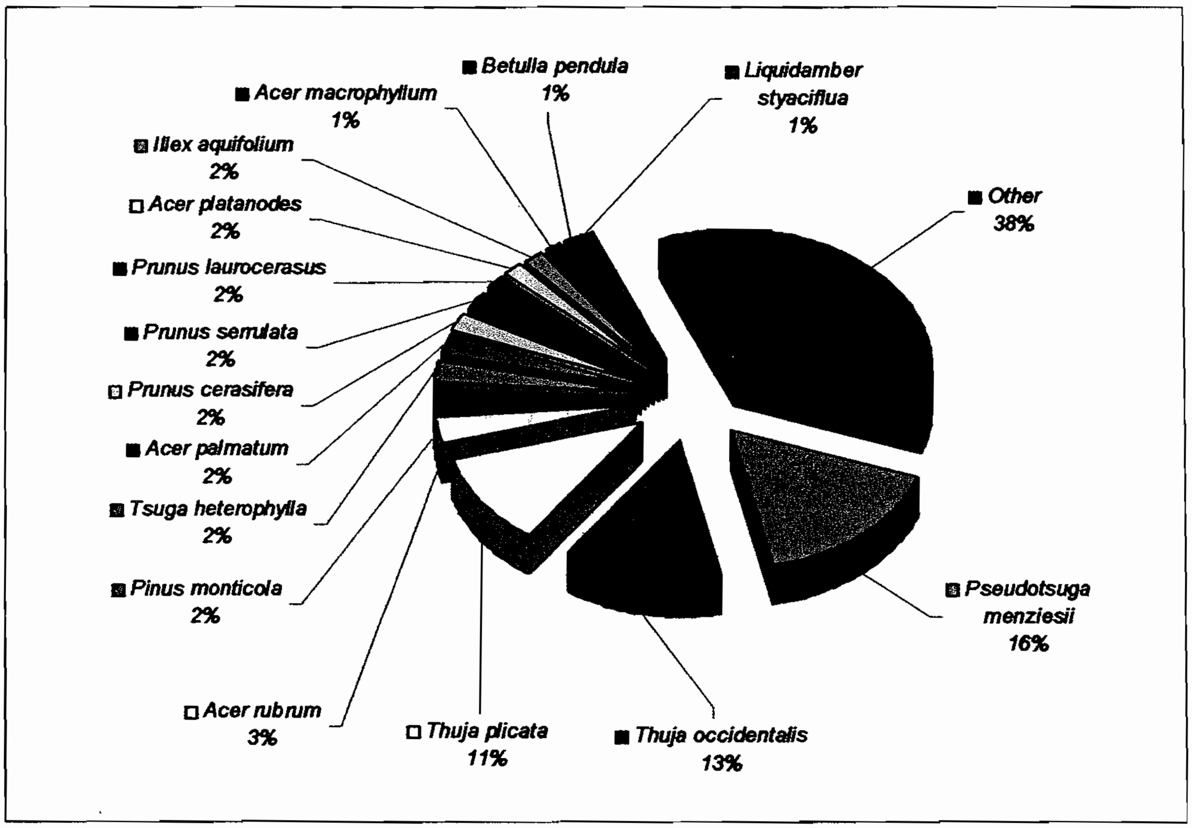


Figure 3. Species composition and diversity

Regarding a city's tree population, ACRT recommends the 20/10 rule – no more than 20% of the trees from one genus and not more than 10% of the trees of one species. This is to try and minimize the damage by insect pests and disease. Insect and disease pest populations build up more easily when their tree hosts are more abundant. This holds for both introduced and native tree species.

Perhaps the most spectacular example of a pest damaging city trees is Dutch Elm Disease which has devastated trees in cities across North America. Other examples include the Gypsy moth in the eastern United States and the recent outbreak of the emerald ash borer in the Midwest. In California, there is great concern that the newly observed Sudden Oak Death which has devastated native oaks in Marin County and surrounding areas.

With these examples in mind, we suggest that the City of Shoreline closely monitor their tree planting program and possibly even limit planting of tree species after they exceed 10% of the total population. This includes native species such as Douglas fir and Western red cedar.

4.2 Tree Size Class Distribution

Diameter at breast height (DBH), measured at 54" above the ground, is the standard forestry tree measurement and was recorded for all trees to the nearest inch. On trees that forked below 54 inches, the diameter was measured at the narrowest point below the trunk flare. If the tree forked at 54 inches, the diameter was measured just below the fork. For trees that had more than one stem, the diameters of the three largest stems were combined and recorded as the diameter and the tree was noted as having multiple stems. For data analysis, the trees were placed in the following diameter classes: 1-6 inches, 7-12 inches, 13-18 inches, 19-24 inches, 25-30 inches, 31-36-inches, and greater than 42 inches.

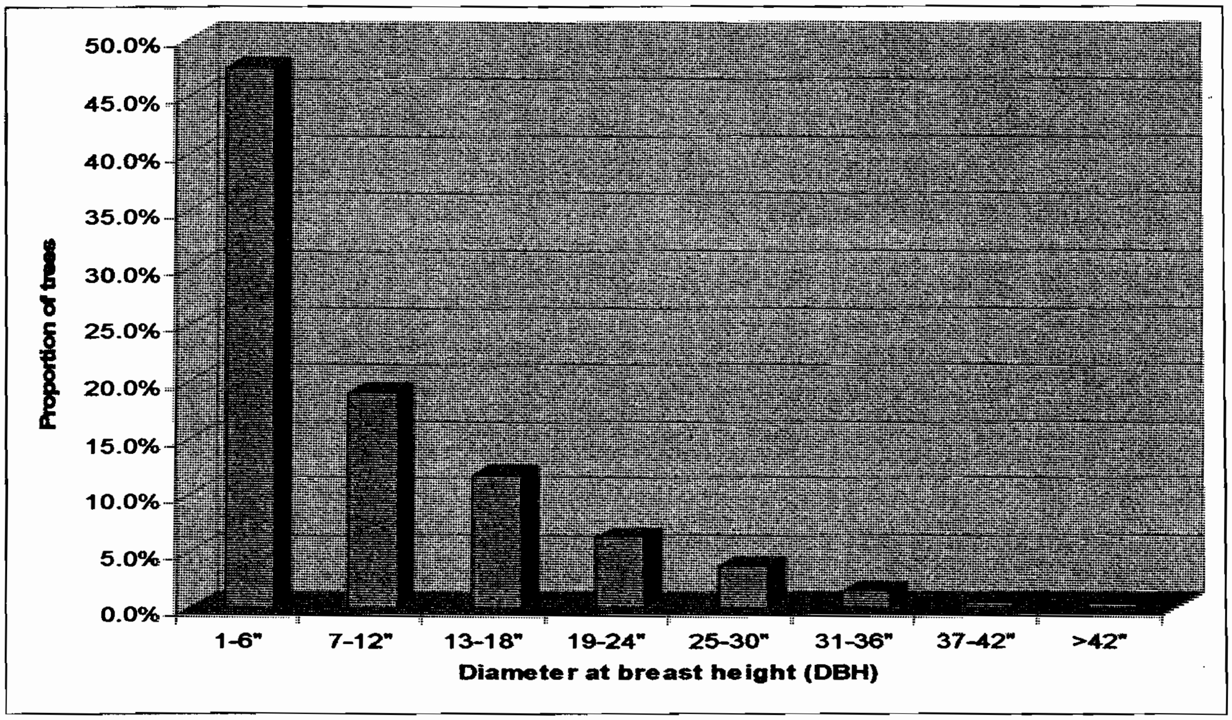


Fig. 4. Size class distribution of street trees

The size class distribution indicates that 77% of Shoreline tree population is composed of small trees less than 12 inches in diameter (Fig. 5). Twenty percent of the trees are medium sized trees with diameters between 13-30 inches and only 1% of the trees are very large trees greater than 30 inches in diameter.

The number of small trees indicates that the City bodes well for the future of Shoreline urban forest. Generally, smaller trees are growing vigorously and are at a stage where maintenance costs are low because they can be pruned from the ground and do not require expensive machinery, such as a bucket truck, to aid with trimming. Proper pruning at this stage will produce trees with good structure that will reduce future maintenance costs and extend the life of the trees.

4.3 Tree Maintenance

Each tree was assigned a maintenance category and an overview of the maintenance requirements for the City's trees is provided in Fig. 6. Field judgments were made from the ground based on observation and hazard estimation and the most appropriate recommendation for the tree was recorded. Definitions of maintenance categories are as follows

1. **Removal 1:** Trees designated as removal 1 are tall trees over 20 ft in height and generally 6 in. DBH, where failure of the tree could lead to property damage or injury. These trees are either dead or have one or more defects that cannot be

cost-effectively remedied. The majority of the trees in this category have a large percentage of dead crown and are potential safety hazards.

2. **Removal 2:** Trees designated as removal 2 are small trees under 20 ft in height and generally under 6 in. DBH, where failure of the tree would not lead to property damage or injury.
3. **Priority 1 Prune:** Trees designated as priority 1 prune are tall trees over 20 ft in height and generally 6 in. DBH, where failure of the tree limb or other defect could lead to property damage or injury. These trees have broken or hanging limbs, hazardous deadwood and dead, dying or diseased limbs or leaders that require a crew with a bucket truck or manual climbing.
4. **Priority 2 Prune:** Trees designated as priority 2 prune are small trees under 20 ft in height and generally 6 in. DBH, where failure of the tree limb would not lead to property damage or injury. These trees have dead, dying, diseased or weakened branches that can be pruned from the ground.
5. **Re- Inspection:** These trees have recently sustained damage, which has not fully affected the health of the tree yet. Future inspections are necessary to properly evaluate the condition of the tree.
6. **Routine Prune Large:** These trees require routine horticultural pruning to correct structural problems or growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket truck access or manual climbing.
7. **Routine Prune Small:** These trees require routine horticultural pruning to correct structural problems or growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. These trees are small-growing, mature trees that can be evaluated and pruned from the ground.

The causes for tree decline and death may be natural or man induced. Natural causes include disease, insects, drought, maturity, and frost. Man-induced causes include physical injury due to vehicles, vandalism, and improper use of herbicides or lawn care equipment. Removal of unhealthy and declining trees reduces potential for injury to people and property, eliminates breeding sites for insects and diseases, and maintains the aesthetics of the urban forest.

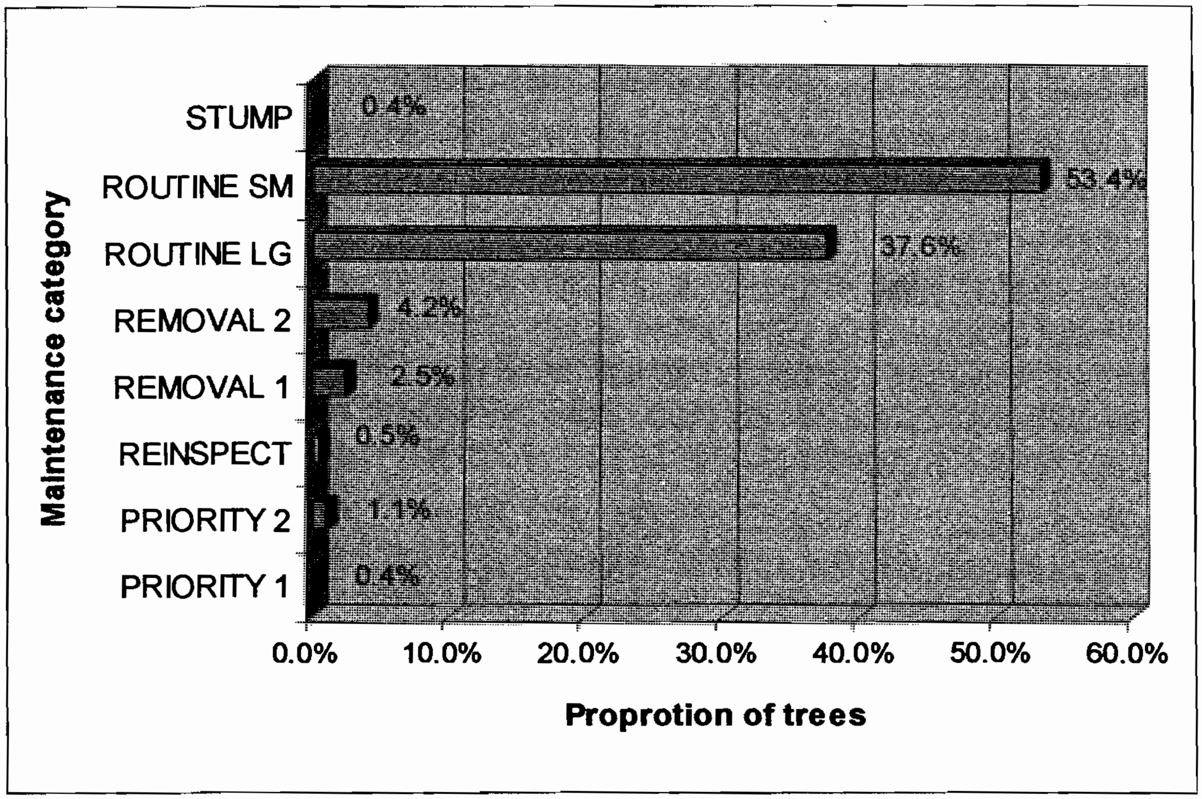


Fig. 5. Maintenance requirements for street trees.

A detailed description of all street and median trees requiring immediate attention, pruning, or removal is provided in Appendices A, B and C. All trees rated as removals should be scheduled to be removed as soon as possible.

Overall, 357 trees were recommended for **removal 1**, 597 for **removal 2**, 70 require **re-inspection**, 50 trees require **priority 1** pruning and 161 trees require **priority 2** pruning. The remainder or approximately 91% of the trees surveyed require routine pruning. These trees do not have any major defects such as large dead branches or other pressing problems. These trees need to be placed on a systematic pruning schedule to ensure that each tree is pruned every five years.

The breakdown of the maintenance requirements by diameter class is detailed in Table 2. This information will assist the City to implement cost-effective street tree maintenance strategies. It should be noted that while the majority of the trees require "routine pruning" many are at the extremes for this category. A more detailed description of trees requiring removal or immediate attention is included in Appendix A.

Maintenance Category	0-6	7-12	13-18	19-24	25-30	31-36	37-42	>42	Totals
Plant	1505	0	0	0	0	0	0	0	1505
Priority 1	0	8	6	10	12	5	5	4	50
Priority 2	4	19	40	34	31	16	9	8	161
Reinspect	13	19	15	12	3	4	2	2	70
Removal 1	50	108	100	49	26	12	6	5	356
Removal 2	502	79	12	4	0	0	0	0	597
Routine Lg	863	1554	1401	792	486	190	54	28	5368
Routine Sm	6060	1182	259	74	27	5	1	0	7608
Stump	9	23	12	5	4	1	0	2	56
Total	**9006**	**2992**	**1846**	**980**	**589**	**233**	**77**	**49**	**15771**

Table 2. Proportion of street and median trees by maintenance needs and size class.

4.4 Tree Condition

The condition rating helps to assess overall tree health and to evaluate species performance. ACRT uses criteria based on the International Society of Arboriculture's (ISA), *Valuation of Landscape Trees, Shrubs, and Other Plants: A Guide to the Methods and Procedures for Appraising Amenity Plants* (9th Edition). This method bases tree condition on several indicators including trunk condition, canopy density, growth rate, structure, presence of insects and diseases, crown development, and life expectancy. After a tree was evaluated, it was placed in one of the following categories: excellent, very good, good, fair, poor, critical and dead.

Trees ranked dead are recommended for removal. Trees ranked as immediate have some defect or other condition that requires attention from City staff. Some street trees ranked poor are expected to continue to decline over time unless extensive maintenance (such as pruning and fertilization) is performed. In many instances, the most appropriate option would be to remove such trees and replant with more vigorous species. Trees ranked fair can be expected to live for several years, but may need considerable maintenance to reduce liability and increase vigor.

Trees ranked good or better can be expected to live well into the future with systematic maintenance. Trees graded as excellent may have little need for immediate maintenance and can be expected to need limited maintenance in the near future.

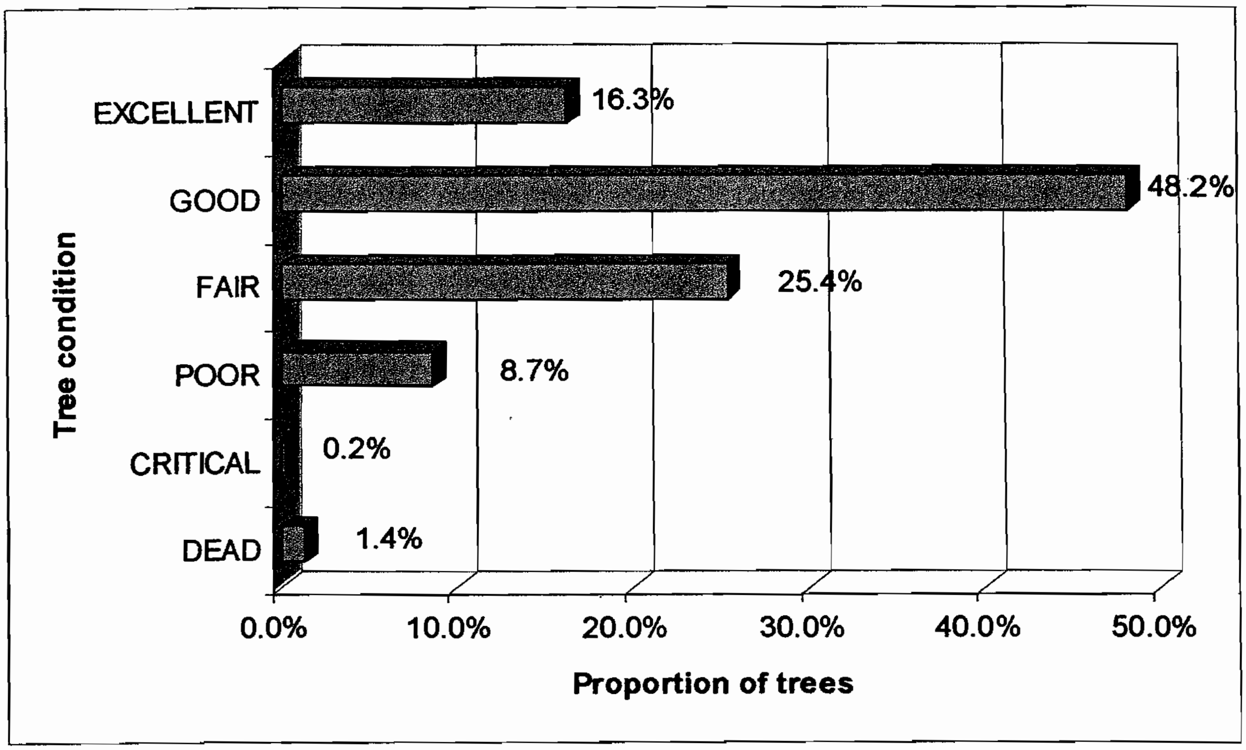


Fig. 6. Tree condition rating for street trees.

The overall condition of Shoreline street trees is good with over 65% of the trees rated as in good or better condition (Figure 6). However, this statistic belies the fact that a significant proportion of the trees are in less than ideal condition. Over 30% of the trees are rated as in fair or worse condition which is 10 - 15% higher than similar sized City's with which ACRT has worked.

Douglas-fir is the most common tree species in the City and 60% are rated as good or above. However, almost all of the 13% rated poor or lower require removal.

Very good performers, for which 80% of the trees were rated as good or better, included American arborvitae and members of the *Chamaecyparis* and *Juniperus* genera. Poor performers included black locust, *Robinia pseudoacacia,* red alder, *Alnus rubra,* and members of the genus *Sorbus* for which less than 50% of the trees were rated in good condition. ACRT would not recommend using these trees for future use in the City's planting program. Fortunately, these species comprise less than 3% of all trees in the City.

4.5 Resource Requirements

4.5.1 Tree Maintenance Budget

Table 3, provides a proposed annual budget for the trees inventoried to be placed on a five-year maintenance cycle. The budget is based on contractual rates and the estimated time to complete each task in Southern California and may not reflect the rates in the Seattle area. The proposed budget does not include tree planting and a proposed tree planting budget is provided in section 4.5.2.

Maintenance	Tree size - DBH (in.)	No. of trees	Work-hours per tree	Prune hours	Hourly Rate	Unit Price	Total Cost
Removal 1	1-6	50	0.5	25	$159.00	$79.50	3,975.00
	6-12	108	1	108	$159.00	$159.00	17,172.00
	12-18	100	1	100	$159.00	$159.00	15,900.00
	18-24	49	1	49	$159.00	$159.00	7,791.00
	24-30	26	1.5	39	$159.00	$238.50	9,301.50
	30-36	12	1.5	18	$159.00	$238.50	4,293.00
	37-42	6	2.0	12	$159.00	$318.00	3,816.00
	>42	5	2.0	10	$159.00	$318.00	3,180.00
Subtotal		**356**		**361**			**$65,428.50**
Removal 2	1-6	502	0.5	251	$159.00	$79.50	39,909.00
	6-12	79	1	79	$159.00	$159.00	12,561.00
	12-18	12	1	12	$159.00	$159.00	1,908.00
	18-24	4	1	4	$159.00	$159.00	636.00
Subtotal		**976**		**346**			**$55,014.00**
Re-inspect	1-6	13	0.5	6.5	$159.00	$79.50	1,033.50
	6-12	19	0.5	9.5	$159.00	$79.50	1,510.50
	12-18	15	0.5	7.5	$159.00	$79.50	1,192.50
	18-24	12	0.5	6	$159.00	$79.50	954.00
	24-30	3	0.5	1.5	$159.00	$79.50	238.50
	30-36	4	0.5	2	$159.00	$79.50	318.00
	37-42	2	0.5	1	$159.00	$79.50	159.00
	>42	2	0.5	1	$159.00	$79.50	159.00
Subtotal		**70**		**35**			**$5,565.00**
Priority 1	1-6	0	0.5	0	$159.00	$79.50	0.00
	6-12	8	1	8	$159.00	$159.00	1,272.00
	12-18	6	1	6	$159.00	$159.00	954.00
	18-24	10	1	10	$159.00	$159.00	1,590.00
	24-30	12	1.5	18	$159.00	$238.50	2,862.00
	30-36	5	1.5	7.5	$159.00	$238.50	1,192.50
	37-42	5	2	10	$159.00	$318.00	1,590.00
	>42	4	2	8	$159.00	$318.00	1,272.00
Subtotal		**46**		**59.5**			**$9,460.50**

Maintenance	Tree size - DBH (in.)	No. of trees	Work-hours per tree	Prune hours	Hourly Rate	Unit Price	Total Cost
Priority 2	1-6	4	0.5	2	$159.00	$79.50	318.00
	6-12	19	1	19	$159.00	$159.00	3,021.00
	12-18	40	1	40	$159.00	$159.00	6,360.00
	18-24	34	1	34	$159.00	$159.00	5,406.00
	24-30	31	1.5	46.5	$159.00	$238.50	7,393.50
	30-36	16	1.5	24	$159.00	$238.50	3,816.00
	37-42	9	2	18	$159.00	$318.00	2,862.00
	>42	8	2	16	$159.00	$318.00	2,544.00
Subtotal		**161**		**199.5**			**$31,720.50**
Routine Prune Large	1-6	863	0.5	431.5	$159.00	$79.50	68,608.50
	6-12	1554	1	1554	$159.00	$159.00	247,086.00
	12-18	1401	1	1401	$159.00	$159.00	222,759.00
	18-24	792	1	792	$159.00	$159.00	125,928.00
	24-30	486	1.5	729	$159.00	$238.50	115,911.00
	30-36	190	1.5	285	$159.00	$238.50	45,315.00
	37-42	54	2.0	108	$159.00	$318.00	17,172.00
	>42	28	2.0	56	$159.00	$318.00	8,904.00
Subtotal		**5368**		**5356.5**			**$851,683.50**
Routine Prune Small	1-6	6060	0.5	3030	$159.00	$79.50	481,770.00
	6-12	1182	1	1182	$159.00	$159.00	187,938.00
	12-18	259	1	259	$159.00	$159.00	41,181.00
	18-24	74	1	74	$159.00	$159.00	11,766.00
	24-30	27	1	27	$159.00	$159.00	4,293.00
	30-36	5	1.5	7.5	$159.00	$238.50	1,192.50
	37-42	1	1.5	1.5	$159.00	$238.50	238.50
	>42	0	1.5	0	$159.00	$238.50	0.00
Subtotal		**7608**		**4581**			**$728,379.00**
Total		**14585**		**10938.5**			**$1,747,261.00**

Table 5. Proposed total tree maintenance requirements based on the inventory conducted by ACRT-Inc, February October 2003.

A five year pruning cycle is proposed as it is considered the optimal timing for pruning street trees in the Pacific Northwest. A pruning cycle greater than five years is generally considered ineffective as homeowner service requests, emergency pruning, removals, and other requests will interrupt routine pruning. In this case, it is probable that many trees will not be pruned in a timely manner requiring more expensive pruning in the future. This will require additional resources and costs which, over time, will approach or exceed the costs for a shorter pruning cycle.

4.5.2 Tree Planting Budget

ACRT typically recommends that a City plant approximately 10% of the vacant planting sites a year, however, with the small number of vacancies noted to date it should be easy for the City to design a plan to meet this target.

At present the City of Shoreline has 1505 planting sites on its boulevards or roughly 10% of total spaces on the City's boulevards. To determine a tree planting budget, the City must first determine an achievable planting goal to be planted annually over the next 5 years. The City must also account for trees lost due to old age, vandalism, planting failure, etc., we suggest that 1% of the present tree population.

Tree planting costs for a 24 inch boxed tree is estimated at between $240.00 - $288.00 per tree or an average cost of $264.00 per tree.

The following calculations are an example designed to determine the number trees required to fill the goal of planting 100% of the present planting sites over five years:

Planting goal (100%) 503 x 100% =		1505 trees
Time (5 years)		/ 5
No. of trees annually		300
+		
Tree replacement of existing trees (1%)		
	150,771x 1% =	150
		450 trees per year
Tree planting costs		
	450 x $264.00 =	$118,800.00

Please note that these calculations are based on the desire to maintain the tree density that we observed while conducting the inventory. Because many of the trees on the City's boulevards are volunteers, it is doubtful that all of the trees that are removed will have to be replaced. However, we feel that the level of tree planting presented here is very modest in comparison to other cities where ACRT has conducted street tree inventories.

4.5.3 Annual Budget

The total dollar amount to maintain the trees presently on the City's boulevards is presented in Table 5. To obtain an annual budgetary figure, the total dollar amount should be divided by the number of years of the pruning cycle.

Please note these figures are only for maintaining trees and new tree planting for the area inventoried. They do not include expenses for salaries for the City's staff, to supply and maintain the City's equipment or other administrative costs.

Five year pruning cycle costs – annual cost

To continue with our suggestion of a five-year pruning cycle the details would be as follows:

1.	Total tree maintenance requirements	$1,747,251.00
2.	No. of years of pruning cycle	5
3.	Annual maintenance requirements	$349,450.00
4.	Annual planting costs	$ 118,800.00
5.	Estimated annual tree planting and maintenance costs for a five-year pruning cycle	$ 468,250.00

4.7 Additional Observations

These observations provide additional information about Shoreline urban forest. Some may pertain to only a few trees while other observations may consider the City's entire urban forest community.

Tree defects: Tree defects such as wounds, cavities, etc., were not identified as a separate issue. Any defects that were observed were used to determine the condition and maintenance requirements for the tree.

Mechanical damage: Damage caused by lawnmowers or weed-eaters and other gardening equipment was not recorded during the survey. In most cases, boulevard trees appeared absent of mechanical damage.

Pest Damage: Damage by insect and disease pests was also not recorded during the survey. However, as with mechanical damage, the majority of the boulevard trees appeared free from pest damage. Generally, most pests of are of no harm to trees, but can cause significant nuisance if present in sufficient numbers.

5.0 Urban Forest Management Plan

The tree inventory has provided a wealth of information about the numbers and condition of trees and other vegetation on the City of Shoreline boulevards. ACRT recommends that the City of Shoreline consider the following goals and objectives to effectively manage the City's urban forest to maximize the social, economic and environmental benefits trees provide its citizens.

5.1 Urban Forestry Goals

A comprehensive urban forest management program requires a commitment to meet defined goals and the City of Shoreline is to be commended for including elements relevant to tree planting and the preservation of native trees in its Community Development Plan. However, to strengthen these elements ACRT recommends that the City of Shoreline adopt a separate mission statement that specifically addresses its commitment to maintaining its urban forest. The following statement is provided as an example.

> *The goal of the City of Shoreline Urban Forestry Program is to manage the municipal forest in a cost-effective manner by providing its citizens innovative and effective leadership and services aimed at improving the health, composition, and structure of the urban forest. The benefits of this program include an improved quality of life for the citizens of Shoreline by providing both aesthetic and economic value. The City of Shoreline is committed to providing residents with tree planting programs, and with high quality maintenance for existing trees. The City of Shoreline Urban Forestry Program will respond to the needs and expectations of its citizens by providing public safety and increased value of real estate through the aesthetic quality of trees. The Urban Forestry Program will help make the City of Shoreline a more desirable place to live and work as well as conserve energy, provide carbon sequestering and environmental quality.*

The urban forestry program administrators are held responsible to their primary clients, the *taxpayers*. The community's urban forestry activities must respond to the needs of Shoreline citizens in a manner consistent with established tree care practices.

5.2 Urban Forestry Objectives

The basic services of a comprehensive urban forestry program include the following objectives:

1. Maintaining Safety in the Urban Forest

Maintaining the trees in the urban forest will protect the safety of the residents and City property. Removing dead and dying trees, pruning trees to clear for traffic control and visibility, and pruning or removing hazardous trees within the City will accomplish this goal. The removal of hazardous trees also reduces potential claims against the city due to tree failure.

2. **Maintaining the Health of the Urban Forest**

Maintaining the health of the City's trees through a systematic pruning schedule and routine surveys for insect pests and diseases will preserve the urban forest for future generations. To best accomplish this, ACRT recommends that a three-year pruning cycle be put in place and strictly adhered to. Adhering to a three-year schedule will also help maintain the safety of the urban forest and minimize poor pruning practices of the past.

3. **Tree Planting and Perpetuating the Urban Forest**

The urban forest is a valuable resource in the urban infrastructure and is one of the few that have the potential to increase in value. New and replacement tree planting is required to perpetuate the urban forest.

4. **Professional Management and Public Relations**

Professional management of the urban forest requires policies, ordinances, and budgets acceptable to both City administration and residents. The urban forestry program must be service-oriented and provide professional expertise needed to manage and protect a dynamic biological resource.

5.3 Maintaining the Safety of the Urban Forest

During the inventory, certain maintenance needs were identified for insuring public safety. These needs included ensuring adequate vision for motorists, tree removals, and priority pruning. The inventory provides a snap shot of the urban forest at this time, however, as a biological entity the urban forest is constantly changing. There will be the need for additional tree removals and safety pruning in the future.

The first major goal of the City should be the complete removal of tree-related hazards as soon as possible. This includes all tree removals, priority pruning followed by sign clearance and other traffic related pruning. Once all the trees designated for removal and priority pruning have been dealt with the City should embark on a systematic pruning program combined with annual surveys by City staff.

5.3.1 Tree Removals

Tree removals are the next priority. Overall, 953 trees were identified for removal along the City's rights-of-ways. Such trees pose both a potential hazard and are aesthetically unappealing if left standing.

The typical life of an urban tree varies from 7 to 50 years. The urban environment imposes stresses that may shorten the life span by half for long-lived species such as maples or oaks. ACRT's experience has shown that the number of removals in an urban forest varies from 0.5 to 3 % of a City's tree population annually. This would translate to 75 to 480 trees for the City of Shoreline. Therefore, tree maintenance provisions must be in place to remove dead and dying street trees in a timely manner. As 65% of the City's trees were rated as in good condition we suggest that a 1% figure be used for calculating tree replacement.

ACRT recommends that public relations be made an integral part of the urban forest program. Many decayed and hazardous trees may appear "healthy" to the untrained observer and may not appear to require removal to concerned citizens. Appropriate public relations should stress the need for public safety and address the fact that tree removals are part of a long-term management plan.

5.3.2 Priority Pruning

Priority pruning should be done as soon as possible after removals are completed. All street trees should be pruned to ANSI A300 Standard Practices for Trees, Shrubs and Other Woody Plant Maintenance. When trees designated as a priority are pruned the entire tree should be trimmed to minimum specifications. This will ensure that all hazards are dealt with not just the first potential hazard identified by the pruning crew.

5.3.3 Annual Surveys for Tree Hazards

Annual surveys are recommended because trees are living organisms that grow decline and eventually die. An annual survey is less intensive, as well as less costly, than the present tree inventory because it takes less time to complete and can be conducted by city staff. It is a spot check that focuses primarily on trees larger than 18" diamter-at-breast-height within the city and is typically conducted in the late winter or early spring after the majority of winter storms have passed. It also focuses on those species which have a history of failure.

The goals of an annual tree surveys are twofold: 1) to identify trees that have grown since the completion of the present tree inventory to obstruct traffic signs or interfere with vehicle traffic, and 2) to identify trees or tree limbs that are in decline or have died and require removal. Annual identification and removal of tree hazards before they pose a threat ultimately reduces maintenance costs and the potential for litigation.

5.3.4 Periodic Re-inventory of the City's Trees

With diligent maintenance, present tree inventory will provide the City with a wealth of valuable information for many years. However, the urban forest is a biological entity that will change overtime. The present trees will grow and become larger while many older trees may decline and require removal. There is the possibility that some errors may be introduced into the database. Therefore, we suggest that the City consider conducting a resurvey of its street trees after a period of five or more years.

5.4 Maintaining the Health of the Urban Forest

The need to maintain urban trees continues to increase with additions to infrastructure development and environmental considerations. Maintaining trees with routine pruning schedules and pest management will increase the longevity and enhance the safety of the urban forest.

Routine maintenance will also reduce the incidence and expenditures for future corrections of hazardous trees. Without routine maintenance, the stress placed on trees by an urban environment greatly reduces their life spans, as well as the aesthetic value, economic, and environmental benefits they provide.

The scientific community continues to quantify the benefits urban trees provide. Among the most important benefits are energy conservation, carbon sequestration, and pollution reduction. Strategically planted trees can shield buildings from cold winds in winter and intense sunlight in summer. Large mature trees maximize carbon sequestration and new research has shown that several tree species are capable of removing some pollutants, such as heavy metals, from the soil.

Indirect effects such as summer shading and cooling through evapotranspiration help reduce urban heat islands. In winter, wind reduction by trees reduces the heating requirements. Both of these seasonal scenarios translate to reduced energy requirements for electricity and fossil fuels. The cost of maintaining and improving the present urban forest should not overlook the potentially positive environmental and economic benefits that it provides

5.4.1 Tree Pruning

All street trees should be pruned to the ANSI A300 Standards. When a tree is trimmed, the *entire* tree should be trimmed to minimum specifications. If trees are pruned to specification in a timely manner, the City will recognize several benefits including improved condition of the trees, enhanced longevity of many of the mature trees, an increase in property values, and an increase in the appraised value of the street trees.

Each street tree should be pruned systematic cycle. The ideal cycle varies considerably according to many factors including species, tree age, and budget restrictions of the City. However, ACRT's experience is that a pruning cycle of more than eight years is ineffective under any circumstances.

ACRT used a three-year pruning cycle for the calculations used in this management plan. Based on the budget restrictions, the City may wish to consider an alternate pruning cycle. All trees should be pruned to specification, and if no work is required to meet specifications, no resources should be expended.

Young trees should be trained according to ANSI A300 Standards for Young Tree Pruning while large trees should be pruned to either Hazard Reduction Pruning or

Maintenance pruning, depending on the overall condition and life expectancy of the trees.

5.5 Perpetuating the Urban Forest

The future of the urban forest in Shoreline depends on an active, progressive replacement, and reforestation program. A street tree-planting program should maintain and increase the stocking level of the urban forest. Tree planting will have the greatest impact if it is part of a long-term urban forestry plan developed by the City. Random planting or over-planting individual trees without considering streetscape design, existing trees, or utilities seldom produces the desired long-term goals.

ACRT recommends that the City plant a minimum of 20% of the present vacant planting sites over the next five years or 100 trees annually. To account for failed plantings, damage, and vandalism the street planting rate include an additional 100 to account for these losses. Thus the total planting should be 200 trees per year for the portion of the City where the inventory was conducted.

Proper planting and a post-planting program are required to ensure the survival of newly planted trees. Guidelines for proper planting and after care of trees may be found in "Planting and Aftercare of Community Trees" published by Penn State University (Appendix B). Tree mortality occurs when trees are improperly planted or not given adequate follow-up care. If staking is used, the stakes must be removed no later than two seasons after planting. Staking left in place longer than two seasons may result in injury and girdling of the trees.

New street tree planting may be conducted by City crews or by reputable contractors. In either case, qualified City staff should monitor all planting on City property. All new planting conducted by the City should be checked to ensure that nursery stock meets the ANSI Standard for Nursery Stock. Tree species suitable for planting in the Pacific Northwest may be found in "Tree Guidelines for Pacific Northwest Communities" by Mac Pherson et al. 2000 (Appendix C).

Planting stock should be 1.2 – 2.0 inches in diameter, unless survival or vandalism becomes an issue, in which case larger stock should be considered. Trees larger that two inches in diameter at the time of planting are less likely to be damaged or vandalized, but they are more expensive.

5.6 Managing the Urban Forest

The City of Shoreline is to be commended for its urban forestry accomplishments thus far. ACRT recommends that the City of Shoreline should attempt to tap into the public's passion for trees by initiating public education and assistance programs in addition to the public safety, systematic maintenance, and planting programs discussed above.

5.6.1 Public Education and Relations

While conducting the tree inventory our data collectors heard many opinions regarding the city's trees. These opinions ranged from receiving pleasure from the tree(s) in front of their house and fear that the City planned to remove them to one gentleman who requested that the trees be removed so the resident could park his motor home on the sidewalk.

For the City to ensure the long-term success of its urban forestry program, it needs the continued support of the public. It is important that both City officials and residents realize that trees are an integral part of its infrastructure and that the value and environmental benefits that trees provide justify the expenditures for their installation and care.

Many of Shoreline residents are unaware that their urban forest is not a product of nature, but is in fact the product of extensive planning and effort. Arbor Day programs are successful in introducing elementary school students to tree planting and care. Programs such as Project Learning Tree, a national educational program that brings educators and natural resource managers together may be useful in elevating the profile of the City's urban forest. New local programs could be introduced to promote urban forestry awareness to Shoreline citizens, such as the registry for large or historical trees.

An ongoing public education program will further define the value of Shoreline urban forest, the benefits derived from trees, the necessity for professional management, the importance of tree planting, and the importance of safety issues about tree removals. A public education program should discourage the planting of undesirable species, tree topping, and planting trees in unsuitable locations (such as under utility wires).

Workshops for homeowners can also be a useful educational tool. Workshops can cover a wide range of arboricultural topics and can cover a wide range of skills. Such workshops can be presented by professional consultants, creating a network of resources other than the professional arborist employed by the City.

5.6.2 Public Assistance and Involvement

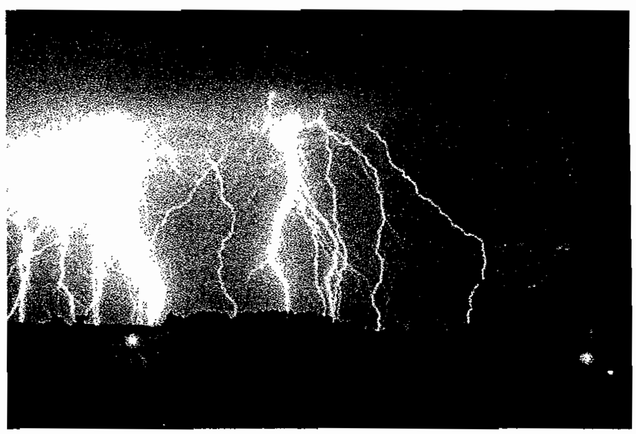
The City of Shoreline may wish to consider establishing a 50/50 cost share public assistance program that encourages citizens to plant trees on private property. When combined with public education, such programs are usually successful from a number of standpoints. Homeowners are able to purchase trees for half of the cost. Similarly, by buying larger quantities the City benefits by having your tree acquisition expenses reduced. The City also benefits from positive public relations with homeowners. Since homeowners are provided information on the planting and care or trees on their property tree survival is increased. Finally, with education about planting trees to avoid utilities the utility company benefits by avoiding conflicts between trees and their facilities.

Another successful program that has been instituted by the City of Berkeley is to initiate a block-planting program. Under this program all homeowners on a block are notified about the City's plan to remove and replace older, overmature trees and fill vacant planting sites. A block meeting is scheduled, the proposal for work on the street is discussed, the residents are provided with a list of potential trees that meet the requirements of the street, and they collectively decide on the new tree specie(s) for their street. During the meeting, information is provided on the maintenance and care of trees.

Once the trees have been planted under the supervision of City staff, the residents are responsible for the care of the newly planted trees freeing staff from the responsibility of caring for the trees. Follow-up to the program is important to the success of the program and may involve reminders to water the trees, a survey asking homeowners to measure the diameter or height of the trees, and a request for comments to share their impressions of the value of the program.

Any public program must include under-ground and aboveground utility safety. Electrical and communication wires, natural gas, sewer, and water pipes may easily be within the area where trees are to be planted. Serious injury or even death may result from contact with such utilities. If it cannot be determined that utilities are safely out of the way, the appropriate authority must locate them and tree planting must be avoided.

5.6.4 Emergency Response Plan



As a vital part of a tree management plan, the City may wish to consider developing a storm management plan for its urban forest. The purpose of the plan would be to establish clear guidelines detailing the appropriate response to disaster and crisis situations and the goals would be to limit the loss of life and property due to tree-related damage in the event of an emergency. The proper use of available resources and personnel is critical to the successful management of emergency operations.

Although the City of Shoreline and surrounding areas are relatively protected by the Olympic Peninsula periodic winter storms may cause tree damage. A proactive storm management program would include:

1. Pruning for structural integrity
2. Planting trees appropriate for the site
3. Minimizing root and soil damage during construction
4. Flammable vegetation management
5. Identification and removal of hazardous trees.

While a system of proactive tree maintenance will reduce the level of storm damage, there is no methodology (barring complete tree removal) that will entirely reduce the tree-related risk. Therefore, an emergency response plan would need to be developed that would involves the following chronological components

1. **Preparation** – disaster planning and warning activities. This would include ensuring communication and coordination of activities among city departments, utility companies, private arborists, as well as contacts with local radio, television, and other media about safety and tree salvage.
2. **Response** – immediate activity during and after the emergency. This would include damage clean up, clearance, office/field communication, identification of debris disposal options, and efficient record-keeping methods.
3. **Recovery** – activities after the emergency that attempt to restore positive conditions that existed before the emergency. Examples include public and private tree planting, tree care, training of volunteers and municipal workers and education of the general public.

For a more in depth treatment of this subject the City may wish to consider developing a storm management plan for preserving its urban forest and the safety of its citizens.

5.7 Review of the City Development Code

A review of the City's Development Code relevant to tree care has been completed. A sample tree ordinance (Appendix D) has been provided that could be used to incorporate the existing codes should the City so choose.

For an excellent example of another city's tree ordinances we suggest you visit the website of the City of Palo Alto at http://www.city.palo-alto.ca.us/trees/.

6.0 Conclusions and Recommendations

6.1 Conclusions

Policy recommendations have been presented regarding some of the safety-related tree and vegetation issues observed during the survey. The following summary of the major findings of the survey forms the basis of ACRT's street tree recommendations for the City of Shoreline.

1. ACRT inventoried a total of 14,226 trees and 1505 planting sites on the City's boulevards.
2. ACRT personnel recorded 170 species from 78 genera on the City's boulevards. The most plentiful species include Douglas-fir, Pseudotsuga menziesii (16%), American arborvitae (13%), Western red-cedar, Thuja plicata, (11%). The other species each composed less than 5% of the total number of trees.
3. The size class distribution indicates that 66.5% of the Shoreline tree population is composed of small trees less than 12 inches in diameter. Twenty three percent of the trees are medium sized trees with diameters between 13-30 inches and 2.3% of the trees are very large trees greater than 30 inches in diameter.
4. The majority of trees (64.5%) were estimated to be in good or better condition, 25.4% fair, 8.7% poor while a little over 1% were rated in critical condition or dead. These results are less favorable than other cities where ACRT has conducted tree inventories.
5. The vast majority of the trees (91.0%) require routine pruning. Of the remainder, just over 2% require priority pruning or re-inspection and 6.7% require removal. While the majority of trees presently require routine pruning, the lack of recent pruning is evident for many trees.
6. A preliminary estimate of the cost to systematically prune the 14,226 street trees based on a typical contract rate is $1,747,251.00 (Section 4.5). This figure is based on the City's current street tree population and does not include the costs to

maintain the City's tree department, nor does it anticipate the costs of future development.

7. ACRT proposes that to effectively manage the street tree population that the City should adopt a five-year pruning cycle. The estimated annual tree maintenance cost for a five-year pruning cycle is $349,450.00 (Section 4.5).
8. To maintain the City's urban forest we recommend that the City replant trees slated for removal and fill the existing vacancies in the coming year. Afterwards the City should budget to plant 100 trees annually to fill existing tree vacancies plus an estimated 1% tree replacement or 100 trees annually for the next five years. With an average tree planting costs of $264.00 per tree the tree planting costs are estimated at $118,800.00 annually.
9. We believe that an annual budget of $468,250.00 should be adequate to maintain the City's trees. Note: the simplified costs presented in this report may not reflect the true costs to run this program as suggested and may require additional funds after a more thorough review to reflect accurate local costs.
10. ACRT believes that maintaining the City's trees at this level will provide the citizens of Shoreline with a pleasing urban environment.

6.1 Recommendations

ACRT proposes the following recommendations for the City of Shoreline consideration:

1. **A commitment to manage and maintain the urban forest within the City of Shoreline and to maintain or increase funding levels as necessary.**

2. **A commitment to a detailed five-year general vegetation maintenance program based on this street tree inventory including the quantity of vegetation requiring maintenance, prioritization of tasks to be completed, a tree planting program, estimation of equipment and labor needs, and anticipated budgets.**

3. **A mission statement and objectives: Shoreline should adopt a mission statement and objectives to perpetuate, manage and maintain the urban forest within the City.**

4. **Administration and reporting: this would include up to date recording of changes to the tree inventory.**

5. **Systematic pruning: Shoreline street trees should be pruned on a systematic basis every five years. Although the majority of Shoreline trees at present require routine pruning this situation will not remain static. As time progresses, even**

routine pruning will require more time and effort and the number of trees requiring priority pruning will increase.

6. Priority maintenance: Shoreline should ensure that immediate correction of any tree hazard that endangers life or property. This includes trees that are dead, dying, or are potentially hazardous and require immediate action to protect human safety and property. Hazardous tree conditions should be proactively identified and corrected to reduce the City's potential for liability and litigation.

7. Tree planting: a) the street tree population should be managed so that no more than 20% of the population consists of one tree genus and no more than 10% consists of one tree species or cultivar; and b) the rate of annual tree planting should be increased to a minimum of 20 trees per year. New tree planting should be undertaken to replace dead, diseased, and declining trees and to fill vacant planting sites. ACRT suggests that the City replaces trees as they are removed and that new planting take place immediately. The City should also seek the public's input and involvement in new street tree planting.

8. The City should review and update its policies and ordinances, where necessary, regarding the public planting of trees, shrubs and hedges on City boulevards and on private property where such vegetation may pose a threat to public safety, e.g.: such vegetation obstructing traffic signs, traffic signals, motorists vision, pedestrian traffic and other safety concerns.

9. Shoreline should consider public education programs to inform the public about tree policies and programs, and to ensure public enthusiasm and support for the City's street tree program.

APPENDIX A:

Description of Street trees designated Removal 1.

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
BALLINGER	19256	12TH AV NE	10	BIGLEAF MAPLE	25	35	DEAD	REMOVAL 1
BALLINGER	19515	12TH AV NE	1	DOUGLAS FIR	14	37	POOR	REMOVAL 1
BALLINGER	19230	14TH AV NE	2	MADRONE	24	36	CRITICAL	REMOVAL 1
BALLINGER	19230	14TH AV NE	1	BITTER CHERRY	16	26	DEAD	REMOVAL 1
BALLINGER	1303	195TH ST NE	5	DOUGLAS FIR	10	55	DEAD	REMOVAL 1
BALLINGER	1032	197TH ST NE	11	.WESTERN HEMLOCK	9	45	DEAD	REMOVAL 1
BALLINGER	20025	19TH AV NE	1	DOUGLAS FIR	7	12	DEAD	REMOVAL 1
BALLINGER	20004	24TH AV NE	1	RED ALDER	11	13	DEAD	REMOVAL 1
BRIARCREST	15504	27TH AV NE	5	RED ALDER	9	15	DEAD	REMOVAL 1
CRISTA MINISTRIES	19531	DAYTON AV N	24	DOUGLAS FIR	16	36	POOR	REMOVAL 1
CRISTA MINISTRIES	19531	DAYTON AV N	23	.WESTERN HEMLOCK	18	36	POOR	REMOVAL 1
ECHO LAKE	18515	1ST AV NE	2	PACIFIC MADRONE	15	20	DEAD	REMOVAL 1
ECHO LAKE	18515	1ST AV NE	4	PACIFIC MADRONE	20	20	DEAD	REMOVAL 1
ECHO LAKE	19030	1ST AV NE	7	DOUGLAS FIR	13	40	POOR	REMOVAL 1
ECHO LAKE	19546	6TH AV NE	1	DOUGLAS FIR	15	45	DEAD	REMOVAL 1
ECHO LAKE	715	NE 204TH ST	4	PRUNUS SPECIES	7	6	POOR	REMOVAL 1
ECHO LAKE	18850	STONE AV N	1	AMABILS/PAC SIL FIR	12	24	DEAD	REMOVAL 1
HILLWOOD	19526	2ND AV NW	4	GRAND FIR	7	27	POOR	REMOVAL 1
HILLWOOD	19526	2ND AV NW	1	ALBERTA SPRUCE	10	23	POOR	REMOVAL 1
HILLWOOD	19526	2ND AV NW	2	ALBERTA SPRUCE	12	23	POOR	REMOVAL 1
HILLWOOD	19526	2ND AV NW	3	DOUGLAS FIR	12	27	POOR	REMOVAL 1
HILLWOOD	19105	3RD AV NW	2	LOMBARDY POPLAR	0	13	CRITICAL	REMOVAL 1
HILLWOOD	20028	3RD AV NW	6	DOUGLAS FIR	3	35	DEAD	REMOVAL 1
HILLWOOD	19004	8TH AV NW	4	BITTER CHERRY	8	23	DEAD	REMOVAL 1
HILLWOOD	19425	AURORA AV N	6	BLACK COTTONWOOD	4	40	FAIR	REMOVAL 1
HILLWOOD	14531	DAYTON AV N	1	DOUGLAS FIR	18	30	POOR	REMOVAL 1
HILLWOOD	18753	DAYTON PL N	3	MADRONE	12	20	POOR	REMOVAL 1
HILLWOOD	18557	FIRLANDS WY N	1	WHITE PINE	12	30	FAIR	REMOVAL 1
HILLWOOD	19005	FIRLANDS WY N	3	GOLDENCHAIN TREE	6	27	FAIR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	9	CHERRYLAUREL	10	20	FAIR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	6	DOUGLAS FIR	4	25	POOR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	2	DOUGLAS FIR	5	30	POOR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	4	DOUGLAS FIR	5	30	POOR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	5	DOUGLAS FIR	5	30	POOR	REMOVAL 1
HILLWOOD	19201	FIRLANDS WY N	1	DOUGLAS FIR	6	30	POOR	REMOVAL 1
HILLWOOD	19207	FIRLANDS WY N	9	DOUGLAS FIR	6	30	FAIR	REMOVAL 1
HILLWOOD	19207	FIRLANDS WY N	8	DOUGLAS FIR	7	30	FAIR	REMOVAL 1
HILLWOOD	19341	FIRLANDS WY N	3	EUROPEAN MOUNTAINASH	3	30	FAIR	REMOVAL 1
HILLWOOD	19370	FIRLANDS WY N	31	DOUGLAS FIR	11	45	POOR	REMOVAL 1
HILLWOOD	19370	FIRLANDS WY N	29	DOUGLAS FIR	12	50	POOR	REMOVAL 1
HILLWOOD	19370	FIRLANDS WY N	26	DOUGLAS FIR	17	50	POOR	REMOVAL 1
HILLWOOD	18855	FREMONT AV N	2	SHORE PINE	15	28	POOR	REMOVAL 1
HILLWOOD	18855	FREMONT AV N	1	DOUGLAS FIR	8	21	POOR	REMOVAL 1
HILLWOOD	19335	GREENWOOD AV N	1	WESTERN RED CEDAR	8	25	POOR	REMOVAL 1
HILLWOOD	20129	GREENWOOD AV N	2	OTHER	14	12	POOR	REMOVAL 1
HILLWOOD	14911	LINDEN AV N	3	.WESTERN HEMLOCK	26	30	POOR	REMOVAL 1
HILLWOOD	19327	LINDEN AV N	1	DOUGLAS FIR	23	32	FAIR	REMOVAL 1
HILLWOOD	19330	LINDEN AV N	8	BITTER CHERRY	2	30	POOR	REMOVAL 1
HILLWOOD	19330	LINDEN AV N	1	BITTER CHERRY	4	29	POOR	REMOVAL 1
HILLWOOD	19330	LINDEN AV N	7	DOUGLAS FIR	8	37	DEAD	REMOVAL 1
HILLWOOD	19330	LINDEN AV N	6	DOUGLAS FIR	10	21	DEAD	REMOVAL 1
HILLWOOD	19330	LINDEN AV N	2	DOUGLAS FIR	12	30	FAIR	REMOVAL 1
HILLWOOD	418	N 145TH ST	1	PACIFIC MADRONE	30	40	POOR	REMOVAL 1
HILLWOOD	719	N 150TH ST	2	DOUGLAS FIR	17	69	POOR	REMOVAL 1
HILLWOOD	806	N 153RD PL	7	LOMBARDY POPLAR	28	69	POOR	REMOVAL 1
HILLWOOD	806	N 153RD PL	9	LOMBARDY POPLAR	30	67	POOR	REMOVAL 1
HILLWOOD	806	N 153RD PL	10	LOMBARDY POPLAR	30	72	POOR	REMOVAL 1
HILLWOOD	806	N 153RD PL	6	LOMBARDY POPLAR	32	76	POOR	REMOVAL 1
HILLWOOD	14903	N PARK AV	2	WHITE PINE	30	67	POOR	REMOVAL 1
HILLWOOD	415	NW 196TH PL	1	WHITE BIRCH	6	26	POOR	REMOVAL 1
HILLWOOD	337	NW 200TH ST	13	DOUGLAS FIR	4	25	POOR	REMOVAL 1
HILLWOOD	337	NW 200TH ST	12	DOUGLAS FIR	5	30	POOR	REMOVAL 1
HILLWOOD	333	NW 205TH ST	7	WHITE PINE	8	30	FAIR	REMOVAL 1
HILLWOOD	333	NW 205TH ST	6	DOUGLAS FIR	9	40	FAIR	REMOVAL 1
HILLWOOD	19859	PHINNEY AV N	2	DOUGLAS FIR	5	27	POOR	REMOVAL 1
MERIDAIN PARK	17921	1ST AV NE	1	WHITE PINE	42	72	POOR	REMOVAL 1
MERIDAIN PARK	18044	1ST AV NE	1	RED ALDER	38	64	POOR	REMOVAL 1

