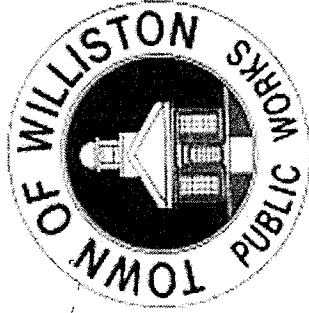


TOWN of WILLISTON

Williston Urban Street Tree Inventory & Assessment Report



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December 19, 2005

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PROJECT HISTORY

Enabled by the Vermont Department of Forests, Parks & Recreation the Town of Williston was granted a TLC Planning & Education Grant in June of 2005 to solicit RFP's for a qualified professional to perform a tree inventory and assessment of the existing tree infrastructure within the Town's public highway right-of-ways, municipally property and parkland. Specifically, the Town was seeking the condition of the physical characteristics and health of five subdivisions and the Taft Corners area, the Town Hall and adjacent Old Brick Church, Brennan Park, and the Community Park.

The end goal was to develop a tree maintenance schedule for the Town maintenance personnel, to provide recommendations to include future streetscape planning, and additionally to train municipal staff and members of local citizen communities.

The Town of Williston requires new developments to provide and plant street trees within the public right-of-way as part of its subdivision site plan and local permit process. This requirement has been enforced since May 1997.

Since May of 1997, many trees have been planted within the Town's rights-of-ways. As a result the department of Public Works assumes responsibility of the tree maintenance. Increasing demand of development occurs in Williston and due to the local permit process in place the Town will become responsible for many new future street trees.

The inventory information collected will enable the Town to short and long term management guidelines for this newer tree generation.

PLANNING INFORMATION

Planning in urban and community forestry occurs principally on two levels. At the broadest level, a strategic plan defines the overall goals and objectives of urban and community forestry efforts. It is a long-range, comprehensive master plan that is the blueprint for the administration and management of the tree program. The basic tenets of a tree program are described in Appendix A.

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Some suggested goals for an urban and community forestry strategic plan are listed in Appendix B. Once goals are determined, strategies are developed for achieving them. Ideally, strategic planning is one of the first tasks undertaken in the establishment of a community forestry program. A community tree inventory is a typical objective to attain the strategic goal of efficient and cost-effective urban forest management. Actions to achieve this objective might include applying for a grant, hiring a consultant, conducting the inventory, and analyzing the inventory findings.

A strategic plan is most effective when it includes input from local citizens, organizations, businesses, municipal staff and elected officials, and when it is integrated with other comprehensive community plans. Land use plans, greenway plans, site development plans, and similar efforts should have input from those involved with public tree care.

A management plan differs from a strategic plan in that it is specific to the field operations of the tree program. A management plan is typically based on a detailed tree inventory and identifies and prioritizes site-specific tree maintenance, removal, and planting activities within a multi-year time frame. The remainder of this report details the findings of the Williston's tree inventory and lists prioritized recommendations based on those results, tasks that will help define an ongoing tree maintenance program.

TREE INVENTORY PROCEDURES

Inventory tree data and mapping points were collected for a total of 1,123 trees. Data was gathered during the period of August 18 - September 1, 2005, when trees had leafed out and were actively growing.

Information about each tree was entered into a Palm™ handheld computer, using the MCTI software program created by the USDA Forest Service for free public use. (More information about this program can be found at www.umass.edu/urbantree). Trees were mapped using black and white aerial photographs supplied by the Town of Williston.

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Palm™ Method of Data Collection

TNE used a Palm™ 515 handheld personal digital assistant (PDA) in the field to collect tree data. This method streamlines the field work and helps ensure accuracy, since there is no data entry from paper to computer.

Data was entered directly into the Palm™ version of the USDA Forest Service's MCTI software program. At the end of each day's work, the data was uploaded onto the MCTI Desktop Version by synchronizing the Palm™ with the computer ("Hot-Sync").

Mapping with Aerial Photographs

TNE mapped tree locations using aerial photographs. For each tree, the Tree ID Number and mapping points were recorded on paper maps in the field. Upon completion of data collection, the tree location point data was used to create a digital map file using ESRI ArcView 3.2A.

The tree location point data is being delivered to the Town of Williston in an ArcView® GIS shapefile (extension .shp).

In addition to tree map shapefile, a polygon shapefile was created to outline each of the streets upon which data was collected. Each polygon includes the tabular data with the corresponding tree identification numbers that reside within that polygon.

Inventory Products

The Town of Williston is receiving an electronic copy of the tree data on CD-Rom. This includes the 2005 Williston tree inventory data in Microsoft Access and Excel program, an ArcView shapefile with the NAD83 Map Projection, and three copies of the management plan. In addition, the Town is receiving printed maps broken down by street, as the data was collected in the field. Copies of all these products are being delivered to the Public Works Department.

TREE DATA COLLECTED

Data was collected for a total of 1,123 trees.

The following are each of the data items available within the MCTI software program and collected on all the trees in the Town's inventory.

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Unique Tree Identification Number

Each tree inventoried was assigned a unique tree identification number (the Tree ID number). All items of data recorded were associated with the unique Tree ID number for that particular tree. The same Tree ID number was used to collect points on the aerial photographs (minus the VTWIL prefix) in order to match location with the entire tree database.

Due to a data collection oversight, the Tree ID numbers 1122 and 1123 are not in sequential order. This is noted in the polygon map review shapefile.

Address

The street name was used as the address when appropriate. When not available the area name, commonly referred to by the Town, was used to associate an address for the tree.

Address Number

The tree's address number was referenced to a house number when appropriate. When a number was not available an assigned number was created. The assigned number was chosen to split the difference between the address number before and after the property where the tree lives.

Species

Trees are identified by genus and species, and by common name. The Tree List screen in the MCTI desktop program shows all the tree data in a tabular form. On this screen the name of the tree is a two-letter abbreviation for scientific name. Clicking on the "Details" index tab brings up a screen that shows all the information for the one selected tree. Here in the Species box, the abbreviation is followed by the scientific name and then the common name.

DBH

Following standard community forestry practices for measuring tree size, tree measurements are DBH, diameters measured at breast height, defined as 4.5' above ground. Measurements were made using a Biltmore Stick, a yardstick-type arborist's tool.

In this inventory, the diameter of multi-stemmed trees was recorded as the sum of all stems divided by the total number stems, to obtain an average

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diameter per stem. There were a few multi-stemmed trees whose diameter was measured below the forking point in order to give a more accurate picture of those individual trees. If a tree was measured in any way other than as a single trunk at 4.5' above ground, it is noted thus in the Comments section within the inventory data.

The MCTI program is set up for recording DBH within ranges, not exact inches. The DBH column on the MCTI Tree List screen of the desktop program shows numbers ranging from 0-10. These are coded categories, *not* DBH range numbers. Clicking on the "Details" index tab, the DBH box shows a code number of 1-10 followed by parentheses with the corresponding DBH range in inches for the selected tree.

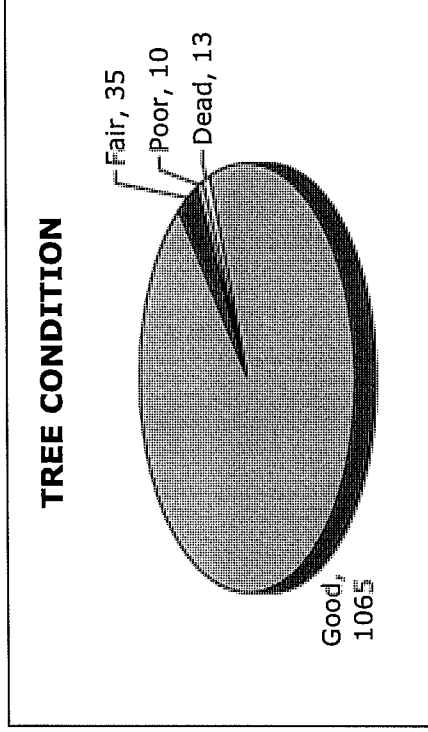
Note that in the MCTI program, the DBH numbers overlap from one category to the next. If the measured DBH was a number that overlapped from one class to the next, TNE recorded the lower of diameter class (e.g. a DBH of 15" was recorded in Class 5, not Class 6).

Code	DBH Range
0	0-2
1	2-4
2	4-6
3	6-9
4	9-12
5	12-15
6	15-18
7	18-24
8	24-30
9	30-36
10	>36"

Condition

The overall condition of the Town's trees is in good condition. The good condition reflects the health of the trees as inventoried the day the tree data was collected. This does not forecast any potential health issues that could create maintenance issues or concerns in the future.

Figure 1. Tree Condition



The Condition column on the MCTI Tree List screen of the desktop program shows code numbers ranging from 0-4. Each number represents a condition rating. Clicking on the "Details" index tab, the Condition box shows the code number 1-4 followed by parentheses with the corresponding word that describes the condition rating.

