

Officer's Row Preserve

Sustainability Plan & Planting Program



Mike Duddy, Tree Warden, Town of Cape Elizabeth
December 2016

MEMORANDUM

To: Bob Malley, Public Works Director
From: Mike Duddy, Tree Warden
Re: Officer's Row Preserve Sustainability Plan & Planting Program
Date: December 12, 2016

EXECUTIVE SUMMARY

Officer's Row Preserve is one of the most important features of Fort Williams Park. Many of the trees in the Preserve, however, are showing signs of decline. Worse, the Preserve consists predominantly of Red oak trees, and Red oak trees in Cape Elizabeth are extremely vulnerable to attack by Winter Moth (*Operophtera brumata*). Although the Winter Moth infestation has not yet reached Fort Williams Park, it will likely do so within a season or two, and all of the Red oak trees in the Preserve will be threatened. While there are steps (ie. banding, spraying) that can be taken to help protect individual Red oak trees after Winter Moth arrives in the Park in force, plans need to be made and implemented now to protect the long term integrity of the Preserve. In order to manage Officer's Row Preserve for sustainability, the Preserve's diversity must be greatly enhanced. Accordingly, it is important to begin an aggressive program of under planting the existing canopy with new trees and replacement trees. The trees planted should be hardwood trees which evidence little to no susceptibility to Winter Moth defoliation. The purpose of this memo is to (1) describe the current status of the trees in Officer's Row Preserve; (2) propose planting 82 new or replacement trees in the Preserve over the next 10 years; and (3) provide an estimate of costs.

BACKGROUND

The 2004 Fort Williams Forestry and Arboriculture Assessment and Maintenance Program (the "2004 Forestry Plan") describes Officer's Row Preserve as "one of the seminal areas of woody vegetation that defines the vegetation of the Park." 2004 Forestry Plan p. 10. The 2004 Forestry Plan identifies Officer's Row Preserve as Section 6.2, which is an area in the center of the Park extending from Ocean Road to the Officer's Quarters Buildings and including the Bandstand. Officer's Row Preserve logically also includes Section 6.7, which the 2004 Forestry Plan refers to as a "successional growth area." According to the 2004 Forestry Plan, Section 6.7 "is an open area of trees that has developed similarly to the Officer's Row Preserve," and "should be managed similarly to the Officer's Row Preserve." 2004 Forestry Plan p. 17. Accordingly, for

purposes of this discussion, Officer's Row Preserve is considered to consist of the two areas identified as Sections 6.2 and 6.7 in the 2004 Forestry Plan. See Map 1, which displays the location of Officer's Row Preserve in relation to Sections 6.2 and 6.7.

DATA COLLECTION

The location of the individual trees in the Officer's Row Preserve was surveyed in the fall of 2016 using one or more Total Stations. Coordinate information obtained from the Total Stations was converted to a projected coordinate system (NAD 1983 UTM Zone 19N) for display using ArcGIS software. Individual tree data, including species, diameter at breast height ("DBH"), and condition were also collected in the fall of 2016, along with measurements of average stand height. Field data were also collected on the location of benches, grills, sidewalks, paths, roads, rocky outcrops, and shrubs.

AREA AND FEATURES

Officer's Row Preserve consists of 3.2 total acres, oriented in a northeast/southwest direction, bounded on three sides by secondary, paved, park roads, and on the fourth side by an iron fence. See Map 2, which displays the location of Officer's Row Preserve within Fort Williams Park.

The Preserve contains 175 trees. Within the Preserve, there is one section of paved road, along with a paved sidewalk. There are also paths, picnic areas, benches, grills, rocky outcrops not suitable for growing trees, and a bandstand. If these areas are subtracted from the total area, Officer's Row Preserve consists of 2.8 net usable acres for tree growth. See Map 3, which shows the distribution of features in Officer's Row Preserve.

STAND DIVERSITY

For purposes of arboricultural management, the three key levels of botanical classification for trees are family, genus, and species. The diversity of a stand of trees can be described with reference to each of these three levels of botanical classification. As a general matter, Officer's Row Preserve consists mostly of Red oak trees, belonging to the oak genus, which in turn is assigned to the oak and beech family.

Table 1 provides a summary of stand diversity at the family level. There are ten families represented in the 175 trees that constitute Officer's Row Preserve. Of these ten families, 71% of the trees are classified in the family Fagaceae, which is the scientific name for the oak and beech family; 10% of the trees are classified in the family Betulaceae, which is the birch family; and 9% of the trees are classified in the family Aceraceae, which is the maple family. The other seven families have very small representation in Officer's Row Preserve.

Table 2 provides a summary of stand diversity at the genus level. The statistics for genus diversity are exactly the same as for family diversity, because every family of trees in Officer's Row Preserve is represented by exactly one genus. Thus, 71% of the trees in the Officer's Row

Preserve are classified in the genus *Quercus*, which is the oak genus; 10% of the trees are classified in the genus *Betula*, which is the birch genus; 9% of the trees are classified in the genus *Acer*, which is the maple genus. Each of the remaining seven genera are represented by small percentages of trees.

Table 3 provides a summary of stand diversity at the species level. The numbers here are slightly different than for family and genus diversity, because there are two different species of oaks present in Officer's Row Preserve (Red oak and White oak), and two different species of maples present (Red maple and Sugar maple). Accordingly, there are a total of 12 different species represented in Officer's Row Preserve.

The numbers are nevertheless still skewed disproportionately toward oaks. *Quercus rubra* (Red oak) constitutes 70% of all the trees in Officer's Row Preserve; 10% of the trees are *Betula papyrifera* (White birch); 7% of the trees are *Acer rubra* (Red maple); and 5% of the trees are *Fraxinus americana* (White ash). There are small percentages of trees for each of the remaining eight species. See Map 4, which depicts tree species diversity for Officer's Row Preserve.

STAND DENSITY, TREE DIAMETER, AGE & STAND HEIGHT

As mentioned above, Officer's Row Preserve contains 175 trees distributed over 2.8 net usable acres. This results in 62 trees per acre. It also results in 148 square feet of basal area per acre. Basal area is a forestry metric which consists of the summation of the cross sectional area occupied by the diameter of each of the trees. (Basal area in sq. ft. = $\sum(0.005454 \times \text{DBH}^2)$). Along with trees per acre, basal area per acre is a metric used to quantify and compare tree stand density.

The smallest diameter trees in Officer Row Preserve are 1 inch DBH. The largest diameter tree in the Preserve measures 46 inches DBH. The mean DBH of all trees in the Officer's Row Preserve is 19 inches. See Map 5 for a display of tree diameters in Officer's Row Preserve. Average stand height is 55 feet.

The 2004 Forestry Plan indicates that the larger, mature oaks were established in the early 1900s, 2004 Forestry Plan p. 10, which means the larger oaks are presently about 100 years old. While diameter is not necessarily correlated with age, the smaller diameter, mature trees in the Preserve are estimated to be from 40 to 80 years old. Trees in the Preserve, however, have not been cored, and extensive heart rot in the stumps of removed trees prevents accurate tree ring analysis of age.

STAND CONDITION

Overall, 129 (74%) of the trees in Officer's Row Preserve are in good condition (defined as likely to survive for more than 10 years)¹; 36 (21%) of the trees are in fair condition (defined as likely to survive 4 -10 years); and 10 (6%) of the trees are in poor condition (defined as likely to survive 0 - 3 years). See Table 4, which presents a summary of stand condition. Also see Map 6, which shows the location of good, fair, and poor trees in the Preserve.

Red oak makes up the lion's share of trees in good and fair condition. See Tables 5 and 6, which present summaries of trees in good and fair condition. White birch makes up fully half of the trees in poor condition. See Tables 6 and 7, which present summaries of trees in fair and poor condition.

Taking a closer look at the condition of the Red oak trees in the Preserve, 119 (97%) of the Red oak trees are in good (98 trees) or fair (21 trees) condition. See Table 8, which summarizes condition data for Red oak. Taking a closer look at the condition of White birch trees in the Preserve, 14 (82%) of the White birch trees are in fair (9 trees) to poor (5 trees) condition. See Table 9, which summarizes condition data for White birch. In other words, most of the Red oak trees in the Preserve are in decent health, while most of the White birch trees are in declining health.

MANAGING FOR DIVERSITY

Stand diversity is important for sustainability. As a general proposition, the greater the diversity among trees in a stand, the greater the sustainability of the stand of trees. For many years, urban forest managers have used the 30/20/10 rule as a guideline to manage diversity. John Ball, The 5 Percent Rule, American Nurseryman (digital edition), January 21, 2015. Under the 30/20/10 rule, no more than 30% of the trees in a town forest (or applicable management unit, such as a contiguous stand of trees) should belong to any one family. No more than 20% of the trees should belong to any one genus, and no more than 10% of the trees should belong to any one species. Applying this rule Officer's Row Preserve, we see that stand diversity is woefully inadequate. Rather than 30/20/10, we have 71/71/70. Accordingly, using a conventional measure of stand diversity, Officer's Row Preserve is not very sustainable over time.

With the increasing occurrence of invasive insects and diseases causing widespread tree damage, a new diversity guideline is gaining traction. Tree pests frequently attack most or all of the species in any one genus, and thus managing for diversity at the species level does little to improve sustainability. For instance, Winter Moth attacks all species of oaks, not just Red oaks. Therefore, planting additional White oaks to supplement the Red oaks would do nothing to help protect the Preserve from Winter Moth attack.

¹ Estimates of survival do not take into account Winter Moth. If the Winter Moth infestation spreads to Fort Williams Park, and the oaks and other hardwoods in Officer's Row Preserve are not protected (by banding, spraying, etc.), then survival estimates could be significantly shortened.

Similarly, diversity at the family level does not appear to contribute to sustainability. For instance, the emerald ash borer (EAB) which has destroyed millions of ash trees from the Great Lakes to New Hampshire, and which will likely arrive in Maine within the next few years, attacks and kills all species of ash in the genus *Fraxinus*, but with one possible exception appears not to attack any other genera in the family *Oleaceae*. Therefore, working to increase diversity at the family level doesn't appear to be worth the effort.