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
MERIDAIN PARK	18053	2ND AV NE	1	EUROPEAN MOUNTAINASH	12	30	POOR	REMOVAL 1
MERIDAIN PARK	18038	3RD AV NE	1	EUROPEAN MOUNTAINASH	5	20	POOR	REMOVAL 1
MERIDAIN PARK	16547	ASHWORTH AV N	5	DOUGLAS FIR	5	15	POOR	REMOVAL 1
MERIDAIN PARK	18339	ASHWORTH AV N	2	DOUGLAS FIR	18	38	DEAD	REMOVAL 1
MERIDAIN PARK	16034	BURKE AV N	1	SPRUCE SSP.	18	39	POOR	REMOVAL 1
MERIDAIN PARK	16725	CORLISS AV N	1	BIRDS NEST SPRUCE	28	45	POOR	REMOVAL 1
MERIDAIN PARK	17739	CORLISS AV N	1	BALSAM FIR	23	51	POOR	REMOVAL 1
MERIDAIN PARK	17819	INTERLAKE AV N	1	ALASKA CEDAR	16	22	DEAD	REMOVAL 1
MERIDAIN PARK	16321	MERIDIAN AV N	1	RED MAPLE	10	29	POOR	REMOVAL 1
MERIDAIN PARK	16323	MERIDIAN AV N	1	RED MAPLE	13	37	POOR	REMOVAL 1
MERIDAIN PARK	16507	MERIDIAN AV N	1	RED MAPLE	20	36	POOR	REMOVAL 1
MERIDAIN PARK	16710	MERIDIAN AV N	1	RED MAPLE	17	33	POOR	REMOVAL 1
MERIDAIN PARK	17077	MERIDIAN AV N	8	RED OAK	3	25	POOR	REMOVAL 1
MERIDAIN PARK	17077	MERIDIAN AV N	7	RED OAK	4	21	POOR	REMOVAL 1
MERIDAIN PARK	18409	MERIDIAN AV N	1	RED MAPLE	17	44	POOR	REMOVAL 1
MERIDAIN PARK	17219	MIDVALE AV N	2	TULIP TREE	46	46	POOR	REMOVAL 1
MERIDAIN PARK	2103	N 166TH ST	1	DOUGLAS FIR	12	47	POOR	REMOVAL 1
MERIDAIN PARK	1358	N 167TH ST	3	WHITE PINE	14	55	POOR	REMOVAL 1
MERIDAIN PARK	1304	N 169TH ST	1	CHOKE CHERRY	11	12	POOR	REMOVAL 1
MERIDAIN PARK	1900	N 170TH ST	1	MOUNTAIN HEMLOCK	18	54	POOR	REMOVAL 1
MERIDAIN PARK	1925	N 170TH ST	1	RED MAPLE	10	33	POOR	REMOVAL 1
MERIDAIN PARK	2118	N 171ST ST	1	COLORADO BLUE SPRUCE	16	27	DEAD	REMOVAL 1
MERIDAIN PARK	1229	N 172ND ST	2	SHORE PINE	16	29	POOR	REMOVAL 1
MERIDAIN PARK	2103	N 172ND ST	1	RED MAPLE	22	35	POOR	REMOVAL 1
MERIDAIN PARK	1205	N 173RD ST	1	BALSAM FIR	18	45	POOR	REMOVAL 1
MERIDAIN PARK	1214	N 173RD ST	1	SCOTCH PINE	30	45	POOR	REMOVAL 1
MERIDAIN PARK	1301	N 178TH ST	2	PACIFIC MADRONE	22	37	POOR	REMOVAL 1
MERIDAIN PARK	1334	N 178TH ST	6	CHERRY SSP.	8	41	DEAD	REMOVAL 1
MERIDAIN PARK	1352	N 178TH ST	1	WESTERN RED CEDAR	26	43	POOR	REMOVAL 1
MERIDAIN PARK	2107	N 178TH ST	1	WESTERN SYCAMORE	13	36	POOR	REMOVAL 1
MERIDAIN PARK	2130	N 178TH ST	3	THINLEAF ALDER	9	35	POOR	REMOVAL 1
MERIDAIN PARK	2130	N 178TH ST	2	DOUGLAS FIR	16	43	POOR	REMOVAL 1
MERIDAIN PARK	2305	N 178TH ST	1	BIGLEAF MAPLE	35	45	POOR	REMOVAL 1
MERIDAIN PARK	1327	N 180TH ST	1	BLACK LOCUST	24	52	POOR	REMOVAL 1
MERIDAIN PARK	1601	N 183RD ST	2	BLACK LOCUST	28	47	POOR	REMOVAL 1
MERIDAIN PARK	1803	N 185TH ST	1	.WESTERN HEMLOCK	14	19	DEAD	REMOVAL 1
MERIDAIN PARK	1803	N 185TH ST	2	.WESTERN HEMLOCK	14	20	DEAD	REMOVAL 1
MERIDAIN PARK	1825	N 185TH ST	1	AUTUMN ASH	17	32	POOR	REMOVAL 1
MERIDAIN PARK	17537	STONE AV N	1	CHERRY SSP.	17	24	POOR	REMOVAL 1
MERIDAIN PARK	17845	WALLINGFORD AV N	1	CHERRY SSP.	9	35	POOR	REMOVAL 1
MERIDAIN PARK	17854	WALLINGFORD AV N	4	WESTERN CHOKE CHERRY	12	40	POOR	REMOVAL 1
MERIDAIN PARK	17854	WALLINGFORD AV N	1	.WESTERN HEMLOCK	22	65	POOR	REMOVAL 1
MERIDAIN PARK	18322	WALLINGFORD AV N	4	AMERICN MOUNTAIN-ASH	14	25	POOR	REMOVAL 1
MERIDAIN PARK	17804	WAYNE AV N	1	.WESTERN HEMLOCK	11	25	POOR	REMOVAL 1
NORTH CITY	18922	10TH AV NE	3	DOUGLAS FIR	5	35	DEAD	REMOVAL 1
NORTH CITY	18218	11TH AV NE	1	DOUGLAS FIR	42	110	FAIR	REMOVAL 1
NORTH CITY	18315	12TH AV NE	1	PACIFIC WILLOW	20	21	POOR	REMOVAL 1
NORTH CITY	356	178TH ST NE	2	.WESTERN HEMLOCK	8	22	DEAD	REMOVAL 1
NORTH CITY	356	178TH ST NE	3	.WESTERN HEMLOCK	15	21	DEAD	REMOVAL 1
NORTH CITY	809	180TH ST NE	1	GOLDEN CHAIN TREE	8	16	POOR	REMOVAL 1
NORTH CITY	809	180TH ST NE	2	GOLDEN CHAIN TREE	13	18	POOR	REMOVAL 1
NORTH CITY	809	180TH ST NE	7	WHITE PINE	13	23	DEAD	REMOVAL 1
NORTH CITY	809	180TH ST NE	6	WHITE PINE	14	24	DEAD	REMOVAL 1
NORTH CITY	1005	180TH ST NE	12	LODGEPOLE PINE	12	24	DEAD	REMOVAL 1
NORTH CITY	1117	180TH ST NE	2	WHITE BIRCH	12	17	POOR	REMOVAL 1
NORTH CITY	1117	180TH ST NE	1	WHITE BIRCH	17	17	POOR	REMOVAL 1
NORTH CITY	1208	180TH ST NE	3	OTHER	34	15	DEAD	REMOVAL 1
NORTH CITY	846	188TH ST NE	1	ENGLISH HAWTHORN	12	17	POOR	REMOVAL 1
NORTH CITY	846	188TH ST NE	2	ENGLISH HAWTHORN	17	15	POOR	REMOVAL 1
NORTH CITY	16563	18TH AV NE	1	PRUNUS SPECIES	14	10	POOR	REMOVAL 1
NORTH CITY	16549	21ST AV NE	2	PRUNUS SPECIES	9	12	CRITICAL	REMOVAL 1
NORTH CITY	17123	22ND AV NE	2	WHITE PINE	16	16	DEAD	REMOVAL 1
NORTH CITY	17556	5TH AV NE	14	RED ALDER	50	70	POOR	REMOVAL 1
NORTH CITY	18051	5TH AV NE	2	WHITE PINE	9	18	DEAD	REMOVAL 1
NORTH CITY	18034	7TH AV NE	6	WHITE PINE	7	20	DEAD	REMOVAL 1
NORTH CITY	18302	7TH AV NE	7	ROWAN TREE	21	31	DEAD	REMOVAL 1
NORTH CITY	17806	8TH AV NE	3	.WESTERN HEMLOCK	8	14	DEAD	REMOVAL 1
NORTH CITY	17807	8TH AV NE	1	RED ALDER	28	23	POOR	REMOVAL 1
NORTH CITY	17807	8TH AV NE	2	AMERICN MOUNTAIN-ASH	20	28	CRITICAL	REMOVAL 1
NORTH CITY	18554	8TH AV NE	3	LOMBARDY POPLAR	27	47	POOR	REMOVAL 1
NORTH CITY	18915	8TH AV NE	6	BLACK LOCUST	6	26	POOR	REMOVAL 1
NORTH CITY	18920	6TH AV NE	1	ROWAN TREE	36	32	POOR	REMOVAL 1

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
NORTH CITY	2123	NE 168TH ST	1	PRUNUS SPECIES	16	11	POOR	REMOVAL 1
NORTH CITY	2115	NE 177TH ST	4	PRUNUS SPECIES	8	8	DEAD	REMOVAL 1
NORTH CITY	2115	NE 177TH ST	6	PRUNUS SPECIES	8	11	DEAD	REMOVAL 1
NORTH CITY	1656	NE 185TH ST	1	WHITE PINE	32	45	DEAD	REMOVAL 1
NORTH CITY	1811	NE 185TH ST	1	WHITE PINE	17	20	DEAD	REMOVAL 1
NORTH CITY	1811	NE 185TH ST	2	WHITE PINE	21	20	POOR	REMOVAL 1
NORTH CITY	1229	PERKINS WY NE	3	.WESTERN HEMLOCK	18	32	POOR	REMOVAL 1
NORTH CITY	528	SERPENTINE PL NE	6	WHITE PINE	16	50	DEAD	REMOVAL 1
NORTH CITY	528	SERPENTINE PL NE	1	WHITE PINE	24	30	DEAD	REMOVAL 1
NORTH CITY	802	SERPENTINE PL NE	6	MADRONE	14	19	DEAD	REMOVAL 1
NORTH CITY	903	SERPENTINE PL NE	3	LOMBARDY POPLAR	8	57	POOR	REMOVAL 1
NORTH CITY	903	SERPENTINE PL NE	4	LOMBARDY POPLAR	15	70	POOR	REMOVAL 1
NORTH CITY	903	SERPENTINE PL NE	6	LOMBARDY POPLAR	18	75	POOR	REMOVAL 1
PARKWOOD	15755	ASHWORTH AV N	2	DOUGLAS FIR	24	37	POOR	REMOVAL 1
PARKWOOD	15517	BURKE AV N	5	SIBERIAN ELM	5	17	POOR	REMOVAL 1
PARKWOOD	15517	BURKE AV N	11	SIBERIAN ELM	16	26	POOR	REMOVAL 1
PARKWOOD	15554	BURKE AV N	2	DOUGLAS FIR	36	85	POOR	REMOVAL 1
PARKWOOD	14606	CORLISS AV N	1	FLOWERING DOGWOOD	8	13	POOR	REMOVAL 1
PARKWOOD	15504	DENSMORE AV N	3	SWEETGUM	16	40	POOR	REMOVAL 1
PARKWOOD	14509	MERIDIAN AV N	1	RED MAPLE	23	53	POOR	REMOVAL 1
PARKWOOD	14526	MERIDIAN AV N	1	RED MAPLE	24	52	POOR	REMOVAL 1
PARKWOOD	14526	MERIDIAN AV N	2	RED MAPLE	25	60	POOR	REMOVAL 1
PARKWOOD	14527	MERIDIAN AV N	2	RED MAPLE	22	50	POOR	REMOVAL 1
PARKWOOD	14703	MERIDIAN AV N	1	RED MAPLE	20	49	POOR	REMOVAL 1
PARKWOOD	14711	MERIDIAN AV N	1	RED MAPLE	23	54	POOR	REMOVAL 1
PARKWOOD	14829	MERIDIAN AV N	2	RED MAPLE	20	51	POOR	REMOVAL 1
PARKWOOD	14829	MERIDIAN AV N	1	RED MAPLE	24	60	POOR	REMOVAL 1
PARKWOOD	15228	MERIDIAN AV N	7	RED OAK	14	44	POOR	REMOVAL 1
PARKWOOD	15228	MERIDIAN AV N	3	RED OAK	16	48	POOR	REMOVAL 1
PARKWOOD	15503	MERIDIAN AV N	2	SWEETGUM	18	60	POOR	REMOVAL 1
PARKWOOD	15539	MERIDIAN AV N	1	WESTERN SYCAMORE	28	48	POOR	REMOVAL 1
PARKWOOD	2018	N 148TH ST	1	RED MAPLE	20	51	POOR	REMOVAL 1
PARKWOOD	2345	N 149TH ST	1	LOMBARDY POPLAR	60	71	POOR	REMOVAL 1
PARKWOOD	2122	N 150TH ST	1	CHOKE CHERRY	7	18	POOR	REMOVAL 1
PARKWOOD	1210	N 152ND ST	4	WHITE PINE	26	70	POOR	REMOVAL 1
PARKWOOD	2028	N 153RD PL	3	RED OAK	14	45	POOR	REMOVAL 1
PARKWOOD	1201	N 155TH ST	2	SWEETGUM	22	44	POOR	REMOVAL 1
PARKWOOD	1210	N 155TH ST	4	SWEETGUM	16	36	POOR	REMOVAL 1
PARKWOOD	1425	N 155TH ST	1	SWEETGUM	16	43	POOR	REMOVAL 1
PARKWOOD	1509	N 155TH ST	3	SWEETGUM	10	52	POOR	REMOVAL 1
PARKWOOD	1522	N 155TH ST	1	SWEETGUM	18	38	POOR	REMOVAL 1
PARKWOOD	1615	N 155TH ST	2	SWEETGUM	23	61	POOR	REMOVAL 1
PARKWOOD	1817	N 155TH ST	3	WESTERN SYCAMORE	24	53	POOR	REMOVAL 1
PARKWOOD	1817	N 155TH ST	2	WESTERN SYCAMORE	32	55	POOR	REMOVAL 1
PARKWOOD	1803	N 157TH ST	1	BLACK LOCUST	20	64	POOR	REMOVAL 1
PARKWOOD	2159	N 158TH ST	1	BIRDS NEST SPRUCE	24	69	POOR	REMOVAL 1
PARKWOOD	128	NE 147TH ST	1	CHERRY SSP.	18	14	POOR	REMOVAL 1
PARKWOOD	14518	STONE AV N	1	WHITE PINE	4	18	DEAD	REMOVAL 1
PARKWOOD	14801	STONE AV N	4	DOUGLAS FIR	14	41	DEAD	REMOVAL 1
PARKWOOD	15346	STONE AV N	3	BLACK COTTONWOOD	10	27	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	21	RED ALDER	18	42	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	9	PACIFIC MADRONE	14	30	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	13	PACIFIC MADRONE	15	16	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	22	DOUGLAS FIR	8	39	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	19	.WESTERN HEMLOCK	9	51	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	12	4 ALL FICTIOUS ADRES	17	41	POOR	REMOVAL 1
PARKWOOD	15135	STONE LN N	11	4 ALL FICTIOUS ADRES	22	47	POOR	REMOVAL 1
PARKWOOD	14842	WALLINGFORD AV N	1	FREMONT COTTONWOOD	58	72	POOR	REMOVAL 1
PARKWOOD	15738	WALLINGFORD AV N	2	.WESTERN HEMLOCK	40	70	POOR	REMOVAL 1
PARKWOOD	15749	WALLINGFORD AV N	1	WEEPING WILLOW	44	65	POOR	REMOVAL 1
RICHMOND BEACH	19121	12TH AV NW	2	PACIFIC MADRONE	6	18	DEAD	REMOVAL 1
RICHMOND BEACH	19121	12TH AV NW	3	PACIFIC MADRONE	16	21	DEAD	REMOVAL 1
RICHMOND BEACH	19121	12TH AV NW	1	PACIFIC MADRONE	20	32	DEAD	REMOVAL 1
RICHMOND BEACH	19604	12TH AV NW	1	CRAPPLE SSP.	8	8	CRITICAL	REMOVAL 1
RICHMOND BEACH	15709	1ST AV NW	1	PURPLE-LEAF PLUM	18	22	POOR	REMOVAL 1
RICHMOND BEACH	19300	23RD AV NW	1	PACIFIC MADRONE	16	15	DEAD	REMOVAL 1
RICHMOND BEACH	15740	2ND AV NW	1	SIBERIAN ELM	28	60	POOR	REMOVAL 1
RICHMOND BEACH	19504	8TH AV NW	4	RED ALDER	20	40	FAIR	REMOVAL 1
RICHMOND BEACH	19509	8TH AV NW	1	AMERICAN LINDEN	16	30	POOR	REMOVAL 1

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND BEACH	19509	8TH AV NW	2	AMERICAN LINDEN	18	34	POOR	REMOVAL 1
RICHMOND BEACH	19520	8TH AV NW	8	RED OAK	8	27	FAIR	REMOVAL 1
RICHMOND BEACH	19529	8TH AV NW	1	OTHER	21	30	POOR	REMOVAL 1
RICHMOND BEACH	19839	8TH AV NW	2	BIGLEAF MAPLE	18	25	POOR	REMOVAL 1
RICHMOND BEACH	19839	8TH AV NW	1	BIGLEAF MAPLE	25	30	POOR	REMOVAL 1
RICHMOND BEACH	19839	8TH AV NW	3	BIGLEAF MAPLE	29	25	POOR	REMOVAL 1
RICHMOND BEACH	20059	8TH AV NW	1	BIGLEAF MAPLE	25	26	POOR	REMOVAL 1
RICHMOND BEACH	20061	8TH AV NW	3	BIGLEAF MAPLE	25	26	POOR	REMOVAL 1
RICHMOND BEACH	20061	8TH AV NW	4	BIGLEAF MAPLE	25	26	POOR	REMOVAL 1
RICHMOND BEACH	20061	8TH AV NW	2	BIGLEAF MAPLE	30	26	POOR	REMOVAL 1
RICHMOND BEACH	20061	8TH AV NW	1	BIGLEAF MAPLE	33	26	POOR	REMOVAL 1
RICHMOND BEACH	20130	8TH AV NW	4	BIGLEAF MAPLE	20	30	POOR	REMOVAL 1
RICHMOND BEACH	20316	8TH AV NW	9	DOUGLAS FIR	6	45	FAIR	REMOVAL 1
RICHMOND BEACH	15235	FREMONT AV N	1	DOUGLAS FIR	7	13	DEAD	REMOVAL 1
RICHMOND BEACH	15235	FREMONT AV N	2	DOUGLAS FIR	14	14	DEAD	REMOVAL 1
RICHMOND BEACH	MED	N 149TH ST	5	WILSON HOLLY	22	27	POOR	REMOVAL 1
RICHMOND BEACH	MED	N 149TH ST	11	WHITE PINE	19	76	POOR	REMOVAL 1
RICHMOND BEACH	MED	N 149TH ST	9	EUROPEAN MOUNTAINASH	16	55	CRITICAL	REMOVAL 1
RICHMOND BEACH	MED	N 149TH ST	2	WESTERN RED CEDAR	15	41	POOR	REMOVAL 1
RICHMOND BEACH	302	N 158TH PL	2	SWEETGUM	3	21	DEAD	REMOVAL 1
RICHMOND BEACH	302	N 158TH PL	3	SWEETGUM	3	16	POOR	REMOVAL 1
RICHMOND BEACH	302	N 158TH PL	1	SWEETGUM	4	22	DEAD	REMOVAL 1
RICHMOND BEACH	903	N 165TH ST	1	EUROPEAN MOUNTAINASH	13	41	POOR	REMOVAL 1
RICHMOND BEACH	903	N 165TH ST	3	EUROPEAN MOUNTAINASH	17	38	POOR	REMOVAL 1
RICHMOND BEACH	508	N GREENWOOD DR	8	DOUGLAS FIR	24	20	DEAD	REMOVAL 1
RICHMOND BEACH	1203	NW 199TH PL	1	CRAPPLE SSP.	11	10	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	17601	1ST AV NW	2	DOUGLAS FIR	12	6	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18547	1ST AV NW	10	DOUGLAS FIR	11	55	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17344	2ND AV NW	2	BIGLEAF MAPLE	30	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18206	3RD AV NW	1	DOUGLAS FIR	6	18	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	18526	3RD AV NW	16	GOLDENCHAIN TREE	18	25	CRITICAL	REMOVAL 1
RICHMOND HIGHLANDS	18532	3RD AV NW	1	DOUGLAS FIR	13	20	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18306	6TH AV NW	18	DOUGLAS FIR	6	35	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	18306	6TH AV NW	4	DOUGLAS FIR	12	25	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	17001	DAYTON AV N	5	WHITE PINE	24	42	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17002	DAYTON AV N	1	DOUGLAS FIR	32	45	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17002	DAYTON AV N	2	DOUGLAS FIR	34	71	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18210	DAYTON AV N	3	DOUGLAS FIR	8	20	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	19915	DAYTON AV N	2	DOUGLAS FIR	22	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	19915	DAYTON AV N	1	DOUGLAS FIR	23	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18361	DAYTON PL N	2	SHORE PINE	17	20	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	16802	FIRLANDS WY N	1	DOUGLAS FIR	16	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	16756	FREMONT AV N	2	DOUGLAS FIR	10	16	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17131	FREMONT AV N	3	DOUGLAS FIR	10	51	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	17300	FREMONT AV N	7	.WESTERN HEMLOCK	21	66	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17505	FREMONT AV N	2	EUROPEAN MOUNTAINASH	25	22	POOR	REMOVAL 1
RICHMOND HIGHLANDS	17208	GREENWOOD PL N	1	BIGLEAF MAPLE	40	30	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	17803	LINDEN AV N	1	RED ALDER	9	27	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	18002	LINDEN AV N	1	DOUGLAS FIR	10	35	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	18028	LINDEN AV N	1	BLACK LOCUST	10	35	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	18200	LINDEN AV N	77	BLACK LOCUST	6	30	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	266	N 171ST ST	5	WHITE HIMA. BIRCH	6	44	POOR	REMOVAL 1
RICHMOND HIGHLANDS	266	N 171ST ST	3	WHITE PINE	14	56	POOR	REMOVAL 1
RICHMOND HIGHLANDS	520	N 173RD ST	2	DOUGLAS FIR	35	65	POOR	REMOVAL 1
RICHMOND HIGHLANDS	103	N 175TH ST	5	WESTERN RED CEDAR	5	35	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	104	N 178TH ST	2	WHITE PINE	12	17	FAIR	REMOVAL 1

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	422	N 179TH PL	2	DEODAR CEDAR	6	40	POOR	REMOVAL 1
RICHMOND HIGHLANDS	422	N 179TH PL	3	DEODAR CEDAR	6	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	422	N 179TH PL	4	DEODAR CEDAR	8	20	POOR	REMOVAL 1
RICHMOND HIGHLANDS	422	N 179TH PL	1	DEODAR CEDAR	10	21	POOR	REMOVAL 1
RICHMOND HIGHLANDS	733	N 184TH ST	1	LOMBARDY POPLAR	20	55	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	733	N 184TH ST	2	LOMBARDY POPLAR	38	55	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	600	N 185ST ST	1	DOUGLAS FIR	6	20	POOR	REMOVAL 1
RICHMOND HIGHLANDS	320	N 185TH ST	1	SCOTCH PINE	9	25	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	411	N 190TH ST	9	BITTER CHERRY	9	40	POOR	REMOVAL 1
RICHMOND HIGHLANDS	535	N 190TH ST	2	CRAPPLE SSP.	8	22	POOR	REMOVAL 1
RICHMOND HIGHLANDS	716	N 193RD ST	1	WHITE BIRCH	12	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	716	N 193RD ST	3	OTHER	10	20	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	26	PINE SP.	25	60	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	25	DOUGLAS FIR	5	25	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	27	DOUGLAS FIR	6	30	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	28	DOUGLAS FIR	10	18	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	13	DOUGLAS FIR	12	50	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	15	DOUGLAS FIR	12	50	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	735	N 193RD ST	17	DOUGLAS FIR	12	50	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	205	N 195TH ST	7	DOUGLAS FIR	6	35	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	712	N 195TH ST	8	GOLDENCHAIN TREE	11	23	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	712	N 195TH ST	1	DOUGLAS FIR	5	25	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	1002	N 195TH ST	1	WHITE PINE	4	27	POOR	REMOVAL 1
RICHMOND HIGHLANDS	916	N 199TH ST	16	WHITE PINE	4	40	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	916	N 199TH ST	9	WESTERN RED CEDAR	6	40	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	905	N 201ST ST	5	.WESTERN HEMLOCK	13	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	700	N 202ND ST	1	WESTERN RED CEDAR	9	35	POOR	REMOVAL 1
RICHMOND HIGHLANDS	700	N 202ND ST	3	.WESTERN HEMLOCK	12	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	700	N 202ND ST	5	.WESTERN HEMLOCK	12	40	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	700	N 202ND ST	7	.WESTERN HEMLOCK	15	45	POOR	REMOVAL 1
RICHMOND HIGHLANDS	123	N 203RD ST	1	DOUGLAS FIR	15	30	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	100	NW 175TH ST	2	NORWAY MAPLE	16	17	POOR	REMOVAL 1
RICHMOND HIGHLANDS	306	NW 175TH ST	2	DOUGLAS FIR	15	38	POOR	REMOVAL 1
RICHMOND HIGHLANDS	336	NW 175TH ST	1	BIGLEAF MAPLE	8	17	POOR	REMOVAL 1
RICHMOND HIGHLANDS	336	NW 175TH ST	2	BIGLEAF MAPLE	35	19	POOR	REMOVAL 1
RICHMOND HIGHLANDS	105	NW 178TH ST	2	JAPANESE FLOWERING C	10	20	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	106	NW 178TH ST	1	DOUGLAS FIR	6	40	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	106	NW 178TH ST	2	DOUGLAS FIR	6	40	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	104	NW 181ST ST	2	AMABILS/PAC SIL FIR	7	28	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	104	NW 181ST ST	1	MOUNTAIN HEMLOCK	12	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	107	NW 185TH ST	2	DOUGLAS FIR	8	24	POOR	REMOVAL 1
RICHMOND HIGHLANDS	107	NW 185TH ST	1	DOUGLAS FIR	11	26	POOR	REMOVAL 1
RICHMOND HIGHLANDS	358	NW 189TH ST	2	EUROPEAN MOUNTAINASH	9	25	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	204	NW 191ST ST	2	DOUGLAS FIR	15	25	POOR	REMOVAL 1
RICHMOND HIGHLANDS	224	NW 195TH ST	1	DOUGLAS FIR	20	26	POOR	REMOVAL 1
RICHMOND HIGHLANDS	224	NW 195TH ST	17	BLACK LOCUST	10	25	POOR	REMOVAL 1

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	800	NW 195TH ST	1	AMERICAN LINDEN	20	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	800	NW 195TH ST	2	AMERICAN LINDEN	20	35	POOR	REMOVAL 1
RICHMOND HIGHLANDS	117	NW 198TH ST	2	.WESTERN HEMLOCK	10	30	POOR	REMOVAL 1
RICHMOND HIGHLANDS	218	NW 198TH ST	1	NORWAY MAPLE	17	18	POOR	REMOVAL 1
RICHMOND HIGHLANDS	240	NW 203RD ST	7	MAPLE SPECIES	6	27	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	240	NW 203RD ST	11	RED ALDER	12	60	POOR	REMOVAL 1
RICHMOND HIGHLANDS	240	NW 203RD ST	12	RED ALDER	12	20	DEAD	REMOVAL 1
RICHMOND HIGHLANDS	302	NW 203RD ST	8	RED ALDER	8	32	POOR	REMOVAL 1
RICHMOND HIGHLANDS	302	NW 203RD ST	17	RED ALDER	9	30	FAIR	REMOVAL 1
RICHMOND HIGHLANDS	16857	PALATINE AV N	1	WHITE POPLAR	15	13	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18504	PALATINE PL N	7	DOUGLAS FIR	15	13	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18505	PALATINE PL N	3	ONE-SEED HAWTHORN	8	20	POOR	REMOVAL 1
RICHMOND HIGHLANDS	18505	PALATINE PL N	8	EUROPEAN MOUNTAINASH	4	25	POOR	REMOVAL 1
RIDGECREST	15503	10TH AV NE	2	MAPLE SPECIES	12	25	POOR	REMOVAL 1
RIDGECREST	16204	10TH AV NE	3	PACIFIC MADRONE	13	12	DEAD	REMOVAL 1
RIDGECREST	15503	12TH AV NE	3	MAPLE SPECIES	13	23	POOR	REMOVAL 1
RIDGECREST	15503	12TH AV NE	2	MAPLE SPECIES	14	32	POOR	REMOVAL 1
RIDGECREST	16607	3RD PL NE	2	PRUNUS SPECIES	15	9	POOR	REMOVAL 1
RIDGECREST	16607	3RD PL NE	3	PRUNUS SPECIES	18	10	DEAD	REMOVAL 1
RIDGECREST	15124	5TH AV NE	1	RED MAPLE	16	45	POOR	REMOVAL 1
RIDGECREST	15415	5TH AV NE	3	RED MAPLE	17	44	POOR	REMOVAL 1
RIDGECREST	15415	5TH AV NE	1	SWEETGUM	8	27	POOR	REMOVAL 1
RIDGECREST	15518	5TH AV NE	1	RED MAPLE	10	34	POOR	REMOVAL 1
RIDGECREST	15642	5TH AV NE	1	RED MAPLE	16	47	POOR	REMOVAL 1
RIDGECREST	15726	5TH AV NE	1	RED MAPLE	13	41	POOR	REMOVAL 1
RIDGECREST	16535	5TH AV NE	1	RED MAPLE	22	45	POOR	REMOVAL 1
RIDGECREST	16745	5TH AV NE	1	RED MAPLE	24	55	POOR	REMOVAL 1
RIDGECREST	17011	5TH AV NE	2	RED MAPLE	18	50	POOR	REMOVAL 1
RIDGECREST	17041	5TH AV NE	1	RED MAPLE	15	47	POOR	REMOVAL 1
RIDGECREST	17048	5TH AV NE	1	RED MAPLE	17	59	POOR	REMOVAL 1
RIDGECREST	17402	5TH AV NE	1	RED MAPLE	12	55	POOR	REMOVAL 1
RIDGECREST	15502	6TH AV NE	3	MAPLE SPECIES	11	21	POOR	REMOVAL 1
RIDGECREST	16036	6TH AV NE	1	ROWAN TREE	22	20	POOR	REMOVAL 1
RIDGECREST	15501	9TH AV NE	1	MAPLE SPECIES	13	27	POOR	REMOVAL 1
RIDGECREST	15502	9TH AV NE	3	MAPLE SPECIES	11	21	POOR	REMOVAL 1
RIDGECREST	15502	9TH AV NE	1	MAPLE SPECIES	12	24	POOR	REMOVAL 1
RIDGECREST	435	NE 153RD ST	1	PINE SP.	18	12	DEAD	REMOVAL 1
RIDGECREST	1411	NE 155TH ST	1	MAPLE SPECIES	11	24	POOR	REMOVAL 1
RIDGECREST	302	NE 159TH ST	4	PACIFIC MADRONE	18	20	POOR	REMOVAL 1
RIDGECREST	154	NE 165TH ST	3	AUSTRIAN PINE	10	18	DEAD	REMOVAL 1
RIDGECREST	607	NE 165TH ST	3	CHERRY SSP.	11	10	CRITICAL	REMOVAL 1
RIDGECREST	505	NE 170TH LN	1	RED MAPLE	9	41	POOR	REMOVAL 1
RIDGECREST	421	NE 170TH ST	1	RED MAPLE	24	54	POOR	REMOVAL 1
RIDGECREST	923	NE 174TH ST	2	PACIFIC MADRONE	9	13	CRITICAL	REMOVAL 1
RIDGECREST	229	NE 175TH ST	2	ROWAN TREE	22	16	DEAD	REMOVAL 1
RIDGECREST	345	NE 175TH ST	1	RED MAPLE	5	23	POOR	REMOVAL 1

Description of Street trees designated Removal 2.

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
BALLINGER	19723	10TH AV NE	5	MADRONE	7	10	DEAD	REMOVAL 2
BALLINGER	19505	14TH AV NE	4	RED ALDER	3	17	POOR	REMOVAL 2
BALLINGER	19505	14TH AV NE	3	DOUGLAS FIR	1	8	FAIR	REMOVAL 2
BALLINGER	840	195TH ST NE	6	RED ALDER	1	6	POOR	REMOVAL 2
BALLINGER	840	195TH ST NE	12	DOUGLAS FIR	9	26	POOR	REMOVAL 2
BALLINGER	1204	195TH ST NE	11	TREE OF HEAVEN	2	16	FAIR	REMOVAL 2
BALLINGER	1313	195TH ST NE	30	WESTERN RED CEDAR	5	21	POOR	REMOVAL 2
BALLINGER	1313	195TH ST NE	25	.WESTERN HEMLOCK	8	12	POOR	REMOVAL 2
BALLINGER	1003	196TH ST NE	6	RED ALDER	5	19	POOR	REMOVAL 2
BALLINGER	1003	196TH ST NE	17	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
BALLINGER	1003	196TH ST NE	18	DOUGLAS FIR	4	17	POOR	REMOVAL 2
BALLINGER	1003	196TH ST NE	16	DOUGLAS FIR	6	35	POOR	REMOVAL 2
BALLINGER	1010	197TH ST NE	2	WESTERN RED CEDAR	4	22	DEAD	REMOVAL 2
BALLINGER	1032	197TH ST NE	1	.WESTERN HEMLOCK	2	10	DEAD	REMOVAL 2
BALLINGER	1002	198TH ST NE	2	ENGLISH HOLLY	1	9	POOR	REMOVAL 2
BALLINGER	20334	21ST AV NE	1	PINE SP.	5	18	POOR	REMOVAL 2
BALLINGER	20003	24TH AV NE	1	ROWAN TREE	9	9	FAIR	REMOVAL 2
BALLINGER	1119	BALLINGER PL NE	7	DOUGLAS FIR	1	12	POOR	REMOVAL 2
BALLINGER	1119	BALLINGER PL NE	8	DOUGLAS FIR	1	8	FAIR	REMOVAL 2
BALLINGER	1119	BALLINGER PL NE	4	.WESTERN HEMLOCK	1	8	POOR	REMOVAL 2
CRISTA MINISTRIES	307	N 200TH ST	2	AMABILS/PAC SIL FIR	3	18	FAIR	REMOVAL 2
ECHO LAKE	304	NE 191ST ST	2	WHITE PINE	11	30	DEAD	REMOVAL 2
HILLWOOD	18900	1ST AV NW	1	EUROPEAN MOUNTAINASH	20	15	POOR	REMOVAL 2
HILLWOOD	19111	1ST AV NW	1	EUROPEAN MOUNTAINASH	3	20	POOR	REMOVAL 2
HILLWOOD	19331	2ND AV NW	1	NORWAY MAPLE	5	22	FAIR	REMOVAL 2
HILLWOOD	19526	2ND AV NW	5	TREE OF HEAVEN	1	18	POOR	REMOVAL 2
HILLWOOD	19526	2ND AV NW	7	ENGLISH HOLLY	0	12	FAIR	REMOVAL 2
HILLWOOD	19526	2ND AV NW	6	WESTERN LARCH	1	18	DEAD	REMOVAL 2
HILLWOOD	19526	2ND AV NW	9	SCOTCH PINE	6	28	POOR	REMOVAL 2
HILLWOOD	19526	2ND AV NW	8	SCOTCH PINE	12	26	POOR	REMOVAL 2
HILLWOOD	19532	2ND AV NW	3	WESTERN RED CEDAR	3	24	POOR	REMOVAL 2
HILLWOOD	19536	2ND AV NW	7	AMERICAN ARBORVITAE	1	13	POOR	REMOVAL 2
HILLWOOD	19536	2ND AV NW	19	AMERICAN ARBORVITAE	2	13	CRITICAL	REMOVAL 2
HILLWOOD	19536	2ND AV NW	4	WESTERN RED CEDAR	4	24	POOR	REMOVAL 2
HILLWOOD	19536	2ND AV NW	6	WESTERN RED CEDAR	6	20	POOR	REMOVAL 2
HILLWOOD	19536	2ND AV NW	5	WESTERN RED CEDAR	12	24	POOR	REMOVAL 2
HILLWOOD	19316	3RD AV NW	6	GOLDENCHAIN TREE	8	20	FAIR	REMOVAL 2
HILLWOOD	19358	3RD AV NW	1	ENGLISH HOLLY	6	18	FAIR	REMOVAL 2
HILLWOOD	19709	3RD AV NW	3	BIGLEAF MAPLE	3	16	DEAD	REMOVAL 2
HILLWOOD	19709	3RD AV NW	2	BIGLEAF MAPLE	4	16	POOR	REMOVAL 2
HILLWOOD	19709	3RD AV NW	4	BIGLEAF MAPLE	4	17	POOR	REMOVAL 2
HILLWOOD	19709	3RD AV NW	5	BIGLEAF MAPLE	5	18	POOR	REMOVAL 2
HILLWOOD	19709	3RD AV NW	8	BIGLEAF MAPLE	5	18	POOR	REMOVAL 2
HILLWOOD	19709	3RD AV NW	7	HORSE CHESTNUT	2	12	POOR	REMOVAL 2
HILLWOOD	19713	3RD AV NW	3	WILLOW SPP.	8	32	POOR	REMOVAL 2
HILLWOOD	19713	3RD AV NW	4	WESTERN RED CEDAR	12	48	POOR	REMOVAL 2
HILLWOOD	19721	3RD AV NW	9	MADRONE	4	22	POOR	REMOVAL 2
HILLWOOD	19721	3RD AV NW	11	WATER BIRCH	1	18	POOR	REMOVAL 2
HILLWOOD	20015	3RD AV NW	8	CRAPPLE SSP.	3	13	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	5	DOUGLAS FIR	4	11	DEAD	REMOVAL 2
HILLWOOD	20037	3RD AV NW	9	DOUGLAS FIR	4	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	11	DOUGLAS FIR	4	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	1	DOUGLAS FIR	5	11	DEAD	REMOVAL 2
HILLWOOD	20037	3RD AV NW	2	DOUGLAS FIR	6	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	3	DOUGLAS FIR	6	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	4	DOUGLAS FIR	6	11	CRITICAL	REMOVAL 2
HILLWOOD	20037	3RD AV NW	7	DOUGLAS FIR	6	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	8	DOUGLAS FIR	6	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	10	DOUGLAS FIR	7	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	6	DOUGLAS FIR	9	11	POOR	REMOVAL 2
HILLWOOD	20037	3RD AV NW	12	DOUGLAS FIR	10	11	POOR	REMOVAL 2
HILLWOOD	20103	3RD AV NW	2	GOLDENCHAIN TREE	2	10	POOR	REMOVAL 2
HILLWOOD	19004	8TH AV NW	6	ENGLISH HOLLY	1	16	FAIR	REMOVAL 2
HILLWOOD	19004	8TH AV NW	8	ENGLISH HOLLY	1	7	FAIR	REMOVAL 2
HILLWOOD	19004	8TH AV NW	9	ENGLISH HOLLY	1	7	FAIR	REMOVAL 2
HILLWOOD	19004	8TH AV NW	5	BITTER CHERRY	0	4	FAIR	REMOVAL 2
HILLWOOD	19425	AURORA AV N	2	DOUGLAS FIR	3	20	POOR	REMOVAL 2
HILLWOOD	19706	DAYTON AV N	1	COULTER PINE	9	12	POOR	REMOVAL 2
HILLWOOD	19801	DAYTON AV N	1	AMERICAN ARBORVITAE	0	4	DEAD	REMOVAL 2
HILLWOOD	19801	DAYTON AV N	2	AMERICAN ARBORVITAE	0	4	DEAD	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
HILLWOOD	19801	DAYTON AV N	3	AMERICAN ARBORVITAE	1	4	POOR	REMOVAL 2
HILLWOOD	20019	DAYTON AV N	15	WEST. DOGWOOD	0	3	POOR	REMOVAL 2
HILLWOOD	20019	DAYTON AV N	14	.WESTERN HEMLOCK	0	3	POOR	REMOVAL 2
HILLWOOD	20315	DAYTON AV N	3	WESTERN RED CEDAR	3	15	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	5	DOUGLAS FIR	2	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	6	DOUGLAS FIR	2	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	7	DOUGLAS FIR	2	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	8	DOUGLAS FIR	3	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	1	DOUGLAS FIR	4	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	3	DOUGLAS FIR	4	25	FAIR	REMOVAL 2
HILLWOOD	18750	DAYTON PL N	2	WESTERN RED CEDAR	4	25	FAIR	REMOVAL 2
HILLWOOD	18753	DAYTON PL N	2	DOUGLAS FIR	8	26	FAIR	REMOVAL 2
HILLWOOD	19829	DAYTON PL N	1	MAPLE SPECIES	5	10	POOR	REMOVAL 2
HILLWOOD	18811	FIRLANDS WY N	5	SPRUCE SSP.	0	4	POOR	REMOVAL 2
HILLWOOD	18811	FIRLANDS WY N	2	DOUGLAS FIR	1	14	FAIR	REMOVAL 2
HILLWOOD	18811	FIRLANDS WY N	7	DOUGLAS FIR	1	16	FAIR	REMOVAL 2
HILLWOOD	18811	FIRLANDS WY N	4	DOUGLAS FIR	2	15	FAIR	REMOVAL 2
HILLWOOD	18811	FIRLANDS WY N	3	DOUGLAS FIR	3	18	POOR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	15	HORSE CHESTNUT	4	10	FAIR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	18	WHITE PINE	0	5	POOR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	13	DOUGLAS FIR	1	10	POOR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	14	DOUGLAS FIR	1	10	POOR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	19	DOUGLAS FIR	1	13	FAIR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	21	DOUGLAS FIR	1	13	FAIR	REMOVAL 2
HILLWOOD	18840	FIRLANDS WY N	4	DOUGLAS FIR	2	14	FAIR	REMOVAL 2
HILLWOOD	19005	FIRLANDS WY N	4	GOLDENCHAIN TREE	8	20	POOR	REMOVAL 2
HILLWOOD	19027	FIRLANDS WY N	1	BIGLEAF MAPLE	1	10	POOR	REMOVAL 2
HILLWOOD	19201	FIRLANDS WY N	10	ENGLISH HOLLY	2	10	FAIR	REMOVAL 2
HILLWOOD	19201	FIRLANDS WY N	3	DOUGLAS FIR	3	20	POOR	REMOVAL 2
HILLWOOD	19207	FIRLANDS WY N	2	SERVICEBERRY SSP.	1	12	DEAD	REMOVAL 2
HILLWOOD	19207	FIRLANDS WY N	4	SERVICEBERRY SSP.	1	12	DEAD	REMOVAL 2
HILLWOOD	19207	FIRLANDS WY N	5	SERVICEBERRY SSP.	1	12	DEAD	REMOVAL 2
HILLWOOD	19207	FIRLANDS WY N	7	WHITE PINE	1	6	POOR	REMOVAL 2
HILLWOOD	19207	FIRLANDS WY N	6	DOUGLAS FIR	1	6	POOR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	15	HORSE CHESTNUT	4	29	FAIR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	4	ENGLISH HOLLY	1	20	FAIR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	5	BITTER CHERRY	3	31	FAIR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	12	BITTER CHERRY	3	35	FAIR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	13	BITTER CHERRY	3	35	FAIR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	17	BITTER CHERRY	3	28	POOR	REMOVAL 2
HILLWOOD	19341	FIRLANDS WY N	18	BITTER CHERRY	3	28	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	25	MAPLE SPECIES	3	22	DEAD	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	8	SERVICEBERRY SSP.	4	20	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	5	MADRONE	1	12	DEAD	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	14	MADRONE	1	9	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	10	MADRONE	3	13	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	17	GOLDENCHAIN TREE	1	15	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	6	SPRUCE SSP.	0	4	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	18	SPRUCE SSP.	2	10	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	16	SPRUCE SSP.	5	24	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	28	WHITE PINE	1	12	CRITICAL	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY	9	DOUGLAS FIR	1	8	FAIR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
		N						
HILLWOOD	19370	FIRLANDS WY N	12	DOUGLAS FIR	1	5	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	3	DOUGLAS FIR	2	15	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	19	DOUGLAS FIR	2	10	FAIR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	27	DOUGLAS FIR	4	30	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	24	DOUGLAS FIR	5	30	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	30	DOUGLAS FIR	6	35	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	13	WESTERN RED CEDAR	3	18	POOR	REMOVAL 2
HILLWOOD	19370	FIRLANDS WY N	22	WESTERN RED CEDAR	8	50	FAIR	REMOVAL 2
HILLWOOD	18510	FREMONT AV N	1	ENGLISH HOLLY	1	5	FAIR	REMOVAL 2
HILLWOOD	18510	FREMONT AV N	2	ENGLISH HOLLY	1	5	FAIR	REMOVAL 2
HILLWOOD	18531	FREMONT AV N	1	GOLDENCHAIN TREE	7	20	POOR	REMOVAL 2
HILLWOOD	20002	FREMONT AV N	7	CHERRY SSP.	2	15	FAIR	REMOVAL 2
HILLWOOD	20200	FREMONT AV N	1	FREMONT COTTONWOOD	2	30	FAIR	REMOVAL 2
HILLWOOD	19359	GREENWOOD AV N	4	ENGLISH HOLLY	2	12	FAIR	REMOVAL 2
HILLWOOD	19359	GREENWOOD AV N	2	.WESTERN HEMLOCK	3	15	FAIR	REMOVAL 2
HILLWOOD	19359	GREENWOOD AV N	3	.WESTERN HEMLOCK	4	18	POOR	REMOVAL 2
HILLWOOD	20004	GREENWOOD AV N	2	EUROPEAN MOUNTAINASH	4	13	POOR	REMOVAL 2
HILLWOOD	20129	GREENWOOD AV N	1	OTHER	5	12	FAIR	REMOVAL 2
HILLWOOD	20332	GREENWOOD AV N	2	WHITE PINE	1	5	POOR	REMOVAL 2
HILLWOOD	20357	GREENWOOD AV N	4	COCKSPUR HAWTHORN	5	12	FAIR	REMOVAL 2
HILLWOOD	20357	GREENWOOD AV N	7	CRAPPLE SSP.	1	5	POOR	REMOVAL 2
HILLWOOD	20357	GREENWOOD AV N	6	CRAPPLE SSP.	3	5	FAIR	REMOVAL 2
HILLWOOD	20357	GREENWOOD AV N	9	WESTERN RED CEDAR	1	7	DEAD	REMOVAL 2
HILLWOOD	19609	GREENWOOD PL N	4	SITKA SPRUCE	3	20	CRITICAL	REMOVAL 2
HILLWOOD	19807	GREENWOOD PL N	2	MAPLE SPECIES	0	5	FAIR	REMOVAL 2
HILLWOOD	19333	LINDEN AV N	3	.WESTERN HEMLOCK	2	20	POOR	REMOVAL 2
HILLWOOD	19333	LINDEN AV N	1	.WESTERN HEMLOCK	6	26	POOR	REMOVAL 2
HILLWOOD	19333	LINDEN AV N	2	.WESTERN HEMLOCK	6	26	POOR	REMOVAL 2
HILLWOOD	500	N 149TH ST	5	BIRDS NEST SPRUCE	15	62	POOR	REMOVAL 2
HILLWOOD	778	N 203RD ST	1	JAPANESE FLOWERING C	3	7	CRITICAL	REMOVAL 2
HILLWOOD	779	N 204TH ST	2	ENGLISH HOLLY	2	10	POOR	REMOVAL 2
HILLWOOD	360	NW 195TH ST	1	BIGLEAF MAPLE	5	24	FAIR	REMOVAL 2
HILLWOOD	360	NW 195TH ST	4	ONE-SEED HAWTHORN	1	10	FAIR	REMOVAL 2
HILLWOOD	360	NW 195TH ST	5	ENGLISH HOLLY	1	6	FAIR	REMOVAL 2
HILLWOOD	360	NW 195TH ST	7	ENGLISH HOLLY	1	5	FAIR	REMOVAL 2
HILLWOOD	360	NW 195TH ST	25	EUROPEAN MOUNTAINASH	1	14	POOR	REMOVAL 2
HILLWOOD	401	NW 196TH PL	1	EDIBLE APPLE	6	14	POOR	REMOVAL 2
HILLWOOD	327	NW 198TH ST	3	WHITE PINE	2	3	POOR	REMOVAL 2
HILLWOOD	327	NW 198TH ST	4	WHITE PINE	2	3	POOR	REMOVAL 2
HILLWOOD	319	NW 205TH ST	3	OTHER	12	15	POOR	REMOVAL 2
HILLWOOD	319	NW 205TH ST	5	OTHER	13	26	POOR	REMOVAL 2
HILLWOOD	319	NW 205TH ST	1	DOUGLAS FIR	8	26	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	9	BIGLEAF MAPLE	3	26	FAIR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	4	RED ALDER	4	22	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	5	RED ALDER	7	30	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	6	DOUGLAS FIR	7	24	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	7	DOUGLAS FIR	10	24	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	3	.WESTERN HEMLOCK	4	30	POOR	REMOVAL 2
HILLWOOD	325	NW 205TH ST	2	.WESTERN HEMLOCK	5	14	POOR	REMOVAL 2
HILLWOOD	333	NW 205TH ST	2	DOUGLAS FIR	4	35	FAIR	REMOVAL 2
HILLWOOD	333	NW 205TH ST	3	DOUGLAS FIR	4	35	FAIR	REMOVAL 2
HILLWOOD	333	NW 205TH ST	9	DOUGLAS FIR	4	26	FAIR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	5	RED ALDER	7	25	POOR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	1	DOUGLAS FIR	1	8	POOR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	7	DOUGLAS FIR	4	30	POOR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	10	DOUGLAS FIR	4	27	POOR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	9	DOUGLAS FIR	5	30	POOR	REMOVAL 2
HILLWOOD	341	NW 205TH ST	4	.WESTERN HEMLOCK	1	12	DEAD	REMOVAL 2
HILLWOOD	20107	WHITMAN AV	1	JAPANESE FLOWERING C	1	10	POOR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
		N						
INNIS ARDEN	18841	8TH AV NW	7	BITTER CHERRY	0	10	FAIR	REMOVAL 2
MERIDAIN PARK	18332	2ND AV NE	1	PURPLE-LEAF PLUM	1	8	DEAD	REMOVAL 2
MERIDAIN PARK	17844	ASHWORTH AV N	1	AMERICAN ARBORVITAE	3	9	DEAD	REMOVAL 2
MERIDAIN PARK	18022	ASHWORTH AV N	1	CHERRY SSP.	14	23	POOR	REMOVAL 2
MERIDAIN PARK	18308	ASHWORTH AV N	1	PACIFIC MADRONE	8	27	DEAD	REMOVAL 2
MERIDAIN PARK	16227	BAGLEY PL N	1	EUROPEAN MOUNTAINASH	18	21	POOR	REMOVAL 2
MERIDAIN PARK	16706	CORLISS AV N	3	CHERRY SSP.	5	9	POOR	REMOVAL 2
MERIDAIN PARK	16223	CORLISS PL N	1	JAPANESE MAPLE	10	12	POOR	REMOVAL 2
MERIDAIN PARK	16746	MERIDIAN AV N	2	RED MAPLE	4	22	POOR	REMOVAL 2
MERIDAIN PARK	1851	N 165TH ST	1	4 ALL FICTIOUS ADRES	11	16	POOR	REMOVAL 2
MERIDAIN PARK	2103	N 171ST ST	2	RED MAPLE	7	32	POOR	REMOVAL 2
MERIDAIN PARK	2001	N 175TH ST	20	AUTUMN ASH	2	14	POOR	REMOVAL 2
MERIDAIN PARK	2001	N 175TH ST	1	PURPLE-LEAF PLUM	2	11	POOR	REMOVAL 2
MERIDAIN PARK	2001	N 175TH ST	6	PURPLE-LEAF PLUM	2	12	POOR	REMOVAL 2
MERIDAIN PARK	2130	N 178TH ST	1	THINLEAF ALDER	22	45	POOR	REMOVAL 2
MERIDAIN PARK	2139	N 178TH ST	1	BITTER CHERRY	12	12	POOR	REMOVAL 2
MERIDAIN PARK	1121	N 180TH ST	6	PURPLE-LEAF PLUM	10	13	POOR	REMOVAL 2
MERIDAIN PARK	1849	N 180TH ST	1	KWANZAN CHERRY	12	18	POOR	REMOVAL 2
MERIDAIN PARK	1849	N 180TH ST	2	KWANZAN CHERRY	13	13	POOR	REMOVAL 2
MERIDAIN PARK	1303	N 184TH CT	2	RED MAPLE	1	14	POOR	REMOVAL 2
MERIDAIN PARK	1803	N 185TH ST	3	.WESTERN HEMLOCK	22	40	POOR	REMOVAL 2
MERIDAIN PARK	342	NE 193RD ST	2	CHINESE JUNIPER	3	3	DEAD	REMOVAL 2
MERIDAIN PARK	16160	STONE AV N	3	.VINE MAPLE	4	13	POOR	REMOVAL 2
MERIDAIN PARK	16025	WALLINGFORD AV N	1	CHERRY SSP.	6	9	CRITICAL	REMOVAL 2
MERIDAIN PARK	18322	WALLINGFORD AV N	3	AMERICN MOUNTAIN-ASH	20	28	POOR	REMOVAL 2
NORTH CITY	18035	10TH AV NE	1	AMERICN MOUNTAIN-ASH	2	10	FAIR	REMOVAL 2
NORTH CITY	18548	10TH AV NE	2	BITTER CHERRY	1	8	FAIR	REMOVAL 2
NORTH CITY	19220	10TH AV NE	2	RED ALDER	1	5	POOR	REMOVAL 2
NORTH CITY	19220	10TH AV NE	3	RED ALDER	1	7	POOR	REMOVAL 2
NORTH CITY	19220	10TH AV NE	4	ENGLISH HOLLY	0	4	POOR	REMOVAL 2
NORTH CITY	18200	11TH AV NE	1	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
NORTH CITY	19200	11TH AV NE	6	DOUGLAS FIR	6	24	POOR	REMOVAL 2
NORTH CITY	19004	12TH AV NE	1	DOUGLAS FIR	1	6	POOR	REMOVAL 2
NORTH CITY	19004	12TH AV NE	2	DOUGLAS FIR	1	6	POOR	REMOVAL 2
NORTH CITY	19011	12TH AV NE	14	BIGLEAF MAPLE	1	6	FAIR	REMOVAL 2
NORTH CITY	19011	12TH AV NE	21	MADRONE	2	8	POOR	REMOVAL 2
NORTH CITY	19011	12TH AV NE	20	BITTER CHERRY	2	12	FAIR	REMOVAL 2
NORTH CITY	19021	12TH AV NE	2	DOUGLAS FIR	1	9	POOR	REMOVAL 2
NORTH CITY	19021	12TH AV NE	4	DOUGLAS FIR	1	7	FAIR	REMOVAL 2
NORTH CITY	19021	12TH AV NE	5	DOUGLAS FIR	1	7	FAIR	REMOVAL 2
NORTH CITY	19217	12TH AV NE	2	BLACK LOCUST	1	6	FAIR	REMOVAL 2
NORTH CITY	17518	15TH AV NE	1	CRAPPLE SSP.	2	8	DEAD	REMOVAL 2
NORTH CITY	17763	15TH AV NE	1	AMERICN MOUNTAIN-ASH	1	11	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	3	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	4	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	6	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	8	ENGLISH HOLLY	1	7	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	9	ENGLISH HOLLY	1	8	POOR	REMOVAL 2
NORTH CITY	523	180TH ST NE	1	AMERICN MOUNTAIN-ASH	1	11	POOR	REMOVAL 2
NORTH CITY	809	180TH ST NE	4	GOLDEN CHAIN TREE	7	14	POOR	REMOVAL 2
NORTH CITY	1000	185TH ST NE	2	DOUGLAS FIR	7	22	CRITICAL	REMOVAL 2
NORTH CITY	1211	185TH ST NE	7	DOUGLAS FIR	1	6	POOR	REMOVAL 2
NORTH CITY	1211	185TH ST NE	2	AMERICN MOUNTAIN-ASH	1	8	POOR	REMOVAL 2
NORTH CITY	1243	185TH ST NE	11	MADRONE	6	11	DEAD	REMOVAL 2
NORTH CITY	1243	185TH ST NE	9	PACIFIC WILLOW	11	18	POOR	REMOVAL 2
NORTH CITY	1060	188TH ST NE	3	ENGLISH HOLLY	1	10	POOR	REMOVAL 2
NORTH CITY	18764	18TH AV NE	2	RED ALDER	3	12	DEAD	REMOVAL 2
NORTH CITY	18023	5TH AV NE	2	WHITE PINE	4	18	FAIR	REMOVAL 2
NORTH CITY	18051	5TH AV NE	8	DOUGLAS FIR	3	20	DEAD	REMOVAL 2
NORTH CITY	18040	7TH AV NE	2	PAPER BIRCH	1	5	FAIR	REMOVAL 2
NORTH CITY	18300	8TH AV NE	6	GOLDEN CHAIN TREE	2	12	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	8	BLACK LOCUST	0	4	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	3	BLACK LOCUST	1	6	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	4	BLACK LOCUST	1	6	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	5	BLACK LOCUST	1	5	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	6	BLACK LOCUST	1	8	POOR	REMOVAL 2
NORTH CITY	18509	8TH AV NE	7	BLACK LOCUST	1	11	POOR	REMOVAL 2
NORTH CITY	18915	8TH AV NE	5	AMERICAN ARBORVITAE	3	7	DEAD	REMOVAL 2
NORTH CITY	2107	NE 177TH ST	2	FLOWERING DOGWOOD	4	10	DEAD	REMOVAL 2
NORTH CITY	1041	PERKINS WY NE	17	ENGLISH HOLLY	1	7	POOR	REMOVAL 2
NORTH CITY	1041	PERKINS WY	14	DOUGLAS FIR	3	18	FAIR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
NORTH CITY	1115	NE PERKINS WY	7	BIGLEAF MAPLE	1	7	FAIR	REMOVAL 2
NORTH CITY	1115	NE PERKINS WY	9	BIGLEAF MAPLE	1	6	FAIR	REMOVAL 2
NORTH CITY	1115	NE PERKINS WY	10	BIGLEAF MAPLE	1	6	FAIR	REMOVAL 2
NORTH CITY	1115	NE PERKINS WY	12	BIGLEAF MAPLE	2	7	POOR	REMOVAL 2
NORTH CITY	1115	NE PERKINS WY	8	ENGLISH HOLLY	1	6	FAIR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	2	BIGLEAF MAPLE	1	14	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	12	BIGLEAF MAPLE	1	10	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	5	BIGLEAF MAPLE	2	16	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	1	WHITE PINE	1	6	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	6	DOUGLAS FIR	2	15	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	7	DOUGLAS FIR	2	17	POOR	REMOVAL 2
NORTH CITY	1130	NE PERKINS WY	11	DOUGLAS FIR	4	18	POOR	REMOVAL 2
NORTH CITY	1229	NE PERKINS WY	2	.VINE MAPLE	1	7	FAIR	REMOVAL 2
NORTH CITY	1416	NE PERKINS WY	3	.WESTERN HEMLOCK	3	19	DEAD	REMOVAL 2
NORTH CITY	361	NE SERPENTINE PL NE	14	DOUGLAS FIR	2	12	POOR	REMOVAL 2
NORTH CITY	830	SERPENTINE PL NE	2	PAPER BIRCH	1	12	DEAD	REMOVAL 2
NORTH CITY	903	SERPENTINE PL NE	2	LOMBARDY POPLAR	3	23	POOR	REMOVAL 2
NORTH CITY	1102	SERPENTINE PL NE	5	JUNIPER SPECIES	2	7	POOR	REMOVAL 2
NORTH CITY	1102	SERPENTINE PL NE	6	JUNIPER SPECIES	2	6	POOR	REMOVAL 2
NORTH CITY	1102	SERPENTINE PL NE	2	JUNIPER SPECIES	3	11	POOR	REMOVAL 2
NORTH CITY	1102	SERPENTINE PL NE	3	JUNIPER SPECIES	3	12	POOR	REMOVAL 2
PARKWOOD	15310	ASHWORTH AV N	1	REDBUD	8	13	POOR	REMOVAL 2
PARKWOOD	15703	MIDVALE AV N	2	AFRICAN SUMAC	5	25	POOR	REMOVAL 2
PARKWOOD	2165	N 155TH ST	16	WHITE HIMA. BIRCH	9	39	POOR	REMOVAL 2
PARKWOOD	2165	N 155TH ST	12	CHERRY SSP.	4	16	POOR	REMOVAL 2
PARKWOOD	14518	STONE AV N	2	DOUGLAS FIR	4	16	POOR	REMOVAL 2
RICHMOND BEACH	19612	12TH AV NW	1	CRAPPLE SSP.	4	6	CRITICAL	REMOVAL 2
RICHMOND BEACH	19612	12TH AV NW	3	CRAPPLE SSP.	9	6	CRITICAL	REMOVAL 2
RICHMOND BEACH	19841	5TH AV NW	2	PINE SP.	12	13	POOR	REMOVAL 2
RICHMOND BEACH	19841	5TH AV NW	1	PINE SP.	15	13	POOR	REMOVAL 2
RICHMOND BEACH	19351	8TH AV NW	2	ENGLISH HOLLY	1	13	POOR	REMOVAL 2
RICHMOND BEACH	19351	8TH AV NW	1	ENGLISH HOLLY	2	15	POOR	REMOVAL 2
RICHMOND BEACH	19504	8TH AV NW	5	BLACK LOCUST	4	15	FAIR	REMOVAL 2
RICHMOND BEACH	19520	8TH AV NW	4	JAPANESE FLOWERING C	6	23	POOR	REMOVAL 2
RICHMOND BEACH	20030	8TH AV NW	6	OTHER	4	22	DEAD	REMOVAL 2
RICHMOND BEACH	20081	8TH AV NW	1	TREE OF HEAVEN	1	11	POOR	REMOVAL 2
RICHMOND BEACH	20116	8TH AV NW	1	DOUGLAS FIR	1	12	POOR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	6	JAPANESE MAPLE	1	8	POOR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	7	OTHER	2	15	POOR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	9	BITTER CHERRY	3	25	FAIR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	2	DOUGLAS FIR	2	22	POOR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	3	DOUGLAS FIR	2	24	FAIR	REMOVAL 2
RICHMOND BEACH	20130	8TH AV NW	11	AMERICAN LINDEN	1	10	POOR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	12	WESTERN RED CEDAR	1	6	POOR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	13	WESTERN RED CEDAR	1	6	DEAD	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	10	WESTERN RED CEDAR	2	10	POOR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	5	WESTERN RED CEDAR	4	10	POOR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	14	.WESTERN HEMLOCK	11	45	FAIR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	17	.WESTERN HEMLOCK	12	50	FAIR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	18	.WESTERN HEMLOCK	12	40	FAIR	REMOVAL 2
RICHMOND BEACH	20144	8TH AV NW	16	.WESTERN HEMLOCK	13	40	DEAD	REMOVAL 2
RICHMOND BEACH	20304	8TH AV NW	1	DOUGLAS FIR	2	18	FAIR	REMOVAL 2
RICHMOND BEACH	20304	6TH AV NW	3	DOUGLAS FIR	5	35	POOR	REMOVAL 2
RICHMOND BEACH	20304	8TH AV NW	2	DOUGLAS FIR	7	35	POOR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	5	WATER BIRCH	2	15	POOR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	14	WHITE BIRCH	3	30	FAIR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	2	ENGLISH HOLLY	1	12	FAIR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	1	OTHER	2	8	FAIR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	7	BITTER CHERRY	3	25	FAIR	REMOVAL 2
RICHMOND BEACH	20316	8TH AV NW	12	WESTERN RED CEDAR	10	22	DEAD	REMOVAL 2
RICHMOND BEACH	20323	8TH AV NW	2	SITKA ALDER	0	10	POOR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND BEACH	20323	8TH AV NW	3	ENGLISH HOLLY	0	6	POOR	REMOVAL 2
RICHMOND BEACH	20002	FREMONT AV N	10	BIGLEAF MAPLE	0	7	POOR	REMOVAL 2
RICHMOND BEACH	20121	FREMONT AV N	1	WESTERN RED CEDAR	1	5	DEAD	REMOVAL 2
RICHMOND BEACH	20121	FREMONT AV N	2	WESTERN RED CEDAR	1	5	DEAD	REMOVAL 2
RICHMOND BEACH	20121	FREMONT AV N	3	WESTERN RED CEDAR	1	5	DEAD	REMOVAL 2
RICHMOND BEACH	15248	GREENWOOD AV N	1	BLACK HAWTHORN	11	16	POOR	REMOVAL 2
RICHMOND BEACH	MED	N 149TH ST	16	JAPANESE DOGWOOD	1	9	POOR	REMOVAL 2
RICHMOND BEACH	1205	NW 191ST ST	1	JAPANESE MAPLE	3	7	CRITICAL	REMOVAL 2
RICHMOND BEACH	1047	NW 197TH PL	3	CRAPPLE SSP.	5	6	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	17327	1ST AV NW	1	SASKATOON	7	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	17346	1ST AV NW	1	PURPLE-LEAF PLUM	11	6	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18537	1ST AV NW	1	ONE-SEED HAWTHORN	7	13	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18537	1ST AV NW	2	ONE-SEED HAWTHORN	7	13	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18537	1ST AV NW	3	CRAPPLE SSP.	10	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18547	1ST AV NW	12	ONE-SEED HAWTHORN	8	13	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18547	1ST AV NW	7	ENGLISH HOLLY	0	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18548	1ST AV NW	1	ONE-SEED HAWTHORN	7	6	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18554	1ST AV NW	4	SASKATOON	1	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18554	1ST AV NW	3	ONE-SEED HAWTHORN	8	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18554	1ST AV NW	5	HAWTHORN SSP.	7	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18005	3RD AV NW	2	EUROPEAN MOUNTAINASH	8	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18206	3RD AV NW	6	JAPANESE MAPLE	2	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18206	3RD AV NW	5	DOUGLAS FIR	3	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18206	3RD AV NW	2	WESTERN RED CEDAR	1	8	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18206	3RD AV NW	3	WESTERN RED CEDAR	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18206	3RD AV NW	4	WESTERN RED CEDAR	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17841	4TH AV NW	3	SHORE PINE	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17845	5TH AV NW	14	AMERICAN ARBORVITAE	2	6	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	17830	6TH AV NW	1	RED ALDER	6	18	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	18300	6TH AV NW	6	ENGLISH HOLLY	1	8	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	8	BIGLEAF MAPLE	9	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	14	ENGLISH HOLLY	3	17	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	20	GOLDENCHAIN TREE	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	3	GOLDENCHAIN TREE	2	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	1	GOLDENCHAIN TREE	3	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18306	6TH AV NW	9	GOLDENCHAIN TREE	11	17	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17616	DAYTON AV N	2	DOUGLAS FIR	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17616	DAYTON AV N	1	DOUGLAS FIR	2	15	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	17916	DAYTON AV N	1	DOUGLAS FIR	3	15	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	17916	DAYTON AV N	2	WESTERN RED CEDAR	2	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	19915	DAYTON AV N	3	DOUGLAS FIR	6	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18303	DAYTON PL N	1	DOUGLAS FIR	1	7	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18345	DAYTON PL N	2	DOUGLAS FIR	8	30	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18334	EVANSTON AV N	1	ENGLISH HOLLY	1	6	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18350	EVANSTON AV N	1	GOLDENCHAIN TREE	10	24	POOR	REMOVAL 2
RICHMOND HIGHLANDS	16554	FREMONT AV N	5	PRUNUS SPECIES	2	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	16554	FREMONT AV N	9	PRUNUS SPECIES	2	9	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17546	FREMONT AV N	2	HORSE CHESTNUT	3	12	FAIR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	17803	FREMONT AV N	8	COLORADO BLUE SPRUCE	1	5	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	17925	FREMONT AV N	1	DOUGLAS FIR	18	30	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17925	FREMONT AV N	2	DOUGLAS FIR	18	30	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17934	FREMONT AV N	2	ENGLISH HOLLY	1	7	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	3	WATER BIRCH	0	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	5	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	6	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	7	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	8	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	9	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	10	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	11	WATER BIRCH	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	17263	GREENWOOD PL N	1	COLORADO BLUE SPRUCE	4	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	6	JAPANESE FLOWERING C	6	20	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	7	DOUGLAS FIR	1	17	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	15	DOUGLAS FIR	2	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	8	JAPANESE TREE LILAC:	1	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	9	WESTERN RED CEDAR	3	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	17965	LINDEN AV N	11	WESTERN RED CEDAR	4	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18028	LINDEN AV N	2	DOUGLAS FIR	2	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18200	LINDEN AV N	58	ONE-SEED HAWTHORN	3	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	18200	LINDEN AV N	57	AMERICAN ARBORVITAE	1	4	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18200	LINDEN AV N	76	AMERICAN ARBORVITAE	1	10	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	18200	LINDEN AV N	65	AMERICAN ARBORVITAE	2	10	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	18200	LINDEN AV N	54	AMERICAN ARBORVITAE	12	16	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18405	LINDEN AV N	3	WESTERN RED CEDAR	4	20	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	760	N 165TH ST	6	JUNIPER SPECIES	0	4	POOR	REMOVAL 2
RICHMOND HIGHLANDS	760	N 165TH ST	7	JUNIPER SPECIES	0	4	POOR	REMOVAL 2
RICHMOND HIGHLANDS	760	N 165TH ST	2	JUNIPER SPECIES	1	6	POOR	REMOVAL 2
RICHMOND HIGHLANDS	760	N 165TH ST	1	JUNIPER SPECIES	2	7	POOR	REMOVAL 2
RICHMOND HIGHLANDS	760	N 165TH ST	5	JUNIPER SPECIES	2	7	POOR	REMOVAL 2
RICHMOND HIGHLANDS	266	N 171ST ST	1	.WESTERN HEMLOCK	4	17	POOR	REMOVAL 2
RICHMOND HIGHLANDS	250	N 172ND PL	3	EUROPEAN MOUNTAINASH	4	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	11	EUROPEAN MOUNTAINASH	15	15	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	16	WESTERN RED CEDAR	2	22	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	18	WESTERN RED CEDAR	2	22	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	17	WESTERN RED CEDAR	4	35	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	14	WESTERN RED CEDAR	5	30	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 175TH ST	2	WESTERN RED CEDAR	6	35	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	120	N 175TH ST	2	WHITE PINE	3	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	120	N 175TH ST	1	DOUGLAS FIR	3	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	507	N 178TH CT	8	OTHER	2	17	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	508	N 178TH CT	1	ENGLISH HOLLY	1	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 178TH ST	13	TREE OF HEAVEN	10	15	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	700	N 178TH ST	9	SERVICEBERRY SSP.	2	10	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	700	N 178TH ST	8	FLOWERING DOGWOOD	2	10	DEAD	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	700	N 178TH ST	10	.WESTERN HEMLOCK	7	20	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	13	DOUGLAS FIR	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	14	DOUGLAS FIR	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	17	DOUGLAS FIR	2	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	19	DOUGLAS FIR	3	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	1	DOUGLAS FIR	5	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	15	DOUGLAS FIR	5	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	16	DOUGLAS FIR	5	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	18	DOUGLAS FIR	5	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	729	N 178TH ST	20	DOUGLAS FIR	5	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	505	N 179TH PL	1	PURPLE-LEAF PLUM	8	6	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	505	N 179TH PL	2	PURPLE-LEAF PLUM	8	6	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	531	N 183RD ST	7	ENGLISH HOLLY	1	11	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	N 184TH ST	4	PINE SP.	3	60	POOR	REMOVAL 2
RICHMOND HIGHLANDS	702	N 184TH ST	3	GOLDENCHAIN TREE	8	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	556	N 185TH PL	1	SHORE PINE	10	24	POOR	REMOVAL 2
RICHMOND HIGHLANDS	105	N 185TH ST	1	OTHER	1	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 185TH ST	1	NORWAY MAPLE	2	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 185TH ST	2	NORWAY MAPLE	2	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 185TH ST	3	NORWAY MAPLE	3	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	305	N 188TH ST	1	PACIFIC CRABAPPLE	4	25	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	310	N 188TH ST	4	NORWAY MAPLE	1	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	310	N 188TH ST	3	DOUGLAS FIR	1	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	521	N 188TH ST	4	DOUGLAS FIR	1	5	POOR	REMOVAL 2
RICHMOND HIGHLANDS	706	N 188TH ST	3	DOUGLAS FIR	0	1	POOR	REMOVAL 2
RICHMOND HIGHLANDS	707	N 188TH ST	2	.WESTERN HEMLOCK	2	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 188TH ST	1	ENGLISH HOLLY	2	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 188TH ST	2	DOUGLAS FIR	2	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	411	N 190TH ST	2	ENGLISH HOLLY	3	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	411	N 190TH ST	4	WESTERN RED CEDAR	3	17	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	429	N 190TH ST	1	WESTERN RED CEDAR	1	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	127	N 193RD ST	3	JAPANESE FLOWERING C	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	127	N 193RD ST	4	JAPANESE FLOWERING C	0	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	734	N 193RD ST	1	EUROPEAN MOUNTAINASH	10	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	735	N 193RD ST	12	DOUGLAS FIR	3	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	8	AMABILS/PAC SIL FIR	1	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	10	AMABILS/PAC SIL FIR	3	30	POOR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	3	DOUGLAS FIR	1	17	POOR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	5	DOUGLAS FIR	1	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	7	DOUGLAS FIR	1	16	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	2	DOUGLAS FIR	2	20	POOR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	9	DOUGLAS FIR	2	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	4	DOUGLAS FIR	4	31	POOR	REMOVAL 2
RICHMOND HIGHLANDS	100	N 195TH ST	6	DOUGLAS FIR	5	30	POOR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	14	MADRONE	2	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	4	OTHER	4	10	DEAD	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	205	N 195TH ST	15	DOUGLAS FIR	2	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	13	DOUGLAS FIR	3	17	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	11	.WESTERN HEMLOCK	1	10	POOR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	16	.WESTERN HEMLOCK	2	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	205	N 195TH ST	17	.WESTERN HEMLOCK	2	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	10	NORWAY MAPLE	4	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	8	MADRONE	7	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	2	GOLDENCHAIN TREE	1	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	3	GOLDENCHAIN TREE	1	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	5	OTHER	3	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	1	BITTER CHERRY	7	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	210	N 195TH ST	9	DOUGLAS FIR	2	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	705	N 195TH ST	3	PACIFIC YEW	3	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	712	N 195TH ST	5	GOLDENCHAIN TREE	3	17	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	712	N 195TH ST	2	DOUGLAS FIR	1	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	923	N 195TH ST	19	ENGLISH HOLLY	2	16	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	923	N 195TH ST	2	GOLDENCHAIN TREE	2	15	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	923	N 195TH ST	3	WHITE PINE	1	14	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	923	N 195TH ST	4	WHITE PINE	1	9	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	923	N 195TH ST	23	DOUGLAS FIR	1	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	507	N 197TH CT	1	DOUGLAS FIR	0	6	POOR	REMOVAL 2
RICHMOND HIGHLANDS	507	N 197TH CT	4	EUROPEAN MOUNTAINASH	3	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	12	DOUGLAS FIR	7	25	POOR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	23	WESTERN RED CEDAR	1	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	21	WESTERN RED CEDAR	2	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	11	WESTERN RED CEDAR	3	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	13	WESTERN RED CEDAR	3	36	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	15	WESTERN RED CEDAR	3	25	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	6	WESTERN RED CEDAR	5	38	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	916	N 199TH ST	18	WESTERN RED CEDAR	5	22	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	940	N 199TH ST	5	OTHER	4	17	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	715	N 200TH ST	1	DOUGLAS FIR	1	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	908	N 200TH ST	2	WESTERN RED CEDAR	3	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	914	N 200TH ST	1	WATER BIRCH	6	14	POOR	REMOVAL 2
RICHMOND HIGHLANDS	928	N 200TH ST	5	OTHER	2	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	11	THINLEAF ALDER	4	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	8	WHITE BIRCH	5	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	9	OTHER	5	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	12	OTHER	5	20	POOR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	13	OTHER	5	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	10	FREMONT COTTONWOOD	3	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	14	WESTERN RED CEDAR	2	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	6	WESTERN RED CEDAR	3	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	15	WESTERN RED CEDAR	3	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	700	N 202ND ST	16	WESTERN RED CEDAR	6	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	721	N 202ND ST	10	THINLEAF ALDER	2	10	FAIR	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	721	N 202ND ST	7	ENGLISH HOLLY	3	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	610	N 203RD CT	1	ENGLISH HOLLY	5	7	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	153	N 203RD ST	2	MADRONE	7	25	POOR	REMOVAL 2
RICHMOND HIGHLANDS	153	N 203RD ST	1	DOUGLAS FIR	3	25	POOR	REMOVAL 2
RICHMOND HIGHLANDS	158	N 203RD ST	10	BIGLEAF MAPLE	4	25	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	135	NW 171ST ST	3	DOUGLAS FIR	3	25	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	200	NW 175TH ST	7	GOLDENCHAIN TREE	1	13	POOR	REMOVAL 2
RICHMOND HIGHLANDS	200	NW 175TH ST	3	GOLDENCHAIN TREE	2	14	POOR	REMOVAL 2
RICHMOND HIGHLANDS	200	NW 175TH ST	2	GOLDENCHAIN TREE	3	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	328	NW 175TH ST	1	DOUGLAS FIR	7	16	POOR	REMOVAL 2
RICHMOND HIGHLANDS	346	NW 175TH ST	1	PINE SP.	2	12	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	9	SITKA ALDER	4	16	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	7	ENGLISH HOLLY	0	6	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	5	ENGLISH HOLLY	1	8	POOR	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	11	ENGLISH HOLLY	1	7	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	10	DOUGLAS FIR	2	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	12	DOUGLAS FIR	2	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	229	NW 177TH ST	15	DOUGLAS FIR	2	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	305	NW 177TH ST	6	DOUGLAS FIR	2	21	POOR	REMOVAL 2
RICHMOND HIGHLANDS	324	NW 177TH ST	2	PURPLE-LEAF PLUM	10	13	POOR	REMOVAL 2
RICHMOND HIGHLANDS	621	NW 178TH PL	3	WHITE PINE	12	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	634	NW 178TH PL	15	DOUGLAS FIR	2	7	POOR	REMOVAL 2
RICHMOND HIGHLANDS	643	NW 178TH PL	3	MOUNTAIN HEMLOCK	3	18	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	105	NW 178TH ST	3	ENGLISH HOLLY	3	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	106	NW 178TH ST	3	DOUGLAS FIR	2	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	615	NW 180TH ST	1	WESTERN RED CEDAR	6	20	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	631	NW 180TH ST	2	DOUGLAS FIR	10	30	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	154	NW 183RD ST	6	AMABILS/PAC SIL FIR	3	20	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	154	NW 183RD ST	12	NORWAY MAPLE	6	8	POOR	REMOVAL 2
RICHMOND HIGHLANDS	154	NW 183RD ST	4	EUROPEAN MOUNTAINASH	4	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	305	NW 183RD ST	1	PINE SP.	4	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	317	NW 185TH ST	4	GOLDENCHAIN TREE	2	12	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	317	NW 185TH ST	1	CHERRYLAUREL	7	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	615	NW 185TH ST	2	GOLDENCHAIN TREE	1	11	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	103	NW 188TH ST	1	BITTER CHERRY	4	27	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	117	NW 188TH ST	1	JAPANESE FLOWERING C	11	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	117	NW 188TH ST	2	JAPANESE FLOWERING C	11	15	POOR	REMOVAL 2
RICHMOND HIGHLANDS	117	NW 188TH ST	3	JAPANESE FLOWERING C	13	17	POOR	REMOVAL 2
RICHMOND HIGHLANDS	103	NW 189TH ST	1	HAWTHORN SSP.	6	20	POOR	REMOVAL 2
RICHMOND HIGHLANDS	103	NW 189TH ST	2	HAWTHORN SSP.	7	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	104	NW 189TH ST	1	WEST. DOGWOOD	3	20	POOR	REMOVAL 2
RICHMOND HIGHLANDS	104	NW 189TH ST	2	COLORADO BLUE SPRUCE	13	27	POOR	REMOVAL 2
RICHMOND HIGHLANDS	204	NW 195TH ST	1	WILLOW SPP.	3	22	CRITICAL	REMOVAL 2
RICHMOND HIGHLANDS	655	NW 195TH ST	3	BLACK WALNUT	2	17	POOR	REMOVAL 2
RICHMOND HIGHLANDS	655	NW 195TH ST	10	PINE SP.	2	8	DEAD	REMOVAL 2
RICHMOND HIGHLANDS	655	NW 195TH ST	11	PINE SP.	2	8	DEAD	REMOVAL 2

