WFU Campus Tree Care Plan

Purpose

The overall goal of this plan is to ensure a safe, attractive, healthy and sustainable campus forest. The following guidelines will further this goal by providing designers, construction firms, landscaping personnel and other members of the university community with the tools needed to minimize the negative impacts of their programs on the university forest. A major contributor to the success of this plan will be a program of public education about tree care issues and North Carolina Arbor Day in March. By promoting thorough contemplation and conscientious action, this plan will provide for the proper care of the university's trees now to ensure optimal enjoyment and use of the university trees for generations to come.

Awareness and Responsibility: All persons working on Wake Forest University property will have knowledge of these guidelines before work begins. It is the contractor's or site manager's responsibility to ensure that his workers and sub-contractors understand and abide by these guidelines and any subsequent plans. Penalty assessments will be made in the event of any breach of these aforementioned guidelines and contractors may be required to reimburse Wake Forest for tree damages caused in failing to follow these guidelines

Responsible Department

Facilities and Campus Services – Landscaping Services Department

Campus Tree Advisory Committee

The Campus Tree Advisory Committee will be a formal standing committee sponsored by the Vice President for Administration and his or her Capital Planning Committee, composed of 6-8 members, one each from Landscaping Services, the Office of Sustainability, Facilities Planning & Construction, relevant academic departments and the Wake Forest Community at large. A student representative, appointed by the Student Sustainability Council will also serve on the committee.

The Committee will advise the university on proposed modifications to campus open space and landscaping to insure high aesthetic and functional quality; develop and maintain a list of satisfactory and desired species of

trees; encourage the use of an appropriate variety of plant materials in new plantings; and make recommendations on landscape renovations and maintenance.

Representatives will serve for three years with a renewal option at the end of their term with the exception of the student member, who will serve for one year. Terms correspond to the calendar year except for faculty and student terms, which correspond to the academic year with optional participation from May to August. The committee will meet twice per semester with additional meetings scheduled as needed throughout the year.

The Campus Tree Care Plan will be revisited by the Committee every five years to maintain relevancy.

Campus Arboriculture Practices

Planting and Landscaping

Tree species and/or cultivars included in the List of Recommended Trees shall be hardy to a minimum of USDA hardiness zone 7 and be pest resistant so as to minimize pesticide use and maintenance needs. In order to remain on the cutting edge of tree breeding, the University Arborist and the Director of Landscaping Services will have the final say on the appropriateness of species introduced to campus so long as the species is not included in the list of prohibited trees (Appendix A of this document).

Trees planted on the university grounds will be complementary to existing buildings and will be proportional in size to the surrounding buildings and landscape. Existing trees that block essential building vistas will be pruned judiciously to maximize the aesthetics of the vista while maintaining the health of the trees. Recommendations to remove trees to allow clear view and access of important building features will be given to the Tree Advisory Committee, by University Arborist and Landscaping Services Director for consideration.

Tree Planting Standards

- *Holes* must be at least twice as wide as the diameter of the root ball of a tree.
- *Trunk Flare* should be visible after the tree has been planted and mulched.
- *Height:* Before placing the tree in the hole, check to see if the hole is deep enough. The top of the root ball should be 2-3 inches above grade.
    - Avoid damaging the tree when setting it in the hole by always lifting by the root ball.
- *Straighten* the tree in the hole, being sure to view the tree from several directions to confirm the tree is straight.
- *Fill:* Fill about one third of the hole, then gently pack the soil around the root ball. If using a balled and burlap root ball, cut the twine, remove the top third of the wire basket and pull back the burlap to expose the top of the root ball. Fill in the remainder of the hole and gently pack to remove air pockets that may cause roots to dry out.
    - If the soil is poor or full of debris, it should be removed and replaced with fertile topsoil.
    - In the soil is compacted, it should be broken up, loosened and amended with composted organic material.
        - Composted organic material will improve the drainage and aeration of the clay soil.
        - This material should be incorporated at 25-50 percent of total soil volume in the rooting area.
- *Water:* thoroughly water in the root ball and add more soil if settling of backfill occurs
- *Mulch:* Cover the tree ring with 2-4 inches of mulch making sure the trunk is not covered. There should be a mulch free area of 1-2 inches from the trunk flare.

Trees Planted within Patio Spaces

- The minimum size for an in-pavement planter cutout is 4 feet by 4 feet in sidewalks, patios, and parking lots.
- If the soil is poor or full of debris, it should be removed and replaced with fertile topsoil.
- In the soil is compacted, it should be broken up, loosened and amended with composted organic material.
    - Composted organic material will improve the drainage and aeration of the clay soil.
    - This material should be incorporated at 25-50 percent of total soil volume in the rooting area.
- *Root Control Fabric* will be used when planting within a hardscape in order to control the growth of roots and prevent expensive damage of pavement and other landscaping details without permanent damage to the tree's root system.