As a result, urban forest managers have begun to use the 5% rule as a better guideline for managing diversity. John Ball, The 5 Percent Rule, American Nurseryman (digital edition), January 21, 2015. According to the 5% rule, no more than 5% of the trees in a stand should belong to any one genus. Applying this rule to Officer's Row Preserve, we see that diversity at the genus level is woefully inadequate: 71% of the trees in the Preserve belong to the genus *Quercus*, which is the oak genus.

Accordingly, in order to improve the sustainability of Officer's Row Preserve, we must begin aggressively managing for diversity at the genus level. Twenty percent diversity at the genus level is probably no longer sufficient. However, 5% genus diversity is probably unrealistic given the current composition of the trees in the Preserve. Taking into account the 30/20/10 rule and the 5% rule, it is more realistic and likely sufficient to manage Officer's Row Preserve so that no more than 10% - 20% of the trees in the Preserve belong to any one genus.

PLANTING PROGRAM

In order to reduce the percentage of Red oak trees in Officer's Row Preserve, and work toward the goal of 10% - 20% diversity at the genus level, we need to (1) plant new trees in the Preserve from genera other than *Quercus*, thereby increasing the overall number of trees in the Preserve; and (2) replace Red oak trees in fair to poor condition as they succumb, with trees from genera other than *Quercus*.

Map 7 identifies 36 planting locations for new trees. These locations represent spots where there are gaps in the tree canopy or stand density is a little thin, and where there appears to be sufficient soil for planting. Map 7 identifies another 10 locations for replacement trees. Each of these locations is adjacent to a tree in poor condition, which we can anticipate will fail or need to be taken down within the next three years.

Altogether, Map 7 identifies 46 planting locations. Public Works crews should plan on planting 10 trees per year for the next four years, with 6 trees planted in year 5. Generally speaking, the southwest end of the Preserve near Shore Road needs the most work, so planting locations near the southwest end of the Preserve should be filled in first, moving across the Preserve toward the northeast tip over the course of the five years. Trees in poor condition should be removed before a replacement tree is planted in the immediate vicinity.

At the end of five years, the total number of trees in Officer's Row Preserve will have been increased from 175 to 211. Of the total, there will be 121 trees in the genus *Quercus*. As Tables 10 and 11 illustrate, the percentage of trees in the *Quercus* genus will have been reduced from 71% to 57% (which represents only a reduction of from 124 to 121 oak trees, but the denominator is larger, going from 175 to 211 total trees).

In years six through ten, the goal is to maintain the overall number of trees in the Preserve at 211, and replace the trees in fair condition as they decline and need to be removed. There are presently 36 trees in fair condition. These trees should be replaced at the rate of 6 - 7 trees per year during years six through ten, with trees from genera other than *Quercus*. Of the 36 trees in fair condition, 22 are oaks in the genus *Quercus*. Once all of these trees have been replaced by year 10, the percentage of trees in the *Quercus* genus will have been further reduced from 57% to 47% (representing a reduction of from 121 to 99 oak trees).

Thereafter, the goal will be to maintain the number of trees in the Preserve at 211, and selectively replace oak trees which are now in good condition, but which will decline in health over time, with trees from other genera. Since the goal is to have no more than 10% - 20% of the trees in Officer's Row Preserve in any one genus, the number of oak trees in the Preserve ultimately needs to be reduced through attrition and removal to between 21 to 42 trees.

TREE SELECTION AND PLACEMENT

Several factors bear on tree selection for the planting program. Obviously, the goal of increasing diversity necessitates selecting trees other than oak trees for planting, but there are other factors to consider as well.

According to the 2004 Forestry Plan, the management goal for Officer's Row Preserve is to "Maintain high canopy oak and hardwood stand." 2004 Forestry Plan p. 13. This remains a viable overall objective, even though the diversity goals of this Sustainability Plan and Planting Program require reducing the heavy preponderance of oak trees in the Preserve. Accordingly, in order to remain consistent with the 2004 Forestry Plan, trees selected for the Planting Program need to be able to develop into high canopy hardwoods. Trees of small to medium stature, and conifers, can be ruled out.

Average stand height is 55 ft. Accordingly, trees selected from the planting program should be hardwood trees ultimately capable of reaching heights of approximately 50 ft or more.

The current major threat to Officer's Row Preserve is Winter Moth. In Cape Elizabeth, Winter Moth appears to prefer oaks, maples, ash trees, fruit trees (apples, cherries, etc.), and Japanese zelkova. Thus, all of these trees should be avoided. The major future threat to the Preserve is Emerald Ash Borer (EAB), which attacks and kills all ash trees. Thus, ash trees must also be avoided.

Finally, undertaking a program of planting new and replacement trees underneath an existing tree canopy requires being cognizant of the shade tolerance of different types of trees. Hardwoods which are intolerant of shade should only be planted along the perimeter of Officer's Row Preserve where there is sufficient sunlight. Hardwoods selected for planting in the interior of the Preserve should be tolerant or of intermediate tolerance to shade.

Taking all these factors into consideration, Table 12 contains a list of hardwood trees appropriate for planting in Officer's Row Preserve. The trees on the list are organized according to shade tolerance. A Field Planting Map, which is included as a loose map with this Memo, designates the specific trees chosen for planting in the 46 specific locations for years one through five. Trees of the same species are generally shown planted in clusters near each other, based on growing research demonstrating that trees of the same species benefit from having interconnected root systems. Depending on availability of planting stock and field experience over time, however, any trees on the list in Table 12 can be substituted for the specific trees shown on the Field Planting Map. Replacement trees for years six through ten should also be selected from among the trees listed in Table 12.

PLANTING AND TREE REMOVAL METHODS

Planting stock should be from 2.5 inches to 3.5 inches caliper. Trees planted along the perimeter of Officer's Row Preserve, or otherwise accessible from paved roads, can be planted as B&B stock with the assistance of heavy equipment to move the trees and dig planting holes. Heavy equipment must not be permitted in the interior of the Preserve, as the equipment will compact the soil and damage the roots of the existing canopy trees. Accordingly, all trees planted in the interior of the Preserve should be planted as bare root stock, or the B&B root ball should be bare rooted by using the root washing technique, and planting holes should be hand dug.

When removing trees, the same precautions should be observed. Bucket trucks and other heavy equipment can be used around the perimeter of Officer's Row Preserve and from paved roads, but the use of heavy equipment for tree removal cannot be allowed in the interior of the Preserve. Tree removal from the interior of the Preserve must be accomplished with climbers, and winching out or otherwise removing debris by hand.

ESTIMATED COSTS

The average cost of a new tree for planting, delivered to the site, is approximately \$450. The total cost of planting stock for the first four years (10 trees per year), is \$4,500 per year. The cost in year five (6 trees) is \$2,700. Total cost of planting stock for the first five years is \$20,700.

The average cost to remove a tree of the size typical of the 10 poor trees to be removed in the first five years is \$750 per tree. Accordingly, in addition to the cost of purchasing planting stock,

tree removal during the first five years will cost approximately \$7,500. Thus, total costs for the Planting Program during the first five years is approximately \$28,200.

Over the subsequent five years, the Planting Program calls for the removal of 36 trees, and the planting of 36 replacement trees. At today's costs, the total cost of the Planting Program over years six through ten is \$43,200. Adjusted for likely inflation, the costs will likely be in the range of \$45,000 to \$50,000.

Total ten year cost for planting stock and tree removal for the Officer's Row Preserve Sustainability Plan and Planting Program is estimated at approximately \$75,000 to \$80,000.

CONCLUSION

Officer's Row Preserve is one of the most important landscape features in Fort Williams Park. The Preserve is extremely vulnerable to attack by Winter Moth and other invasive tree pathogens. In order to promote the sustainability of Officer's Row Preserve over time, the Preserve must be managed to increase diversity at the genus level. Due to the expanding Winter Moth infestation in Cape Elizabeth, an aggressive Planting Program should be commenced starting in 2017, with challenging but feasible five and ten year diversity goals.

Table 1: Summary of Stand Family Diversity

Total Number of Trees = 175
 Total Number of Families = 10

Family	Number of Trees	Percentage
Fagaceae	124	71
Betulaceae	17	10
Aceraceae	15	9
Oleaceae	9	5
Juglandaceae	4	2
Ulmaceae	2	1
Magnoliaceae	1	1
Platanaceae	1	1
Rosaceae	1	1
Taxaceae	1	1