AREA	ADDR_NO	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RICHMOND HIGHLANDS	655	NW 195TH ST	4	DOUGLAS FIR	3	19	POOR	REMOVAL 2
RICHMOND HIGHLANDS	655	NW 195TH ST	8	WESTERN RED CEDAR	2	15	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	204	NW 200TH ST	1	WESTERN RED CEDAR	4	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	235	NW 200TH ST	1	DOUGLAS FIR	4	11	POOR	REMOVAL 2
RICHMOND HIGHLANDS	213	NW 203RD ST	3	OTHER	2	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	213	NW 203RD ST	4	OTHER	3	19	POOR	REMOVAL 2
RICHMOND HIGHLANDS	213	NW 203RD ST	2	OTHER	6	10	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	302	NW 203RD ST	9	JAPANESE MAPLE	2	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	302	NW 203RD ST	10	JAPANESE MAPLE	2	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	302	NW 203RD ST	11	JAPANESE MAPLE	2	18	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	302	NW 203RD ST	13	JAPANESE MAPLE	4	21	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	302	NW 203RD ST	18	MADRONE	5	13	FAIR	REMOVAL 2
RICHMOND HIGHLANDS	311	NW 203RD ST	7	OTHER	6	18	POOR	REMOVAL 2
RICHMOND HIGHLANDS	533	NW 205TH ST	1	DOUGLAS FIR	2	16	POOR	REMOVAL 2
RICHMOND HIGHLANDS	541	NW 205TH ST	6	DOUGLAS FIR	5	30	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18020	PALATINE AV N	1	BITTER CHERRY	2	12	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18505	PALATINE PL N	6	HAWTHORN SSP.	2	22	POOR	REMOVAL 2
RICHMOND HIGHLANDS	18521	PALATINE PL N	1	ENGLISH HOLLY	0	5	POOR	REMOVAL 2
RICHMOND HIGHLANDS	16717	WHITMAN AV N	3	PURPLE-LEAF PLUM	5	13	POOR	REMOVAL 2
RIDGECREST	15504	11TH AV NE	2	BIGLEAF MAPLE	3	15	POOR	REMOVAL 2
RIDGECREST	16018	11TH AV NE	1	JAPANESE MAPLE	4	8	DEAD	REMOVAL 2
RIDGECREST	17003	13TH AV NE	2	PRUNUS SPECIES	3	6	POOR	REMOVAL 2
RIDGECREST	17019	13TH AV NE	3	PRUNUS SPECIES	7	10	POOR	REMOVAL 2
RIDGECREST	17228	4TH AV NE	2	PRUNUS SPECIES	1	6	DEAD	REMOVAL 2
RIDGECREST	15705	5TH AV NE	1	SUGAR MAPLE	1	5	POOR	REMOVAL 2
RIDGECREST	15551	8TH AV NE	1	PRUNUS SPECIES	5	6	DEAD	REMOVAL 2
RIDGECREST	133	NE 159TH ST	1	STAGHORN SUMAC	8	9	DEAD	REMOVAL 2
RIDGECREST	345	NE 161ST ST	2	WHITE BIRCH	1	7	DEAD	REMOVAL 2
RIDGECREST	1499	NE 170TH ST	3	WESTERN RED CEDAR	3	6	DEAD	REMOVAL 2
RIDGECREST	228	NE 174TH ST	1	PRUNUS SPECIES	4	6	DEAD	REMOVAL 2

Description of Street trees designated Priority Prune 1.

AREA	ADDR_No	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
BALLINGER	19800	14TH AV NE	3	RED ALDER	9	32	FAIR	PRIORITY 1
BALLINGER	19800	14TH AV NE	2	RED ALDER	10	29	FAIR	PRIORITY 1
BALLINGER	19522	12TH AV NE	1	RED ALDER	17	58	FAIR	PRIORITY 1
BRIARCREST	16333	25TH PL NE	1	RED ALDER	18	16	FAIR	PRIORITY 1
BRIARCREST	15504	27TH AV NE	1	RED ALDER	28	25	FAIR	PRIORITY 1
BRIARCREST	1703	NE 150TH ST	1	PACIFIC MADRONE	35	25	POOR	PRIORITY 1
HILLWOOD	14810	LINDEN AV N	3	BIGLEAF MAPLE	56	67	POOR	PRIORITY 1
HILLWOOD	14531	DAYTON AV N	8	DOUGLAS FIR	40	86	POOR	PRIORITY 1
HILLWOOD	14509	EVANSTON AV N	2	BLACK LOCUST	19	65	POOR	PRIORITY 1
MERIDAIN PARK	18302	ASHWORTH AV N	1	WHITE PINE	22	45	POOR	PRIORITY 1
MERIDAIN PARK	1312	N 180TH ST	1	WHITE PINE	31	43	POOR	PRIORITY 1
MERIDAIN PARK	1121	N 180TH ST	3	PURPLE-LEAF PLUM	10	16	POOR	PRIORITY 1
MERIDAIN PARK	18016	STONE AV N	2	DOUGLAS FIR	30	79	FAIR	PRIORITY 1
MERIDAIN PARK	1430	N 160TH ST	1	DOUGLAS FIR	46	83	POOR	PRIORITY 1
MERIDAIN PARK	17077	MERIDIAN AV N	15	RED OAK	21	42	FAIR	PRIORITY 1
MERIDAIN PARK	1222	N 171ST ST	1	BLACK LOCUST	32	62	POOR	PRIORITY 1
MERIDAIN PARK	1801	N 183RD ST	5	SIBERIAN ELM	14	31	POOR	PRIORITY 1
NORTH CITY	1041	PERKINS WY NE	13	MADRONE	10	37	POOR	PRIORITY 1
NORTH CITY	1115	PERKINS WY NE	3	MADRONE	23	45	FAIR	PRIORITY 1
NORTH CITY	1227	180TH ST NE	2	MADRONE	26	32	POOR	PRIORITY 1
NORTH CITY	17807	8TH AV NE	3	BLACK COTTONWOOD	19	85	FAIR	PRIORITY 1
NORTH CITY	18626	16TH AV NE	1	ROWAN TREE	26	12	FAIR	PRIORITY 1
NORTH CITY	903	SERPENTINE	8	SIBERIAN ELM	24	65	FAIR	PRIORITY 1

		PL NE						
PARKWOOD	2165	N 155TH ST	9	OREGON CRAB APPLE	10	14	POOR	PRIORITY 1
PARKWOOD	2122	N 150TH ST	2	CHOKE CHERRY	10	18	POOR	PRIORITY 1
PARKWOOD	1358	N 150TH ST	4	DOUGLAS FIR	26	74	FAIR	PRIORITY 1
PARKWOOD	1358	N 152ND ST	8	DOUGLAS FIR	34	87	FAIR	PRIORITY 1
PARKWOOD	1350	N 150TH ST	1	DOUGLAS FIR	38	82	POOR	PRIORITY 1
PARKWOOD	14528	WALLINGFOR D AV N	5	DOUGLAS FIR	38	84	FAIR	PRIORITY 1
PARKWOOD	15005	WALLINGFOR D AV N	2	DOUGLAS FIR	40	76	POOR	PRIORITY 1
PARKWOOD	15221	ASHWORTH AV N	3	DOUGLAS FIR	40	83	FAIR	PRIORITY 1
PARKWOOD	15526	WALLINGFOR D AV N	2	DOUGLAS FIR	44	90	FAIR	PRIORITY 1
PARKWOOD	2351	N 148TH ST	1	WESTERN RED CEDAR	19	60	FAIR	PRIORITY 1
PARKWOOD	15005	WALLINGFOR D AV N	1	WESTERN HEMLOCK	30	70	POOR	PRIORITY 1
RICHMOND BEACH	16100	LINDEN AV N	3	WHITE HIMA. BIRCH	14	43	POOR	PRIORITY 1
RICHMOND BEACH	MED	N 149TH ST	13	WHITE PINE	48	77	FAIR	PRIORITY 1
RICHMOND BEACH	19604	11TH AV NW	2	PURPLE-LEAF PLUM	11	8	POOR	PRIORITY 1
RICHMOND BEACH	16343	LINDEN AV N	2	DOUGLAS FIR	30	65	FAIR	PRIORITY 1
RICHMOND HIGHLANDS	328	NW RICHMOND BCH RD	1	NORWAY MAPLE	25	40	FAIR	PRIORITY 1
RICHMOND HIGHLANDS	17841	4TH AV NW	2	WESTERN LARCH	18	40	POOR	PRIORITY 1
RICHMOND HIGHLANDS	18006	3RD AV NW	1	WESTERN LARCH	25	35	FAIR	PRIORITY 1
RICHMOND HIGHLANDS	105	NW 178TH ST	1	SHORE PINE	15	30	POOR	PRIORITY 1
RICHMOND HIGHLANDS	18025	FREMONT AV N	2	DOUGLAS FIR	25	65	POOR	PRIORITY 1
RIDGECREST	17059	3RD AV NE	1	NORWAY MAPLE	21	22	FAIR	PRIORITY 1
RIDGECREST	16756	5TH AV NE	2	RED MAPLE	23	61	FAIR	PRIORITY 1
RIDGECREST	17047	3RD AV NE	1	NORWAY MAPLE	27	27	FAIR	PRIORITY 1
RIDGECREST	1121	NE 158TH ST	1	AUSTRIAN PINE	12	15	FAIR	PRIORITY 1
RIDGECREST	16012	12TH AV NE	1	BLACK LOCUST	24	25	FAIR	PRIORITY 1
RIDGECREST	1410	NE 158TH ST	2	ROWAN TREE	26	20	POOR	PRIORITY 1
RIDGECREST	17001	1ST AV NE	3	ROWAN TREE	33	28	FAIR	PRIORITY 1

Description of Street trees designated Priority Prune 2.

AREA	ADDR_No	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
BALLINGER	1003	196TH ST NE	9	RED ALDER	4	29	FAIR	PRIORITY 2
BALLINGER	1003	196TH ST NE	8	RED ALDER	14	70	FAIR	PRIORITY 2
BALLINGER	19800	14TH AV NE	9	MAGNOLIA SSP.	4	12	FAIR	PRIORITY 2
BALLINGER	20037	15TH AV NE	8	BITTER CHERRY	16	22	POOR	PRIORITY 2
BRIARCREST	15504	27TH AV NE	3	RED ALDER	13	25	FAIR	PRIORITY 2
BRIARCREST	14500	15TH AV NE	2	WHITE PINE	28	35	FAIR	PRIORITY 2
BRIARCREST	14724	15TH AV NE	1	PONDEROSA PINE	30	40	POOR	PRIORITY 2
BRIARCREST	1530	NE 146TH ST	1	ROWAN TREE	30	20	FAIR	PRIORITY 2
BRIARCREST	1703	NE 150TH ST	7	WESTERN RED CEDAR	26	40	FAIR	PRIORITY 2
BRIARCREST	16022	28TH AV NE	3	SIBERIAN ELM	27	35	FAIR	PRIORITY 2
BRIARCREST	16022	28TH AV NE	1	SIBERIAN ELM	30	35	FAIR	PRIORITY 2
HILLWOOD	343	NW 201ST PL	1	EDIBLE APPLE	4	10	POOR	PRIORITY 2
HILLWOOD	343	NW 201ST PL	2	EDIBLE APPLE	7	10	POOR	PRIORITY 2
HILLWOOD	19305	FIRLANDS WY N	1	DOUGLAS FIR	20	30	FAIR	PRIORITY 2
HILLWOOD	19305	FIRLANDS WY N	2	DOUGLAS FIR	20	30	FAIR	PRIORITY 2
HILLWOOD	709	N 150TH ST	5	DOUGLAS FIR	20	69	FAIR	PRIORITY 2
HILLWOOD	500	N 149TH ST	4	DOUGLAS FIR	24	72	POOR	PRIORITY 2
HILLWOOD	709	N 150TH ST	1	DOUGLAS FIR	26	84	POOR	PRIORITY 2
HILLWOOD	902	N 149TH ST	1	DOUGLAS FIR	34	87	FAIR	PRIORITY 2
HILLWOOD	14810	LINDEN AV N	2	DOUGLAS FIR	38	82	FAIR	PRIORITY 2
HILLWOOD	14515	DAYTON AV N	1	DOUGLAS FIR	40	86	FAIR	PRIORITY 2

AREA	ADDR_No	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
HILLWOOD	14822	LINDEN AV N	1	DOUGLAS FIR	40	90	POOR	PRIORITY 2
HILLWOOD	902	N 149TH ST	1	DOUGLAS FIR	54	91	POOR	PRIORITY 2
HILLWOOD	500	N 149TH ST	3	4 ALL FICTIOUS ADRES	50	75	FAIR	PRIORITY 2
MERIDAIN PARK	16727	MERIDIAN AV N	1	RED MAPLE	11	32	POOR	PRIORITY 2
MERIDAIN PARK	16441	MERIDIAN AV N	1	RED MAPLE	15	36	FAIR	PRIORITY 2
MERIDAIN PARK	18055	STONE AV N	3	BIGLEAF MAPLE	29	42	POOR	PRIORITY 2
MERIDAIN PARK	2130	N 178TH ST	5	PACIFIC MADRONE	11	33	POOR	PRIORITY 2
MERIDAIN PARK	1841	N 183RD ST	1	COLORADO BLUE SPRUCE	20	57	FAIR	PRIORITY 2
MERIDAIN PARK	1143	N 165TH ST	1	COLORADO BLUE SPRUCE	20	50	FAIR	PRIORITY 2
MERIDAIN PARK	1358	N 167TH ST	4	WHITE PINE	13	56	FAIR	PRIORITY 2
MERIDAIN PARK	16029	MERIDIAN AV N	1	WESTERN SYCAMORE	16	41	FAIR	PRIORITY 2
MERIDAIN PARK	1334	N 178TH ST	4	CHERRY SSP.	15	35	FAIR	PRIORITY 2
MERIDAIN PARK	1225	N 178TH ST	3	DOUGLAS FIR	13	46	FAIR	PRIORITY 2
MERIDAIN PARK	1358	N 167TH ST	6	DOUGLAS FIR	13	61	FAIR	PRIORITY 2
MERIDAIN PARK	1358	N 167TH ST	5	DOUGLAS FIR	14	61	FAIR	PRIORITY 2
MERIDAIN PARK	1358	N 167TH ST	2	DOUGLAS FIR	17	60	FAIR	PRIORITY 2
MERIDAIN PARK	1358	N 167TH ST	1	DOUGLAS FIR	18	61	POOR	PRIORITY 2
MERIDAIN PARK	1336	N 180TH ST	2	DOUGLAS FIR	23	71	FAIR	PRIORITY 2
MERIDAIN PARK	2343	N 178TH ST	2	DOUGLAS FIR	24	73	FAIR	PRIORITY 2
MERIDAIN PARK	17920	STONE AV N	5	DOUGLAS FIR	24	71	FAIR	PRIORITY 2
MERIDAIN PARK	1851	N 183RD ST	3	DOUGLAS FIR	25	69	POOR	PRIORITY 2
MERIDAIN PARK	1225	N 178TH ST	1	DOUGLAS FIR	25	59	FAIR	PRIORITY 2
MERIDAIN PARK	2162	N 178TH ST	1	DOUGLAS FIR	25	64	FAIR	PRIORITY 2
MERIDAIN PARK	1851	N 183RD ST	2	DOUGLAS FIR	27	69	FAIR	PRIORITY 2
MERIDAIN PARK	17526	WALLINGFORD AV N	2	DOUGLAS FIR	27	74	POOR	PRIORITY 2
MERIDAIN PARK	1147	N 180TH ST	1	DOUGLAS FIR	30	71	FAIR	PRIORITY 2
MERIDAIN PARK	1207	N 161ST ST	1	DOUGLAS FIR	30	71	POOR	PRIORITY 2
MERIDAIN PARK	18016	STONE AV N	1	DOUGLAS FIR	31	82	FAIR	PRIORITY 2
MERIDAIN PARK	18353	ASHWORTH AV N	1	DOUGLAS FIR	31	79	FAIR	PRIORITY 2
MERIDAIN PARK	1851	N 183RD ST	1	DOUGLAS FIR	32	71	FAIR	PRIORITY 2
MERIDAIN PARK	17526	WALLINGFORD AV N	1	DOUGLAS FIR	32	76	FAIR	PRIORITY 2
MERIDAIN PARK	17550	WALLINGFORD AV N	1	DOUGLAS FIR	33	82	POOR	PRIORITY 2
MERIDAIN PARK	18016	STONE AV N	3	DOUGLAS FIR	34	81	FAIR	PRIORITY 2
MERIDAIN PARK	18338	WALLINGFORD AV N	1	DOUGLAS FIR	41	82	FAIR	PRIORITY 2
MERIDAIN PARK	1802	N 183RD ST	1	DOUGLAS FIR	43	84	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	3	RED OAK	12	37	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	1	RED OAK	13	32	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	4	RED OAK	14	36	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	19	RED OAK	16	40	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	13	RED OAK	19	41	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	24	RED OAK	19	39	FAIR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	11	RED OAK	20	33	POOR	PRIORITY 2
MERIDAIN PARK	17077	MERIDIAN AV N	23	RED OAK	20	36	POOR	PRIORITY 2
MERIDAIN PARK	17854	ASHWORTH AV N	1	BLACK LOCUST	13	57	FAIR	PRIORITY 2
MERIDAIN PARK	1601	N 183RD ST	1	BLACK LOCUST	30	41	FAIR	PRIORITY 2
NORTH CITY	1828	NE SERPENTINE PL	3	BIGLEAF MAPLE	22	30	FAIR	PRIORITY 2
NORTH CITY	1828	NE SERPENTINE PL	2	BIGLEAF MAPLE	26	30	FAIR	PRIORITY 2
NORTH CITY	18764	18TH AV NE	4	RED ALDER	9	14	POOR	PRIORITY 2
NORTH CITY	550	185TH ST NE	11	LONDON PLANE	7	19	POOR	PRIORITY 2
NORTH CITY	18023	5TH AV NE	1	DOUGLAS FIR	13	38	POOR	PRIORITY 2
NORTH CITY	1813	NE 169TH ST	1	BLACK LOCUST	24	28	FAIR	PRIORITY 2
NORTH CITY	802	SERPENTINE PL NE	9	ROWAN TREE	7	27	POOR	PRIORITY 2
NORTH CITY	18921	8TH AV NE	1	ROWAN TREE	17	24	FAIR	PRIORITY 2
NORTH CITY	809	180TH ST NE	5	.WESTERN HEMLOCK	22	27	POOR	PRIORITY 2
PARKWOOD	1815	N 155TH ST	1	NORWAY MAPLE	18	38	POOR	PRIORITY 2
PARKWOOD	1817	N 155TH ST	5	SWEETGUM	17	40	POOR	PRIORITY 2
PARKWOOD	1815	N 155TH ST	3	SWEETGUM	18	60	FAIR	PRIORITY 2
PARKWOOD	2165	N 155TH ST	8	OREGON CRAB APPLE	8	18	POOR	PRIORITY 2
PARKWOOD	15135	STONE LN N	23	CHERRY SSP.	19	56	POOR	PRIORITY 2
PARKWOOD	15213	ASHWORTH AV N	1	DOUGLAS FIR	18	75	FAIR	PRIORITY 2
PARKWOOD	1358	N 152ND ST	9	DOUGLAS FIR	18	73	FAIR	PRIORITY 2
PARKWOOD	1358	N 150TH ST	3	DOUGLAS FIR	22	77	FAIR	PRIORITY 2
PARKWOOD	15213	ASHWORTH AV N	2	DOUGLAS FIR	22	77	FAIR	PRIORITY 2
PARKWOOD	15213	ASHWORTH AV N	3	DOUGLAS FIR	22	74	FAIR	PRIORITY 2
PARKWOOD	1210	N 152ND ST	3	DOUGLAS FIR	22	72	FAIR	PRIORITY 2
PARKWOOD	1358	N 152ND ST	7	DOUGLAS FIR	22	81	POOR	PRIORITY 2

AREA	ADDR_No	STREET	TREE_ CELL	COMM_NAME	DBH	HT	COND	MAINT
PARKWOOD	14813	INTERLAKE AV N	2	DOUGLAS FIR	24	78	FAIR	PRIORITY 2
PARKWOOD	1358	N 152ND ST	11	DOUGLAS FIR	24	67	FAIR	PRIORITY 2
PARKWOOD	15004	WALLINGFORD AV N	4	DOUGLAS FIR	29	77	FAIR	PRIORITY 2
PARKWOOD	15004	WALLINGFORD AV N	3	DOUGLAS FIR	30	80	FAIR	PRIORITY 2
PARKWOOD	15526	WALLINGFORD AV N	1	DOUGLAS FIR	32	85	FAIR	PRIORITY 2
PARKWOOD	15520	BURKE AV N	3	DOUGLAS FIR	34	75	FAIR	PRIORITY 2
PARKWOOD	1358	N 152ND ST	10	DOUGLAS FIR	38	86	FAIR	PRIORITY 2
PARKWOOD	15228	MERIDIAN AV N	11	RED OAK	12	39	FAIR	PRIORITY 2
PARKWOOD	15228	MERIDIAN AV N	2	RED OAK	14	55	POOR	PRIORITY 2
PARKWOOD	15228	MERIDIAN AV N	10	RED OAK	19	57	FAIR	PRIORITY 2
PARKWOOD	15228	MERIDIAN AV N	1	RED OAK	29	60	FAIR	PRIORITY 2
PARKWOOD	2165	N 155TH ST	11	BLACK LOCUST	14	56	POOR	PRIORITY 2
PARKWOOD	2165	N 155TH ST	10	BLACK LOCUST	19	56	FAIR	PRIORITY 2
RICHMOND BEACH	20114	RICHMOND BCH DR NW	2	BIGLEAF MAPLE	10	18	FAIR	PRIORITY 2
RICHMOND BEACH	20001	RICHMOND BCH DR NW	1	RED ALDER	15	14	FAIR	PRIORITY 2
RICHMOND BEACH	2008	NW 190TH ST	2	PACIFIC MADRONE	30	28	FAIR	PRIORITY 2
RICHMOND BEACH	MED	N 149TH ST	7	SUBALPINE LARCH	52	76	FAIR	PRIORITY 2
RICHMOND BEACH	508	N GREENWOOD DR	7	WHITE PINE	18	67	GOOD	PRIORITY 2
RICHMOND BEACH	MED	N 149TH ST	12	WHITE PINE	26	75	FAIR	PRIORITY 2
RICHMOND BEACH	MED	N 149TH ST	14	WHITE PINE	35	76	FAIR	PRIORITY 2
RICHMOND BEACH	MED	N 149TH ST	15	WHITE PINE	42	76	FAIR	PRIORITY 2
RICHMOND BEACH	15235	FREMONT AV N	3	DOUGLAS FIR	16	28	POOR	PRIORITY 2
RICHMOND BEACH	MED	N 149TH ST	10	DOUGLAS FIR	32	86	GOOD	PRIORITY 2
RICHMOND BEACH	16006	GREENWOOD AV N	1	DOUGLAS FIR	36	92	POOR	PRIORITY 2
RICHMOND BEACH	319	N 149TH ST	1	DOUGLAS FIR	50	91	GOOD	PRIORITY 2
RICHMOND BEACH	16310	FREMONT PL N	5	DOUGLAS FIR	52	84	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	101	NW RICHMOND BCH RD	10	NORWAY MAPLE	8	22	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	621	NW 178TH PL	1	NORWAY MAPLE	8	17	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	101	NW RICHMOND BCH RD	8	NORWAY MAPLE	9	25	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	101	NW RICHMOND BCH RD	9	NORWAY MAPLE	9	25	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	250	N 172ND PL	1	BIGLEAF MAPLE	14	20	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	107	NW 185TH ST	3	BIGLEAF MAPLE	17	25	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	733	N 184TH ST	3	BIGLEAF MAPLE	20	45	POOR	PRIORITY 2
RICHMOND HIGHLANDS	634	NW 178TH PL	16	WHITE BIRCH	22	30	POOR	PRIORITY 2
RICHMOND HIGHLANDS	134	N 178TH ST	2	SWEETGUM	10	18	POOR	PRIORITY 2
RICHMOND HIGHLANDS	513	N 169TH ST	2	SITKA SPRUCE	28	68	POOR	PRIORITY 2
RICHMOND HIGHLANDS	134	N 178TH ST	1	SHORE PINE	16	17	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	16535	LINDEN AV N	1	WHITE PINE	46	65	POOR	PRIORITY 2
RICHMOND HIGHLANDS	18318	GREENWOOD AV N	2	DOUGLAS FIR	10	24	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	502	N 169TH ST	5	DOUGLAS FIR	16	76	GOOD	PRIORITY 2
RICHMOND HIGHLANDS	17300	FREMONT AV N	9	DOUGLAS FIR	22	72	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	16756	FREMONT AV N	3	DOUGLAS FIR	22	76	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	17321	EVANSTON AV N	2	DOUGLAS FIR	22	78	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	502	N 169TH ST	1	DOUGLAS FIR	26	82	POOR	PRIORITY 2
RICHMOND HIGHLANDS	805	N 170TH ST	1	DOUGLAS FIR	28	80	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	502	N 169TH ST	4	DOUGLAS FIR	28	80	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	17329	EVANSTON AV N	1	DOUGLAS FIR	33	82	FAIR	PRIORITY 2
RICHMOND HIGHLANDS	17321	EVANSTON AV N	1	DOUGLAS FIR	35	79	POOR	PRIORITY 2
RICHMOND HIGHLANDS	16535	LINDEN AV N	4	DOUGLAS FIR	36	82	GOOD	PRIORITY 2
RICHMOND HIGHLANDS	16759	N PARK AV N	4	DOUGLAS FIR	40	84	GOOD	PRIORITY 2
RICHMOND HIGHLANDS	17321	EVANSTON AV N	3	DOUGLAS FIR	40	85	GOOD	PRIORITY 2
RICHMOND HIGHLANDS	17601	1ST AV NW	1	EUROPEAN MOUNTAINASH	9	22	POOR	PRIORITY 2
RICHMOND HIGHLANDS	17300	FREMONT AV N	8	WESTERN HEMLOCK	18	68	FAIR	PRIORITY 2

AREA	ADDR_No	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RIDGECREST	15502	6TH AV NE	1	MAPLE SPECIES	7	23	FAIR	PRIORITY 2
RIDGECREST	1206	NE 155TH ST	1	MAPLE SPECIES	13	26	POOR	PRIORITY 2
RIDGECREST	1216	NE 155TH ST	1	MAPLE SPECIES	14	27	FAIR	PRIORITY 2
RIDGECREST	1216	NE 155TH ST	3	MAPLE SPECIES	14	28	FAIR	PRIORITY 2
RIDGECREST	16510	5TH AV NE	1	RED MAPLE	16	52	POOR	PRIORITY 2
RIDGECREST	16002	5TH AV NE	1	RED MAPLE	19	49	FAIR	PRIORITY 2
RIDGECREST	17217	2ND AV NE	1	NORWAY MAPLE	21	26	GOOD	PRIORITY 2
RIDGECREST	16751	5TH AV NE	1	RED MAPLE	25	52	FAIR	PRIORITY 2
RIDGECREST	17028	2ND AV NE	1	NORWAY MAPLE	28	32	FAIR	PRIORITY 2
RIDGECREST	16204	10TH AV NE	2	PACIFIC MADRONE	11	12	FAIR	PRIORITY 2
RIDGECREST	17228	4TH AV NE	1	MAINDENHAIR TREE	5	14	FAIR	PRIORITY 2
RIDGECREST	905	NE 147TH ST	2	BLACK COTTONWOOD	18	35	GOOD	PRIORITY 2
RIDGECREST	17019	13TH AV NE	6	PRUNUS SPECIES	14	18	FAIR	PRIORITY 2
RIDGECREST	17210	1ST AV NE	2	RED OAK	17	30	GOOD	PRIORITY 2
RIDGECREST	16018	12TH AV NE	1	BLACK LOCUST	26	25	FAIR	PRIORITY 2
RIDGECREST	199	NE 175TH ST	5	BLACK LOCUST	28	35	GOOD	PRIORITY 2
RIDGECREST	199	NE 175TH ST	6	BLACK LOCUST	30	35	GOOD	PRIORITY 2
RIDGECREST	17205	2ND AV NE	2	BLACK LOCUST	38	40	GOOD	PRIORITY 2
RIDGECREST	17201	15TH AV NE	1	BLACK LOCUST	54	38	GOOD	PRIORITY 2
RIDGECREST	17011	3RD AV NE	2	ROWAN TREE	22	20	FAIR	PRIORITY 2
RIDGECREST	14602	12TH AV NE	1	WESTERN RED CEDAR	32	45	GOOD	PRIORITY 2

Description of Street trees designated for Re-inspection.

AREA	ADDR_No	STREET	TREE_ CELL	COMM_NAME	DBH	HT	COND	MAINT
BRIARCREST	14707	17TH AV NE	1	PACIFIC MADRONE	30	30	FAIR	REINSPECT
ECHO LAKE	1101	N 205TH ST	17	PORT ORFORD CEDAR	5	15	POOR	REINSPECT
ECHO LAKE	1309	N 195TH ST	4	PACIFIC CRABAPPLE	18	25	FAIR	REINSPECT
ECHO LAKE	1101	N 205TH ST	33	COULTER PINE	5	14	GOOD	REINSPECT
ECHO LAKE	19015	CORLISS AV N	2	PRUNUS SPECIES	4	13	GOOD	REINSPECT
ECHO LAKE	1309	N 195TH ST	5	BITTER CHERRY	22	25	GOOD	REINSPECT
HILLWOOD	19359	GREENWOOD AV N	1	RED ALDER	20	45	POOR	REINSPECT
HILLWOOD	19330	3RD AV NW	3	SASKATOON	7	40	POOR	REINSPECT
HILLWOOD	19301	GREENWOOD AV N	1	DEODAR CEDAR	15	55	POOR	REINSPECT
HILLWOOD	19004	8TH AV NW	2	OTHER	8	30	FAIR	REINSPECT
HILLWOOD	19551	1ST AV NW	3	WHITE PINE	12	40	FAIR	REINSPECT
HILLWOOD	19551	1ST AV NW	4	WHITE PINE	12	40	FAIR	REINSPECT
HILLWOOD	429	NW 197TH ST	1	SCOTCH PINE	15	12	POOR	REINSPECT
HILLWOOD	19551	1ST AV NW	5	WHITE PINE	15	60	FAIR	REINSPECT
HILLWOOD	19603	GREENWOOD PL N	1	CHERRY SSP.	5	11	POOR	REINSPECT
HILLWOOD	731	N 195TH ST	3	DOUGLAS FIR	10	60	POOR	REINSPECT
HILLWOOD	731	N 195TH ST	2	DOUGLAS FIR	12	60	POOR	REINSPECT
HILLWOOD	19143	2ND AV NW	1	EUROPEAN MOUNTAINASH	19	30	POOR	REINSPECT
HILLWOOD	19342	3RD AV NW	1	.WESTERN HEMLOCK	14	50	POOR	REINSPECT
HILLWOOD	19359	GREENWOOD AV N	8	.WESTERN HEMLOCK	20	55	POOR	REINSPECT
MERIDAIN PARK	135	NE 195TH ST	16	WHITE PINE	19	45	FAIR	REINSPECT
MERIDAIN PARK	2322	N 185TH ST	1	DOUGLAS FIR	23	70	GOOD	REINSPECT
PARKWOOD	15228	MERIDIAN AV N	13	RED MAPLE	18	52	POOR	REINSPECT
PARKWOOD	15228	MERIDIAN AV N	5	RED OAK	12	35	POOR	REINSPECT
RICHMOND BEACH	19342	1ST AV NW	7	RED ALDER	13	50	FAIR	REINSPECT
RICHMOND BEACH	19342	1ST AV NW	8	RED ALDER	13	50	FAIR	REINSPECT
RICHMOND BEACH	19920	3RD AV NW	2	DOUGLAS FIR	15	50	FAIR	REINSPECT
RICHMOND BEACH	19560	8TH AV NW	2	WESTERN RED CEDAR	20	60	FAIR	REINSPECT
RICHMOND HIGHLANDS	900	N 175TH ST	6	RED MAPLE	2	12	GOOD	REINSPECT
RICHMOND HIGHLANDS	324	NW 203RD ST	5	BIGLEAF MAPLE	21	62	POOR	REINSPECT
RICHMOND HIGHLANDS	17123	3RD AV NW	1	BIGLEAF MAPLE	24	50	POOR	REINSPECT
RICHMOND HIGHLANDS	17043	2ND AV NW	5	BIGLEAF MAPLE	40	55	POOR	REINSPECT
RICHMOND HIGHLANDS	712	N 195TH ST	6	HORSE CHESTNUT	18	30	POOR	REINSPECT
RICHMOND HIGHLANDS	712	N 195TH ST	7	HORSE CHESTNUT	18	30	POOR	REINSPECT
RICHMOND HIGHLANDS	205	N 195TH ST	20	RED ALDER	3	18	FAIR	REINSPECT
RICHMOND HIGHLANDS	205	N 195TH ST	21	RED ALDER	3	18	FAIR	REINSPECT
RICHMOND HIGHLANDS	204	NW 195TH ST	4	RED ALDER	6	28	FAIR	REINSPECT
RICHMOND HIGHLANDS	204	NW 195TH ST	5	RED ALDER	10	41	FAIR	REINSPECT
RICHMOND HIGHLANDS	204	NW 195TH ST	3	RED ALDER	12	30	FAIR	REINSPECT
RICHMOND HIGHLANDS	127	N 175TH ST	1	WHITE BIRCH	10	40	FAIR	REINSPECT
RICHMOND HIGHLANDS	18513	PALATINE PL N	1	WHITE BIRCH	12	35	FAIR	REINSPECT
RICHMOND HIGHLANDS	324	NW 203RD ST	6	WEST. DOGWOOD	5	36	POOR	REINSPECT
RICHMOND HIGHLANDS	324	NW 203RD ST	13	WEST. DOGWOOD	11	50	POOR	REINSPECT
RICHMOND HIGHLANDS	324	NW 203RD ST	14	WEST. DOGWOOD	11	50	POOR	REINSPECT
RICHMOND HIGHLANDS	712	N 195TH ST	3	GOLDENCHAIN TREE	8	18	POOR	REINSPECT
RICHMOND HIGHLANDS	712	N 195TH ST	4	GOLDENCHAIN TREE	8	15	POOR	REINSPECT
RICHMOND HIGHLANDS	717	N 188TH ST	2	MAGNOLIA SSP.	22	50	POOR	REINSPECT
RICHMOND HIGHLANDS	717	N 188TH ST	3	MAGNOLIA SSP.	35	50	POOR	REINSPECT
RICHMOND HIGHLANDS	717	N 188TH ST	1	MAGNOLIA SSP.	42	40	CRITIC AL	REINSPECT
RICHMOND HIGHLANDS	310	N 188TH ST	5	WHITE PINE	3	20	GOOD	REINSPECT
RICHMOND HIGHLANDS	735	N 193RD ST	4	PINE SP.	7	30	CRITIC AL	REINSPECT
RICHMOND HIGHLANDS	735	N 193RD ST	1	PINE SP.	25	60	POOR	REINSPECT
RICHMOND HIGHLANDS	17300	FREMONT AV N	6	LONDON PLANE	15	40	FAIR	REINSPECT
RICHMOND HIGHLANDS	18300	6TH AV NW	7	LOMBARDY POPLAR	55	60	POOR	REINSPECT
RICHMOND HIGHLANDS	18300	6TH AV NW	1	LOMBARDY POPLAR	56	60	POOR	REINSPECT
RICHMOND HIGHLANDS	17844	5TH AV NW	2	PURPLE-LEAF PLUM	6	11	POOR	REINSPECT
RICHMOND HIGHLANDS	18205	3RD AV NW	5	DOUGLAS FIR	23	65	GOOD	REINSPECT
RICHMOND HIGHLANDS	17610	DAYTON AV N	1	DOUGLAS FIR	25	65	FAIR	REINSPECT
RICHMOND HIGHLANDS	630	NW 180TH ST	2	DOUGLAS FIR	34	60	POOR	REINSPECT
RICHMOND HIGHLANDS	358	NW 189TH ST	1	BLACK LOCUST	12	50	FAIR	REINSPECT
RICHMOND HIGHLANDS	358	NW 189TH ST	5	BLACK LOCUST	17	40	FAIR	REINSPECT
RICHMOND HIGHLANDS	755	N 182ND ST	7	BLACK LOCUST	20	40	FAIR	REINSPECT
RICHMOND HIGHLANDS	324	NW 203RD ST	16	EUROPEAN MOUNTAINASH	6	30	POOR	REINSPECT
RICHMOND HIGHLANDS	317	NW 185TH ST	5	EUROPEAN MOUNTAINASH	31	30	POOR	REINSPECT
RICHMOND HIGHLANDS	317	NW 185TH ST	6	EUROPEAN MOUNTAINASH	31	30	POOR	REINSPECT
RICHMOND HIGHLANDS	310	N 188TH ST	6	WESTERN RED CEDAR	3	20	GOOD	REINSPECT
RICHMOND HIGHLANDS	631	NW 180TH ST	4	WESTERN RED CEDAR	17	65	POOR	REINSPECT
RICHMOND HIGHLANDS	700	N 178TH ST	19	.WESTERN HEMLOCK	12	50	FAIR	REINSPECT

AREA	ADDR_No	STREET	TREE_CELL	COMM_NAME	DBH	HT	COND	MAINT
RIDGECREST	16734	5TH AV NE	2	RED MAPLE	7	42	FAIR	REINSPECT
RIDGECREST	1202	NE 145TH ST	1	DOUGLAS FIR	14	16	FAIR	REINSPECT

APPENDIX B:

Planting and After Care of Community Trees

PENNSTATE

College of Agricultural Sciences
Agricultural Research and Cooperative Extension

This publication is for people who plant trees in public landscapes, such as streets and parks. Much of the advice is useful also to those who plant trees around homes and businesses. To properly plant trees, you should understand the characteristics of planting sites, the tolerances and growth characteristics of tree species, and the benefits you want to receive from the trees.

Start planning 6 to 12 months before planting and allow time to conduct a thorough site analysis, to find and obtain quality trees, and to arrange for supplies, equipment, and workers. Trees should be selected that are well adapted to the planting site and strategically located so their roots, trunks, and branches have adequate room to grow. Trees need adequate space above and below ground to remain healthy, safe, attractive, and to grow to a mature size.