Special Trees

Heritage Trees: individual trees on Wake Forest University campus that have developed exceptional historical, cultural, or aesthetic value because of their age, descent, legendary stature, contribution to the diversity of the campus landscape, exemplary representation of genus or species, rarity, or association with an important event or person. **Our expectation is that these trees will not be affected by development of the campus.**

- *Criteria:* The following will be seriously considered when designating a tree or group of trees as heritage trees.
    - Age is an important criterion and will vary by species.
    - Historic Significance is an association with an important event or person.
    - Location and Setting designates a contribution to a significant view or spatial structure of a setting.
    - Size or Habit designates an exemplary representation or a genus's or species' characteristics.
    - Diversity describes a significant contribution to the distinct plant life of campus.
- *Process:* The following process will be followed in order to designate trees not specified in this Tree Care Plan as heritage trees.
    - The University Arborist has determined initial designations after consultation with relevant university community members.
    - Subsequent nominations may be made by any member of the university community. Nominations should include a photo documentation of the candidate tree as well as a narrative explaining how the candidate tree fulfills a minimum of three criteria for heritage designation.
    - The Campus Tree Advisory Committee will review and evaluate all nominations. The university community will be notified of newly designated heritage trees.
    - To ensure appropriate protection of heritage trees and landmark space, Landscaping Services will maintain the list of heritage trees and landmark spaces and a map of their locations.
- For a listing of current heritage trees and their locations on campus, see Appendix B, "Heritage Trees."

Memorial Trees: Individuals and organizations seeking to dedicate a tree, plant, or bench in memory or honor of a member of the university community will adhere to the 2007 Policy and Process for Naming Memorials and Designated Spaces.

- The Director of Gift Stewardship is the initial contact for the donor. If requests for memorial trees fall within the standard guidelines, the Director of Gift Stewardship may proceed with the installation of the tree. All other requests must be directed to the Vice President for Administration.
- A minimum donation of $2,500 is requested to plant a memorial tree. The donation covers the purchase and installation of the tree and provides funds for future maintenance. Trees will not be plaqued.

- The Reynolda Campus Capital Planning Committee serves in an advisory role regarding special naming proposals. The Capital Planning Committee will review each proposal and make recommendations to the VP for Administration as approved, approved with conditions, or disapproved.
- *Recommended Tree Varieties for Memorial Trees*
    - *Ornamental Trees:* Japanese Maple (Acer palmatum); Crape Myrtle (Lagerstroemia indica); 'Oklahoma' redbud (Cercis reniformis 'Oklahoma'); Star Magnolia (Magnolia stellata); Kousa Dogwood
    - *Deciduous Trees:* American Beech (Fagus grandifolia); White Oak (Quercus alba); Shurmard Oak (Quercus shurmardii); 'Green Mountain' Sugar Maple (Acer Saccharinum 'Green Mountain'); 'October Glory' Red Maple (Acer Rubrum 'October Glory'); American Hornbeam (Carbinus Caroliniana)
    - *Evergreen Trees:* American Holly (Ilex opaca); Deodar Cedar (Cedrus Deodara); Norway Spruce (Picea Abies); Southern Magnolia (Magnolia grandiflora 'Bracken's Brown Beauty' or 'Little Gem')
- For a listing of current Memorial Trees, and their locations on campus, see Appendix C, "Memorial Trees."

Maintenance

Pruning Schedule: The maintenance pruning schedule shall be dictated by tree species, age, function, and placement.

- Trees less than 7 years old should receive structural pruning on an annual or biennial basis
- Trees 7-20 years old should receive structural pruning every two to five years.
- Trees 20 years old and older receive maintenance pruning every five to seven years to clean dead, diseased, dying, and defective branches from the crown.
- Trees adjacent to roadways, walkways, signs, and street lights are annually inspected for safety and clearance issues and maintenance pruned as necessary.

Pruning Practices: To encourage the development of a strong, healthy tree, the following guidelines shall be followed when pruning.

- Pruning shall not be conducted without a clear objective. The order of significance of objectives is as follows:
    1. Safety
    2. Health of tree
    3. Aesthetics
- When removing branches, the pruning cut shall not damage the branch park ridge and branch collar.
- Internode (heading) cuts should not be used except in storm response and crown restoration procedures.
- Branch reduction or thinning should be used to achieve pruning objectives rather than making large branch removal cuts.
- Large branches that are dead, diseased, dying or defective should be removed with the aid of ropes and rigging equipment to minimize the risk of tree injury from falling debris.
- *Thinning*: performed to reduce the density of branches, which increases light penetration, improves visibility, and decreases wind load.
    - Assess how a tree will be pruned from the top down.
    - Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark.

- Remove any branches that rub or cross another branch.
- Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the main stem to discourage the development of co-dominant stems.
- Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.

- *Raising*: performed to provide vertical clearance from thoroughfares, signs, street lights, and structures.
  - Maintain live branches on at least two-thirds of a tree's total height.
  - Remove basal sprouts and vigorous epicormic sprouts.
- *Reduction*: performed to decrease the overall height of a tree or to decrease the length of an individual branch.
  - Use only when absolutely necessary.
  - Make the pruning cut at a lateral branch that is at least one-third the diameter of the stem to be removed.
  - If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.