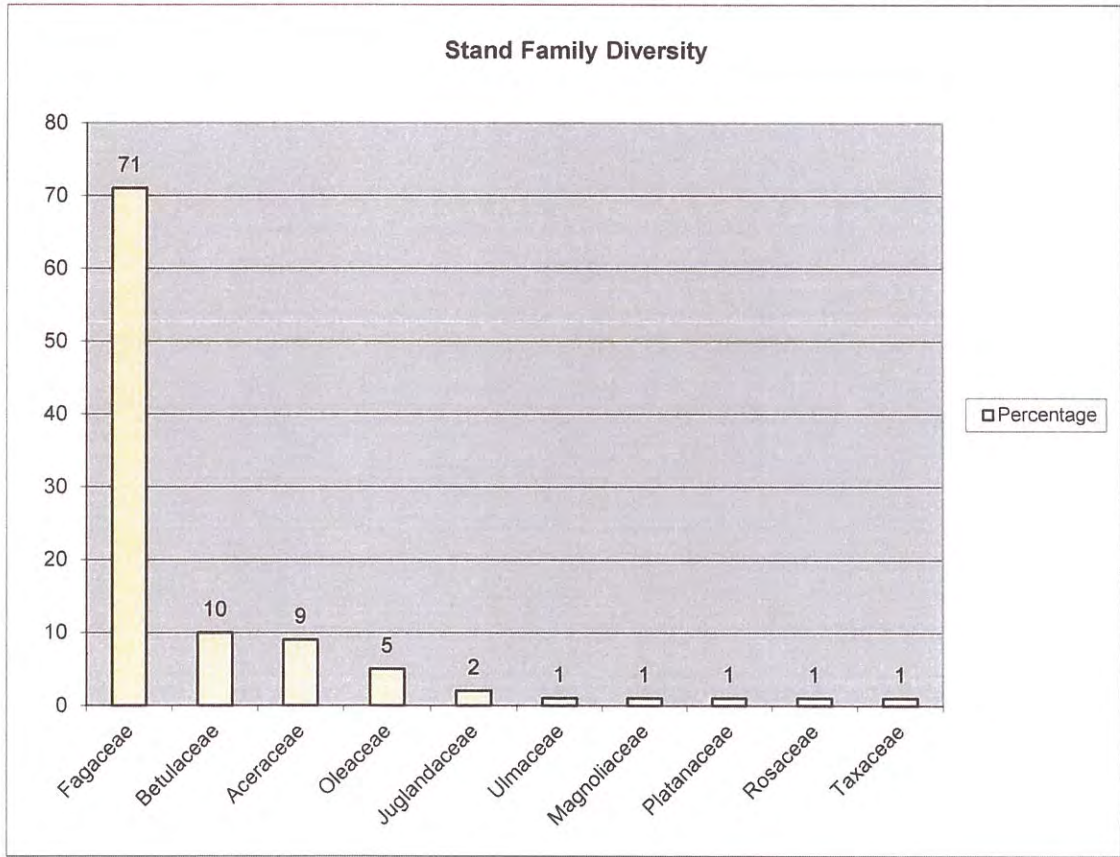


Table 2: Summary of Stand Genus Diversity

Total Number of Trees = 175

Total Number of General = 10

Genus	Number of Trees	Percentage
Quercus	124	71
Betula	17	10
Acer	15	9
Fraxinus	9	5
Carya	4	2
Ulmus	2	1
Taxus	1	1
Prunus	1	1
Platanus	1	1
Liriodendron	1	1

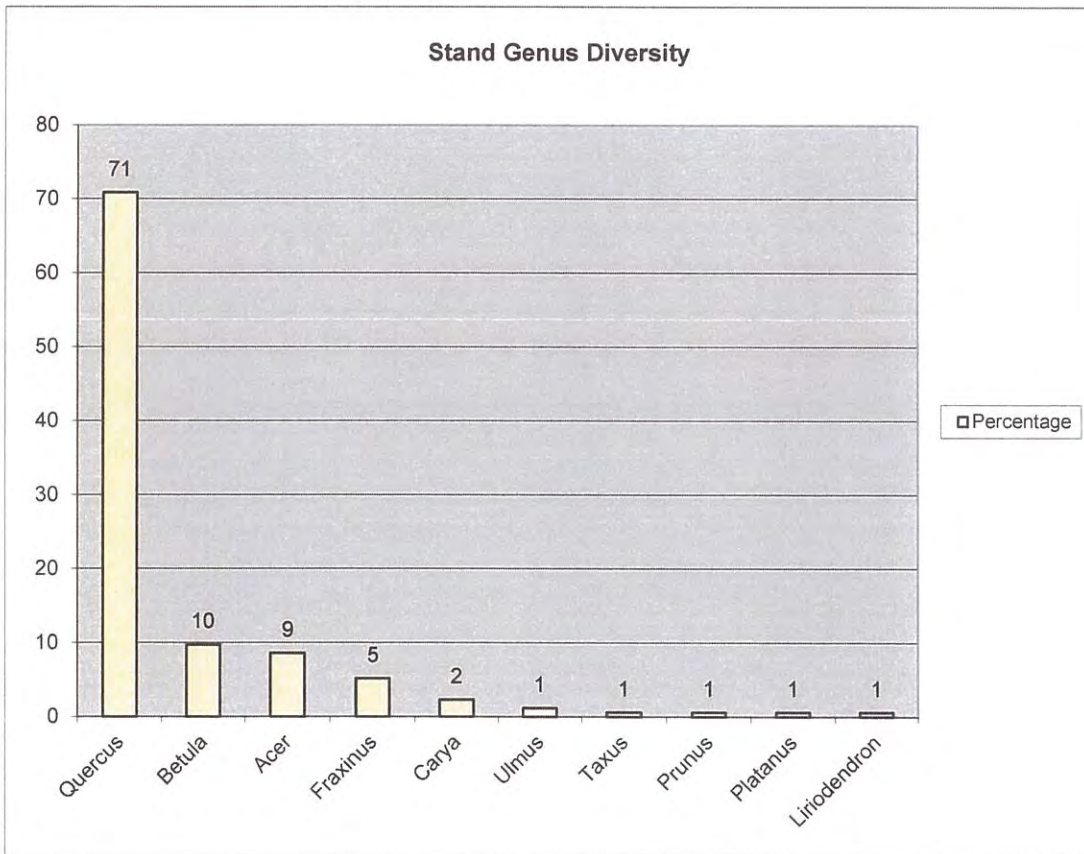


Table 3: Summary of Stand Species Diversity

Total Number of Trees = 175

Total Number of Species = 12

Species	Number of Trees	Percentage
<i>Quercus rubra</i>	122	70
<i>Betula papyrifera</i>	17	10
<i>Acer rubra</i>	12	7
<i>Fraxinus americana</i>	9	5
<i>Carya ovata</i>	4	2
<i>Acer saccharum</i>	3	2
<i>Quercus alba</i>	2	1
<i>Ulmus spp</i>	2	1
<i>Liriodendron tulipifera</i>	1	1
<i>Platanus occidentalis</i>	1	1
<i>Prunus serotina</i>	1	1
<i>Taxus spp</i>	1	1