Understanding the Planting Site

Trees differ in their requirements for growth. Selecting trees that will become established and thrive in the biological and physical conditions of the planting site requires observation and thought. A thorough planting site analysis will identify important site conditions that can affect the survival and growth of the trees to be planted. Experienced tree commission members or arborists are best qualified for analyzing tree planting sites, but even a novice can do a site analysis reasonably well by using good information and common sense. A thorough site analysis includes all of the following:

Essentials for Evaluating Planting Sites

Climate and Weather

- Temperature extremes
- Moisture
- Light
- Wind

Soil

- Structure
- Compaction
- Drainage
- Texture
- Depth to hardpan or rock
- pH (acid or alkaline)
- Fertility
- Salinity
- Contamination and pollution

Growing Space

- Volume of soil for roots
- Space available for trunk and crown growth
- Placement of utilities
- Constraints of sidewalks, curbs, streets, and buildings
- Conflicts with pedestrian and vehicular traffic

Functional Benefits of Trees

- Design themes, sense of place
- Complement existing flora
- Climate modification
- Noise reduction
- Screen or enhancement of views
- Pedestrian and vehicular traffic considerations
- Erosion control
- Wildlife food and cover

- Visit or meet with people in the neighborhood to inform them, listen to their concerns, and seek their assistance in planning planting projects. People can help care for trees, or they can ignore or vandalize them, so the attitudes of people living where street and park trees are to be planted are important.

- Assure that all legal requirements will be met. Many municipalities have ordinances describing who may plant trees, what trees may be planted, and where.

- Consider landscape design. Trees are used for various design purposes, such as creating a sense of place, security, and comfort. They may complement important views and architectural features. Tree plantings can be formal and uniform or informal and diverse. Narrow trees can accent or frame significant features; broad trees or groups can soften or screen harsh features. Their flowers, fruit, foliage, and bark can stimulate the senses with fragrance, texture, and color.

- The trees selected for planting must be able to withstand the coldest temperature that can be expected in the area. Determine the hardiness zone of your tree planting site by checking a hardiness map based on low temperature extremes. These maps are available at your local library or county extension office, in many nursery catalogs, or in *Street Tree Factsheets* (Gerhold et al. 1993).

- Safety is important. Consider how clearance for pedestrians, vehicles, lighting, signs, and utilities will be maintained. Visibility at street intersections is reduced as trunks grow in diameter.

- Space is often limited in urban areas. Look up, look down, look all around! The planting space above and below ground should be large enough for the selected trees to reach their mature height, branch spread, trunk diameter, and root extension without interfering with surrounding objects and the activities of people. Roots can extend well beyond the spread of branches. Identify objects such as buildings, roads, sidewalks, signs, and underground and above ground utilities that could restrict or conflict with the growth of roots and canopy. If enough space exists for a tree to grow to its mature size, damage to sidewalks and curbs will be reduced or eliminated, and severe pruning will not be required later.

- An adequate amount of fertile soil is crucial for tree growth. Tree roots need sufficient amounts of water, oxygen, and nutrients supplied from soil to grow. Investigate critical soil factors such as depth, texture, structure, amount of rocks and other debris, compaction, drainage, pH (acidity or alkalinity), and fertility levels by digging one or more test holes. Soil compaction restricts root growth. Poor drainage and standing water can cause a tree to be unhealthy, limit its growth, or kill it. If compaction or drainage is a concern, pour a gallon of water into a 12-inch-wide, 24-inch-deep test hole. If the water does not drain from the hole in 8 hours, consider planting the tree in another location that has better drainage. Replacing the soil in a planting area may or may not help drainage problems caused by surface or subsurface soil compaction; suggestions for managing compacted soils are provided later in this publication. Some species of trees such as red maple, red oak, pin oak, and sweetgum can not tolerate alkaline soil (pH above 7.0). If concerned about the fertility or pH of a soil, ask for advice about completing a soil test from your county extension office.

Fig. 1. Large-growing trees such as red oak and Norway maple should not be planted under power lines.

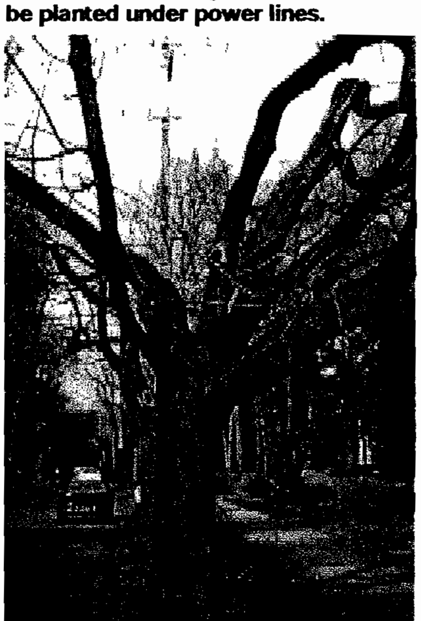
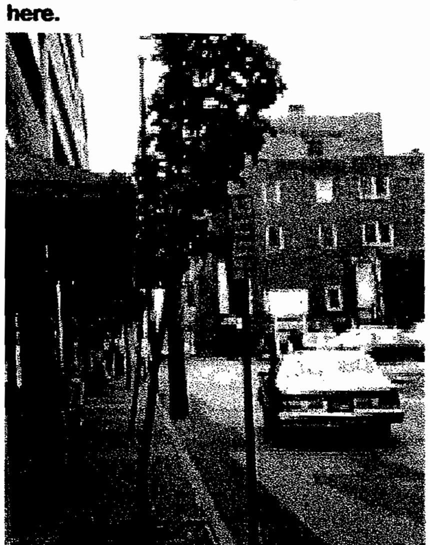


Fig. 2. Planting large trees in confined areas causes sidewalk and other damage.

Fig. 3. There is not enough room above or below ground to plant trees here.



- The condition of nearby trees and other plants can indicate whether health problems can be expected and what tree species may or may not do well. Browning and scorching of leaves during summer, premature fall coloration, and yellow or chlorotic leaves can indicate sites that are hot, droughty, compacted, or that have a high pH or road salt problems. Some species tolerate certain adverse conditions better than others do. Also, the condition of neighboring trees can indicate insect or disease problems such as plant bug, verticillium wilt, or fire blight that can cause problems to susceptible tree species.
- Investigate the sun and shade patterns of the site. Some trees need full sun, others will tolerate partial shade, and a few prefer shade. Trees can be planted strategically around buildings to provide summer cooling and decrease winter shade, which reduces energy expenditures for air conditioning and heating. Plant trees on the west and east sides of buildings to shade during summer. To decrease the shading of buildings during the winter, keep trees away from the south side of buildings a distance that is at least twice the mature height of the tree. Thicker rows of evergreen trees can be planted on the north side of buildings to shield against winter winds.

Keep in mind that trees can have a long life span if properly selected, planted, and maintained. If trees will not receive inadequate pruning, watering, and other care, trees should be selected that tolerate a low level of care. It is also important to consider the future health of trees by thinking about how the site conditions might change, and recognizing the size and form that a mature tree will have both above and below ground.

Selecting the Right Tree

The tree variety chosen for a planting site should be tolerant of the site conditions determined during site analysis, compatible with the landscape design, and capable of providing the desired benefits. Important characteristics to consider when deciding what tree to plant include cold hardiness, mature size, shape, branch structure and strength, flowers and fruit, growth rate, longevity, rooting characteristics, and resistance to common insect and disease problems. Also, consider the tree's tolerance to soil compaction, heat, drought, sun or shade, and to pollutants such as road salt.

You should consider the ornamental benefits of trees such as fall color, showy flowers, fruit, and bark. Trees can be used to control pedestrian and vehicular traffic, hide unsightly buildings and views, and increase human comfort by screening the wind and shading buildings, sidewalks, and parking lots. They can be used to provide cover and food for birds. Trees can also provide feelings of security and comfort. Also, consider possible maintenance problems. Some trees require excessive pruning, while others drop messy fruits and flowers.

Selecting the wrong type of tree that is not well adapted to a planting site can lead to low survival, sickly or unattractive growth, and premature death. Planting the wrong type of tree also can lead to unattractive streets, increased sidewalk and curb damage, and interference with utilities and signs. Desirability of tree fruits by birds and wildlife are additional considerations in species selection since bird droppings can be a nuisance in parking lots and other public places. All of these add to long-term maintenance costs.

Besides the many tree species that are available, nurserymen and horticulturists have developed numerous cultivars. Cultivars originate when an individual tree is selected for its superior qualities such as form, fall color, size, or disease resistance. Cultivars are asexually propagated by budding onto ordinary seedlings, by rooting of cuttings, or by tissue culture. All the trees of a cultivar are uniform in appearance and their disease tolerance, growth, fall color, flowering, and fruiting are predictable.

Fig. 4. Trees grow in many different shapes and sizes, from broadly spreading to upright.

To find information on tree species and cultivars consult a Cooperative Extension specialist or a publication such as *Street Tree Factsheets* (Gerhold et al. 1993).

Buying Quality Nursery Stock

To improve the chances for success in tree planting, it is important to begin with healthy plants with good structural form that have been properly grown, dug, and transported.

A good tree for planting has:

- a strong, straight trunk
- bark that is not cut or damaged
- branches that are evenly spaced along and around the trunk
- branches that are not split or broken
- dense, dark green foliage
- no diseases or harmful insects
- a firm root ball that is securely wrapped with fresh, non-synthetic burlap
- no roots growing out of the bottom of the container
- no roots circling the inside or top of the container
- no weeds growing in the container or from the root ball
- moist soil in the root ball
- been freshly dug, briefly stored with moist packing material (for bare-root stock)
- the specifications listed in the *American Standard for Nursery Stock*

Trees are available in three nursery types: balled-and-burlapped, bare-root, and containerized. Each type has advantages and disadvantages. Balled-and-burlapped (B&B) trees are the most common type available from local nurseries, and the most reliable for good survival and growth because many fine roots are intact in the root ball and ready to proliferate. However, B&B trees are heavy and much of their root system is severed and left behind at the nursery when the trees are dug.

Containerized stock is much lighter and has intact root systems, but can have problems with circling and girdling roots if they remain in the container too long. Containerized trees can be transplanted during the summer, outside the usual spring and fall planting seasons. They do need to be watered more frequently than B&B trees until they are established.

Bare-root stock is less expensive, smaller, and easier to handle. It can only be harvested and planted when dormant, so is only available in early spring and late fall. It is more likely to suffer from drying and requires greater care in handling and faster planting after digging. The roots of bare-root trees must be kept moist during shipping, storage, and planting. Roots can be dipped in water to moisten them, but should not be immersed in water for long periods because roots need to "breathe."

Genetic adaptation to site conditions is just as important as the physical quality of trees. Trees such as red maple and sweetgum, which are native to Pennsylvania, are not necessarily winter hardy if they are grown from seed collected in southern regions. To avoid this possibility, buy cultivars that are known to be hardy, or obtain plants that have been grown several years in Pennsylvania nurseries, or other states with similar climates.

Many important characteristics to consider when purchasing nursery stock, such as height-diameter relations and root ball sizes, can be found in the *American Standard for Nursery Stock* (American Landscape and Nursery Association, 1997). In general, the following are important in obtaining a high-quality tree:

- To improve chances of obtaining the type and size of trees you desire, order them 6 to 12 months ahead of the planting date and check prices of several nurseries. Nurseries often sell out of the most popular trees.
- Obtaining the best price for trees should be a secondary consideration to quality. Low-price trees that perform poorly or die are no bargain.
- Many nurseries allow customers to inspect and tag trees for future delivery. This helps ensure that you will receive the quality of trees that you want.
- Look for reasonably straight, single trunks with healthy, well-spaced branches, reasonable crown symmetry, and trunks and limbs free of scrapes or other damage.
- The most common sizes used for street trees are from 1 1/2 to 2 1/2 inches in caliper. Caliper is the diameter of the trunk measured 6 inches from the ground on trees that are 4 inches or smaller, and 12 inches above the ground on larger trees. Trees larger than 2 inches in caliper are most suitable for areas where vandalism is likely or pedestrian traffic or children's play is frequent. Larger trees can be used if a prominent landscape effect is desired immediately.

Table 1. Typical Sizes and Weights of Deciduous B&B Trees

Caliper	Ball Diameter	Approximate Weight	Typical Height
1 1/2 to 1 3/4"	20"	225 lbs.	10 to 12'
1 3/4 to 2"	22"	260 lbs.	11 to 13'
2 to 2 1/2"	24"	300 lbs.	12 to 14'
2 1/2 to 3"	28"	600 lbs.	13 to 15'
3 to 3 1/2"	32"	750 lbs.	14 to 16'

Fig. 5. Even after years in the ground, plastic burlap will not decay, eventually resulting in root and tree death. It must be completely removed at planting.

Fig. 6. This tree has poor branching structure and should not have been purchased or planted.

- The proper root ball size of a B&B tree is determined by its caliper. See Table 1 for sizes and weights of root balls for trees of different caliper. Tree trunks should be centered in the root balls.
- Root balls should be moist, tightly wrapped, and free of cracks. The trunk should not move loosely in the root ball.
- Be cautious with trees whose root balls are wrapped in plastic burlap (Figure 5), or if fresh burlap has been placed over old burlap. Plastic burlap and twine must be completely removed after a tree has been placed in the planting hole. To determine if you are working with plastic burlap, try burning the burlap. Plastic will melt; natural burlap will turn to ash and blow away.
- Some nurseries will guarantee the replacement of trees that die within a year at an added cost.

It is important to inspect trees both in the nursery and when delivered. Consider rejecting trees if any of the following are present:

- Two main trunks or double leaders (Figure 6). This is especially important for street trees. If planting ornamental trees in a lawn, you may plant certain trees that have double leaders or multiple trunks.
- Fungal cankers on branches or trunk. Look and feel for discolored, sunken, or swollen areas in the bark.
- Signs of drying, such as dead buds, brittle twigs, or parched root balls.
- Scrapes or other damage to the bark that exceed one quarter of the trunk circumference.
- Cracked or loosened root balls.

Fig. 7. An example of a good B&B root ball: large enough, firmly wrapped and caged, and roots covered with fresh burlap.

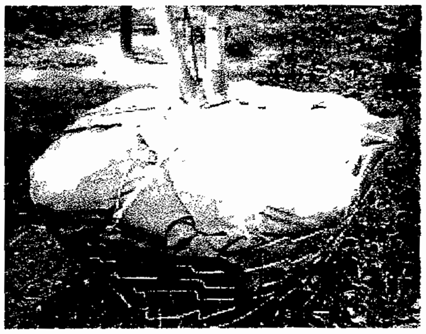


Fig. 8. An example of a poor B&B root ball: too small, loosely wrapped and caged, and roots exposed.

Fig. 9. Encircled and kinked roots can be a problem with containerized trees. Trees with these root problems should not be purchased or planted.

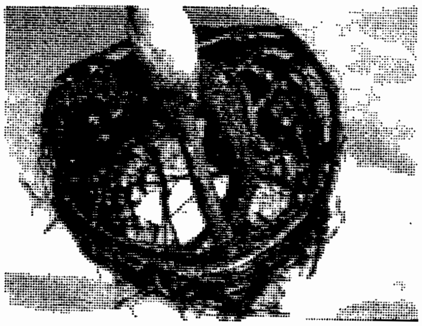
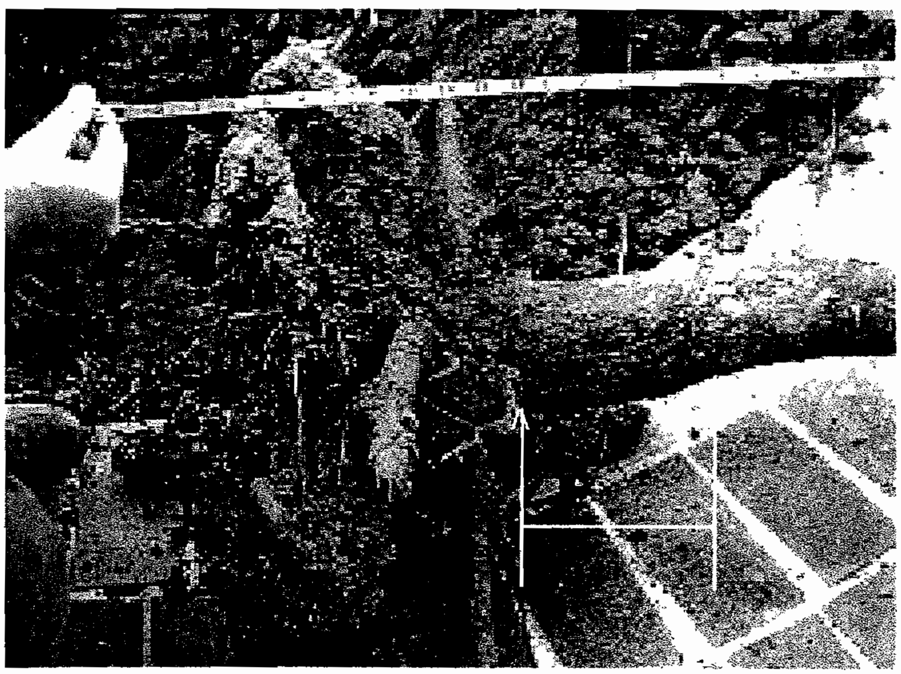


Fig. 10. This tree was planted too deep at the nursery, resulting in a small root mass when the tree was balled. No soil should be placed above the arrow when a tree is balled or planted.



- Unhealthy, circling, or kinked roots. Containerized stock, especially if left in a container too long, can have circling roots that can eventually kill a tree or slow its development.
- A root crown that is too deep in the root ball. Trees that were planted too deep in the nursery, or that have been covered with soil by mechanical cultivation, are too deep in the root ball.

If a large number of B&B trees have been ordered, remove the burlap from the top of the root ball of a few trees and determine how much soil is covering the roots. If there is more than 6 inches of soil, additional trees in the order should be inspected. Trees with more than 6 inches of soil covering roots should be rejected. Entire root balls of containerized plants can be inspected. Trees with heavily kinked or encircled roots should be rejected.

Shipping and Handling

After trees have been selected and purchased, it is important to assure proper shipping and handling, especially if inexperienced municipal employees or volunteer crews are being used to move and plant trees. Some tips for shipping and handling trees are:

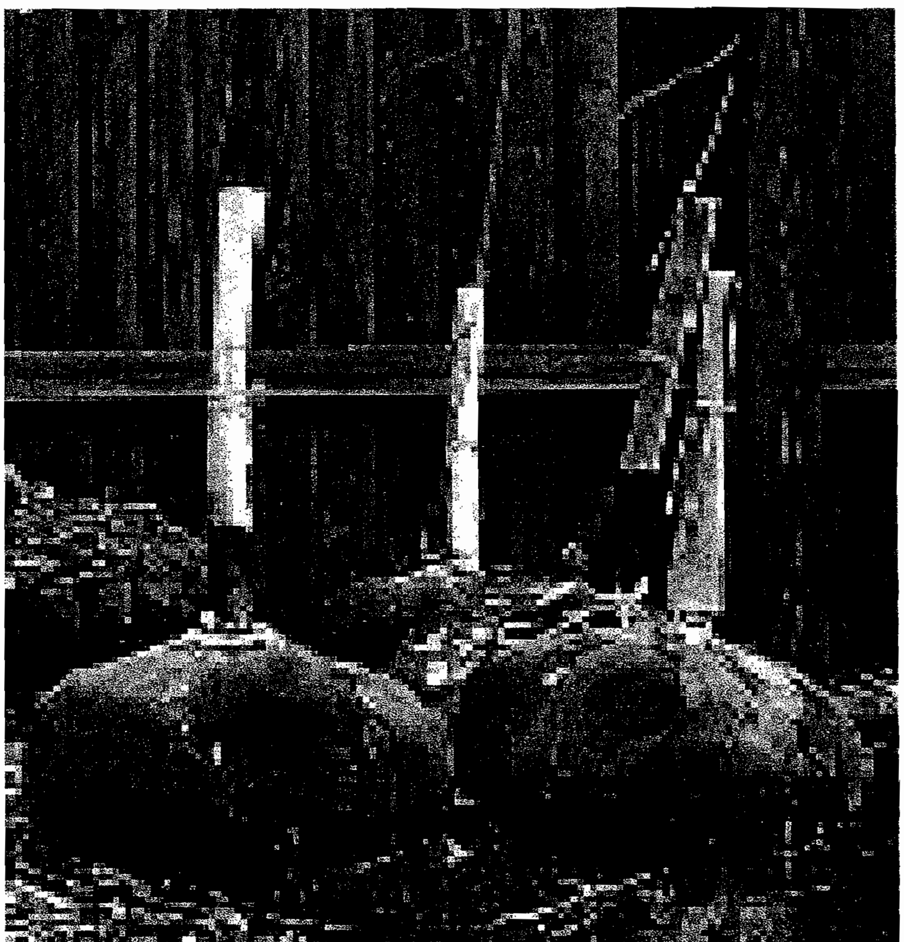
- When transporting trees in an open vehicle, even for short distances, cover trees with a tarp to prevent them from drying out and being damaged by the wind.
- The protective covering around the trunk should remain in place until the tree has been planted, to protect against damage from equipment or shovels. Then the covering should be removed.
- Always try to unload the tree as close to the planting site as possible and gently lower the tree into the planting hole. Never drop trees off a truck since this can cause cracks in the root ball and serious root damage.
- Remember that B&B trees are very heavy. Use a front-end loader or backhoe to unload them. Make sure that enough people are helping when lifting and lowering a root ball. Be careful not to drop a tree onto the legs or feet of people standing in a planting hole.
- Always lift a tree by its root ball. Never drag or lift a tree by the trunk because the root system can separate from the soil and break roots. Do not wrap chain or rope around a tree's trunk to lift it. Alternatives for lifting and moving trees include using a tree sling, hand truck, or front-end loader. If hooking a chain into the wire basket on a tree, always hook to at least two wires. If hooked to just one, the wire can break and injure people.

Storage

Trees can be stored temporarily, but should be planted as soon as possible after delivery. Tips for proper tree storage are:

- The roots of bare-root trees must be kept moist at all times. It is best to plant bare-root trees within one week. If trees are to be stored longer, they should be kept at a low temperature (around 35°F) and high humidity. Keep wrapping materials on bare-root trees until you are ready to plant them. Keep trees out of the sun and their roots cool and moist by covering them with a damp cloth or moist packing material.
- B&B trees can be stored longer by using these procedures: 1) stand the trees upright together in a group close to the shaded north side of a building; 2) cover the containers or balls with mulch; 3) water trees enough to keep the root balls moist. Avoid temperature extremes when storing trees and do not let the root balls become dry or overwatered. If B&B trees have been stored for a long period, handle them carefully as the burlap and twine may have begun to rot. If the burlap has rotted, wrap the root balls in fresh burlap before handling them.
- Containerized trees can be stored in any open, flat area. They should not be stored with B&B plants because they require more frequent irrigation, especially after bud break. Since they are well drained, containerized trees may have to be watered every day.

Fig. 11. These trees are stored incorrectly; they should be in a shady area and covered with damp mulch.

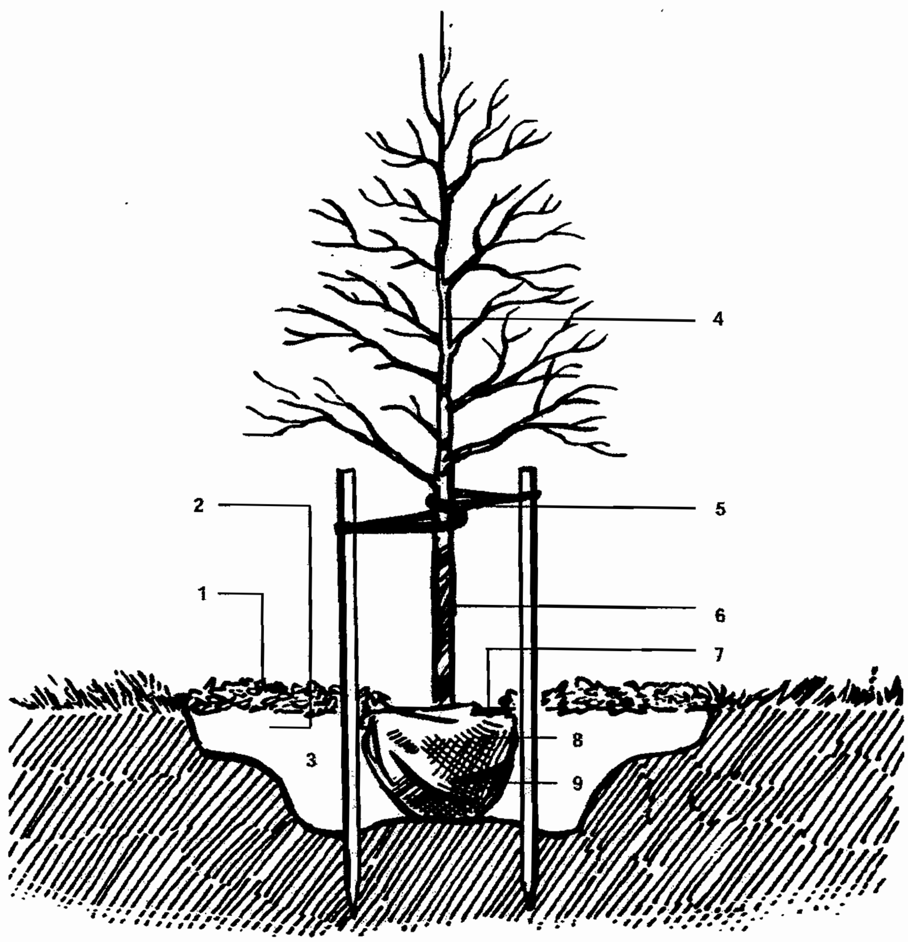


Planting Trees in Spacious Places

Techniques for planting B&B, container-grown, and bare-root trees do not differ greatly when there is ample space. The following guidelines can be used for planting trees in parks, lawns, large lawns along streets, or other spacious areas.

- Arrangements for workers, volunteers, and equipment should be made months in advance.
- To avoid hitting underground utilities while digging, contact the One-Call System a few weeks before the planting date. This system will schedule someone to identify the location of underground utilities. Check with the public works department in your municipality to locate the One-Call System.
- The ideal time for planting in the temperate zone is spring, as soon as the ground has thawed and excess moisture has drained from the soil. Fall plantings should be done soon after deciduous trees have dropped their leaves and before the ground has frozen, but can be started in early September. Some trees such as oaks and ornamental pears are not recommended for planting in the fall because of the potential for excessive mortality.
- Digging proper planting holes by hand can be extremely time consuming and labor intensive especially for youth and other volunteers. Try to obtain a backhoe and operator from the municipality, borrow one from a construction firm, or rent one. A backhoe not only makes it easier to plant trees, but it also helps in the correct digging of wide planting holes. Communicate with the backhoe operator to make sure the operator understands the size of tree planting holes that you want, or you will be filling in holes that are too deep, which can cause trees to settle, tilt, or be planted too deep.
- If possible, mark out a planting area that is three to five times the diameter of the root ball; the wider the hole, the better. Loosen the soil in the entire planting area to the depth of the root ball. At a minimum, the planting hole would be 2 1/2 times the diameter of the root ball and soil loosened to 12 inches as far around the planting hole as possible.

Fig. 12. Diagram for planting a tree in a spacious place.



1. 3" to 4" mulch of bark or wood chips
2. Wider hole if soil is compacted
3. Good native soil or topsoil
4. Single straight trunk
5. Slack rubber hose or strap
6. 1 1/2" to 2 1/2" caliper
7. Keep mulch away from root collar
8. Remove burlap or fold down burlap and wire basket
9. Root ball on undisturbed soil

- In the center of the loosened soil, dig a hole that is twice the diameter and exactly as deep as the root ball. To prevent the root ball from being planted too deeply, it should sit on solid, undisturbed ground rather than on loose soil. To plant the tree at the proper depth, make sure the upper surface of the root ball is level with the existing grade of the area. Because of cultivation in the nursery, B&B stock may have soil piled on top of the root collar (where the tree trunk flares out to the roots) causing trees to be planted too deeply. Pull this excess soil away to determine the proper depth of the planting hole.

- Before placing the tree upright in the planting hole, carefully remove any twine that may be holding branches together.

- Once the tree is properly situated in the planting hole, cut and remove any twine holding burlap in place. Remove burlap from at least the upper third of the root ball; cut it off or shove it down into the planting hole. All artificial burlap must be removed from the planting hole. If a tree has come in a wire basket, cut at least the top one-third or two tiers of wire and remove it. Before backfiling, check from two sides and assure the trunk is vertical.

- Hold the tree upright while backfilling around the root ball. Gently pack the soil to prevent any major air pockets; water occasionally to help settle the soil. When the root ball has been covered with soil, rake the soil evenly over the entire planting area and cover the area with 3 to 4 inches of composted mulch. Keep mulch a few inches away from the tree trunk because mulch piled around the trunk may keep it too moist and lead to fungal problems. Deeply water the entire excavated area.

Fig. 13. For good establishment and growth, trees must be planted at the right depth as shown here, with the top of the root ball level with the existing grade. Note that the root collar is exposed.

Fig. 14. This tree was planted about 7 inches too deep, which can cause death or long-term decline.

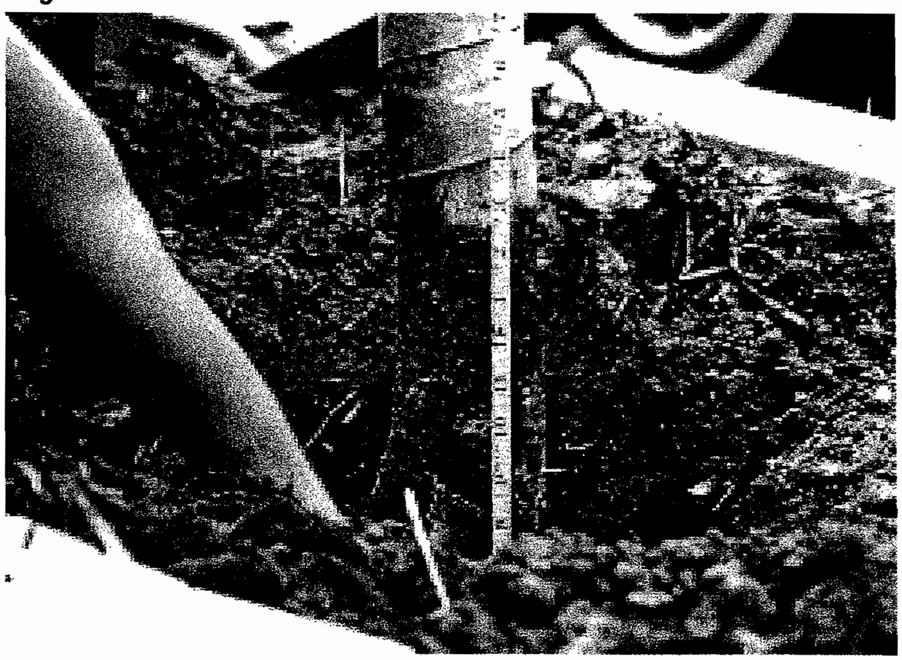
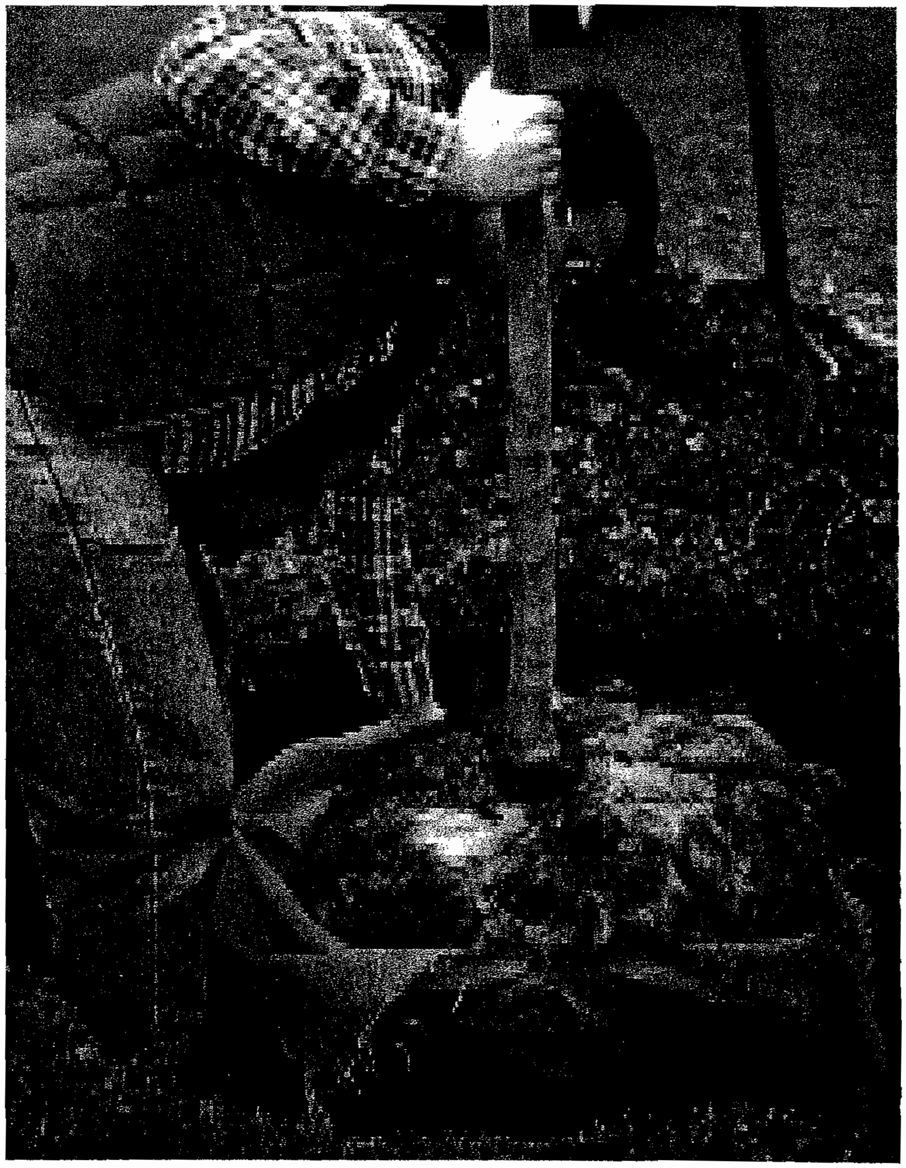


Fig. 15. This tree was planted slightly too high and the twine and burlap should have been removed. The suckers growing from the base should have been removed.

Fig. 16. The twine, burlap, and metal cage should be removed from at least the top third of a B&B root ball to avoid poor root growth and root girdling.



- Mounding the soil at the outer edge of the root ball to form a water-holding berm can help hold a larger quantity of water, but it may also encourage root growth to remain close to the tree. If you decide to use a watering berm, the berm should be made slightly beyond the root ball to promote root extension into the surrounding soil. Cover the berm with mulch, keeping mulch away from the tree trunk.
- The roots of bare-root trees should be supported by a mound of soil within the planting hole, so they will be evenly distributed within the planting hole. Do not kink the roots of bare-root trees to force them into a planting hole that is too small. Their root collar should be positioned level with the existing grade.

Fig. 17. Trees must be watered at planting and for the first 2 years during periods of hot, dry weather.

A new system for planting bare-root trees

The Urban Horticulture Institute at Cornell University has developed a system for transplanting large bare-root nursery trees that can be used to replace B&B trees in plantings. Instead of shipping trees balled-and-burlapped, bare-root trees are dipped in a slurry of hydrogel and placed in large, pleated plastic bags. Trees are treated at the nursery and loaded into an enclosed truck or an open bed covered with a tarp. Store the trees in a cool, shady spot and plant as soon as possible, but within a week.

Larger bare-root trees should be planted in a shallow hole, no more than 12 to 18 inches deep and wider than the spread-out root system. Fill the planting hole with loosened, fertile soil and mulch the planting area correctly. Because there is no added weight from a root ball, bare-root trees need to be staked. It is important to keep bare-root trees well watered during warm weather in the first few growing seasons.

Trees should be planted when they are dormant in late fall or early spring, and only deciduous trees can be planted using this method. Trees that have responded well to this new method of planting include hybrid freeman maple, hedge maple, shadblow, crabapple, Japanese tree lilac, shantung maple, Norway maple, sycamore maple, black alder, ash, ginkgo, honeylocust, Kentucky coffee tree, sweetgum, scholar tree, linden, and Japanese zelkova.

Planting in Sidewalks and Other Harsh Environments

The size that a tree can attain depends mainly on the volume and quality of soil accessible to its roots. Providing an adequate amount of soil volume will increase the amount of moisture and nutrients available to a tree, leading to larger, healthier, and long-lived trees. Various techniques can be used to modify harsh or confined planting areas, but these usually are expensive; some should be designed with the assistance of an engineer or landscape architect. It is important to properly water and maintain trees that are planted in harsh environments. There is no sense in designing and constructing special planting areas only to have trees perish because they are not watered. Before trying extraordinary site modification techniques, consider whether tree planting sites can be relocated to nearby yards or other more favorable areas.

Planting pits in concrete

Planting cut-outs in sidewalks, patios, or parking lots should be a minimum of 4 feet long, 4 feet wide, and as deep as the root ball. If removing polluted or inferior soil, the depth of the cut-outs can be deeper than the root ball. The volume of soil provided in a pit this size can sustain a stress-tolerant tree that remains small, but not a tall-growing tree. A minimum of 200 cubic feet (5' x 10' x 4') of fertile soil is required for large trees such as oak. To provide more soil to the tree, enlarge the cut-out by increasing its length and width, rather than its depth. Loosen all soil within the planting pit and plant the tree as described for spacious areas. (See Fig 12.) If the excavated soil is poor, or full of debris, do not amend with sand or organic material; instead, replace with a fertile topsoil. (See Fig 20B.) If the drainage of the area is poor, consider moving the planting location or using the subsequent recommendations for managing compacted soils.

Limestone gravel and cement associated with streets, sidewalks, or patios increase soil alkalinity, so only plant trees in these areas that are tolerant of alkaline soils. Do not plant red oak, pin oak, sweetgum, or red maple in these areas. In places with heavy pedestrian traffic, use stakes or iron guards to protect trees from damage and vandalism. Sidewalk planting pits should be located so that trees will not interfere with business or traffic signs, with sight visibility at intersections or be hit by car doors and bumpers. Alternatives for using pavers and other surface materials are discussed later. Sidewalk, patio, or parking lot cut-outs can be improved by using shared space for trees, continuous planters, or raised planters, especially when major repair or sidewalk construction is being planned.

Fig. 18. Cutouts measuring 4' X 4' X 4' (64 cubic feet of fertile soil) are the minimum size for planting trees in sidewalks, patios, or parking lots. Pits measuring 5' X 10' X 4' are used in Philadelphia and other cities to plant large trees such as oak and sycamore.

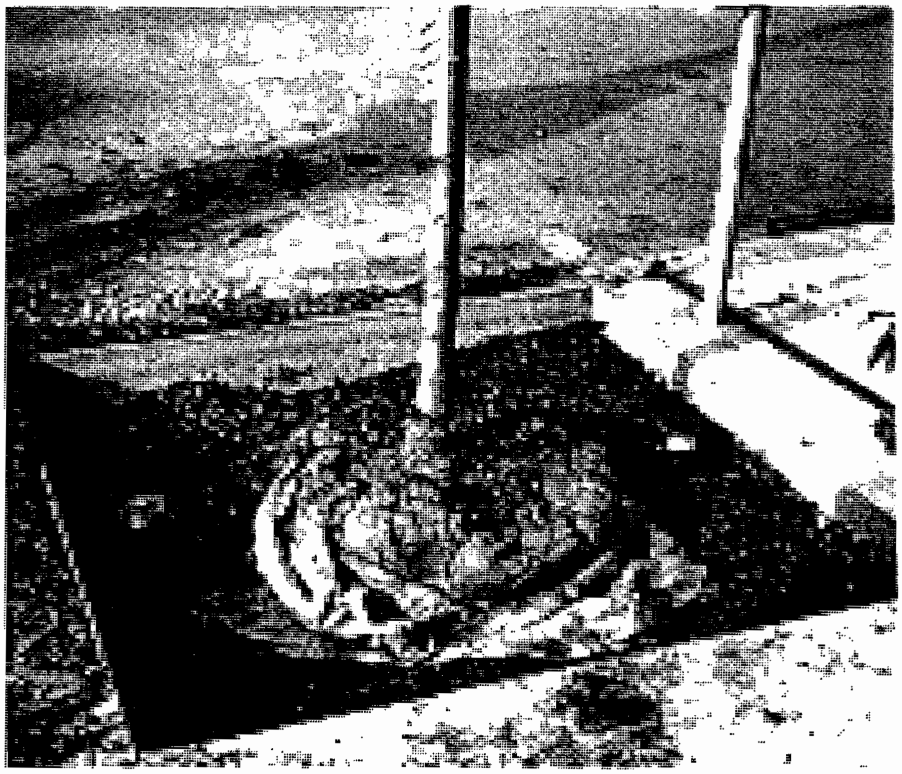


Fig. 19. Limestone gravel, cement, and asphalt will raise the soil pH in planting sites. Pin oak, red oak, red maple, and other trees intolerant of alkaline soils should not be planted in these areas.

Fig. 20A. Example of an aeration system that can be constructed from PVC piping for use in sidewalks and other plantings. The system can also be used to promote deep watering.

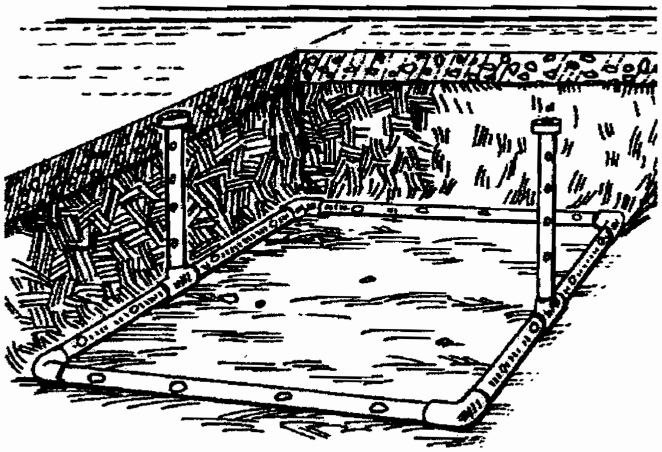
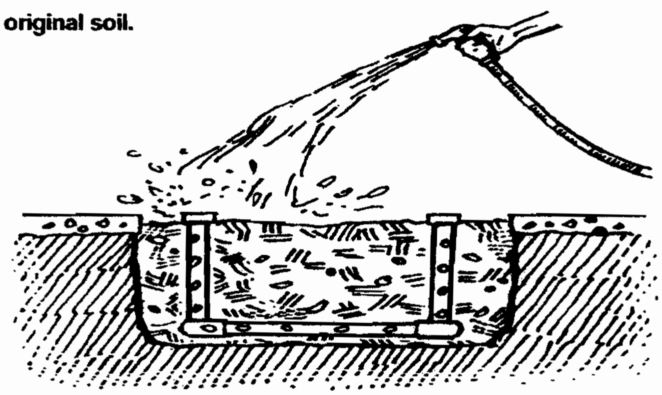
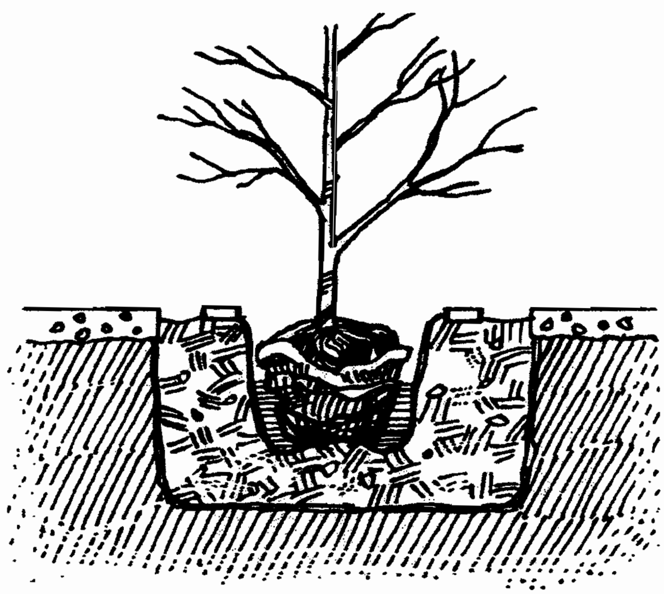


Fig. 20B. Diagram for planting a tree in a sidewalk after removing original soil.

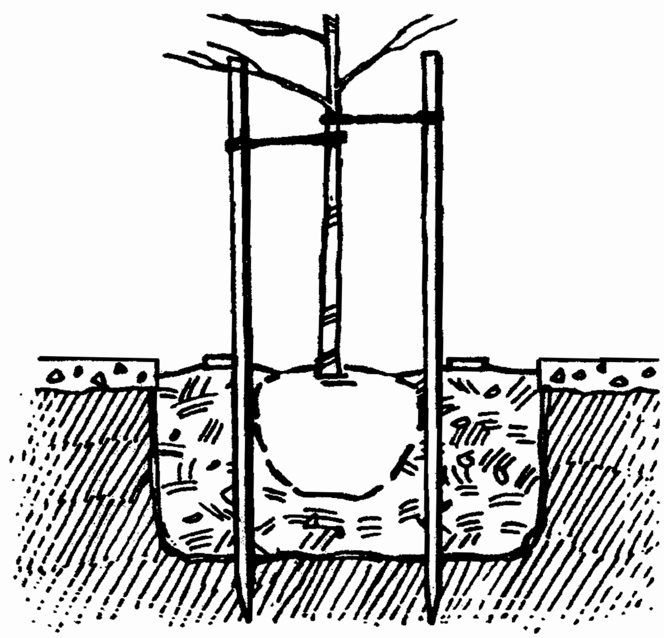
Remove all non-fertile soil in minimum 4' x 4' x 4' pit.



Construct aeration system per Fig. 20A and fill with fertile topsoil. New soil should be "watered in" to settle and slightly compact.



Dig planting hole in the new soil and plant tree per specifications in Fig.12 (see page 9). Soil under root ball should be lightly compacted to prevent settling of root ball.



Stake to protect street trees.

Shared spaces and cluster plantings

Groups of trees can share larger soil spaces, which improve the growing conditions for all of the trees. Shared spaces promote a mutually beneficial environment that provides cool shade, higher humidity, and organic material to improve soil structure and fertility. Larger planting areas can be designed in sidewalks, patios, and parking lots to support groups of trees and other plants instead of the traditional single cut-outs in concrete, without necessarily increasing costs or taking up more space.

In shared planting areas, it is beneficial to loosen all soil in the planter to the depth of the root balls being planted, and then plant trees as described in the section on planting in spacious areas. Keep the bottom of shared planters open and cultivate new soil into old to provide for better root growth.

Continuous planting spaces

In wide sidewalks, a continuous tree planting space can be constructed by cutting a minimum 4-foot-wide strip parallel to the curb and trenching to break soil compaction, or by removing and replacing poor or contaminated soil. The planting space should be as deep as the root balls being planted, have an open bottom, and be filled with good topsoil. A cantilevered cement top, brick, or other porous paving material can cover the planting space. This type of planting space can promote root growth parallel to the curb and provide trees with larger, shared rooting volumes in sidewalks or other paved areas.

Fig. 21. Shared planters can be used to provide more soil nutrients, moisture, and shade to tree roots. Keep the bottom of shared planters open to provide more soil volume.

Fig. 22. Continuous planters provide good soil volume and can be covered with brick or cantilevered cement panels.

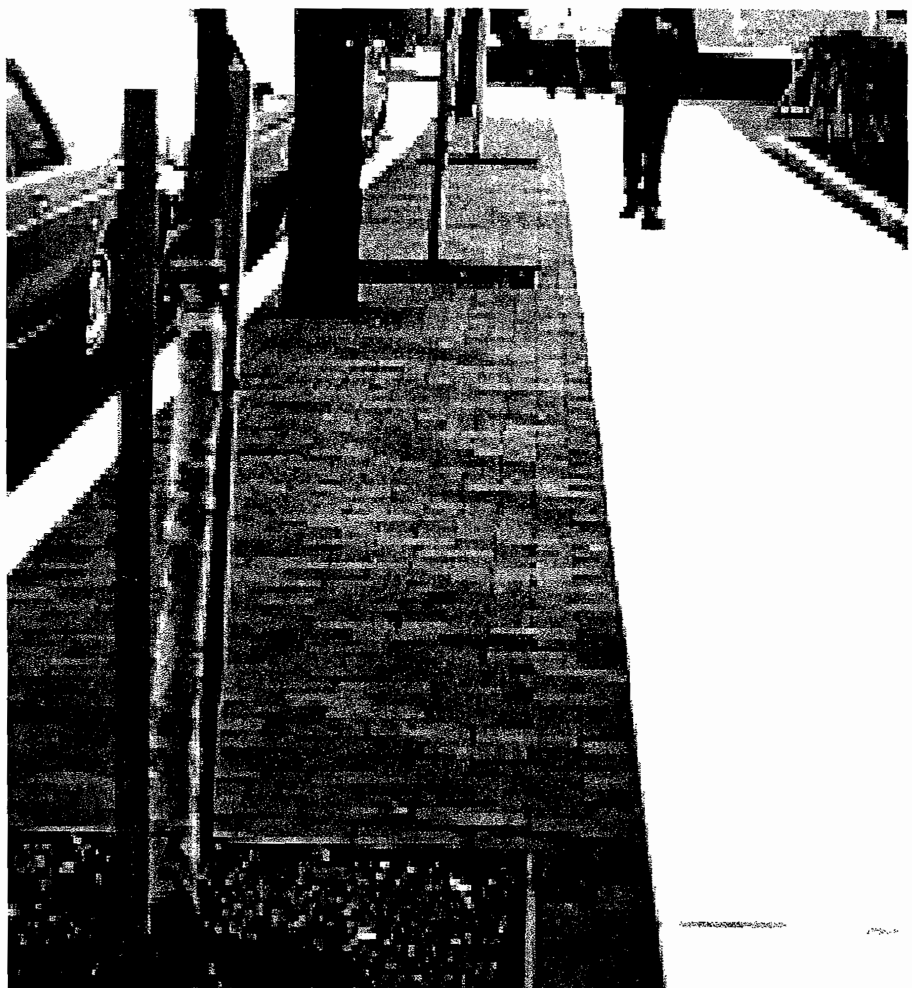


Fig. 23A. Elevation view of a continuous planter. Where needed, the aeration system can be connected to a storm drain to provide drainage. Where drainage is not needed, the system can be used to deeply water the trees.

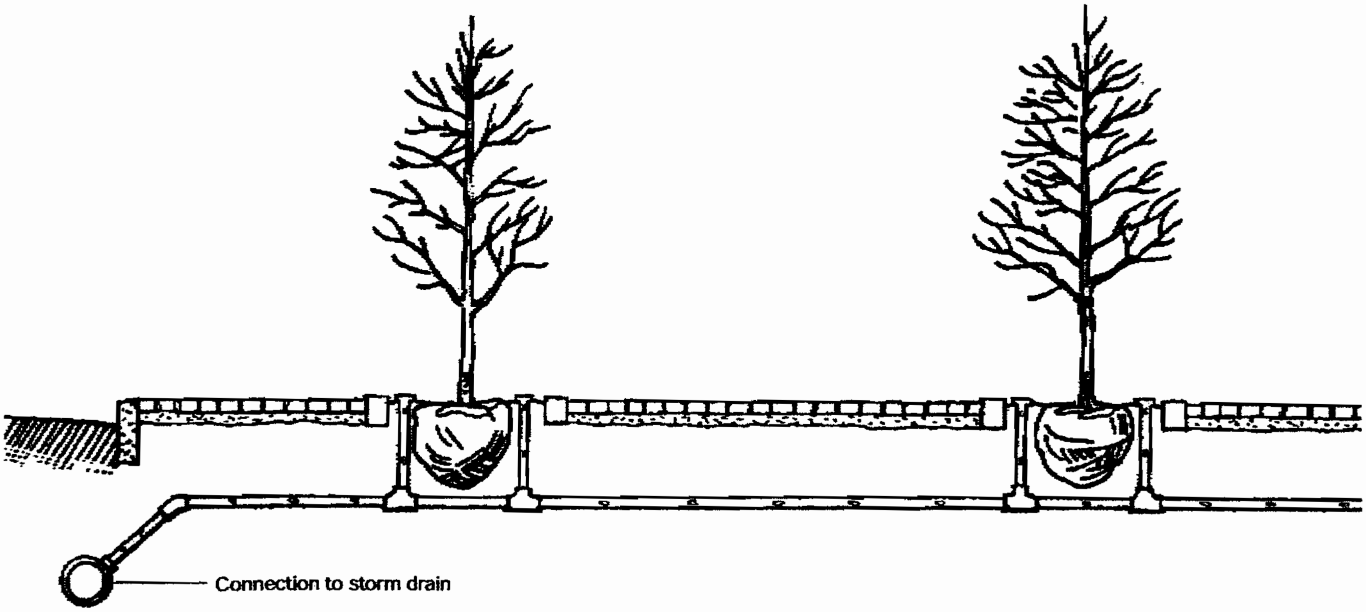
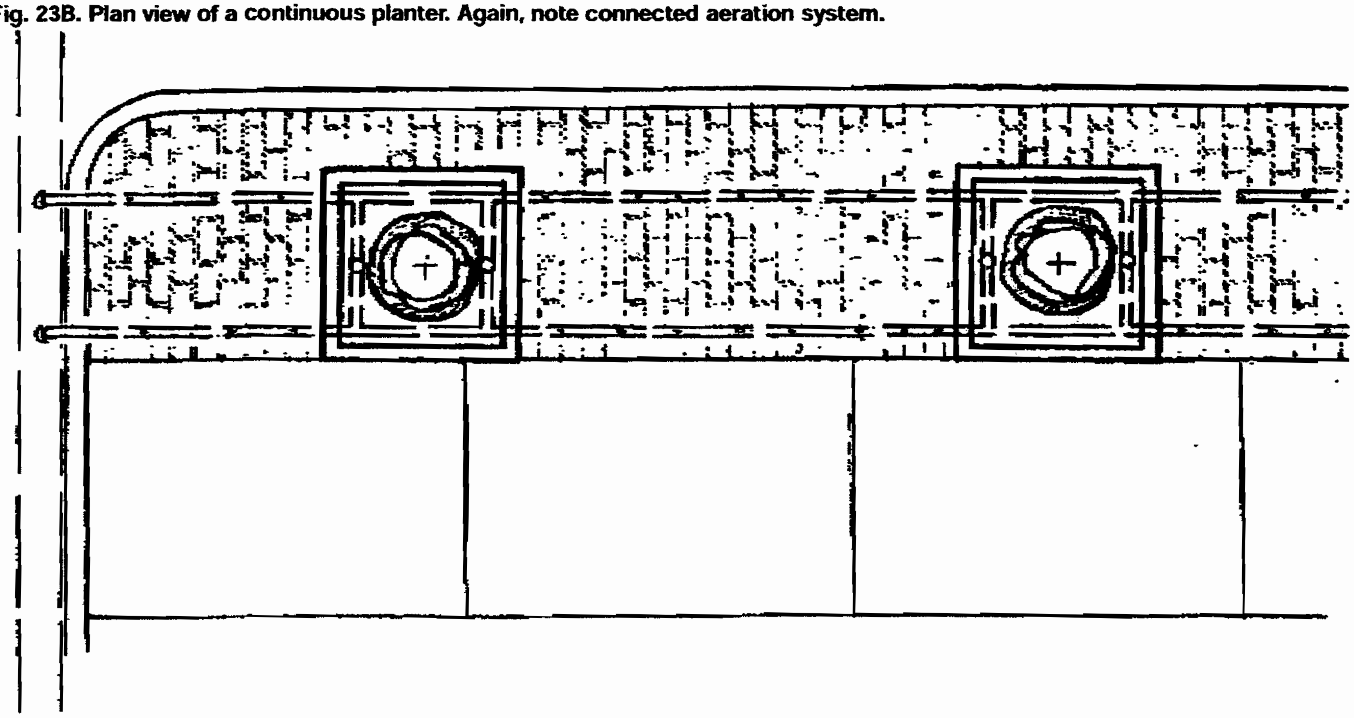


Fig. 23B. Plan view of a continuous planter. Again, note connected aeration system.



Raised planters

Elevating planting spaces above sidewalks or parking lots is a good way to provide positive drainage, avoid salty run-off, and discourage compaction due to pedestrian traffic. With heights up to 36 inches, the planter lip can provide seating. Raised planters should be filled with good topsoil and be a minimum of 4 feet wide and 2 feet high. They can also be quite large and blend into the natural grade of an area. Keeping the bottom of the bed open and cultivating planting soil into the original soil will encourage roots to escape from the bed into surrounding soil. French drains or other channels or sinks filled with gravel can be incorporated into the design to improve drainage.

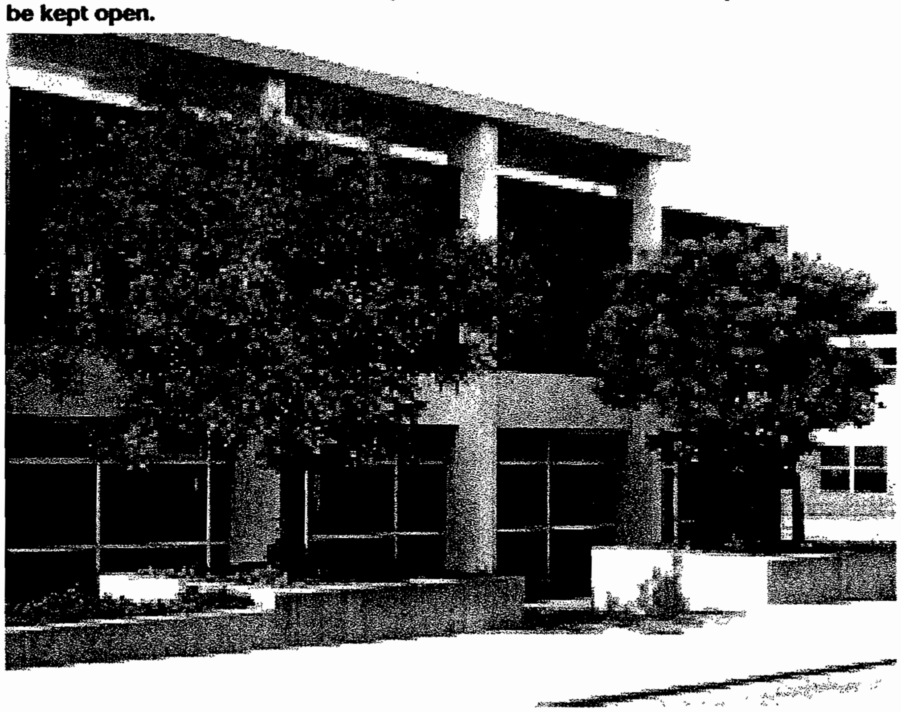
Designing aeration systems for confined areas

Tree roots are opportunistic, tending to grow in soil where the air-water balance is most favorable. Therefore, aeration systems may encourage deeper rooting of trees by increasing oxygen and water at greater depths than would normally occur under sidewalks, parking lots, and other confined areas. Promoting deeper root growth will improve the health and longevity of trees, and result in less damage to sidewalks and curbs from surface rooting. Constructing parking lots and sidewalks with permeable materials can also be used to improve soil moisture and aeration.