Cultural Practices

- *Mulching:* Every two years for trees up to approximately 6". Periodically, drip lines of larger trees and tree grouping are mulched extensively with waste woodchips.
  - Six foot diameter mulch areas shall be maintained around all trees. Mulch shall be maintained at a depth of one to three inches.
- *Irrigation:* New shrub and tree planting is hand watered from a spigot or a mobile water tank. Although time consuming, hand watering or spot watering is very water wise as only the plants that need water receive water rather that the entire surrounding landscape. Newly planted trees shall receive one inch supplemental water per week in the absence of 1 or more inches rainfall, for the first two years through the automatic sprinkler system or through hand-watering.
  - The rest of campus irrigation is PC controlled. These new systems are linked to a "weather station" on campus which shuts the system off in the event of a significant rain.
  - There are also flow sensors that monitor and shut off the system should a major leak occur. A notification from the PC informs Landscaping Services that there is a problem with the irrigation system, allowing a repair to occur in a timely manner.
- *Fertilization:* There is no regular tree fertilization beyond treatment received as a result of lawn fertilization. Specimen or high-value trees may receive prescription fertilization when severe nutrient deficiencies are diagnosed.
- *Pest Management:* Most pest management is handled through the university's integrated pest management plan, though trees may be treated for pest problems as needed. Should a pest infestation be suspected, please contact the University Arborist at 758-6072.
  - Integrated Pest Management (IPM) is a pest management strategy in which a combination of means including design choices, cultural practices and chemical controls are used to manage pests in the landscape. The university employs an integrated pest management system in all landscaping performed on the Reynolda Campus. A healthy sustainable landscape is dependent upon choosing the right plant for the site. The Landscaping Services department strives to use improved cultivars, disease resistant varieties and proven species whenever possible.
  - Several cultural practices are implemented in a successful IPM program. Soil is amended to promote healthy vigorous plants. Mulches are used to suppress weeds, insulate the soil and regulate moisture. Turf is mowed at regular intervals at the proper height and fertilized per North Carolina Department of Agriculture recommendations. Proper pruning is practiced on all trees and shrubs in accordance with the specifications outlined in the Campus Tree Care Plan. A wide variety of species are planted not only for visual interest but for genetic diversity. Older, more

disease prone varieties are gradually removed and replaced with disease and insect resistant varieties.

- As a last resort chemical means are used to control pests. Chemical controls are generally used only as a curative measure, however there are some circumstances where less chemicals used in a preventative application are more effective than a greater quantity of chemicals when curatively applied. The university is committed to using the least toxic chemicals available to control particular pests. Organic pesticides are used whenever possible.
- The university currently treats specific trees for pests including:
  - Carolina Hemlocks, treated for the Hemlock wooly adelgid
  - Nellie Steven's Hollies, treated for scale insects
  - American Holly, treated for Leaf Miners.

Removal

- Live trees are generally removed only when required to protect the public safety, when they interfere with construction, or detract from the quality of the landscape.
- Diseased trees are generally treated where the possibility of recovery is reasonable. Should the disease be irrecoverable, the tree will be removed for the publics' safety.
- Trees may only be removed after consultation with the Campus Tree Advisory Committee.
- A tree that is removed shall be replaced with the same species in the same location when appropriate if:
  - The stump can be removed to the extent necessary to replant.
  - There are no utility or location conflicts.
  - The species is not on the list of Prohibited trees
- *Notification:* The campus community will be notified of the removal of significant trees via a broadcast e-mail that includes that reasons for removal and a photo of the tree.

Emergency Situations

Storm response and recovery are generally accomplished in-house. Additional labor may be contracted. In a crisis, the first priority is to remove tree debris that blocks campus roads, disrupts operations, or poses hazards to the campus community. Once these needs are addressed, a recovery plan is implemented:

- Unsalvageable trees are systematically removed
- Salvageable trees are pruned to restore their health and structure.
- Lost trees are strategically replaced using the Tree Endowment Fund to restore the structure and function of the campus forest in a reasonable time frame.

Service Learning Opportunities

The Adopt an Area Program encourages service from the university's extensive Greek Life community with the goal of 100 percent participation from individual Greek organizations as well as the Pan-Greek organizations on campus. Groups can become involved in three ways:

- Participation in a Campus Clean-up
- A scheduled work day each semester
- Or a group can adopt an area of campus for continued care.

Fraternity members help mulch a campus natural area.

Prohibited Practices

Wake Forest University trees may not be used for any purpose that in any way would be detrimental to the trees. The activities restricted under this policy include but are not limited to:

- Posting of signs, artwork, or banners
- The hanging of hammocks, or the employment of slacklines
- Bicycle parking
- Leashing dogs
- Attaching any object to a tree
- Cutting down or otherwise destroying or damaging campus trees

The University Arborist has the authority to enforce these rules.

Protection and Preservation

Planning before Construction: In the early stages of construction planning, the Landscape Department will be notified in order to assess the trees and other green spaces within the proposed work site. Recommendations will be made based on this assessment and presented to the project manager and all appropriate personnel.