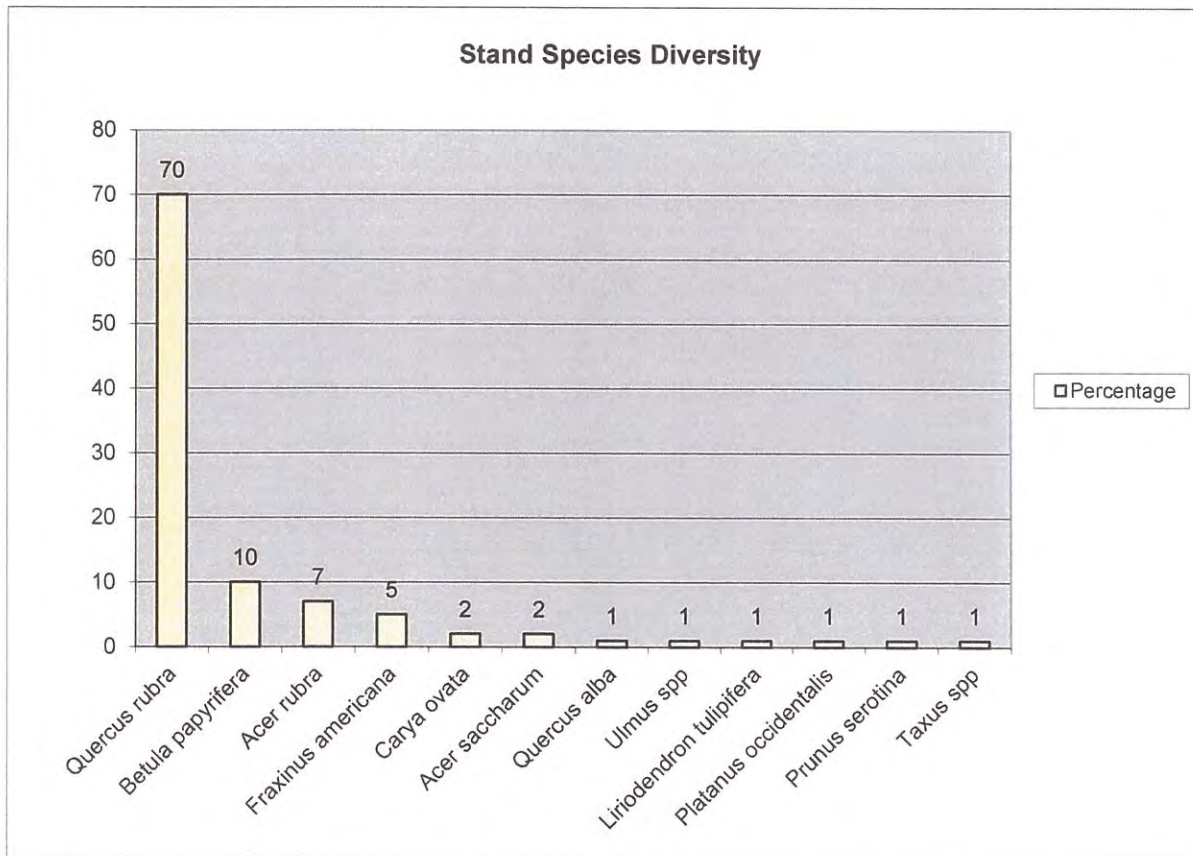


Table 4: Summary of Stand Condition

Total Number of Trees = 175

Condition	Number of Trees	Percentage
Good	129	74
Fair	36	21
Poor	10	6

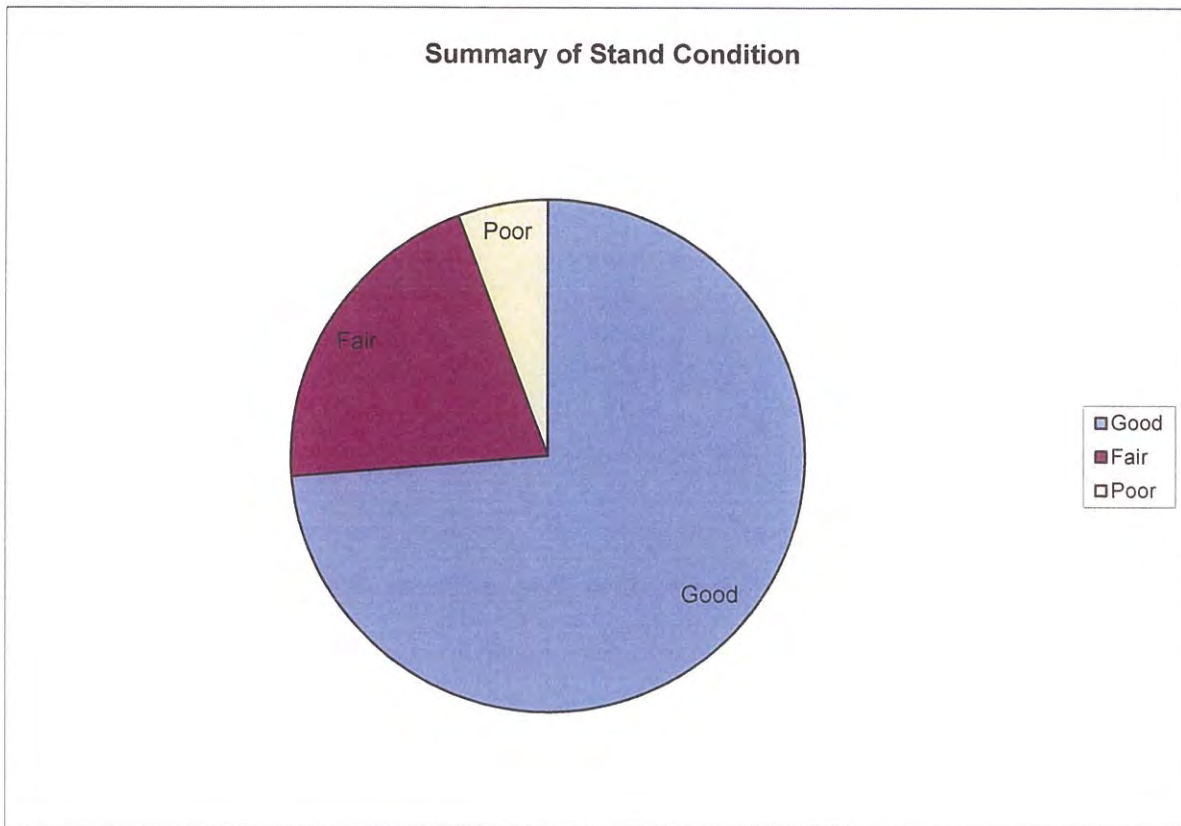


Table 5: Summary of Trees in Good Condition By Species

Total Number of Trees = 175

Total Number of Good Trees = 129

Species	Number of Trees	Percentage
<i>Quercus rubra</i>	98	76
<i>Acer rubra</i>	9	7
<i>Fraxinus americana</i>	7	5
<i>Carya ovata</i>	4	3
<i>Acer saccharum</i>	2	2
<i>Betula papyrifera</i>	3	2
<i>Ulmus spp</i>	2	2
<i>Liriodendron tulipifera</i>	1	1
<i>Platanus occidentalis</i>	1	1
<i>Quercus alba</i>	1	1
<i>Taxus spp</i>	1	1

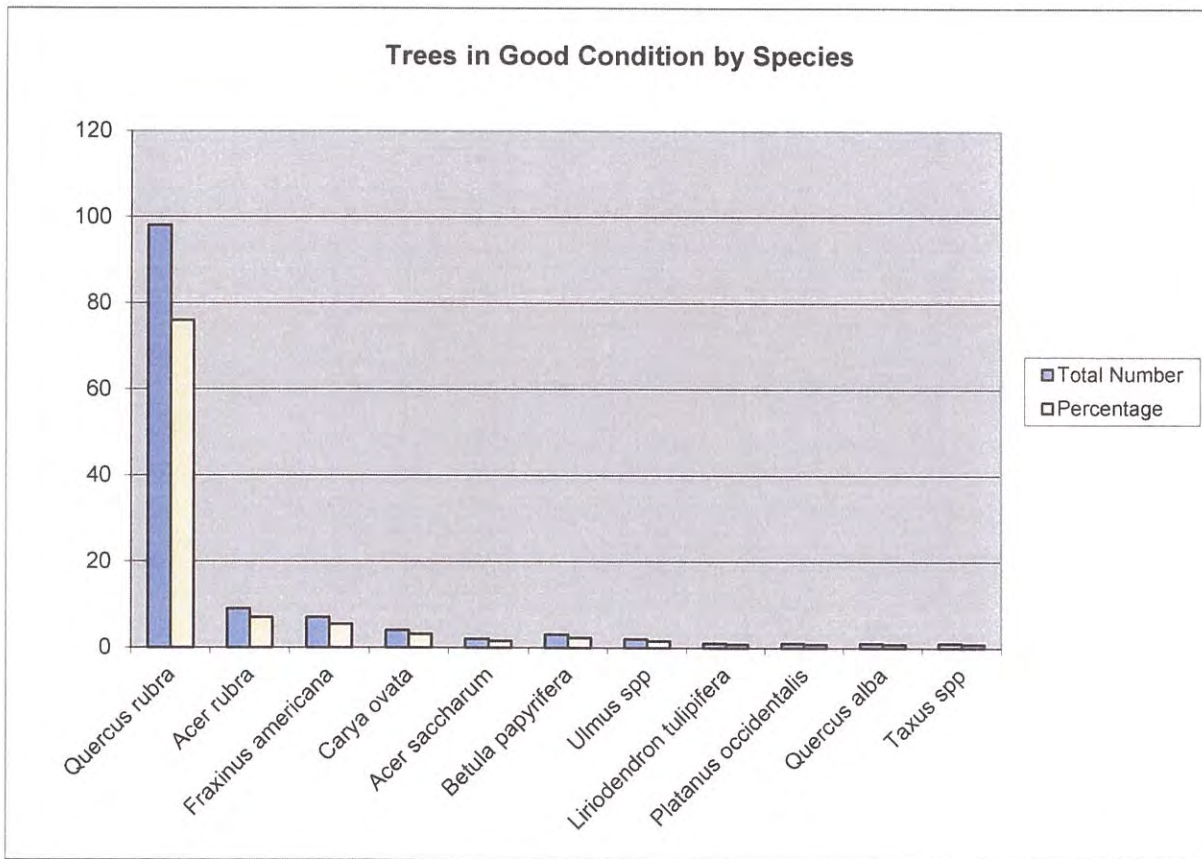


Table 6: Summary of Trees in Fair Condition By Species

Total Number of Trees = 175

Total Number of Fair Trees = 36

Species	Number of Trees	Percentage
Quercus rubra	21	58
Betula papyrifera	9	25
Acer rubra	2	6
Fraxinus americana	2	6
Prunus serotina	1	3
Quercus alba	1	3

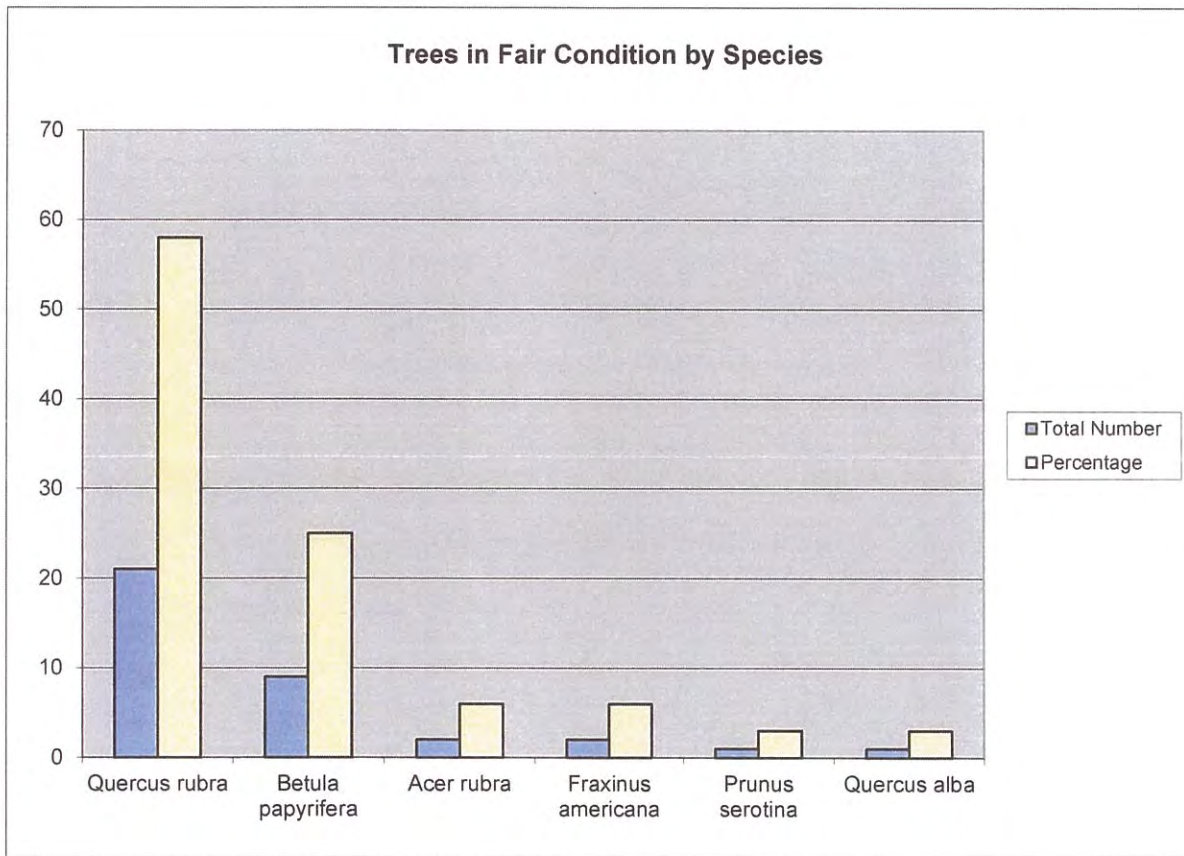


Table 7: Summary of Trees in Poor Condition by Species

Total Number of Trees = 175

Total Number of Trees in Poor Condition = 10

Species	Number of Trees	Percentage
Betula papyrifera	5	50
Quercus rubra	3	30
Acer rubra	1	10
Acer saccharum	1	10