It has been proposed that aeration systems can be built into concrete cut-outs, continuous planters, or containers to improve the root environment and encourage root growth. The system depicted in Figures 18, 20, 23, and 23B has several purposes: to help increase aeration and provide a means of watering and fertilizing the tree. The extent to which embedded pipes may improve root growth has not been well documented, but they certainly do offer a practical means of irrigation that may promote deeper root growth if drainage is sufficient.

An aeration system is best designed and installed by an expert when major sidewalk or parking lot work is being completed. To prevent tree roots from clogging the system, the pipe should be wrapped with geotextile. The tops of vertical pipes should be covered with slotted caps to allow free air exchange, but keep out litter. The pipe system can be attached to a storm drain or other channel of moving air to help increase aeration and move excess water away from tree pits. In more complicated systems, a check valve should be installed at the connection to the storm drain to prevent water backflow.

Fig. 24. Raised planters can be used to provide more soil volume, avoid road salt and other run-off, and provide shady seats. The bottoms of raised planters should be kept open.



Preventing root interference with sidewalks

The majority of tree roots can be found within the top 2 feet of soil. When a tree root encounters an obstruction such as a sidewalk, it may extend underneath and raise the concrete as it grows in diameter every year. The likelihood of this occurring increases with compacted soils that limit the depth of root growth, especially when larger trees are planted in small spaces. Preventing root damage to sidewalks and curbs requires selecting species to match the planting site, altering sidewalk construction, installing root barriers, and providing good maintenance such as slow, deep waterings. It is not advisable to plant trees in areas where planting strips are less than 2 feet wide. In strips 2-to-4-feet wide, plant trees with a mature height less than 30 feet. In strips 4-to-6-feet wide, plant trees with a mature height of less than 45 feet. Trees that grow taller than 45 feet can be planted in planting areas over 6 feet wide.

Tree roots are less apt to raise sidewalk blocks if the cement blocks are thick and heavy enough and properly engineered. Sidewalk design can be altered through using more expansion joints near trees, curving or bowing sidewalks around trees, or reducing sidewalk width to 3 feet while expanding the size of a planting cut-out. Using root barriers between planted trees, sidewalks, and curbs can reduce damage, but the use of root barriers should be coupled with good tree selection, planting area and sidewalk design, proper planting, and proper maintenance. Root barriers that are commercially available include polypropylene plastic and geotextile fiber impregnated with herbicides. Six-mil plastic film also has been suggested as a root barrier. Barriers should be installed in trenches along the sidewalk or curb to a depth of 12 inches and extend 3 to 4 feet in each direction from the tree trunk. Water recently planted trees slowly and thoroughly, no more than once a week. Frequent shallow irrigation may encourage the development of a shallow root system.

Using a structural soil mix

A structural soil mix developed at Cornell University can be used in sidewalks, patios, and other confined planting areas. Use of this mix is believed to reduce sidewalk and curb damage and increase tree vigor and life span. The structural soil mix provides both a penetrable rooting volume and a load-bearing surface for asphalt and concrete. The three components of the mix are an angular crushed stone (to provide a skeleton to hold weight), a clay soil (to provide for nutrient and water-holding capacity), and a small amount of hydrogel (to bind soil and stone together). A ratio of 80 percent stone, 20 percent soil, and a small amount of hydrogel is recommended. Limestone gravel should not be used if planting trees, such as pin oak, red oak, and red maple, that are not tolerant of high pH soils.

Fig. 25. Although soil is used in the planting pit, structural soils can be used under sidewalks to expand the soil volume available for root growth.

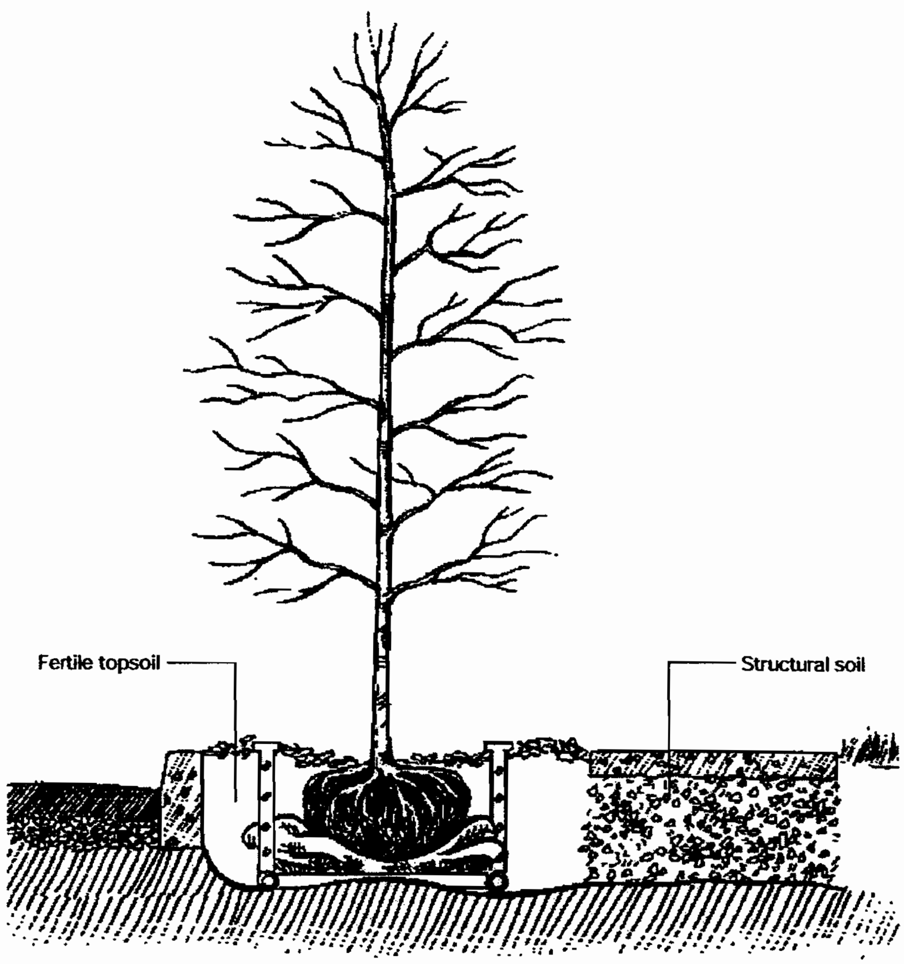


Fig. 26. Root barriers used along with proper site preparation, species selection, planting, and watering can decrease damage to curbs and sidewalks.

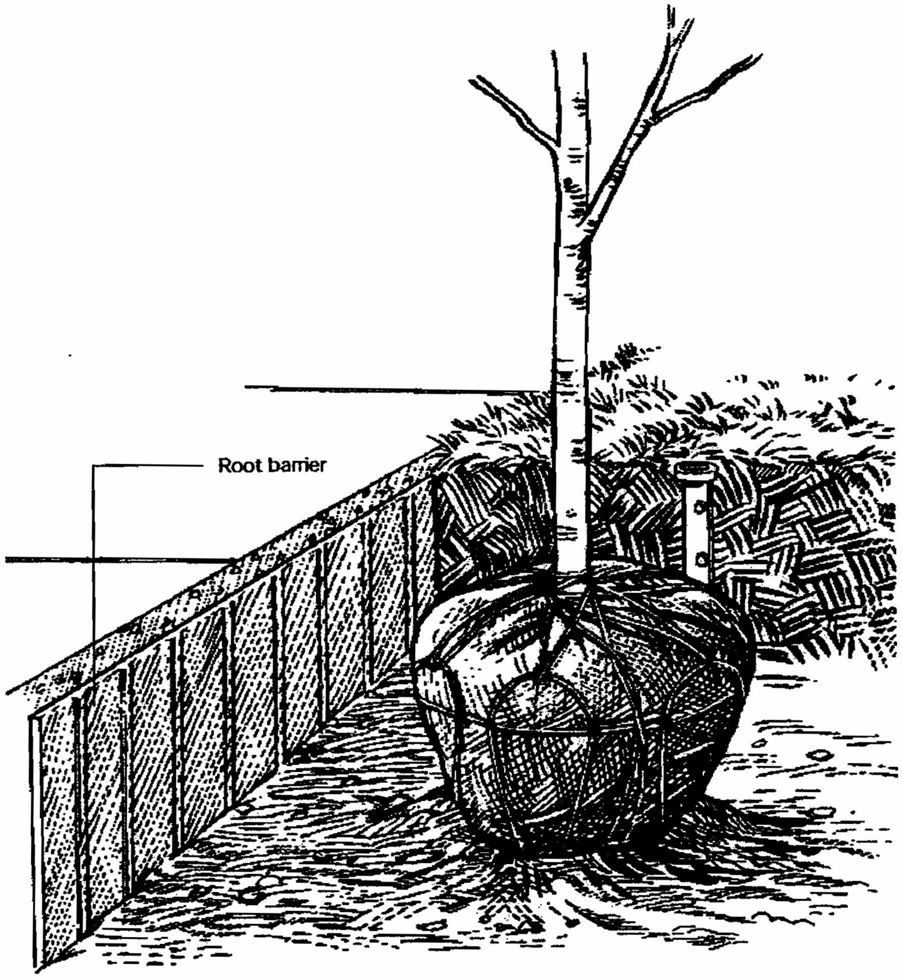


Fig. 27. Structural soils in continuous planters, under sidewalks, and under asphalt allow tree roots to grow while supporting the weight of cement and asphalt. The actual planting pit is filled with fertile soil.

Fig. 28. Operating heavy equipment has ruined this soil. Soil structure must be protected to plant or preserve trees.

Managing Soil Problems

Because of grading and construction requirements, soils under pavements and around buildings are mixed and compacted. Even parks that have been graded can have severely compacted soils. Soil compaction can also be caused or worsened by pedestrian and vehicular traffic.

Compacted soils have less oxygen available to tree roots, slower infiltration of water, and physically restrict root growth. Suggestions for managing compacted soils before tree planting are:

- Select trees such as sycamore, honeylocust, flowering pear, and thornless hawthorn that are more tolerant of compacted conditions. Do not plant trees that require good aeration such as flowering cherry, magnolia, serviceberry, or sugar maple in compacted soils.
- Adding peat moss, sand, or leaf mold to individual planting holes is usually unnecessary and may be counterproductive. Usually, compacted topsoil should just be broken and loosened, not amended. Some believe that moss acts like a sponge and may hold excessive water in the planting hole, especially in heavy clay soils.

- The best way to improve both droughty, sandy soils and compacted, poorly aerated/drained clay soils in large planting areas is to incorporate composted organic material into them. Composted organic material will improve the water-holding capacity of sandy soils and the drainage and aeration of heavy clay soils (Figure 29). Composted organic material should be incorporated at 25–50 percent of the total soil volume in the rooting area. Composted sewage sludge is satisfactory (maximum amount 25 percent of soil volume), but composted yard wastes (leaves, grass clippings, and wood chips) are preferred. A mix of composted sewage sludge and composted yard waste is acceptable.

- When using composted organic material, thoroughly mix the native soil and amendment together throughout the planting area. *Amending or replacing soil in individual planting holes is not recommended.* Abrupt transitions and dramatic differences in soil texture and fertility at the edge of a planting hole can actually inhibit the growth and spread of roots. When amending or replacing soil, it is best to loosen and amend or replace as much soil area as possible, not just soil in the planting hole. When replacing soil, a soil similar in texture and structure, or a soil coarser than the original, should be used. Whenever amending or replacing soils, it is important to blend the replacement soils together with the existing soil so that a sharp soil interface is not created. Soil interfaces do not allow free movement of air, water, or roots.

Fig. 29. Organic material should be incorporated/cultivated into large planting areas, not just planting holes.

Fig. 30. Larger holes should be dug when planting trees near schools, parks, and other areas with compacted soil.

Fig. 31. Along with larger planting holes, trenches can be dug leading away from the root ball to allow for expanded root growth in compacted soils. Trenches should be as deep as the root ball.

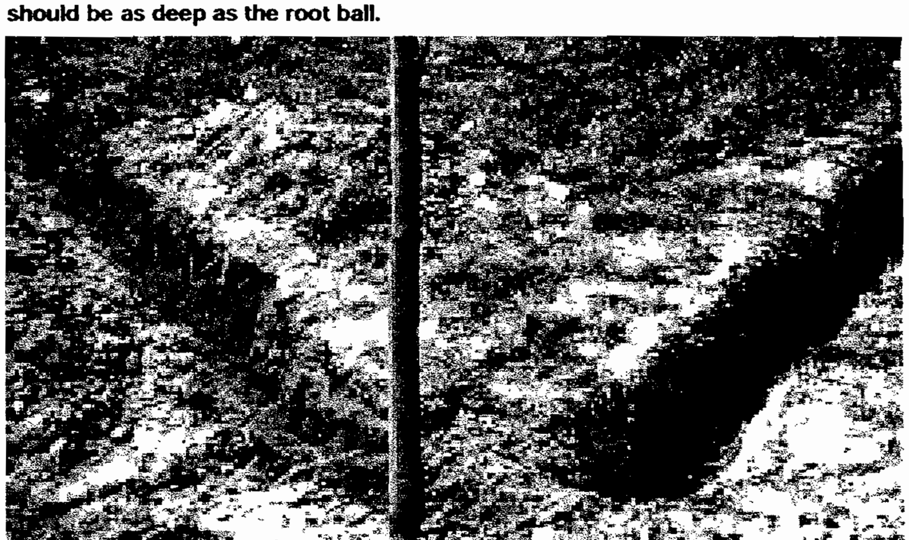


Fig. 32. Placing a thin amount of soil over compacted gravel or clay does not allow for good plant growth. The parking lot planter should be well drained and filled with a minimum of 4 feet of fertile topsoil.

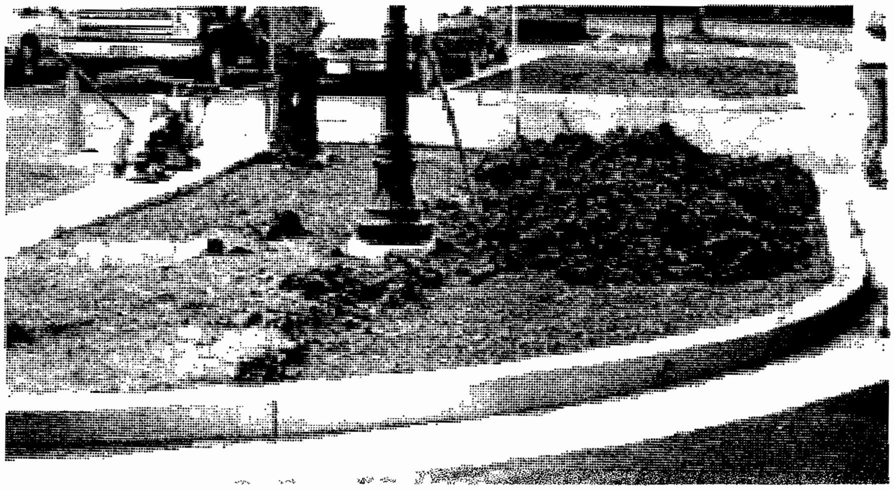
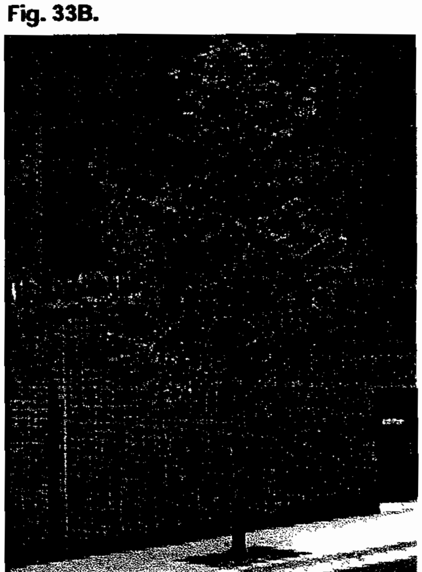


Fig. 33A. Planted at the same time in a shared space that provided more soil volume, the two trees grew much faster and larger than the sidewalk tree, below.

Fig. 33B.



- If individual trees must be planted in compacted soil, such as in a park or schoolyard, mark out a planting area that is five times the diameter of the root ball. Loosen and mix the soil in the entire planting area to the same depth as the root ball. If the soil is extremely heavy clay, consider replacing it with a good quality topsoil. French drains or gravel-filled sinks may be required where impermeable barriers exist below the planting area.

- Another alternative for planting in compacted soils is to dig a planting hole that is 12–24 inches wider than the root ball and then digging three to five trenches as deep as the root ball, extending 5–10 feet radially out from the planting hole. The trenches will look like spokes from a wheel hub. The soil in the trenches should be broken up or replaced with topsoil. Roots from the tree can then grow into the loosened soil.

- In sites that have mainly dirty fill, building rubble, or other impermeable barriers to root growth, consider replacing the soil in a continuous planter to a depth of 3–4 feet. To prevent settling of trees, moderately pack the replaced soil under the root ball and plant trees so that the root crown is slightly above the existing grade. Recommendations for amending rather than replacing soils can be complicated and depend on location, use, and existing soils. Contact your county Cooperative Extension for assistance when concerned about soil amendment.

Staking

Before staking a tree, you should consider if it is necessary. Most B&B trees are so heavy they do not require staking to hold them upright. Staking is recommended only if a tree needs support or protection. Staking should be used to protect trees from car doors and vandalism when planted near curbs, sidewalks, or playground.

Staking should keep a tree in an upright position, but allow for trunk movement. Trunk movement caused by the wind promotes taper in the trunk and increases trunk diameter and strength. There are various techniques for staking or guying. A simple method that will meet most planting situations is shown in Figure 12. Common staking problems can be avoided by following these guidelines:

- Ties can be made in various ways. A loosely fitted figure-8 tie of rubber garden hose, or webbed strap is easy to install, provides good support, and cushions the tree from rubbing. Do not use wire ties.
- Regardless of the tree size or the tie used, always allow enough slack to let the tree sway. This movement is necessary for building the strength of the trunk.
- Avoid driving stakes through the root ball or damaging tree roots when staking.
- Remove stakes and ties within one year, before ties girdle the trunk. If a tree will not stand on its own after one year of staking, consider removing the tree and replanting.

Fig. 34. Wire ties should not be used when staking because of girdling and other wounds. Ties should be removed after the first season.

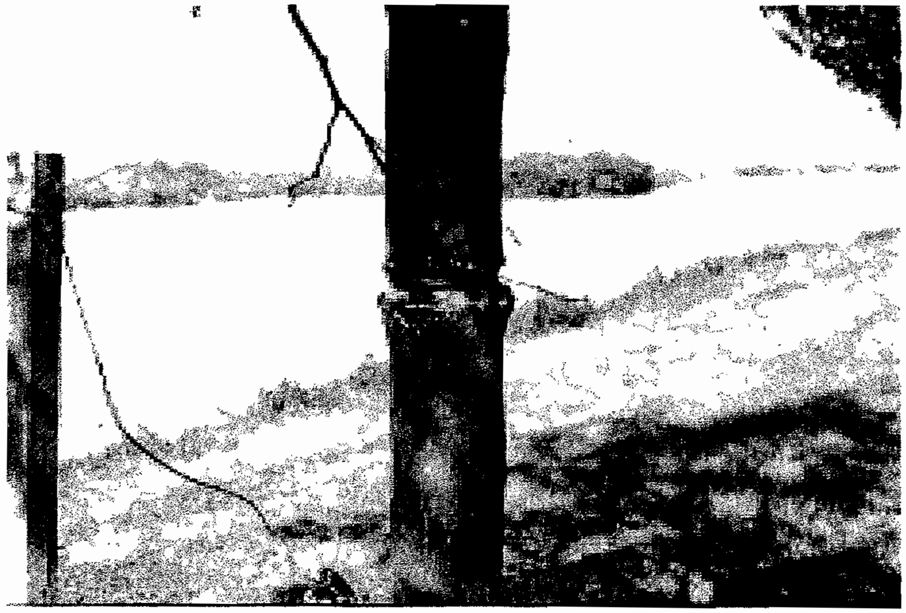
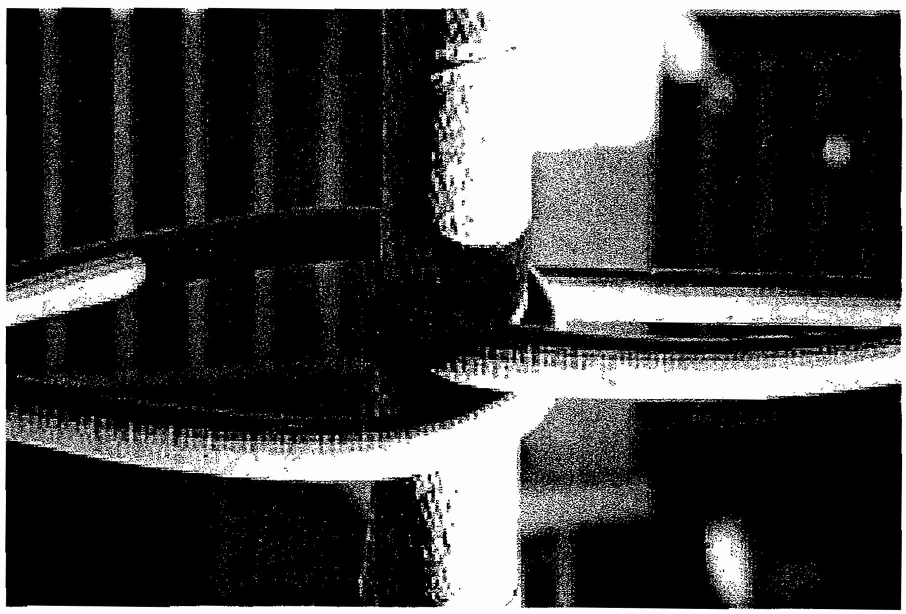


Fig. 35. Only soft materials, such as rubber hose or straps, should be used to attach trees to stakes.



Watering

Inadequate or excessive water reduces the chance that a tree will become established and grow. Trees become established when their root systems adequately support root and branch growth. Trees and other plants must be watered when planted and periodically thereafter until well established. The amount of water needed and when to apply it depends mainly upon inadequate rainfall, but also on the moisture-holding capacity of a soil, drainage, and the type of mulch used.

Rapid water loss on hot summer days can cause the death of young or newly planted trees. During hot, dry periods it is advisable to water trees every week during the first few growing seasons. A 2-or 2-1/2-inch caliper tree should receive 20–40 gallons of water each time it is watered. The need for watering will gradually fade in successive years as trees become established, but will still be beneficial during extended droughts. Water should be applied slowly and uniformly over the planting area until it penetrates the bottom of the root ball. This can be done by using perforated containers called TREEGATORS® or by using a 5-gallon plastic bucket with several small holes made in the sides, close to the bottom. Excessive watering combined with inadequate drainage deprives roots of oxygen and can kill them. *The symptoms of overwatering are the same as those for drought: wilting, loss of leaves, and poor growth.*

Fertilizing

Trees grown in good soils in a nursery, with proper weed control and that are irrigated and fertilized regularly, develop a "growth momentum." This momentum allows trees to reestablish both a dense, healthy canopy and root system after planting. The momentum is a result of high levels of carbohydrates (energy reserves) and nutrients (mineral elements) that accumulate in the trunk, limbs, and roots while growing under optimum nursery conditions.

Following the first flush of growth, some nutrients need to be replenished in a tree. Nitrogen is always needed, but should be applied in relatively small amounts, compared to phosphorus or potassium. The amount of fertilizer to apply should be based on the results of a soil test.

Trees planted in newly developed areas, sidewalk cutouts, and other harsh urban sites without soil amendment or replacement may benefit from fertilization at planting. Since soils in developed areas vary greatly from one site to another, and it is impractical to test the soil at each planting site, a general-purpose, complete fertilizer can be applied.

Newly emerging roots are sensitive to high salt levels in soils, so only fertilizers with low-salt indexes should be used. Fertilizers high in nitrogen can encourage heavy foliage growth, which may place a high demand for water on roots and increase problems with fire blight or other diseases or insects. Use a slow-release fertilizer that has a low proportion of nitrogen, such as a 10-20-20.

Recommendations for the amount of fertilizer are based on the number of cubic yards (for newly planted trees) or per 1000 ft^2 of canopy for larger trees.

Mulch and Other Surface Materials

Mulching newly planted trees is one of the easiest and most effective ways to protect them and encourage rapid establishment. Mulch conserves soil moisture, stabilizes soil temperatures, reduces competition from grasses and weeds, provides nutrient-rich organic material to a soil, lessens lawn mower and "weed trimmer" damage, and prevents soil compaction by pedestrians. Composted, coarse shredded mulch should be used for street plantings because it is less likely to be blown away. However, mulch should not be applied too thick and never placed against a tree trunk. Apply 3 to 4 inches of mulch over the rooting area of a tree. Because noncomposted mulch may take nitrogen from the soil, composted mulch is preferable. Leaf mulch is another option, but it will decompose more quickly and will have to be replenished more frequently. Maintaining the mulch layer each year will improve tree health substantially and can improve the structure of compacted soils.

Other materials can be used in sidewalk cut-outs and areas where mulch may be impractical. Although expensive, iron tree grates are long lasting and require little maintenance. Every few years the sections that interfere with the enlargement of the tree trunk must be cut out. Grates should have small openings that will not cause pedestrians to trip and won't collect debris. Bricks or paving stones set in sand are sometimes used, but these tend to settle and must be reset periodically. Special paving bricks, which support each other, can avert this problem. A mulch or gravel surface is practical only if it can be contained within an edging barrier. Paving materials, which permit little water to infiltrate and deprive trees of moisture essential to their health, should be avoided.

Fig. 36. If TREEGATORS® are not available, five-gallon buckets with small holes in the sides near the bottom can be used to water trees slowly and deeply.

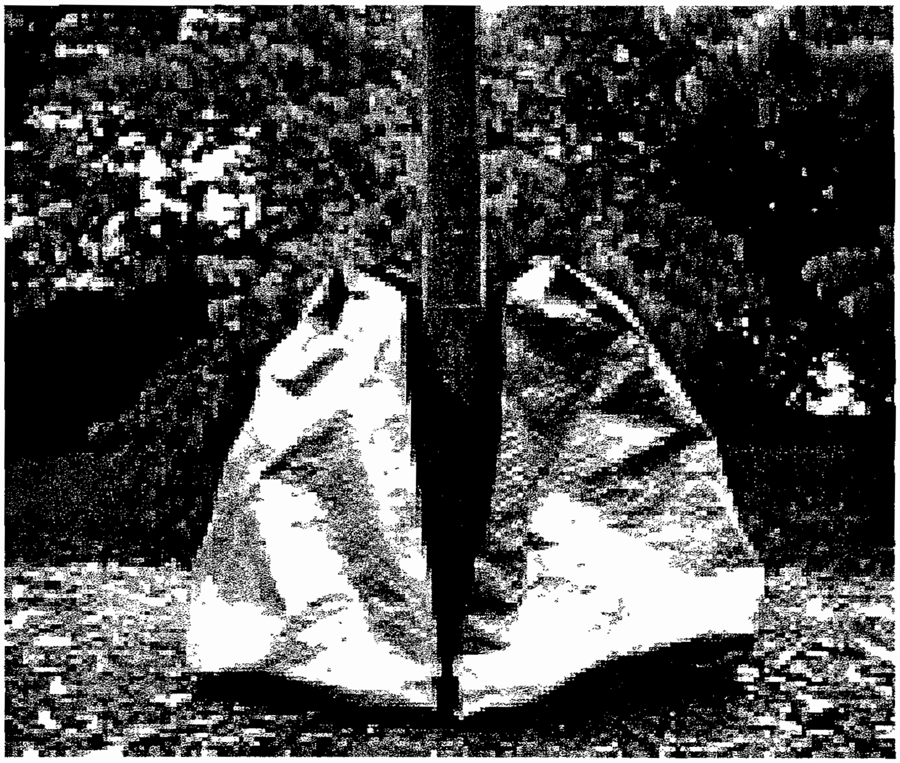


Fig. 37. Mulch improves soil and protects a tree from lawnmower and weed-trimmer damage. Only 3 to 4 inches of mulch are needed and should be kept away from the tree trunk.

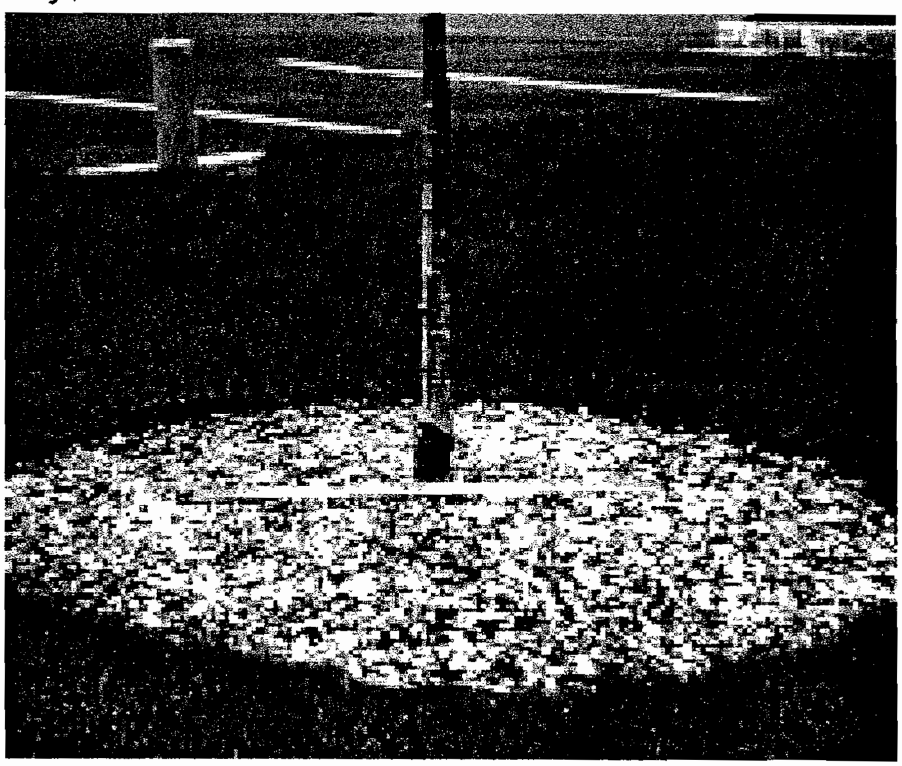


Fig. 38. Decay damage done by adding too much mulch, and by placing mulch against the tree trunk (below).

Controlling Disease, Insects, and Calamitous Damage

The best way to manage tree problems is to select and plant trees that are resistant to insect and disease problems and tolerant of existing site conditions. To reduce calamitous damage within the community forest from severe storms and unanticipated diseases such as Dutch elm disease, use a planting strategy that creates a diversity in age and species composition. Judicious pruning throughout the life of a tree and removing hazardous trees and limbs also will prevent many problems.

Training Young Trees

Responsibility for the care of newly planted trees should be designated even before they have been placed in the ground. Proper maintenance includes not only mulching and irrigation, but pruning as well. The purpose of pruning is to develop a balanced and well-spaced structure of branches while maintaining the typical form of a tree. Pruning trees while they are young is easier and causes smaller cut surfaces that heal faster and provide smaller entry ways for infection. Pruning to promote a strong framework during the first 10 years of a tree's life is a sound investment, which will decrease maintenance problems, efforts, and costs later.

Properly trained trees fulfill their intended functions sooner and should require less corrective pruning as they mature and branches become larger. Young trees should be trained so that they have a sturdy, tapered trunk with well-spaced branches. Remember that trees grow from the tips and top, not from the bottom. If not pruned, a branch that is at a height of 4 feet on a young tree will be at the same height on a mature tree. The training guidelines provided below apply primarily to large-growing trees such as maple, ash, and oak.

With proper training and supervision, volunteers can be used to prune young trees. It is important to show volunteers how and what to prune and to supervise their work. Before you start pruning a tree, look at the tree from all sides and decide which branches should be removed.

- Use sharp, clean tools in a safe manner. Common sense, a hand pruner, and a curved, narrow-pointed saw are all the tools needed for pruning young trees.

- Do not perform compensatory pruning on young trees in an attempt to bring a tree's canopy and root system into equilibrium. Trees bring themselves into balance. The less efficient leaves, twigs, and branches will naturally die out as a tree grows. Only prune broken, damaged, poorly attached, malformed, parallel, or crossing branches from newly planted trees.

- To encourage the growth of young trees, it is important to leave the lower, temporary branches below the lowest permanent branch. When temporary branches grow to about 1 to 2 inches in diameter, they should be removed so that wounds will be small and heal quickly. The height of the lowest permanent branch will depend on the function and location of the tree. Ornamental trees such as bronze beech are meant to have low, drooping branches and should be planted in areas that allow this. In parks and yards, retain small branches for 1 to 5 years to increase trunk size and taper. Gradually remove lower branches over several years, not in one pruning. Depending on their height, street trees should have been pruned up to 4 to 6 feet at the nursery. If additional branches need to be pruned, remove them gradually through multiple prunings over several years to provide clearance for pedestrians (8 feet) and vehicle traffic (15 feet). If needed, temporary branches can be shortened by pruning back to a side branch to provide clearance.

- For most trees, maintain a single, straight trunk or central leader. After the first year's growth, removing or pruning back other competing leaders can encourage a single leader. Overly crowded branches need to be thinned. Retain permanent branches that will provide a strong structure and grow into a shape that is natural for the species. Permanent branches should be well spaced vertically and radially. If any need to be shortened, they can be pruned back to a side branch. See Figure 39a for examples of branches that should be pruned. If two major limbs are growing so close together that they will grow into each other, one should be removed.

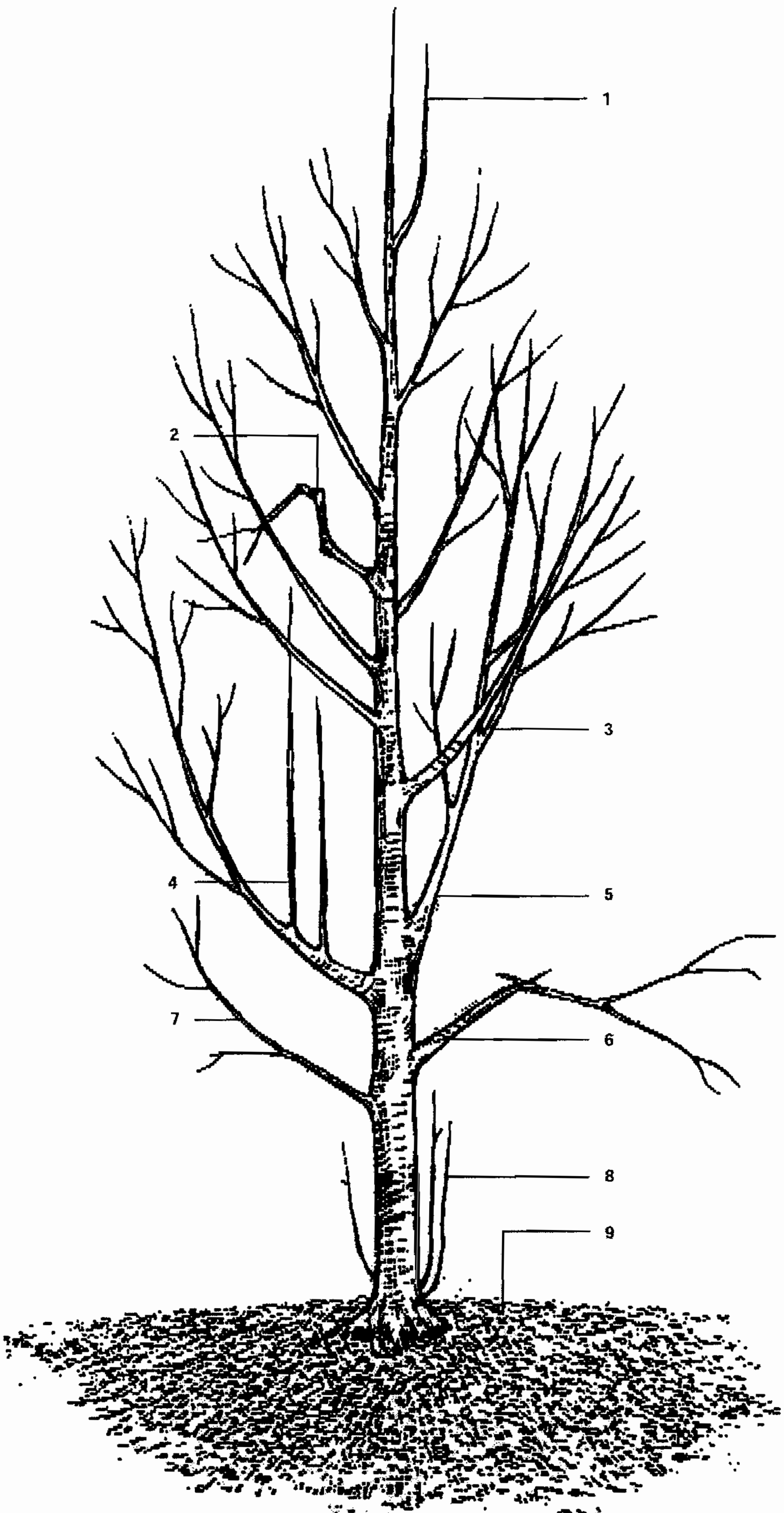
- Pruning back to a side branch or bud can retard the growth of a branch or leader. By pruning in this manner, the growth of the unpruned branch or leader can be accentuated over another.

- The angle of branch attachment and the relative size of a branch in relation to the trunk of a tree are important for the strength of branch attachment. Permanent branches should be one half or less the diameter of the trunk. Branches with unnaturally sharp angles should be removed, to avoid development of included bark and weak branch crotches. Clustering of branches that occur in species like zelkova and ornamental pear should be thinned, resulting in better vertical and radial spacing.

- Wound dressings are unnecessary and can be detrimental.

As a tree grows to maturity, pruning should concentrate on maintaining or improving its structure and removing deadwood and hazardous branches. Thinning tree crowns properly, based on species, tree age, and tree vigor, can increase the tree's health by allowing more light and air into the tree canopy and reducing insect and disease problems. Before pruning mature trees, consult the many specifications that have been developed for safe and proper pruning. Only a trained arborist should climb into large trees. Pruning should accentuate the natural form of a tree—trees should not be topped. By planting the right tree in the right place, the need to reduce the size of any tree can be minimized.

Fig. 39A. This figure shows examples of branches that should be pruned from newly planted trees.



1. Remove a competing leader. Cut back the less vigorous branch to prevent the development of two leaders, which could cause the fork to split as the tops grow larger.
2. Remove any malformed branch.
3. Remove any crossing branch. It may rub against and damage another branch.
4. Remove water sprouts.
5. Except for trees that have naturally ascending branches, remove any branch growing at a sharp or unnatural angle. When this branch becomes larger, the bark can separate the trunk and the branch. As the tree grows and the limb gets heavier, the added weight can result in the limb splitting from the trunk.
6. Remove any broken or badly damaged branches.
7. Remove lower branches over time. These branches should be removed during the first two years to provide clearance for vehicles and pedestrians.
8. Remove suckers, which take energy away from desirable growth.
9. Apply 3 to 4 inches of composted mulch at the base of the tree. Mulch should be kept 2 to 3 inches away from the trunk of the tree.

Fig. 39B. Growth of a properly pruned young tree.

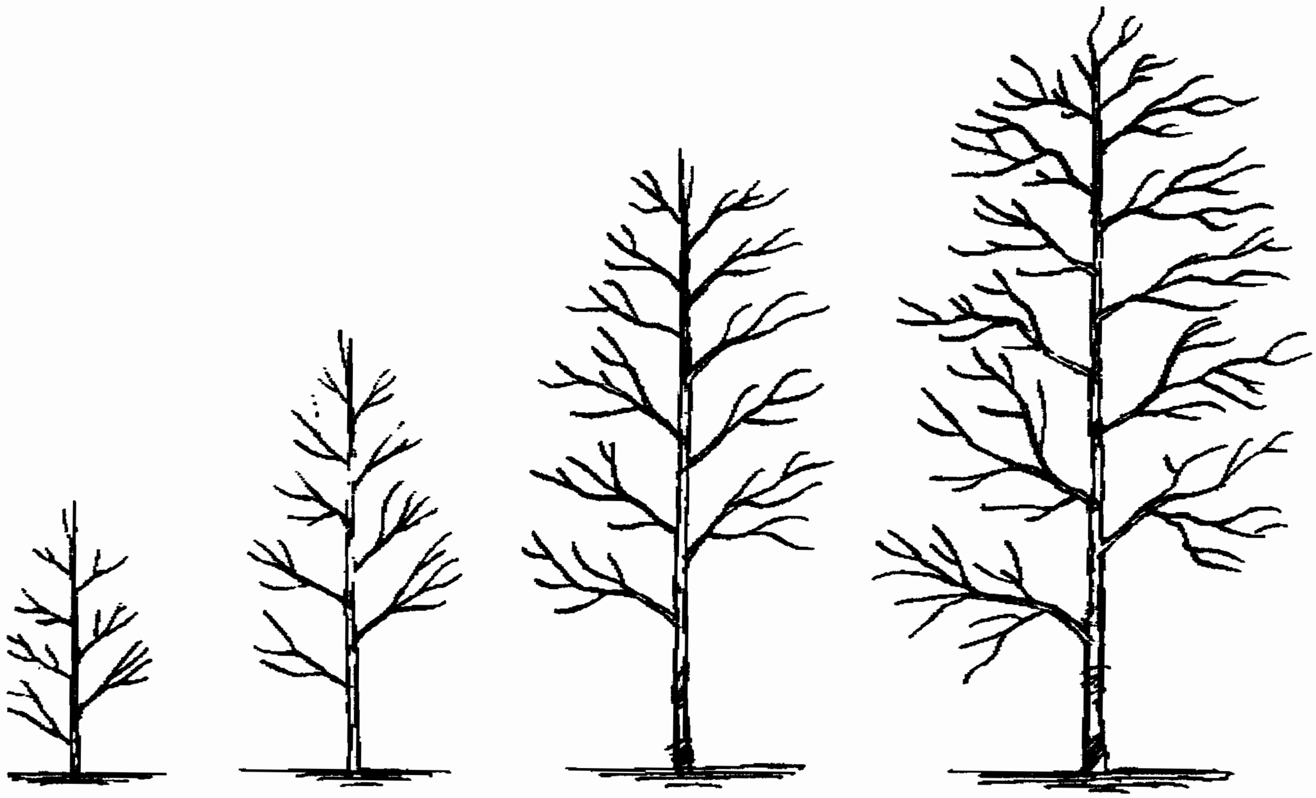
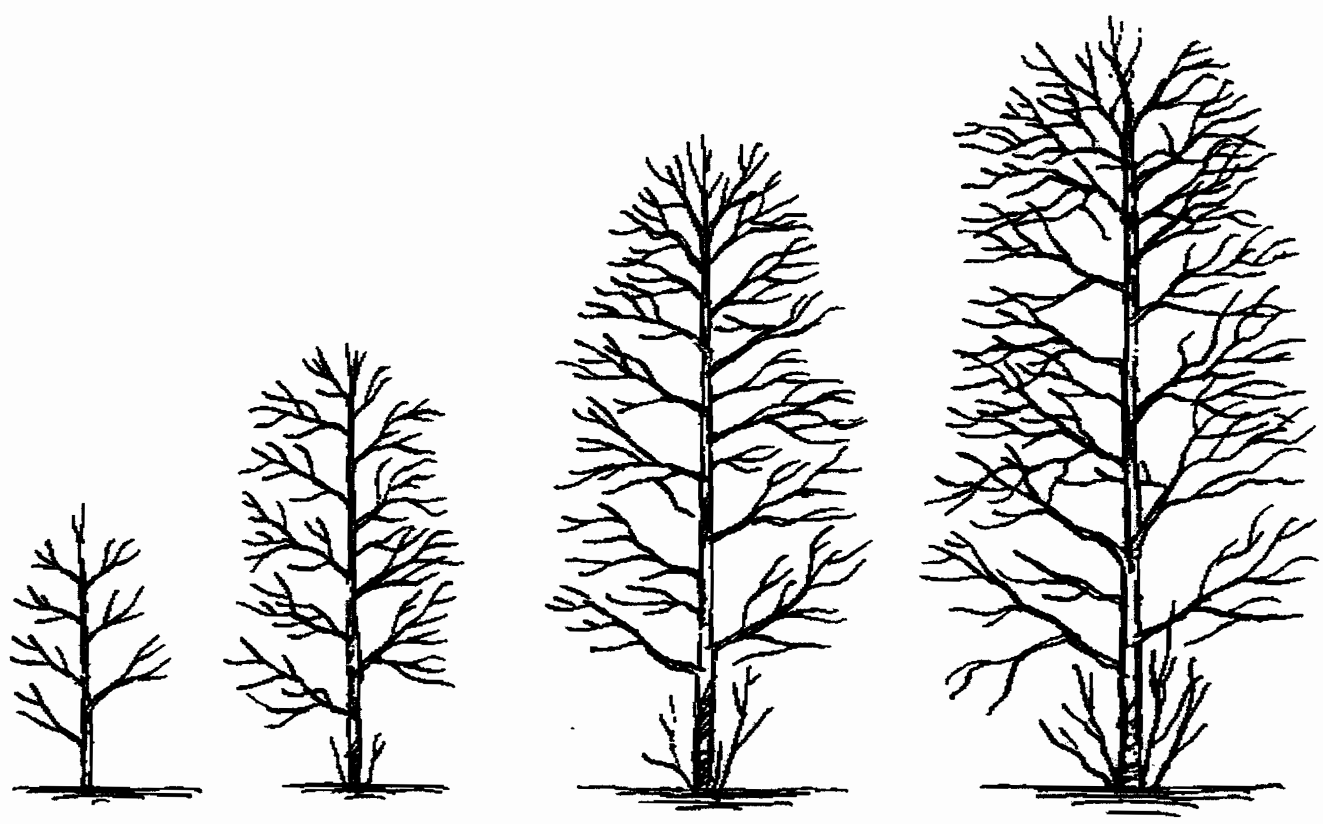


Fig. 39C. Growth of a young tree that has not been pruned.



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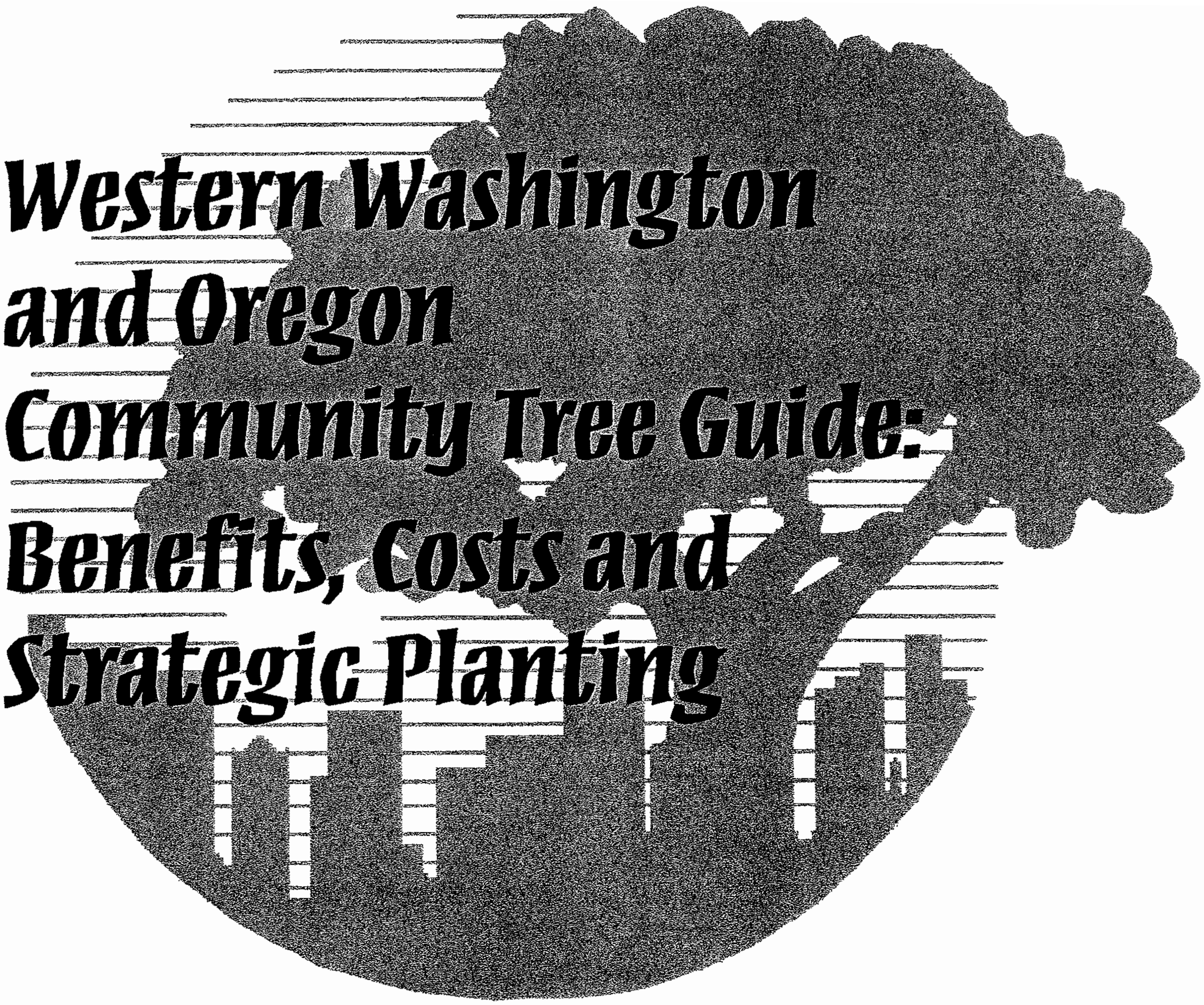
APPENDIX C:

Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting



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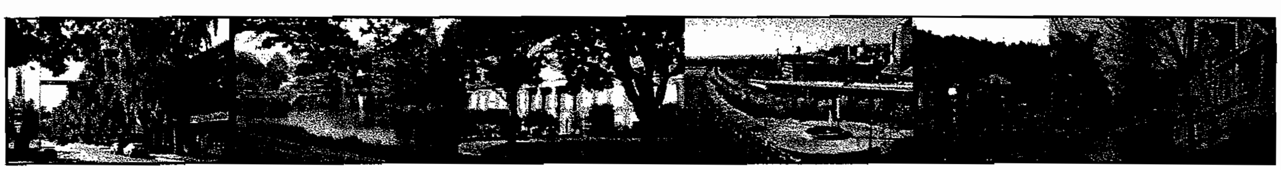

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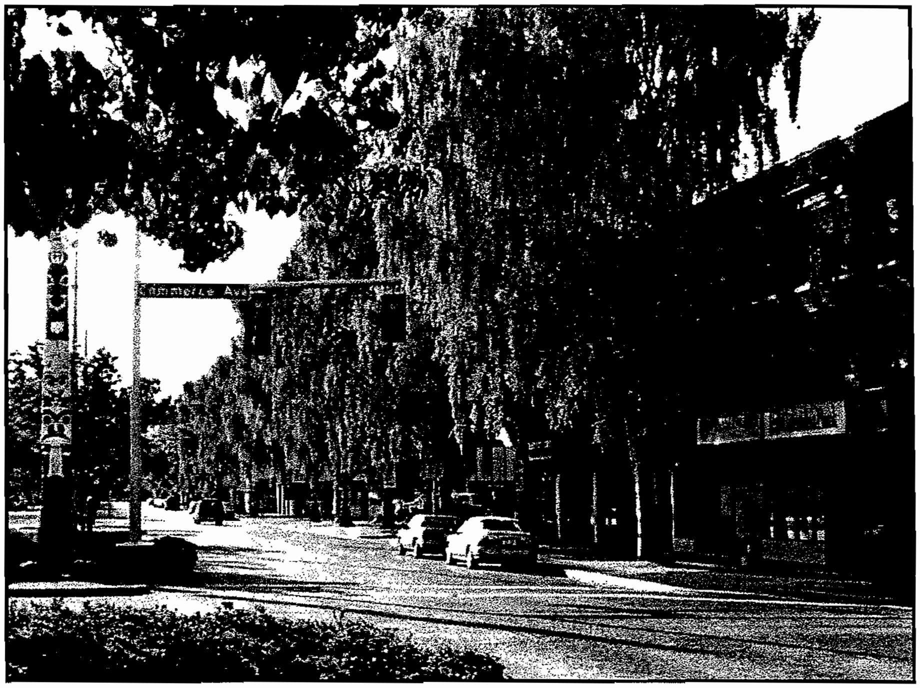


The green infrastructure is a significant component of Western Washington and Oregon communities.

Introduction

Communities in Western Washington and Oregon include nearly 7.4 million people (State of Washington 2001, US Census Bureau 2001) comprising almost 80% of the states' total populations. The region's rapid growth, development, and increasing congestion belie the area's verdant repute. Forests continue to be a quintessential component of the Pacific Northwest's economic, physical, and social fabric. However, with reliance on traditional forest products waning, urban and community forests bring opportunity for economic renewal, combating development woes, and increasing the quality of life for community residents.

1. The Western Washington and Oregon region (unshaded region) extends from the U.S.-Canada border, near Bellingham, to coastal southern Oregon.

Compared with the Northwest's interior, Western Washington and Oregon's maritime climate is mild enough to grow a diverse array of trees. These guidelines are specific to this region, where mild rainy winters with relatively warm, dry summers predominate. This region extends from Western Whatcom County along the Canadian border in the north, and south throughout the Willamette Valley. It includes communities of the West Cascade foothills, Puget Sound, Olympic Peninsula Lowland, and the length of Oregon's coastal region (Figure 1). Boundaries correspond with Sunset Climate Zones 4, 5, and 6 (Brenzel 1997) and USDA Hardiness Zones 3-8.

As many Western Washington and Oregon communities continue to grow during the next decade, sustaining healthy community forests becomes integral to the quality of life residents experience. The role of urban forests to enhance the environment, increase community attractiveness and livability, and foster civic pride is taking on greater significance as communities strive to balance economic growth with environmental quality and social well-being. The simple act of planting trees provides opportunities to connect residents with nature and with each other. Neighborhood tree plantings and stewardship projects stimulate investment by local citizens, business, and government in the betterment of their communities (Figure 2).

Trees provide environmental benefits

Western Washington and Oregon communities can promote energy efficiency through tree planting and stewardship programs that strategically locate trees to save energy, mitigate urban heat islands, and minimize conflicts with powerlines and other aspects of the urban infrastructure. These same trees can provide additional benefits by reducing stormwater runoff, improving local air, soil, and water quality, reducing atmospheric carbon dioxide (CO_2), providing wildlife habitat, increasing property values, enhancing community attractiveness and investment, and promoting human health and well-being.

Scope defined

Remnant native forest parcels throughout the Pacific Northwest are one component of the community forests found in the region. Their importance to the people and ecology of regional communities has been the focus of recent regional analyses (American Forests 1998, 2001). As these studies show, the rapid decline and loss of the forest cover they provide is not trivial. However, of no less importance are the open-grown, urban tree resources. This guide provides information on benefits and costs of open-grown trees in yard, park, and street locations. It should not be used to estimate benefits and costs for trees growing in forest stands.

2. Tree planting and stewardship programs provide opportunities for local residents to work together to build better communities.

Present in all communities of Western Washington and Oregon, street, park, and shade trees are components of community forests that impact every resident. The benefits they afford communities are myriad. However, with municipal tree programs dependent on taxpayer-supported general funds (Thompson and Ahern 2000), communities are forced to ask whether trees are worth the price to plant and care for over the long term, thus requiring urban forestry programs to demonstrate their cost-effectiveness (McPherson 1995). If tree plantings are proven to benefit communities, then monetary commitment to tree programs will be justified. Therefore, the objective of this tree guide is to identify and describe the benefits and costs of planting trees in Western Washington and Oregon – providing a tool for community officials and tree managers to increase public awareness and support for tree programs (Dwyer and Miller 1999).

This tree guide addresses a number of questions about the environmental and aesthetic benefits community trees provide in Western Washington and Oregon:

- What is their potential to improve environmental quality, conserve energy, and add value to communities?
- Where should residential and public trees be placed to maximize their cost-effectiveness?
- Which tree species will minimize conflicts with powerlines, sidewalks, and buildings?

Answers to these questions should assist policy makers, urban forest managers, non-profit organizations, design and planning professionals, utility personnel, and concerned citizens who are planting and managing trees to improve their local environments and build better communities.

What's in the Tree Guide

This tree guide is organized as follows:

Chapter 1. Provides background information on the potential of trees in Western Washington and Oregon to provide benefits, as well as management costs that are typically incurred.

Chapter 2. Provides detailed assumptions, data sources, and calculations for tree benefits and costs.

Chapter 3. Illustrates how to estimate urban forest benefits and costs in your community and tips to increase cost-effectiveness.

Chapter 4. Presents guidelines for selecting and siting of trees in residential yards and public open spaces.

Chapter 5. Contains a tree selection list with information on tree species recommended for Western Washington and Oregon communities.

Chapter 6. Lists references cited in the guide.

Chapter 7. Provides definitions for technical terms used in the guide.

Appendix A. Contains tables that list annual benefits and costs of typical trees at 5-year intervals for 40 years after planting.

1. Identifying Benefits and Costs of Urban and Community Forests

This chapter provides an in-depth look at benefits and costs of public and privately managed trees. First, the functional benefits and associated economic value of community forests are described. Second, expenditures related to tree care and management are assessed–a procedure prerequisite to cost-effective programs (Hudson 1983).