Any deviation from these standards must be approved in writing by the University Arborist or by the Director or Manager of Landscaping Services if the Arborist should be unavailable.

- *City Ordinance:* All construction projects and related tree protection measures will be executed in compliance with chapter B, article 3, section 4 of the City Council of the City of Winston-Salem, North Carolina's Unified Development Ordinances; "Landscaping and Tree Preservation Standards." This ordinance became effective on 5 October 2009.
- Any infrastructure project that impacts campus trees must provide a written Tree Protection Plan to the Landscaping Services Department for review and approval no less than 2 weeks before construction begins. Trees may not be removed or damaged before approval is received.
- A replacement value for displaced or destroyed trees, including those located within a construction site as well as those in the perimeter that will be destroyed by construction, will be paid to the university Tree Endowment Fund for replacement on other areas of campus.
- Prior to developing a cost estimate, all involved should be made aware of the Tree Protection Guidelines and the specific site recommendations. Design and bid specifications will incorporate these guidelines for awareness.
- Protection of trees that remain within a construction site is a high priority and the university requires contractors to use every reasonable measure to protect the root system and canopy of these trees. The Landscaping Services department is available to contractors for consultation on the best measures to protect individual trees and root systems.
- *Vehicle access:* set entrance and exit points on site will be determined prior to breaking ground on the project. Vehicles accessing the site will use only the designated entrances and exits so as to prevent damage to on-site trees.
    - Unless impractical, designate only one access route on and off the construction site. Landscaping Services approval must be obtained for additional access road locations.
    - The access drive should be restricted to an area that will later serve as a route for utility wires, water lines or roads/sidewalks.
        - If the access drive cannot be confined to a space to be used for utility wires, water lines, or roads/sidewalks, logging mats will be used to protect critical tree root areas.
        - This construction entry shall consist of 10' by 16' oak logging mats on 6' coarse, chipped, hardwood placed on a permeable structural filter fabric, top-dressed with an additional

10’ of hardwood mulch. Mulch and logging mats shall be supplemented throughout the project to keep the access area structurally functional.

- Parking: All contractors must be instructed where they are permitted to drive and park their vehicles. Contractors will not be authorized to park on landscape or sidewalks without express approval from Landscaping Services. Offsite parking for site personnel and visitors is available at the 1st Assembly Church lot. Contractors are encouraged to maximize use of the off-side parking and use shuttle services to move work personnel to and from the site.

Protective Measures: Within a site, tree protection fencing will be installed around the root zone of each tree before any construction, excavation, demolition, land clearing, grading, or other land disturbance begins.

- The University Arborist or a qualified member of the WFU landscaping department will determine which trees require protection and the area of protection and mark said area.
- The contractor or subcontractor or personnel responsible for the project will construct and maintain fencing, for each protected tree or group of trees on the site, encircling the outer limits of the critical root zone to prevent unnecessary damage. Project managers will ensure that work sites do not spread onto nearby areas outside the designated work zone.
- *Fencing*: Chain link fencing or wood fencing of at least four feet height and supported at a maximum of ten-foot intervals by posts will be used. Wooden stakes and rebar posts are not considered an approved method sufficient enough to keep the fence upright and in place. See Appendix D, “Fencing” for illustrations of proper fencing techniques.
  - For every inch of trunk diameter measured at 4’ above grade, fencing will be 1 foot from the tree trunk. For example: a five-inch diameter tree will have fencing at least 5 feet from the tree. All fencing will remain in place until construction is completed.
  - Within the fenced areas no materials, soil, gravel, etc. will be stored, no vehicles or equipment will be parked or maneuvered, neither excavations nor grade changes will occur and no new pavement will be installed.
  - If materials are stored outside the fenced area but within the drip line of trees, logging mats and mulch will be used to prevent compaction of the soil surrounding tree roots.
  - *Signage:* Clearly visible “Keep Out” signs are to be posted on all sides of fencing at minimum intervals of 15’. These signs are to be maintained as long as the fence is in place. All protective fencing will remain in place until exterior work has been completed.
  - *Vinyl construction fencing:* such fencing will only be permitted as an exception for cases where metal or wood fencing is not feasible. Contractors must obtain written approval from the Director or Manager of Landscaping Services to use vinyl fencing for tree protection.
- *Stump removal*: Trees cleared from the site and the perimeters of the site will have their stumps removed by grinding them out to protect and preserve nearby saved trees.

Construction Interference from Remaining Trees: When trees to remain on site after construction interfere with construction attempts, the following guidelines apply:

- *Trenching*: When trenching or digging near trees, every effort will be made to avoid damage to the tree’s root system.
  - If utilities cannot be routed a safe distance from a tree as defined by the drip line, boring will be used to minimize damage and future risk.
  - Roots damaged by trenching or digging should be pruned by a professional arborist before the area is backfilled. Root pruning is a process in

which clean cuts are made to allow for the fastest callusing of necessary wounds and healthy re-growth of lost root systems.