Trees in Poor Condition by Species

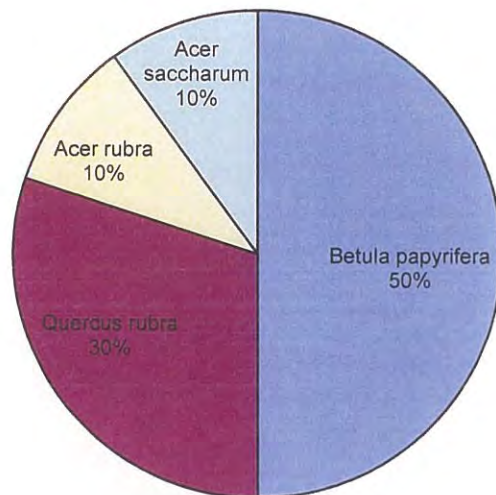


Table 8: Summary of Quercus Rubra (Red Oak) Condition

Total Number of Trees = 122

Condition	Number Trees	Percentage
Good	98	80
Fair	21	17
Poor	3	2

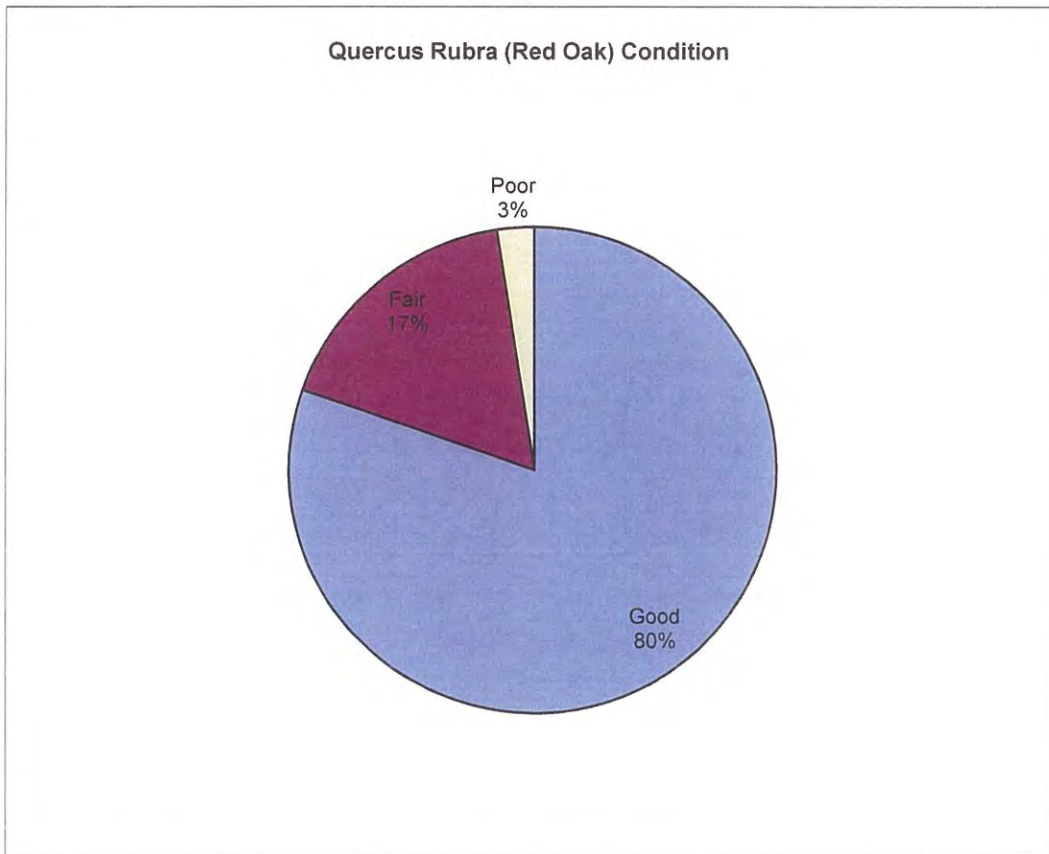


Table 9: Summary of Betula Papyrifera (White Birch) Condition

Total Number of Trees = 17

Condition	Number Trees	Percentage
Good	3	18
Fair	9	53
Poor	5	29

Betulus Papyrifera (White Birch) Condition

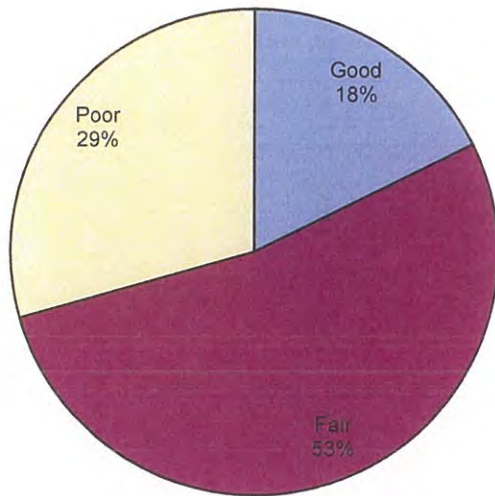


Table 10:
Summary of Stand Genus Diversity

Total Number of Trees = 175
Total Number of Genera = 10

Family	Number of Trees	Percentage
Fagaceae	124	71
Betulaceae	17	10
Aceraceae	15	9
Oleaceae	9	5
Juglandaceae	4	2
Ulmaceae	2	1
Magnoliaceae	1	1
Platanaceae	1	1
Rosaceae	1	1
Taxaceae	1	1

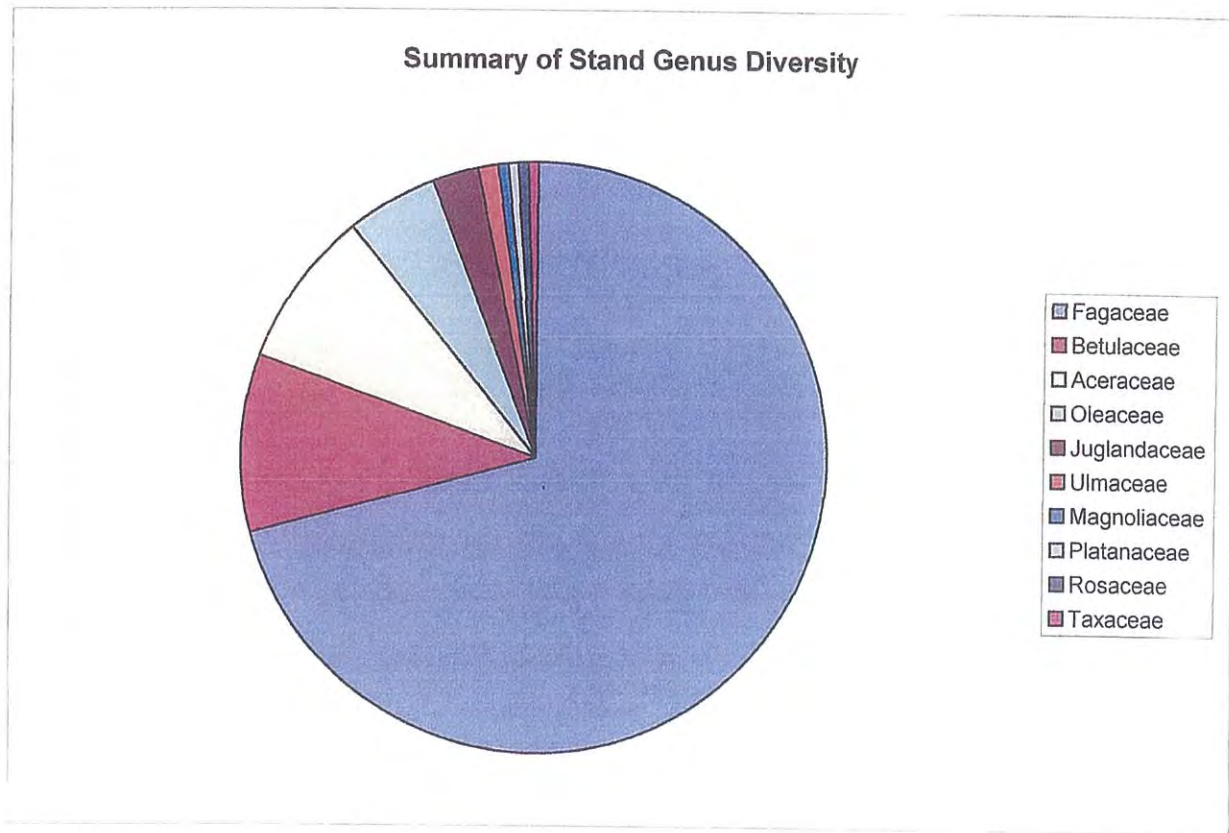


Table 11: Summary of Stand Genus Diversity Year 5

Total Genera = 20

Total Trees = 211

Genus	Number of Trees	Percentage
Quercus	121	57
Betula	17	8
Acer	13	6
Fraxinus	9	4
Carya	8	4
Liriodendron	6	3
Tilia	5	2
Platanus	4	2
Ulmus	4	2
Magnolia	4	2
Celtis	3	1
Fagus	3	1
Gymnocladus	3	1
Aesculus	2	1
Catalpa	2	1
Liquidambar	2	1
Nyssa	2	1
Prunus	1	1
Taxus	1	1
Juglans	1	1

