



City of DuPont Inventory Summary

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Prepared for:

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Summary

This inventory was conducted through a partnership between Washington Department of Natural resources, the City of DuPont, and Davey Resource Group. The data collected is compatible with Treeworks software and may be used by city managers to make informed decisions about community tree management.

The inventory included 6,492 tree sites, including 196 vacant sites and 38 stumps. The primary species were red maple (*Acer rubrum*) with 814 trees (13% of the population), and Douglas fir (*Pseudotsuga menziesii*) with 693 trees (11% of the population). Maple (*Acer*) was the most prevalent genus, representing 25% of the population. The most prevalent maintenance recommendation is clearance pruning (2,309 trees)

Davey Resource Group recommends the following:

- Immediately address the high priority and immediate action maintenance items.
- Develop a plan to provide recommended standard maintenance.
- Determine and develop a 5-10 year pruning cycle.
- Provide adequate irrigation to maintain the tree resource.
- Provide pest treatment.
- Develop a plan to mitigate lawnmower mechanical damage.

With this data, city managers have an opportunity to conduct further data analysis including species diversity, creating a stocking plan, determining the ecosystem services provided by the tree population, and developing a more thorough understanding of the urban forest.



Methods

An ISA Certified Arborist gathered data for each tree using a pen tablet computer and ArcPad. This software uses a Geographic Imaging System (GIS) interface to plot trees over electronic basemaps. A laser range finder and diameter measuring tape were used to determine accurate tree heights, canopy widths, and diameters at breast height (DBH).

Included Trees

Trees in the public right-of-way (ROW) within 10' of the curb were collected. In some areas, trees were collected beyond the 10' threshold as determined in collaboration with city staff. Trees in back yards and on private roads were not inventoried. Vacant sites were collected along main streets as directed by city staff. Trees maintained by Homeowners' Associations were not inventoried as directed by city staff. In addition, the following parks and city facilities were inventoried:

- **Parks:** Clock Tower Park; Ross Plaza Park; Sellers Park; Ethel Lumsdon Park; Robinson Park; Iaphrati Park; Edmond Village Park; Garry Oaks Park; Parkview Park; Tract 1 Park; Leschi Park; Powderworks Park; two Bell Hill parks
- **City Facilities:** city hall, police & fire dept; community center; museum; public works

Arborvitae planted as hedges and trees in natural, unmaintained areas of parks were not collected.

Data Collection

Attributes collected for individual trees included:

- **Tree ID**, Automatically assigned.
- **Tree Location**, GPS Coordinates
- **Park**
- **Street Address**
- **Grow Space Size**
- **Land Use**
- **Utilities**
- **Location Value**
- **Site Type**
- **Hardware**
- **Tree Genus and Species**
- **Number of Stems**
- **Tree Diameter Class**
- **Tree Height Class**
- **Canopy Width Class**
- **Tree Condition**
- **Defects**
- **Risk Tree (imminent failure)**
- **Maintenance Task**
- **Task Priority**
- **Pavement Conflict**
- **Notes**



Tree Location

Each tree was added to a geo-referenced aerial photo and GIS coordinates were assigned. The data map projection was State Plane NAD83 (HARN) Washington South, feet.

Task Priority

When a maintenance task was assigned, the priority was given so managers can determine an appropriate schedule for the recommended tasks. **Immediate Action** trees should be addressed as soon as possible. **High Priority** trees should be addressed within three months. **Standard priority** trees should be distributed over a few years in the regular maintenance schedule.

Maintenance Task

In addition to work priority, each tree was further classified for Maintenance Task. Up to two tasks were proscribed, so some trees may require two maintenance activities. This “prescription” helps determine the type of work, in addition to routine pruning, that should be performed when the work priority, or cycle, is scheduled. Anticipating maintenance needs also improves the ability of community managers and contractors to forecast workloads and costs. The recommended maintenance needs were based on current conditions and estimated future requirements as visually determined at the time of the inventory.