Benefits

Saving Energy

Heat islands increase temperatures

Buildings and paving, along with low canopy and soil cover, increase the ambient temperatures within a city. Research shows that even in temperate climate zones–such as those of the Pacific Northwest–temperatures in urban centers are steadily increasing by approximately 0.5°F (0.3°C) per decade. Winter benefits of this warming do not compensate for the detrimental effects of magnifying summertime temperatures. Because electric demand of cities increases about 1-2% per 1°F (3-4% per °C) increase in temperature, approximately 3-8% of current electric demand for cooling is used to compensate for this urban heat island effect of the last four decades (Akbari et al. 1992).

Warmer temperatures increase CO_2

Warmer temperatures in cities, compared to surrounding rural areas, have other implications. Increases in CO_2 emissions from fossil fuel power plants, municipal water demand, unhealthy ozone levels, and human discomfort and disease are all symptoms associated with urban heat islands. These problems are accentuated by global climate change, which may double the rate of urban warming.

What can trees do?

In Western Washington and Oregon, there is ample opportunity to "retrofit" communities with more sustainable landscapes through strategic tree planting and stewardship of existing trees. Accelerating urbanization hastens the need for landscapes that reduce stormwater runoff, conserve energy and water, sequester CO_2, attract wildlife, and provide other aesthetic, social, and economic benefits in new development.

How trees work

Trees of the urban forest modify climate and conserve building-energy use in three principal ways:

- Shading–reduces the amount of radiant energy absorbed and stored by built surfaces.
- Transpiration–converts moisture to water vapor and thus cools by using solar energy that would otherwise result in heating of the air.
- Wind speed reduction–reduces the infiltration of outside air into interior spaces and conductive heat loss where thermal conductivity is relatively high (e.g., glass windows) (Simpson 1998).

Trees lower temperatures

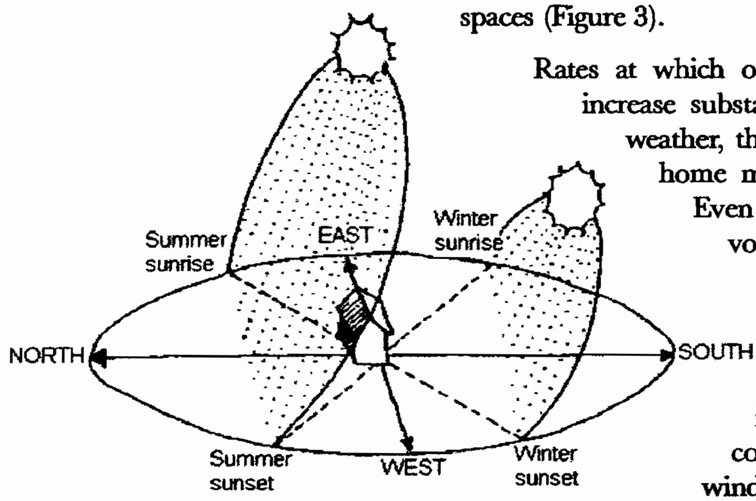
Trees and other greenspace within individual building sites may lower air temperatures 5°F (3°C) compared to outside the greenspace. At the larger scale of urban climate (6 miles or 10 km square), temperature differences of more than 9°F (5°C) have been observed between city centers and more vegetated suburban areas (Akbari et al. 1992).

Urban forests cool

The relative importance of these effects depends on the size and configuration of trees and other landscape elements (McPherson 1993). Generally, large greenspaces (300-1,500 ft [100-500 m] distance) have a greater sphere of influence on the climate than do smaller greenspaces. Tree spacing, crown spread and vertical distribution of leaf area influence the transport of cool air and pollutants along streets and out of urban canyons.

Trees increase home energy efficiency

For individual buildings, strategically placed trees can increase energy efficiency in the summer and winter. Solar angles are important when the summer sun is low in the east and west for several hours each day. Tree shade to protect east–and especially west–walls help keep buildings cool. In the winter, solar access on the southern side of buildings can warm interior spaces (Figure 3).



3. Paths of the sun at winter and summer solstices (from Sand 1991).

Rates at which outside air infiltrates into a building can increase substantially with wind speed. In cold windy weather, the entire volume of air in a poorly sealed home may change two to three times per hour. Even in newer or tightly sealed homes, the entire volume of air may change every two to three hours. Windbreaks reduce wind speed and resulting air infiltration by up to 50%, translating into potential annual heating savings of 25% (Heisler 1986). Reductions in wind speed reduce heat transfer through conductive materials as well. Cool winter winds, blowing against single-pane windows, can contribute significantly to the heating load of homes and buildings by increasing the temperature gradient between inside and outside temperatures. Windbreaks reduce air infiltration and conductive heat loss from buildings.

Shade saves $

Compared with the Northwest interior, the maritime influence on Western Washington and Oregon moderates the potential energy savings from trees during the heating/cooling seasons. A computer simulation of annual cooling savings for an energy efficient home in Portland, OR indicated that the typical household with air conditioning spent about $50 each year for cooling and $600 for heating. Two 25-ft tall (7.5 m) trees–on the west side of the house–were estimated to save $18 each year for cooling, a 36% reduction (365 kWh) (McPherson et al. 1993). The same two trees reduced annual heating costs by about $7 (1%). The total $25 savings represented a 4% reduction in annual heating and cooling costs.

Reducing Atmospheric Carbon Dioxide

Trees reduce CO_2

Urban forests can reduce atmospheric CO_2 in two ways:

- Trees directly sequester CO_2 as woody and foliar biomass while they grow, and
- Trees near buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with electric power production.

Releases of CO_2

On the other hand, vehicles, chain saws, chippers, and other equipment release CO_2 during the process of planting and maintaining trees. And eventually, all trees die and most of the CO_2 that has accumulated in their woody biomass is released into the atmosphere through decomposition.

Avoided CO_2 emissions

Regional variations in climate and the mix of fuels that produce energy to heat and cool buildings influence potential CO_2 emission reductions. Average emission rates for three main Western Washington and Oregon operator-based Power Control Areas–Puget Sound Power & Light Co., Portland General Electric Co., and Seattle City Light–are approximately 0.67 lbs (0.30 kg) CO_2/kWh (US EPA 2001). Due to the mix of fuels used to generate the power, this emission rate was higher than the two-state average (0.27 lbs [0.12 kg] CO_2/kWh), where hydroelectric power predominates. Trees' role in reducing energy demand is vital to reducing these emissions.

What is the complete CO_2 picture?

To provide a complete picture of atmospheric CO_2 reductions from tree planting it is important to consider CO_2 released into the atmosphere through tree planting and care activities, as well as decomposition of wood from pruned or dead trees. The combustion of gasoline and diesel fuels by vehicle fleets, and equipment such as chainsaws, chippers, stump removers, and leaf blowers is a relatively minor source of CO_2. Typically, CO_2 released due to tree planting, maintenance, and other program-related activities is about 2-8% of annual CO_2 reductions obtained through sequestration and avoided power plant emissions (McPherson and Simpson 1999).

Financial value of CO_2 reduction

One of the most comprehensive studies of atmospheric CO_2 reductions by an urban forest found that Sacramento California's six million trees removed approximately 335,100 tons (304,000 metric tonnes) of atmospheric CO_2 annually, with an implied value of $3.3 million (McPherson 1998). Avoided power plant emissions (83,300 tons [75,600 tonnes]) accounted for 32% of the amount reduced (262,300 tons [238,000 tonnes]). The amount of CO_2 reduction by Sacramento's urban forest offset 1.8% of total CO_2 emitted annually as a byproduct of human consumption. This savings could be substantially increased through strategic planting and long-term stewardship that maximizes future energy savings from new tree plantings, as with the Cities for Climate Protection Campaign (McPherson 1994).

CO_2 reduction in Portland

Portland's nonprofit tree planting organization, Friends of Trees, estimated that planting 144,250 trees and seedlings over five years would sequester more than 74,679 tons (73,000 tonnes) of CO_2 at a cost of about $34/ton

($31/tonne) (Friends of Trees 1995). The average annual sequestration rate at maturity was 223 lb (101 kg) per tree planted. This calculation assumed loss rates of 20% and 60% for trees planted in urban areas (yards and streets) and those in natural areas, respectively. After the study was completed, Portland General Electric funded a tree planting and education plan aimed at reducing atmospheric CO_2.

Improving Air Quality

Trees improve air quality

Urban trees provide air quality benefits in four main ways:

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

Trees and ozone relationship

In the absence of the cooling effects of trees, higher air temperatures contribute to ozone formation. Most trees emit various biogenic volatile organic compounds (BVOCs) such as isoprenes and monoterpenes that can contribute to ozone formation. The ozone-forming potential of different tree species varies considerably. A computer simulation study for the Los Angeles basin found that increased tree planting of low BVOC emitting tree species would reduce ozone concentrations and exposure to ozone (Taha 1996). However, planting of medium- and high-emitters would increase overall ozone concentrations.

Although many communities in Western Washington and Oregon do not experience poor air quality, several areas have exceeded U.S. Environmental Protection Agency (EPA) standards. Recently, there have been few cases of noncompliance, but several areas in the region continue to experience periods of poor air quality. Continued progress is needed to meet and sustain mandated air quality standards.

The extent to which urban trees reduce air pollutants in Western Washington and Oregon communities has begun to be documented. As a result, potentially cost-effective approaches to improving air quality, such as urban tree planting, are being examined.

Community trees in the Pacific Northwest

American Forest's (1998) study of the Puget Sound area found that tree canopy cover in 1996 removed 38,990 tons (35,380 metric tonnes) of air pollutants valued at $166.5 million. A similar analysis for the Willamette/Lower Columbia Region reported that existing tree cover in 2000 (24%) removed 89,000 tons (80,740 tonnes) of pollutants annually with a value of $419 million (American Forests 2001). Trees were most effective in removing ozone (O_3), nitrogen dioxide (NO_2), and particulate matter (PM_{10}).

Trees "eat" pollutants and save money

Other West Coast studies highlight recent research aimed at quantifying air quality benefits of urban trees. The annual value of pollutant uptake by a typical medium-sized tree in coastal southern California was estimated at approximately $20, and $12 in the San Joaquin Valley (McPherson et al. 1999a, 2000).

What about hydrocarbons?

Trees in a Davis, CA parking lot were found to benefit air quality by reducing air temperatures 1-3°F (0.5-1.5°C) (Scott et al. 1999). By shading asphalt surfaces and parked vehicles, the trees reduced hydrocarbon emissions from gasoline that evaporates out of leaky fuel tanks and worn hoses. These evaporative emissions are a principal component of smog, and parked vehicles are a primary source. In Chicago, the EPA adapted this research to the local climate and developed a method for easily estimating evaporative emission reductions from parking lot tree plantings. Grant applicants can use this approach to quantify pollutant reductions from parking lot tree planting projects.

Reducing Stormwater Runoff and Hydrology

Trees protect water and soil resources

Urban stormwater runoff is a major source of pollution entering riparian areas of the Pacific Northwest. With several salmon species now listed as threatened and endangered, stormwater management requirements have become increasingly stringent and costly. A healthy urban forest can reduce the amount of runoff and pollutant loading in receiving waters in three primary ways:

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows,
- Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and reduce overland flow,
- Tree canopies reduce soil erosion by diminishing the impact of raindrops on barren surfaces.

Trees reduce runoff

Studies that have simulated urban forest effects on stormwater report annual runoff reductions of 2-7%. Annual interception of rainfall by Sacramento's urban forest for the urbanized area was only about 2% due to the winter rainfall pattern and predominance of non-evergreen species (Xiao et al. 1998). However, average interception on land with tree canopy cover ranged from 6-13% (150 gal [20 m^3] per tree on average), close to values reported for rural forests. In Modesto, CA, each street and park tree was estimated to reduce stormwater runoff by 845 gal (3.2 m^3) annually, with a benefit valued at $7 per tree (McPherson et al. 1999b). A typical medium-sized tree in coastal southern California was estimated to intercept 2,380 gal (9 m^3) ($5) annually (McPherson et al. 2000). These studies showed that broadleaf evergreens and conifers intercept more rainfall than deciduous species where winter rainfall patterns prevail.

In Puget Sound, the existing canopy was estimated to reduce runoff by 2.9 billion ft^3 (82.1 million m^3) valued at $5.9 billion (American Forests 1998).

In the Willamette/Lower Columbia region, existing canopy (24%) reduced runoff by 8.5 billion ft^3 (240.7 million m^3) (American Forests 2001). The one-time construction cost for detention basins large enough to handle this amount of runoff was $20.2 billion, with an annualized value of $140 million.

Urban forests can dispose of waste water

Urban forests can provide other hydrologic benefits. For example, irrigated tree plantations or nurseries can be a safe and productive means of wastewater treatment and disposal (Dwyer et al. 1992). Reused wastewater can recharge aquifers, reduce stormwater treatment loads, and create income through sales of nursery or wood products. Recycling urban wastewater into greenspace areas can be an economical means of treatment and disposal, while at the same time providing other environmental benefits.

Shade yields less water use at power plants

Power plants consume water in the process of producing electricity. For example, coal-fired plants use about 0.6 gal/kWh (0.002 m^3/kWh) of electricity provided. Trees that reduce the demand for electricity can also reduce water consumed at the power plant (McPherson et al. 1993). Precious surface water resources are preserved and thermal pollution of rivers reduced.

Aesthetics and Other Benefits

Trees provide a host of aesthetic, social, economic, and health benefits that should be included in any benefit-cost analysis. One of the most frequently cited reasons that people plant trees is for beautification. Trees add color, texture, line, and form to the landscape. In this way, trees soften the hard geometry that dominates built environments. Research on the aesthetic quality of residential streets has shown that street trees are the single strongest positive influence on scenic quality (Schroeder and Cannon 1983).

Retail settings

Consumer surveys have found that preference ratings increase with the presence of trees in the commercial streetscape. In contrast to areas without trees, shoppers indicated that they shop more often and longer in well-landscaped business districts, and were willing to pay more for goods and services (Wolf 1999).

Public safety

Research in public housing complexes found that outdoor spaces with trees were used significantly more often than spaces without trees. By facilitating interactions among residents, trees can contribute to reduced levels of domestic violence, as well as foster safer and more sociable neighborhood environments (Sullivan and Kuo 1996).

Property values

Well-maintained trees increase the "curb appeal" of properties. Research comparing sales prices of residential properties with different tree resources suggests that people are willing to pay 3-7% more for properties with ample tree resources versus few or no trees. One of the most comprehensive studies of the influence of trees on residential property values was based on actual sales prices and found that each large front-yard tree was associated with about a 1% increase in sales price (Anderson and Cordell 1988). A much greater value of 9% ($15,000) was determined in a U.S. Tax Court case for the loss of a large black oak on a property valued at $164,500 (Neely 1988). Depending on average home sales prices, the value of this benefit can contribute significantly to cities' property tax revenues.

Social and psychological benefits

Scientific studies confirm our intuition that trees in cities provide social and psychological benefits. Humans derive substantial pleasure from trees, whether it is inspiration from their beauty, a spiritual connection, or a sense of meaning (Dwyer et al. 1992; Lewis 1996). Following natural disasters people often report a sense of loss if the urban forest in their community has been damaged (Hull, 1992). Views of trees and nature from homes and offices provide restorative experiences that ease mental fatigue and help people to concentrate (Kaplan & Kaplan 1989). Desk-workers with a view of nature report lower rates of sickness and greater satisfaction with their jobs compared to those having no visual connection to nature (Kaplan 1992). Trees provide important settings for recreation and relaxation in and near cities. The act of planting trees can have social value, for community bonds between people and local groups often result.

Human health benefits

The presence of trees in cities provides public health benefits and improves well-being of those who live, work and recreate in cities. Physical and emotional stress has both short term and long-term effects. Prolonged stress can compromise the human immune system. A series of studies on human stress caused by general urban conditions and city driving show that views of nature reduce stress response of both body and mind (Parsons et al. 1998). City nature also appears to have an "immunization effect," in that people show less stress response if they've had a recent view of trees and vegetation. Hospitalized patients with views of nature and time spent outdoors need less medication, sleep better, and have a better outlook than patients without connections to nature (Ulrich 1985). Trees reduce exposure to ultraviolet light, thereby lowering the risk of harmful effects from skin cancer and cataracts (Tretheway and Manthe 1999).

Noise reduction

Certain environmental benefits from trees are more difficult to quantify than those previously described, but can be just as important. Noise can reach unhealthy levels in cities. Trucks, trains, and planes can produce noise that exceeds 100 decibels, twice the level at which noise becomes a health risk. Thick strips of vegetation in conjunction with landforms or solid barriers can reduce highway noise by 6-15 decibels. Plants absorb more high frequency noise than low frequency, which is advantageous to humans since higher frequencies are most distressing to people (Miller 1997).

Wildlife

Although urban forests contain less biological diversity than rural woodlands, numerous types of wildlife inhabit cities and are generally highly valued by residents. For example, older parks, cemeteries, and botanical gardens often contain a rich assemblage of wildlife. Remnant woodlands and riparian habitats within cities can connect a city to its surrounding bioregion. Wetlands, greenways (linear parks), and other greenspace resources can provide habitats that conserve biodiversity (Platt et al. 1994).

Jobs and environmental education

Urban forestry can provide jobs for both skilled and unskilled labor. Public service programs and grassroots-led urban and community forestry programs provide horticultural training to volunteers across the U.S. Also, urban and community forestry provides educational opportunities for residents who want to learn about nature through first-hand experience (McPherson and Mathis 1999). Local nonprofit tree groups, along with municipal volunteer programs, often provide educational materials, work with area schools, and hands-on training in the care of trees.

Costs

Planting and Maintaining Trees

PNW cities spend about $3.25 per tree

The environmental, social, and economic benefits of urban and community forests come with a price. A 1994 survey reported that communities in the Pacific Northwest spent an average of $3.25 per tree, annually, for street and park tree management (Tschantz and Sacamano 1994). Generally, the single largest expenditure was for tree pruning, followed by tree removal/disposal, and tree planting.

Most trees in new residential subdivisions are planted by developers, while cities/counties and volunteer groups plant most trees on existing streets and parklands. In many cities, tree planting has not kept pace with removals. Moreover, limited growing space in cities is responsible for increased planting of smaller, shorter-lived trees that provide fewer benefits compared to larger trees.

Residents spend about $5-$10 per tree

Annual expenditures for tree management on private property have not been well-documented. Costs vary considerably, ranging from some commercial/residential properties that receive regular professional landscape service to others that are virtually "wild" and without maintenance. An initial analysis of data for Sacramento and other cities suggested that households typically spent about $5-$10 annually per tree for pruning and pest and disease control (McPherson et al. 1993, Summit and McPherson 1988).

Irrigation costs

Despite the temperate climate in Western Washington and Oregon, newly planted trees require irrigation for about three years. Installation of drip or bubbler irrigation can increase planting costs by $100 or more per tree. Once planted, 15-gal trees typically require 100-200 gal (0.4-0.8 m^3) per year during the establishment period. Assuming a water price of $1.76/Ccf, annual irrigation water costs are initially less than $1 per tree. However, as trees mature their water use can increase with an associated increase in annual costs. Trees planted in areas with existing irrigation may require supplemental irrigation. Other trees grown in the region, however, require little or no supplemental irrigation after an establishment period.

Conflicts with Urban Infrastructure

Tree roots and sidewalks can conflict

Like other cities across the U.S., communities of Western Washington and Oregon are spending millions of dollars each year to manage conflicts between trees and powerlines, sidewalks, sewers, and other elements of the urban infrastructure. In California, for example, a 1998 survey showed that cities spent an average of $2.36 per capita on sidewalk, curb and gutter repair, tree removal and replacement, prevention methods, and legal/liability costs (McPherson 2000). Some cities spent as little as $0.75 per capita while others spent $6.98 per resident. These figures were for street trees only and did not include repair costs for damaged sewer lines, building foundations, parking lots, and various other hardscape elements. When these additional expenditures were included, the total cost of root-sidewalk conflicts was well over $100 million per year in California alone.

In Washington and Oregon, dwindling budgets are forcing an increasing number of cities to shift the costs of sidewalk repair to residents. This shift especially impacts residents in older areas, where large trees have outgrown small sites and infrastructure has deteriorated.

Cost of conflicts

The consequences of efforts to control these costs are having alarming effects on urban forests (Bernhardt and Swiecki 1993, Thompson and Ahern 2000):

- Cities are continuing to "downsize" their urban forests by planting smaller-stature trees. Although small trees are appropriate under powerlines and in small planting sites, they are less effective than large trees at providing shade, absorbing air pollutants, and intercepting rainfall.
- Sidewalk damage was the second most common reason that street and park trees were removed. We lose thousands of healthy urban trees and forgo their benefits each year because of this problem.
- 25% of cities surveyed were removing more trees than they were planting. Residents forced to pay for sidewalk repairs may not want replacement trees.

Use the right tree to fix conflicts

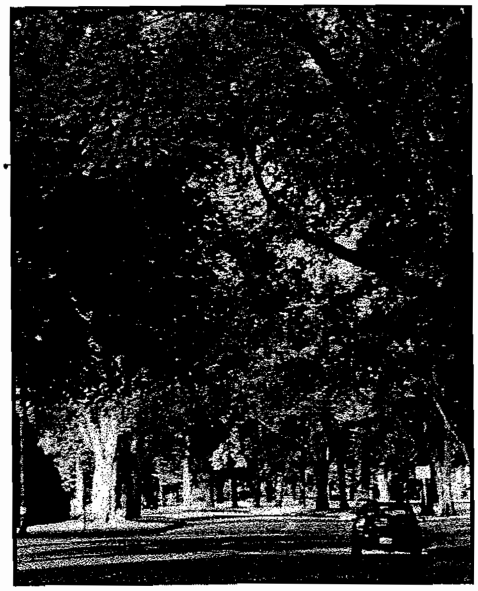
Collectively, this is a lose-lose situation. Cost-effective strategies to retain benefits from large street trees while reducing costs associated with infrastructure conflicts are described in *Strategies to Reduce Infrastructure Damage by Tree Roots* (Costello et al. 2000). Matching the growth characteristics of trees to conditions at the planting site is one strategy. The recommended tree selection list in Chapter 5 contains information on planting suitability by location and size.

Roots can damage sewer lines

Tree roots can damage old sewer lines that are cracked or otherwise susceptible to invasion. Sewer repair companies estimate that sewer damage is minor until trees and sewers are over 30 years old, and roots from trees in yards are usually more of a problem than roots from trees in planter strips along streets. The later assertion may be due to the fact that sewers are closer to the root zone as they enter houses than at the street. Repair costs typically range from $100 for rodding to $1,000 or more for excavation and replacement.

Cleaning up after trees

Most communities sweep their streets regularly to reduce surface-runoff pollution entering local waterways. Street trees drop leaves, flowers, fruit, and branches year round that constitute a significant portion of debris collected from city streets. When leaves fall and winter rains begin, leaf litter from trees can clog sewers, dry wells, and other elements of flood control systems. Costs include additional labor needed to remove leaves, and property damage caused by localized flooding. Clean-up costs also occur after windstorms. Although these natural crises are infrequent, they can result in large expenditures.



4. Although large trees can increase clean-up costs and repair costs to sidewalks compared to small trees, their shade can extend the life of street surfaces and defer costs for re-paving.

Conflicts between trees and powerlines are reflected in electric rates. In Portland, the local electric utility, Portland General Electric, prunes approximately 50,000 trees annually at a total cost of $2.5 million ($50/tree) (Johnson 2002). Large trees under powerlines require more frequent pruning than better-suited trees. Frequent crown reduction reduces the benefits these trees could otherwise provide.

Tree shade on streets can help offset some of these costs by protecting the paving from weathering. The asphalt paving on streets contains stone aggregate in an oil binder. Tree shade lowers the street surface temperature and reduces the heating and volatilization of the oil. As a result, the aggregate remains protected for a longer period by the oil binder. When unprotected, vehicles loosen the aggregate and much like sandpaper, the loose aggregate grinds down the pavement (Brusca 1998). Because most weathering of asphalt concrete pavement occurs during the first 5-10 years, when new street tree plantings provide little shade, this benefit mainly applies when older streets are resurfaced (Figure 4).

Wood Salvage, Recycling and Disposal

In our survey, Western Washington and Oregon cities are recycling most if not all of their green waste from urban trees as mulch, compost, and firewood. In many cases, the net costs of waste wood disposal are less than 1% of total tree care costs as cities and contractors strive to break-even (hauling and recycling costs are nearly offset by revenues from purchases of mulch, milled lumber, and firewood). Hauling waste wood and recycling is the primary cost.

Greenwaste recycling saves $

The city of Longview, WA salvages 85% of its wood waste at a break-even point, and recycles the remaining 15% at a cost of $12/ton ($13/tonne), a substantial savings over the typical landfilling fee of $28/ton ($31/tonne). Sixty-five percent of the salvaged wood is turned into mulch, 30% into firewood, and 5% into milled lumber.

2. Quantifying Benefits and Costs of Community Forests in Western Washington and Oregon Communities

In this chapter, we present estimated benefits and costs for trees planted in typical residential and public sites. Because benefits and costs vary with tree size, we report results for typical large-, medium-, and small-stature trees. Tree growth rates and dimensions are based on street and park tree data obtained in Longview, WA during the summer of 2001.

Estimates are initial approximations

Estimates of benefits and costs are initial approximations–as some benefits and costs are intangible or difficult to quantify (e.g., impacts on psychological health, crime, and violence). Also, limited knowledge about the physical processes at work and their interactions makes estimates imprecise (e.g., fate of air pollutants trapped by trees and then washed to the ground by rainfall). Tree growth and mortality rates are highly variable and benefits and costs depend on the specific conditions at a site (e.g., tree species, growing conditions, maintenance practices). Therefore, this method of quantification was not intended to account for each penny. Rather, this approach was meant to be a general accounting of the benefits produced by urban trees; an accounting with an accepted degree of uncertainty that can, nonetheless, provide a platform on which decisions can be made (Maco 2001).

Procedures and Assumptions

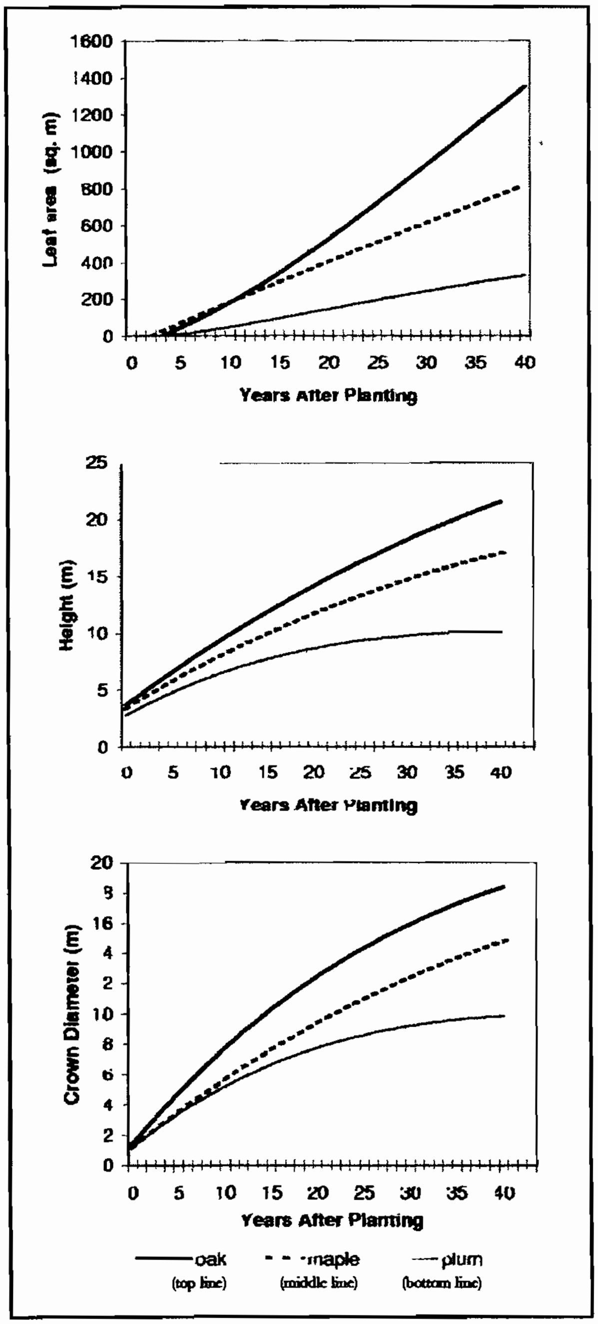
Approach

Pricing benefits and costs

In this study, annual benefits and costs were estimated for newly planted trees in three residential yard locations (east, south, and west of the dwelling unit) and a public streetside/park location for a 40-year planning horizon. Prices were assigned to each cost (e.g., planting, pruning, removal, irrigation, infrastructure repair, liability) and benefit (e.g., heating/cooling energy savings, air pollution absorption, stormwater runoff reduction) through direct estimation and implied valuation of benefits as environmental externalities. This approach made it possible to estimate the net benefits of plantings in "typical" locations and with "typical" tree species. To account for differences in the mature size and growth rates of different tree species, we report results for large (*Quercus rubrum*, red oak), medium, (*Acer platanoides*, Norway maple), and small (*Prunus cerasifera*, purple-leaf plum) trees. Results are reported at 5-year intervals for 40 years.

Leaf surface area and crown volume are useful indicators

Mature tree height is frequently used to distinguish between large, medium, and small species because matching tree height to available overhead space is an important design consideration. However, in this analysis, leaf surface area (LSA) and crown volume were also used to differentiate mature tree size. These additional measurements are useful indicators for many functional



5. Tree dimensions are based on data from street and park trees in Longview. Data for typical" large, medium, and small trees are from the red oak, Norway maple, and purple-leaf plum, respectively. Differences in leaf surface area among species are most important for this analysis because functional benefits such as rainfall interception, pollutant uptake, and shading are related to leaf surface area.

benefits of trees in relation to leaf-atmosphere processes (e.g., interception, transpiration, photosynthesis). Tree growth rates, dimensions, and LSA estimates are based on measurements taken for 30-60 street and park trees of each species in Longview, WA (Figure 5).

Reporting Results

Tree mortality included. Results are reported in terms of annual values per tree planted. However, to make these calculations realistic, mortality rates must be included. Therefore, based on our survey of regional municipal foresters, average mortality rates (23.4%) for public and residential trees are assumed over the 40-year period. Annual mortality rates of trees are 1% for the first five years and 0.53% for the remaining 35 years. Hence, this accounting approach "grows" trees in different locations and uses computer simulation to directly calculates the annual flow of benefits and costs as trees mature and die (McPherson 1992).

Benefits and costs are connected with tree size. Benefits and costs are directly connected with tree size variables such as trunk diameter at breast height (DBH), tree canopy cover, and LSA. For instance, pruning and removal costs usually increase with tree size expressed as diameter at breast height (DBH). For some parameters, such as sidewalk repair, costs are negligible for young trees but increase relatively rapidly as tree roots grow large enough to heave pavement. For other parameters, such as air pollutant uptake and rainfall interception, benefits are related to tree canopy cover and leaf area.

Annual vs. periodic costs. Most benefits occur on an annual basis, but some costs are periodic. For instance, street trees may be pruned on regular cycles but are removed in a less regular fashion (e.g., when they pose a hazard or soon after they die). Most costs and benefits are reported for the year that they occur. However, periodic costs such as pruning, pest and disease control, and infrastructure repair are presented on an average annual basis. Although spreading one-time costs over each year of a maintenance cycle does not alter the 40-year nominal expenditure, it can lead to inaccuracies if future costs are discounted to the present.

Benefit and Cost Valuation

Frequency and costs of tree management were directly estimated based on surveys with municipal foresters in Washington (Longview, Olympia, and Seattle) and Oregon (Portland, Tigard, and Albany) cities. Private arborists throughout the region were also contacted as a source for tree management costs and frequency of contracted activities on residential properties.

Municipal foresters and private arborists were source of costs estimates

Regional electricity and natural gas prices were used in this study to quantify energy savings (McPherson and Simpson 1999). Control costs were used to estimate society's willingness to pay for air quality and stormwater runoff improvements. For example, the price of stormwater benefits was estimated using marginal control costs, which represent the opportunity cost that can be avoided by implementing alternative control measures (e.g., trees) other than measures traditionally used to meet standards–that is, if other control measures are implemented, the most costly control measure can be avoided (Wang and Santini 1995). If a developer is willing to pay an average of 2.7¢ per gallon of stormwater–treated and controlled–to meet minimum standards, then the stormwater mitigation value of a tree that intercepts one gallon of stormwater, eliminating the need for treatment and control, should be 2.7¢.

Pruning benefits

Calculating Benefits

Air Conditioning and Heating Energy Savings

The prototype building used as a basis for the simulations was typical of post-1980 construction practices, and represented 10-20% of the total single-family residential housing stock in Western Washington and Oregon. This house was a two-story, wood frame building with crawl space and a conditioned floor area of 2,070 ft^2 (192 m^2), window area (double-glazing) of 383 ft^2 (36 m^2), and wall, ceiling and floor insulation of R11, R19, and R32, respectively. The central cooling system had a seasonal energy efficiency ratio (SEER) of 10, and the natural gas furnace had an annual fuel utilization efficiency (AFUE) of 78%. Building footprints were square, reflective of average impacts for a large building population (McPherson and Simpson 1999). Buildings were simulated with 1.5-ft (0.45-m) overhangs. Blinds had a visual density of 37%, and were assumed closed when the air conditioner was operating. Summer thermostat settings were 78° F (25° C); winter settings were 68° F (20° C) during the day and 60° F (16° C) at night. Because the prototype building was more energy efficient than most other construction types, our projected energy savings are relatively conservative. The energy simulations relied on typical year meteorological data from Seattle (Marion and Urban 1995).

Using a typical single-family residence for energy simulations

The dollar value of energy savings was based on average residential electricity and natural gas prices of $0.06 per kWh (Puget Sound Energy 2001a; Seattle City Light 2001; Tacoma Public Utilities 2001; Portland General Electric 2001) and $0.92 per therm (NW Natural 2001; Puget Sound Energy 2001b), respectively. Electricity rates were 2001, baseline rates of both public-

Calculating energy savings

and investor-owned utilities serving Western Washington and Oregon. Gas prices were year 2000 baseline averages for all communities served by the region's two largest providers–NW Natural and Puget Sound Energy. Homes were assumed to have central air conditioning and natural gas heating.

Calculating shade effects

Residential yard trees were within 60 ft (18 m) of homes so as to directly shade walls and windows. Shading effects of these trees on building energy use were simulated for large, medium, and small trees at three tree-building distances, following methods outlined by McPherson and Simpson (1999). The large tree (red oak) has a visual density of 80% during summer and 23% during winter. The medium tree (Norway maple) has a leaf-off visual density of 31% and leaf-on density of 88%. The small tree (purple-leaf plum) has a leaf-off visual density of 40% and a summer density of 80%. All three trees are leafless November 15–March 31. Results for each tree were averaged over distance and weighted by occurrence of trees within each of three distance classes: 28% 10-20 ft (3-6 m), 68% 20-40 ft (6-12 m), and 4% 40-60 ft (12-18 m) (McPherson and Simpson 1999). Results are reported for trees shading east-, south-, and west-facing surfaces. Our results for public trees are conservative in that we assumed that they do not provide shading benefits. In Modesto, 15% of total annual dollar energy savings from street trees were due to shade and 85% due to climate effects (McPherson et al. 1999a). In Longview, over 60% of street trees sampled were within 60 ft (18 m) of conditioned structures.

6. Although park trees seldom provide energy benefits from direct shading of buildings, they provide settings for recreation and relaxation as well as modify climate, sequester carbon dioxide, reduce stormwater runoff, and improve air quality.

In addition to localized shade effects, which were assumed to accrue only to residential yard trees, lowered air temperatures and wind speeds from increased neighborhood tree cover (referred to as climate effects) produce a significant net decrease in demand for winter heating and summer cooling (reduced wind speeds by themselves may increase or decrease cooling demand, depending on the circumstances). Climate effects on energy use, air temperature and wind speed reductions, as a function of neighborhood canopy cover, were estimated from published values (McPherson and Simpson 1999). Existing canopy cover (trees + buildings) was estimated to be 25% (American Forests 1998, 2001; Mead 2001). Canopy cover was calculated to increase by 7%, 19% and 23% for mature small, medium, and large trees at maturity, respectively, based on an effective lot size (actual lot size plus a portion of adjacent streets and other rights-of-way) of 8,000 ft^2 (743 m^2), and assumed one tree per lot on average. Climate effects were estimated as described previously for shading by simulating effects of wind and air temperature reductions on energy use. Climate effects accrue for both public (Figure 6) and private trees.

Atmospheric Carbon Dioxide Reduction

Calculating the value of reduced CO_2 emissions

Conserving energy in buildings results in reduced CO_2 emissions from power plants. These avoided emissions were calculated as the product of energy savings for heating and cooling based on the respective CO_2 emission factors for cooling and heating (Table 1). Pollutant emission factors were based on data for the region's three largest power control areas–Seattle City

Light, Puget Sound Power and Light, and Portland General Electric Company–and were weighted based on average fuel mixes: 49% hydro, 30% natural gas, 16% coal, and 5% other (US EPA 2001) (Table 1). The value of CO_2 reductions (Table 1) was based on social costs (e.g., loss of arable land) associated with increased global warming (California Energy Commission 1994).

Calculating Carbon Storage. Sequestration, the net rate of CO_2 storage in above- and below-ground biomass over the course of one growing season, was calculated using tree height and DBH data with biomass equations (Pillsbury et al. 1998). Lacking equations for red oak, Norway maple and purple plum, formulas for London plane (*Platanus acerifolia*), sawleaf zelkova (*Zelkova serrata*) and Chinese pistache (*Pistacia chinensis*) were substituted, respectively. Volume estimates were converted to green and dry weight estimates (Markwardt 1930) and divided by 78% to incorporate root biomass. Dry weight biomass was converted to carbon (50%) and these values were converted to CO_2. The amount of CO_2 sequestered each year is the annual increment of CO_2 stored as trees add biomass each year.

Table 1. Emissions factors and prices for air pollutants.

	– Emission Factor[1] –		
	Electricity lbs/MWh	Natural gas lbs/MBtu	Price[2] $/lb
CO_2	1,460	116	0.015
NO_2	3.223	0.2248	2.40
SO_2	2.102	0.0013	1.00
PM_{10}	0.232	0.0164	2.72
VOCs	0.216	0.0119	6.65

1 U.S. Environmental Protection Agency 2001.
2 $30/ton for CO_2 (California Energy Commission 1994) and values for all other pollutants are based on emission control costs in Western Oregon (Oregon Public Utilities Commission 1993; Wang and Santini 1995).

Power equipment releases CO_2. A national survey of 13 municipal forestry programs determined that the use of vehicles, chain saws, chippers, and other equipment powered by gasoline or diesel results in the average annual release of 0.78 lb of CO_2/inch DBH (0.14 kg CO_2/cm DBH) (McPherson and Simpson 1999). This value was utilized for private and public trees, recognizing that it may overestimate CO_2 release associated with less intensively maintained residential yard trees.

Decomposition releases CO_2

To calculate CO_2 released through decomposition of dead woody biomass, we conservatively estimated that dead trees are removed and mulched in the year that death occurs, and that 80% of their stored carbon is released to the atmosphere as CO_2 in the same year.

Air Quality Improvement

Value of emission reductions

Reductions in building-energy use also result in reduced emissions of air pollutants from power plants and space heating equipment. Volatile organic hydrocarbons (VOCs) and nitrogen dioxide (NO_2)–both precursors of ozone formation–as well as sulfur dioxide (SO_2) and particulate matter of <10 micron diameter (PM_{10}) were considered. Changes in average annual emissions and their offset values were calculated in the same way as for CO_2, using utility-specific emission factors for electricity and heating fuels (Ottinger et al. 1990; US EPA 1998), with the price of emissions savings (Table 1) based on cost of control studies to meet air pollution standards in Oregon, west of the Cascade mountains (Oregon Public Utilities Commission 1993; Wang and Santini 1995).

Calculating pollutant uptake by trees

Trees also remove pollutants from the atmosphere. The hourly pollutant dry deposition per tree is expressed as the product of a deposition velocity ($V_d = 1/[R_a+R_b+R_c]$), a pollutant concentration (C), a canopy projection area (CP), and a time step. Hourly deposition velocities for each pollutant were calculated during the growing season using estimates for the resistances (Ra, Rb, and Rc) estimated for each hour throughout the year using formulations described by Scott et al. (1998). Hourly concentrations for NO_2, and O_3 (ppm), daily total PM_{10} (µg^{-3}, approximately every sixth day) and hourly meteorological data (e.g., air temperature, wind speed, solar radiation) for 1998 were obtained from the Oregon Department of Environmental Quality (Barnack 2001) (atmospheric concentrations of SO_2 were not available and therefore not included in air pollutant uptake calculations). See Scott et al. (1998) for details of the methods employed. We used implied values from Table 1 to price emissions reductions; the implied value of NO_2 was used for ozone.

Estimating BVOC emissions from trees

Annual emissions of biogenic volatile organic compounds (BVOCs) were estimated for the three tree species (red oak, Norway maple, and purple-leaf plum) using the algorithms of Guenther et al. (1991, 1993). Annual emissions were simulated during the growing season over 40 years. The emission of carbon as isoprene was expressed as a product of a base emission rate adjusted for sunlight and temperature (µg-C g^{-1} dry foliar biomass hr^{-1}) and the amount of dry, foliar biomass present in the tree. Monoterpene emissions were estimated using a base emission rate adjusted for temperature. The base emission rates for the three species were based upon values reported in the literature (Benjamin and Winer 1998). Hourly emissions were summed to get monthly and annual emissions.

Annual dry foliar biomass values for red oak and purple plum were taken from the literature (Winer et al. 1998). The value for sweetgum (*Liquidambar styraciflua*) foliar biomass was substituted for Norway maple. Annual dry foliar biomass was derived from field data collected in Longview, WA during the summer of 2000. The amount of foliar biomass present for each year of the simulated tree's life was unique for each species. Year 1998 hourly air temperature and solar radiation data from Portland were used as model input. This year was chosen because data were available and it closely approximated long-term, regional climate records.

Calculating net air quality benefits

Net air quality benefits were calculated by subtracting the costs associated with BVOC emissions from benefits due to pollutant uptake and avoided power plant emissions. These calculations do not take into account the ozone reduction benefit from lowering summertime air temperatures, thereby reducing hydrocarbon emissions from anthropogenic and biogenic sources. Simulation results from Los Angeles indicate that ozone reduction benefits of tree planting with "low-emitting" species exceed costs associated with their BVOC emissions (Taha 1996).

Stormwater Runoff Reduction

Estimating rainfall interception by tree canopies

A numerical simulation model was used to estimate annual rainfall interception (Xiao et al. 1998). The interception model accounts for water intercepted by the tree, as well as throughfall and stem flow. Intercepted water is stored temporarily on canopy leaf and bark surfaces. Once the leaf is saturated, it drips from the leaf surface and flows down the stem surface to the ground or evaporates. Tree canopy parameters include species, leaf area, shade coefficient (visual density of the crown), and tree height. Tree height data were used to estimate wind speed at different heights above the ground and resulting rates of evaporation.

The volume of water stored in the tree crown was calculated from crown projection area (area under tree dripline), leaf area indices (LAI, the ratio of leaf surface area to crown projection area), and water depth on the canopy surface. Species-specific shade coefficients and tree surface saturation (0.04 in for all three trees) values influence the amount of projected throughfall. Hourly meteorological and rainfall data for 1999 from the Pacific Northwest Cooperative Agricultural Network--at Aurora, Oregon--were used for this simulation. Annual precipitation during 1999 was 41.7 inches (1059 mm), somewhat greater than the 30-year average annual precipitation of 39.4 inches (1001 mm), as reported at Portland International Airport (Hydrosphere Data Products 2001). A more complete description of the interception model can be found in Xiao et al. (1998).

Calculating the water treatment and flow control benefit of intercepted rainfall

To estimate the value of rainfall intercepted by urban trees, stormwater management control costs were used based on minimum requirements for stormwater management in Western Washington (Herrera Environmental Consultants 2001). For a 10-acre, single-family residential development on permeable soils (e.g., glacial outwash or alluvial soil) it costs approximately \$20.79/Ccf (\$0.02779/gal [\$.00011/m^3]) to treat and control flows stemming from a 6-month, 24-hr storm event. Runoff control for very large events (100-year, 24-hr storm) was omitted, as trees effective interception diminishes once surfaces have been saturated.

To calculate water quality benefits, the management cost was multiplied by gallons of rainfall intercepted after the first 0.078 in (2mm) had fallen for each event (24-hr without rain) during the year. Based on surface detention calculations for Olympia, WA, this initial abstraction (~0.1 in) of rainfall seldom results in runoff (City of Olympia 1995; NRCS 1986). Thus, interception is not a benefit until precipitation exceeds this amount (4% of total rainfall in 1999).

Aesthetics and Other Benefits

Many benefits attributed to urban trees are difficult to translate into economic terms. Beautification, privacy, wildlife habitat, shade that increases human comfort, sense of place and well-being are products that are difficult to price. However, the value of some of these benefits may be captured in the property values for the land on which trees stand. To estimate the value of these "other" benefits we applied results of research that compared differences in sales prices of houses to statistically quantify the amount of difference associated with trees.

The amount of difference in sales price reflects the willingness of buyers to pay for the benefits and costs associated with the trees. This approach has the virtue of capturing what buyers perceive to be as both the benefits and costs of trees in the sales price. Limitations to using this approach include the difficulty associated with determining the value of individual trees on a property, the need to extrapolate results from studies done years ago in the east and south to Washington and Oregon, and the need to extrapolate results from front yard trees on residential properties to trees in other locations (e.g., back yards, streets, parks, and non-residential land uses).

A large tree adds $1,978 to sale price of a home

Anderson and Cordell (1988) surveyed 844 single-family residences in Athens, Georgia and found that each large front-yard tree was associated with a 0.88% increase in the average home sales price. This percentage of sales price was utilized as an indicator of the additional value a resident in Western Washington and Oregon would gain from selling a home with a large tree.

The sales price of residential properties varied widely by location within the region. For example, year 2000 average home prices ranged from less than $100,000 in Grays Harbor, WA to over $325,000 in Lake Oswego, OR (RMS Multiple Listing Service 2000; NW MLS 2001). For the year 2000, the average home price for Western Washington and Oregon communities was $224,261. Therefore, the value of a large tree that added 0.88% to the sales price of such a home was $1,978. Based on growth data for a 40-year-old red oak, such a tree is 71 ft tall (21.5 m), has a 60-ft (18 m) crown diameter, and has a 28-inch DBH (71 cm); leaf surface area totals 15,897 ft^2 (1,477 m^2).

Calculating aesthetic value of residential yard trees

To calculate the base value for a large tree on private residential property we assumed that a 40-year old red oak in the front yard would increase the property's sales price by $1,978. Approximately 75% of all yard trees, however, are in backyards (Richards et al. 1984). Lacking specific research findings, it was assumed that backyard trees have 75% of the impact on "curb appeal" and sales price compared to front yard trees. The average annual aesthetic benefit for a tree on private property was, therefore, $0.10/$ft^2$ ($0.01/$m^2$) LSA. To estimate annual benefits, this value was multiplied by the amount of leaf surface area added to the tree during one year of growth.

Calculating the base value of a street tree

Street trees were treated similar to front yard trees in calculating their base value. However, because street trees may be adjacent to land with little value or resale potential, an adjusted value was calculated. An analysis of street trees in Modesto, CA, sampled (8% of population) from aerial photographs, found that 15% were located adjacent to non-residential or commercial land uses (McPherson et al. 1999b). We assumed that 33% of these trees–or 5% of the entire street tree population–produced no benefits associated with property value increases.

Although the impact of parks on real estate values has been reported (Hammer et al. 1974; Schroeder 1982; Tyrvainen 1999), to our knowledge the on-site and external benefits of park trees alone have not been isolated (More et al. 1988). After reviewing the literature and recognizing an absence of data, we assumed that park trees had the same impact on property sales prices as street trees. Given these assumptions, the typical large street and park trees were estimated to increase property values by $0.118 and $0.124/ft^2 ($0.01 and $0.012/m^2) LSA, respectively. Assuming that 85% of all municipal trees are on streets and 15% are in parks, a weighted average benefit of $0.119/ft^2 ($0.011/m^2) LSA was calculated for each tree, dependent on annual change in leaf area.

Calculating Costs

Planting Costs

Planting costs are two-fold, the cost for purchasing the tree and the cost for planting, staking, and mulching the tree. Based on our survey of Western Washington and Oregon municipal and commercial arborists, the total cost for purchasing, planting, staking, and mulching a 15-gal (1-1/4" cal.) container public tree was $122. The total cost was $125 for a residential yard tree.

Pruning Costs

Calucating pruning costs

After studying data from municipal forestry programs and their contractors we assumed that during the first three years after planting, young public trees were pruned once a year at a cost of $10.67/tree. Thereafter, pruning occurred on a 9-year average cycle. Pruning of small public trees cost $38.67/tree until their height exceeded 18 ft (6 m) and more expensive equipment was required. Medium-sized trees (taller than 18 ft [6 m] and less than 46 ft [14 m]) were pruned at a cost of $112/tree. The cost increased to $201/tree for large trees (taller than 46 ft [14 m]). After factoring in pruning frequency, annualized costs were $7.47, $3.01, $8.71, and $15.66 for public young, small, medium, and large trees, respectively.

Pruning residential trees

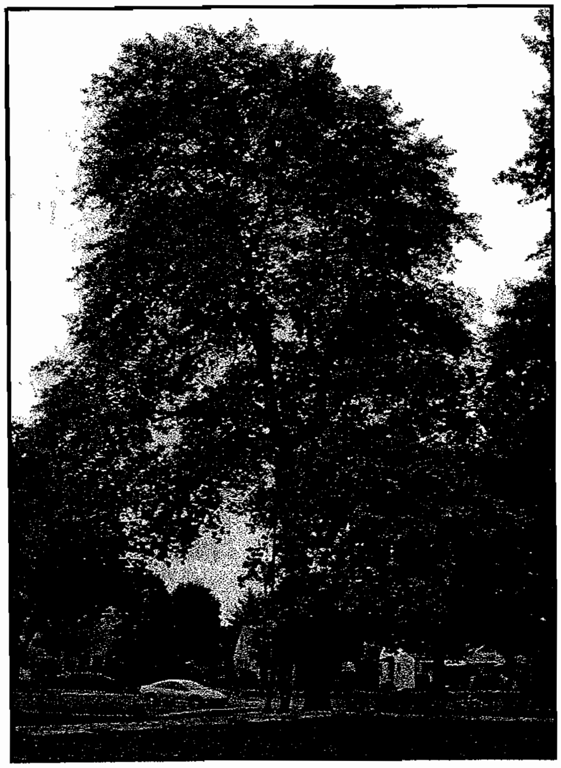
Based on findings from our survey of Western Washington and Oregon commercial arborists, only 30% of residential trees were assumed to be professionally pruned. Using this contract rate, along with average pruning prices ($15, $48, $165, and $377 for young, small, medium, and large trees, respectively), the average annual cost for pruning a residential yard tree was $4.50, $1.61, $5.50, and $12.56 for young, small, medium, and large trees. These prices include pruning frequencies and mortality rates identical to public trees, as well as costs for waste wood recycling.

Tree and Stump Removal and Disposal

The costs for removing public and private trees were $18 and $12 per inch ($46 and $30/cm) DBH, respectively. Stump removal and wood waste disposal costs were $7/in ($18/cm) DBH for public and private trees. The total cost for public and private trees was $26 and $19/in ($66 and $48/cm) DBH.

Pest and Disease Control

Public trees receive treatments to control pests and disease on an as needed basis. In Western Washington and Oregon communities this expenditure was small, averaging about $0.11 per tree per year, or approximately $0.01 per inch ($0.03/cm) DBH.



A mature red oak, used in this tree guide as representative of a large tree.

Though results of our survey suggest that commercial arborists cared for 30% of residential trees, only 15% of these trees were treated for pests or disease. Of the trees that were treated, regional arborists report that control measures were contracted about every nine years. Based on these figures–and average treatment prices charged by arborists ($85)–the average annual cost for pest and disease control was calculated at $0.43 per residential yard tree per year; this averages $0.03 per inch ($0.08/cm) DBH.

Irrigation Costs

Trees in most Western Washington and Oregon landscape situations require relatively little supplemental irrigation after establishment because they are planted in irrigated areas or can use existing soil moisture. The cost for irrigating a public street or park tree was $9 per year for the first three years after planting. This price was the average price of labor and equipment to irrigate young trees with a municipal water truck during the arid summer weeks.

Based on evapotranspiration (ET) calculations, irrigation costs for residential yard trees assume that supplemental water was applied at a maximum rate of 0.2 gallons/ft^2 LSA over a 6-week period in midsummer. For the first three years after planting, all trees were watered. Thereafter, however, it was assumed that only 30% of trees were irrigated regularly for the remainder of their life. Assuming that water was purchased at a price of $1.76 Ccf (Portland Water District 2001), and the mature tree had 15,897 ft^2 (1,477 m^2) of LSA, the annual price was approximately $0.0005/ft^2 LSA. Hence, annual irrigation water cost was assumed to increase with tree leaf area.

Other Costs for Public and Private Trees

Infrastructure conflicts

Other costs associated with the management of trees include expenditures for infrastructure repair/root pruning, leaf litter clean-up, litigation/liability, and inspection/administration.

Tree roots can cause damage to sidewalks, curbs, paving, and sewer lines. Though sidewalk repair is typically the single largest expense for public trees (McPherson and Peper 1995), many Western Washington and Oregon municipalities reported that these costs were the responsibility of abutting property owners. As a result, infrastructure related expenditures for public trees were less here than in comparable cities nationwide (McPherson 2000;

McPherson and Peper 1995), averaging approximately $1.59/tree ($0.12/in [$0.30/cm] DBH) on an annual basis.

Liability costs

Urban trees can, and do, incur costly legal fees due to trip and fall claims. A survey of Western U.S. cities showed that an average of 8.8% of total tree-related expenditures were spent on tree-related liability (McPherson 2000). This percentage, coupled with the average total expenditure reported for Pacific Northwest cities (Tschantz and Sacamano 1994) adjusted to 2001 dollars, suggests the annual cost of this expenditure was $0.35/tree ($0.03/in [$0.08/cm] DBH). Because street trees are in closer proximity to sidewalks and sewer lines than most trees on private property, we assumed that repair and legal costs were 25% of those for public trees (McPherson et al. 1993).

Litter and storm clean-up

The average annual per tree cost for litter clean-up (i.e., street sweeping) was $1.57 ($0.12/in [$0.30/cm] DBH). This value was based on costs in Longview, WA, where litter removal was approximately 5.8% of tree related expenditures. Because most residential yard trees are not littering the street with leaves, it was assumed that clean-up costs for private trees were 25% of those for public trees.

Inspection and administration costs

Municipal tree programs have administrative costs for salaries of supervisors and clerical staff, operating costs, and overhead. Surveys show that average annual costs for inspection and administration associated with street and park tree management is approximately 10% of the total budget. This number was used to calculate associated costs for publicly managed trees only–trees on private property do not accrue this expense.

Calculating Net Benefits

Benefits accrue at different scales

When calculating net benefits, it is important to recognize that trees produce benefits that accrue both on- and off-site. Benefits are realized at four different scales: parcel, neighborhood, community, and global. For example, property owners with on-site trees not only benefit from increased property values, but they may also directly benefit from improved human health (e.g., reduced exposure to cancer-causing UV radiation) and greater psychological well-being through visual and direct contact with plants. However, on the cost side, increased health care may be incurred because of nearby trees, as with allergies and respiratory ailments related to pollen. We assumed that these intangible benefits and costs were reflected in what we term "aesthetics and other benefits."

The property owner can obtain additional economic benefits from on-site trees depending on their location and condition. For example, judiciously located on-site trees can provide air conditioning savings by shading windows and walls and cooling building microclimates. This benefit can extend to the neighborhood because trees provide off-site benefits. Adjacent neighbors can benefit from shade and air temperature reductions that lower their cooling costs.

Neighborhood attractiveness and property values can be influenced by the extent of tree canopy cover on individual properties. On the community scale, benefits are realized through cleaner air and water, as well as social, educational, and employment and job training benefits that can reduce costs for health care, welfare, crime prevention, and other social service programs. Reductions in atmospheric CO2 concentrations due to trees are an example of benefits that are realized at the global scale.

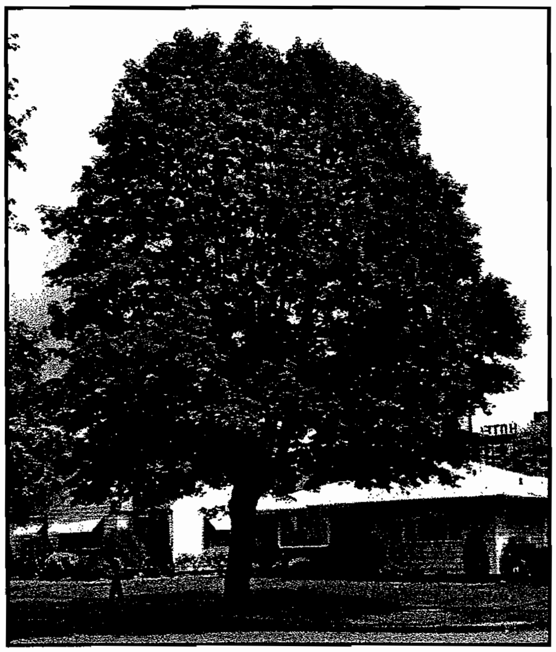
The sum of all benefits

The sum of all benefits was used to capture the value of all annual benefits (B):

$$B = E + AQ + CO_2 + H + A$$

where

- E = value of net annual energy savings (cooling and heating)
- AQ = value of annual air quality improvement (pollutant uptake, avoided power plant emissions, and BVOC emissions)
- CO_2 = value of annual carbon dioxide reductions (sequestration, avoided emissions, release due to tree care and decomposition)
- H = value of annual stormwater runoff reductions (water quality and flood control)
- A = value of annual aesthetics and other benefits



A mature Norway maple, representative of medium trees in this tree guide.