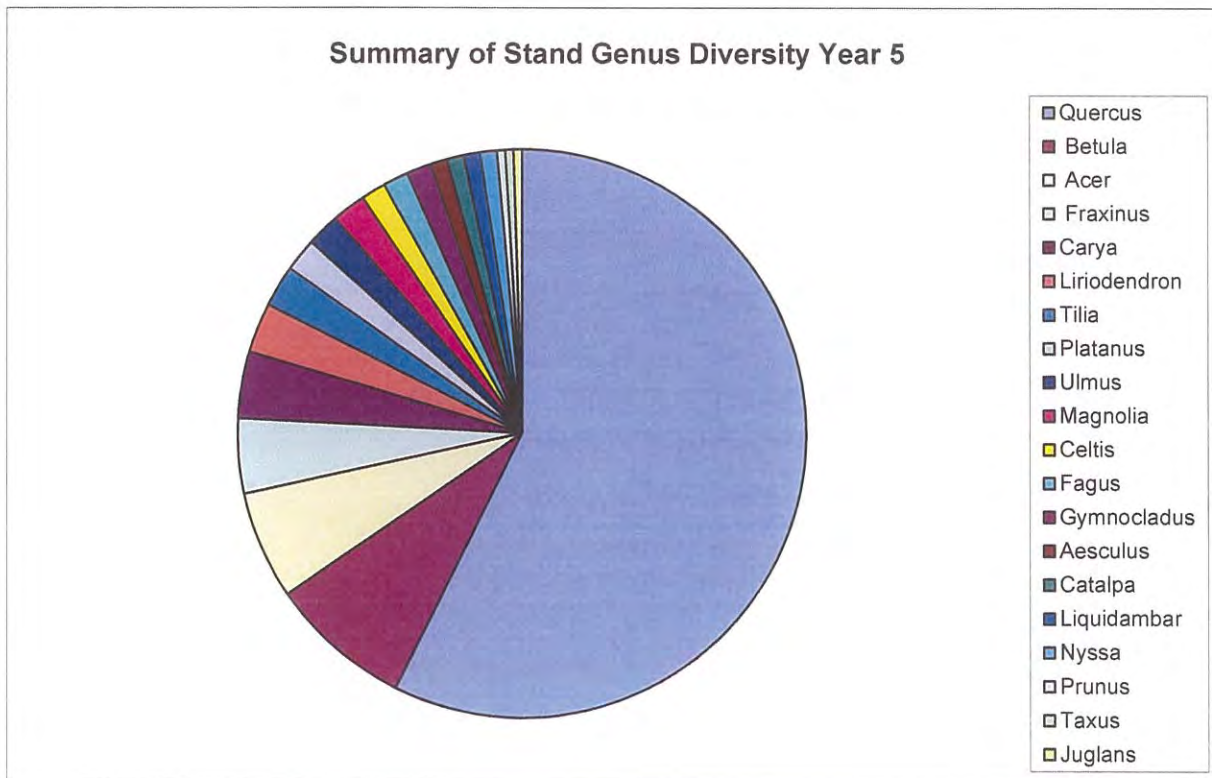


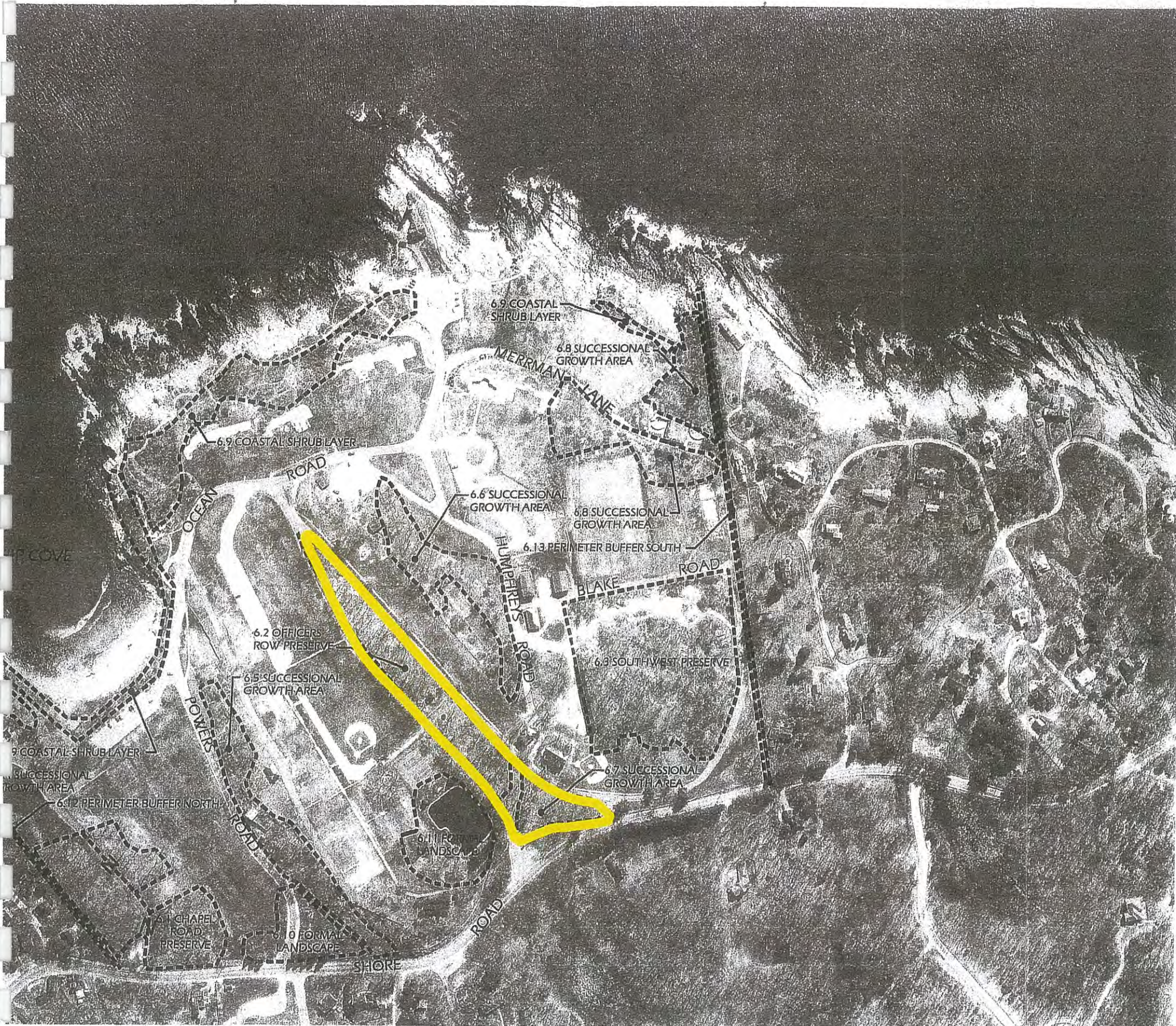
Table 12: List of Approved Trees for Planting in Officer's Row Preserve

<u>Species</u>	<u>Common Name</u>	<u>Expected Height (FT)</u>	<u>Native</u>	<u>Cultivar</u>
<u>Shade Tolerant Species</u>				
Aesculus hippocastanum	Horse chestnut	50 - 70	N	
Celtis laevigata	Sugarberry	60 - 80	N	
Fagus grandifolia	American beech	50 - 80	Y	
Fagus sylvatica	European beech	50 - 60	N	
Nyssa sylvatica	Blackgum	40 - 55	Y	
Tilia americana	Basswood	60 - 80	Y	
<u>Intermediate Shade Tolerant Trees</u>				
Betula alleghaniensis	Yellow birch	70 - 85	Y	
Carya glabra	Pignut hickory	50 - 80	Y	
Carya ovata	Shagbark hickory	60 - 70	Y	
Celtis occidentalis	Hackberry	40 - 60	Y	
Magnolia acuminata	Cucumbertree	50 - 80	N	
Platanus occidentalis	American sycamore	75 - 100	Y	
Ulmus americana	American elm	50 - 70	Y	Princeton
Ulmus parvifolia	Lacebark elm	40 - 50	N	
<u>Shade Intolerant Trees</u>				
Betula papyrifera	White birch	50 - 70	Y	
Catalpa bignonioides	Southern catalpa	40 - 60	Y	
Catalpa speciosa	Northern catalpa	40 - 60	Y	
Eucommia ulmoides	Hardy rubber tree	40 - 60	N	
Ginkgo biloba	Ginkgo	50 - 80	N	
Gymnocladus dioicus	Kentucky coffeetree	60 - 75	N	
Juglans nigra	Black walnut	50 - 75	N	
Liquidambar styraciflua	Sweetgum	60 - 75	N	
Liriodendron tulipifera	Tulip poplar	70 - 90	Y	

Map 1
Reference to
2004 Forestry Plan



Legend



OEST
Associates, Inc.
343 Carham Road · South Portland, ME 04106
Tel: (207)761-1770 Fax: (207)774-1246
Web: www.oest.com Email: mail@oest.com

FORT WILLIAMS ADVISORY COMMISSION
FORT WILLIAMS PARK FORESTRY PLAN
FORT WILLIAMS VEGETATION FEATURES

SCALE: AS NOTED
DATE : _____
DES BY: _____
DWN BY: _____
CHK BY: _____

PROJECT NO.
360.27.01

SHEET OF
1 1

DRAWING NO.
C-1

Cadd: 3602701_C1.dwg

FORT WILLIAMS FORESTRY PLAN

SCALE: 1"=100'

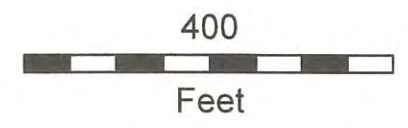
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Map 2