Maintenance Task - Provide Clearance

The tree is conflicting or will soon conflict with roadways, sidewalks, driveways, pathways, access, lighting, or wires. Clearance may be provided by trimming or removing a few branches.

Maintenance Task – Crown Clean

Trees proscribed for Clean will benefit from selective pruning to remove dead, diseased, and broken branches. In addition to a routine pruning, cleaning may limit the development of future problems and reduce risk for trees that have, or that may develop, problems if not corrected.

Maintenance Need – Structural Prune

Structural pruning is often proscribed for newly planted trees, immature trees, and some mature, small-stature trees less than 25 feet in height that need structural pruning in order to reduce the development of future problems. These trees have correctable structural problems or minor amounts of deadwood that pose little or no threat to personal injury or property damage currently but, if left unchecked, may develop problems as they mature.

Maintenance Need – Restoration

A prescription to restore generally indicates that the tree has lost a major limb and requires pruning to restore balance in the canopy. These trees require corrective or restorative pruning in order to regain an appropriate species-specific shape based on their growth habit.



Maintenance Need – Remove

Recommendations for tree removal were based on multiple factors including overall condition, structure, and potential for failure. In addition, site compatibility was considered for species that may pose risks to workers, visitors, and property as they mature or shed debris. In most cases, restorative pruning is the preferred strategy, so trees recommended for removal are those which have reached a threshold when they are unlikely to ever perform well in the landscape.

Maintenance Task – Stake Removal & Remove Object

Tree stakes can be beneficial to trees in the first year of life, but should then be removed. If a tree is not able to stand on its own after one year, a serious root or soil problem may be occurring, and removal and replacement is a better option than ongoing staking. In most cases, the trees identified for stake removal are stable and sturdy enough to have their stakes removed. Stakes and ties left on trees can cut into their bark causing major structural defects. Object removal includes removal of any ties or foreign bodies in the tree. Trees should not have objects attached to them as it can hinder their growth and development.

Maintenance Task – Inspect

A tree recommended for inspection may have damage that cannot be assessed from the ground, a major defect or flaw, or an unidentified disease.

Maintenance Task – Pest Treatment

This task is recommended when the tree has a treatable disease, such as aphids or mistletoe.

Maintenance Task – Expose Root Flair

When trees are buried too deep at planting, their ability to thrive in the landscape is limited. Very young trees can be removed and replanted at a higher level, but for older trees, the only remedy for trees buried too deep is to remove soil around the base of the tree to expose the root flair and crown. This soil should be removed at a radius equal to the dripline of the tree.

Maintenance Task – Water

Trees require irrigation to become established, and some need summer watering their entire lives. Trees identified for this maintenance task are showing symptoms of drought stress and will likely decline or die if not irrigated.

Notes

Stem Girdling Root

Stem-girdling roots reduce the tree's ability to develop, and often result in basal tree failure. Stem-girdling roots can be removed by a qualified certified arborist, but sometimes the damage to the trunk or root system is too great and removal is necessary.



Findings

Species Frequency

The inventory included 6,492 tree sites, including 196 vacant sites and 38 stumps. The primary species were red maple (*Acer rubrum*) with 814 trees (13% of the population), and Douglas fir (*Pseudotsuga menziesii*) with 693 trees (11% of the population). Maple (*Acer*) was the most prevalent genus, representing 25% of the population.

Maintenance Needs

	Clearance	Crown Clean	Structural	Restoration	Removal	Stake Removal	Inspect	Pest treatment	Remove Object	Expose Flair	Water
Immediate Action		1			1	6	1				
High Priority	2	15	4		3	1					
Standard	2309	388	395	103	110	188	3	101	92	111	70
Total	2311	403	399	103	113	189	3	101	92	111	70

Table 1. Maintenance Needs

High priority and immediate action trees should be addressed soon. Stake removal (195 trees), object removal (92 trees), and watering (70 trees) can be performed by city staff, and should be added to the regular maintenance schedule. The most common maintenance recommendation was standard pruning for clearance (2,311 trees), followed by standard pruning for crown cleaning (403 trees). Qualified tree workers supervised by a Certified Arborist should be contracted to conduct clearance pruning, crown cleaning, structural pruning, restoration, and removal of any trees over 20'. Inspection, root and flair treatment, and pest treatments can be conducted by ground crews supervised by a Certified Arborist.

