LANDSCAPE AND TREE ORDINANCE MANUAL

ARBORICULTURAL SPECIFICATIONS MANUAL



Best Management Standard Practices For Trees

Recommended by the Liberty Consolidated Planning Commission

2010

PREFACE

The Landscape and Tree Protection Ordinance is the primary tool that provides systematic protection of specified trees, and at the same time is promoting health, safety, and welfare and enhancing the quality of life for the residents of the governing jurisdiction. The Tree Protection Ordinance's intent is that all applicable sites maintain or obtain a **50% minimum tree canopy coverage over a 30 year period.** By assuring preservation and protection through regulations and standards such as those outlined in this technical manual, these natural resources will be significantly enhanced and protected.

This manual is a supplement to the "Landscape and Tree Protection Ordinance". It is intended to serve as a guide for persons planting or performing work on any plant material. It is also intended to serve as a guide for those persons who are required by ordinance to install trees and landscaping or abate a tree-related public nuisance.

The current and comprehensive arboricultural standards of practice that are detailed in this manual are recommended by the most knowledgeable persons and organizations in the horticulture and arboricultural fields. These standards specify the proper planting and maintenance procedures for trees, and they must be strictly adhered to when planting new trees and protecting existing trees during construction.

The following outlines the objective of this manual:

- ✓ Expanding/retaining the overall <u>minimum tree canopy coverage of 50%</u> over a period of 30 years by maintaining existing trees, and by planting species of canopy trees
- Encouraging the use of proper preventive tree maintenance techniques to ensure longlived trees, thereby reducing the need for tree removals
- ✓ Increasing public awareness of and involvement in urban forestry through educational efforts to promote landscaping and tree care on private properties
- ✓ Encouraging site designs to provide for the accommodations of trees with other infrastructure, such as utilities, parking lots, buildings, signs, streets, and sidewalks.

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Introduction

What is an Urban Forest?

An urban forest is simply trees and vegetation in and around a the city or County environment. Trees provide a wide variety of social, community, economic, and environmental benefits for us all that include such things as climate moderation, better air quality, water conservation, habitat for birds, and other wildlife and increased property values. Like a natural forest, an urban forest is an entire ecosystem which includes trees on both public and private property. However, unlike a natural forest, an urban forest usually needs help from people to survive.

This Arboricultural Specifications Manual contains the technical information necessary to perform the work outlined in the "Landscape and Tree Protection Ordinance" for the LCPC. This manual is divided into five sections:

Section 1	Tree Basics
Section 2	Maintenance and Care of Existing Trees
Section 3	New Tree Establishment and Installation
Section 4	Tree Species Selection and Placement
Section 5	Tree Protection During Construction

The first four sections outline the specific practices that must be followed when working with plant material. The last section references the Tree Protection requirements that are stated in the the Ordinance for new developments, new construction, or areas undergoing major rehabilitation or redevelopment.

. Trees and landscaping-and, collectively, the urban forest-are important assets that require care and maintenance. Tree care is a specialized type of maintenance that requires Best Management Practices.

What are Best Management Practices?

The Best Management Practices (referred to throughout the Manual as "BMPs") are technically correct and widely accepted *arboricultural practices* and *standards* used by professional arborists, urban and community foresters, landscape architects and other tree care and landscape professionals. The goal of the manual is to provide the basic and practical information on how to best accomplish the most important tree management activities. The goal of Best Management Practices is to maintain trees under generally accepted standards that will give trees in the development environment a better chance for surviving. The primary goal is to increase canopy coverage and to ensure that the protection and management of the trees and landscaping are adequately addressed during the construction process .Trees and landscaping are an essential part of a development's infrastructure.

SECTION 1: TREE BASICS

INTRODUCTION

The loss of tree cover is becoming a critical issue in many areas. Many tree-care issues affect the use, management, and protection of trees. These include proper care of trees to increase longevity and decrease hazards, alleviation and prevention of soil compaction, providing for better wildlife habitat, the effect of air pollution on tree health, and public mandates for stormwater retention and flood prevention.

The Value Trees within a Community

Trees have environmental, social, aesthetic, and economic values.

Trees are economic assets as property values are increased by 15-20% when homes are surrounded by large trees or are located on well-shaded avenues *Urban forests save energy:*

- A mature tree in summer transpires up to 100 gallons of water a day, equivalent to five large air conditioners operating 20 hours a day, with resulting temperature decreases of 5-12 degrees.
- Canopy trees can reduce the temperature on the exterior surface of buildings by 16 degrees Fahrenheit, cutting air conditioning costs.
- Windbreaks of trees can reduce winter heating costs 20-30%.

Urban forests improve our air:

- An 80-foot beech tree daily removes the amount of carbon dioxide produced by two single family dwellings.
- A tree produces oxygen and therefore contributes to better air quality.
- Globally, tree planting may slow the greenhouse effect.

Urban forests protect our water:

- A tree also controls soil erosion and recycles water.
- Windbreaks help control wind erosion; greenbelts around watersheds can decrease water erosion and runoff and preserve water quality.

Urban forests improve our communities:

- Trees soften architectural lines; articulate entry points, and lend color and distinction to public buildings.
- Well-placed tree buffers help channel traffic, control hazardous glare, and reduce unwanted noise
- Shaded sidewalks, parks, greenspaces, and forested spaces provide places for recreation, rest and contemplation.
- Trees and landscaping provide habitat for wildlife.

1.0 Basic Tree Biology and Structure

1.1.1. What is a tree?

A *tree* is a woody plant with a single erect perennial trunk at least 3 inches in diameter at 4.5' above the ground, breast height (DBH). Most trees have definitely formed crowns of foliage and attain heights in excess of 13 feet Trees are generally referred to by their *mature size or height*. For reference purposes in this guide tree height will be defined as **small, medium, or large:**

- > Small Trees Less than 25 feet tall at maturity
- ➢ Medium Trees − 25 to 40 feet tall at maturity
- Large trees 40 to 100+ feet tall at maturity

1.1.2. Parts of tree:

<u>Crown</u>

The crown, which consists of the leaves and branches at the top of a tree, plays an important role in filtering dust and other particles from the air (Figure 1). It also helps cool the air by providing shade and reduces the impact of raindrops on the soil below.

The *canopy* of an individual tree refers to the extent of the outer layer of a tree's leaves. *Dripline* means an imaginary vertical plumb line that extends downward from the tips of the outermost tree branches and intersects the ground.



Figure 1:

<u>Trunk</u>

The trunk refers to the main structural member of a tree that is supported by and directly attached to the roots and which in turn supports the branches. In order to properly prune a tree or to repair damage to the trunk, a basic understanding of a tree's structure is required. A cross section of a tree trunk reveals it is composed of many layers (Figure 2). Each year a tree essentially grows a new "coat of wood" over the older wood. The outside layer of the tree is dead bark which provides protection from the environment. The inner bark layer is composed of live tissue that transports food downward. Between the bark and wood is the cambium layer which is responsible for increases in tree diameter (by creating annual rings) and responds to injury by producing callus tissue.

Fig: 2



The trunk, or bole, of a tree supports the crown and gives the tree its shape and strength.

The size of a tree is generally referred to by taking a measurement of the trunk of the tree at a distance of 4.5' above the ground, commonly called diameter at breast height (DBH) (Figure 3).

- 1) Vertically growing tree is on a slope. There are several commonly accepted ways to find the DBH height. Probably the easiest method is to measure diameter 4.5 ft from the ground on the upper side of the slope.
- 2) **Tree forks below DBH or near DBH.** The measurement is recorded at the narrowest part of the main stem below the fork. The height of the DBH measurement and the fork should be noted (e.g., 3 ft diameter @ 2 ft [Forks @ 4 ft]).
- 3) **Tree leans.** There are several commonly accepted ways to find the DBH height. The US Forest Service measures 4.5 ft up the stem in the direction of the lean. Some references (e.g., ISA) say to measure 4.5 ft from the midpoint of the lean.
- 4) **Tree splits into several trunks close to ground level.** Measure DBH of each trunk separately, using the principals shown in categories 1-4 above. The DBH for the tree is found by taking the square root of the sum of all squared stem DBHs.

Figure 3: Taking DBH Measurements









Branches

Branches are attached to the tree trunk by interlocking

branch and trunk tissue. A new layer of interlocking tissue is produced each year over the previous layers. A woody branch collar, produced by the trunk, holds the branch base. When branches on the main trunk that have a narrow angle increase in diameter they eventually run out

of room to grow. The branch bark becomes surrounded by woody trunk and branch tissue. The bark that becomes overgrown is referred to as <u>included bark</u> (Figure 4)

The union is weak and likely to split. Leaves on every branch must produce enough food to feed itself . Food does not move from roots or other branches to supply a starving branch. Branches unable to support themselves are sealed off. Branches on the interior of a tree that do not receive adequate light will die and eventually fall.

A tree branch has a **branch bark ridge**, often referred to as a **branch collar** that separates the branch from the tree trunk (Figure 5). The collar is the swelling located at the base of a branch where the branch meets the trunk. The callus that forms the collar is an area of tissue that contains a chemically protective zone. The natural decay of a dead branch stops when it reaches the collar. When pruning a dead branch, do not create a new wound by cutting into the ring that forms around the dead branch.





Roots

Anchor the tree into the ground. Tree roots develop and survive where there is adequate oxygen and moisture. **Most active tree roots are in the top 3 feet of soil; the majority are in the top 12 inches** (Figure 6). The more compacted or poorly drained the soil the closer the roots are to the soil surface. Roots grow most of the year, stopping only when soil temperatures are cold. They occur as perennial woody roots and as annual absorbing roots.



Woody roots become thicker each year; absorbing roots die but are replaced by

Figure 6:

new absorbing roots. Annual absorbing roots form shallow, horizontal fans that take-up water and nutrients. A few woody support roots grow downward and outward to anchor the tree in place. Most trees do not have a deep tap root. While a tap root may develop in trees growing in the woods in well-drained soils, they generally do not develop on trees transplanted into the landscape or on trees grown in compacted or poorly drained soil.

Roots normally grow outward to about three times the branch spread. Only 50 percent of the trees root system occurs between the trunk and the dripline. Roots on one side of the tree normally supply the foliage on the same side of the tree. When the roots on one side of the tree are injured the branches on that side of the tree may die back or drop. With some trees, such as maple, the effect may develop anywhere in the tree canopy.

Wound Response

Trees have a natural defense response to wounds and pruning cuts. When wounded trees respond by sealing off their wounds. They form four types of walls to compartmentalize the area thus preventing the spread of decay organisms (Figure 7). The decay or injury remains but is sealed off and does not increase in size if the walls are stronger than the decay organisms. Wall 1 is formed by plugging the vertical vascular system vessels following an injury. It is the weakest wall but can slow the vertical spread of decay. Wall 2 is formed at the outer edge of a growth ring. It is a weak barrier but does offer resistance to inward spread of decay. Each growth ring is subdivided into compartments



Figure 7:

with a radial wall (Wall 3). It is the strongest of the three walls and provides resistance to lateral spread. It presents a maze of physical obstacles as well as a chemical barrier. Wall 4 is formed by cambium growth after an injury. It is the strongest of all the walls. Internally, it separates the wood present at the time of injury from new wood formed as the tree grows. Externally, callus tissue develops around the injury and should eventually cover it by growing over the dead wood. This natural defense response is known as *Compartmentalization of Decay In Trees (CODIT)*.

<u>1.1.3. The Critical Root Zone or Protected Root Zone</u>

The most ignored measure related to tree protection is often the most important. It is the "**ROOT**" of the matter. A big part of the tree is underground. Being that it is out-of-sight, it unfortunately is also out-of-mind in most cases. This is exactly where most damage occurs.

The health and well being of trees is directly related to the condition of the roots. The critical root zone is the underground area that contains the most important types and amounts of a tree's roots. It is this area that requires protection if a tree is to survive and remain structurally stable.

One of the most critical and most successful steps in preserving trees that will remain on-site during and after construction and development is to protect the tree's roots from disturbance. For existing trees, there is a minimum amount of area, above (for the trunk and crown) and below

ground (for soil health and the root system vitality) that is required to protect trees and preserve tree health. This area has been identified as the **Critical Root Zone** (**CRZ**).



To calculate critical root zone radius, begin by measuring the diameter at breast height (DBH). This is done by measuring the tree's trunk diameter (thickness) at a point 4.5 feet above the ground. The measurement should be done in inches. For each inch of DBH, allow for 1.0 feet of critical root radius For example, if a tree's DBH is 10 inches, then its critical root radius is 10 feet

The health of the critical root zone can be damaged by:

- Cutting roots
- Excavating surrounding soil
- Applying chemicals
- Compacting surrounding soil
- Applying any material that impedes the flow of water or air to the roots

Trees need protection. Protect the critical root zone. Damage in the critical root zone can kill a tree. Death may not be instantaneous. It can often be a slow three to six year process. Some species can tolerate more damage and loss in the critical root zone than others.

1.1.4. Growing Space

Young trees grow up to be large trees and require ground space for future growth. Getting trees started correctly in your yard, along streets or in a park is critical to long tree life, easy care and low-cost maintenance. One way to ensure trees are planted correctly is to give them plenty of room to grow.

Do not plant trees in spaces too small for their mature size. When little follow-up care and maintenance is planned, the best thing for trees is to provide them with plenty of space. It is critical to provide adequate space for rapidly expanding root systems (Figure 10). Trees with large areas in which to grow have the best chance of being healthy and long-lived, and of

developing few problems. The amount of space required varies with soil conditions, site stress levels and species of tree.



Figure 10: The above-ground portions of a tree occupy less space than the below ground portions.

1.1.5. Rooting Space

Rooting space should be the primary consideration in tree selection. The mature size, growth rate and longevity of a tree are directly related to the available rooting space. Many trees in the landscape are predisposed at planting to a short life and limited growth potential due to poor soil conditions and limited rooting space.

The graph below shows the relationship between root space and ultimate tree size. For example, a tree with a 28-foot wide canopy (16-inch trunk diameter) will require 500 square feet of rooting space, 2 feet deep (1000 cubic feet rooting volume).

Consideration of the amount of soil area for root growth is also required for successful growth to maturity. Most people do not realize the amount of space needed for mature trees.

Whether preserving trees or planting trees always consider the rule of thumb "*the larger the critical root zone area the greater the chance of tree survival.*" The minimum requirements based on tree size are listed below:

\succ	Small Tree:	25 square feet (5 x 5 feet)
\succ	Medium Tree	100 square feet (10 x 10 feet)
\triangleright	Large Tree	400 square feet (20 x 20 feet)

Tree roots and soil are a cooperative venture which generates healthy trees and healthy soils. Understanding how roots grow and utilize soil is critical to proper tree management.

Section 2: Maintenance and Care of Existing Trees

The management of trees is an important task. Each tree species will generally require specific pest management, pruning, and fertilization to maintain its health and vitality. Identifying, quantifying, and understanding a specific tree population is crucial to determining a comprehensive, long term approach to its well being. Trees will generally live longer and gradually require less intensive care with scheduled maintenance.