Tree condition was assigned by examining and evaluating the following items:

- Trunk condition
- Foliage color and size
- Crown development
- Growth rate, as observed on small branches and twigs
- Overall tree structure
- Visible root problems
- Presence of diseases or insects

Based on this assessment, trees were assigned one of the four condition classes. The evaluation criteria for each class as follows:

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TABLE 2. CODES FOR CONDITION CLASSES

CODE	CONDITION
0	Unknown
1	Good
2	Fair
3	Poor
4	Dead/Dying

Good Condition (75-100%)

- Full canopy
- Minimal to no mechanical damage to trunk
- No dieback of branches over 2" diameter
- No suckering (root or water)
- Foliage color and leaf size is typical of species during growing season
- Form is characteristic of species

Fair Condition (50-75%)

- Thinning canopy
- New growth medium to low amount, or stunted
- Significant mechanical damage to trunk, new or old
- Insect or disease that is affecting tree
- Foliage may be off-color, or exhibit early fall color
- Leaves may be smaller or sparser than normal
- Form not representative of species

Poor Condition (25-50%)

- Tree is declining
- Visible dead branches over 2" in diameter in canopy
- Significant dieback of other branches
- Severe mechanical damage to trunk, usually including decay resulting from damage
- Foliage may be off-color, or exhibit early fall color
- Leaves may be smaller or sparser than normal
- Needs priority pruning

Dead or Dying (0-25%)

- No signs of life or viable new buds
- Bark may be beginning to peel

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Checkboxes to Record Special Concerns

Certain conditions may signal the need for prompt inspection, for critical maintenance and/or to alleviate a potentially dangerous situation. This MCTI feature is designed for recording significant issues of health and structure that require further evaluation. If it is noted that a tree requires a consultation, one or more of the following reasons was usually checked:

- Consult Needed
 - o This box was reserved to draw additional attention to any extenuating health conditions which would further inspection.
- Weak Fork
- Cavity
- Wires

Planting Locations

In MCTI, the choice of planting location is limited to the following four options:

TABLE 3. DEFINITIONS OF PLANTING LOCATIONS	
CODE	DEFINITION
1	In a tree planter or tree pit surrounded by hardscape
2	In a planting strip less than 4 feet wide, between the road and the sidewalk
3	In a planting strip greater than 4 feet wide, between the road and the sidewalk
4	Located on a terrace or park property; assumed to be in a broader area of grass or mulch

As in the case of the DBH and Condition codes, it is important to note that the MCTI Tree List screen of the desktop program shows only code numbers; the Details screen will describe the planting location.

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Maintenance Needs

MAINTAIN

If the "Maintain" radio button is selected, checkboxes are available for the following options:

Crown Clean

Remove dead, diseased, obstructing, split, and broken branches that are less than 4" in diameter. Also describes the need to thin dense or heavy foliar masses, in order to reduce susceptibility to branch or whole tree failure.

Crown Raise

Remove lower limbs to provide clearance for vehicles and/or pedestrians. Limbs above the road should be no lower than eighteen feet (18'). Limbs above sidewalks should be no lower than eight feet (8').

Crown Reduce

Reduce the overall canopy mass by cutting back the top and sides, or by just removing individual tree limbs. Reducing the crown is usually associated with pruning away from buildings or other structures.

REMOVE

If the "Remove" radio button is selected, the above checkboxes are unavailable.

Hazard Tree Evaluation

This category is designed to identify and specifically rate hazard trees. The highest possible rating is twelve (12). The higher the score, the more severe the problem is judged to be. Use of a rating system enables

TABLE 4. SCALE FOR SIZE OF DEFECT

SIZE OF DEFECTIVE PART	MCTI ASSIGNED POINTS
Parts less than 4 inches in diameter	1
Parts from 2 to 10 inches in diameter	2
Parts from 4 to 20 inches in diameter	3
Parts greater than 20 inches in diameter	4

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identification of hazardous trees, as well as budget forecasting and priority management in a thorough, proactive way.

The MCTI evaluation checklist, listed in Appendix C., was developed by Dr. David Bloniarz of the USDA Forest Service Northeast Center for Urban and Community Forestry and Dr. Dennis Ryan of the University of Massachusetts. The checklist rates potentially hazardous trees by assigning individual scores in four areas:

1. Probability of failure (1-low, 2-medium, 3-high)
2. Size of the defect (1-4 scale)
3. Target impact (1-3 scale)
4. Strength of the species in question (0-2 scale)

Size of the Defect. The MCTI point scale of 1-4 was based on the size ranges and included in the following table. TNE used this point assignment when a hazard tree or tree parts were identified.

According to both versions of the USDA Forest Service methodology, the probability of target impact is scaled 1-3 based on the road use priority as follows:

TABLE 5. SCALE FOR TARGET IMPACT		
FREQUENCY OF USE	TYPE OF ROAD	TARGET IMPACT
Occasional use	Low use roads and park trails; parking lots adjacent to low use areas; natural areas	1
Intermediate use	Moderate to low use playgrounds, parks; secondary roads and park trails within moderate to high use areas	2
Frequent use	Principal arterial roadways and expressways	3

Species Ratings (0-2 Points). Using wood strength tables from the USDA Forest Service, Drs. Bloniarz and Ryan defined species ratings in a general manner as follows:

TABLE 6. GENERAL SPECIES RATINGS BY CATEGORY		
SPECIES TYPE	DEFINITION	POINTS
Durable	Not Prone to Failure eg: Red Oak, Sugar Maple	0
Average	Moderate Strength	1
Weak/Dead	Prone to Failure eg: Poplar, Willow, White Pine	2

In this final hazard evaluation category, the new USDA Forest Service methodology allows for notation of not only tree species growth characteristics but also a multitude of other risk factors. TNE adhered to the original MCTI methodology and rated the tree species on a scale of 0-2. The score was based on professional knowledge of various wood strengths and experience with engineering weaknesses typical of each species growth structure. A list of all trees with species hazard ratings is found in Appendix E.

INVENTORY RESULTS

Trees and other living organisms are classified by genus (plural "genera") and species. The broader genus name, e.g. Maple, scientific name *Acer*, is further defined by a species name, such as *Acer rubrum* (Red Maple) or *Acer platanoides* (Norway Maple). There are a total of 21 genera and 35 species represented in the Town of Williston. A mere four genera – Ash, Maple, Oak and Linden - comprise 85% of the population. This is a poor representation of species diversity.

An important goal in community forestry is to maintain a diverse range of genus and species in planning for and planting new trees. Guidelines for sound practices recommend working toward goals of no more than 10% of a tree population in any one genus, and no more than 5% in any one species. The

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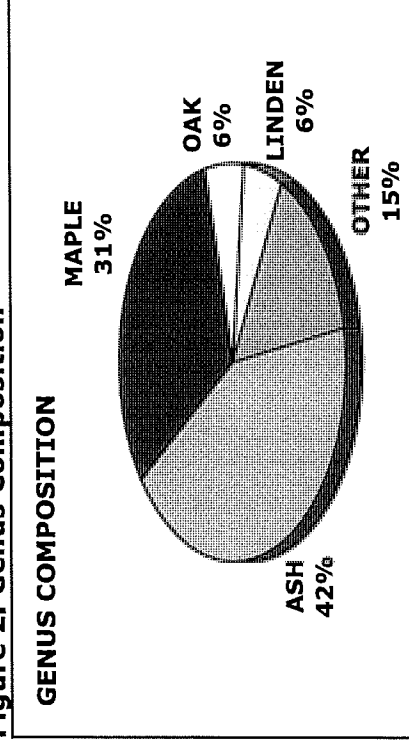
rationale for this guideline is to try to prevent a disaster such as with what happened with Dutch elm disease, when cities and towns lost almost all their roadside trees at the same time, because almost all were the same genus and species, American Elm (*Ulmus americana*).

The percentage of Ash trees (genus *Fraxinus*) at 43% is well above the standard guideline of 10%, and it is strongly recommended not to increase this percentage. Maple (genus *Acer*) trees account for an overly large percentage 31% and should also be avoided in new plantings. The Town should focus on species diversification in planning for new and replacement trees. A list of some suggested species is found later in this report in Appendix D.

DATA SUMMARY

The tree data represented a total of 21 tree genus and 35 different species.