It was noted that the irrigation water was decreased to save money. Such cost savings, where it results in the decline or death of trees is short sighted and should not be repeated. The trees identified as needing water should be inspected and those irrigation schedules should not be reduced next summer. These 70 trees represent 1.1% of the population.

Lawnmower damage, and lack of mower clearance was common. This type of mechanical damage causes wounds on the surface roots and base of the tree. If decay occurs at the base of the tree, it can result in failure of the entire tree. Properly applied mulch circles at the base of trees can help alleviate this ongoing problem. Mulch circles should be a 3-6" application of bark or wood chips, and should extend 3-6' away from the base of the tree. In areas of heavy shade, mulch may be a more appropriate groundcover than lawn.



Recommendations

The inventory arborist determined specific maintenance needs based on the needs of the tree or on the existence of potential safety hazards. Determination was based on observation of the trunk, scaffold branches, and canopy of each tree. Recommendations for work priority primarily identified pruning cycles and removals. While this inventory has identified immediate maintenance recommendations, once those are addressed, attention can be given to the entire tree population with an eye toward long term sustainability and safety.

Routine Maintenance Pruning should take place on a cyclical basis for the entire tree population. Regular pruning is extremely beneficial for the overall health and longevity of trees. Through routine pruning, potentially costly problems can be avoided because trees can be closely inspected during the pruning cycle. Proper and timely decisions can be made on declining trees, and potential hazards can be managed appropriately before any serious incidents occur. Benefits of routine pruning include:

- Increased clearance and visibility
- Better structure and evenly spaced branches
- Less storm damage
- Increased average tree longevity
- Decreased need for removal of large branches as the tree matures
- Regular inspection to identify hazards before property damage occurs

Typically, a 5-10 year pruning cycle is ideal to provide clearance and structural pruning. In a ten year pruning cycle, 10% of the trees are pruned each year, resulting in the entire tree population pruned or inspected after 10 years. This would require maintenance of 626 trees per year. This kind of proactive tree pruning is more cost effective than emergency-response pruning because routine pruning can be scheduled, specified, bid out, and conducted in a season that is convenient for city staff.

Opportunities

Analyze Species Diversity

This summary report highlights a few key parts of the inventory, but the data provided can be further analyzed to help managers make informed decisions about managing their city forest. The inventory identified 87 distinct species, and provides the opportunity to determine the diversity of the tree population. Managers may wish to determine the percent of the population represented by each species and adjust future planting palettes accordingly. It is generally recommended that the population be comprised of no more than 10% of one species, no more than 20% of one genus, and no more than 30% of one family.



Evaluate Stocking

Vacant and stump sites should be evaluated for suitability as new planting sites. Where appropriate, new trees should be installed. In general, it is recommended that a minimum of 2% of the tree population be planted each year. Alternatively, managers may wish to pursue a 1:1 policy, replanting one tree for each city tree removed or lost annually.

Conduct a Resource Analysis

The data collected can be used to conduct a resource analysis to determine some of the ecosystem services trees are providing to the community. These benefits, including energy savings, stormwater reduction and infiltration, air quality improvements, habitat, and aesthetic values can be substantial. Understanding how trees “pay us back” can help to justify maintenance and replanting budgets. These analyses can be conducted using the free suite of i-tree software tools available at <http://www.itreetools.org/>.