  - *Silt Fences*: Silt fencing will be anchored above tree roots by folding one foot of the fencing to the uphill side of the tree and then covering this fold with six inches to one foot of gravel to hold it in place. Placing silt fence as such should avoid unnecessary trenching of tree roots. The city of Winston-Salem will be notified when these protection measures are implemented in sensitive tree root areas.

Improper trenching on South Campus resulted in severe root damage to this oak tree.

- *Above Ground Pruning*: In the event limbs are causing a clearance issue for equipment or otherwise, the Landscape Department should be notified as soon as possible. All pruning of above ground branches will be performed by or under the supervision of the University Arborist.
- *Root Pruning*: As with above ground pruning; trees benefit from clean cuts on their roots as well. Notify the Landscape Department or University Arborist when encountering roots during construction. The Arborist may want to prune these cleanly before backfilling occurs.

Remediation and Recovery: The University will take steps to aid in the recovery of trees traumatized by construction in the surrounding area.

- Remove contaminated soil and aerate compacted soil.
- Keep the same grade as before construction – more than two additional inches of soil or sod can ultimately kill an otherwise healthy tree.
- Monitor trees for as long as needed, checking for insects or disease that can strike a weakened tree.
- Water trees during dry periods to help them recover from construction stress. Fertilize annually with a slow-release non-burning complete fertilizer.

Tree Damage Assessment

Any tree damage created by a contractor or outside source will be evaluated and the cost of damage, replacement or maintenance will be evaluated by the University Arborist with an option for WFU to engage an independent arborist if the contractor disputes the value as excessive. Damage estimates will be based on the Tree Value Calculations formula outlined in Appendix E: Tree Value Calculations. Trees located over utility lines will still be counted toward the total value of trees though they cannot be relocated from the site.

The party responsible for the damage will then be billed by the University for damage incurred by paying into the Tree Endowment Fund. If the damage was a result of a construction project, the cost will be billed to the contractor. For projects with a CM @ Risk or negotiated contract, tree removal unplanned by the University Arborist or damage to any tree shall not be considered general conditions or a cost of the work and billed to the owner or submitted as a claim to the owners builders risk policy.

Goals and Targets

Tree Inventory/Digital Arboretum

A partial tree inventory of the Reynolda Campus was created in the fall of 2008. This database, available online, includes the locations and basic details of all major trees on campus. The university looks to expand upon this project and increase the utility of the project, particularly as pertains to future construction projects, campus planning projects, tree management, academic exercises and public education. The Digital Arboretum will also be expanded to include an interactive gallery of heritage and memory trees on campus.

- http://darwin.winston.wfu.edu/arboretum/index.php/Main/HomePage

Public Awareness

The second goal of the Campus Tree Care Plan is to promote public awareness of the university's diverse, valuable campus forest by increasing transparency in facilities and landscaping operations and promoting the recognition of North Carolina Arbor Day on the first Friday after March 15th each spring.

Tree Endowment Fund

The university will establish a Tree Endowment Fund with the sole purpose of providing and managing funds to replenish the university's forest when impacted by construction projects or campus disasters. The requirement for tree replacement is a one-to-one ratio of tree basal circumference. For example, a tree with a basal circumference of four feet could be replaced with two trees of basal circumference two feet or four trees with basal circumferences of one foot, or any other combination of circumferences equal to four feet.

When a construction project cannot replace all trees on-site, the equivalent value of these trees will be charged to the project and added to the Tree Endowment Fund for replacement elsewhere on campus. The Tree Endowment Fund will be managed by the Landscaping Services Department.

Glossary

Backfill: Material used to refill an excavated area

Basal Circumference: The circumference of a tree at 1.3 meters (approximately 4.2 feet) above the ground; used to determine replacement requirements for removed trees

Canopy Trees: A tree that will grow to a mature height of at least 40 feet with a spread of at least 30 feet

Hardiness Zone: Zones showing a geographically-defined area in which a species of tree is capable of growing, as defined by the climatic conditions, including its ability to withstand the minimum temperatures of the zone

Internode: a part or space between two knots or joints

Integrated Pest Management (IPM) Plan: An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices including knowledge about the lifecycles of pests, prevalence of weeds, and resistance of particular plants

Silt Fence: a temporary sediment control device used on construction sites to protect water quality in nearby streams, rivers, lakes and bays from sediment in storm water runoff

Trenching: The process of digging long, narrow channels in the ground for the purpose of laying pipes and wires during construction projects

Trunk Flare: The base of a tree trunk where the root system begins. When planting, you should be able to see the part of the trunk where it spreads out to become roots above ground after backfilling.

Communication Strategy

After approval of the Campus Tree Care Plan and Policies by the Wake Forest University Administration, the plan will be broadcast to the university community via the electronic mail distribution system and the plan will be available electronically on the web site of the Facilities and Campus Services Department and the Office of Sustainability web site.

This plan will also be included in the WFU Design Guidelines so that they will be available to WFU project managers, designers and construction firms for including in project specifications.