The following section outlines the standards of practice that must be followed by anyone performing maintenance on plant/tree material including public rights-of-way.

Effective tree care is an investment in the future. Healthy trees increase in value with age while providing both tangible and intangible benefits.

2.1 PRUNING STANDARDS

Pruning is the most common tree maintenance procedure. The objective of pruning is to produce strong, healthy, attractive plants. Most pruning is done for "people reasons". Pruning cuts must be made with an understanding of tree biology and their basic requirements in order to optimize the health and structure of trees through pruning. By understanding how, when and why to prune, and by following a few simple principles, this objective can be achieved.

All pruning shall be done in accordance with the American National Standards Institute (ANSI) A300 standards, ANSI Z133.1 Safety Requirements and International Society of Arboriculture (ISA) Best Management Practices (BMPs) guidelines for pruning and all state and local guidelines for traffic control and public safety, with no exceptions.

No tree should be pruned without first establishing clearly defined objectives. Seven main objectives are described below along with pruning types that help meet those objectives.

1) **Reduce risk of failure**: Reduce risk by establishing a structural pruning program that begins at planting and carries through the first 25 years. This program should be designed to create structurally sound tree architecture that will sustain the tree for a long period. Medium-aged and mature trees can be cleaned, thinned, reduced, raised, or restored to manage risk. Some structural pruning can be conducted on these older trees as well. The choice among these pruning types depends on the tree and the situation.

2) Provide clearance: Growth can be directed away from an object such as a building, security light, or power line by reducing or removing limbs on that side of the tree. Regular pruning is required to maintain the artificial clearance. Canopy reduction or pollarding helps maintain a tree smaller than it would be without pruning. Utility pruning keeps limbs clear of overhead wires and other utility structures. The canopy can be raised to provide underclearance by shortening low branches so those toward the middle and top of the tree are encouraged to grow.

3) Reduce shade and wind resistance: A lawn, ground covers or shrubs can receive more sunlight when live foliage is removed from the crown. Thinning, reducing and pollarding can be used to accomplish this.

4) Maintain health: Maintain health by cleaning the crown, especially in medium-aged and mature trees. Removing dead, diseased, and rubbing branches in the crown of young trees may be a lesser priority. Root pruning can also be used to reduce the rate of spread of certain vascular diseases, such as oak wilt and Dutch elm disease.

5) Influence flower or fruit production: The number and/or size of flowers or fruit can be influenced by pruning. Fruit size can be increased on certain plants such as peaches by removing some of the developing fruit or flowers. Flower cluster size can be increased on crape myrtle and some other trees by making heading cuts on many branches. Fruit production can be eliminated by removing flowers.

6) **Improve a view**: A view can be enhanced or opened by removing live branches. This pruning can include thinning, reducing, pollarding, and raising.

7) **Improve aesthetics**: A tree can be pruned to make it look more appealing. Cleaning, reducing, thinning, pollarding, and restoring can be used to meet this objective.

2.1.1. When to prune

Time of pruning varies with plant species. Prune at times that best complement the growth characteristics, flowering, and other objectives you desire.

- Conifers may be pruned any time of year, but pruning during the dormant season may minimize sap and resin flow from cut branches.
- Hardwood trees and shrubs without showy flowers: prune in the dormant season to easily visualize the structure of the tree, to maximize wound closure in the growing season after pruning, to reduce the chance of transmitting disease, and to discourage excessive sap flow from wounds.
- Flowering trees and shrubs: these should also be pruned during the dormant season for the same reasons stated above; however, to preserve the current year's flower crop, prune according to the following schedule:
 - Trees and shrubs that flower in early spring (redbud, dogwood, etc.) should be pruned immediately after flowering (flower buds arise the year before they flush, and will form on the new growth).
 - Many flowering trees are susceptible to fireblight, a bacterial disease that can be spread by pruning. These trees should be pruned during the dormant season.
 - Trees and shrubs that flower in the summer or fall always should be pruned during the dormant season (flower buds will form on new twigs during the next growing season, and the flowers will flush normally).
- *Removal of dying*, diseased, broken, rubbing, or dead limbs can be accomplished any time, with little negative effect on the tree.

2.1.2. How much to prune

The widely accepted rule of thumb is never to remove more than *one-fourth* (25%) of a tree's leaf bearing canopy in any one year.

2.1.3. Types of pruning cuts

Pruning cuts may be classified by where they are made on the branch or stem. The preferred place to make a cut is to the parent branch or trunk, just to the outside of the branch collar. There are four general cuts used in arboricultural pruning: branch removal cut, reduction cut, heading cut, and deadwood removal cuts.

1. Branch Removal Cut (Thinning Cut)

To find the proper place to cut a branch, look for the branch collar that grows from the stem tissue at the underside of the base of the branch (Figure 12). On the upper surface, there is usually a branch bark ridge that runs (more or less) parallel to the branch angle, along the stem of the tree. A proper pruning cut does not damage either the branch bark ridge or the branch collar.



Figure 12: Proper branch removal cut

2. Reduction Cut (Cutting to a Lateral, Lateral Cut, Drop-Crotch Cut)

A reduction cut (also referred to as a drop-crotch cut) removes a stem back to a lateral branch that is at least one-third the diameter of the cut stem (Figure 13). Sprouts commonly follow a reduction cut, especially if a large portion (greater than about one-quarter) of the live foliage was removed with the cut. If the branch that remains is less than about one-third the diameter of the cut stem, the cut is considered a heading cut. Reduction cuts are used to reduce the length of a stem or branch. Heading cuts are not considered appropriate in most instances in the landscape.



Figure 13: Reduction Cut

3. Heading Cut

A heading cut removes a branch to a stub, a bud or a lateral branch not large enough to assume the terminal role (Figure 14). Heading cuts should not be used because vigorous, weakly attached upright sprouts are forced just below such cuts, and the tree's natural form is altered. In some situations, branch stubs die or produce only weak sprouts. Trees shall not be topped unless necessary for utility line clearance or under unusual circumstances for which a pruning permit is necessary.



Figure 14: Heading Cut (Topping Cut, Lopping Cut)

NO TREE TOPPING ALLOWED

4. Pruning large branches

• To remove large branches, three or four cuts will be necessary to avoid tearing the bark (Figure 15). Make the first cut on the underside of the branch about 18 inches from the trunk. Undercut one-third to one-half way through the branch. Make the second cut an inch further out on the branch; cut until the branch breaks free.

• Before making the final cut severing a branch from the main stem, identify the branch collar. The branch collar grows from the stem tissue around the base of the branch. Make pruning cuts so that only branch tissue (wood on the branch side of the collar) is removed. Be careful to prune just beyond the branch collar, but **DON'T** leave a stub. If the branch collar is left intact after pruning, the wound will seal more effectively and stem tissue probably will not decay.



Figure 15: Large Branch Removal

- The three-step cutting method: 1. Undercut to prevent limb breakage
- 2. Cut down and removed limb
- 3. Trim branch stub at branch collar
- The third cut may be made by cutting down through the branch, severing it. If, during removal, there is a possibility of tearing the bark on the branch underside, make an undercut first and then saw through the branch.

When removing a live branch, pruning cuts should be made just outside the branch bark ridge and collar. This location of cut is in contrast to a "flush cut" which is made inside the branch bark ridge and collar. Flush cuts *shall be avoided* because they result in a larger wound and expose the trunk tissues to the possibility of decay. If no collar is visible, the angle of the cut should approximate the angle formed by the branch bark ridge and trunk. Pruning cuts should be clean and smooth; leaving the bark at the edge of the cut firmly attached to the wood. A threecut process will reduce chances of injury when removing large limbs.

2.1.4. Pruning Techniques

Specific types of pruning may be necessary to maintain a mature tree in a healthy, safe and attractive condition.

- **Crown cleaning** is the removal of dead, dying, diseased, crowded, weakly attached and low-vigor branches from the crown of a tree.
- **Crown thinning** is the selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, without compromising the tree's natural shape.
- **Crown lifting** removes the lower branches from a tree in order to provide clearance for buildings, vehicles, pedestrians and vistas.
- **Crown reduction** reduces the size of a tree, often for clearance for utility lines. Reducing the height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least one-third the diameter of the cut stem). Compared to topping, this helps maintain the form and structural integrity of the tree.

- **Crown Restoration** is intended to improve the structure and appearance of trees that have sprouted vigorously after being broken, topped or severely pruned using heading cuts. Crown restoration may require several pruning's over a number of years.
- Utility Pruning of a tree's growth under utility lines is most economically managed by directional pruning (thinning cuts). Directional pruning is the removal of a branch to the trunk or a significant lateral branch growing away from the conductor.

2.1.5. Training Young Trees

Properly trained trees will develop into structurally strong trees well suited to the site and their intended landscape function. These trees will fulfill their intended function sooner and should require little corrective pruning as they mature. Young trees that reach a large mature size should have a sturdy, tapered trunk with well-spaced branches.

- a. Training young trees 5 steps
 - 1) **Remove broken, dead, dying, diseased, or damaged branches.** Inspect the canopy and remove or cut back these branches.
 - 2) Select and establish a central leader. There should be only one leader. Select the strongest and most vertical stem as the leader and remove or cut back competing stems.
 - 3) Select and establish the lowest permanent branch. Look for a well-attached branch at the desired height (determined by location and use), and remove closely spaced, competing branches. The diameter of the lowest permanent branch should be no more than one-half that of the central leader or trunk (at the point of attachment). Smaller temporary branches should be left close to the lowest permanent branch. Larger temporary branches should be pruned back to one or two buds.
 - 4) Select and establish scaffold branches. Look for well-attached branches above the lowest permanent branch that are no more than one-half the diameter of the central leader. Scaffold branches should be well spaced both vertically and radially. Vertical spacing should be 18 inches or more for large trees and 12 inches for smaller trees. Radial spacing should allow for balanced branch distribution around the central leader. Leave small branches close to scaffolds as temporary branches and remove or cut back larger branches.
 - 5) Select temporary branches below the lowest permanent branch. Some or all the branches below the lowest permanent branch can be retained as temporaries. If possible, leave the smallest branches and cut back or remove the largest branches. If a temporary branch is more than the diameter of the trunk, cut it back by at least 50% to discourage excess growth.

ISA (International Society of Arboriculture) standards dictate that when pruning you should never remove more than **25%** of living tree mass.

2.1.6. Summary of Pruning

- a) Only experience professionals should prune trees. Arborist should follow ANSI A-300 Standards for Tree Care Operations.
- b) The objectives for tree pruning should be established prior to commencement of pruning activity.

- c) Tree should never be "topped". Topping a tree permanently damages a tree's structure, destroys its value, damages its health, and decreased the tree's safety.
- d) Climbing spikes should never be used to prune a tree.
- e) Always prune branches back to parent branches or branches at least 1/3 the diameter of the branch being pruned.
- f) No more than 1/4 of the foliage of a mature tree should be removed in any one growing season.
- g) Make proper pruning cuts, using the three cut method. Avoid stub cuts, flush cuts and wounds on the remaining limbs and trunk.
- h) Pruning cuts should be made just on the outside of the branch collar.
- i) At the time of planting prune only dead, damaged, broken crossing, or rubbing branches.
- j) Do not remove more that 1/3 of the foliage from a young tree during any one growing season.

2.2. REMOVAL OF TREES

Tree removal is a necessary part of a sound tree management program. Removal is thought of as a last resort measure, but many trees must be removed for safety, and to make way for younger, healthier landscape plants.

There are several ways trees can become unsafe including natural processes such as diseases and pests, neglect, storm damage, improper pruning, and construction damage. The wood deterioration that can result from wounds and the tree's attempt to wall-off the injured area delineates the future fault lines. Failure occurs when the tree can no longer counteract external forces acting upon it.

Tree removal should be based on sound management practices such as:

- ✓ Tree is dead.
- ✓ Tree is deemed hazardous, when the hazardous condition cannot be corrected through pruning or other reasonable arboricultural practices.
- \checkmark A tree is infected with a contagious and fatal disease.
- ✓ A tree is injured by construction, lightning, vandalism, or auto accident and cannot be saved.
- ✓ More than fifty (50%) percent of the crowning is missing or dying as a result of decline or storm damage.
- \checkmark Age of tree
- ✓ Desirability of the tree species
- ✓ Conflict of trees with utility service
- ✓ Persistent and uncontrollable insect, disease or fruiting problems.
- ✓ Frequency and extensiveness of the tree's maintenance requirements.
- ✓ Quality and extent of past pruning and other tree maintenance practices the tree has undergone.
- ✓ Extent and frequency of damage the tree is causing to surrounding infrastructure such as sidewalks, streets, sewers, etc.
- ✓ Location of the tree with regard to streetlights, traffic control devices, intersection sight lines and the requirements of the tree related to available growing space.

✓ Removal should enhance the health of remaining trees within the immediate vicinity and be consistent with good forestry practices.

The decision to remove any public tree will rest with the Administrator. Consideration will be given to the location, health, age, aesthetic value, uniqueness, historical significance, and wildlife habitat of the public tree. A completed application for a permit to remove public trees must be submitted to LCPC at least five business days before the scheduled work is to begin. If LCPC approves the removal of the public tree, the following procedures must be strictly followed:

- 1. All removal shall be done in accordance with the American National Standards Institute (ANSI) A300 standards, ANSI Z133.1 Safety Requirements and International Society of Arboriculture (ISA) Best Management Practices (BMPs) guidelines for pruning and all state and local guidelines for traffic control and public safety, with no exceptions.
- 2. Whenever a street must be blocked off, the Governing Authority must be notified of the location and length of time that the street will be blocked. They must also be notified when the barriers are removed or if they are to remain longer than originally expected.
- 3. Whenever large tree sections are removed, the work area must be barricaded using street and sidewalk barriers, highway cones, or signs. These barriers must be placed to insure the safety of the general public with as little inconvenience as possible to vehicular and pedestrian traffic. Flashing signals or flares must be placed on all barriers remaining in the street after dark. At least one responsible worker must serve specifically to coordinate safe operations from the ground at all times.
- 4. Whenever barricades or work areas block any portion of a street, flagmen must be stationed to insure as little obstruction to the flow of traffic as possible.
- 5. The stumps of all removed trees must be removed to a minimum depth of six (6) inches below ground level. The area must be backfilled, the soil leveled, and vegetation restored within thirty (30) days.
- 6. Neither utility poles nor trees may be used as an anchor for winch trucks.
- 7. Replacement of public trees may be required as a condition for permit approval. Replacement public trees must meet specifications outlined in this manual.
- 8. Failure to receive permission to remove a tree on right-of-ways, on commercially zoned properties or common areas within residential subdivisions is a violation of the ordinance and may result in fines and/or restitution for damages..

2.3 GENERAL MAINTENANCE FOR ESTABLISHED TREES

2.3.1 Watering

Water is essential to tree survival. Minerals and nutrients from the soil are transported to the leaves by water. You can apply water effectively using sprinklers, drip irrigation, or a hose running on the soil surface. Established plant material should not be given supplemental water except under water stress or drought conditions. Regardless of how you apply the water, follow these basic rules.