Train Young Trees for Structure

Training young trees for structure and form is one of the most cost-effective sustainable solutions to improve tree health and longevity. Young trees should be trained to have one single central stem or leader, and evenly spaced scaffold branches should be selected. Other branches including dead, diseased, damaged or crossing branches should be removed or headed back. This treatment is especially effective on trees under 25'. By pruning trees when young, the cost of maintenance and the size of pruning wounds are greatly reduced. This helps the tree and the city's bottom line.



Appendix A: Data Dictionary

Category	Field	Type	Selections	Description	
Location	Site ID/Modified	Auto Fill		Unique ID value for tree generated by data collection system. Includes date of collection and Staff ID.	
	Mapping Coordinate	Auto Fill		X and Y (latitude/longitude) coordinate locations captured using GIS maps and/or GPS equipment	
	Park or Facility Name	Drop Down Menu	List of Parks and Facilities	List provided by the City	
	Address Number	Text Box		Street Number of tree location. Medians and Arterials shall use block side addressing. Medians should be addressed and sequenced to even side of street. .	
	Address Street	Drop Down Menu	Pre-load Street Names	Street name for address of location of tree - From GIS layer provided by the City.	
	Grow Space Size	Text or Drop Down	0-4, small		Describing the terrace width and/or other characteristics of the immediate context of the site.
			4-8, medium		
			8+, larger		8+ indicates that would accommodate a larger tree
			8+, medium		
			8+, small		
			Tree Grate		
			Tree Guard		
	Land Use	Drop Down Menu	boulevard		Tree is in the median
			business		
church					
hospital					
industrial					
island					



Category	Field	Type	Selections	Description
Location			multi-family	
			municipal	
			other	
			park tree	
			parking lot	
			residence	
			school	
			street tree	Traffic thoroughfare with no other land use present
			vacant lot	
	Utilities	Drop Down Menu	hydrant	Choose limiting factor. Underground determined by evidence/presence of box, vault of any utility
			other	
			overhd lines-com	
			overhd lines-live	
			street light	
	Location	Drop Down Menu	Very high:90-100	Determines the value of the location based on site attributes.
			High:80-89	
			Average 70-79	
			Low:60-69	
			Very Low:10-59	
	Special Tree	Drop Down Menu	Yes/No	Note if the tree has special significance. Placard or evidence of tree being dedicated, donated, historical, heritage.
Site Type	Drop Down Menu	P	Planting Site	
		R	Removal site	
		S	Stump	
		T	Tree	



Category	Field	Type	Selections	Description
Attributes	Hardware	Drop Down Menu	Cabled	
			Staked	
	Species	Drop Down Menu	Provided by DNR	Trees will be identified by genus and species, cultivar if evident, and by common name. Species found but not in list will be assigned a "Z-Species" number and added to system in update. "Vacant" will be selection for empty planting sites. "Stump" will be used for locations that require stump grinding.
	Stems/Trunks	Drop Down Menu	1-9	Number of stems will be counted at 4.5ft (breast height). Stems equal to or greater than 1 inch at 4.5ft above ground level will be counted. • For trees whose DBH breaks below 4'6" : 1. If there is a defined trunk greater than 1' in height before branch break, measure below the break for a single DBH. 2. If a tree does not have a defined trunk more than 1' in height before branch break measure all stems at 4'6" and provide an average as "DBH" Low forming branches should NOT be counted as stems, or taken into account when measuring DBH
	Diameter	Drop Down Menu		Tree trunk diameter will be recorded to the nearest inch. Average of stems for DBH
	Height	Text or Drop Down	5 10 15 20...	Tree height will be estimated in increments of 5 feet.
Canopy Width	Text or Drop Down	5 10 15	Canopy width will be estimated in increments of 5 feet.	