General Location
Officer Row Preserve



Legend

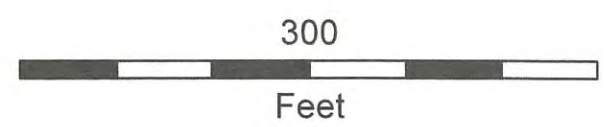


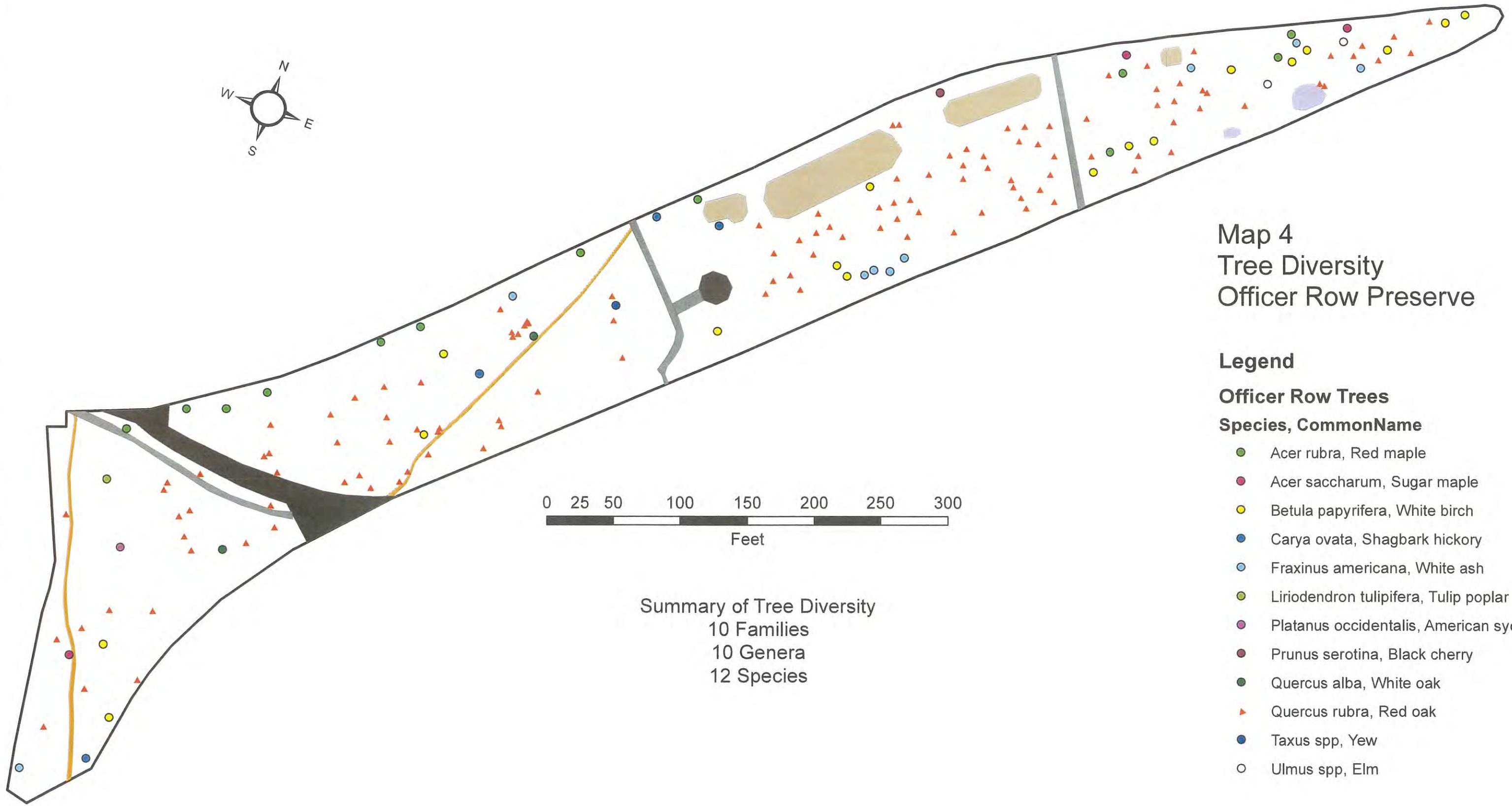
Map 3 Overview of Officer Row Preserve Features



Legend

- Grills
- Stumps
- Existing Trees
- Benches
- Shrubs
- Picnic Areas
- Paths
- Road
- Sidewalks
- Bandstand
- Rock Outcrops
- Contours 2ft
- ORP Boundary



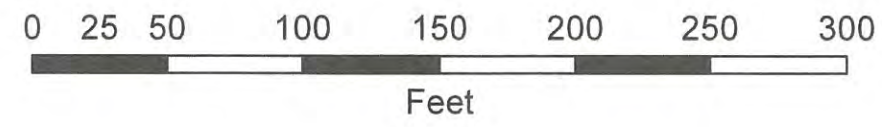


Map 4
Tree Diversity
Officer Row Preserve

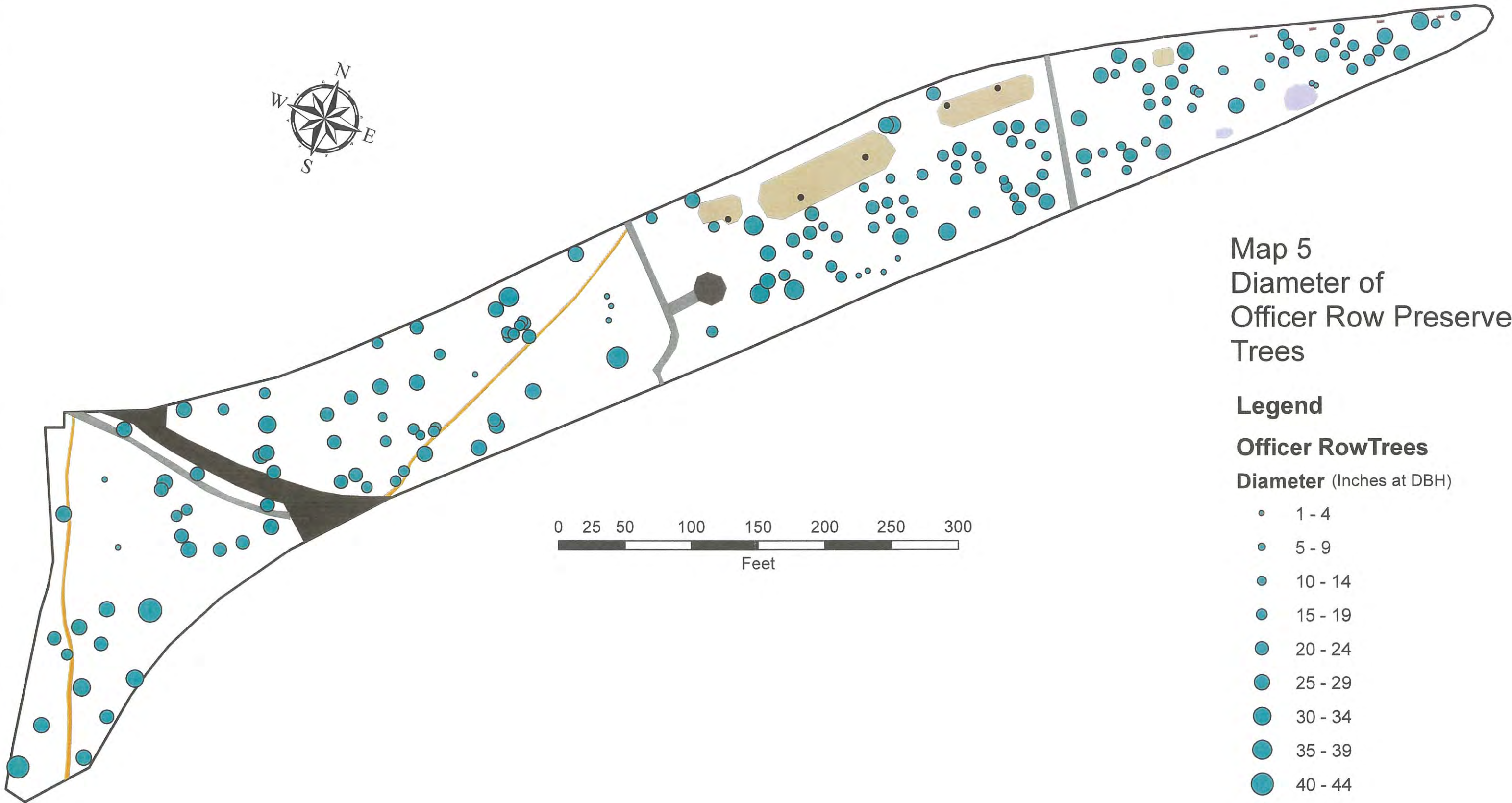
Legend

**Officer Row Trees
Species, CommonName**

- Acer rubra, Red maple
- Acer saccharum, Sugar maple
- Betula papyrifera, White birch
- Carya ovata, Shagbark hickory
- Fraxinus americana, White ash
- Liriodendron tulipifera, Tulip poplar
- Platanus occidentalis, American sycamore
- Prunus serotina, Black cherry
- Quercus alba, White oak
- ▲ Quercus rubra, Red oak
- Taxus spp, Yew
- Ulmus spp, Elm