- Water deeply rather than frequently: Because most tree roots are found in the upper 0 - 24 inches of the soil, this is the zone that should be wetted up in each irrigation cycle (Figure 21). Each deep irrigation will meet a tree's water needs for between 10 days to 4 weeks during the hottest part of the summer, depending on the tree species and soil type.
- Established trees: Don't irrigate the area directly adjacent to the trunk this can increase the risk of disease. Roots extend far beyond the edge of canopy or drip line. Water in the outer half of the area under the canopy and beyond the edge of the canopy (Figure 22).





2.3.2 Fertilizing

The main reason for fertilizing trees is to maintain reasonable vigor so that plants will be able to resist environmental stresses and pests. Fertilization should only be done based on soil test results or foliar analysis to correct a deficiency. Rates of fertilizer application or based on industry standards published in American National Standards (ANSI) and Best Management Practices - ANSI. 2004. A300 (Part 2). American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance -- Standard Practices (Fertilization) and International Society of Arboriculture (ISA) Best Management Practices Series - Tree Fertilization. The Georgia Cooperative Extension Service also provides services for soil testing, foliar analysis, and recommendations, as do private laboratories.

- Fertilizer recommendations for trees are based:
 - 1) The essential nutrient "Nitrogen"
 - 2) Fertilizer ratio of 3:1:1 or 3:1:2
 - 3) The nitrogen (N) content of the material.

- 4) The grade of fertilizer to be used should be a low-salt-index (<50), slow release (WIN>50%) fertilizer.
- 5) Application rates are based on square footage of tree area.
- 6) The standard rates of slow-release fertilizers are 2 to 4 pounds of nitrogen per 1000.
- Methods of application:
 - 1) Broadcast surface application
 - 2) Subsurface application (used when run-off may occur)
 - 3) Liquid injection method
 - 4) Foliar application (use to correct minor element deficiencies)
 - 5) Implant and injections (do not use as a routine method)
- When to apply fertilizer:
 - Time your application to coincide with active root growth and adequate soil moisture. Trees and shrubs should be fertilized in early spring, and a light fertilizer application can be made in early summer if conditions are conducive to plant growth (that is, reasonable temperatures and soil moisture).

2.3.3. Pest Management

Pest Management involves the control of biotic (living agents) and abiotic (nonliving agents) problems associated with trees. Correct diagnosis of tree problems requires careful examination of the situation and systematic elimination of possibilities by following a few important steps.

- 1) Accurately identify the plant
- 2) Look for a pattern of abnormality
- 3) Carefully examine the site
- 4) Note the color, size, and thickness of the foliage
- 5) Check the trunk and branches, and
- 6) Examine the roots and root collar

The majority of tree health problems are not caused by insects, mites, fungi, or bacteria. Rather, 70 to 90 percent of all plant problems result from adverse cultural and environmental conditions such as soil compaction, drought, moisture fluctuations, temperature extremes, mechanical injuries, or poor species selection.

In years past, the commonly accepted approach to keeping plants healthy was an application of pesticides to control insects and diseases. Today, sound plant management principles are based on maintaining plants in good health. The new approach is based on the concepts of Integrated Pest Management (IPM) and Plant Health Care.

✓ <u>Integrated Pest Management</u> (IPM) is a strategic approach to plant and animal care that seeks to suppress pest populations while minimizing pest control costs and environmental disruption. IPM attempts to integrate numerous control tactics, such as cultural, mechanical, biological and chemical methods. Treatment decisions are based on information derived from site-specific scouting, production economics, pest and host biology and ecology, toxicology, and weather.

- ✓ <u>Plant Health Care</u> (PHC) is a holistic and comprehensive program to manage the health, structure, and appearance of plants in the landscape. Plant Health Care involves monitoring, using preventive treatments, and adopting a strong commitment to working closely with you, the tree owner.
- Applying Pesticides:
 - The following guidelines must be strictly adhered to when applying pesticides All persons applying pesticides must follow the guidelines, rules, and regulations set by the Georgia Department of Agriculture, Division of Plant Industries, Bureau of Pesticide Control. They must also adhere to all applicable federal regulations.
 - 2) All pesticides must be applied strictly according to the label. No pesticide may be applied in any manner or amount inconsistent with the label instructions.
 - 3) No pesticide may be applied in any conditions that would allow drift from the targeted area.
 - 4) Any chemical spills must be handled according to label directions.

SECTION 3: NEW TREE ESTABLISHMENT AND INSTALLATION

Regardless of the amount of care they are given, some trees and plant material will be lost due to natural causes or unavoidable circumstances. Continual investment in new plantings is necessary to sustain and expand this vital resource. However, indiscriminate or unregulated planting could cause more harm than good. The wrong tree planted in a good area, or a good tree planted in the wrong area, is often worse than no tree planted at all. Street trees that are planted in conflict with things like public utilities, traffic signals, and pedestrian walkways can create long-term maintenance issues.

3.1 Establishment and Installation

Proper planting is critical to the establishment and long-term health of trees and shrubs. In fact poor planting and follow-up care likely leads to more tree death than all other causes combined. Common problems include planting too deep, failure to address soil problems, failure to fix circling and girdling roots, improper staking and guying, poor mulching and improper watering. To help people get new trees off to a good start, the following planting guidelines have been developed.

3.3.1 SELECTION OF NURSERY STOCK

Well managed tree planting projects start with appropriate site analysis, customer expectations, site design, and tree selection. Site conditions and after care capabilities should dictate maximum tree size at planting, root ball characteristics, appropriate tree production method, and tree structure. Tree selection includes choosing the appropriate species or cultivar for the planting site based on site analysis. Then, suitable nursery stock must be chosen based on site conditions and intended after care.

3.3.2. SPECIFICATIONS FOR TREE SELECTION

Successful landscape plantings can only occur when high quality nursery stock is selected which has the proper limb structure and root/shoot ratio balance. Trees should be healthy, free of disease and insect pests, and the quality should be maintained during transportation from the nursery and throughout the planting process. The following check list offers "minimum" guidelines for selection of trees for the landscape.

Canopy trees should:

- ✓ Have a strong, straight central leader with no lateral branches greater than 2/3s the caliper of the main leader.
- ✓ Have branches equally spaced around the central leader at least 6 inches apart. Each branch should have its own space.
- \checkmark Have a uniform canopy in shape from all sides and free of large voids.
- ✓ Have trunks which are free from all cuts and scratches. There should be no more that 40% of the height which is clear of branches unless it is specified by the designer.
- \checkmark Have proper pruning cuts that are not flush cuts but pruned to the collar.
- ✓ Have been root-pruned and irrigated during production for a better root system.
- ✓ Have root balls in B&B plantings which are of the appropriate size and they should be firm.
- ✓ Have container roots which fill the entire container without having any root greater than 1/5 the tree caliper and no large roots in the upper 3 inches of media encircling more than 1/3 of the root ball. If kinked roots are less than 1/3 of the root ball, they can be pruned.
- \checkmark Have tree branches with good spacing and wide angles from the main trunk with no included bark.
- ✓ Be smaller rather than larger. Plant 2.5" caliper trees unless instant effect is desired and good soil conditions permit a large planting. Smaller trees establish better in poorly drained, low oxygen soils.

Plants usually come in one of three forms – bare-root, container grown, or balled and burlapped



Figure 16:

Trees can be obtained from nurseries and garden centers as bare-root stock, balled-andburlapped stock (B&B), container grown or tree-spaded (not shown).

3.3.3. CHOOSING NURSERY PRODUCTION AND HARVESTING METHODS

To ensure greater transplant survival it is essential to choose trees grown in the nursery production system best suited for the irrigation capabilities at the planting site. Today, more and more plants are being grown in containers, and container plants can be planted twelve months out of the year-provided they are given some care. Balled in burlap and bare root plants should be planted while they are dormant. Regardless of what form they come in, planting in the dormant season, puts less stress on the newly planted plants. There is usually ample natural moisture, which allows the new plants to begin forming roots without much care from us. Do pay attention to the weather and if we go without natural rainfall for several weeks, you will need to water, even when it is cold.

3.3.4. TIME FOR PLANTING

The best time to plant trees in Southeast Georgia is from December through March. During that time, the soil is still warm, which encourages vigorous root growth, and trees will have several months to get established before next summer's heat. At the same time, the weather is cool, and the trees are going dormant, which reduces stress. Another plus is that generous rainfall during the winter makes constant attention to watering unnecessary.

Planting at this time is especially beneficial for balled-and-burlapped trees, because they lose so much of their root system when they are dug.

3.3.5. BASIC PLANTING GUIDE

- 1. Proper planting technique is essential to new tree survival before digging; find the topmost root growing from the trunk of the tree. This is called the root flare area. Remove any soil above that point across the entire root ball. Measure from the topmost root to the base of the root ball to determine its height.
- 2. Dig the planting hole roughly three times wider than the diameter of the root ball. Dig no deeper or slightly less deep than the height of the root ball. The hole should be bowl-shaped with the sides sloped. Save the soil.
- 3. Place the tree in the hole so that the top of the ball (root flare) is even with the soil level or slightly higher. Don't cultivate the bottom of the hole; it may cause the root ball to settle and the tree to be planted too deep. Remove any burlap, wire, twine or strapping.
- 4. Back fill with the soil that was removed from the hole. Don't amend the soil with compost, peat moss, other soil, or fertilizer. Tamp soil lightly but do not compact.
- 5. Form a one-to-two-inch berm of soil around the edge of the planting hole to hold water. Fill the "saucer" with water once or twice.
- 6. Mulch the root ball surface and planting area. Use three to four inches of organic material. Keep the mulch one or two inches away from the trunk.
- 7. Keep the tree well watered for the first year. Water every day for 2 weeks and every other day for two months and then weekly until the tree is established. **Remember** watering frequency depends on many factors: rainfall, temperature, and soil type. When watering, use two gallons of water per inch of trunk diameter. Do not over water or saturate the soil.

8. Call - DIGGERS HOTLINE AND LOCAL UTILITIES

Diggers Hotline and the local utility companies must be notified of all locations before any digging commences including planting, root repair, staking and stump removal. This is required so that no underground utility facilities are damaged. It takes three to ten days for the utilities to locate them. This not only prevents the disruption of service to the residents, but prevents a serious safety hazard to the employees.

a. **Planting procedure on good drainage soils:**

Planting illustration (Figure 17) shows correcting planting procedure when planting on site with good drainage.



Figure 17:

The planting hole should be shallow and wide to allow for rapid root growth after planting. Planting trees too deep is a common problem.

b. Planting procedure on soils with poor drainage:

Planting with Poor Drainage/Compaction (Figure 18) – Poor drainage can and should be improved if possible by grading or installing drain tiles to carry water away (see diagram). On flat sites or sites with moderate drainage or compaction problems trees can be planted shallow, with one-third or more of the root ball above grade and the backfill soil mounded up to cover the root system. Trees can even be placed on top of the existing, problem soil with their roots surrounded by a mound or berm. Such trees may do well but also may have a fairly small root system and will need more care and attention than trees on better sites.



Figure 18:

Where adequate drainage is a problem, either elevate part of the root ball above grade and gradually slope the soil around it.

3.3.6. NEW TREE CARE

a. Mulching:

Mulch should be applied at time of planting and reapplied annually in the spring. Mulch depth should be three to four inches. Ideally, create a circle of mulch at least two feet in diameter for each inch of trunk diameter. Do not pile mulch against the trunk. Instead, keep mulch six to eight inches from the trunk. Recommended mulch is shredded bark or aged wood chips.

Figure 19 illustrates standard for recommended mulching methods.



• No Mulch Volcanoes

Improper mulching kills trees. Mulch should never be piled into a cone around a tree trunk. This type of mulching is referred to as a "mulch volcano". "Mulch volcanoes" waste money, mulch and eventually lead to diseased trees (Figure 20).



Figure 20

b. Watering:

New trees should be watered for minimum of three years after planting to supplement natural rainfall. Water the root ball, not the back fill. Plants should receive a total of two inches of water every week, or 1.5 to 3 gallons of water for each inch of trunk diameter. Watering is critical when summer temperatures exceed 90 degrees for extended days.

• Rule of Thumb for watering:

One inch of water each week for the first season is a good rule of thumb, but monitoring soil moisture and applying water as needed is preferable. Establishment period is 12 months for each inch tree caliper (ex. 3" caliper = 36 month establishment period). Two to three gallons of water is required for each caliper inch of tree. Irrigation is applied to the root ball. If root ball is wet, do not irrigate.

c. Fertilizing:

Fertilization is not usually necessary on newly planted landscape trees. Research has indicated that fertilization has little to no benefit. It is best to focus on irrigation, mulch, and weed control to insure optimum tree health.

d. Staking:

Only those trees in windy open areas, along floodplains, or with loose root balls should be staked. Stakes should not entirely restrict movement or sway of the tree. Freedom of movement in a tree trunk helps a tree develop a stronger trunk. If staking, avoid cutting roots while driving the stake or damaging bark with any rope or wire used. All staking materials should be removed after one year from installation.

Section 4: Tree Species Selection and Placement

Best Management Practices (BMPs) for successful landscape tree establishment depends on the design, site analysis, tree species selection, and proper planting and maintenance. All these factors are interrelated. Compromises to any of the BMPs are cumulative and affect other establishment factors. Successive compromises result in stress to the tree with potential death or failure of the planting. Each factor will be highlighted separately but keep in mind that all factors are evaluated with attention to each other.

4.1. Site Evaluation

Evaluation of the site to develop the design is the first step in a tree planting program. Trees grow when selected according to plant requirements and site condition. Once you know the restraints of the site and the design requirements, plants can be selected and planting and maintenance specifications written to meet the site limitations. The following points should be considered during the site evaluation and design process:

- 1) What USDA hardiness zone is the planting site located in? The USDA hardiness zone for Liberty County is Zone 8 9. Hardiness is not as big a concern as tolerance to heat.
- 2) What is the average annual rainfall in the area?
- 3) Is irrigation available?
- 4) What is the light exposure, sun or shade?
- 5) What is the soil nutrition analysis, especially pH, phosphorus and potassium? These nutrients are better adjusted according to the soil test prior to planting.