Figure 2. Genus Composition



The most common genera were:

1. Ash	481	42.8%
2. Maple	348	30.9%
3. Oak	63	5.6%
4. Linden	63	5.6%
5. Other	168	14.9%

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Species represented			
1. Green Ash	481	42.8%	
2. Norway Maple	138	12.3%	
3. Red (Swamp) Maple	105	9.3%	
4. Red Oak	62	5.5%	
5. Littleleaf Linden	58	5.2%	
6. Flowering Crabapple	39	3.5%	
7. Sugar Maple	34	3.0%	
8. Hedge Maple	32	2.8%	
9. Honeylocust	27	2.4%	
10. Canadian Hemlock	16	1.4%	
11. Norway Maple Crimson King	14	1.2%	
12. Silver Maple	14	1.2%	
13. Eastern White Pine	13	1.2%	
14. Boxelder	10	0.9%	
15. Colorado Blue Spruce	10	0.9%	
16. White Spruce	9	0.8%	
17. Buckthorn	7	0.6%	
18. Balsam Fir	7	0.6%	
19. Serviceberry	7	0.6%	
20. Norway Spruce	6	0.5%	
21. American Linden or Basswood	5	0.4%	
22. Paper Birch	4	0.4%	
23. Cottonwood	4	0.4%	
24. American Arborvitae	4	0.4%	
25. Larch	3	0.3%	
26. Flowering Cherry	2	0.2%	
27. American Elm	2	0.2%	
28. Katsura tree	2	0.2%	
29. River Birch	2	0.2%	

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30. Willow	1	0.1%
31. Black locust	1	0.1%
32. Amur Maple	1	0.1%
33. Callery Pear	1	0.1%
34. Red Pine	1	0.1%
35. Pin Oak	1	0.1%
TOTAL	1123	

Tree Composition & Count By Road

Barrett Lane = 56

▶ Green Ash	17
▶ Red Oak	15
▶ Red (Swamp) Maple	8
▶ Honeylocust	8
▶ Littleleaf Linden	6
▶ Norway Maple	1
▶ American Linden or Basswood	1

Brennan Park = 43

▶ Red (Swamp) Maple	15
▶ Canadian Hemlock	9
▶ Eastern White Pine	7
▶ Paper Birch	4
▶ Balsam Fir	4
▶ River Birch	2
▶ Norway Maple	1
▶ Green Ash	1

BRENNAN WOODS DR = 148

▶ Green Ash	44
▶ Norway Maple	41
▶ Red Oak	25
▶ Littleleaf Linden	14

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- ▶ Norway Maple Crimson King 13
- ▶ Serviceberry 7
- ▶ American Linden or Basswood 2
- ▶ Sugar Maple 1
- ▶ Flowering Crabapple 1

Chamberlin Dr = 41

- ▶ Green Ash 25
- ▶ Red Oak 8
- ▶ Norway Maple 5
- ▶ Littleleaf Linden 2
- ▶ Flowering Crabapple 1

Community Park = 68

- ▶ Norway Maple 14
- ▶ Green Ash 10
- ▶ White Spruce 7
- ▶ Eastern White Pine 6
- ▶ Canadian Hemlock 5
- ▶ Flowering Crabapple 4
- ▶ Honeylocust 4
- ▶ Larch 3
- ▶ Red (Swamp) Maple 3
- ▶ Balsam Fir 3
- ▶ Littleleaf Linden 2
- ▶ American Arborvitae 2
- ▶ American Elm 2
- ▶ Norway Spruce 1
- ▶ American Linden or Basswood 1
- ▶ Hedge Maple 1

Coyote Lane = 12

- ▶ Norway Maple 12

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Hanon Drive = 127

▶ Red (Swamp) Maple	56
▶ Littleleaf Linden	26
▶ Honeylocust	15
▶ Green Ash	15
▶ Red Oak	8
▶ Sugar Maple	2
▶ Silver Maple	2
▶ Norway Maple	2
▶ American Linden or Basswood	1

Harvest Lane = 143

▶ Green Ash	134
▶ Littleleaf Linden	6
▶ Cottonwood	2
▶ Red (Swamp) Maple	1

Jensen Road = 24

▶ Norway Maple	24
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Katie Lane = 20

▶ Flowering Crabapple	20
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Library Lane = 59

▶ Silver Maple	12
▶ Flowering Crabapple	9
▶ Colorado Blue Spruce	9
▶ Green Ash	7
▶ Norway Spruce	4
▶ Sugar Maple	3
▶ Red (Swamp) Maple	3
▶ Canadian Hemlock	2

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- ▶ White Spruce 2
- ▶ Katsura tree 2
- ▶ Cottonwood 2
- ▶ American Arborvitae 2
- ▶ Willow 1
- ▶ Black locust 1

Maple Tree Place = 85

- ▶ Green Ash 39
- ▶ Hedge Maple 27
- ▶ Red (Swamp) Maple 16
- ▶ Flowering Cherry 2
- ▶ Callery Pear 1

Marshall Ave = 103

- ▶ Green Ash 71
- ▶ Norway Maple 32

Old Brick Church = 41

- ▶ Sugar Maple 18
- ▶ Boxelder 10
- ▶ Buckthorn 6
- ▶ Flowering Crabapple 2
- ▶ Red Pine 1
- ▶ Red (Swamp) Maple 1
- ▶ Norway Spruce 1
- ▶ Green Ash 1
- ▶ Colorado Blue Spruce 1

Sadler Lane = 28

- ▶ Green Ash 9
- ▶ Norway Maple 6

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▶ Hedge Maple	4
▶ Red Oak	3
▶ Red (Swamp) Maple	2
▶ Littleleaf Linden	2
▶ Norway Maple Crimson King	1
▶ Amur Maple	1

Town Hall = 18

▶ Sugar Maple	10
▶ Red Oak	3
▶ Green Ash	2
▶ Pin Oak	1
▶ Flowering Crabapple	1
▶ Buckthorn	1

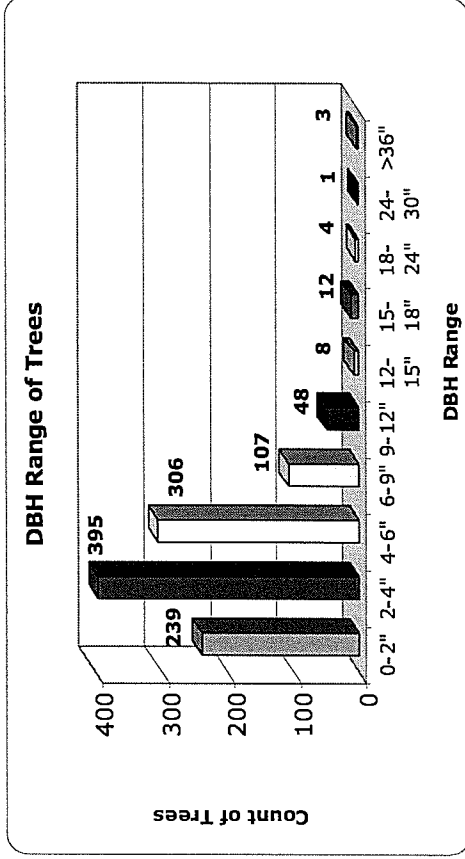
Wildflower Circle = 107

▶ Green Ash	106
▶ Flowering Crabapple	1

Size

Another important goal of urban and community forestry is to maintain a diversity of size classes among a tree population, in order to ensure a range of young, middle-aged, and older trees. The urban forestry standard for size is trunk diameter, measured at breast height. This measurement is abbreviated as DBH. Breast height is defined as 4.5 feet above ground level. The DBH for each tree was measured and recorded according to the size classes in the MCTI software program. The graph below shows the Esplanade's trees grouped into the eleven diameter classes that are in the MCTI program.

FIGURE 3. Diameter Distribution of Trees



The ideal distribution is an even number of trees in all size classes. The Williston inventory illustrates a heavy diameter cluster of young size classes from very small to small. The information shown graphically indicates the need to identify these new plantings to foster their health for future age and size development. This would ensure an ongoing number of trees for a sustainable population.

In the case of most shade trees and evergreens that are medium and tall-growing, diameter size is a fair indication of maturity. Although size is generally an indication of age, this is not necessarily the case with ornamental and fruit trees such as Flowering Cherry and Apple. These trees can be quite old and yet not of large diameter. In addition, some ornamentals and fruit trees are multi-stemmed. Because DBH was recorded as an average diameter of all stems, these trees may be quite mature and yet appear in the smaller size classes.

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MANAGEMENT RECOMMENDATIONS

The first goal of the suggested maintenance schedule is the identified 5 hazard tree priority removals. For public safety the following trees should be removed this coming year. The trees are listed in order of highest to lowest priority:

Maintenance Goals

1. VTWIL-97, Rating = 9, DBH = 4-6, Old Brick Church, Norway maple, Trunk injury & cavity
2. VTWIL-98, Rating = 8, DBH = 4-6, Old Brick Church, Norway maple, Trunk injury, deadwood & cavity
3. VTWIL-30, Rating = 6, DBH = 18-24, Old Brick Church, Green ash
4. VTWIL-15, Rating = 6, DBH = 4-6, Old Brick Church, Boxelder, Trunk injury & weak fork
5. VTWIL-14, Rating = 6, DBH = 6-9, Old Brick Church, Boxelder, Trunk injury & weak fork

The second goal is structural pruning. Eighty four percent (~84%) of the urban street trees inventoried are <6" in diameter. 93% are below 9" in diameter.