Appendix A: Prohibited Trees

Fraxinus americana, white ash
Liquidambar styraciflua, Sweet gum
Acer saccharinum, silver maple
Zelkova serrata, zelkova
Ulmus parvifolia, Chinese elm
X Cupressocyparis leylandii, Leyland Cyprus
Crataegus Phaenopyrum, Washington Hawthorn

The following prohibited trees are listed on The NC Native Plant Society Invasive Exotic Species List as a Severe Threat:
Alianthus altissima, Tree of Heaven
Albizia julibrissin, Mimosa
Paulownia tomentosa, Princess tree

The following prohibited trees are listed on The NC Native Plant Society Invasive Exotic Species List as a Significant Threat:
Morus alba, White mulberry
Pyrus calleryana ‘Bradford’, Bradford pear

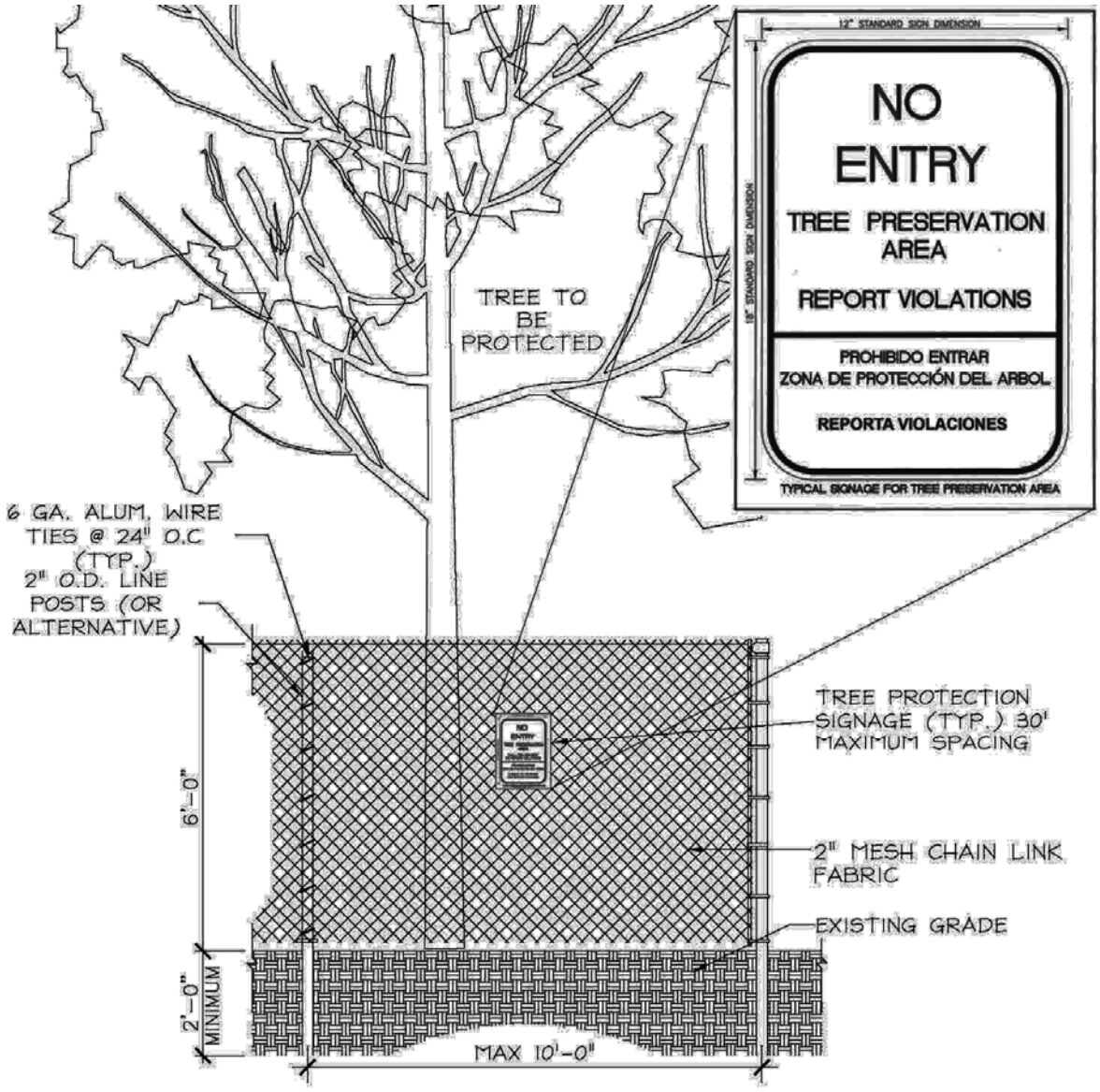
Appendix B: Heritage Trees

	Scientific Name	Common Name	Location	Criteria
1	Quercos phellos	Willow Oak	Campus Perimeter	Age, History, Location
2	Acer palmatum	Japanese Maple	Bostwick Hall and Jasper Memory Lane	Diversity, Location
3	Magnolia grandiflora	Southern Magnolia	Manchester plaza, North Campus Apartment, Winston Hall, and Scales Fine Arts Center	History, Location, Age
4	Quercus alba	White Oak	WFDD, Starling Hall, North Campus Apartments	Age, Size, History
5	Ilex opaca	American Holly	Hearn Plaza, University entrance	Location, Size
6	Metesequoia glyptostroboides	Dawn Redwood	West side of Winston Hall	Diversity, Size
7	Ginkgo biloba	Gingko	West side of Winston Hall	Diversity, Size
8	Fagus grandifolia	American Beech	Manchester Plaza	History, Location
9	Acer saccharum	Sugar Maple	Huffman residence hall and Wait Chapel	Age, History, Location
10	Juniperus virginiana	Eastern Red Cedar	University Water Tower	Size, History
11	Ulmus Americana	American Elm	Davis Field	History, Age

Appendix C: Memorial Trees

	Scientific Name	Common Name	Location	In memoriam
a	Fraxinus americana ‘Autumn Purple’	Ash	Hearn Plaza	Nell Adams Mason
b	Acer rubrum	Maple	Tribble Hall	Grace A. O’Neill
c	Acer palmatum	Maple	Babcock Hall	Matthew James Alexander
d	Cornus kousa	Dogwood	Hearn Plaza	Caroline Elizabeth McCullough
e	Cornus florida	Dogwood	Winston Hall	Robert Sullivan
f	Zelkova serrata	Zelkova	Tribble Hall	David Smiley
g	Acer rubrum	Maple	Wingate Hall	Presence of Judaism
h	Acer rubrum	Maple	Scales Fine Arts Center	Allen Watson
i	Prunus serrula ‘Kwanzan’	Cherry	Taylor Hall	Benjamin Cooke Kellogg
j	Quercus shumardii	Oak	Hearn Plaza	The “Howler”
k	Magnolia grandiflora	Magnolia	Davis Field	Thomas Hearn
l	Prunus serrula ‘Kwanzan’	Cherry	Davis Field	Rebecca Street
m	Cornus florida	Dogwood	East side of Wait Chapel	Rosemary Bernard Groves
n	Cornus florida	Dogwood	West side of Wait Chapel	Rosemary Bernard Groves
o	Prunus subhirtella ‘Weeping Higan’	Cherry	Kentner Stadium	Maria Whitehead