- 6) What is the internal soil drainage? Test by digging a hole 18 inches deep and filling it with water. If water is gone in 1 to 2 hours, the soil is well drained; 12 to 24 hours, soil drainage is moderate; more than 24 hours, soil drainage is poor.
- 7) What is the soil texture? Clay, loam, or sand
- 8) What is the soil density? The soil is compacted and hard, or the soil is loose.
- 9) Will the tree be planted in a tree lawn or streetscape (the grassy strip between the curb and the sidewalk)? If so, how wide is the tree lawn?
- 10) Will the tree be planted along a street without a sidewalk? If so, how far from the edge of the road will the tree be planted?
- 11) Will the tree be planted in a sidewalk cutout?
- 12) Will the tree be planted in a parking lot? If so, will it be planted in a sidewalk cutout, parking lot island, buffer strip, or narrow linear strip of soil?
- 13) Will the tree be planted in an open lawn area or in a shrub bed? What is the approximate size of this area?
- 14) Will the tree be planted within 8 feet of a sidewalk, driveway or other hard surface?
- 15) Is there a swimming pool, vegetable garden, masonry wall or septic tank or drain field within 50 feet of the planting site? If so, how far away is it?
- 16) Are overhead wires within 30 feet of the planting site? If so, what is the horizontal distance between the planting hole and the wire? What is the distance between the ground and the lowest wire?
- 17) Is there a street light or security-type light within 35 feet of the planting hole?
- 18) Is the planting site within 35 feet of a building? If so, what is the horizontal distance between the planting hole and the building?
- 19) Would you care to eliminate trees that could drop messy fruit, large leaves or twigs during an extended period?
- 20) Are there landscaping or tree ordinances that would affect selection and size of trees?
- 21) What is an assessment of tree diversity in the area?
- 22) Are the trees to be used for a screen, shade, or a focal point?
- 23) What trees currently exist in the planting area? What construction activities have recently gone on that might impact these trees? Are they healthy, desirable trees?
- 24) Are there storefronts, signs, traffic vision concerns or other views that may need to be considered in the selection of the trees?

Tree species vary considerably in their minimum requirements for rooting volume, soil pH, drainage, etc. A site evaluation will allow you to choose the very best trees for a given location. Without a site evaluation, communities often choose a tree species that will handle the worst possible site conditions as a safeguard against tree failure.

4.2. LOCATION AND PLACEMENT OF TREES

4.2.1. Parking Lots:

Parking lots and paved areas are essential urban features that tend to be unsightly in their basic form. Landscaping in and around parking lots and pavement improves appearance, prevents soil erosion, and reduces carbon dioxide through photosynthesis. Planted areas also reduce storm water drainage problems, reduce the detrimental effects of wind and noise, and enhance human comfort by providing heat-reducing shade.

Selecting appropriate trees for parking lots and other paved areas is challenging. Paved surfaces are engineered to quickly shed water, often in directions that either deprive trees of adequate soil moisture or leave their roots submerged in excess water. Heat from parking lots and other pavement is exacerbated by the solar heat sink of the pavement, with adjacent buildings and cars adding to the stress. Limited soil volumes confine roots, restricting root growth, reducing anchorage, and often supplying inadequate moisture and nutrients. The stress of compaction and low soil fertility, coupled with other physical, environmental and human forces acting against trees makes parking lots and paved areas unfriendly to trees. These factors combined may reduce the average life expectancy of most urban trees.

Use appropriate tree species. Avoid trees with large surface roots that may damage pavement, and trees with dense canopies that block light penetration to the pavement, preventing rapid evaporation of precipitation. Also avoid trees that can litter the pavement with fruit, branches, and large leaves.

Where trees will be installed into parking lot "islands" which create a pseudo-container for roots, design these islands with as much soil volume as possible. Ideally, the roots should be able to grow at least to the drip line or crown edge of the tree at maturity. A soil volume of 2 to 3 cubic feet per 1 square foot of crown spread is recommended.

BMPs Recommendations for Parking Lots

Select trees based on planting locations and size of planting space.

Plant drought tolerant trees.

Avoid trees with large surface roots that may damage pavement.

Avoid trees that can litter the pavement with fruit, branches, and large leaves.

Whenever possible, design permanent drip or pop-up irrigation systems.

Use of engineered soil to satisfy the needs of both trees and pavement.

Plant one large tree for every <u>twelve (12)</u> parking spaces

Require curbing around all tree planting locations with at least 30 inches space from curbing to tree. Maintain DOT requirement of 8-foot minimum height to branching for vehicle and pedestrian clearance.

Tree planting islands should have a minimum width of 12 feet.

Consider use of porous pavement material to increase the uptake of moisture and gas exchange for trees.

4.2.2. Utility Lines:

<u>Guidelines for planting close to utilities:</u> Trees and power lines can coexist, and potential conflicts can be avoided by selecting and planting trees with size and growth characteristics appropriate to their location (Figure 23). In the design process, considerations need to be made for the above ground growing space available for the tree (without the need for pruning) and the below ground space for root growth. This is of primary concern under utility lines as the utility has the right-of-way. Frequent pruning required to keep utility lines clear cause's problems for trees and utility. Recommended trees for planting under Utility Lines are Small Trees Only.



Figure 23: Placement of Various Tree Sizes with utilities:

<u>Planting trees near streetlights</u>: Shade trees should be spaced an adequate distance away from streetlights to avoid illumination problems.

<u>Trees in relation to underground utilities:</u> Tree root systems typically grow only 2 to 3 feet below the surface so there are opportunities to plant near some underground utilities (Figure 24). However, some species (for instance, those that have root systems that can cause penetration into sewer lines) should be avoided.

Figure 24: Placement of Trees Over Underground Utilities



4.2.3. Parks:

Determining proper tree spacing is an important step in the design process, but is always a compromise between short-term and long term goals. In a natural forest, tree spacing constantly changes as trees die and are replaced during forest succession. Guidelines for spacing of trees are:

- This principal should be used whether planting park trees "on center" or in creating informal or more natural landscapes. Park trees that will grow to large sizes should be spaced 50' apart.
- In natural landscaping trees should be grouped together in multiples. Trees can be of all one species or preferably of several species that visually compliment each other. A grouping should contain at least 5 individuals for best effect with no limit to the maximum number of trees used. The only limiting factor is the space being planted. Canopy trees should be spaced on average 45' to 50' apart but don't sweat the numbers. In nature mature trees may grow two feet apart or twenty the figure is simply a guide.
- Smaller or under-story trees can be planted in between or among large trees, depending on the situation.
- In urban park settings, tree spacing may vary and be less than the recommended 50 foot of separation depending upon: available space along sidewalks, underground utilities, fire hydrants, curb cuts and similar factors.
- The long-term objective is to gradually replace the large expanse of grass with landscaped islands of native trees and shrubs interspersed with mowed lawn. This cannot be accomplished over night no matter how much you desire it. Trees and shrubs need time to mature and develop.
- Space park trees in such a manner that the crowns of large deciduous trees will typically grow to touch or nearly touch each other.
- When planting along entrance roads or open park areas plant trees with the thought in mind to be park-like or natural in appearance, plant a diversity of species in informal patterns to mimic nature.

Plant trees in an appropriate manner to the park landscape:

Large growing trees have significantly greater environmental benefits. Consider large tree species whenever the space allows. With proper structural training, large trees have minimal potential for storm and wind damage.

In choosing a mix of trees within the park and along the streets, service roads, sidewalks, and trails, choose species that will have similar proportions when they grow to maturity.

Recommended species for planting and space standards are shown in Appendix Tree List.

4.2.4. Streets and Parkways:

The planting of street trees certainly can raise some challenges, since they are usually located on public property and are often subject to local ordinances. Concerns that trees may interfere with utilities, block views of traffic, or have other potentially undesirable consequences have caused many communities to restrict the planting of street trees.

Guideline for Location of Street Trees

Intersections	40'
Stop signs, traffic signs, street lights,	30'
traffic signals	
Fire hydrant, gas or water valves	10'
Underground utilities	10'
Driveways	10'

When planting street trees keep these points in mind:

- At maturity, the tree should not interfere with overhead utility lines, underground sewers, lighting, or street traffic.
- Any unusual maintenance problems, such as messy fruit, should be addressed.
- To guard against the potential disaster of having an entire street of trees wiped out (such as Dutch elm disease) street tree plantings should ideally be comprised of a diversity of species.
- Minimize problems by choosing species that are durable, placing them in appropriate spots, and providing necessary maintenance on an ongoing basis.
- If over sidewalks, plant trees that will provide at least 8 feet of clearance for pedestrians and bicyclists.
- Do not plant trees in spaces between curb and sidewalk if less than 3 feet.
- If planted over major streets, vertical clearance shall be 14 feet for vehicles.

Recommended species for planting and space standards are shown in the Appendix Tree List.

4.2.5. Non acceptable trees for planting:

Undesirable Trees are not suitable for any locations within any jurisdiction in Liberty County. This is based on undesirable growth habits, fruiting habits, form, susceptibility to insects, serious diseases and storm damage, and improper growing conditions. See Appendix

SECTION 5 – Tree Protection Standards

The objective of this section is to reduce the negative impacts of construction on trees to a less than significant level. Trees vary in their ability to adapt to altered growing conditions. Mature trees have established stable biological systems in the preexisting physical environment. Disruption of this environment by construction activities interrupts the tree's physiological processes causing depletion of energy reserves and a decline in vigor, often resulting in the trees death. Typically, this reaction may develop from one to eight years or more after disruption.

Trees and construction activities (new buildings, roads, and utility lines) often interact nonconstructively, resulting in damage or death to trees. Construction damage is one of the most common causes of tree death. The decision to protect and preserve trees on a construction site is an important one. It is possible to preserve trees on building sites if the right measures are taken.

5.1 Tree Preservation

The LCPC uses the tree/landscaping quality points crediting system to determine if new developments meet the requirements of the Ordinance. . Saving trees makes sense. Successful development requires careful planning. Tree preservation is an important part of a project's plan. It should be contemplated at the very first stage of the process before any work is done on the site. The goal of tree protection is to help trees remain as healthy after you work around them as they were before you began.

5.1.1. TREE SURVEY STANDARDS

This section describes the format of tree surveys as well as the types of tree identification required in the field. These standards and specifications assure a faster review process as they relate to tree protection and mitigation.

a.Type of Tree Survey

This ordinance requires use of a tree survey, which identifies all trees over sixteen (16 inches) in diameter.

b. Tree Survey Certification

All tree surveys shall be certified. The tree survey will be performed by a certified arborist, registered landscape architect, or a registered professional land surveyor. Trees proposed to be retained

c.Information To Be Gathered in the Field

The data required to be collected and illustrated in the site plan include tree locations, diameters, species, limits of construction, and certain tree graphics.

- 1. *Location* Tree data submitted must be obtained from a ground survey. A number shall be assigned and a corresponding numbered tag placed on each tree proposed to be retained.. Tree numbers will remain on the trees until the project has received its certificate of occupancy.
- 2. *Diameter* Diameters of existing trees are measured as follows. Diameter measurement should be recorded to the nearest inch. Trees may be measured with a caliper, cruise stick, standard tape measure or diameter tape. Measurement of diameter is described in Section 1- Figure 3 of this manual.
- 3. *Species* The name of the species, such as Live Oak, Tulip Popular, or Pecan should be accurately reflected. Tree types may be listed by common names or Latin names..

d. Information to be provided on the tree survey

1. *Trunk location* - The trunk location on the plan must represent the center of the trunk at ground level in the field. If the tree leans substantially above that point, show the direction of the lean with an arrow. See the legend under the sample Tree Survey in Illustration 1-2 for an example.
- 2. *Critical Root Zone (CRZ)* Trees are to be represented on the tree survey by a concentric circle centered on the trunk location, with a radius equal in feet to the number of inches of the tree's trunk diameter. For example, an oak tree with a trunk diameter measuring fifteen (15) inches would be represented to scale on the tree survey with a circle representing a fifteen (15) foot radius. Trees to be retained will be represented by a solid circle. Trees to be removed are to be represented by being crossed out.
- 3. *Diameters and types of existing trees* Tree diameters and types shall be shown on the survey through a legend. Trees to be removed will be highlighted in bold print. Special conditions such as "dead" will be noted.
- 4. *Tree numbers* Tree numbers on the plan will correlate with tags assigned to trees during the survey.
- 5. *Tree survey table:* A table will be included listing all surveyed trees by number, species, sizes, removal status, and health conditions.. It will also include a legend indicating the protection status of the tree.

e. Additional Information

There are other types of information related to tree structure and condition which may affect site plan design. The Administrator may request these types of information. The information will be expressed as a written note on the survey and include the tree number and a description of any of the following:

- 1. *Crown configuration* If a tree has a crown which is skewed in one direction, this information would be useful for surveyors to note. Project designers and plan reviewers need such information to more accurately assess design impacts on such trees.
- 2. *Crown Clearance* This information is often critical in determining whether a given structure or vehicular use area can practically be placed within the drip line of a tree. If this information is recorded, the surveyor should consider the vertical distance to any major branches.
- 3. *Condition* This is one of the principle factors in determining whether a tree should or should not be preserved. Surveyors should not speculate about the condition of all trees unless they have the necessary credentials; however if a tree is obviously in poor condition, it should be noted to prevent unnecessary expense in trying to design around it.
- 4. *Spot elevation* Taking an elevation reading near the trunks of some trees will provide valuable information for project designers. Since grade changes are the most destructive impacts on trees, it is important to get the most accurate information possible. If there is more than a six inch change, existing and proposed grade elevation will need to be reflected on the tree survey.

Illustration 5-1: Example of Tree Survey

Tree #	DBH	Species
1	8"	Live Oak
2	10"	Hackberry
3	16"	Live Oak
4	18"	Live Oak
5	14"	Red Maple
6	12"	Chinaberry
7	30"	Laurel Oak
8	12"	Sycamore
9	10"	Pecan
10	25"	Live Oak
11	4"	Live Oak
12	5"	White Oak
13	5"	Red Maple

TREE SURVEY TABLE

5.1.2. TREE PROTECTION STANDARDS

The tree protection section of the Ordinance and the standards in this section are provided to ensure that appropriate practices will be implemented in the field to eliminate undesirable consequences that may result from uninformed or careless acts, and preserve both trees and property values. Construction projects are required to implement the protective practices described in this section.

Typical negative impacts that may occur during construction include:

- \checkmark Mechanical injury to roots, trunk, or branches
- Compaction of soil, which degrades the functioning of roots and inhibits the development of new ones and restricts drainage, which desiccates roots and enables water mold fungi to develop
- \checkmark Changes in existing grade which can cut or suffocate roots
- ✓ Alteration of the water table either raising or lowering
- ✓ Microclimate change exposing sheltered trees to sun or wind
- ✓ Sterile soil conditions associated with stripping off topsoil

a. Critical Root Zone (CRZ):

Each tree to be retained shall have a designated CRZ identifying the area sufficiently large enough to protect the tree and roots from disturbance. The CRZ is defined as a radius equal in feet to the number of inches of the tree's trunk diameter, with a minimum of ten (10) feet. The CRZ shall be shown on all tree surveys, tree replacement plans, and construction plans. Improvements or activities such as paving, utility and irrigation trenching and other activities shall occur outside the CRZ, unless authorized by the Administrator. Unless otherwise specified, the protective fencing shall define the CRZ.

Because they are so important, it is critical to protect roots that lie in the path of

construction. The part of this root system in which construction damage should be avoided is called the Critical Root Zone (CRZ).

Figure 25:

Fence the area off to shield the soil around the tree from any disturbance; additionally this protects the trunk from mechanical damage. The fences should

be placed as far out from the trunk of the trees as possible (**Figure 26**). As a general rule, allow **1 foot of diameter from the trunk** for each inch of trunk diameter for trees. The intent is not to only protect the aboveground portions of the tree but also the root systems. For this reason you should protect as much of the area beyond the dripline as possible.