The sum of all costs. On the other side of the benefit-cost equation are costs for tree planting and management. Expenditures are borne by property owners (irrigation, pruning, and removal) and the community (pollen and other health care costs). Annual costs for residential yard trees (C_Y) and public trees (C_P) were summed:

$$C_Y = P + T + R + D + I + S + C + L$$

$$C_P = P + T + R + D + I + S + C + L + A$$

where

- P = cost of tree and planting
- T = average annual tree trimming cost
- R = annual tree and stump removal and disposal cost
- D = average annual pest and disease control cost
- I = annual irrigation cost
- S = average annual cost to repair/mitigate infrastructure damage
- C = annual litter and storm clean-up cost
- L = average annual cost for litigation and settlements due to tree-related claims
- A = annual program administration, inspection, and other costs.

Net benefits. Net benefits are calculated as the difference between total benefits and costs (B – C).

Limitations of this Study

This analysis does not account for the wide variety of trees planted in Western Washington and Oregon communities or their diverse placement. It does not incorporate the full range of climatic differences within the region that influence potential energy, air quality, and hydrology benefits. There is much uncertainty associated with estimates of aesthetics and other benefits as well as the true value of hydrology benefits because science in these areas is not well developed. We considered only residential and municipal tree cost scenarios, but realize that the costs associated with planting and managing trees can vary widely depending on program characteristics. For example, our analysis does not incorporate costs incurred by utility companies and passed on to ratepayers for maintenance of trees under powerlines. However, as described by example in Chapter 3, local cost data can be substituted for the data in this report to evaluate the benefits and costs of alternative programs.

A mature purple-leaf plum, representative of small trees in this tree guide.

Future benefits are not discounted to present value. In this analysis, results are presented in terms of future values of benefits and costs, not present values. Thus, findings do not incorporate the time value of money or inflation. We assume that the user intends to invest in community forests and our objective is to identify the relative magnitudes of future costs and benefits. If the user is interested in comparing an investment in urban forestry with other investment opportunities, it is important to discount all future benefits and costs to the beginning of the investment period. For example, trees with a future value of $100,000 in 10 years, have a present value of $55,840, assuming a 6% annual interest rate.

Findings of this Study

Average Annual Net Benefits

Average annual net benefits increase with size of tree

Average annual net benefits (40-year total/40 years) increase with mature tree size (see Appendix A for detailed results):

- $1 to $8 for a small tree
- $19 to $25 for a medium tree
- $48 to $53 for a large tree

Large trees provide the most benefits

This finding suggests that average annual net benefits from large-growing trees, like the red oak, can be substantially greater than those from small trees like purple-leaf plum. Average annual net benefits for the small, medium, and large street/park trees are $1, $19, and $48, respectively. The largest average annual net benefits, however, stem from residential yard trees opposite a west-facing wall: $8, $25, and $53 for the small, medium, and large trees, respectively. Residential yard trees produce net benefits that are greater than public trees primarily because of lower maintenance costs.

Net annual benefits at year 40

The large residential tree opposite a west wall produces a net annual benefit of $81 at year 40 and $2,120 total over a 40-year span. Planting the red oak in a public site produces a slightly reduced annual net benefit–$74 at year 40. Over the entire 40-year period, it produces a stream of net benefits that total $1,880.

Forty-year benefits for medium and small trees follow a similar pattern. Forty years after planting, they produce annual net benefits of $37 and $15 for west-side residential trees, netting $1,480 and $600 of the full 40 years, respectively. The small plum in a typical public space nets $7 at year 40, while a medium maple in the same location produces $28 in annual net benefits. Over 40 years, net benefits total $280 for the plum and $1,120 for the maple tree in street/park locations.

Net annual benefits at year 20

Twenty years after planting, annual net benefits for a residential yard tree located west of a home are estimated to be approximately $51 for a large tree, $29 for a medium tree, and $12 for a small tree (Table 2). For a large red oak at 20 years after planting, the total value of environmental benefits ($28), alone, is two times greater than annual costs ($14). Similarly, environmental

Table 2. Estimated annual benefits for a small-, medium- and large-sized residential yard tree opposite a west-facing wall 20 years after planting.

BENEFIT CATEGORY	SMALL TREE 28 ft tall, 25 ft spread LSA = 1,891 sq. ft.		MEDIUM TREE 38 ft tall, 31 ft spread LSA = 4,770 sq. ft.		LARGE TREE 46 ft tall, 41 ft spread LSA = 6,911 sq. ft.	
Electricity savings ($0.06/kWh)	62 kWh	$3.89	93 kWh	$5.87	125 kWh	$7.85
Natural gas ($0.92/therm)	-150 kBtu	-$1.38	-80 kBtu	-$0.73	133 kBtu	$1.22
Carbon dioxide ($0.015/lb)	28 lb	$0.42	76 lb	$1.14	263 lb	$3.95
Ozone ($2.40/lb)	0.13 lb	$0.32	0.21 lb	$0.51	0.35 lb	$0.84
NO_2 ($2.40/lb)	0.07 lb	$0.18	0.14 lb	$0.34	0.24 lb	$0.58
SO_2 ($1.00/lb)	0.04 lb	$0.04	0.07 lb	$0.07	0.10 lb	$0.10
PM_{10} ($2.72/lb)	0.15 lb	$0.41	0.24 lb	$0.66	0.40 lb	$1.09
VOCs ($6.65/lb)	0.001 lb	$0.018	0.002 lb	$0.063	0.005 lb	$0.030
BVOCs ($6.65/lb)	-0.004 lb	-$0.024	-0.012 lb	-$0.081	-0.034 lb	-$0.224
Rainfall Interception ($0.028/gal)	169 gal	$4.70	288 gal	$8.01	449 gal	$12.47
ENVIRONMENTAL SUBTOTAL		$8.58		$15.85		$27.91
Other Benefits		$9.38		$20.19		$37.27
Total Benefits		$17.96		$36.04		$65.18
Total Costs		$6.23		$6.87		$13.72
NET BENEFITS		$11.73		$29.16		$51.46

LSA=leaf surface area

Table 3. Tree numbers by age class and estimated annual net benefits for three street tree species in Longview, WA.

	< 10 yrs	10-19 yrs	20-29 yrs	30-39 yrs	40+ yrs	Total
red oak (#)	29	76	50	37	67	259
$/tree	-7	41	52	63	66	–
Total $	-217	3,082	2,611	2,349	4,424	12,249
Norway maple (#)	138	28	126	149	312	753
$/tree	-13	19	25	23	25	–
Total $	-1,806	537	3,120	3,447	7,834	13,132
cherry plum (#)	367	650	501	160	15	1,693
$/tree	-24	4	6	7	7	–
Total $	-8,802	2,394	3,146	1,124	101	-2,037
Grand Total $	**-10,825**	**6,013**	**8,877**	**6,920**	**12,359**	**23,344**
$/tree	**-20**	**8**	**13**	**20**	**31**	**9**

benefits total $16 for the Norway maple, with tree care costs totaling less than half ($7). Annual environmental benefits are nearly $9 for a 20-year-old small yard tree, while management costs are about $6.

What is the net benefit for an urban forest?

The average annual net benefit for a population of trees can be estimated using data presented here and in Appendix A. For example, the city of Longview's street and park tree inventory indicates that there are about 12,000 trees: 259 are red oak (2%), 753 are Norway maple (6%), and 1,693 are purple-leaf plums (14%). Table 3 shows the distribution of these trees among age classes and the estimated annual net benefits assuming costs and benefits described in this report. The total annual net benefits produced by the oaks, maples, and plums are $12,249 ($47/tree), $13,132 ($17/tree), -$2,037 (-$1.20/tree), respectively. Together, trees belonging to these three species account for 22% of Longview's tree population and their benefits exceed costs by approximately $23,300 ($8.63/tree). Chapter 3 shows how to adjust benefit and cost data to account for impacts of a proposed change in a street tree planting program.

Average Annual Costs

Costs increase with size of tree

Average annual costs for tree planting and care increase with mature tree size (see Appendix A for detailed results):

- $9 to $17 for a small tree
- $12 to $20 for a medium tree
- $14 to $23 for a large tree

Table 4. Estimated annual costs for a small-, medium- and large-sized public and private, residential yard tree located opposite a west-facing wall 20 years after planting.

	SMALL TREE 28 ft tall, 25 ft spread LSA = 1,891 sq. ft.		MEDIUM TREE 38 ft tall, 31 ft spread LSA = 4,770 sq. ft.		LARGE TREE 46 ft tall, 41 ft spread LSA = 6,911 sq. ft.	
COSTS ($/yr/tree)	Private: West	Public Tree	Private: West	Public Tree	Private: West	Public Tree
Tree and Planting	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pruning	$4.79	$7.59	$4.79	$7.59	$11.00	$13.73
Remove and Dispose	$0.28	$1.45	$0.34	$1.79	$0.42	$2.22
Pest and Disease	$0.31	$0.08	$0.38	$0.10	$0.47	$0.12
Infrastructure	$0.28	$1.13	$0.35	$1.39	$0.43	$1.73
Irrigation	$0.24	$0.00	$0.60	$0.00	$0.86	$0.00
Clean-Up	$0.28	$1.11	$0.34	$1.37	$0.43	$1.71
Liability and Legal	$0.06	$0.25	$0.08	$0.31	$0.10	$0.38
Administration and Other	$0.00	$1.29	$0.00	$1.39	$0.00	$2.21
Total Costs	**$6.23**	**$12.90**	**$6.87**	**$13.94**	**$13.72**	**$22.10**
Total Benefits	$17.96	$18.12	$36.04	$37.24	$65.18	$68.92
Total Net Benefits	**$11.73**	**$5.22**	**$29.16**	**$23.30**	**$51.46**	**$46.82**

Larger trees are more expensive to maintain

Given our assumptions and the dimensions of these trees, it is 35-55% more expensive to maintain a large tree than a small tree (Table 4). Average annual maintenance costs for private trees are $9-$14 per tree, considerably less than estimated costs for a public tree ($17-$23). Tree pruning is the single greatest cost for private and public trees, averaging approximately $4-$11/year/tree. Annualized expenditures for tree planting are the second most important cost whether planted on private or public lands.

For public trees in Western Washington and Oregon, significant additional costs include annual expenditures for program administration (about $2/tree), tree removal ($1-$2/tree), infrastructure repair ($1-$2/tree) and leaf/debris clean-up ($1-$2/tree). Strategies are needed to reduce these costs so that municipalities can use their limited funds to plant and care for more trees rather than abate challenges posed by trees.

Average Annual Benefits

Average annual net benefits increase with size of tree

Average annual benefits (40-year total / 40 years) also increase with mature tree size (see Appendix A for detailed results):

- $13 to $17 for a small tree
- $33 to $39 for a medium tree
- $60 to $71 for a large tree

Aesthetic and Other

Benefits greatest for property values

Benefits associated with property value account for the largest proportion of total benefits. Average annual values range from \$8-\$10, \$20-\$23, and \$35-\$41 for the small, medium, and large tree, respectively. These values reflect the region's relatively high residential real estate sales prices and the potential beneficial impact of urban forests on property values and the municipal tax base.

Public vs. private trees and property values

Aesthetic and other benefits are slightly greater for the public street/park tree than the residential yard tree because of the assumption that most of these trees have backyard placements, where they have less impact on home value than front yard trees. This assumption has not been tested so there is a high level of uncertainty associated with this result.

Stormwater Runoff

Stormwater runoff benefits are crucial to environmental integrity

After aesthetics, values are largest for benefits associated with rainfall interception. Annual averages are substantial for all three trees. The red oak intercepts 549 gal/yr (2.1 m^3/yr) on average with an implied value of \$15. Bark and foliage of a Norway maple intercepts 346 gal/yr (1.3 m^3/yr) on average, with a value of \$9.72. By intercepting 182 gallons (0.7 m^3) of rainfall annually, a typical purple-leaf plum provides over \$5 in stormwater management savings.

Though a large, red oak at 40 years after planting has an interception rate of over 1,100 gal/yr (4.2 m^3/yr)–valued at \$31–total rainfall intercepted is lower than trees planted in similar locations, but warmer, drier climates (Xiao et al. 2000). The deciduous nature of the "typical" trees coupled with cool, rainy winters reduces the rainfall storage capacity as well as surface evaporation rate.

Carbon Dioxide

CO_2 reduction is substantial for large and medium trees

Benefits associated with atmospheric CO_2 reduction were significant for the large tree and marginally positive for the medium tree. Average annual net reductions range from 206-279 lbs (94-127 kg) (\$3-\$4) for the large tree and 22-78 lbs (10-35 kg) (\$0.35-\$1.15) for the medium tree. Trees opposite west-facing walls produce the greatest CO_2 reduction due to avoided power plant emissions associated with energy savings. Releases of CO_2 associated with tree care activities offsets CO_2 sequestration by the small trees when averaged over the four locations (opposite west-, south-, and east-facing residential buildings and street/park); avoided power plant emissions are small because energy savings are small.

Energy

Larger trees produce more energy savings

Mature tree size matters when considering energy benefits. A large tree produces approximately four to six times more energy savings than a small tree due to the greater effects on wind, building shade, and increased transpirative cooling. However, as trees mature and their leaf surface area increases, energy savings increase regardless of their mature size (Figures 7 and 8).

West is the best

Average annual net energy benefits for residential trees are estimated to be greatest for a tree located west of a building because the detrimental effects on heating costs associated with winter shade is minimized. A yard tree located south of a building typically produces the least net energy benefit, while trees located east of a building provide intermediate net benefits. Winter shade, however, is a function of size, branch pattern and density, and foliar period, resulting in a slightly better performance of a south-side Norway maple over that of an east-side placement. The small plum–opposite both south- and east facing walls–increases heating costs more than shading and climate benefits reduce cooling and heating costs. Thus, this small tree is a net energy cost at these locations.

The medium-sized maple and large oak provide net energy benefits at all locations. Their annual average cooling savings during the summer months ($1-$7) more than offset heating costs associated with winter shade ($1-$3). These results indicate that energy savings are significant even in Western Washington and Oregon's temperate climate. Annual savings can be doubled through strategic placement of solar friendly tree species to maximize summer shade and winter sunlight.

Air Quality

Large trees remove more air pollutants

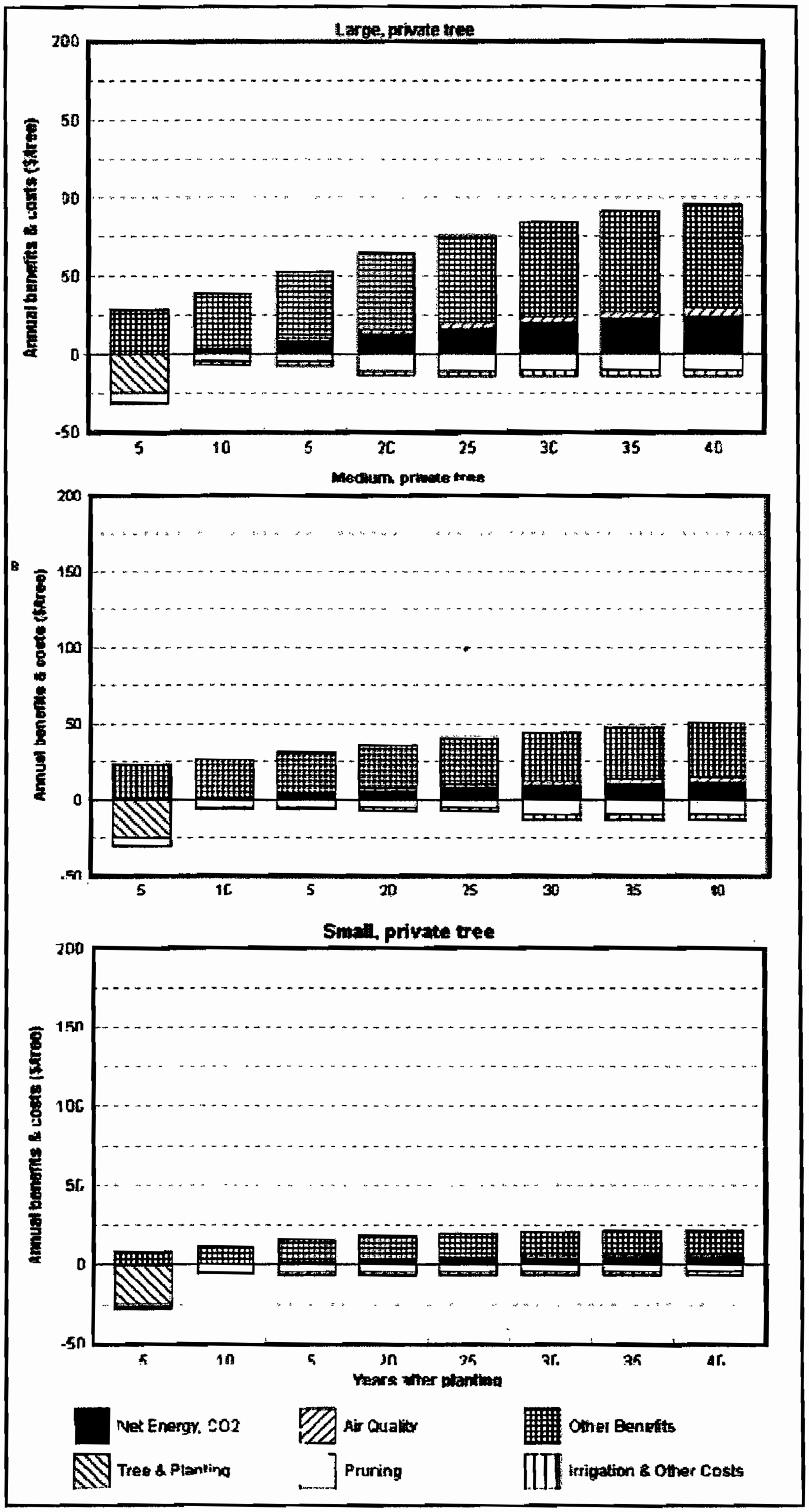
Air quality benefits were defined as the sum of pollutant uptake by trees and avoided power plant emissions due to energy savings, minus BVOCs released by trees. Contributions to the air quality of Western Washington and Oregon provided 4%-7% of the total average annual benefits for the small ($1), medium ($2) and large tree ($3). Benefit values are greatest for PM_{10} and O_3, followed by NO_2. Though positive, trees had minimal effect on SO_2 and VOCs.

The cost of BVOCs released by the low-emitting plum and maple was negligible and similar to the benefit from avoided VOC emissions from power plants due to energy savings. Pollutant uptake benefits far exceed the benefits of avoided pollutant emissions. A single, large red oak at 40 years can remove approximately 2.4 lbs (1.1 kg) of pollutants each year valued at $6. However, because this tree emits about 1 oz (28 grams) more BVOCs than VOCs avoided, the net economic benefit is slightly lower, $5.50/year.

Benefit Summary

Environmental benefits alone can exceed costs for many trees

When totaled and averaged over the 40-year period, summed benefits for all trees, in all locations, exceed costs of tree planting and management. Surprisingly, in many situations, annual environmental benefits, alone, exceed total costs. Trees that meet this standard include all large trees (public or private), all medium trees on residential property, and small trees planted opposite a west-facing wall. Adding the value of aesthetics and other benefits to these environmental benefits results in substantial net benefits.



7. Residential trees. Estimated annual benefits and costs for a large (red oak), medium (Norway maple), and small (purple-leaf plum) residential yard tree located west of the building. Costs are greatest during the initial establishment period while benefits increase with tree size.

Table 5. Estimated 40-year total benefits and costs for Evergreen's street tree planting (100 trees).

	50 Large Trees		30 Medium Trees		20 Small Trees		100 Tree Total	
Benefits	Res units	$	Res units	$	Res units	$	Res units	$
Electricity (kWh)	94,000	8,460	26,400	2,376	7,200	648	127,600	11,484
Natural Gas (kBtu)	954,000	8,740	267,600	2,448	68,800	632	1,290,400	11,820
Net Energy (kBtu)	1,898,000	14,680	531,600	4,116	136,800	1,064	2,566,400	19,860
Net CO_2 (lb)	514,000	7,720	73,200	1,092	12,000	184	599,200	8,996
Air Pollution (lb)	2,000	5,620	1,200	2,268	0	776	3,200	8,664
Hydrology (gal)	1,098,000	30,500	415,200	11,544	145,600	4,040	1,658,800	46,084
Aesthetics and Other Benefits		82,680		27,888		7,920		118,488
Total Benefits		**$158,400**		**$51,732**		**$15,264**		**$225,396**
Costs		Public		Public		Public		Public
Tree and Planting		13,768		4,356		2,904		21,028
Pruning		21,040		11,160		5,552		37,752
Remove and Dispose		4,420		2,172		1,136		7,728
Infrastructure		220		108		56		384
Irrigation		3,300		1,620		864		5,784
Clean-Up		1,340		804		536		2,680
Liability and Legal		3,240		1,596		848		5,684
Administration and Other		720		360		192		1,272
Total Costs		**$48,048**		**$22,176**		**$12,088**		**$82,312**
Total Net Benefits		**$110,352**		**$29,556**		**$3,176**		**$143,084**

Res units = Resource Unit

Adjust for local costs

To adjust the cost figures, we eliminate a row for pest and disease control costs in Table 5. We multiply 50 large trees by the unit planting cost ($180) to obtain the adjusted cost for Evergreen (50 x $180 = $9,000). The average annual 40-year costs for other items are multiplied by 40 years and the appropriate number of trees to compute total costs. These 40-year cost values are entered into Table 5.

Calculate cost savings and benefits forgone

Net benefits are calculated by subtracting total costs from total benefits for the large ($110,352), medium ($29,556), and small ($3,176) trees. The total net benefit for the 40-year period is $143,084 (total benefits – total costs), or $1,431/tree ($143,084/100 trees) on average (Table 5). By not investing in street tree planting and maintenance, the city saves $82,312 in total costs, but forgoes $225,396 in total benefits, for a net loss of potential benefits in the amount of $143,084 or $1,431/tree.

Following the results of our survey, this analysis assumes 23.4% of the planted trees die. It does not account for the time value of money from a municipal capital investment perspective, but this could be done using the municipal discount rate. For a more complete analysis it is important to consider the extent to which benefits from increased yard tree plantings may offset the loss of street tree benefits.

Increasing Program Cost-Effectiveness

What if the program you have designed is promising in terms of stormwater runoff reduction, energy savings, volunteer participation, and ancillary benefits, but the costs are too high? This section describes some steps to consider that may increase benefits and reduce costs, thereby increasing cost-effectiveness.

What if the costs are too high?

Increase Benefits

Improved stewardship to increase the health and survival of recently planted trees is one strategy for increasing cost-effectiveness. An evaluation of the Sacramento Shade program found that tree survival rates had a substantial impact on projected benefits (Hildebrandt et al. 1996). Higher survival rates increased energy savings and reduced tree removal costs.

Work to increase survival rates

Conifers and broadleaf evergreens intercept rainfall and particulates year-round. Also, they tend to have relatively more leaf surface area than similar sized deciduous trees. Locating these types of trees in yards, parks, school grounds, and other open space areas can increase benefits.

Target tree plantings with highest pay back

You can further increase energy benefits by targeting a higher percentage of trees for locations that produce the greatest energy savings, such as opposite west-facing walls and close to buildings. By customizing tree locations to increase numbers in high-yield sites, cooling savings can be boosted.

Customize planting locations

Reduce Program Costs

Cost-effectiveness is influenced by program costs as well as benefits:

Cost-effectiveness = Total Net Benefit / Total Program Cost

Reduce up-front and establishment costs

Cutting costs is one strategy to increase cost-effectiveness. A substantial percentage of total program costs occur during the first three years and are associated with tree planting (McPherson 1993). Some strategies to reduce these costs include:

- Plant bare root or smaller tree stock
- Use trained volunteers
- Provide follow-up care to increase tree survival and reduce replacement costs
- Select and locate trees to avoid conflicts

Where growing conditions are likely to be favorable, such as yard or garden settings, it may be cost effective to use smaller, less expensive stock or bare root trees that reduce planting costs. However, in highly urbanized settings

Use less expensive stock where appropriate

and sites subject to vandalism, large stock may survive the initial establishment period better than small stock.

Train volunteers to monitor tree health

Investing in the resources needed to promote tree establishment during the first three years after planting is usually worthwhile, because once trees are established they have a high probability of continued survival. If your program has targeted trees on private property, then encourage residents to attend tree care workshops. Develop standards of "establishment success" for different types of tree species. Perform periodic inspections to alert residents to tree health problems, and reward those whose trees meet your program's establishment standards. Replace dead trees as soon as possible, and identify ways to improve survivability.

Prune early

A cadre of trained volunteers can easily maintain trees until they reach a height of about 20 ft (6 m) and limbs are too high to prune from the ground with pole pruners. By the time trees reach this size they are well-established. Pruning during this establishment period should result in a safer tree that will require less care in the long-term. Training young trees will provide a strong branching structure that requires less frequent thinning and shaping. Although organizing and training these volunteers requires labor and resources, it is usually less costly than contracting the work. As trees grow larger, contracted pruning costs may increase on a per-tree basis. The frequency of pruning will influence these costs, since it takes longer to prune a tree that has not been pruned in 10 years than one that was pruned a few years ago. Although pruning frequency varies by species and location, a return frequency of about five years is usually sufficient (Miller 1997).

Match tree to site

Carefully select and locate trees to avoid conflicts with overhead powerlines, sidewalks, and underground utilities. Time spent planning the planting will result in long-term savings. Also consider soil type and irrigation, microclimate, and the type of activities occurring around the tree that will influence its growth and management.

It all adds up

When evaluating the bottom line—whether trees pay—do not forget to consider benefits other than the stormwater runoff reductions, energy savings, atmospheric CO_2 reductions, and other tangible benefits described in this report. The magnitude of benefits related to employment opportunities, job training, community building, and enhanced human health and well-being can be substantial. Moreover, these benefits extend beyond the site where trees are planted, furthering collaborative efforts to build better communities.

Additional information

Additional information regarding urban and community forestry program design and implementation can be obtained from the following references:

- *An Introductory Guide to Community and Urban Forestry in Washington, Oregon, and California.* World Forestry Center, Portland, OR.
- *A Technical Guide to Urban and Community Forestry.* World Forestry Center, Portland, OR. 1993.

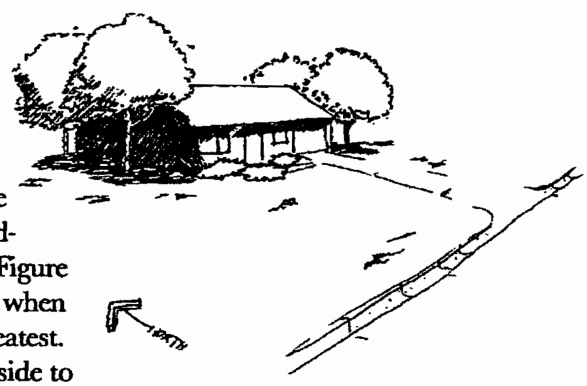
Copies are available from your state urban and community forestry coordinator in Washington (Department of Natural Resources) and Oregon (Department of Forestry).

4. General Guidelines for Selecting and Siting Trees

In this chapter, general guidelines for selecting and locating trees are presented. Both residential trees and trees in public places are considered.

Residential Yard Trees

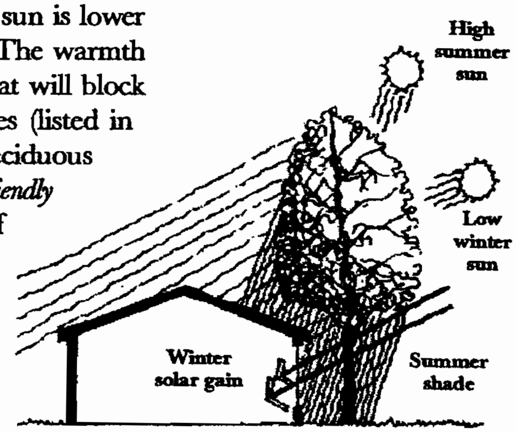
Maximizing Energy Savings from Shading



9. Locate trees to shade west and east windows (from Sand 1993).

Where should shade trees be planted? The right tree in the right place can save energy and reduce tree care costs. In midsummer, the sun shines on the east side of a building in the morning, passes over the roof near midday, and then shines on the west side in the afternoon (Figure 3 on page 6). Electricity use is highest during the afternoon when temperatures are warmest and incoming sunshine is greatest. Therefore, the west side of a home is the most important side to shade. Depending on building orientation and window placement, sun shining through windows can heat a home quickly during the morning hours. The east side is the second most important side to shade when considering the net impact of tree shade on cooling and heating costs (Figure 9).

Use solar friendly trees. 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 (Figure 10). 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 (listed in Chapter 5) 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%). Examples of solar friendly trees include most species and cultivars of maple (*Acer spp.*) and ash (*Fraxinus spp.*).



10. Select solar friendly trees for south exposures and locate close enough to provide winter solar access and summer shade (from Sand 1991).

To maximize summer shade and minimize winter shade, locate trees about 10-20 ft (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 (Figure 11).

Roots, branches and buildings don't mix. 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 ft (1.5-3 m) from the home to avoid these conflicts, but within 30-50 ft (9-15 m) to effectively shade windows and walls.

BEFORE

AFTER

11. Trees south of home before and after pruning. Lower branches are pruned up to increase heat gain from winter sun (from Sand 1993).

Patios, driveways and air conditioners need shade. 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. If a home is equipped with an air conditioner, shading can reduce its energy use – but do not plant vegetation so close that it will obstruct the flow of air around the unit.

Avoid power, sewer, and water lines. Plant only suitable trees under overhead powerlines 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 should not be planted under powerlines.

Planting Windbreaks for Heating Savings

With the relatively long winter heating season in Western Washington and Oregon, additional energy savings can be obtained in situations where lot sizes are large enough to plant windbreaks. A tree's size and porosity can make it an ideal wind filter, reducing the impacts of cold winter weather.

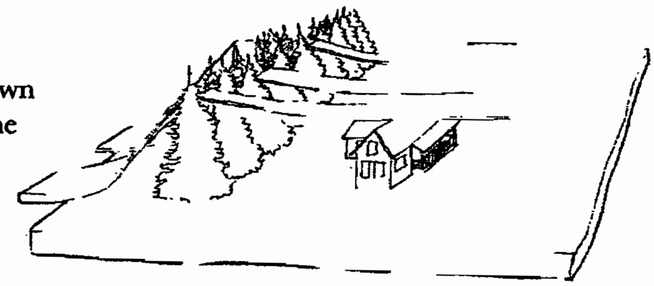
Locating windbreaks. Locate rows of trees perpendicular to the primary wind (Figure 12). Design the windbreak row to be longer than the building being sheltered because the wind speed increases at the edge of the windbreak. Ideally, the windbreak is planted upwind about 25-50 ft (7-15 m) from the building 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 (Figure 13). 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 ft (2 m) on center. If there is room for two or more rows, then space rows 10-12 ft (3-4 m) apart.

Plant dense evergreens. Evergreens are preferred over deciduous trees for windbreaks because they provide better wind protection. The ideal windbreak tree is fast growing, visually dense, has strong branch attachments, and has stiff branches that do not self-prune. Large windbreak trees for Western Washington and Oregon communities include western hemlock, (*Tsuga heterophylla*), incense-cedar (*Calocedrus decurrens*), and western redcedar (*Thuja pli-*

cata). Good windbreak species for smaller sites include American arborvitae (*Thuja occidentalis*), English laurel (*Prunus laurocerasus*), and Fraser photinia (*Photinia* x *fraseri*).

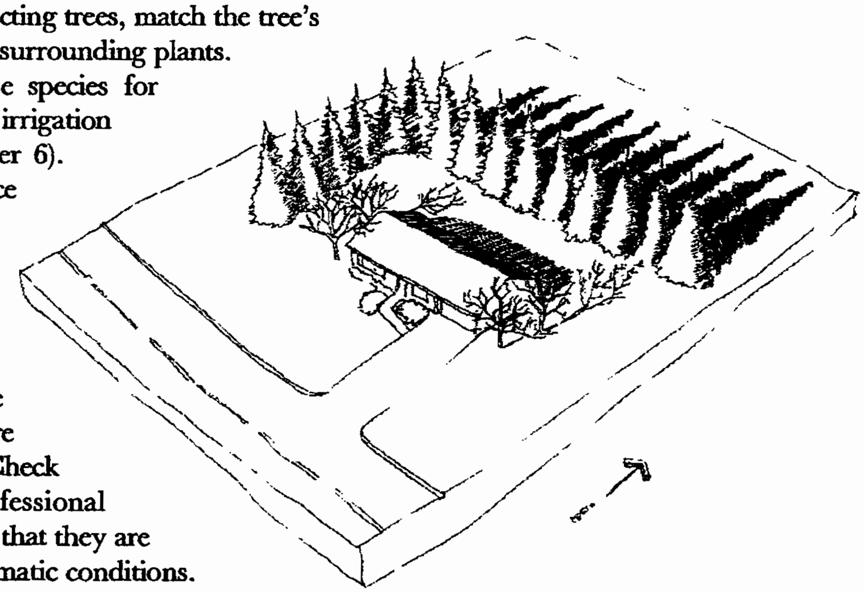
Selecting Yard Trees to Maximize Benefits



12. *Evergreens guide wind over the building (from Sand, 1993).*

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 powerlines 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 cottonwoods (*Populus spp.*) because of their invasive roots, weak wood, and large size, and ginkgos (*Ginkgo biloba*) because of their sparse shade and slow growth.

Picking the right tree. 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 (see Tree Selection List in Chapter 6). Also, match the tree's maintenance requirements with the amount of care and the type of use different areas in the landscape receive. For instance, tree species that drop fruit that can be a slip-and-fall problem should not be planted near paved areas that are frequently used by pedestrians. 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.



13. *Mid-winter shadows from a well-located windbreak and shade trees do not block solar radiation on the south-facing wall (from Sand 1993).*

Trees in Public Places

Locating and Selecting Trees to Maximize Climate Benefits

Large trees mean more shade. 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 (Scott et al. 1998). Large trees can shade more area than smaller trees, but should be used only where space permits. Remember that a tree needs space for both branches and roots.

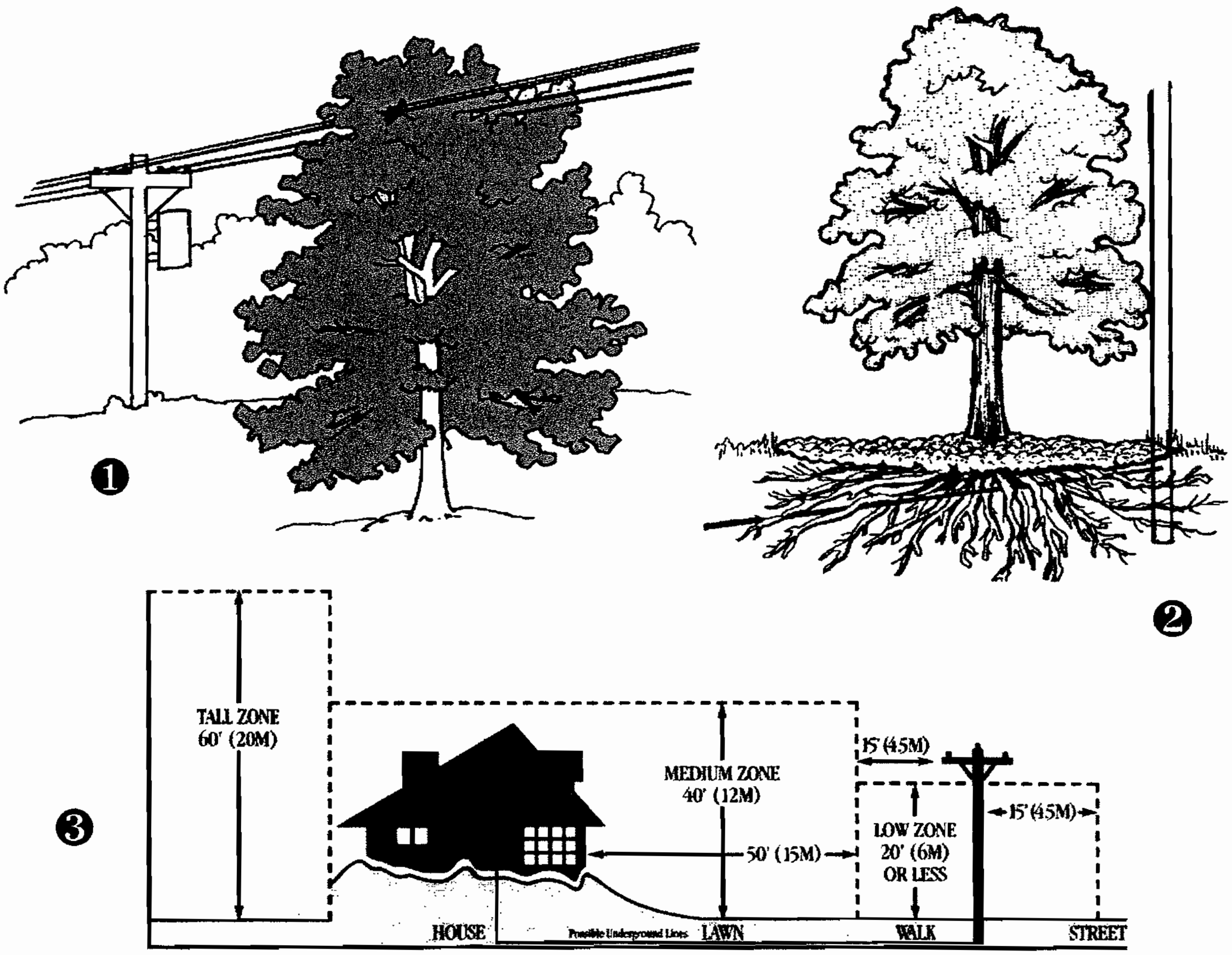
For CO_2 reduction, select trees well-suited to the site.

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 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 the Tree Selection List (see Chapter 5), and consult with your local landscape professional or arborist 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.

How to maximize trees as CO_2 sinks

Parks and other public landscapes serve multiple purposes. Some of the following guidelines may help you maximize their ability to serve as CO_2 sinks:

- ➢ Provide as much pervious surface as possible so that trees grow vigorously and store more CO_2.
- ➢ Maximize use of woody plants, especially trees, since 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 diversity 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 run and will avoid CO_2 emissions stemming from high maintenance needs.
- ➢ Group species with similar landscape maintenance requirements together and consider how irrigation, pruning, fertilization, weed, pest, and disease control can be done most efficiently.
- ➢ Compost litter 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 work sites.
- ➢ 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.



14. (❶, ❷) Know where power lines and other utility lines are before planting. ❸ Under power lines use only small-growing trees ("Low Zone"), and avoid planting directly above underground utilities. Larger trees may be planted where space permits ("Medium" and "Tall" zones) (from ISA 1992)

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

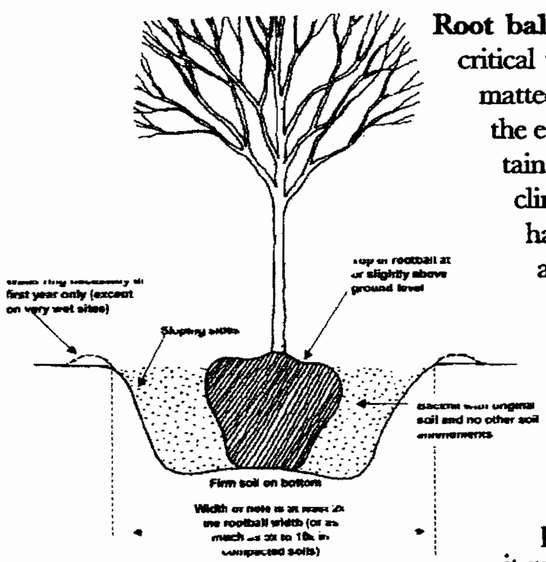
Pay attention to infrastructure. Contact your local utility company before planting to locate underground water, sewer, gas, and telecommunication lines. Note the location of powerlines, streetlights, and traffic signs, and select tree species that will not conflict with these aspects of the city's infrastructure. Keep trees at least 30 ft (10 m) away from street intersections to ensure visibility. Avoid planting shallow rooting species near sidewalks, curbs, and paving. Tree roots can heave pavement if planted too close to sidewalks and patios. Generally, avoid planting within 3 ft (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 ft tall [8 m]) for locations under overhead powerlines, and do not plant directly above underground water and sewer lines (Figure 14). Avoid locating trees where they will block illumination from streetlights or views of street signs in parking lots, commercial areas, and along streets.

Match tree to site on case-by-case basis

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 the 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 exudates. Plant only small or medium sized trees under powerlines. Consult the Tree Selection List in Chapter 5 and your local landscape professional for horticultural information on tree traits.

General Guidelines to Maximize Long-Term Benefits

Selecting a tree from the nursery that has a high probability of becoming a healthy, trouble-free mature tree is critical to a successful outcome. Therefore, select the very best stock at your nursery, and when necessary, reject nursery stock that does not meet industry standards.



Root ball critical to survival. The health of the tree's root ball is critical to its ultimate survival. If the tree is in a container, check for matted roots by sliding off the container. Roots should penetrate to the edge of the root ball, but not densely circle the inside of the container or grow through drain holes. If the tree has many roots circling around the outside of the root ball or the root ball is very hard it is said to be pot-bound. The mass of circling roots can act as a physical barrier to root penetration into the surrounding soil after planting. Dense surface roots that circle the trunk may girdle the tree. Do not purchase pot-bound trees.

A good tree is well-anchored. Another way to evaluate the quality of the tree before planting is to gently move the trunk back and forth. A good tree trunk bends and does not move in the soil, while a poor quality trunk bends little and pivots at or below the soil line. If it pivots and the soil loosens, it may not be very well anchored to the soil.

15. Prepare a broad planting area, plant tree with rootball at ground level, and provide a watering ring to retain water (from Head et al. 2001).

Plant the tree in a quality hole. Dig the planting hole one inch shallower than the depth of the root ball to allow for some settling after it is watered in. The crown of the root ball should be slightly above ground level. Make the hole two to three times as wide as the root ball and roughen the sides of the hole to make it easier for roots to penetrate. Backfill with the native soil unless it is very sandy, in which case you may want to add composted organic matter such as peat moss or shredded bark (Figure 15).

Use the extra backfill to build a berm outside the root ball that is 6 inches (15 cm) high and 3 ft (1 m) in diameter. Soak the tree, and gently rock it to set-

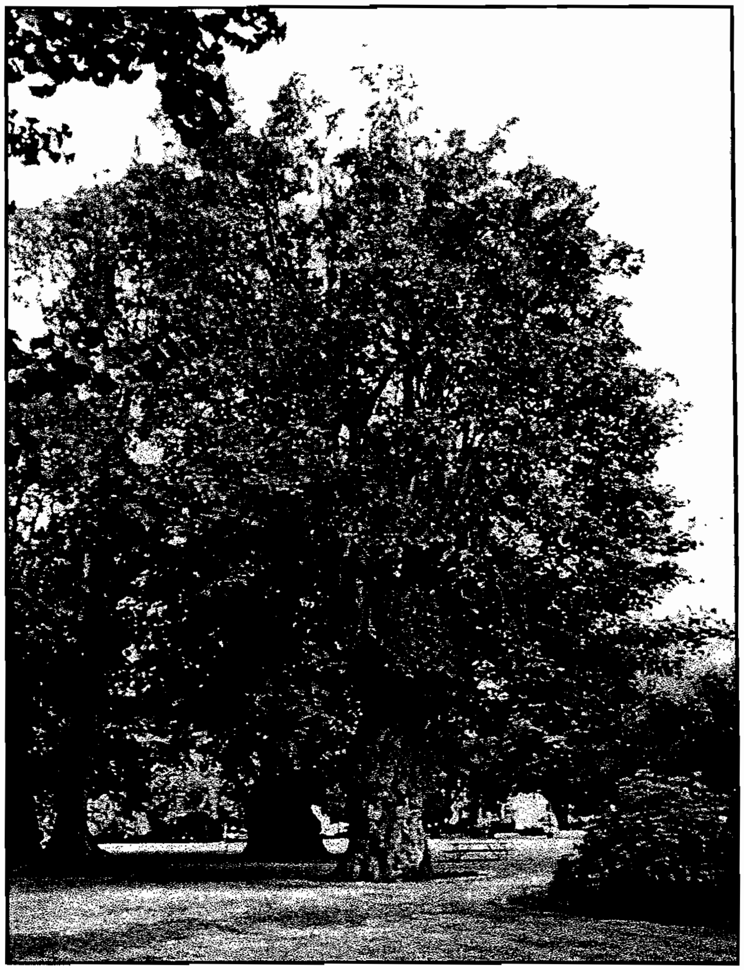
Mulch and water

tle it in. Cover the basin with a 4-inch (10 cm) thick layer of mulch, but avoid placing mulch against the tree trunk. Water the new tree twice a week for the first month and weekly thereafter for the following two growing seasons.

Don't forget about the tree

Inspect your tree several times a year, and contact a local tree or landscape professional if problems develop. If your tree needed staking to keep it upright, remove the stake and ties as soon as the tree can hold itself up. Reapply mulch and irrigate the tree as needed. Prune the young tree to maintain a central leader and equally spaced scaffold branches. As the tree matures, have it pruned on a regular basis by a certified arborist or experienced professional. By keeping your tree healthy, you maximize its ability to intercept rainfall, reduce atmospheric CO_2, and provide other benefits.

For additional information on tree planting, establishment and care, see *Principles and Practice of Planting Trees and Shrubs* (Watson and Himelick 1997), *Arboriculture* (Harris et al. 1999), and the video *Training Young Trees for Structure and Form* (Costello 2000).



5. Recommended Trees for Western Washington and Oregon Communities

In this chapter, recommended trees and their attributes are presented to help select the right tree for specific planting situations throughout Western Washington and Oregon.

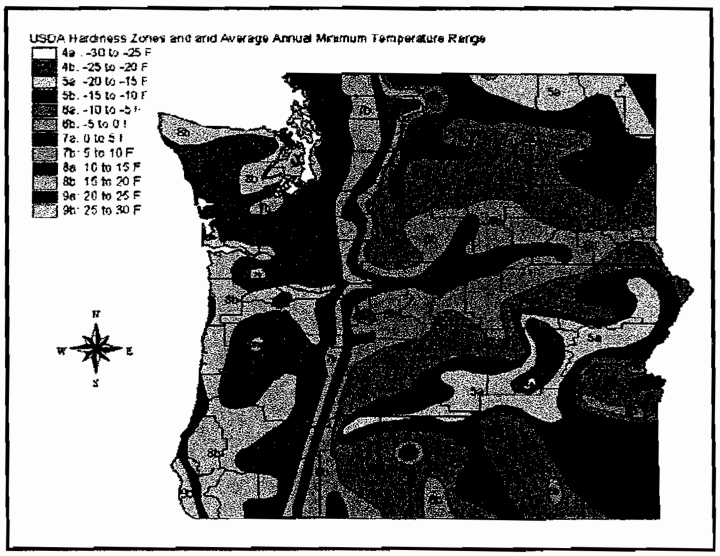
What is the geographic scope?

Because of their natural adaptability, many of the trees listed in Table 6 (starting on p. 50) are suitable for growing in the cold, drier areas east of the Cascade mountain range in Oregon and Washington, as well as the typically rainy areas west of the Cascades (Figure 1 on page 1). However, many of the species listed grow more vigorously in the growing conditions west of the Cascades. Cost-benefit data and other information in this tree guide pertain to trees growing in areas west of the Cascades only.

What are the selection criteria?

Species listed in Table 6 were selected for several reasons:

- Have been documented to grow well in USDA Hardiness Zones 3-8 and are acceptable or recommended for use by a number of municipalities in the region (Figure 16).
- Typically have no serious pest or excessive maintenance problems.
- Provide energy conservation benefits by creating significant amounts of summer shade when planted individually.
- Are readily available in the regional nursery industry based on the most recent production data available (Note: some of the 'newer' cultivars may not be available in large quantities).



16. Recommended trees for Western Washington and Oregon grow well in USDA Hardiness Zones 3-8 and are acceptable for use by a number of municipalities in the Pacific Northwest region.

This list includes a number of species that have traditionally made up the urban forest in the Pacific Northwest as well as a number of 'newer' species and cultivars that warrant increased planting by municipalities and homeowners. Readers are encouraged to use the reference materials cited in this chapter to identify additional species and cultivars to plant in their communities. It is important to select species and cultivars that are not currently overplanted in your community to maintain a stable tree population. A species-diverse urban forest can help minimize potential disease or insect epidemics, as well as increase community attractiveness and expand the availability of well-adapted species.

One recommendation is that no single genera should constitute more than 12% of the total tree population, and no single species should constitute more than 5%. While valuable as a guideline, it's important to remember that communities differ in growing conditions and management needs. Planting decisions should consider the need for well-adapted species, some experimental species, as well as overall diversity (Richards 1983).

What information is included?

Tree species are listed alphabetically by botanical name, and includes information regarding their mature size, leaf retention habit, growth rate, power-line compatibility, and best uses within the urban landscape. Trees are also classified as Solar Friendly–or not–based on data reported by the City of Portland and the Oregon Energy Office (1987). Solar friendly trees are deciduous and have relatively open crowns. When leafless, they permit transmission of winter sunlight. Also, they tend to be early to drop leaves and late to leaf-out. When planted south of buildings, solar friendly trees maximize winter solar heat gain. A "Comments" column highlights specific features for some of the trees.

It is important to note that a tree's size, lifespan, growth, and rooting pattern are highly variable depending on how it was planted, its growing conditions, and the care it receives. Therefore, the tree's actual performance can be very different from that described here. Use this information as a general guide and obtain more specific information from the references cited below and from local landscape professionals. In preparing this information, the following important assumptions were made:

- Trees will be planted as 15-gallon container sized plants.
- Conventional planting practices will be followed, such as appropriate site/soil preparation, root ball management, and mulching.
- Trees will be maintained and irrigated as needed until established (2-3 years) and then receive about 60% to 80% of reference evapotranspiration.

How to Match the Tree to the Site

Finding the best tree for a specific site takes time and study. Collecting information on conditions at the site is the first step. Consider the amount of below- and above-ground space, soil type and irrigation, microclimate, and the type of activities occurring around the tree that will influence its growth and management (e.g., mowing, parking, social events). In most cases, it is too expensive to alter site conditions by making them more suitable for a specific tree species. Instead, it is more practical to identify trees with characteristics that best match the existing site conditions, particularly those conditions that will be most limiting to growth. For example, microclimate can effect disease susceptibility of some genera (e.g., *Prunus* and *Malus*) and should be carefully considered when matching a tree to a site. Information in this chapter, such as disease susceptibility, will assist in finding the best match possible.

Tree List References

For more information

References used to develop the tree list include:

Ames, M.J. 1987. **Solar friendly trees report.** City of Portland, Oregon, Energy Office. Portland Oregon.

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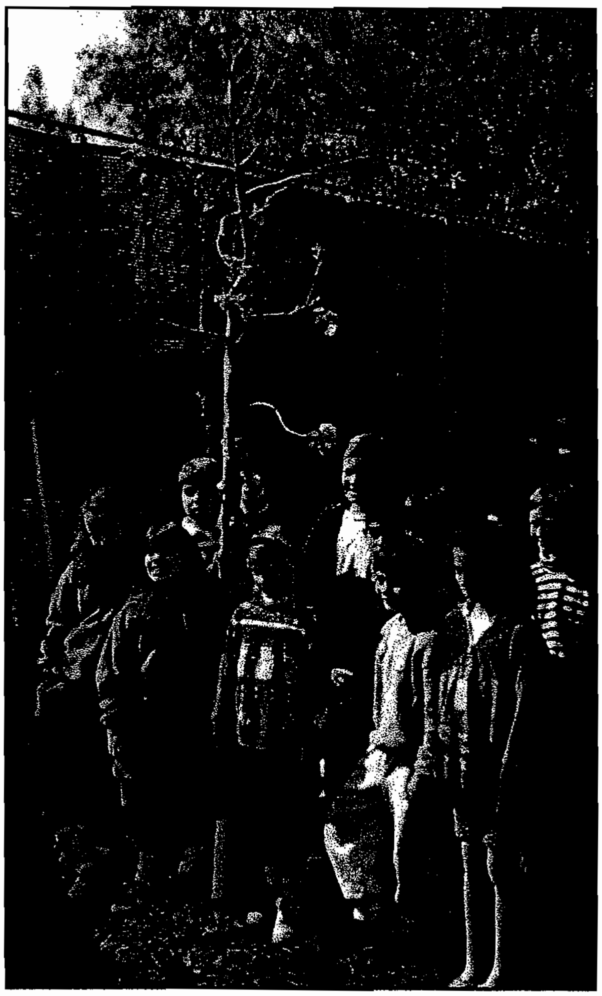

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Table 6. Recommended Trees for Western Washington and Oregon Communities

Common Name	Botanical Name	Height (feet)	Spread (feet)	Evergreen Deciduous	Growth Rate	USDA Zone	Suitable Under Powerline	Planting Location	Solar Friendly	Comments
Trident Maple	*Acer buergeranum*	30	30	D	S	5-8	Y	P/C; LR/C; SR/C	Y	Good bark effect on mature specimens, yellow-orange-red fall color.
Queen Elizabeth™ Hedge Maple	*Acer campestre* 'Evelyn'	35	30	D	S	6-8	N	P/C; LR/C; SR/C	Y	Oval-round crown, flat top, dense growth, leaves are dark green, yellowish fall color.
Vine Maple	*Acer circinatum*	15-30	10-20	D	S	5-8	Y	P/C; LR/C; SR/C; P	Y	Tolerates considerable shade, often found as multi-stemmed tree.
David Maple	*Acer davidii*	30-50	20-35	D	M	5-8	N	P/C; LR/C	Y	Grown for the spectacular bark which is green with white stripes.
Paperbark Maple	*Acer griseum*	25	25	D	S	5-8	Y	P/C; LR/C; SR/C	Y	Bark is spectacular, cinnamon colored and peeling, excellent red fall color, tolerates some shade.
Fernleaf Fullmoon Maple	*Acer japonicum* 'Aconitifolium'	25	25	D	M	5-8	Y	P/C; LR/C; SR/C;	Y	A multi-stemmed selection of spreading habit with superb yellow-red fall color.
Pacific Sunset™ Maple	*Acer* 'Warrenred'	30	25	D	M	5-8	Y	P/C; LR/C; SR/C; P	Y	Very glossy dark green leaves, yellow-orange-red fall color.
Japanese Maple	*Acer palmatum*	6-40	5-25	D	S	5-8	Y	P/C; LR/C; SR/C; P	Y	Huge number of cultivars, much variation in plant size, color, habit.
Parkway® Norway Maple	*Acer platanoides* 'Columnarbroad'	45	35	D	M	4-8	N	P/C; LR/C	Y	Surface-rooted, adapted to poor soil, heat and drought-tolerant, yellow fall color, one of the best cultivars for urban sites, tolerant of verticillium wilt.
Columnar Norway Maple	*Acer platanoides* 'Columnare'	60	20	D	M	4-8	N	P/C; LR/C	Y	Surface-rooted, adapted to poor soil, heat and drought-tolerant, may seed itself.
Crimson King Norway Maple	*Acer platanoides* 'Crimson King'	45	40	D	M	4-8	N	P/C; LR/C	Y	Surface-rooted, adapted to poor soil, heat and drought-tolerant, maroon leaf color, may seed itself.

Height: average ultimate height in feet for mature tree growing in these areas.
Spread: average ultimate spread in feet for mature tree growing in theses areas.
Type: E = evergreen; D = deciduous.
Growth Rate: years to mature size when planted from a 15-gal. container; S = slow, >20 years; M = moderate, 10-20 years; F = fast, <10 years.
Use categories:
Suitable under powerlines: Tree has a mature height of 30 ft. or less and is suitable for planting under powerlines.
Suitable planting locations:
P/C = park/commercial: ±8,000 sq.ft. of planting area; ultimate ht. >50 ft.
LR/C = large residential/commercial: 4,000 – 8,000 sq.ft. of planting area; ultimate ht. 30 = 50 ft.
SR/C = small residential/commercial: <4,000 sq.ft. of planting area; ultimate ht. 30 ft. or less.
P = patio: very clean; ultimate ht. of 20-30 ft.
Solar friendly: Y=yes (promotes winter solar gain), N=No, NDA= No Data Available.

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Common Name	Botanical Name	Height (feet)	Spread (feet)	Evergreen Deciduous	Growth Rate	USDA Zone	Suitable Under Powerline	Planting Location	Solar Friendly	Comments
Deborah Norway Maple	*Acer platanoides* 'Deborah'	50	45	D	M	4-8	N	P/C; LR/C	Y	Surface-rooted, adapted to poor soil, heat and drought-tolerant, brilliant red new growth, orange-yellow fall color, may seed itself.
Emerald Queen Norway Maple	*Acer platanoides* 'Emerald Queen'	50	40	D	M-F	4-8	N	P/C; LR/C	Y	Surface-rooted, adapted to poor soil, heat and drought-tolerant, ascending branches, rapid grower, commonly used cultivar, may seed itself.
Autumn Flame Red Maple	*Acer rubrum* 'Autumn Flame'	50	40	D	M-F	3-8	N	P/C; LR/C	Y	Rounded crown on mature trees, red fall color.
Bowhall Red Maple	*Acer rubrum* 'Bowhall'	50	15	D	M-F	3-8	N	P/C; LR/C	Y	Upright form with yellowish-red fall color.
Karpick Red Maple	*Acer rubrum* 'Karpick'	45	20	D	M-F	3-8	N	P/C; LR/C	Y	Twigs are distinctly red, yellow-red fall color.
October Glory® Red Maple	*Acer rubrum* 'October Glory'	45	30	D	M-F	3-8	N	P/C; LR/C	Y	Oval-rounded form, orange-red fall color.
Red Sunset® Red Maple	*Acer rubrum* 'Franksred'	45	35	D	M-F	3-8	N	P/C; LR/C	Y	Rounded outline, orange to red fall color.
Commemoration Sugar Maple	*Acer saccharum* 'Commemoration'	50	35	D	F	4-8	N	P/C; LR/C	Y	Fast-growing oval-rounded tree, glossy dark green leaves, yellow-orange-red fall color.
Green Mountain® Sugar Maple	*Acer saccharum* 'Green Mountain'	70	45	D	M	4-8	N	P/C; LR/C	Y	Dark green leathery leaves, yellow-red fall color. May be more tolerant than other cultivars of drought.
Legacy Sugar Maple	*Acer saccharum* 'Legacy'	50	35	D	M	4-8	N	P/C; LR/C	Y	Glossy dark green leaves, very dense crown, yellow-orange fall color.
Pattern Perfect Tatarian Maple	*Acer tataricum* 'Pattern Perfect'	15-20	15-20	D	M	3-8	Y	P/C; LR/C; SR/C	NDA	Attractive small specimen tree, good substitution for *A. ginnala*, red samaras in summer.
Armstrong Maple	*Acer x freemanii* 'Armstrong'	50	15	D	F	4-8	N	P/C; LR/C	NDA	Fast-growing, silvery underside to leaf, yellow-orange fall color.
Autumn Blaze® Maple	*Acer x freemanii* 'Autumn Blaze'	50	40	D	F	4-8	N	P/C; LR/C	N	Fast-growing, orange-red fall color.
Briotii Red Horsechestnut	*Aesculus x carnea* 'Briotii'	50	45	D	M	5-8	N	P/C; LR/C	N	Rounded head, resistant to blotch and mildew, red flowers in 10" panicles.
Fort McNair Red Horsechestnut	*Aesculus x carnea* 'Fort McNair'	40-50	40-50	D	M	5-8	N	P/C; LR/C	N	Flowers 6-8" long, reddish-pink with yellow throats.