The DBH (diameter at breast height) range of trees in the inventory illustrates the serious need to foster a well developed young urban forest. The benefits of encouraging a strong tree form and structure on these young trees will

- ▶ increase public safety, becoming less prone to future wind & storm breakage
- ▶ avoid larger tree breakage problems later on due to lack of structural strength
- ▶ lower long-term maintenance costs
- ▶ enhance tree's appearance

It is apparent that the current subdivision permit plans do not incorporate the "right tree, right place" philosophy to specify that a suitable or "right" tree be planted for the appropriate planting location. As with building a house, you must think of the way (the house) will exist on the property, how the house will affect its surrounding and how the surroundings will affect the structure.

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Trees are the same way. Currently the permit process is too broad and it allows developers to place any type of tree, no matter what the mature size and height the tree will grow to, in any location. This will create substantial tree management and care headaches in the future. Trees can eventually block sight lines of road intersections, hinder pedestrian sight lines, obstruct views of vehicle traffic signals, create obstacles for plowing and can initiate walking hazards for pedestrians on sidewalks. With proper planning these maintenance issues can be avoided.

The following maintenance needs have been identified from the tree inventory.

Removals	37
▶ Priority	5 <i>(with a hazard rating range of 6-12)</i>
▶ Non-priority	32
Pruning – first priority	
▶ Crown Raise	111
▶ Crown Clean	28
▶ Crown Reduce	1
▶ Structural Pruning	940
Pruning - second priority	
▶ Deadwood >75%	14
▶ Deadwood 50-75%	7
▶ Deadwood 25-50%	17
Pruning - third priority	
1. Deadwood <25%	287
Remove Excessive Mulch	278 <i>(greater than 24%!)</i>
Trees Needing Mulch	85
Trees with Trunk Injury	368 <i>(33%)</i>

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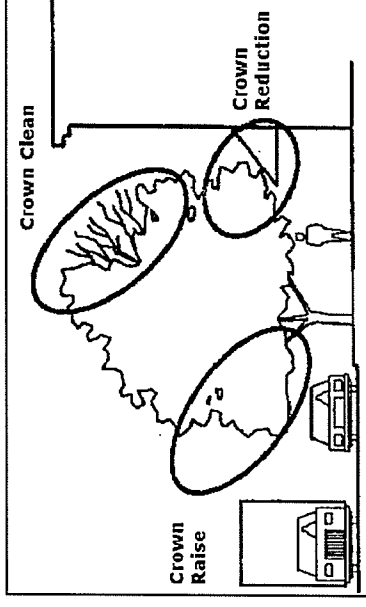
Types of Maintenance

There are a number of routine tree maintenance tasks. Among these are three different types of pruning: crown clean, crown raise, and crown reduce. Most planted trees benefit from regular pruning maintenance. Good pruning practices are the groundwork for creating strong structures and growing healthy trees for the future.

The pruning types are defined in the American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning). This standard is also known as the ANSI A300 (Part 1) – 2001 Pruning and is available for purchase from the International Society of Arboriculture (www.isa-arbor.org).

The definitions of the pruning types are:

- ♦ **Crown cleaning** – selective pruning to remove one or more of the following parts: dead, diseased, and/or broken branches.
- ♦ **Crown raising** – selective pruning to provide vertical clearance. This is often performed to create height clearances for vehicles and pedestrians.
- ♦ **Crown reduction** – selective pruning to decrease height and/or spread, usually near buildings.
- ♦ **Structural pruning of young trees** during the first one to ten years ensures a strong form and eliminates many potentially dangerous situations as the tree matures. Trees should never be pruned at planting time except to remove broken, dead, or crossing branches, because newly-planted trees need all their food-producing branches to nourish the



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developing roots and adjust to the new location. However, structural pruning later on addresses the formation of a strong central leader and evenly spaced scaffold branches. Structural pruning of recently planted trees should be included on the regular cycle of maintenance tasks. A budget line has been created for this maintenance need.

The results of the 2005 Williston tree inventory revealed that over 96% of the population, 1,080 trees, would benefit from one or more types of routine maintenance pruning, divided as follows:

Crown Cleaning	28
Crown Raising	111
Crown Reduction	1
Structural Pruning	940

The other types of routine maintenance noted in the inventory were non-priority tree removals and, root collar excavations to remove excessive mulch. Table 9 lists the number of trees in each of the major maintenance categories of risk and routine management. Lists of specific trees in each category and their associated addresses may be generated using a query of the data in electronic form, with Microsoft Access. A query has been saved for each maintenance category. Each desired report can be generated with the appropriate query selected and then it can be printed with a touch of a button. The MCTI program has certain limitations in regards to queries. This is why the data is being shared with the Town in Microsoft Access.

TABLE 9. Estimated Costs of Maintenance Tasks

MAINTENANCE CATEGORY	# OF TREES	EST. TIME FOR MAINTENANCE /HOUR	TOTAL	\$/HR	EXTENDED
REMOVE: PRIORITY*	5	4.2**	21	\$125	\$2,625.00
REMOVE: NON-PRIORITY	32	1	32	\$100	\$3,200.00
CROWN CLEAN	28	2	56	\$100	\$5,600.00
CROWN RAISE	111	1	111	\$100	\$11,100.00
CROWN REDUCE	1	0.5	.5	\$100	\$50.00
STRUCTURAL PRUNE	940	0.5	470	\$55	\$25,850.00
TOTALS	1117		690.5		\$48,425.00

* Based on a 3 person bucket truck crew, with clean up – Others categories are based on a 2 person crew, except structural pruning based on a one person crew.

** Time estimated based on total DBH of all 5 trees.

Budgeting for Maintenance Tasks

With the results of this inventory, it is possible to create budgets for tree maintenance and removals based on the size of the tree. These numbers are derived from estimated unit prices from Vermont tree care companies. Like all budget figures, these are only estimates, but they are helpful in planning for requests within the budgeting process, and for private fundraising as well.

TABLE 10. Budgeting for Maintenance Tasks

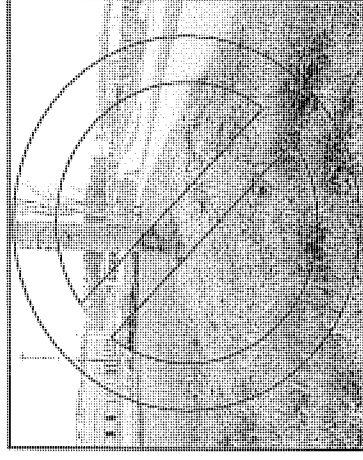
MAINTENANCE	Cost	First Year	Year Two	Year Three	Year Four	Year Five
Priority Removals*	\$2,625.00	\$2,625	0	0	0	0
Non-Priority Removals *	\$3,200.00	0	\$1,600	\$1,600	0	0
Crown Clean	\$5,600	\$1,865	\$1,865	\$1,870	0	0
Crown Raise	\$11,100	\$1,000	\$2,525	\$2,525	\$2,525	\$2,525
Crown Reduce	\$50	\$50	0	0	0	0
Structural Pruning	\$25,850	\$5,170	\$5,170	\$5,170	\$5,170	\$5,170
Totals	\$48,425.00	\$10,710.00	\$11,160.00	\$11,165.00	\$7,695.00	\$7,695.00

* Removal costs are based on diameter classes.

Other Maintenance Tasks

Certain simple maintenance jobs can be accomplished from the ground but can be time-intensive. One such job is a root collar excavation of young trees. When this task was indicated, the notation was made in the "Comments" field.

- ✓ **Root collar excavation** is usually prescribed when excessive mulch has been piled and left around the base of the tree, or where road, driveway or other construction has caused the root flare to be buried by soil and debris. This causes both root suffocation and trunk rot of the cambium, the growing area beneath the bark layer. The result is tree decline and, eventually, death. Removal of the excess material (278 trees) almost always results in a dramatic improvement in tree health.



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Benefits of Mulch

When not excessively applied mulch has so many benefits to the trees (85 selected for mulching) that populate our landscape. Mulch

- ▶ suppresses competing grass and weeds
- ▶ lowers the competition for nutrients caused by grass and weeds growing over the critical root zone
- ▶ eliminates the labor-intensive need to trim around trees
- ▶ protects the trunk from lawnmower and weed-whacker damage
- ▶ retains soil moisture, prevents drying out and soil cracking
- ▶ protects the soil around the tree from extremes of temperature
- ▶ prevents soil compaction

Maintenance of Large Trees

Preservation of very old trees is often more an art than a science. Like people, trees in old age are focusing their energies on maintaining what they have. For trees, this means they do not put out a lot of new growth. If new growth is forced on them by fertilization, they may not be able to manufacture enough food to sustain that new growth. If wounds are inflicted, by cars or by well-intentioned tree care practices, older trees are slower to heal and the wound site may be a target for insect or disease invasion. Old trees should be watered and well-mulched, their trunk flare evident, and deadwood removed from the crown. Removal of invasive vines removes competition for nutrients. Sometimes reducing the size of the crown by thinning allows the tree to sustain itself more easily.