Figure 26: Tree Protection Fencing

Protected

Root Zone (PRZ) -



Activities <u>prohibited</u> within the CRZ include:

- Storage or parking vehicles, building materials, refuse, excavated spoils or dumping of poisonous materials on or
- around trees and roots. Poisonous materials include, but are not limited to, paint, petroleum products, concrete or stucco mix, dirty water or any other material which may be harmful to tree health
- The use of tree trunks as a winch support, anchorage, temporary power pole, sign post or other similar function
- Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches and other miscellaneous excavation without prior approval of the Administrator
- Soil disturbance or grade changes
- Impervious paving
- Vehicular traffic
- Drainage changes

Activities <u>permitted</u> or <u>required</u> within the CRZ include:

- Mulching. During construction, mulch may be spread within the CRZ. The mulch may be removed if improvements or other landscaping is required. Where there are areas of unprotected root zones in the CRZ, those areas shall be covered with four (4) inches of organic mulch to minimize soil compaction. See Chapter 3 of this Manual for a more thorough discussion on mulching.
- Irrigation, aeration, fertilizing or other beneficial practices that have been specifically approved for use within the CRZ and as defined by the Administrator.

Erosion Control – If a tree is adjacent to or in the immediate proximity to a grade slope of 8% (23 degrees) or more, then approved erosion control or silt barriers shall be installed outside the CRZ to prevent siltation and/or erosion within the CRZ.

b. Tree Protection and Preservation Plan and Pre-Construction Requirements

Prior to the start of any development project, the property owner shall have prepared and submitted for review a Tree Protection Plan for all protected trees. The Tree Protection Plan will consist of three elements: 1) illustrations showing options in tree fencing and protection (see illustrations in this section related to fencing and protection), 2) notes as listed in section 5.3.2 (b) of this Manual) tree protection symbols on the tree protection plan as discussed in section 5.3.2 (b) and illustrated in Illustration 5-2 of this Manual. The plan will be reviewed by the Administrator. The following elements will be addressed in the Tree Protection Plan prior to construction:

- 1. *Site Plan Reflecting Critical Root Zones* In addition to the requirements described in the Tree Survey Standards, the CRZ to be enclosed with the specified tree fencing will be indicated on the Tree Replacement Plan and all construction plans as a bold dashed line with a TP placed between dashes (see Illustration 5-2).
- 2. *Tree Protection Notes* The Construction Plan and Site Plan will reflect the following tree protection notes. The following notes must be shown on plans accompanied by the tree protection details as illustrated under the Tree Protection Standards.
 - a. All trees not located within the limits of construction and outside of disturbed areas shall be preserved.
 - b. All trees shown on this plan to be retained shall be protected during construction with fencing.
 - c. Tree protection fences shall be erected including types of fencing and signage.
 - d. Tree protection fences shall be installed prior to the commencement of any site preparation work (clearing, grubbing, or grading) and shall be maintained throughout all phases of the construction project.
 - e. Erosion and sedimentation control barriers shall be installed or maintained in a manner which does not result in soil build-up within the CRZ.
 - f. Fences shall completely surround the CRZ of the tree or clusters of trees, and shall be maintained throughout the construction project in order to prevent the following:
 - 1) Soil compaction in root zone area resulting from vehicular traffic or storage of equipment or material.
 - 2) Root zone disturbances due to grade changes (greater than 6 inches cut or fill) or trenching not reviewed and authorized by the Administrator.
 - 3) Wounds to exposed roots, trunk, or limbs by mechanical equipment.
 - 4) Other activities detrimental to trees such as chemical storage, concrete truck cleaning, and fires.
 - g. Exceptions to installing tree fences at the tree dripline or CRZ, whichever is greater, may be permitted in the following cases:

- 1) Where there is to be an approved grade change, impermeable paving surface, or tree well;
- 2) Where permeable paving is to be installed, erect the fence at the outer limits of the permeable paving area.
- 3) Where trees are close to proposed buildings, erect the fence no closer than 6 feet to the building.
- 4) Where there are severe space constraints due to tract size, or other special requirements, contact the Administrator to discuss alternatives.
- h. Where any of the above exceptions result in a fence that is closer than 5 feet to a tree trunk, protect the trunk with strapped-on planking to a height of 8 feet (or to the limits of lower branching) in addition to the reduced fencing provided.
- i. Where any of the above exceptions result in areas of unprotected root zones within the CRZ, 4 inches of organic mulch shall be installed to minimize soil compaction.
- j. All grading within protected root zone areas shall be done by hand or with small equipment to minimize root damage. Prior to grading, relocate protective fencing to 2 feet behind the grade change area.
- k. Any roots exposed by construction activity shall be pruned flush with the soil. Backfill root areas with good quality top soil within two days. If exposed root areas are not backfilled within 2 days, cover them with organic material in a manner which reduces soil temperature and minimizes water loss due to evaporation.
- 1. Prior to excavation or grade cutting within the CRZ, a clean cut shall be made between the disturbed and undisturbed root zones with a rock saw or similar equipment to minimize damage to remaining roots.
- m. Trees most heavily impacted by construction activities will be watered deeply once a week during periods of hot, dry weather. Tree crowns are to be sprayed with water periodically to reduce dust accumulation on leaves.
- n. When installing concrete adjacent to the root zone of a tree use a plastic vapor barrier behind the concrete to prohibit leaching of lime into the root zone.
- o. Any trenching required for the installation of landscape irrigation shall be placed as far from existing tree trunks as possible.
- p. No landscape topsoil dressing greater than four (4) inches shall be permitted within the CRZ of trees. No topsoil is permitted on root flares of any tree.
- q. Pruning to provide clearance for structures, vehicular traffic, and construction equipment shall take place before construction begins. The Administrator has the authority to require additional tree protection before or during construction.
- r. Trees approved for removal shall be removed in a manner which does not impact trees to be preserved. Prior to construction all lower tree limbs over roadways must be pruned to a height of 14 feet height Deviations from the above notes may be considered ordinance viol*ations if there is substantial noncompliance* or if a tree sustains damage as a result.
- 3. *Pre-Construction Meeting* The demolition, grading, and underground contractors, construction superintendent and other pertinent personnel are required to meet with the Administrator prior to beginning work to review procedures, tree protection measures, and to establish haul routes, staging areas, contacts, watering, etc.

4. *Verification of tree protection*- The project arborist, landscape architect, or contractor shall verify, in writing, that all preconstruction conditions have been met (tree fencing, erosion control, pruning, etc.) and are in place. Written verification must be submitted to and approved by the Administrator before demolition or grading begins.

Illustration 5-2: Site plan with tree protection fence illustrated s circles scaled to indicate the Critical Root Zone.

From: Burditt – Urban Forestry Consultants



5. Tree fencing for protected trees

Fenced enclosures shall be installed at the CRZ to achieve three primary goals:

- 1. To keep the foliage crowns and branching structure clear from contact by equipment, materials, and activities
- 2. To preserve roots and soil conditions in an intact and non-compacted state
- 3. To identify the Critical Root Zone (CRZ) in which no soil disturbance is permitted and activities are restricted, unless otherwise approved.

Illustration 5-3: Examples of tree protection fencing surrounding the Critical Root Zone – Chain link fencing without and with adjacent obstruction *From: LCPC Austin*



a. Size and type of fence

Chain Link:

Chain link fences around protected trees shall be a minimum of four (4) feet high. Fences are to be mounted on two inch diameter galvanized iron posts, driven into the ground to a depth of at least 1-foot at no more than 10-foot spacing. This detail shall appear on grading, demolition and improvement plans.

Wood:

Wood fencing will consist of vertical planks attached to 2x4 inch horizontal stringers which are supported by 2x4 inch intermediate vertical supports and a 4x4 inch post at every fourth vertical support.

Plastic:

Plastic fence will consist of 4' tall plastic mesh fence supported by 6' tall iron T-bar posts driven 2' into ground on no more than 10' centers. Fence is attached to posts with 16 gauge wire ties spaced on 24" centers.

b. Area to be fence

1. Type I Tree Protection

Tree fences shall enclose the entire area of the **CRZ** of the tree(s) to be saved throughout the life of the project, or until final improvement work within the area is completed, typically near the end of the project.

Parking Areas: If the fencing must be located on paving or sidewalk that will not be demolished, the posts may be supported by an appropriate grade level concrete base.

2) Type II Tree Protection

For trees situated within a **narrow planting strip**, only the planting strip shall be enclosed with the required chain link or wood protective fencing in order to keep the sidewalk and street open for public use. For trees **situated near buildings**, partial fencing may only be possible

3) Type III Tree Protection

Trees situated in a small tree well or **sidewalk planter pit**, or when construction will come within five (5) feet of a trunk, shall have the trunk protected with strapped-on planking to a height of eight (8) feet or to the limits of lower branches. During installation of the wood slats, caution shall be used to avoid damaging any bark or branches. Major scaffold limbs may also need protection as directed by the Administrator. See Illustration 5-4.

Illustration 5-4: Example of trunk protection – done when CRZ is less than an 8 foot diameter, upon approval by the Administrator.

From: Burditt – Urban Forestry Consultants



TREE TRUNK (BARK) PROTECTION: WOOD SLATS

c. Duration

Tree fencing shall be erected before demolition, grading, or construction begins and remain in place until the project is completed. Removal of the fence during construction must be approved by the Administrator. *Fence removal without the approval of the Administrator will result in a stop work order*

d. Warning Sign

A warning sign shall be posted on each section of fence or every one hundred (100') feet of fence and state in both English and Spanish the following: 'TREE PROTECTION ZONE – NO ACCESS BY ORDER OF THE LCPC. Durable signs are recommended with a minimum size of 8"x11". See Illustration 5-5.

Illustration 5-5 – **Sample signage for Sign Placement** Illustration from: Conserving Wooded Areas in Developing Communities.



5.1.3. <u>TREE PRUNING, TREE SURGERY, AND REMOVAL PRIOR TO</u> <u>CONSTRUCTION</u>

a. Pruning

Prior to construction, various trees may require that branches be pruned clear from structures, activities, building encroachment or may need to be strengthened by means of mechanical support or surgery per approval of the Administrator. The most compelling reason to prune is to develop a strong, safe framework and tree structure. Cosmetic pruning is left to the discretion of the LCPC. Consult an arborist or landscape architect for best practices if cosmetic pruning is desired. However, practices such as limbing up should be avoided. Heavy pruning just after the spring growth flush should be avoided. This is when trees have just expanded a great deal of energy to produce foliage and early shoot growth. Removal of a large percentage of foliage at this time can stress the tree.

1) All trees (Recommended):

Most routine pruning to remove weak, diseased, or dead limbs can be accomplished at any time during the year with little effect on the tree. As a rule, growth is maximized and wound closure is fastest if pruning takes place between November and March (before spring bud break).

2) Pruning limitations:

- a. *Minimum Pruning* If the project's consulting arborist or landscape architect recommends that trees be pruned, and the type of pruning is left unspecified, the standard pruning shall consist of 'crown cleaning' as described below. Trees shall be pruned to reduce hazards and develop a strong, safe framework.
- b. *Maximum Pruning* Maximum pruning should only occur in the rarest situation and be approved by the Administrator. No more than **one fourth** (**25 percent**) of the functioning leaf and stem area may be removed within one calendar year of any protected tree.
- c. *Tree Workers* Pruning shall not be attempted by construction or contractor personnel, but shall be performed by a certified arborist.

d. Types of Pruning – (See Illustration 5-6)

1. Cleaning:

The removal of dead, dying, diseased, crowded, weakly attached, and lowvigor branches from the crown of a tree.

2. Thinning:

The selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the tree's natural shape.

3. Raising:

Removes the lower branches from a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas.

4. Reduction:

Reduces the size of a tree, often for clearance for utility lines. Reducing the

height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least 1/3 the diameter of the cut stem). Compared to topping, this helps maintain the form and structural integrity of the tree.

Illustration 5-6: Types of crown pruning

From: International Society of Arboriculture



5. Making Proper Cuts (See Illustration 5-7)

- a. Tree topping is prohibited and may result in tree replacement.
- b. Stub cuts are prohibited.
- c. Cuts will be made just beyond the outer edge of the collar of live wood. See illustration 2-6 for an example.
- d. If a large limb is to be removed, its weight should first be reduced. This is done by making an undercut about 12-18 inches from the limb's point of attachment. A second cut is made from the top, directly above or a few inches further out on the limb. This removes the limb leaving the 12-18 inch stub. The stub is removed by cutting back to the branch collar. This technique reduces the possibility of tearing the bark.

Illustration 5-7: Proper Cuts

From: International Society of Arboriculture



Use the 3-out method to remove a large limb.



b. Tree Surgery

If it is necessary to promote health and prolong useful life or the structural characteristics, trees shall be provided the appropriate treatments (e.g. cavity screening, bark tracing, wound treat, cables, rods or pole supports) as specified by the project consulting arborist or landscape architect.

c. Tree Removal

When trees are removed and adjacent trees must be protected (as shown on the approved site plans), then the following tree removal practices apply:

- a) *Tree Removal* Removal of trees that extend into the branches or roots of protected trees shall not be attempted by demolition or construction personnel, grading or other heavy equipment. A certified arborist or tree worker shall remove the tree carefully in a manner that causes no damage above or below ground to the trees that remain.
- b) *Stump Removal* Before performing stump extraction, the contractor shall first consider whether or not roots may be entangled with trees that are to remain. If so, these stumps shall have their roots severed before extracting the stump. Removal shall include the grinding of stump and roots to a minimum depth of 12-inches. All stump grindings debris is to be removed and replaced with native topsoil of the area.

5.1.4. ACTIVITIES DURING CONSTRUCTION & DEMOLITION NEAR TREES

Soil disturbance or other injurious and detrimental activity within the CRZ is prohibited unless approved by the Administrator. If an injurious event inadvertently occurs, or soil disturbance has been specifically conditioned for project approval, then the following mitigation is required:

a. Soil Compaction

If compaction of the soil occurs, it shall be mitigated as outlined in Section 5.1.5

b. Grading Limitations within the Critical Root Zone

- Grade changes within the CRZ are not normally permitted.
- If grading within the CRZ is approved, grading shall be done by hand or with small equipment to minimize root damage.
- Grade changes outside the CRZ shall not significantly alter drainage to the tree.
- Grade changes under specifically approved circumstances shall not allow more than three (3) inches of fill soil added or allow more than three (3) inches of existing soil to be removed from natural grade unless mitigated.
- Grade fills over three (3) inches or impervious overlay shall incorporate an approved permanent aeration system, or other approved mitigation.
- Grade cuts exceeding three (3) inches shall incorporate retaining walls or an appropriate transition equivalent.

Illustration 5-8: Options in tree preservation due to grade change

From: LCPC Austin



Illustration 5-9: Changing grade around tree trunk by grading or fill. Trees which have too high of a grade during or after construction will lack the root flare. *From: A Guide to Preserving Trees in Development Projects*



Illustration 5-10: Using retaining walls when natural grade must be raised or lowered. *From: Building Greener Neighborhoods*



c. Trenching, excavation and equipment use

Normally, trenching is allowed outside of the CRZ. Trenching, excavation or boring activity within the CRZ is restricted to the following activities, conditions and requirements are being outlined below. Mitigating measures shall include prior notification to and direct supervision by the project consulting arborist or landscape architect.