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Common Name	Botanical Name	Height (feet)	Spread (feet)	Evergreen Deciduous	Growth Rate	USDA Zone	Suitable Under Powerline	Planting Location	Solar Friendly	Comments
Heritage® River Birch	*Betula nigra* 'Cully'	50	35	D	M	3-8	N	P/C; LR/C	N	Glossy dark green leaves, yellow fall color, excellent peeling white/cream bark. Quite drought-tolerant.
Whitebark Himalayan Birch	*Betula utilis* var. *jacquemontii*	40	30	D	M	5-8	N	P/C; LR/C	Y	Dark green leaves, exceptional white bark.
Pyramidal Hornbeam	*Carpinus betulus* 'Fastigiata'	30-40	20-30	D	S	4-7	N	P/C; LR/C; SR/C	N	Upright, oval shape; densely branched.
Pyramidal European Hornbeam	*Carpinus betulus* 'Franz Fontaine'	30-35	15-18	D	M	4-7	N	P/C; LR/C; SR/C	NDA	Excellent small landscape tree; strongly fastigiate.
Katsura tree	*Cercidiphyllum japonicum*	60-80	30-50	D	M	4-8	N	P/C; LR/C	Y	Single-stemmed or multi-stemmed forms; heart shaped leaves. Well suited for park sites. Protect from sun scald and does best in an irrigated site.
Eastern Redbud	*Cercis canadensis*	20-30	25-35	D	M	5-8	Y	P/C; LR/C; SR/C	Y	Nice small specimen tree. Rosy pink flowers with legume type fruit in fall. Yellow fall color.
White Redbud	*Cercis canadensis* 'Alba'	20-30	25-35	D	M	5-8	Y	P/C; LR/C; SR/C	Y	White flowers.
Forest Pansy Redbud	*Cercis canadensis* 'Forest Pansy'	20	25	D	M	5-8	Y	P/C; LR/C; SR/C	Y	Purple foliage, rose-purple flowers.
Oklahoma Redbud	*Cercis canadensis* ssp. *texensis* 'Oklahoma'	20	20	D	M	6-8	Y	P/C; LR/C; SR/C	Y	Leaves are shiny, leathery green, rosy magenta flowers.
Yellowwood	*Cladrastis kentukea*	30-50	40-50	D	M	3-8	N	P/C; LR/C	Y	Excellent flowers & leaves; nice shade tree.
June Snow Giant Dogwood	*Cornus controversa* 'June Snow'	30	40	D	M	5-8	Y	P/C; LR/C	Y	Horizontally-branched, wide-spreading tree, flowers in May-June.
Flowering Dogwood	*Cornus florida*	20-30	20-30	D	M	5-8	Y	P/C; LR/C; SR/C	Y	Large number of cultivars, exceptionally showy in flower. May be susceptible to anthracnose.
Kousa Dogwood	*Cornus kousa* 'National' or 'Satomi'	20-30	20-30	D	S	5-8	Y	P/C; LR/C; SR/C	Y	Listed cultivars are most commonly available tree forms, flowers much later than *C. florida*. Has been used as street tree but large, soft red fruit may limit use.

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Common Name	Botanical Name	Height (feet)	Spread (feet)	Evergreen Deciduous	Growth Rate	USDA Zone	Suitable Under Powerline	Planting Location	Solar Friendly	Comments
Cornelian Cherry	*Cornus mas*	25	20	D	M	4-8	Y	P/C; LR/C; SR/C	NDA	Yellow flowers in March, followed by edible red fruit. Fruit may limit use as street tree.
Lavalle Hawthorn	*Crataegus x lavallei*	20-30	20	D	M	4-7	Y	P/C; LR/C; SR/C	N	Small dense oval to rounded canopy, white flowers in late May, orange-red fruit persist into winter.
Washington Hawthorn	*Crataegus phaenopyrum*	30	30	D	M	4-8	Y	P/C; LR/C; SR/C	N	White flowers and very showy red fruit, thorny so avoid high-traffic areas.
Dove Tree	*Davidia involucrata*	40	30	D	M	6-8	N	P/C; LR/C	Y	Exceptionally showy and unusual flower display, best with summer irrigation.
Hardy Rubber Tree	*Eucommia ulmoides*	40	40	D	M	5-8	N	P/C; LR/C	NDA	Excellent foliage effect.
Dawyck Beech	*Fagus sylvatica* 'Dawyck'	50-60	10-20	D	S	4-8	N	P/C; LR/C	NDA	Very columnar to slightly cone shaped.
Purple Fountain Beech	*Fagus sylvatica* 'Purple Fountain'	25	12	D	S	4-8	Y	P/C; LR/C; SR/C	NDA	Narrow upright growth with cascading branches, purple foliage.
Riversii Beech	*Fagus sylvatica* 'Riversii'	50	40	D	S	4-8	N	P/C; LR/C	NDA	Very deep purple leaves.
Autumn Applause White Ash	*Fraxinus americana* 'Autumn Applause'	40	25	D	M	4-8	N	P/C; LR/C	Y	Densely-branched oval form, purple fall color.
Autumn Purple® White Ash	*Fraxinus americana* 'Junginger'	45	60	D	M	4-8	N	P/C; LR/C	Y	Pyramidal-rounded outline, deep green leaves, purple fall color.
Golden Desert™ Ash	*Fraxinus excelsior 'Jaspidea'*	30	20	D	M	4-8	N	P/C; LR/C	Y	Rounded shape, new growth is gold, golden bark with black buds makes interesting winter contrast.
Summit Green Ash	*Fraxinus pennsylvanica* 'Summit'	45	20	D	M	3-8	N	P/C; LR/C	Y	Upright habit, pyramidal in shape, glossy summer foliage, yellow fall color.
Magyar Maidenhair tree	*Ginkgo biloba* 'Magyar'	50	30	D	S-M	4-8	N	P/C; LR/C	Y	True, sterile male clone, excellent yellow fall color.
Fairmount Maidenhair tree	*Ginkgo biloba* 'Fairmount'	70	30	D	S-M	4-8	N	P/C; LR/C	Y	Male tree, strongly upright-growing, yellow fall color.

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Princeton Sentry® Maidenhair tree	*Ginkgo biloba* 'PNI 2720'	60	25	D	S-M	4-8	N	P/C; LR/C	Y	Male tree, upright habit, yellow fall color.
Kentucky Coffeetree	*Gymnocladus dioicus*	60	40	D	S-M	3-8	N	P/C; LR/C	Y	Unusual tree with white flowers, good furrowed bark effect, root suckers easily.
Carolina Silverbell	*Halesia tetraptera*	35	25	D	M	4-8	N	P/C; LR/C; SR/C	Y	White flowers dangle from the branches, good in shady sites.
Goldenrain tree	*Koelreuteria paniculata*	35	35	D	M-F	5-8	N	P/C; LR/C; SR/C	Y	Yellow flowers in summer, followed by interesting brown, papery fruits.
Crape Myrtle	*Lagerstroemia indica x L. fauriei*	25	20	D	M	6-8	Y	P/C; LR/C; SR/C; P	Y	Excellent trees for late summer flowers, bark and foliage effect. Usually multi-stemmed, best with some summer water. 'Natchez', 'Tuskarora' and 'Tuskegee' are good growers in PNW.
Yulan Magnolia	*Magnolia denudata*	30	30	D	M	5-8	Y	P/C; LR/C; SR/C	N	Flowers in early spring, flowers are 5-6" across, white, fragrant.
Galaxy Magnolia	*Magnolia* 'Galaxy'	25	25	D	S	5-8	Y	P/C; LR/C; SR/C	NDA	Flowers are red-purple to pink, later than earliest Magnolias to avoid frost.
Edith Bogue Southern Magnolia	*Magnolia grandiflora* 'Edith Bogue'	30	15	E	S-M	6-8	Y	P/C; LR/C; SR/C	NDA	Dark green, narrow leaves, white, very fragrant flowers in summer. Best with supplemental water.
Victoria Southern Magnolia	*Magnolia grandiflora* 'Victoria'	30	30	E	S-M	6-8	Y	P/C; LR/C; SR/C	NDA	Glossy green leaves with brown undersides, fragrant white flowers in summer. PNW selection and good performer locally.
Royal Star Magnolia	*Magnolia stellata* 'Royal Star'	15	20	D	S	4-8	Y	P/C; LR/C; SR/C	Y	Pure white fragrant flowers in early spring.
Leonard Messel Magnolia	*Magnolia x loebneri* 'Leonard Messel'	20	20	D	M	4-8	Y	P/C; LR/C; SR/C	NDA	Fragrant flowers in early spring, flowers are white on inside, pink on the outside.
Merrill Magnolia	*Magnolia x loebneri* 'Merrill'	25	25	D	M	4-8	Y	P/C; LR/C; SR/C	NDA	Fragrant white flowers, heavy flowering.
Alexandrina Saucer Magnolia	*Magnolia x soulangiana* 'Alexandrina'	20	15	D	M	4-8	Y	P/C; LR/C; SR/C	Y	Often multi-stemmed, flowers in early spring, flowers are purple outside, white inside.
Rustica Rubra Saucer Magnolia	*Magnolia x soulangiana* 'Rustica Rubra'	20	20	D	M	4-8	Y	P/C; LR/C; SR/C	Y	Often multi-stemmed, flowers in early spring, flowers are rose-red outside, white inside.

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Prairifire Crabapple	*Malus* 'Prairifire'	20	20	D	M	4-8	Y	P/C; LR/C; SR/C	Y	Rounded habit, new growth is reddish-green, flowers and fruit are dark purplish-red.
Red Baron Crabapple	*Malus* 'Red Baron'	18	8	D	M	4-8	Y	P/C; LR/C; SR/C	Y	Narrow, columnar shape, purple-bronze foliage, red to pink flowers, good disease resistance.
Red Jewel™ Crabapple	*Malus* 'Jewelcole'	15	12	D	M	4-8	Y	P/C; LR/C; SR/C	N	Upright, pyramidal form, flowers are white, fruit are red, fruit persists very late.
Sentinel Crabapple	*Malus* 'Sentinel'	20	12	D	M	4-8	Y	P/C; LR/C; SR/C	NDA	Narrow, upright shape, dark green glossy leaves, pale pink flowers, red fruit, good to excellent disease resistance.
Spring Snow Crabapple	*Malus* 'Spring Snow'	20-25	15-20	D	M	4-8	Y	P/C; LR/C; SR/C;P	NDA	Upright, oval tree, white flowers, considered fruitless or nearly fruitless. May be susceptible to scab.
Sentinel Crabapple	*Malus* 'Sentinel'	20	12	D	M	4-8	Y	P/C; LR/C; SR/C	NDA	Narrow, upright shape, dark green glossy leaves, pale pink flowers, red fruit, good to excellent disease resistance.
Black Gum	*Nyssa sylvatica*	30-50	20-30	D	S	3-9	N	P/C; LR/C	Y	Specimen tree, superb red fall color, abundant fruit production, street tree when adequate space.
Sourwood	*Oxydendrum arboreum*	30-40	20	D	S	5-9	N	P/C; LR/C; SR/C	Y	A narrow, graceful tree with pendulous lily-of-the-valley-like midsummer flowers and brilliant red fall color. Best with supplemental summer water.
Persian parrotia	*Parrotia persica*	20-40	15-30	D	M	5-8	Y	P/C; LR/C; SR/C	N	Oval crown, sometimes multi-branched tree has beautiful exfoliating bark and excellent fall color. Hardy and pest resistant, but requires good drainage.
Amur Corktree	*Phellodendron amurense*	30-45	30-45	D	M	3-8	N	P/C	Y	Suitable in parks & large areas, resistant to pests.
Ornamental Cherry	*Prunus serrulata*	15-40	15-40	D	M	4-8	—	—	—	Numerous cultivars available. Select carefully for disease and insect resistance.
Chanticleer Flowering Pear	*Pyrus calleryana* 'Chanticleer'	30-50	20-35	D	M	4-8	N	P/C; LR/C	N	Similar to 'Bradford' but more narrow; good for narrow spaces.
Redspire Pear	*Pyrus calleryana* 'Redspire'	30-50	20-35	D	M	4-8	N	P/C; LR/C	N	Small to medium sized tree of upright form; brilliant white flowers and attractive fall color. Superior branching habit to the storm-breakage prone Bradford pear.
Scarlet Oak	*Quercus coccinea*	75	50	D	S	4-8	N	P/C	Y	Glossy dark green foliage, reddish fall color, tan-colored leaves persist on tree in winter.

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Bur Oak	*Quercus macrocarpa*	70-80	70-80	D	S	3-8	N	P/C	N	Excellent tree for large areas, dark green leaves, yellowish fall color, interesting, fringed acorns.
Pin oak	*Quercus palustris*	60-70	30-40	D	M	4-7	N	P/C	N	Distinctive leaves and pyramidal habit, fall color is variable, very intolerant of high pH soil.
Fastigiate English Oak	*Quercus robur* 'Fastigiata'	50-60	10-15	D	S	4-8	N	P/C	N	Upright & columnar form, dark green leaves, no fall color.
Skymaster™ English Oak	*Quercus robur* 'Pyramich'	50	25	D	S	4-8	N	P/C	N	Narrow habit when young, becomes pyramidal with age, dark green leaves, no fall color.
Red Oak	*Quercus rubra*	60-75	40-50	D	F	4-8	N	P/C	N	Excellent fast growing oak for large spaces. Excellent fall color.
Purple Robe Black Locust	*Robinia pseudoacacia* 'Purple Robe'	30-40	30-40	D	M	5-8	Y	P/C; LR/C; SR/C; P	NDA	Compact round form; new foliage is bronze, dark rose-pink flowers.
Korean Mountainash	*Sorbus alnifolia*	40-50	20-30	D	M	4	N	P/C; LR/C	Y	Fruit can be messy; suited for parks, commercial sites.
Japanese Stewartia	*Stewartia pseudocamellia*	20-40	20-30	D	S	5-7	Y	P/C; LR/C; SR/C; P	Y	Outstanding small specimen tree, excellent bark effect, pretty white flowers, best in an irrigated site.
Japanese Snowbell	*Styrax japonicus*	20-30	20-30	D	M	5-8	Y	P/C; LR/C; SR/C; P	Y	Small, graceful tree, rounded crown, white spring flowers.
Ivory Silk Japanese Tree Lilac	*Syringa reticulata* 'Ivory Silk'	20-30	15-20	D	M	3-7	Y	P/C; LR/C; SR/C; P	Y	Trouble-free plant, deep green leaves, very showy white flowers, excellent specimen or street tree, looks good when massed.
Littleleaf Linden	*Tilia cordata*	40-50	25-40	D	F	3-7	N	P/C	Y	Select from cultivars: 'Chancellor', 'DeGroot', 'Glenleven' and 'Greenspire'. Each has slightly different characteristics, growth habit.
Crimean Linden	*Tilia x euchlora*	40-60	20-30	D	M	3-7	N	P/C	Y	Graceful tree with glossy dark green leaves, tolerant of urban conditions and dry soil. May sucker if grafted.
Sterling Silver® Linden	*Tilia tomentosa* 'PP6511'	45	20-25	D	M	4-7	N	P/C	N	Impressive pyramidal specimen. Dark green leaves above, silver underside, and grayish bark.
Lacebark elm; Chinese elm	*Ulmus parvifolia*	40-50	40	D	MF	5-9	N	P/C	N	Suitable to tough sites, and is resistant to Dutch elm disease and elm leaf beetle; attractive bark and form.

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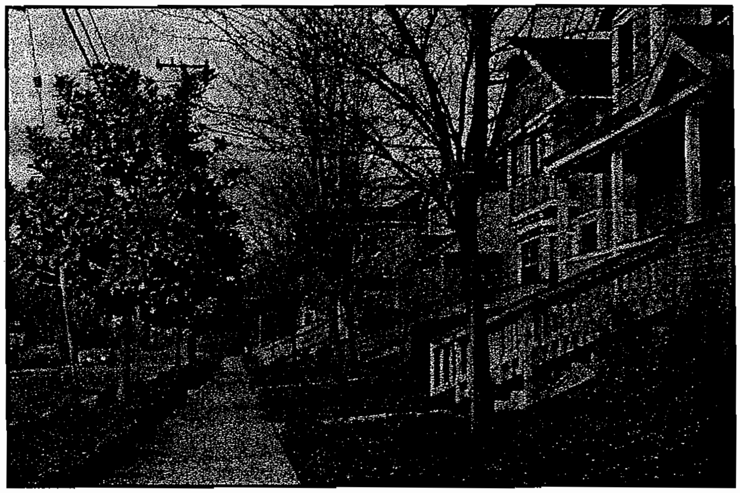
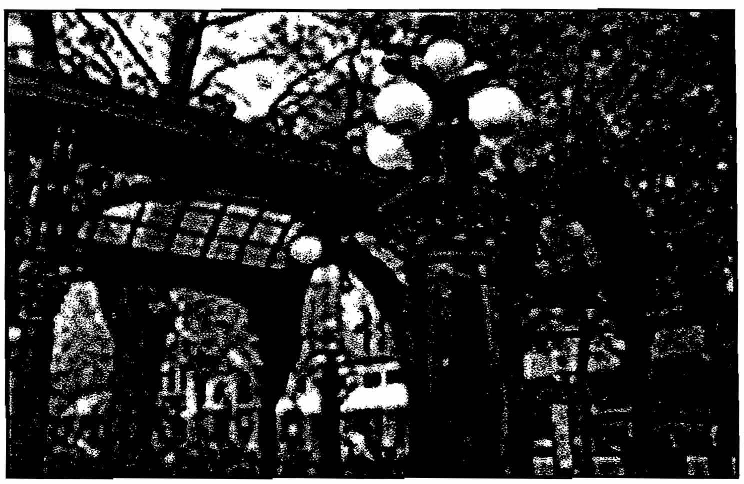
Allee® Elm	*Ulmus parvifolia* 'Emer II'	70	60	D	M	5-9	N	P/C	N	Upright, spreading tree, attractive exfoliating bark, glossy green leaves, yellowish fall color. Drought tolerant; resistant to Dutch elm disease.
Athena® Elm	*Ulmus parvifolia* 'Emer I'	40	55	D	M	5-9	N	P/C	N	Broad spreading tree, attractive exfoliating bark, dark green, leathery leaves, drought-tolerant and resistant to Dutch elm disease.
Green Vase Zelkova	*Zelkova serrata* 'Green Vase'	50-80	50-80	D	MF	5-8	N	P/C	Y	Vase-shaped with upright branches, very vigorous, dark green leaves, bronzy-red fall color.
Village Green Zelkova	*Zelkova serrata* 'Village Green'	50-80	50-80	D	MF	5-8	N	P/C	Y	Large tree with smooth straight trunk, dark green leaves turn rusty-red in fall, resistant to Dutch elm disease.

TREE SELECTION LIST





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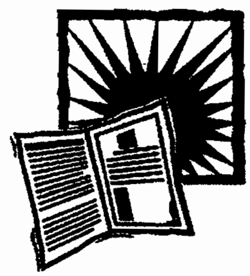

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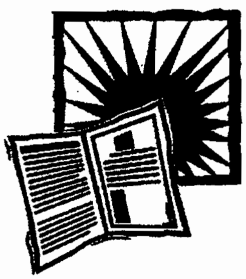

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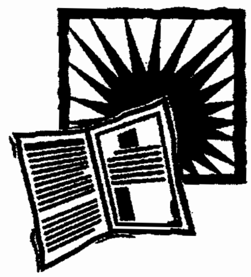

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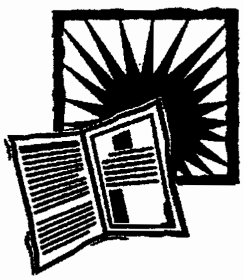

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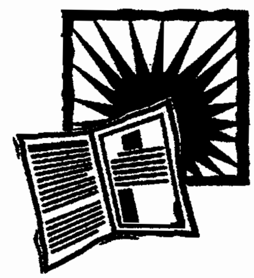

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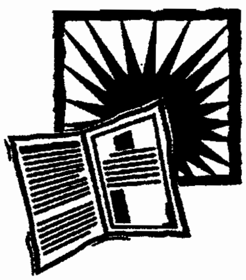

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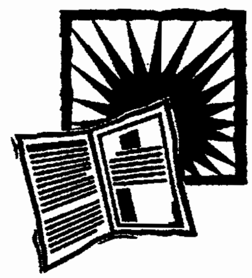
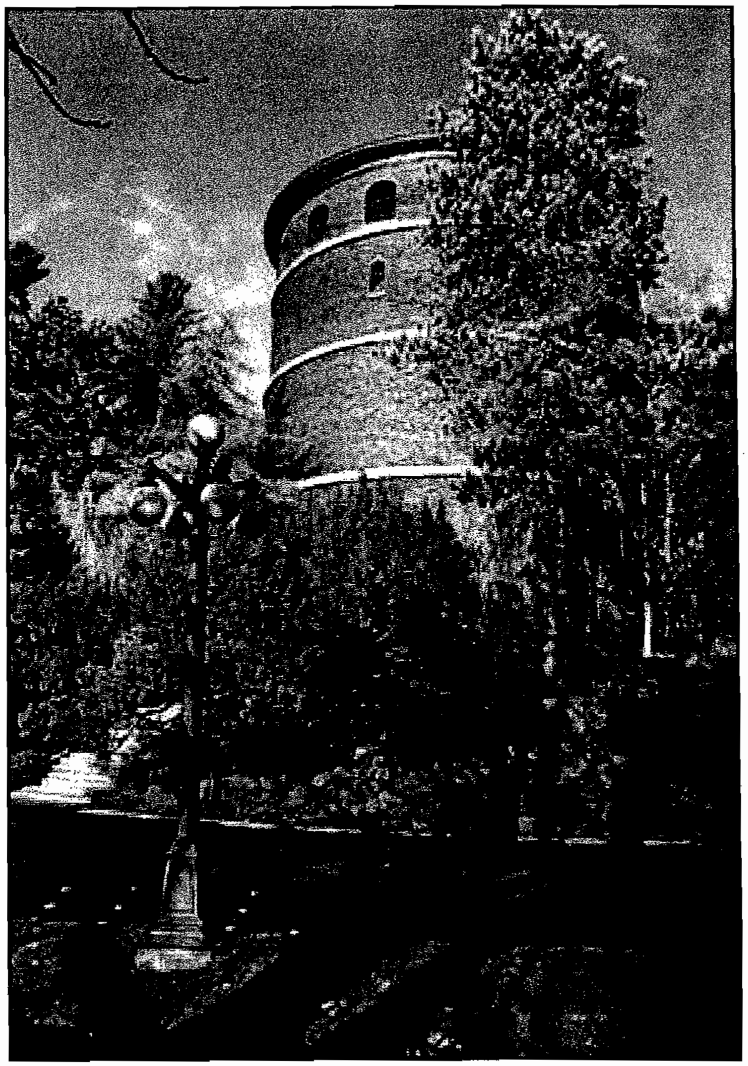




7. Glossary of Terms

AFUE (Annual Fuel Utilization Efficiency): A measure of space heating equipment efficiency defined as the fraction of energy output/energy input.

Anthropogenic: Produced by humans.

Avoided Power Plant Emissions: Reduced emissions of CO_2 or other pollutants that result from reductions in building energy use due to the moderating effect of trees on climate. Reduced energy use for heating and cooling result in reduced demand for electrical energy, which translates into fewer emissions by power plants.

Biodiversity: The variety of life forms in a given area. Diversity can be categorized in terms of the number of species, the variety in the area's plant and animal communities, the genetic variability of the animals, or a combination of these elements.

Biogenic: Produced by living organisms.

BVOCs (Biogenic Volatile Organic Compounds): Hydrocarbon compounds from vegetation (e.g. isoprene, monoterpene) that exist in the ambient air and contribute to the formation of smog and/or may themselves be toxic. Emission rates (ug/g/hr) used for this guide follow Winer et al.1998:

- *Quercus rubrum* - 4.72 (Isoprene); 0.68 (Monoprene); 0.20 (Other)
- *Acer platanoides* - 0.00 (Isoprene); 1.05 (Monoprene); 0.32 (Other)
- *Prunus cerasifera* - 0.00 (Isoprene); 0.04 (Monoprene); 0.04 (Other)

Canopy: A layer or multiple layers of branches and foliage at the top or crown of a forest's trees.

Cities for Climate Protection TM Campaign: Cities for Climate Protection Campaign (CCP), begun in 1993, is a global campaign to reduce the emissions that cause global warming and air pollution. By 1999, the campaign had engaged in this effort more than 350 local governments, who jointly accounted for approximately 7% of global greenhouse gas emissions.

Climate: The average weather (usually taken over a 30-year time period) for a particular region and time period. Climate is not the same as weather, but rather, it is the average pattern of weather for a particular region. Weather describes the short-term state of the atmosphere. Climatic elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather.

Climate Change (also referred to as "global climate change"): The term 'climate change' is sometimes used to refer to all forms of climatic inconsistency, but because the earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, 'climate change' has been used synonymously with the term, 'global warming'; scientists, however, tend to use the term in the wider sense to also include natural changes in the climate.

Climate Effects: Impact on residential space heating and cooling (kg CO_2/tree/year) from trees located greater than 15 m (50 ft) from a building due to associated reductions in wind speeds and summer air temperatures.

Contract Rate: The percentage of residential trees cared for by commercial arborists; the proportion of trees contracted out for a specific service (e.g., pruning or pest management).

Control Costs: The marginal cost of reducing air pollutants using best available control technologies.

Crown: The branches and foliage at the top of a tree.

Cultivar (derived from "*cultivated variety*"): Denotes certain cultivated plants that are clearly distinguishable from others by any characteristic and that when reproduced (sexually or asexually) retain their distinguishing characters. In the United States, variety is often considered synonymous with cultivar.

Deciduous: Trees or shrubs that lose their leaves every fall.

Diameter at Breast Height (DBH): Tree DBH is outside bark diameter at breast height. Breast height is defined as 4.5 feet (1.37m) above ground-line on the uphill side (where applicable) of the tree.

Emission Factor: A rate of CO_2, NO_2, SO_2 and PM_{10} output resulting from the consumption of electricity, natural gas or any other fuel source.

Evapotranspiration (ET): The total loss of water by evaporation from the soil surface and by transpiration from plants, from a given area, and during a specified period of time. Evapotranspiration calculations used the following equation: $ET=(K_c) \times (PET)$; where, Kc is the crop coefficient or plant factor and equals $(K_{species}) \times (K_{density}) \times (K_{microclimate})$; PET is the average evapotranspiration during the peak irrigation period of the year (Akbari et al. 1992; Rain Bird 1998).

Evergreen: Trees or shrubs that are never entirely leafless. Evergreen trees may be broadleaved or coniferous (cone-bearing with needle-like leaves).

Fossil Fuel: A general term for combustible geologic deposits of carbon in reduced (organic) form and of biological origin, including coal, oil, natural gas, oil shales, and tar sands. A major concern is that they emit carbon dioxide into the atmosphere when burnt, thus significantly contributing to the enhanced greenhouse effect.

Global Warming: An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as a result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases.

Greenspace: Urban trees, forests, and associated vegetation in and around human settlements, ranging from small communities in rural settings to metropolitan regions.

Heat Sinks: Paving, buildings, and other built surfaces that store heat energy from the sun.

Hourly Pollutant Dry Deposition: Removal of gases from the atmosphere by direct transfer to and absorption of gases and particles by natural surfaces such as vegetation, soil, water or snow.

Initial Abstraction: Rainfall that is caught and held prior to initiation of runoff. Two components are interception (rainfall caught in plant leaf canopies and evaporated before falling to the ground) and depression storage (stormwater held in surface depressions until it evaporates or infiltrates).

Interception: Amount of rainfall held on tree leaves and stem surfaces.

kBtu: A unit of work or energy, measured as 1,000 British thermal units. One kBtu is equivalent to 0.293 kWh.

kWh (Kilowatt-hour): A unit of work or energy, measured as one kilowatt (1,000 watts) of power expended for one hour. One kWh is equivalent to 3.412 kBtu.

Leaf Surface Area (LSA): Measurement of area of one side of leaf or leaves.

Leaf Area Index (LAI): Total leaf area per unit crown projection area.

Mature Tree: A tree that has reached a desired size or age for its intended use. Size, age, or economic maturity varies depending on the species, location, growing conditions, and intended use.

Mature Tree Size: The approximate tree size 40 years after planting.

MBtu: A unit of work or energy, measured as 1,000,000 British thermal units. One MBtu is equivalent to 0.293 MWh.

Metric Tonne: A measure of weight (abbreviate "tonne") equal to 1,000,000 grams (1,000 kilograms) or 2,205 pounds.

MJ: A unit of work or energy, measured as 1,000,000 Joules.

Municipal Forester: A person who manages public street and/or park trees (municipal forestry programs) for the benefit of the community.

MWh (Megawatt-hour): A unit of work or energy, measured as one Megawatt (1,000,000 watts) of power expended for one hour. One MWh is equivalent to 3.412 Mbtu.

Nitrogen Oxides (Oxides of Nitrogen, NOx): A general term pertaining to compounds of nitric acid (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO_2 may result in numerous adverse health effects.

Ozone: A strong-smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. It is a product of the photochemical process involving the sun's energy. Ozone exists in the upper atmosphere ozone layer as well as at the earth's surface. Ozone at the earth's surface can cause numerous adverse human health effects. It is a major component of smog.

Peak Cooling Demand: The single greatest amount of electricity required at any one time during the course of a year to meet space cooling requirements.

Peak Flow (or Peak Runoff): The maximum rate of runoff at a given point or from a given area, during a specific period.

Photosynthesis: The process in green plants of converting water and carbon dioxide into sugar with light energy; accompanied by the production of oxygen.

PM_{10} (Particulate Matter): Major class of air pollutants consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and mists. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to enter the air sacs (gas exchange region) deep in the lungs where they may get deposited and result in adverse health effects. PM_{10} also causes visibility reduction.

Resource Unit (Res Unit): The value used to determine and calculate benefits and costs of individual trees. For example, the amount of air conditioning energy saved in kWh/yr/tree, air pollutant uptake in pounds/yr/tree, or rainfall intercepted in gallons/yr/tree.

Riparian Habitats: Narrow strips of land bordering creeks, rivers, lakes, or other bodies of water.

SEER (Seasonal Energy Efficiency Ratio): Ratio of cooling output to power consumption; kBtu-output/kWh-input as a fraction. It is the Btu of cooling output during its normal annual usage divided by the total electric energy input in watt-hours during the same period.

Sequestration: Annual net rate that a tree removes CO_2 from the atmosphere through the processes of photosynthesis and respiration (kg CO_2/tree/year).

Shade Coefficient: The percentage of light striking a tree crown that is transmitted through gaps in the crown.

Shade Effects: Impact on residential space heating and cooling (kg CO_2/tree/year) from trees located within 15 m (50 ft) of a building so as to directly shade the building.

Shade Tree Program: Engaged activities, such as tree planting and stewardship, with the express intent of achieving energy savings and net atmospheric CO_2 reductions.

Solar Friendly Trees: Trees that have characteristics that reduce blocking of winter sunlight. According to one numerical ranking system, these traits include open crowns during the winter heating season, early to drop leaves and late to leaf out, relatively small size, and a slow growth rate (Ames 1987).

SO_2 (Sulfur Dioxide): A strong smelling, colorless gas that is formed by the combustion of fossil fuels. Power plants, which may use coal or oil high in sulfur content, can be major sources of SO_2. Sulfur oxides contribute to the problem of acid deposition.

Stem Flow: Amount of rainfall that travels down the tree trunk and onto the ground.

Throughfall: Amount of rainfall that falls directly to the surface below the tree crown or drips onto the surface from branches and leaves.

Transpiration: The loss of water vapor through the stomata of leaves.

Tree or Canopy Cover: The percent of a fixed area covered by the crown of an individual tree or delimited by the vertical projection of its outermost perimeter; small openings in the crown are included. Used to express the relative importance of individual species within a vegetation community or to express the coverage of woody species.

Tree Litter: Fruit, leaves, twigs, and other debris shed by trees.

Tree-Related Emissions: Carbon dioxide releases that result from activities involved with growing, planting, and caring for program trees.

Tree Height: Total height of tree from base (at groundline) to tree top.

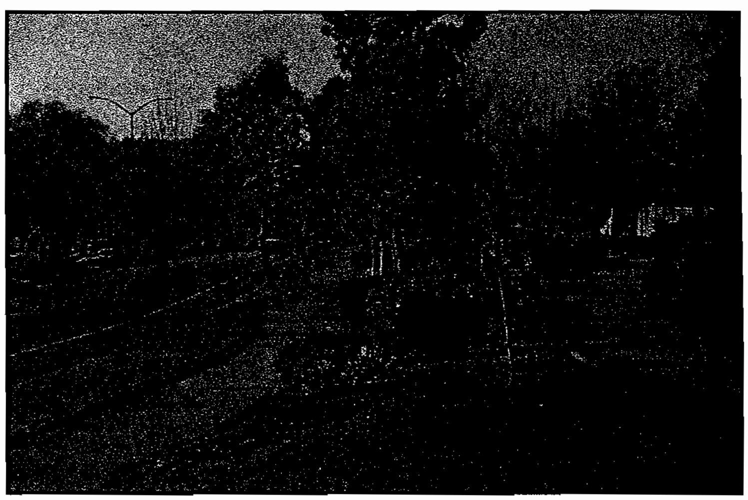
Tree Surface Saturation Storage (or Tree Surface Detention Storage): The volume of water required to fill the tree surface to its overflow level. This part of rainfall stored on the canopy surface does not contribute to surface runoff during and after a rainfall event.

Urban Canyon: A streetscape that is defined spatially by tall buildings so as to create a canyon-like effect.

Urban Heat Island: An "urban heat island" is an area in a city where summertime air temperatures are 3° to 8° F warmer than temperatures in the surrounding countryside. Urban areas are warmer for two reasons: ❶ they use dark construction materials which absorb solar energy, ❷ they have few trees, shrubs or other vegetation to provide shade and cool the air.

VOCs (Volatile Organic Compounds): Hydrocarbon compounds that exist in the ambient air. VOCs contribute to the formation of smog and/or are toxic. VOCs often have an odor. Some examples of VOCs are gasoline, alcohol, and the solvents used in paints.

Willingness to Pay: The maximum amount of money an individual would be willing to pay, rather than do without, for non-market, public goods such as an environmental amenity.



Appendix A. Benefit-Cost Information Tables

Information in this Appendix can be used to estimate benefits and costs associated with proposed or existing tree programs. The three tables contain data for the small (purple-leaf plum), medium (Norway maple), and large (red oak) trees. Data are presented as annual values for each five-year interval after planting.

There are two columns for each five-year interval. In the first column, values describe resource units (Res units): the amount of air conditioning energy saved in kWh/yr/tree, air pollutant uptake in pounds/yr/tree, rainfall intercepted in gallons/yr/tree. These values reflect the assumption that 23.4% of all trees planted will die over 40 years. Energy and CO_2 benefits for residential yard trees (private) are broken out by tree location to show how shading impacts vary among trees opposite west-, south-, and east-facing building walls. In the Aesthetics and Other Benefits row, the dollar value for private trees replaces values in resource units since there is no resource unit for this type of benefit. For the remaining rows, the first column contains dollar values for private trees.

The second column, for each five-year interval, contains dollar values obtained by multiplying resource units by local prices (e.g., kWh saved [Res unit] x $/kWh). In the Aesthetics and Other Benefits row, and all subsequent rows, the dollar values are for a public tree (street/park).

Costs for the private and public tree do not vary by location. Although tree and planting costs are assumed to occur initially at year one, we divided this value by five years to derive an average annual cost for the first five-year period. All other costs, as well as benefits, are the estimated values for each year and not values averaged over five years.

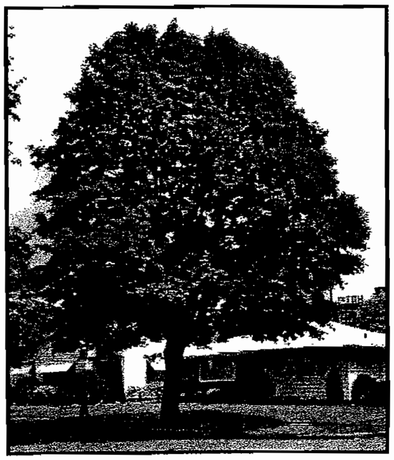
Total net benefits are calculated by subtracting total costs from total benefits. Data are presented for a private tree opposite west-, south-, and east-facing walls, as well as the public tree.

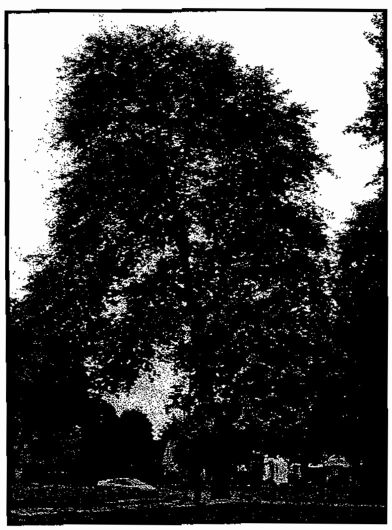
The last two columns in each table present 40-year average values. These numbers were calculated by dividing the total stream of annual costs and benefits (not shown due to lack of space) by 40 years.

DATA TABLE FOR LARGE TREE (RED OAK)

LARGE TREE	Year 5		Year 10		Year 15		Year 20		Year 25		Year 30		Year 35		Year 40		40 year average	
Benefits/tree	Res units	$	Res units	$	Res units	$	Res units	$	Res units	$	Res units	$	Res units	$	Res units	$	Res units	$
Cooling (kWh)																		
Private: West	8	0.48	44	2.80	91	5.70	125	7.85	148	9.32	166	10.45	179	11.25	187	11.78	118	$7.45
Private: South	5	0.30	28	1.78	60	3.75	85	5.38	105	6.62	121	7.59	132	8.31	140	8.80	84	$5.32
Prvate: East	3	0.20	20	1.24	43	2.70	64	4.05	82	5.16	96	6.06	107	6.74	115	7.21	66	$4.17
Public	2	0.10	11	0.67	25	1.60	42	2.66	58	3.64	71	4.46	81	5.09	88	5.54	47	$2.97
Heating (kBtu)																		
Private: West	-38	-0.35	-81	-0.74	3	0.03	133	1.22	267	2.45	384	3.52	477	4.37	546	5.00	211	$1.94
Private: South	-109	-1.00	-325	-2.98	-327	-3.00	-248	-2.27	-145	-1.33	-48	-0.44	35	0.32	100	0.92	-133	-$1.22
Prvate: East	-80	-0.73	-224	-2.05	-190	-1.74	-90	-0.82	25	0.23	131	1.20	218	2.00	285	2.61	10	$0.09
Public	17	0.15	107	0.98	258	2.36	427	3.91	585	5.36	716	6.56	817	7.49	889	8.15	477	$4.37
Net Energy (kBtu)																		
Private: West	38	0.13	364	2.06	909	5.73	1,381	9.06	1,749	11.77	2,043	13.96	2,264	15.61	2,417	16.78	1,396	$9.39
Private: South	-61	-0.70	-42	-1.19	269	0.75	607	3.11	906	5.28	1,158	7.15	1,355	8.63	1,499	9.72	711	$4.09
Prvate: East	-47	-0.53	-27	-0.81	239	0.96	554	3.23	846	5.40	1,094	7.26	1,288	8.73	1,430	9.82	672	$4.26
Public	33	0.25	212	1.64	513	3.97	850	6.57	1,163	9.00	1,424	11.02	1,625	12.57	1,769	13.69	949	$7.34
Net CO2 (lb)																		
Private: West	4	0.06	60	0.90	162	2.42	263	3.96	351	5.27	422	6.34	472	7.08	500	7.50	279	$4.19
Private: South	-8	-0.12	15	0.22	92	1.39	181	2.71	262	3.93	328	4.92	376	5.63	402	6.03	206	$3.09
Prvate: East	-5	-0.08	21	0.32	97	1.46	185	2.77	266	3.99	333	4.99	380	5.70	406	6.10	210	$3.16
Public	6	0.09	58	0.87	143	2.14	236	3.54	321	4.82	390	5.85	439	6.58	466	6.99	257	$3.86
Air Pollution (lb)																		
O3 uptake	0.032	0.08	0.110	0.26	0.220	0.53	0.349	0.84	0.485	1.16	0.618	1.48	0.746	1.79	0.861	2.07	0.43	$1.03
NO2 uptake+avoided	0.013	0.03	0.063	0.15	0.150	0.36	0.244	0.58	0.334	0.80	0.417	1.00	0.491	1.18	0.552	1.33	0.28	$0.68
SO2 avoided	0.005	0.01	0.031	0.03	0.066	0.07	0.096	0.10	0.119	0.12	0.138	0.14	0.151	0.15	0.161	0.16	0.10	$0.10
PM10 uptake+avoided	0.053	0.14	0.150	0.41	0.271	0.74	0.399	1.09	0.523	1.42	0.641	1.75	0.748	2.04	0.844	2.30	0.45	$1.24
VOC's avoided	-0.000	-0.00	0.001	0.00	0.003	0.02	0.005	0.03	0.006	0.04	0.008	0.05	0.009	0.06	0.010	0.06	0.01	$0.03
BVOC's released	-0.004	-0.03	-0.012	-0.08	-0.023	-0.15	-0.034	-0.22	-0.044	-0.29	-0.056	-0.36	-0.064	-0.43	-0.073	-0.49	-0.04	-$0.26
Avoided + net uptake	0.099	0.23	0.343	0.78	0.687	1.56	1.059	2.41	1.422	3.25	1.767	4.06	2.080	4.79	2.355	5.43	1.23	$2.81
Hydrology (gal)																		
Rainfall Interception	14	0.39	109	3.02	265	7.37	449	12.47	636	17.68	816	22.69	978	27.19	1,122	31.17	549	$15.25
Aesthetics and	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public
Other Benefits	$28.27	$33.31	$32.60	$38.42	$35.55	$41.89	$37.27	$43.93	$37.92	$44.69	$37.64	$44.36	$36.57	$43.09	$34.82	$41.03	$35.08	$41.34
Total Benefits	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public
Private: West	$29.08		$39.36		$52.63		$65.18		$75.91		$84.68		$91.24		$95.70		$66.72	
Private: South	$28.07		$35.43		$46.62		$57.97		$68.07		$76.47		$82.81		$87.17		$60.33	
Prvate: East	$28.29		$35.90		$46.90		$58.16		$68.25		$76.64		$82.98		$87.34		$60.56	
Public		$34.28		$44.73		$56.93		$68.92		$79.45		$87.98		$94.22		$98.31		$70.60

LARGE TREE	Year 5		Year 10		Year 15		Year 20		Year 25		Year 30		Year 35		Year 40		40 year average	
Costs ($/yr/tree)	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public
Tree & Planting	25.00	29.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$3.12	$3.63
Trimming	5.23	8.28	5.08	8.05	4.94	7.82	11.00	13.73	10.66	13.31	10.35	12.90	10.02	12.49	9.69	12.08	$7.78	$10.52
Remove & Dispose	0.26	1.39	0.24	1.26	0.33	1.76	0.42	2.22	0.51	2.66	0.59	3.07	0.66	3.45	0.73	3.80	$0.43	$2.21
Pest & Disease	0.17	0.04	0.28	0.07	0.38	0.10	0.47	0.12	0.54	0.14	0.61	0.16	0.66	0.17	0.70	0.18	$0.45	$0.11
Infrastructure	0.15	0.82	0.26	1.04	0.35	1.41	0.43	1.73	0.50	2.01	0.56	2.25	0.61	2.45	0.65	2.61	$0.41	$1.65
Irrigation	0.18	0.00	0.39	0.00	0.62	0.00	0.86	0.00	1.10	0.00	1.33	0.00	1.55	0.00	1.75	0.00	$0.89	$0.67
Clean-Up	0.15	0.81	0.26	1.02	0.35	1.39	0.43	1.71	0.50	1.98	0.55	2.21	0.60	2.41	0.64	2.56	$0.40	$1.62
Liability & Legal	0.03	0.14	0.06	0.23	0.08	0.31	0.10	0.38	0.11	0.44	0.12	0.50	0.13	0.54	0.14	0.57	$0.09	$0.36
Admin & Other	0.00	1.23	0.00	1.30	0.00	1.42	0.00	2.21	0.00	2.28	0.00	2.34	0.00	2.39	0.00	2.42	$0.00	$2.24
Total Costs	$31.18	$41.36	$6.57	$12.96	$7.06	$14.20	$13.72	$22.10	$13.94	$22.84	$14.11	$23.44	$14.23	$23.90	$14.30	$24.23	$13.57	$23.02
Total Net Benefits																		
Private: West	-$2		$33		$46		$51		$62		$71		$77		$81		$53	
Private: South	-$3		$29		$40		$44		$54		$62		$69		$73		$47	
Prvate: East	-$3		$29		$40		$44		$54		$63		$69		$73		$47	
Public		-$7		$32		$43		$47		$57		$65		$70		$74		$48





The Center for Urban Forest Research

Founded in 1992, the Center for Urban Forest Research is a unit of the USDA Forest Service's Pacific Southwest Research Station. With a small staff of scientists and research associates based in Davis, California, the Center serves the 17 western states and Pacific islands with the mission of increasing urban forest investment and sustainability by improving our understanding of how urban forest structure, function, and value are related.

Research is conducted in four main areas: energy conservation, air quality, stormwater runoff, and firewise landscapes. Results of research in these areas has led to technological advancements to help communities optimize urban forest benefits, training programs for community forest managers, and technical aids to help managers solve local problems and build community capacity. Center products include: a web site, newsletter, fact sheets, research summaries, and community tree guides. For more information about the Center and its products:

(530) 752-7636 http://cufr.ucdavis.edu

The Pacific Northwest Isn't the Only Place Where Trees Are Growing!

The Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station, has also developed versions of this tree guide for the San Joaquin Valley, Southern Coast, and Inland Empire regions of California.

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APPENDIX D:

Tree Preservation and Protection

The City of Shoreline's Tree and Vegetation Protection and Preservation Ordinance (Shoreline Municipal Code Title XXX is designed to: Preserve and enhance the City's physical and aesthetic character by preventing indiscriminate removal and destruction of trees and ground cover without preventing the reasonable development of land;

Trees and other types of vegetation perform a number of critical functions within the community. Trees and vegetation:

- Minimize surface water and ground water runoff;
- Assist in noise abatement and protection from wind;
- Reduce siltation and water pollution; and
- Provide wildlife habitat.

SHORELINE MUNICIPAL CODE

A Codification of the General Ordinances of the City of Shoreline, Washington

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Title: XXX

TREE AND VEGETATION PROTECTION AND PRESERVATION

Sections:

1. Short title
2. Purposes and permit criteria
3. Definitions
4. Permits
5. Urban growth management boundary
6. Exemptions
7. Application for permits
8. Conformance to standards
9. Financial security

10. Appeals
11. Violations
12. Requirements for foresters and contractors doing land clearing work in Shoreline
13. Severability

1. Short title. This chapter shall be known and may be cited as the Tree and Vegetation Protection and Preservation Ordinance of the city of Shoreline.

2. Purposes and permit criteria. These regulations are adopted for the following purposes and these purposes are to be used as criteria for the issuance of land clearing permits under Section 5 of this chapter:

A. To promote the public health, safety, and general welfare of the citizens of Shoreline without preventing the reasonable development of land;

B. To preserve and enhance the city's physical and aesthetic character by preventing indiscriminate removal or destruction of trees and ground cover;

C. To minimize surface water and ground water runoff and diversion and to prevent erosion and reduce the risk of slides;

D. To retain trees to assist in the abatement of noise and in protection from wind;

E. To acknowledge that trees and ground cover produce pure oxygen from carbon dioxide;

F. To promote building and site planning practices that are consistent with the city's natural topographical, soils, and vegetational features. At the same time certain factors may require the removal of certain trees and ground cover for things such as, but not limited to disease, danger of falling, proximity to existing and proposed structures and improvements, interference with utility services, protection of scenic views, protection of solar access and the realization of a reasonable enjoyment of property;

G. To insure prompt development, restoration and replanting and effective erosion control of property after land clearing;

H. To reduce siltation and water pollution from siltation in the city's streams and lakes;

I. To implement the goals and objectives of the Washington State Environmental Policy Act;

J. To implement and further the city's comprehensive plan;

K. To encourage protection of wildlife and/or wildlife habitat whenever possible.

3 Definitions.

A. "City" means the city of Shoreline, Washington.

B. "City-owned Tree" Commonly referred to as 'street trees', these trees are all trees growing within the street right-of-way (publicly-owned), outside of private property. In some cases, the property line may lie several feet behind the sidewalk.

Any work in the proximity of street trees is to be consistent with standards outlined below. A permit from Public Works Department is required prior to any work, including pruning or any soil excavation on or around these trees.

C. "Ground cover" means types of vegetation which are normally terrestrial and shall include trees less than four inches in diameter measured twenty-four inches above the ground level.

D. "Land clearing" means the direct and indirect removal of trees and/or ground cover from any undeveloped or partially developed lot, public lands or public right-of-way.

E. "Tree" means any living woody plant characterized by one main stem or trunk and many branches, and having a diameter of four inches or more measured at twenty-four inches above the ground level.

F. A "hazard tree" means any tree with a significant structural defect, disease, extreme size or combinations of these which make it subject to failure.

G. "Drip line" of a tree means an imaginary line on the ground created by the vertical projection of the foliage at its circumference.

H. "Brushing" means the practice of removing significant ground cover to create better visibility on a property for purposes such as marketing or surveying of said property.

I. "Tree protection professional" is a professional with academic and/or field experience that makes him or her a recognized expert in tree preservation and management. The tree protection professional shall be a Certified Arborist with the International Society of Arboriculture or a member of the Society of American Foresters, or the Association of Consulting Foresters, and shall have specific experience with tree management in the state of Washington. Additionally the tree protection professional shall have the necessary training and experience to use and apply the International Society of Arboriculture's guide to evaluation and management of trees and to

B. Removal of hazard trees and ground cover in emergency situations involving immediate danger to life or property or substantial fire hazards as determined by the city's tree protection professional;

C. Removal of obviously dead or diseased ground cover or trees;

D. Removal of less than six trees in any thirty-six consecutive months or ground cover for the purposes of solar access, general property and utility maintenance, landscaping or gardening;

E. Removal of trees and ground cover within a maximum of ten feet (when required for construction) of the perimeter of the building line and any area proposed to be cleared for driveway and septic purposes, of a single-family or duplex dwelling to be constructed as indicated on the plot plan submitted to the building official with an application for a building permit; provided, however, the director may require minor modifications in siting and placement of driveways, utilities and septic tank drain field systems where such modifications will promote the goals of the chapter and still satisfy the need and function of improvements.

F. Removal of obstructions required by the vision clearance at intersections regulations.

7 Application for permits.

A. An application for a land clearing permit or information required by this chapter shall be submitted at the same time as a valid land use application or building permit on a form provided by the city and shall be accompanied by such of the following documents and information as are determined to be necessary by the director:

1. Prints of the plot plan which shall include the following information:

a. Name, address, and telephone number of the applicant and owner of property,

b. Legal description of property,

c. Date, north arrow, and adequate scale as determined by the director, on the map or plot plan,

d. Topography map showing contours at not greater than ten foot intervals of proposed clearing projects within areas of steep slopes, creeks and shorelines, successfully provide the necessary expertise relating to management of trees specified in this chapter.

J. "Director" means director of community development or his/her designee.

4. Permits. No person, corporation, or other legal entity shall engage in timber harvesting or cause land clearing in the city without having complied with one of the following:

A. Received a land clearing permit from the director;

B. Having obtained approval of the proposed work under the processes described in Section 6 A;

C. Having received an exemption from the director under the provisions of Section 6.

5 Urban growth management boundary. Areas within the urban growth management boundaries established pursuant to the urban growth management agreement are anticipated to be developed with urban uses within the next five to ten year period. Lands within the urban growth management area are not considered appropriate for reforestation and long term timber production and harvesting which takes a full thirty year cycle. Timber management activities shall be consistent with the city's land use plans and ordinances for the urban growth area.

To further the purposes of the urban growth management agreement and goals of the tree protection and preservation ordinance, timber harvesting and conversion of timbered lands within the urban growth management boundaries shall not be permitted until such time as a valid land use application for development is made; provided, however, requests may be made for maintenance and thinning of existing timber stands to promote the overall health and growth of the stand until said stand is converted and harvested pursuant to plans provided within a valid land use permit.

6. Exemptions. The following shall be exempt from land clearing permit requirements of this chapter but shall satisfy all standards and requirements of Section 8 and other sections as noted below:

A. Projects requiring approval of the city of Shoreline site plan review committee, or projects requiring review by the hearings examiner or city council, provided that land clearing on such projects shall take place only after approval and shall be in accordance with such approval and the standards of this chapter including the information requirements and standards of Section 7;

e. Location of proposed improvements, including, but not limited to, structures, roads, driveways, utilities, and storm drainage facilities. Said improvement locations shall also be staked on site to enable the city's tree protection professional and other city staff to review improvement locations and their relationship to the site and existing vegetation,

f. Approximate and general location, type, size and condition of trees and ground cover and a general identification of trees and ground cover which are to be removed;

2. A proposed time schedule for land clearing, land restoration, implementation of erosion control and any excavation or construction of improvements;

3. A statement indicating the method to be followed in erosion control and restoration of land during and immediately following land clearing;

4. Proposed general landscape plan or written or graphic description of proposed action;

5. Location of proposed buffers, open space, and other areas of the site where stands of trees are to be saved;

6. On timbered property greater in size than one acre or commercial property with more than fifteen trees, or other sites the city deems it necessary because of special circumstances or complexity, the city's tree protection professional shall review the site and provide a report analyzing the site for tree protection and preservation consistent with the requirements of this chapter. The report shall include but shall not be limited to:

a. Information required under subsection 7 (A)(1) through (5) above;

b. An analysis of technical information requested by the site plan review committee related to trees and forest practices;

c. Analysis of what portion of the site is best for designation of the treed open space and buffers, if required, considering the intent of this chapter, soil type, topography, tree species, health of trees and reasonable project design limitations;

d. Recommendations for saving of individual tree specimens based upon the intent of this chapter, soil type, topography, tree species, health of trees, and reasonable project design limitations;

short plat or preliminary plat except through the provisions of Section 10. Additionally, no tree removal or brushing shall take place on lots or in open space areas of a final short plat or final plat except on a lot by lot basis after individual building permit applications have been made and land clearing activities have been approved for said individual lots pursuant to the requirements of Section 6 or 7.

9 **Financial security.** The site plan review committee may require financial security in such form and amounts as may be deemed necessary to assure that the work shall be completed in accordance with the permit. Financial security, if required, shall be furnished by the property owner, or other person or agent in control of the property at one hundred fifty percent of the estimated cost of improvements.

10. **Appeals.** Any decision of the city of Shoreline in the administration of this chapter may be appealed in accordance with Chapter 1D of the City of Shoreline Development Guidelines and Public Works Standards.

11. **Violations.**

A. Violation of the provisions of this chapter or failure to comply with any of the requirements shall constitute a misdemeanor and such violation shall be punished as provided by the code for the commission of a misdemeanor. Each day such violation continue shall be considered a separate, distinct offense.

B. Any person who commits, participates in, assists or maintains such violation may be found guilty of a separate offense and suffer the penalties as set forth in subsection 11 (A).

C. In addition to the penalties set forth in subsections 11 (A) and (B), any violation of the provisions of this chapter shall be mitigated by comprehensive treatment of environmental impacts through revegetation of the affected site. In assessing environmental damage, the city's tree protection professional shall determine the extent and value of vegetation removed or damaged and other environmental damage inconsistent with the intent and requirements of this chapter. In assessing environmental damage, the tree protection professional shall consider what the outcome of the site should have been had the proposed project been designed around existing topography and vegetation and all appropriate vegetation saved. The tree protection professional shall use the recommendations of the International Society of Arboriculture in determining the value of removed and damaged vegetation.

D. If the violation is discovered after evidence has been removed, the city tree protection professional shall use whatever resources are immediately available to determine environmental damage which may include aerial photographs, other photographs, interviews with adjacent property owners, receipts of timber sales off the site, and any other records available that have a bearing on the quantity and quality of vegetation removed from the site or environmental damage sustained. The tree protection professional also may estimate the probable worth of removed vegetation at the site by analyzing the best case growing capability of the site given soil conditions, health of surrounding tree stands and type of species suspected of removal. The determination of environmental damage made by the tree protection professional shall be given substantial weight in a court of law.

E. If the cost of restoration of the site is less than the true value of environmental damage at the site, the balance shall be paid to the city to an urban tree planting fund. The city shall then utilize those funds for planting trees in other areas of the city.

F. The determination of the city tree protection professional regarding the environmental damage at the site may be appealed to the city hearings examiner pursuant to the requirements of Section 10.

G. In review of the tree protection professional's decision, the hearings examiner shall determine if the tree protection professional's decision accurately reflects the criteria set forth in Section 2.

H. Additionally, the city hearings examiner may consider any other facts the examiner determines are relevant to the specific situation.

I. In cases where the determined value of environmental damage far exceeds the site restoration requirements, and extenuating circumstances the examiner determines are relevant to the case are present, the hearings examiner may reduce the monetary value assigned to the environmental damage, provided the hearings examiner shall reduce the determined compensation only when all of the following criteria are demonstrated by the applicant:

1. A professional forester or other professional who could have alerted the applicant of tree protection requirements was not involved in the action leading to the violation;

2. The violation action was not associated with a tree harvesting operation for monetary gain;

3. The applicant has no previous record of tree and vegetation protection and preservation ordinance violations.