Preservation of trees in the mid-size diameter classes, 73 trees, is an extremely important initiative for the Town to foster its large trees for the future. While tree maintenance is critical to accomplish this goal, funding limitations make it a challenging one to achieve. It would behoove the Town to initiate an Adopt a Tree Program. The program could produce revenue to sustain the trees adopted by Town residents or citizens. With public education and awareness, these funds can be allocated for tree maintenance as well as planting.

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SUMMARY

Williston's tree inventory results reveal a population in overall good condition. However, tree maintenance needs to be addressed within the next calendar year. There is substantial routine maintenance of structural pruning, and removal of excessive mulch, on over 900 newly planted trees to be completed. These problems can be avoided if the Town's permit process is updated to ensure developers are responsible for proper planting techniques.

The other substantial point of concern is the need to diversify future tree planting species. Over 85% of the tree population is comprised of four genera of trees. This lack of diversity could have huge ramifications if ever the Town was to experience an event specifically targeting one type of tree or one size class of trees, like Emerald Ash Borer, an insect which is ravaging Mid-West urban and community forests.

The Town of Williston is fortunate to have recognized the need for a tree inventory and assessment report to identify current and future problems. A strategic plan can be developed from this assessment report; the Town could put all the necessary by-laws and specifications in writing and make it available to all future development or improvements.

Williston needs to create a stricter tree planting guideline, by-laws specifications, if the Town is to succeed at developing a mature, multi-aged healthy urban forest. The right tree in the right place with on-going routine maintenance will translate to a long term manageable tree maintenance budget.

A few suggestions for upcoming revisions to the subdivision and Public Works Standards may be the documentation to enforce the goals and objectives the Town see for its future tree population

- ▶ Update subdivision and Public Works standards to a strictly enforced permit process
- ▶ Create detailed tree planting guidelines, specifications, and requirements. Including tree spacing and distances from hardscape, site lines, traffic signs, and pedestrian walks. Create this specification

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for future tree planting locations incorporating the "Right Tree, Right Place" philosophy.

- ▶ Create a specification requiring that developers too be responsible for information to be shared with the Town to include new trees into the on-going tree inventory.
- ▶ Initiate a Citizen Pruner program with the help of the Master Gardeners Program, the Williston-In-Bloom organization and with Four Season's Garden Center. The Citizen Pruner program can generate interest in the community and generate support for the Town's trees. With increased community involvement and support the Town can lobby for a higher tree maintenance budget. With a successful Citizen Pruner program individuals may want to increase their community outreach and begin a Tree Commission or Tree Board. The individuals can help with routine maintenance, with proper training, and help alleviate the direct costs of simple tasks of structural pruning and the removal of excessive mulch.
- ▶ Consider creating an Adopt-A-Tree program to encourage the awareness of residents' intrinsic value of community trees. The program can help offset the cost of the tree, and the resident will be required to become the steward of the tree's care.
- ▶ Create a proper mulching pamphlet to distribute to the Town. Make resident's aware that over mulching slowly kills their beloved small trees. Allow the community to get involved first hand, through the small step of education.

With conscientious tree management, the Town of Williston will become a model for other developing Vermont communities to emulate. The Town will be host to a well structured, sustainable tree population, as well as an aesthetically pleasing resource to its residents and visitors.

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APPENDIX A Sound Advice for a Cost Effective Tree Program

The following are the basic tenets for an urban and community forestry program.

- ✓ **Keep what you have.** Trees in good health, with good structure, should be preserved. It takes a very long time to grow a large tree, especially on a developed site, and the big trees provide the greatest benefits – aesthetic, economic, social, and environmental. They are worth the investment.
- ✓ **Plan to manage risk.** No community can ever eliminate all its hazards. However, it has been shown in insurance claims and court cases that working toward the goals outlined in a systematic management plan is the best defense.
- ✓ **Plant and preserve with donations.** Private citizens are generally enthusiastic about donating money for tree planting. It is also possible to encourage donations for preservation of existing trees. All planted trees benefit from regular maintenance, and good maintenance practices are the groundwork for growing healthy heritage trees of the future.
- ✓ **Plant with volunteer labor.** It helps build community support and increases the number of people watching out for the tree's safety and health. Use bare root trees when possible: you get more roots, the stock is cheaper, and they are much easier to lift, to carry, and to plant at the proper depth.
- ✓ **Train young trees with volunteer labor.** Such trees are small enough to be pruned from the ground with hand tools. Train the volunteers well so that the trees are pruned for good structure and form, giving them a good start for a long life and fewer maintenance issues down the road.
- ✓ **Establish an annual funding source for large tree pruning.** Regular maintenance will help keep trees safe and healthy and minimize the need for costly emergency clean-up.

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- ✓ **Plant the right tree in the right place and do it right.** Select good specimens of species appropriate for the location, and plant them correctly. To eliminate utility pruning eyesores, do not plant tall-growing species under or near utility wires.
- ✓ **Establish a policy that requires all tree planting and pruning to conform to established standards,** and state this in all Requests for Proposals. For quality plant material, refer to the American Standard for Nursery Stock (ANSI Z60.1). For proper pruning, refer to the Tree Maintenance Standards (ANSI A300).

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APPENDIX B Sample Goals for a Strategic Plan

Goals should be broad but not vague. Quantifiable objectives should be developed for each goal so that progress can be measured. Sample goals include:

1. The urban forestry program has community and political support.
2. Residents are knowledgeable about proper tree planting and care.
3. Trees are integral in all community planning decisions.
4. Optimum tree cover is established and maintained.
5. Community trees are maintained at optimum levels of stocking, health, age and species diversity and are appropriate for the site.
6. Conservation of tree resources is promoted.
7. Street trees are appropriately selected, situated and maintained to minimize hazard, nuisance, and sidewalk damage and maintenance costs.
8. Management of the urban forest is cost-effective and efficient.
9. Management strategies are acknowledged, understood and cooperatively implemented by appropriate municipal departments.

Goals may also be grouped into categories, such as:

PUBLIC AWARENESS

1. Strong public awareness of the values and benefits of community trees
2. Local support for an urban forest management program
3. Understanding among residents about proper tree selection, planting and care

ADMINISTRATION AND MANAGEMENT

1. Trained program staff
2. Updated municipal tree ordinance
3. Alternative sources of program funding
4. Active tree board

TREE RESOURCE

1. Species and age diversity within the population
2. Well-maintained public trees
3. Safe tree population

Credit: Jill Mahon, USDA Forest Service

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APPENDIX C USDA Forest Service Hazard Evaluation

PROBABILITY OF TARGET IMPACT: 1-3 points

- 1. Occasional Use:**
 - ▶ low use trails, woods or open areas with low foot traffic, and roadways.
- 2. Intermittent Use:**
 - ▶ footpaths/trails within moderate to high use areas; roadway intersections in high use areas; dispersed campgrounds and picnic areas; parking lots adjacent to moderate-low use areas.
- 3. Frequent Use:**
 - ▶ campsites (particularly drive-in); high use picnic areas; visitor centers, shelters, and park administrative buildings and residences; interpretive signs, kiosks and scenic vistas; specially marked handicap-access areas; and parking lots adjacent to high use areas.

SIZE OF DEFECTIVE PART (S): 1-3 points

- 1.** Parts **less than 2** inches in diameter
- 2.** Parts from **2 to 10** inches in diameter
- 3.** Parts from **10 to 20** inches in diameter
- 4.** Parts **greater than 20** inches in diameter

PROBABILITY OF FAILURE: 1-3 POINTS

- 1. Low:** some minor defects present – minor branch dieback; minor defects or wounds
- 2. Moderate:** one to several moderate defects present
- 3. High:** multiple or significant defects present stem decay or cavity at shell safety limits;

OTHER RISK FACTORS: 0-2 points

- 0. Durable Species** - Not Prone To Failure (ex. Red Oak, Sugar Maple, etc.)
- 1. Average Species** - Moderate Strength
- 2. Weak Species/Dead Trees** - Prone To Failure (ex. Poplar, Willow, White Pine, etc.)

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APPENDIX D Recommended Trees for Williston, Vermont

The following pages are excerpted from the Recommended Trees for Vermont Communities, Vermont Urban & Community Forestry Program, April 2001. The resource will be provided along with this final inventory report. For further details please refer to this detailed and extremely useful guide established specifically for the state of Vermont.