- a. Notification. Contractor shall notify the project consulting arborist or landscape architect a minimum of 24 hours in advance of the activity in the CRZ. As noted above, the project consulting arborist or landscape architect must notify the Administrator before any work begins in the CRZ.
- b. Root Severance. Roots that are encountered shall be pruned flush with the soil. Backfill root areas with good quality top soil within the same day. If exposed root areas are not backfilled within the same day, cover them with organic material in a manner which reduces soil temperatures and minimizes water loss due to evaporation.
- c. Excavation. Any approved excavation, demolition, or extraction of material shall be performed with equipment sitting outside the CRZ. Methods permitted are hand digging and hydraulic air excavation technology.

If excavation or trenching for drainage, utilities, irrigation lines, etc. is to occur, it is the duty of the contractor to <u>tunnel under</u> any roots 2-inches in diameter and greater (Illustration 5-11).

Illustration 5-11: Tunneling vs. Trenching



Prior to excavation for foundation/footings/walls, grading or trenching within the CRZ, roots shall first be severed cleanly one (1) foot outside the CRZ and to the depth of the future excavation. The trench must then be hand dug and roots pruned with a saw, narrow trencher with sharp blades or other approved root pruning equipment.

- d. Heavy Equipment. Use of backhoes, steel tread tractors, or any heavy vehicles within the CRZ, plans shall specify a design or special foundation, footing, walls, concrete slab or pavement designs subject to Administrator's approval. Discontinuous foundations such as concrete pier and structural grade beam must maintain natural grade (not to exceed a 3-inch cut), to minimize root loss and allow the tree to use the existing soil.
- e. Structural design. If injurious activity or interference with roots greater than 2-inches will occur within the CRZ, plans shall specify a design of special foundation, footing, walls, concrete slab or pavement designs subject to the Administrator's approval. Discontinuous foundations such as concrete pier and structural grade beam must maintain natural grade (not to exceed a 4-inch cut) to minimize root loss and allow the tree to use the existing soil.
- f. Basement excavations shall be designed outside the CRZ of all protected trees and shall not be harmful to other mature or neighboring property trees.

d. Tunneling and directional drilling

If tunneling or pipe installation has been approved within the CRZ, the trench shall be either cut by hand, air-spade, hydraulic vac-on excavation, or by mechanically boring the tunnel under the roots with a horizontal directional drill and hydraulic or pneumatic air excavation technology. In all cases, install the utility pipe immediately, backfill with soil and soak with water within the same day. Installation of private utility improvements shall be tunnel bored beneath the tree and roots per Trenching Tunneling and Distance Table in Illustration 5-12. Emergency utility repairs shall be contacted after any such repairs that may result in significant tree damage or removal.

Illustration 5-12: Trenching and boring distances.

From: Shenandoah Tree Technical Manual Standards and Specification'

\begin{aligned} & \$\begin{aligned} & \$\begin	
Tree diameter at 54 inches is:	Trenching will be replaced with boring If the CRZ is being encroached.
8" – 19" 20" +	CRZ 8' – 19' 20' +
DEPTH OF 7 9" or less 10 – 14" 15 – 19" More than 19"	TUNNELING 2.5' 3.0' 3.5' 4.0'

TRENCHING DISTANCE

Bore pits shall be located at a minimum distance as specified by the Trenching Distance Table Above

e. Construction impact mitigation

A mitigation program is required if the approved development will cause drought stress, dust accumulation, or soil compaction to trees that are to be saved. To help reduce impact injury, one or more of the following mitigation measures shall be implemented and supervised by the project arborist or landscape architect as follows:

- 1. Irrigation program Irrigate or water weekly or as scheduled by Administrator with 10-gallons of water per diameter inch within the CRZ. Duration shall be until project completion or when seasonal rainfall begins.
- 2. Dust control program During periods of extended drought, wind or grading, spray wash trunk, limbs and foliage to remove accumulated construction dust.
- Soil compaction damage Compaction of the soil is the largest killer of trees on construction sites due to suffocation of roots and ensuing decline of tree health. If compaction occurs to the upper 12-inches of soil within the CRZ, then one or more of the following mitigation measures shall be implemented.
 - Type I Mitigation. If paving, hardscape, or other compromising material encroaches within the CRZ, an aeration system shall be designed by the project consulting arborist and landscape architect and used within this area (subject to approval by the Administrator).
 - Type II Mitigation. If inadvertent compaction of the soil has occurred within the CRZ, the soil shall be loosened by one or more of the following methods to promote favorable root conditions: vertical mulching, soil fracturing, coreventing, radial trenching or other method approved by the County Designee.

5.1.5. DAMAGE TO TREES

a. Reporting

Any damage or injury to trees shall be reported the same day to the project consulting arborist, landscape architect, job superintendent, or Administrator so that mitigation can take place. All mechanical or chemical injury to branches, trunk or roots over 1-inch in diameter shall be reported. In the event of injury, the following mitigation and damage control measures shall apply:

- 1. Root injury: If trenches are cut and tree roots 1-inch or larger have been damaged, they must be cleanly cut back to a sound wood lateral root. The end of the root shall be sawed off with a clean cut. All exposed root areas within the CRZ shall be backfilled or covered the same day. Exposed roots may be kept from drying out by temporarily covering the roots and draping layered burlap or carpeting over the upper 2-feet of trench walls.
- 2. Bark or trunk wounding: Current bark tracing and treatment methods shall be performed by a certified arborist tree care specialist within 24 hours.
- 3. Scaffold branch or leaf canopy injury: Remove broken or torn branches back to an appropriate branch capable of resuming terminal growth within three days. If leaves are heat scorched from equipment exhaust pipes, consult the project consulting arborist or landscape architect the same day.

b. Penalty for damage to protected trees

In the event that protected trees or their roots have been damaged, replacement may be required if the Administrator deems that the trees need to be replaced. Damaged trees will be replaced according to the tree points of trees determined by a consulting arborist.

Damage to trees may result in a fine being levied against party responsible in the sum of \$1,000 per incident. All contractors shall be required to be bonded for tree damage to the sum

\$100,000.

5.1.6 PAVEMENT AND HARDSCAPE CONFLICTS WITH TREE ROOTS

Conflicts may occur when tree roots grow adjacent to paving, foundations, sidewalks, or curbs (hardscape). Improper or careless extraction of these elements can cause severe injury to the roots and instability or even death of the trees. The following alternatives must first be considered before root pruning within the CRZ of a protected tree.

1) Removal and replacement of pavement or sidewalk

a. Removal of existing pavement over tree roots shall include the following precautions: Break hardscape into manageable pieces with a jackhammer or pick and hand load the pieces onto a loader. The loader must remain on undisturbed pavement or off exposed roots. Do not remove base rock that has been exploited by established absorbing roots. Apply untreated wood chips over the exposed area within one hour, then wet the chips and base rock and keep moist until overlay surface is applied. b. Replacement of pavement or sidewalk: An alternative to the severance of roots greater than 1 – inch in diameter should be considered before cutting roots. If an alternative is not feasible, remove the sidewalk and grind roots only as approved by the Administrator. Use a wire mesh reinforcement if within 10-feet of the trunk of a protected tree.

2) Alternative methods to prevent root cutting (Recommended)

The following remedies should be considered before cutting tree roots that may result instability or decline:

- a. Grinding a raised sidewalk edge.
- b. Ramping the walking surface over the roots or lifted slab with pliable paving.
- c. Routing the sidewalk around the tree roots.
- d. Inflexible paving or rubberized sections.
- e. On private property, new sidewalk or driveway design should offer alternatives to conventional pavement and sidewalk materials. A substitute for impermeable materials of typical asphalt or concrete overlay, sub-base or footings to consider are: permeable paving materials, interlocking pavers, flexible paving, wooden walkways, porches elevated on posts and brick or flagstone walkways on sand foundations.

3) Alternative base course materials (Recommended)

When designing hardscape areas near trees, the project architect or engineer should consider the use of recommended base course material such as an engineered structural soil mix. Structural soil mix will allow a long term cost effective tree and infrastructure compatibility that is particularly suited for the following types of development projects: repair or replacement of sidewalk greater than 40-feet in length; subdivisions with new street tree plantings; planting areas that are designed over structures or parking garages; confined parking lot median and islands or other specialized conditions as warranted.

4) Avoiding conflict (Recommended)

Conflicts and associated costs can be avoided or reduced by the following planting practices:

- a. Plant deep rooted trees that are proven to be non-invasive.
- b. Over soil that shrinks and swells, install a sidewalk with higher strength that has wire mesh and/or expansion slip joint dowel reinforcement.
- c. Follow soil loosening planting techniques to promote deep rooting.
- d. Install root barrier only along the hardscape area of the tree (but allow roots to use open lawn or planter strip areas).

5.1.7. TOLERANCE OF TREE SPECIES TO CONSTRUCTION DAMAGE

Each tree species, and each unique individual, will respond to the stress and strain of construction activities in different ways. Some trees tolerate damage well -- others tolerate damage poorly. Construction damage to trees is not one that is noticed immediately. The damage can take from 0 to 8 years before trees decline to point of tree death. The relative tolerance differences between native species are given in the **Appendix** as are the primary limiting factors.

This list represents only broad expectations of tree reactions and cannot show specific reactions to specific sites changes and circumstances.

A tree mitigation plan that includes details of how to protect the trees is found in the Appendix.

5.1.8. MITIGATION POLICY TO MEET 1,600 TREE QUALITY POINTS/DEVELOPABLE ACREAGE

By ordinance, all applicable sites must meet the **1,600 Tree Quality Points** whether or not a site had trees prior to development or disturbance of the applicable site. The *points* may be achieved by preserving existing trees, by planting new trees according to the minimum standards in this Ordinance, or by a combination of the two. In some situations the site design may not be suitable for planting trees to meet the requirements. If this occurs, then the developer/owner shall pay into the Tree Fund. The number of trees required for a site will not be reduced as a result of these situations. For calculating contributions to the Tree Fund,

REFERENCES

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APPENDIX - 1

Pruning Young Trees

Proper pruning is essential in developing a tree with a strong structure and desirable form. Trees that receive the appropriate pruning measures while they are young will require little corrective pruning when they mature.

Establishing a Strong Scaffold Structure



A good structure of primary scaffold branches should be established while the tree is young. The scaffold branches provide the framework of the mature tree. Properly trained young trees will develop a strong structure that requires less corrective pruning as they mature.

> The goal in training young trees is to establish a strong trunk with sturdy, well-spaced branches. The strength of the branch structure depends on the relative sizes of the branches, the branch angles, and the spacing of the limbs. Naturally, those factors vary with the growth habit of the tree. Pin oaks and sweet gums, for example, have a conical shape with a central leader. Elms and live oaks are often wide-spreading without a central leader. Other trees, such as lindens and Bradford pears, are densely branched. Good pruning techniques remove structurally weak branches while maintaining the natural form of the tree.

Trunk Development

For most young trees, maintain a single dominant leader. Do not prune back the tip of this leader. Do not allow secondary branches to outgrow the leader. Sometimes a tree will develop double leaders known as co-dominant stems. Co-dominant stems can lead to structural weaknesses, so it is best to remove one of the stems while the tree is young.

The lateral branches contribute to the development of a sturdy well-tapered trunk. It is important to leave some of these lateral branches in place, even though they may be



When co-dominant stems develop, bark may become "included" in the crotch. It is best to prune one of the stems while the tree is young.

pruned out later. These branches, known as temporary branches, also help protect the trunk from sun and mechanical injury. Temporary branches should be kept short enough not to be an obstruction or compete with selected permanent branches.

Permanent Branch Selection



shown in the tree on the left.

Nursery trees often have low branches that may make the tree appear well-proportioned when young, but low branches are seldom appropriate for large-growing trees in an urban environment. How a young tree is trained depends on its primary function in the landscape. For example, street trees must be pruned so that they allow at least 16 feet of clearance for traffic. Most landscape trees require only about 8 feet of clearance.

The height of the lowest permanent branch is determined by the tree's intended function and location in the landscape. Trees that are used to screen an unsightly view or provide a wind break may be allowed to branch low to the ground. Most large-growing

trees in the landscape must eventually be pruned to allow head clearance.

The spacing of branches, both vertically and radially, in the tree is very important. Branches selected as permanent scaffold branches must be well-spaced along the trunk. Maintain radial balance with branches growing outward in each direction.

A good rule of thumb for the vertical spacing of permanent branches is to maintain a distance equal to 3 percent of the tree's eventual height. Thus, a tree that will be 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk. Avoid allowing two scaffold branches to arise one above the other on the same side of the tree.

Some trees have a tendency to develop branches with narrow angles of attachment and tight crotches. As the tree grows, bark can become enclosed deep within the crotch between the branch and the trunk. Such growth is called included bark. Included bark weakens the attachment of the branch to the trunk and can lead to branch failure when the tree matures. You should prune branches with weak attachments while they are young.

Avoid over thinning the interior of the tree. The leaves of each branch must manufacture enough food to keep that branch alive and growing. In addition, each branch must contribute food to grow and feed the trunk and roots. Removal of too many leaves can "starve" the tree, reduce growth, and make the tree unhealthy. A good rule of thumb is to maintain at least half the foliage on branches arising in the lower two-thirds of the tree.

STANDARD TREE PLANTING DETAIL

Tree planting guidelines based on Approved American National Standard ANSI A300 (Part 6)-2005 Transplanting

APPENDIX - 2

Planting Specifications

Trees shall conform to the American Standard for nursery stock for proper relations of height, caliper and root ball diameter.

(1) The diameter of the planting hole shall be a minimum of three (3) times the diameter of the root ball.

(2) The planting hole's sidewalls shall be scored or roughened to eliminate the smooth, slick surface caused by the shovel or auger.

(3) If containerized material is to be planted, any circling roots shall be cut by slicing the root ball vertically from top to bottom in two to three well spaced lines around the root ball with a sharp knife.

(4) The root ball shall rest on undisturbed soil in the planting hole with the top of the root ball on level with the natural ground level or slightly raised (not to exceed a height of two (2) inches above the natural ground level).

(5) Any tree planted with the top of the root ball below natural ground level shall not be counted towards the required Canopy Replacement for the property.

(6) The soil used to backfill around the root ball shall be un-compacted, native soil free of rocks, trash, or any construction debris.

(7) Stakes and guy wires should only be installed when absolutely necessary. Supporting devices shall not interfere with vehicular or pedestrian movement and shall be removed after twelve (12) months.

(8) Mulch in the form of pine straw, pine bark, or wood chips shall be evenly distributed over the planting hole to a settled depth of two (2) inches.

(9) Permanent built-in or temporary watering systems shall be installed to ensure the plants will survive the critical establishment period.

APPENDIX - 3

Proper planting detail

If you form a berm of mulch (preferred) or soil (less preferred) around the root ball to hold irrigation, keep it less than about 4 inches high. Water held in a taller berm wastes water because it simply runs through the root ball. It might be more appropriate to make the berm from mulch since the berm typically ends up on top of the root ball eventually. Placing soil over the root ball cuts off oxygen and water.