p	Acer saccharum ‘Legacy’	Maple	Benson Center	Sylva Billue
q	Prunus x yedoensis	Cherry	Manchester Plaza	Gabiden Kourman
r	Cornus florida	Dogwood	Martin Hall	Canda Kinney

Appendix D: Fencing



A proper Tree Protection Area features chain link fencing and clearly labeled tree protection signage. Fencing must be at least 4 feet in height.

Appendix E: Tree Value Calculations

Tree value calculations and table based on the Agricultural Extension Service of the University of Tennessee "What are Those Plants Worth?" report published July 2003.

When appraising the value of woody landscape plants, a few common factors must be considered that influence monetary value. When appraising a tree, ask the following questions:

- How large is it (size)?
- What kind is it (species)?
- What condition is it in?
- Where is it (location)?

Locate your responses to these questions in the appropriate tables (1-4) and plug the corresponding values into the following formula to calculate tree value:

(Base Value) x (Location Factor) x (Species Rating) x (Condition Rating) = Tree Value

Base Value: To determine the base value of the tree, calculate the area of a cross section of that tree in square inches where d is the diameter in inches.

Area = d^2 x 0.785

This will allow you to calculate the value of the tree by multiplying the Area (in inches^2) by the accepted value/inch^2 set forth by the Southeastern United States Tree Species Guide.

Area x \$48/Inch^2 = Base Value

Ex: What is the base value of a tree with a diameter of 8 inches?

A = 8^2 x 0.785

A = 50.24 Inches^2

50.24 x \$48 = Base Value

\$2,412 = Base Value

For quick estimates of base value by tree diameter, consult Table 1.

Table 1. Cross sectional areas of trees and their base value based on \$48 per square inch.

Diameter	Cross Section Square Inches	Base Value \$48/Sq. In.[1/]
6	28.3	\$1,358
8	50.3	2,414
10	78.5	3,768
12	113.1	5,429
14	153.9	7,387
16	201.1	9,653
18	254.5	12,216
20	314.2	15,082
22	380.1	18,245
24	452.4	21,715
26	530.9	25,483
28	615.8	29,558
30	706.9	33,931
32	804.3	38,606
34	907.9	43,579
36	1017.9	48,859
38	1134.1	54,437
40	1256.6	60,336

[1/] Southeastern United States Tree Species Guide, March, 2001 International Society of Arboriculture-Southern. Reliable tree/plant appraisals require oversight and guidance by a committee of quali- e d local arborists and horticulturists who compile species lists and ratings, determine the size of commonly available transplantable nursery material and costs associated with material, transportation, installation and maintenance. This information is compiled by the Southern Region of the International Society of Arboriculture.