Summary of Tree Diversity
 10 Families
 10 Genera
 12 Species



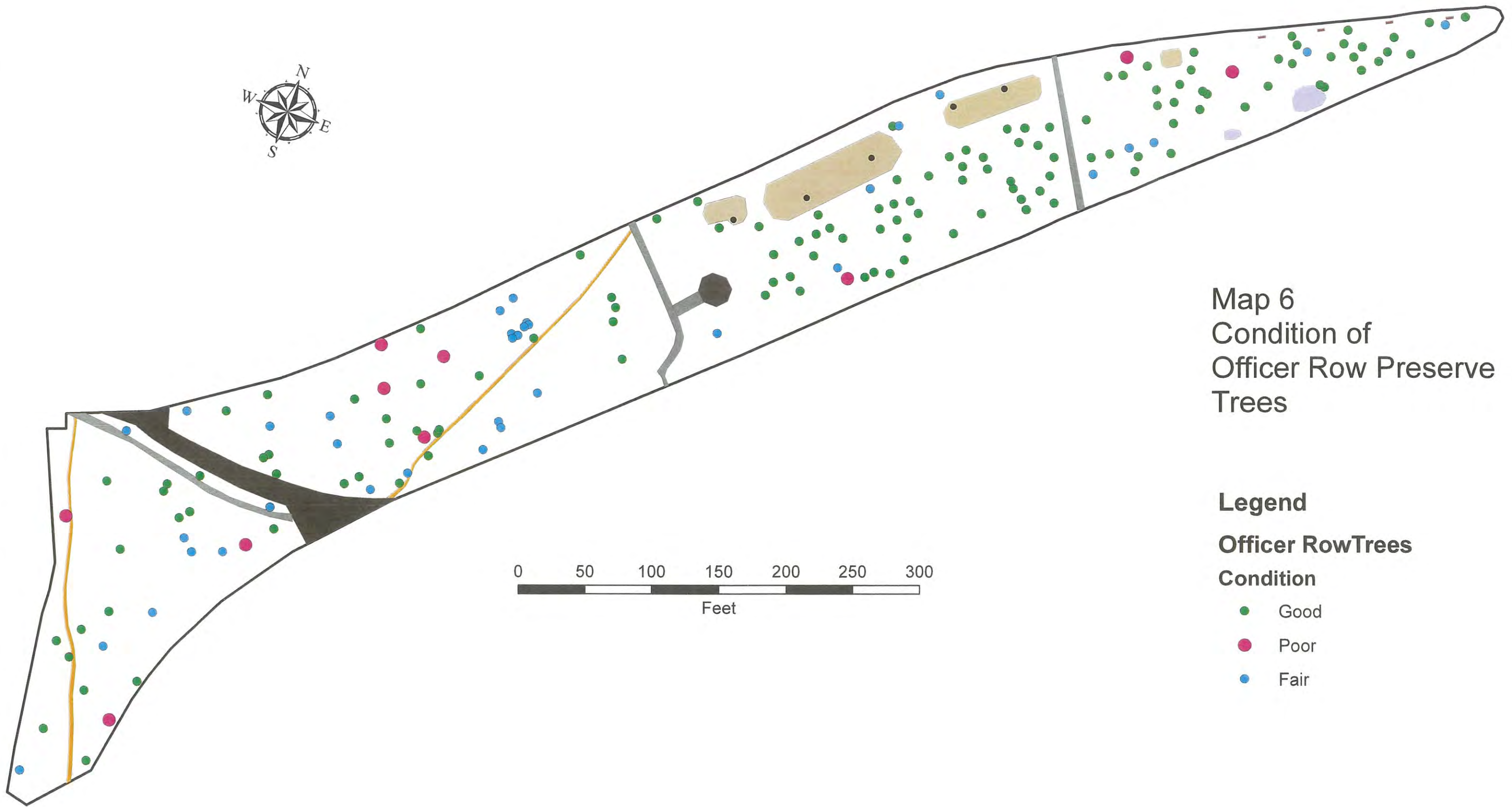
Map 5
Diameter of
Officer Row Preserve
Trees

Legend

Officer Row Trees

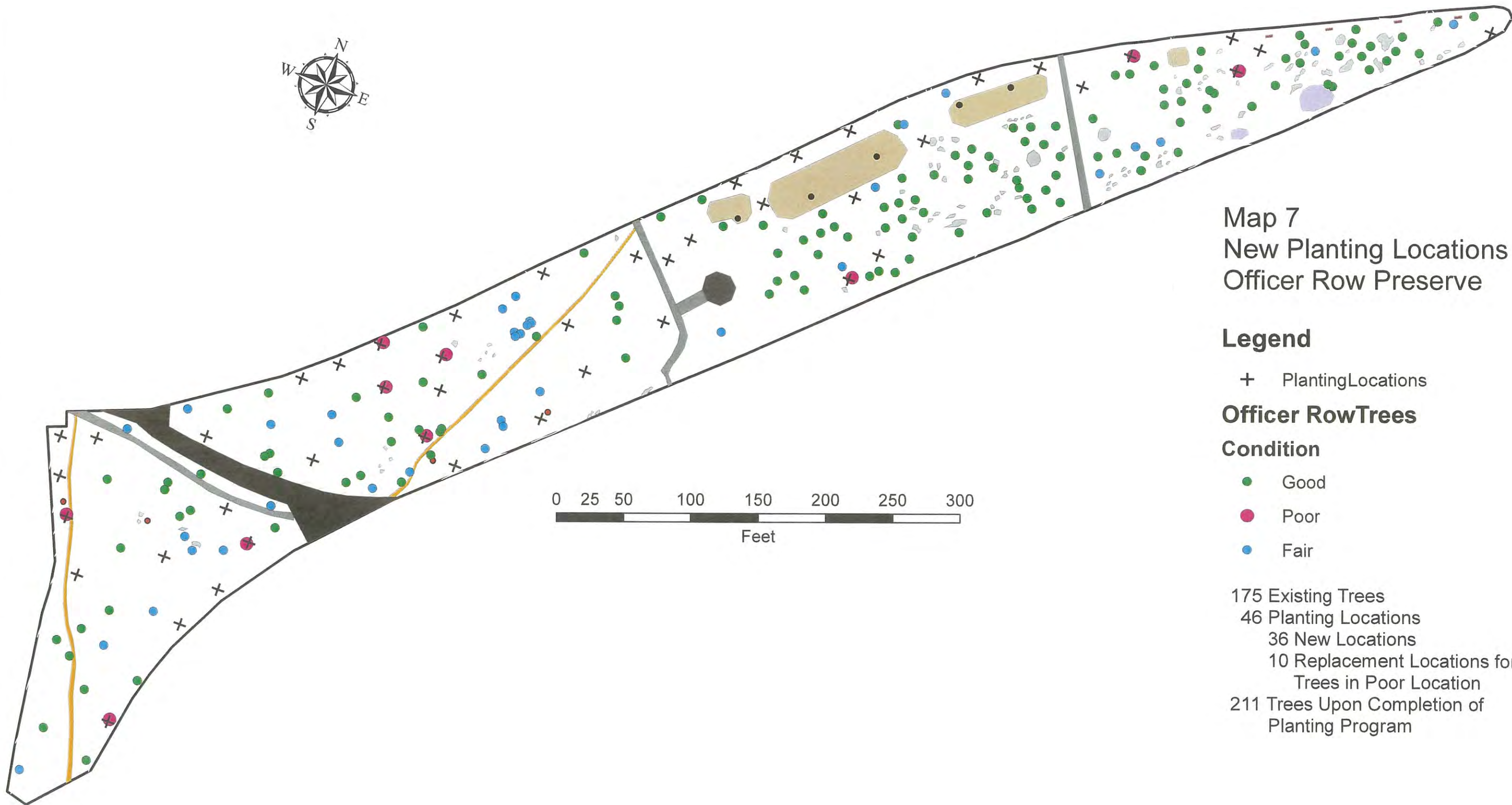
Diameter (Inches at DBH)

- 1 - 4
- 5 - 9
- 10 - 14
- 15 - 19
- 20 - 24
- 25 - 29
- 30 - 34
- 35 - 39
- 40 - 44
- 45 - 49



Map 6
 Condition of
 Officer Row Preserve
 Trees

- Legend**
- Officer Row Trees**
- Condition**
- Good
 - Poor
 - Fair



Map 7
 New Planting Locations
 Officer Row Preserve

Legend

+ Planting Locations

Officer Row Trees

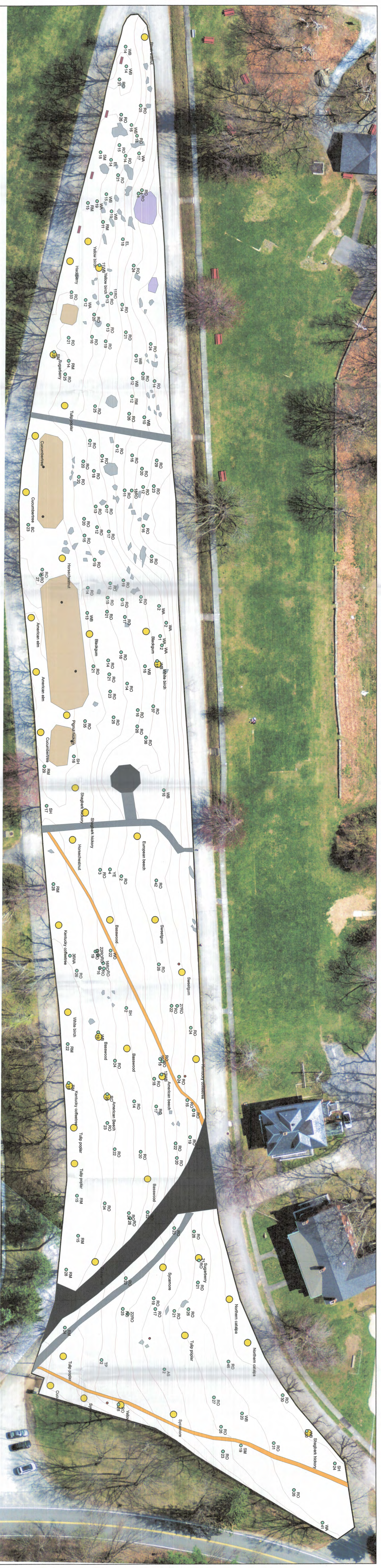
Condition

● Good

● Poor

● Fair

175 Existing Trees
 46 Planting Locations
 36 New Locations
 10 Replacement Locations for
 Trees in Poor Location
 211 Trees Upon Completion of
 Planting Program



Officer's Row Preserve: Planting Map



Legend

● Trees To Be Planted

Key to Abbreviations: (Existing Trees)

- | | | | | | |
|----|-------------|----|------------------|----|--------------|
| RO | Red oak | SH | Shagbark hickory | TP | Tulip poplar |
| WB | White birch | SM | Sugar maple | AS | Am. sycamore |
| RM | Red maple | WO | White oak | BC | Black cherry |
| WA | White ash | EL | Elm | YE | Yew |