When planting on slopes set the tree so the top-most root in the ball on the uphill side is about even with the soil. The side of the root ball on the downhill side will be well above the surrounding soil. Bring in enough soil to cover the sides of the root ball with soil. Apply mulch to finish the planting job as shown in the diagram above.

APPENDIX – 4

Design Standards for Road Frontage Areas

MINIMUM STREET TREE SPACING AND DISTANCE FROM INTERSECTION



PREFERRED PLACEMENT OF URBAN STREET TREES



APPENDIX - 5

Example of Tree Protection Details:



SECTION VIEW

NOTES:

- 1. SEE PLANS FOR LOCATION OF ALL TREE PROTECTION FENCES.
- 2. ALL TREE PROTECTION DEVISES MUST BE INSTALLED PRIOR TO LAND DISTURBANCE, INCLUDING THE CUTTING OF ANY TREES.
- 3. NO GRADING IS TO OCCUR IN THE TREE CONSERVATION AREAS OR TREE CRITICAL ROOT ZONES.
- 4. REMOVE ALL BARRIERS UPON COMPLETION OF PROJECT.

STANDARD TREE PROTECTION DETAIL

APPENDIX – 6

Relative Tolerance of Tree Species to Construction Damage

Scientific Name	Common Name	Tolerance	Limitations
Acer barbatum	Florida maple	m	IS
Acer negundo	boxelder	g	IC
Acer saccharinum	silver maple	р	А
Carpinus caroliniana	American hornbeam	m	SC
Carya cordiformis	bitternut hickory	р	S
Carya glabra	pignut hickory	m	S
Carya ovata	shagbark hickory	р	S
Carya tomentosa	mockernut hickory	mp	S
Celtis laevigata	sugarberry	g	I
Celtis tenuifolia	Georgia hackberry	m	IS
Cercis canadensis	redbud	m	S
Cornus florida	dogwood	m	IP
Diospyros virginiana	persimmon	g	Р
Halesia carolina	Carolina silverbell	m	ISC
Juglans nigra	black walnut	р	IS
Juniperus virginiana	Eastern redcedar	m	I
Liriodendron tulipifera	yellow-poplar	р	IS
Magnolia acuminata	cucumbertree	m	I
Magnolia grandiflora	Southern magnolia	m	I
Nyssa ogeche	Ogeechee tupelo	m	IS
Pinus echinata	shortleaf pine	gm	Р
Pinus palustris	longleaf pine	gm	С
Prunus serotina	black cherry	m	I
Quercus alba	white oak	gm	S
Quercus phellos	willow oak	gm	S
Quercus prinus	chestnut oak	gm	S
Quercus virginiana	live oak	gm	С
Tilia caroliniana	Carolina basswood	р	А
Ulmus americana	American elm	m	Р

Key:

Tolerance: G - Good; M - Medium; P - Poor - Represents: species' reactions to activities around construction sites within one-and-one-half times the drip line distance from the tree.

Limitations: physical injury (compartmentalization and decay) "I"; pest complications (chronic and acute attacks) "P"; soil constraints (aeration and water availability attributes) "S"; limited climatic tolerances (native range, hardiness, and micro-climatic change) "C"; and, all of these reactions combined.

LCPC, GEORGIA TREE SPECIES LISTING

Large Canopy Trees Characteristics Guidelines

Large Trees >50' Suitable for areas with more than 400 square feet of total planting area; in a
planting strip at least 16' x 25' or 20' x 20'

Species	Deciduous	Sun/	Growth	Medians	Parking Lots	Near	Under Utility
Common Name	(D) Evergreen (E)	Shade	Rate		'Hardscapes'	Sidewalks	Lines
Blackgum*	D	PS/FS	S	YES	NO	NO	NO
Bald Cypress*	D	FS/PS	F	YES	NO	NO	NO
Pond Cypress*	D	PS/FS	F	YES	NO	NO	NO
Pignut Hickory*	D	PS/FS	М	YES	YES	NO	NO
Southern Magnolia*	E	PS/FS	М	YES	NO	YES	NO
Red Maple* ^B	D	PS/FS	F	YES	YES	YES	NO
Laurel Oak*	SE	PS/FS	F	YES	NO	NO	NO
Live Oak*	E	PS/FS	М	YES	YES	NO	NO
Nutall Oak*	D	FS	М	YES	YES	NO	NO
Shumard Oak*	D	FS	F	YES	YES	YES	NO
Southern Red Oak*	D	FS	М	YES	YES	YES	NO
Scarlet Oak*	D	FS	М	YES	YES	YES	NO
Swamp Chestnut Oak*	D	PS/FS	М	YES	YES	NO	NO
White Oak*	D	PS/FS	М	YES	YES	NO	NO
Willow Oak*	D	FS	F	YES	YES	YES	NO
Loblolly Pine*	E	FS	F	NO	NO	NO	NO
Longleaf Pine*	E	FS	F	NO	NO	NO	NO
Eastern Redcedar*	E	FS	F	YES	YES	NO	NO
Sweetgum*	D	PS/FS	М	YES	NO	NO	NO
Sycamore*	D	FS	F	YES	NO	NO	NO
Tulip Popular*	D	FS	F	YES	YES	YES	NO
Zelkova	D	FS	М	YES	YES	YES	NO

Key:

* Native to South Georgia	Sun/shade	Growth rate:	Type:	Problems
	exposure:			
** Tree placement and	FS = Full	S = Slow (less than 1' per	D = Deciduous	A. Large fruit
maintenance procedures should	sun	year)		-
be respectful of sight distance				
	PS = Part	M = Medium (1-2' per year)	E = Evergreen	B. Use of hybrids recommende
	sun		-	
	S = Shade	F = Fast (more than 2' per	SE = Semi	
		year)	Evergreen	

Species	Deciduous (D)	Sun/ Shade	Growth Rate	Medians	Parking Lots or Similar	Near Sidewalks	Under Utility Lines
Common Name	Evergreen (E)				'Hardscapes'		
River Birch*	D	PS/FS	F	YES	NO	NO	NO
Lacebark Elm	D	FS	F	YES	YES	YES	NO
Golden Raintree	D	FS/PS	M	YES	YES	YES	YES
East Palatka Holly*	E	FS	М	YES	YES	NO	NO
American Holly*	E	FS	S	YES	YES	NO	NO
Nellie R. Stevens Holly	E	FS	М	YES	YES	NO	YES
Savannah Holly*	E	FS	М	YES	YES	YES	NO
Sweetbay Magnolia*	D	PS	М	YES	YES	YES	NO
Trident Maple	D	PS/FS	М	YES	YES	YES	NO
Overcup Oak	D	FS	М	YES	YES	YES	NO
Cabbage Palm	E	PS/FS	S	YES	YES	YES	NO
Windmill Palm	E	PS/FS	S	YES	YES	YES	NO
Chinese Pistache	D	FS/PS	М	YES	YES	YES	NO
Eastern Redbud*	D	PS	F	YES	YES	YES	YES
Carolina Silverbell*	D	PS/FS	M	YES	YES	YES	YES
Yellowood*	D	PS/FS	M	YES	YES	YES	NO

Medium Trees Characteristics Guidelines

Key:

* Native to South Georgia	Sun/shade	Growth rate:	Type:	Problems
	exposure:			
** Tree placement and	FS = Full sun	S = Slow (less	D = Deciduous	A. Large fruit
maintenance procedures		than 1' per year)		C C
should be respectful of		,		
sight distance				
	PS = Part sun	M = Medium (1-2)	E = Evergreen	B. Use of hybrids
		per year)	-	recommended
	S = Shade	F = Fast (more	SE = Semi	
		than 2' per year)	Evergreen	

Small Trees Characteristics Guidelines.

Species	Deciduous	Sun/	Growth	Medians	Parking Lots	Near	Under Utility
Common Name	Evergreen (E)	Shaue	Rale		'Hardscapes'	Sidewalks	Lines
Chastetree	D	PS/FS	F	YES	YES	YES	YES
Okame Cherry	D	PS/FS	М	YES	YES	YES	YES
Crape Myrtle	D	FS	F/M	YES	YES	YES	YES
Flowering Dogwood*	D	PS	М	YES	YES	YES	YES
Kousa Dogwood	D	PS/FS	S	YES	YES	YES	YES
Fringetree	D	PS/FS	S	YES	YES	YES	YES
Yaupon Holly	E	PS/FS	М	YES	YES	YES	YES
Amur Maple	D	PS/FS	М	YES	YES	YES	YES
'Little Gem' Magnolia	E	PS/FS	М	YES	YES	YES	YES
Pindo Palm	E	PS/FS	S	YES	YES	YES	YES
Chinese Redbud	D	FS	F	YES	YES	YES	YES
'Oklahoma' Redbud	D	PS/FS	F	YES	YES	YES	YES
Snowbell*	D	PS/FS	М	YES	YES	YES	YES
Waxmyrtle*	E	PS/FS	F	YES	YES	YES	YES

Key:

* Native to South	Sun/shade	Growth rate:	Type:	Problems
Georgia	exposure:			
** Tree placement and maintenance procedures should be respectful of sight distance	FS = Full sun	S = Slow (less than 1' per year)	D = Deciduous	A. Large fruit
	PS = Part sun	M = Medium (1-2' per year)	E = Evergreen	B. Use of hybrids recommended
	S = Shade	F = Fast (more than 2' per year)	SE = Semi Evergreen	

Liberty County, GEORGIA – TREES NOT RECOMMENDED FOR PLANTING

The following species are not recommended because they are poor or marginal performers.

Common Name	Scientific Name	Problem
Box Elder	Acer negundo	Aggressive shallow roots, weak wood
Bradford Pear	Pyrus calleryana 'Bradford'	Genetic flaw, splits apart, susceptible to breakage
Catalpa	Catalpa bignonoides	Weak wooded
Chinese Tallowtree	Sapiun sebiferum	Aggressive shallow roots, susceptible to breakage
Female Ginkgo	Ginkgo biloba	Foul smelling fruit
Green ash	Fraxinus pennsylvanica	Anthracnose, Aggressive shallow roots
Hackberry	Cercis spp.	Large diameter surface roots, susceptible to breakage
Mimosa	Albizia julibrissin.	Prone to disease, weedy tree, susceptible to breakage
Pecan	Carya illinoensis	Large diameter surface roots, diseased prone, susceptible to breakage
Princess tree	Paulowina tomentosa	Aggressive shallow roots, Weedy tree, messy, weak wooded
Russian olive	Elaegnus angustifolia	Poor form, disease
Silver Maple	Acer saccharinum	Aggressive shallow roots, weak wood
Sweetgum	Liquidambar styraciflua	Aggressive surface roots, fruit a litter nuisance
Tree-of-	Ailanthus altissima	Aggressive shallow roots, Weedy tree, seeds, weak
heaven		wood
Water Oak	Quercus nigra	Large diameter surface roots, susceptible to breakage

TREE, SHRUB AND GROUND COVER LISTS FOR QUALITY POINTS

LARGE CANOPY TREES FOR TREE QUALITY POINTS (Trees with a mature height of greater than 40', with a minimum of 30' canopy)

• R/O denotes trees which receive retention points only

Minimum planting space for large trees is 400 square feet: 16' x 25' or 20' x 20'

Botanical Name	Drought-Tolerance	Planting Points	Retention Factor	Notes
Common Name				
Acer	Х	90	1.5	Yellow fall color;
Floridanum (Acer				native; good for
barbatum) Florida				parking area; maple
Acer rubrum	X, M	90	1.5	Cvs. "Summer Red,"
Red Maple				"Red Sunset"; Native
Cayra aquatica	М	R/O	1.5	Large tap root; native
Water Hickory				
Carya cordiformis	Х	R/O	1.5	Large tap root; native
Bitternut Hickory				
Carya glabra pignut	Х	R/O	1.5	Large tap root; native
Hickory				
Carya illinoensis	Х	40	.50	Edible nuts; weak
Pecan				wooded; native
Carya pallida	Х	R/O	1.5	Large tap root; native
Sand Hickory				
Cayra tomentosa	Х	R/O	1.5	Large tap root; native
Mockernut Hickory				
Carya	Х	R/O	1.5	Large tap root; native
myristicaeformis				
Nutmeg Hickory				
Cedrus atlantica		40	.50	Blue evergreen;
"Glauca"				central leader dies
Blue Atlas Cedar				back
Cedrus deodara	Х	40	.50	Evergreen
Deodar Cedar				
Celtis laevigata	Х	R/O	1.5	Small leaves; gray
C C				bark; tiny fruit
Cryptomeria japonica	Х	40	.50	Evergreen; hardy,
Japanese Cedar				stately tree
Cunninghamia	М	40	.50	Blue-gray evergreen
lanceolata				
China Fir				
X Cupressorcyparis	Х	15	.50	Susceptible to

leylandii				cankers
Leyland Cypress				
Cupressus		15	.50	Columnar tree;
sempervirens				evergreen; slow-
Italian Cypress				growing
Fagus grandifolia		90	1.5	Gray bark; plant
American Beech				smaller tree
Fraxinum	М	90	1.5	cv. "Marshall's
pennsylvania				Seedless"
Green Ash				
Ginkgo biloba	Х	90	1.5	Pollution tolerant;
Maidenhair tree				yellow fall leaves;
				plant male trees;
				avoid smelly fruit
Gledtisia triacanthos		R/O	.50	Breaks up with age
Honey Locust				
Juglans nigra		R/O	.50	Edible nuts; weak
Black Walnut				wooded tree
Juniperus viginiana	С	90	1.5	Evergreen; long-
Red Cedar				lived; salt tolerant
Liquidambar	Х	15	.50	Weak wooded when
styraciflua				old; messy fruit
Sweetgum				
Liriodendron	Х, М	90	1.5	Showy green-orange
tulipifera				flowers; sensitive
Tulip or Yellow				roots
Poplar				
Magnolia grandiflora	Х	90	1.5	Evergreen; white
Southern Magnolia				fragrant flowers; cvs.
				"Braken's Brown
				Beauty"; "Claudia
				Wanamaker"; "D.D.
		10		Blanchard
Metasequoia	Х	40	.75	Medium growing;
glyptostoboides				late introduction
Dawn Redwood		7.10		
Morus rubra	Х	R/O	.50	Messy fruit; weak
Red Mulberry				wood, historical
		7.12		significance
Nyssa aquatica	М	R/O	1.5	Moist soils;
Water Tupelo				riverbanks
Nyssa sylcatica	М	90	1.5	Good fall color
Black Tupelo or				
Black Gum		1.5		
Pinus echinata		15	.50	Evergreen
Shortleaf Pine	**	1.5		
Pinus elliottii	Х	15	.75	Evergreen; stately
Slash Pine		10	1.00	tree
Pinus glabra		40	1.00	Nice form/foliage;
Spruce Pine	**			evergreen
Pinus palustris	Х	15	1.00	Fire-resistant;
			4.0-	evergreen
Pinus serotina	М	R/O	1.00	Evergreen; native
Pond Pine				
Pinus taeda	Х	15	.50	Evergreen