Category	Field	Type	Selections	Description
Attributes			20...	
	Condition	Drop Down Menu	Excellent - 90	In general, the condition of each tree will be recorded in one of the listed categories adapted from the rating system established by the International Society of Arboriculture:
			Good - 80	
			Fair - 60	
			Poor - 40	
			Very Poor-20	
	Dead - 0			
	Defect		See Appendix B	
	Defect 2		See Appendix B	
	Defect 3		See Appendix B	
	Risk Tree		Yes/No	imminent Risk of failure; call required
	Task Priority	Drop Down Menu	Standard	
			High Priority	
			Immediate	
	Maintenance Task	Drop Down Menu	Remove	
Pest Treatment				
Disease Treatment				
Inspect			further crown inspection required	
Cable				
Water				
Fertilize				
Stake Removal				
Stump Removal				
Plant				
Remove Object				
Prune				



Category	Field	Type	Selections	Description	
Attributes			Monitor	monitor for further decline	
			Root Collar		
	Task Detail		Drop Down Menu	Clearance	
				Subordinate	
				Restoration	
				Reduce Crown	
				Structural	
				Thin Crown	
				Excavate	
				Crown Clean	
				None	
	Task 2			Same as Above	
	Notes				



Appendix B: Defects

Cultural Damage	
Defect	Definition
cable in crown	
concrete in cavity	
construction damage	
curb/road damage	Tree is lifting or disrupting curb more than 1/2"
foreign object	
lawnmower	
sidewalk damage	Uplift is greater than 1/2" measured vertically at highest point of uplift.
staked	
topped	Any major limb is topped. If topped for utilities - record as utility damage.
tree grate	
utility damage	This category trumps improper pruning and topping.
vandalism	Not including graffiti - Record vandalism that injures tree such as ripped branches or bark, snapped young trees.

Insects/Disease	
Defect	Definition
ipps beetle	
leaf miner	
pod gal midge	
root rot	
rust	
scale	
spider mite	



Insects/Disease	
Defect	Definition
tip blight	
verticillium	
wooly adelgid	
anthracnose	
ants	
aphids	
beetles	
canker	
cedar apple rust	
conk/fungus	
dutch elm disease	
mistletoe	
gypsy moth	
disease, other	
insect, other	
none	
apple scab	
borers	
fall webworm	

Structural	
Defect	Definition
basal cavity	
basal decay	Decay greater than 1" not located in root or trunk, but in buttress between root and trunk. Decay trumps scar.



Structural

Defect	Definition
basal scar	Scar greater than 1" not located in root or trunk, but in buttress between root and trunk. Scar is trumped by Cavity or Decay.
branch architecture	A structural problem not including co-dominant stems.
co-dominant stems	Two or more nearly equal diameter leaders with a narrow branching angle. Use only when codominants are significantly negatively affecting tree.
crack	Crack is closed on each end. A Split has one open end. Split trumps crack.
crook	Use rarely.
crown cavity	Cavity greater than 1" in branch. Cavity trumps decay and scar.
crown decay	Decay greater than 1" located in branch. Decay trumps scar.
crown scar	Scar greater than 1" in branch. Scar is trumped by Decay and Cavity.
dead top	Greater than 25% of top of tree is dead.
decline	Use rarely.
dieback-major	Over 50% upper and outer branches dead - not including natural branch dieback due to internal canopy shading.
dieback-minor	Under 25% upper and outer branches dead - not including natural branch dieback due to canopy shading.
dieback-moderate	25% - 50% Upper and outer dieback. Do not include normal internal dieback from canopy shading lower branches.
girdled	Classify as cultural.
hanger	
included bark	Bark is included at major structural branch union generally in the lower 30' of the tree.
lean	Use rarely.
lightning strike	Use rarely.
one-sided	
rib	Use rarely.
root collar missing	A result of being planted too low - tree has no buttress flare.
root rot	
split	
storm damage	Classify as type of damage such as limb failure or lean.
trunk cavity	Cavity greater than 1" on trunk below first scaffold branch and above buttress. Cavity trumps decay and scar.
trunk decay	Decay greater than 1" on trunk below first scaffold branch and above buttress. Decay trumps scar.
trunk scar	Scar greater than 1" on trunk below first scaffold branch and above buttress. Scar is trumped by cavity or decay.
other	