Location Factor: The location factor accounts for the placement and contribution of the tree to the functional and aesthetic qualities of the site.
Generally, trees in arboreta, cemeteries, university campuses and urban residential landscapes receive higher location ratings that trees on rights-of-way.
Locate the most accurate description of site location for the tree on Table 2 to determine the percent value of the tree. Insert the decimal form of this number into the (Location Factor) in the calculation.

Table 2. Location values for landscape trees.

Site Location	Percent Value
Specimen, arboretum or historical	100
Average residential landscape	80
Malls and public areas	80
Park and recreation	60
Golf course	60
City street	60
Environmental screen	60
Industrial area	40
Out-of-city highway	40
Native, open woods	20

Species Rating: To account for the characteristics of different species, a rating scale is developed for each geographic region. Members of the local chapter of the International Society of Arboriculture (ISA) compile the species rating for a particular region.
It is important to note that a species' rank may be different from one geographic area to the next depending on its ability to grow in a particular climate.
Table 3 lists the most common trees for North Carolina.
Locate the tree in question on the table to identify its class. Take the percent next to the class and convert it to a decimal number. Insert this number into the (Species Rating) in the calculation.
Ex:
A Silver Maple tree in NC would receive a Class 5 ranking and so the Species Rating value would be 0.20.
A Red Maple in the same area would receive a Class 1 ranking and so the Species Rating value would be 1.0.

Table 3. Species classification rating for common trees in Tennessee.

Class 1 – 100%	
Red Maple	Dogwood
Ginkgo	American Holly
Tulip Poplar	Scarlet Oak
White Oak	Willow Oak
Class 2 – 80%	
Pecan	Bald Cypress
White Pine	Hemlock
Linden	Disease-resistant Crabapples
Magnolia species	Washington Hawthorn
Bradford Pear	Beech
Red Oak	Southern Red Oak
Class 3 – 60%	
Buckeye	Hickory species
Hackberry	White Ash
Yellowwood	River Birch
Honey Locust	Black Cherry
Sassafras	Kentucky Coffee Tree
Hophornbeam	
Class 4 – 40%	
Sycamore	Osage Orange
Persimmon	Redbud
Virginia Pine	Disease- susceptible Crabapples
Green Ash	Eastern Redcedar
Norway Maple	Post Oak
Class 5 – 20%	
Tree-of-Heaven	Siberian Elm
Boxelder	Black Locust
Catalpa	Silver Maple
Mulberry	Cottonwood & Black Willow

Though created for Tennessee, the species classification ratings listed in Table 3 are accurate for the North Carolina Piedmont. T
Tennessee Department of Agriculture, Division of Forestry, 1988. Shade Tree Values. Miscellaneous Publication. Nashville, TN.

Condition Rating: Evaluation of the health and structure of a tree should be undertaken by a trained professional. A tree with compromised health is valued lower than a healthy, robust tree. Problems typical of the species, such as brittle wood and weak branch attachments, should be excluded from the evaluation of condition, since these factors are included in the species rating.

A tree recommended for removal may have little, no or negative value if the timber or firewood value is less than the removal and cleanup costs.

Compare the health and structure of the tree with the conditions described in Table 4 and assign the most accurate value (in decimal form) to the tree. Insert this number into the (Condition Rating) in the calculation.

Table 4. Tree condition rating table.

	Sound trunk with no rot, healthy bark, good limb structure and balance, no corrective pruning or maintenance needed, good foliage color, no insects or diseases, twigs showing excellent growth.
80%	Similar to above except tree may have minor insect or disease problems and/or need minor corrective maintenance.
60%	Sound trunk and healthy bark, fair limb structure with broken branch stubs, moderate maintenance needed, insect or disease problem present, fair twig growth and leaf color.
40%	Similar to above plus evidence of trunk scars and early stages of decay present.
20%	Advanced stage of decline with major problems in roots, trunk, branches and foliage.

Examples: The following table (Table 5) provides a sample worksheet for calculating tree value with 3 examples.

Table 5. Sample worksheet for determining tree value with 3 examples.

Diameter measured at 4½' or 1' above ground	
Base value	
Species factor %	x
Subtotal	
Condition factor %	x
Subtotal	
Location factor %	x
Final value	$

EXAMPLES

#1 20" diameter Ginkgo, excellent health, well-placed in a residential yard.

$15,082 x 1.00(spp.) x 1.00(cond.) x 0 .80(loc.) = $12,066

#2 26" Hackberry, moderate health, crowding a tennis court in the park.

$25,483 x 0 .60(spp.) x 0.60(cond.) x 0 .40(loc.) = $3,670

#3 8" Boxelder in poor condition, growing along a highway (measure at 1 ft. above ground).

$2,414 x 0.20(spp.) x 0.20(cond.) x 0.40(loc.) = $39

Reference:

"SP614 What Are Those Plants Worth?," The University of Tennessee Agricultural Extension Service, SP 614 - 12M - 7/03, http://trace.tennessee.edu/utk_agexfores/57