Hardiness Zone

This is the lowest hardiness zone for the species/cultivar. Variations in the micro-site should be considered as they can impact plant hardiness.

Tolerances



Indicates the ability of the species/cultivar to withstand drought, poor drainage, alkaline soils, salt, and shade.

Limitations

- 1- Weak wood and/or branch structure-The tree is susceptible to breakage due to ice and snow accumulation and strong winds.
- 2- Litter/sanitation nuisance-Excessive littering of leaves, seeds, and fruit could create a clean up problem
- 3- Prone to major insect/disease problems-The tree is susceptible to numerous or serious insect/disease problems
- 4- Potentially invasive species-Species/cultivar has the potential to invade and naturalize in unwanted areas; plant with discretion
- 5- Limited availability-Species/cultivar may be difficult to locate at local nurseries
- 6- Problems with excessive sucker growth-Tree is prone to suckering from roots or lower stem and pruning may be required to maintain form
- 7- Requires well drained soil-Species/cultivar performs best on well drained soils such as sands, or coarse loams; avoid planting in low lying areas
- 8- Requires wet soil-species/cultivar performs best on moist, poorly drained soils such as clay, silt and fine loam; avoid planting on hilltops, dry slopes, and

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- excessively drained areas
- 9- Low urban tolerance-species/cultivar performs best in parks, lawns, and along residential streets with ample growing space

Mature Height

The total height of a typical street at maturity

S- <30 feet **M-** 30-50 feet **L-** >50 feet

Native Trees		
Common Name	Scientific Name	Size
Hackberry, Common	<i>Celtis occidentalis</i>	L
Hawthorn, Thornless Cockspur	<i>Crataegus crusgalli</i>	S
Hophornbeam	<i>Ostrya virginiana</i>	M
Hornbeam, American	<i>Carpinus caroliniana</i>	M
Nannyberry	<i>Viburnum lentago</i>	S
Serviceberry	<i>Amelanchier canadensis</i>	S
Serviceberry, Alleghany	<i>Amelanchier laevis</i>	S
Tupelo, Black	<i>Nyssa sylvatica</i>	L

Other Recommended Trees		
Common Name	Scientific Name	Size
Beech, European or Purple	<i>Fagus sylvatica (does not like salt)</i>	L
Chokecherry, Amur	<i>Prunus maackii</i>	M
Katsura tree	<i>Cercidiphyllum japonicum</i>	M
Sourwood	<i>Oxydendrum arboreum</i>	L
Yellowwood	<i>Cladrastis kentuckea</i>	M
Zelkova, Japanese	<i>Zelkova serrata</i>	L

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Trees for Dry Sites		
Common Name	Scientific Name	Size
Buckeye, Ohio	<i>Aesculus glabra</i>	L
Coffeetree, Kentucky	<i>Gymnocladus dioicus</i>	L
Corktree, Amur	<i>Phellodendron amurense</i>	M
Crabapple	<i>Malus spp.</i>	S
Gingko	<i>Ginkgo biloba</i>	L
Hackberry	<i>Celtis occidentalis</i>	L
Hawthorn	<i>Crataegus crusgalli</i>	S
Honeylocust	<i>Gleditsia trianchanthos var. inermis</i>	L
Hophornbeam	<i>Ostrya virginiana</i>	M
Lilac, Japanese Tree	<i>Syringa reticulata</i>	S

Trees for Wet Sites		
Common Name	Scientific Name	Size
Birch, River	<i>Betula nigra</i>	L
Elm, American	<i>Ulmus americana</i>	L
Hackberry	<i>Celtis spp.</i>	L
Honeylocust	<i>Gleditsia trianchanthos var. inermis</i>	L
Tupelo, Black	<i>Nyssa sylvatica</i>	L

Trees for High Salt Spaces		
Common Name	Scientific Name	Size
Birch, River	<i>Betula nigra</i>	L
Buckeye, Ohio	<i>Aesculus glabra</i>	L
Cherry, Sargent	<i>Prunus sargentii</i>	M
Crabapple	<i>Malus spp.</i>	S
Honeylocust	<i>Gleditsia trianchanthos var. inermis</i>	L
Lilac, Japanese Tree	<i>Syringa reticulata</i>	S
Maackia, Amur	<i>Maackia amurensis</i>	S
Mountain Ash, Swedish	<i>Sorbus intermedia</i>	S
Nannyberry	<i>Viburnum lentago</i>	S
Serviceberry	<i>Amelanchier spp.</i>	S

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Trees for Small Spaces		
Common Name	Scientific Name	Size
Crabapple	<i>Malus spp.</i>	S
Hawthorn	<i>Crataegus crusgalli</i>	S
Lilac, Japanese Tree	<i>Syringa reticulata</i>	S
Maackia, Amur	<i>Maackia amurensis</i>	S
Mountain Ash, Swedish	<i>Sorbus intermedia</i>	S
Nannyberry	<i>Viburnum lentago</i>	S
Serviceberry	<i>Amelanchier spp.</i>	S

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The following charts will further explain specific tree details.

Tree Specifics

Hardness Zone	Tolerance To				Limitations	Common Name	Scientific Name	'Cultivar'	Mature height	Crown Spread	Spring Planting	Under Power Line	Comments
	Drought	Poor Drainage	Alkaline Soil	Salt									
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5,9	Beech, European	<i>Fagus sylvatica</i>		L 50'	x		needs wide greenbelt and setback	
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1,8	Birch, River	<i>Betula nigra</i>		L 35'			improved urban tolerance over white birch	
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1,8	'Heritage'			L 35'				
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1,7	Cherry, Sargent	<i>Prunus sargentii</i>	'Columnaris'	M 15'	x			short-lived tree
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3,7	Chokecherry, Amur	<i>Prunus maackii</i>		M 30'				needs wide greenbelt and setback
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,5	Coffeetree, Kentucky	<i>Gymnocladus dioica</i>		L 55'				fruitless, vase shaped
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	'Espresso'			L 30'				fruitless, upright form
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	'Stately Manor'			L 20'				male clone
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Corktree, Amur	<i>Phellodendron amurense</i>	'Macho'	M 40'				
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,6,7	Crabapple	<i>Malus</i> spp.	'Adams', 'Centurion', 'Harvest Gold', 'Liset', 'Sugar Tyme'	S 15'		x		
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,5,6,7	'Adirondack'			S 10'		x		
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,6,7	'Donald Wyman', 'Indian Summer', 'Mary Potter', 'Katherine', 'Robinson'			S 20'		x		
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,6,7	'Crabapple	<i>Malus x zumi</i>	'Redbud'	S 25'		x		
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,6,7	Crabapple, Siberian	<i>Malus baccata</i>	'Jackii'	S 25'	x			
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Cyprus, Bald	<i>Taxodium distichum</i>		M 20'				conical form
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Elm, Accolade	<i>U.japonica</i> x <i>U.wilsoniana</i>	'Morton'	L 25'	x			disease resistant
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Elm, American	<i>Ulmus americana</i>	'Princeton'	L 60'				disease resistant
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	'Valley Forge'			L 75'				disease resistant
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	'Washington'			L 60'				disease resistant
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Elm, Lacebark	<i>Ulmus parvifolia</i>		L 35'				disease resistant
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	'Dynasty'			M 60'				disease resistant
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	Elm, Regal Hybrid	<i>Ulmus x 'Regal'</i>		M 55'				disease resistant
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2,5	Filbert, Turkish	<i>Corylus colurna</i>		L 45'				may require pruning for clearance
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5,7	Ginkgo	<i>Ginkgo biloba</i>	'Autumn Gold'	L 30'				select male only
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5,7	'Fairmount'			L 35'				fruitless male cultivar
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7	'Princeton Sentry'			L 30'				fruitless male cultivar
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7	Gum, Black	<i>Nyssa sylvatica</i>		M 25'	x			transplant balled and burlapped spring
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	Hackberry, Common	<i>Celtis occidentalis</i>		L 50'	x			
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1,3	'Prairie Pride'			L 45'	x			improved leaf appearance and habit

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Tolerance To		Limitations	Common Name	Scientific Name	'Cultivar'	Mature height	Crown Spread	Spring Planting	Under Power Line	Comments
Hardiness Zone	Drought									
4	4	1	Hackberry, Sugar	<i>Celtis laevigata</i>	'All Seasons'	L 40'	40'	x	x	sheltered location
4	4	2,7	Hawthorn, Green	<i>Crataegus viridis</i>	'Winter King'	S 25'	25'	x	x	sheltered location
5	5	5,7	Hardy Rubber Tree	<i>Eucommia ulmoides</i>		M 50'	50'			
4	4	2,3,7	Hawthorn, Thornless	<i>Cockspur Crataegus</i>	'var. inermis'	S 25'	25'	x	x	pois can create litter nuisance
4	4	1,3	Honeylocust	<i>Gleditsia triacanthos</i>	'Halika'	L 45'	45'			
4	4	1,3		'Imperial'		M 40'	40'			
4	4	1,3		'Moraine'		L 55'	55'			thornless and fruitless
4	4	1,3		'Shademaster'		L 55'	55'			thornless and fruitless, improved form
4	4	1,3		'Skyline'		L 60'	60'			upright branching
5	5	1,3		'Sunburst'		L 45'	45'			
4	4	5,7	Hophornbeam or Ironwood	<i>Ostrya virginiana</i>		M 35'	35'	x		poor performance as a street tree
3	3	5	Hornbeam, American or Muscledwood	<i>Carpinus caroliniana</i>		M 25'	25'	x		
5	5	5,7	Hornbeam, European	<i>Carpinus betulus</i>	'Fastigiata'	M 15'	15'	x		
4	4	3,7	Horsechestnut, Common	<i>Aesculus hippocastaneum</i>	'Baumanni'	M 50'	50'			fruitless cultivar, suffers leaf scorch
5	5	5	Horsechestnut, Ruby Red	<i>Aesculus x carnea</i>	'Briotii'	M 40'	40'			nearly fruitless, bright red flowers
5	5	1	Katsuratree	<i>Cercidiphyllum japonicum</i>		M 35'	35'	x		requires watering to establish
3	3		Lilac, Japanese Tree	<i>Syringa reticulata</i>	'Ivory Silk'	S 15'	15'		x	
3	3			'Summer Snow'		S 20'	20'		x	
3	3	5,6	Linden, Crimean	<i>Tilia x euchlora</i>		L 25'	25'			
3	3		Linden, Silver	<i>Tilia tomentosa</i>		L 55'	55'			more pest resistant than other lindens
4	4	2	Maackia, Amur	<i>Maackia amurensis</i>		S 35'	35'		x	
4	4	5	Magnolia, Loebner	<i>Magnolia x loebneri</i>	'Merrill'	M 25'	25'			
3	3	2,4,7	Maple, Amur	<i>Acer ginnala</i>		S 15'	15'	x	x	potentially invasive
4	4	1	Maple, Freeman	<i>Acer x freemanii</i>	'Autumn Blaze'	L 45'	45'	x		
4	4	1		'Celebration'		L 30'	30'	x		
5	5	2,7	Maple, Hedge	<i>Acer campestre</i>		M 30'	30'	x		requires pruning for clearance
5	5	5,9	Maple, Paperbark	<i>Acer griseum</i>		M 30'	30'	x		ornamental bark
5	5	5	Maple, Purpleblow	<i>Acer truncatum</i>		M 30'	30'			requires pruning to maintain single stem
4	4	1	Maple, Red	<i>Acer rubrum</i>		L 40'	40'	x		all red maples require acid soils

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Hardiness Zone	Tolerance				Limitations	Common Name Scientific Name 'Cultivar'	Mature height	Crown Spread	Spring Planting	Under Power Line	Comments
	Drought	Poor Drainage	Alkaline Soil	Salt							
4	█	█	█	█		Maple, Red <i>Acer rubrum</i> 'Autumn Flame'	L 50'	x			
4	█	█	█	█	1	'Bowhall'	L 25'	x			
5	█	█	█	█		'October Glory'	L 45'	x			Plant in sheltered location
4	█	█	█	█		'Red Sunset'	L 45'	x			improved branch structure
3	█	█	█	█	7,9	Maple, Sugar	L 60'				better as a park tree than a street tree
4	█	█	█	█	7,9	'Green Mountain'	L 50'				needs wide greenbelt and setback
4	█	█	█	█	7,9	'Legacy'	L 35'				more drought tolerant than species
3	█	█	█	█	5,7,9	'Majesty'	L 45'				improved resistance to sunscald
3	█	█	█	█	2	Maple, Tatarian <i>Acer tataricum</i>	S 20'	x		x	
4	█	█	█	█	2,3,7,9	Mountain Ash, Korean, <i>Sorbus alnifolia</i>	M 25'				Specimen tree for lawns & parks
3	█	█	█	█	5,6	Nannyberry, Tree Form, <i>Viburnum lentago</i>	S 10'		x		Good for naturalized areas
3	█	█	█	█	1,2	Oak, Bur <i>Quercus macrocarpa</i>	L 70'	x			needs wide greenbelt and setback
5	█	█	█	█	2,5	Oak, Chinkapin <i>Quercus muehlenbergii</i>	L 55'	x			needs wide greenbelt and setback
5	█	█	█	█	2	Oak, English <i>Quercus robur</i> 'Fastigiata'	L 15'	x			narrow form, good for restricted spaces
4	█	█	█	█	2	'Regal Prince'	L 20'	x			narrow form, good for restricted spaces
4	█	█	█	█	2,5	'Skymaster' or 'Pyramich'	L 30'	x			pyramidal form, strong branch structure
4	█	█	█	█	2,7	Oak, Northern Red <i>Quercus rubra</i>	L 55'	x			
4	█	█	█	█	1,2	Oak, Pin <i>Quercus palustris</i>	L 50'	x			low branching, requires acid soils
4	█	█	█	█	2,5	Oak, Shingle <i>Quercus imbricaria</i>	L 45'	x			
4	█	█	█	█	2,5	Oak, Scarlet <i>Quercus coccinea</i>	L 45'	x			
3	█	█	█	█	2	Oak, Swamp White <i>Quercus bicolor</i>	L 60'	x			will tolerate some flooding
5	█	█	█	█	1	Pear, Callery <i>Pyrus calleryana</i> 'Aristocrat'	M 30'	x			more susceptible to fire blight
4	█	█	█	█	1	'Autumn Blaze'	M 30'	x			some thorns, susceptible to fire blight
5	█	█	█	█	1	'Chanticleer' or 'Cleveland Select'	M 15'	x			good choice where space is limited
5	█	█	█	█	1	'Redspire'	M 30'	x			slightly improved branch structure
5	█	█	█	█	1,7	Redbud, Eastern <i>Cercis canadensis</i>	S 25'	x			
5	█	█	█	█	1,2,5	Scholar Tree <i>Sophora japonica</i> 'Princeton Upright'	M 30'	x			sheltered location, summer flowers
5	█	█	█	█	1,2,5	'Regent'	M 35'	x			sheltered location, summer flowers
3	█	█	█	█	1,6,7	Serviceberry <i>Amelanchier canadensis</i>	S 15'				

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Tolerance To		Common Name	Scientific Name	Limitations	Mature Height	Crown Spread	Spring Planting	Under Power Line	Comments
Hardiness Zone	Drought								
4	<input type="checkbox"/>		Common Name Scientific Name 'Cultivar'		S	15'			
4	<input type="checkbox"/>		Serviceberry, Allegheny <i>Amelanchier laevis</i>	7	S	15'	X	X	
4	<input type="checkbox"/>		'Cumulus' Tree Form	7	S	15'			
4	<input type="checkbox"/>		Serviceberry, Apple <i>Amelanchier x oxaniflora</i> 'Autumn Pink'	1.7	S	15'	X	X	
4	<input type="checkbox"/>		'Autumn Sunset'	1.5.7	S	15'	X	X	
4	<input type="checkbox"/>		'Robin Hill'	1.7	S	15'	X	X	
5	<input type="checkbox"/>		Sourwood <i>Oxyeleoalum zthoreum</i>	5.7	L	40'	X		Sheltered location, needs
4	<input type="checkbox"/>		Yellowwood <i>Cladrastis kentuckea (Jules)</i>	1.5.7	M	50'			
5	<input type="checkbox"/>		Zelkova, Japanese <i>Zelkova serrata</i> 'Green Vase'	1	L	55'	X		sheltered location
5	<input type="checkbox"/>		'Village Green'	1	L	55'	X		sheltered location

UNDESIRABLE SPECIES TO PLANT

Common Name	Scientific Name	Limiting Factor
Black Locust	<i>Robiniana pseudoacacia</i>	High risk of branch failure, susceptible to borer infestation
Boxelder	<i>Acer negundo</i>	High failure rate
Catalpa	<i>Catalpa spp.</i>	High risk of failure due to internal decay
Cottonwood	<i>Populus deltoides</i>	Weak wood, high failure rate
Green Ash	<i>Fraxinus pennsylvanica</i>	Over planted species
Littleleaf Linden	<i>Tilia cordata</i>	Becoming over planted
Norway Maple *	<i>Acer platanoides</i>	Over planted species, potentially invasive
Poplar	<i>Populus spp.</i>	Weak wood, high failure rate
Siberian Elm	<i>Ulmus pumila</i>	High risk of branch failure, poor branch structure
Silver Maple	<i>Acer sacharinum</i>	Poor branch structure, high rate of failure for old, mature trees
Silver Poplar	<i>Populus alba</i>	Weak wood, high failure rate
Tree of Heaven	<i>Ailanthus altissima</i>	High failure rate when large, invasive species
Willow	<i>Salix spp.</i>	High rate of failure, limbs fail during snow and ice storms

*The use of all Ash, Maple, Oak, & Linden species should ONLY BE used when all other selections have been exhausted. There is an extreme over abundance of the species in the Town's street tree population.

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APPENDIX E
Tree Species Strength Ratings

Species Ratings				
Common Name	Botanical Name	Species Rating	Code	Code2
Shadblow or Serviceberry	Amelanchier canadensis	0	A1	AMCA
Amelanchier species	Amelanchier spp.	0	A2	AMSP
Crimson King Norway Maple	Acer platanoides x Crimson King	2	A3	ACPL2
Hedge Maple	Acer campestre	0	AC	ACCA
Amur Maple	Acer ginnala	0	AG	ACGI
Sugar Maple	Acer saccharum	0	AM	ACSA2
Norway Maple	Acer platanoides	2	AP	ACPL
Red (Swamp) Maple	Acer rubrum	1	AR	ACRU
Silver Maple	Acer saccharinum	2	AS	ACSA1
European White Birch	Betula pendula	1	BE	BEPE
Grey Birch	Betula populifolia	2	BG	BEPO
River Birch	Betula nigra	0	BN	BENI
Paper Birch	Betula papyrifera	1	BP	BEPA
Ironwood	Carpinus betulus	0	CB	CABE
English Hawthorn	Crataegus laevigata	0	CE	CRLA
Katsura tree	Cercidiphyllum japonicum	0	CJ	CEJA
Kousa Dogwood	Cornus kousa	0	CK	COKO
Yellowwood	Cladrastis kentukea	1	CL	CLLU
Hackberry	Celtis occidentalis	1	CO	CEOC
Washington Hawthorn	Crataegus phaenopyrum	0	CP	CRPH
Northern Catalpa	Catalpa speciosa	1	CS	CASP
White Ash	Fraxinus americana	1	FA	FRAM
American Beech	Fagus grandifolia	0	FG	FAGR
Green Ash	Fraxinus pennsylvanica	1	FP	FRPE
European Beech	Fagus sylvatica	0	FS	FASY1
Copper or Purple Beech	Fagus sylvatica 'Purpurea'	0	FX	FASY2

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Ginkgo	Ginkgo biloba	0	GB	GIBI
Honeylocust	Gleditsia triacanthos	0	GT	GLTR
GoldenrainTree	Koelreuteria paniculata	0	KP	KOPA
Sweetgum	Liquidambar styraciflua	0	LS	LIST
Tuliptree	Liriodendron tulipifera	1	LT	LITU
Flowering Crabapple	Malus x spp.	0	MA	MAFL80
Sourwood	Oxydendrum arboreum	0	OA	OXAR
Sargent Cherry	Prunus sargentii	1	P1	PRSA
Purpleleaf Plum	Prunus spp. x cistena	1	P2	PRCI
Black/Wild Cherry	Prunus serotina	0	P3	PRSE
Norway Spruce	Picea abies	1	PA	PIAB
Callery Pear	Pyrus calleryana 'Bradford'	2	PC	PYCA
Japanese Flowering Cherry	Prunus serrulata	1	PF	PRCI
White Spruce	Picea glauca	1	PG	PIGL1
Higan Cherry	Prunus subhirtella	1	PH	PRSU
Pitch Pine	Pinus rigida	1	PI	PIRI
Kwanzan Cherry	Prunus serrula 'Kwanzan'	1	PK	PRSE1
Amur Corktree	Phellodendron amurense	1	PL	PHAM
Sycamore	Platanus occidentalis	0	PO	PLOC
Colorado Blue Spruce	Picea pungens	1	PP	PIPU
Red Pine	Pinus resinosa	1	PR	PIRE
Eastern White Pine	Pinus strobus	1	PS	PIST
London Planetree	Platanus x acerifolia	0	PX	PLAC
Yoshino or Mt. Fuji Cherry	Prunus serrula 'Mt. Fuji'	1	PY	PRSE2
White Oak	Quercus alba	0	QA	QUAL
Pin Oak	Quercus palustris	0	QP	QUPA
Red Oak	Quercus rubra	0	QR	QURU
Black Oak	Quercus velutina	0	QV	QUVE
Black Locust	Robinia psuedoacacia	2	RP	ROPS

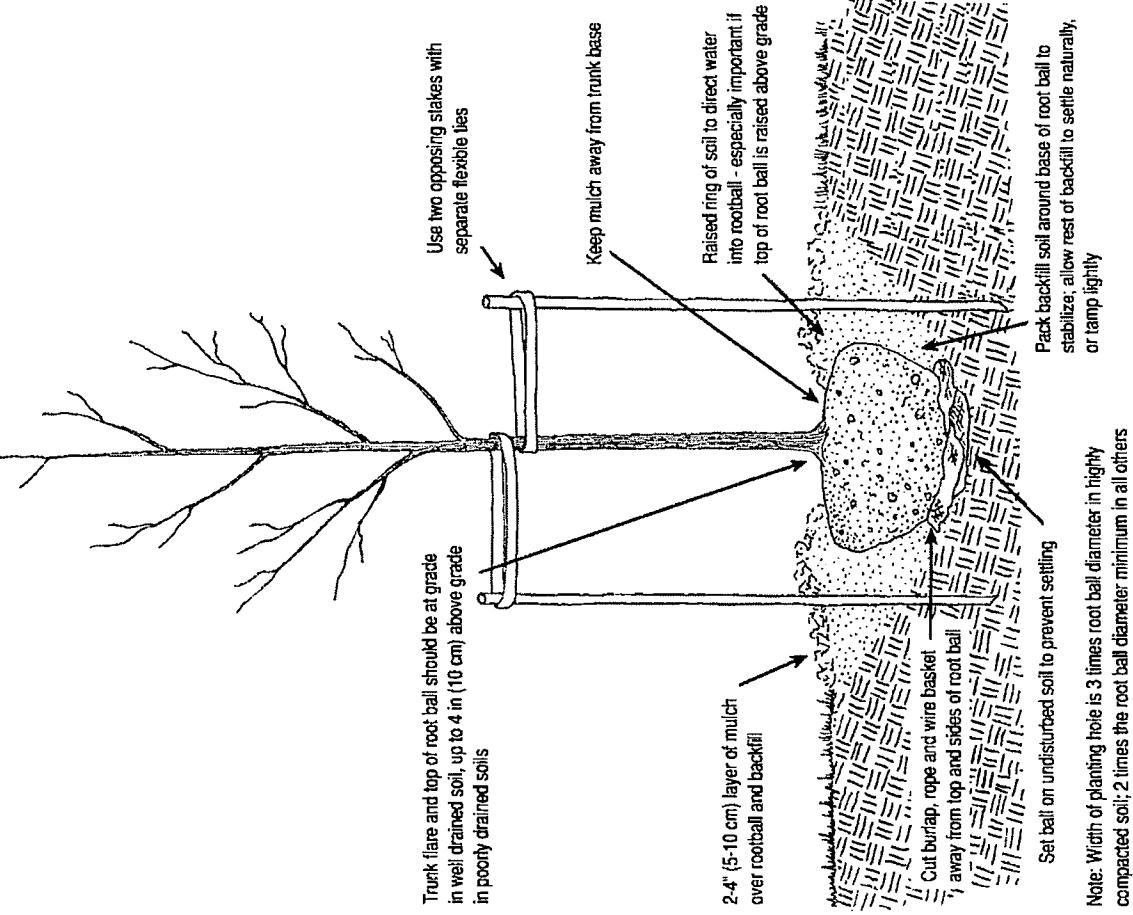
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European Mountainash	Sorbus aucuparia	2	SA	SOAU
Weeping Willow	Salix babylonica	2	SB	SABA
Crack Willow	Salix fragilis	2	SF	SAFR
Scholar Tree	Sophora japonica	0	SJ	SOJA
Black Willow	Salix nigra	1	SN	SANI
Japanese Tree Lilac	Syringa reticulata	0	SR	SYRE
American Linden	Tilia americana	0	TA	TIAM
Baldcypress	Taxodium distichum	0	TD	TADI
Littleleaf Linden	Tilia cordata	0	TL	TICO
American Arborvitae	Thuja occidentalis	2	TO	THOC
Canadian Hemlock	Tsuga canadensis	0	TS	TSCA
American Elm	Ulmus americana	0	UA	ULAM
Lacebark Elm	Ulmus parvifolia	1	UL	ULPA
Siberian Elm	Ulmus pumila	2	US	ULPU
Japanese Zelkova	Zelkova serrata	1	ZS	ZESE

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APPENDIX F
Tree Planting Diagram

Credit: University of Connecticut Extension



**TREE INVENTORY - MAPPED
STREETS**