Loblolly Pine				
Plantanus x acerifolia London Planetree		90	1.5	Large tree; coarse texture
Plantanus occidentalis American Sycamore	М	90	1.5	Exfoliating bark; deciduous
Populus alba White Poplar	М	90	1.5	Fuzzy seeds; deciduous; native
Prunus serotina Black Cherry		R/O	.50	Dark bark; wildlife planting; deciduous; native
Quercus acutissima Sawtooth Oak	Х	90	.75	Medium sized tree; excellent
Quercus alba White Oak		90	1.5	Deciduous; sensitive roots
Quercus falcata Southern Red Oak	Х	90	1.5	Deciduous; sensitive roots
Quercus laurifolia Laurel Oak	Х	90	1.5	Semi-evergreen
Quercus lyrata Overcup Oak	М	90	1.5	Native
Quercus macrocarpa Bur Oak	X	90	1.5	Deeply furrowed bark in older specimens
Quercus michauxii Swamp Chestnut Oak	М	90	1.5	Platy, gray bark; orange fall color; distinctive tree
Quercus nigra Water Oak	М	R/O	.50	Weak wooded Oak; native
Quercus phellos Willow Oak	Х	90	.75	Deciduous
Quercus Shumardii Shumard's Red Oak	Х	90	1.5	Deciduous; large spreading
Quercus stellata Post Oak	Х	R/O	1.5	Large spreading
Quercus velutina Black Oak	Х	R/O	1.5	Large spreading; blackish colored bark
Quercus virginiana Live Oak	X	90	1.5	State tree; most majestic of southern oaks; evergreen
Taxodium ascenduns Pond Cypress	М	90	1.5	Grow in moist conditions; use plants which are acclimated to the specific site soil condition
Taxodium distichum Bald Cypress	М	90	1.5	Adaptable to conditions; better foliage than T. ascendens; use plants which are acclimated to specific site soils
Ulmus Americana American Elm		90	.75	Susceptible to Dutch Elm Disease (except

				cv "Princeton")
Ulmus parvifolia		90	.75	Cvs: "Athena",
Lacebark Chinese				"Drake", exfoliating
Elm				bark; good for
				smaller areas
Ulmus rubra		R/O	.75	Bark used
Slippery Elm				medicinally
Zelkova serrata	Х	40	.75	Cvs: "Village
Japanese Zelkova				Green";
-				"Greenspire"; good
				for smaller areas

MEDIUM CANOPY TREES FOR TREE QUALITY POINTS (Trees with a mature height between 25' - 40')

* R/O denotes trees which receive retention points only

Minimum planting space for medium trees is a min: 10' x 10'

Botanical Name	Drought-Tolerance	Planting Points	Retention Factor	Notes
Common Name				
Acer Buergerianum	Х	15	.75	
Trident Maple				
Amelanchier arborea		R/O	1.5	White flowers in
Downy Serviceberry				early spring
Amelanchier		R/O	1.5	White flowers in
Canadensis				early spring
Shadblow				
Serviceberry				
Betula nigra	М	30	.50	Prefer moisture;
River Birch				good cultivars:
				"Heritage"
Carpinus caroliniana	Х	30	1.5	Blue, muscled wood
American Hornbeam				
Castanea pumila		R/O	.75	Wind pollinated
Chinquapin				
Catalpa bignonioides	X	R/O	.50	White flowers in
Common Catalpa				May; coarse leaves;
				long pods
Fraxinus caroliniana	X	R/O	.75	Native
Carolina Ash				
Fraxinus profunda	М	R/O	.75	Native
Pumpkin Ash				
Gleditsia aquatica	М	R/O	.75	Native
Water Locust				
Gordonia lasianthus	М	30	1.5	White flowers in late
Loblolly Bay				summer; moist, acid
				soil; evergreen
Halesia Carolina	X	30	1.5	Good dogwood
Carolina Silverbell				substitute; white bell
				like flowers
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Ilex opaca	Х	30	1.5	Evergreen; female
American Holly				produces berries;
Ĵ				needs male
				pollinator
Juniperus salicicola		30	1.5	Evergreen
Southern Red Cedar		50	1.5	Lvergreen
Koalrautaria	v	15	1.5	Pad fall aplom
Koelleuteria	Λ	15	1.5	Ked fall color,
bipinnata				golden Howers
Bourgainvilla				
Goldenraintree				
Magnolia virginiana	Х	30	1.5	White flowers in
Sweet Bay Magnolia				summer
Nyssa ogeche	Μ	30	1.5	Moist soil; native;
Ogeechee Lime				river banks of
_				Ogeechee
Ostrya virginiana		30	1.5	Native
Eastern				
Hophornbeam				
Oxydendrum	X	30	15	Crimson red leaves
arboretum	11	50	1.5	in fall: acidic soil:
Sourwood				white papicled
Sourwood				flowers in summer
Dometic noncios	v	20	1.5	Cood fall solor
Pariota persica	Λ	50	1.5	Good fall color;
Persian Parrotia	N/	20	1.7	hardy street tree
Pistacia chinensis	Χ	30	1.5	Good fall color;
Chinese Pistachio				hardy street tree;
				strong wooded, no
				nuts
Populus deltiodes	Х, М	R/O	.75	Native
Eastern Cottonwood				
Populus heterophylla	Х, М	R/O	.75	Native evergreen;
Swamp Cottonwood				reseeds readily
Prunus caroliniana	Х	15.	.75	May become
Carolina Cherry				invasive
Laurel				
Prunus vedoensis		30	.75	White flowing plant;
Yoshino Cherry				tidal basin:
				Washington DC
Quercus myrsinifolia	Х	30	1.5	Evergreen
Chinese Evergreen		20	110	2.019.000
Oak				
Dobinio psoudosossio		20	50	Erggrant flowers
Robina pseudoacacia Black Locust		50	.50	Plagrant nowers
Salim habedon sig	М	15	50	Chart line de moranin a
Salix Dabyloncia	IVI	15	.50	Short fived; weeping
weeping willow	27	D /O		
Salıx nıgra	Μ	R/O	.50	Native
Black Willow				
Sassafras albidum	Х	15	1.5	Native
Sassafras				

SMALL CANOPY TREES FOR LANDSCAPE QUALITY POINTS (Trees with a mature height up to 25')

* R/O denotes trees which receive retention points only Minimum planting space for small

trees varies between 25	- 100 square feet	(depending on	species)
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Botanical Name	Drought-Tolerance	Planting Points	Retention Factor	Notes
Common Name				
Acer palmatum		5.75		Plant in high shade;
Japanese Maple				red fall color
Celtis Georgiana	Х, М	R/O	.50	Moist areas
Georgia Hackberry				
Cercis Canadensis	Х	10	1.5	"Texensis" and
White Hybrid Eastern				"Alba"; "Forest
Redbud				pansy"; has
				burgundy leaves
Cercis chinesnsis	Х	10	1.5	Pink flowers;
Chinese Redbud				sometimes available
Cercis reniformis	Х	10	1.5	Wine red flowers;
Oklahoma Redbud				"Oklahoma"; glossy
				leaves
Chionanthus retusus	Χ, Μ	10	1.5	White, fringed
Chinese Fringetree				flowers; good
				ornamental tree
Chionanthus	Х, М	10	1.5	White, fringed
virginicus				flowers, good
Fringetree				ornamental tree
Cornus florida		10	1.5	White bracts of
Flowering Dogwood				flowers; red berries;
				semi-shade
Cornus kousa		10	1.5	White bracts of
Kuosa Dogwood				flowers; red berries;
				semi-shade
Elliottia racemosa	Х	R/O	1.5	Endangered species;
Elliottia Southern				moist sandy areas
Plume				
Eriobotrya japonica	Х	5	.75	Evergreen; edible
Loquat				fruit; may be messy;
_				fire blight susceptible
Forestiera acuminanta	М	R/O	1.5	Rare native tree;
Swamp Privet				black fruits
Franklinia alatamaha		10	1.5	No longer found in

Franklinia				the wild; evergreen;
Hay y attanuata	v	10	1.5	white flowers
Fast Palatka Holly	Λ	10	1.5	provide male and
Last Falatka Holly				female plants for
				berries
x attenuate	X	10	15	Good for narrow
"Fosteri" Foster	21	10	1.5	spaces: same
Holly				comments as above
Ilex x attenuate	Х	10	1.5	Same as for East
Savannah Holly		-		Palatka
Ilex cassine		5	1.5	Transparent red fruits
Dahoon Holly				on female plants;
_				deciduous
Ilex decidua	Х	5	.75	Orange fruits on
Possumhaw				female plants;
				deciduous
Ilex latifolia	Х	10	.75	Glossy green leaves;
Lusterleaf Holly				evergreen
Ilex myrtifolia		5	.75	Same as above
Myrtleleaf Holly				
llex x "Nellie R.		10	.75	One male needed
Stevens"				with females for fruit
Nellie R Stevens				
Holly	V	10	1.5	
llex vomitoria	А	10	1.5	Evergreen; red fruits
Y aupon Holly	v	10	1.5	"Dandula" Sama as
Weening Vounen	Λ	10	1.5	show
Holly				above
Juniperus chinensis	Х	5	.75	"Torulosa"
Hollywood Juniper				Interesting form
Juniperus virginiana	Х	10	1.5	"Burkii" evergreen;
Red Cedar				vertical accent
Lagerstroemia indica	Х	10	.50	"Muskogee",
"Cherokee"				"Natchez",
				"Tuscarora", etc.
				Same as above, but
				hybridized, disease
				resistant; Indian
.	**	10		names
Ligustrum lucidum	Х	10	.50	Tree form; glossy
Glossy Privet				evergreen leaves;
Magnalia r	V	10	1 5	Dive Diack berries
Magnona x	Λ	10	1.5	Plink purple flowers;
Sourangeana Saucer Magnolia				frost: deciduous
Magnolia stellata	X	5	75	White starlike
Star Magnolia	<u>^</u>	5	.10	flowers: often hurned
				by frost: deciduous
Morus alba	X	R/O	.50	Messy fruit: weak
White Mulberry				wooded tree: historic
				interest
Myrica cerifera	Х	10	1.5	Evergreen aromatic
Wax Myrtle				leaves

Osmanthus	Х	10	1.5	Evergreen
americanus Devil Wood				
Osmanthus x fortunei		10	1.5	Fragrant small
Fortune's Tea Olive				flowers in fall; no
				pests; border or as
				screen
Osmanthus gragrans		10	.50	Fragrant flowers Oct.
Fragrant Tea Olive				to Jan.; no pests;
Osmanthus		10	75	Dark green foliage:
heterophyllus		10	.15	spiny holly like
Hollyleaf Osmanthus				leaves; fall fragrant
				blooms
Planera aquatica	М	R/O	.75	Native
Planertree		10	1.5	Evergreen, derk
rouocarpus macrophyllus "Maki"		10	1.5	color
Southern Yew				0101
Prunus angustifolia	Х	R/O	.50	Native
Chickasaw Plum				
Prunus campanulata		10	.75	Dark pink flowers in
Taiwan Cherry		10		Feb.
Prunus cerasifera	Х	10	.75	Purple leaves; while
Autopurpurea A Purple leaf Plum				plink nowers
Prunus ceraifera	X	10	.75	
"Newport" Cherry				
Plum				
Prunus mume		10	.75	Light pink flowers in
Flowering Apricot		10		JanFeb.
Prunus persica		10	.50	
Prunus serrulata		10	75	Many good cultivars:
Japanese Flowering		10	.15	"Kwanzan":
Cherry				"Okame"; early
, , , , , , , , , , , , , , , , , , ,				spring blooming
Prunus umbellate		R/O	.50	Native
Hog Plum		10	1.7	
Vaccinium arboretum		10	1.5	Small blueberries;
Sparkleberry				ornamental
Vitex agnus-castus	X	10	50	White to lilac
Lilac Chastetree	2 X	10	.50	flowers in summer:
				aromatic, deciduous
				leaves

PALM-TYPE and CYCAD TREE AND SHRUB LIST

(Note: All palm LQP are based on height, not DBH)

Botanical Name	Drought-Tolerance	Planting Points	Minimum Space	Notes
Common Name	-		-	
Butia captitata	Х	2 points/foot of	8' x 8'	Treeform
Jelly or Pindo Palm		height		
Chamaerops humilis	Х	2 points/foot of	8' x 8'	Tree form
European Fan Palm		height		
Cycas revolute	Х	2 points/foot of	4' x 4'	Shrublike/small tree
Sago Cycas		height		
Phoenix canariensis	Х	2 points/foot of	8' x 8'	Treeform
Canary Date Palm		height		
Rapidophyllum	М	2 points/foot of	8' x 8'	Shrubform; small tree
histrix		height		
Needle Palm				
Sabal etonia		3.0 new/1.5 retained		Shrublike; native
Scrub Palmetto				
Sabal minor	М	3.0 new/1.5 retained		Shrublike; native
Dwarf Palmetto				
Sabal palmetto	Х	2 points/foot of	8' x 8'	Treeform; native
Cabbage		height		
Palmetto Serenoa	Х			Shrublike; native
repens				
Saw Palmetto				
Trachycarpus	Х	2 points/foot of	8' x 8'	Treeform
fortunei		height		
Fortune's Windmill				
Palm				
Washintonia robusta	Х	2 points/foot of	8' x 8'	Treeform
Washington Palm		height		

LARGE EVERGREEN SHRUB SPECIES LIST

Shrubs 8 –	12 feet in l	neight - All	shrubs in	this list a	re 5.0 point eac	ch
	12 1000 111 1				i e e lo pome eu	

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Apiso (See Illicium)				
Anise (See Inforum) Azalea sp. Southern Indica Azaleas; Duc de Roham duchess of Cyprus Fielder's White Formosa George L. Tabor Mrs. GG Gerbing Iveryana Judge Soloman Lawrence A. Walker; President Clay Pride of Mobile Pride of Summerville Red Formosa Salmon Soloman Southern Charm	PS	WD		Shade in summer and in afternoon; acid soil; orange red; salmon- blush with reddish blotch white with chartreuse blotch; magenta orchid with magenta blotch; white; white with red flecks; watermelon pink; salmon; cherry red with magenta blotch; watermelon red; salmon; deep magenta; salmon pink; watermelon pink
Bambusa Multiplex Fernleaf Bamboo	S/Sh	WD		Good for screens; contained clump; fast growing; pest free
Banana Shrub (See Michelia)				
Callistemon lanceolatus Bottlebrush	S	WD	X	Red bloom spike in spring; thorny; pest free; Use as background hedge or screen
Camellia japonica Camellia	PSh	M, WD	X	No wet feet; blooms in fall-winter; tea scale; rich, humousy acid soil
Camellia sasnqua Camellia	PSh	M, WD	Х	Same as above
Ceratiola ericoides Rosemary	S	Sandy	X	Native shrub with lavender flowers in early spring; well- drained sandy soil
Cleyera japonica Cleyera	PS/Sh	WD	Х	Upright; dark green leaves; pest free
Elaegnus pungens Elaegnus	S/Sh	Tol.	X	Rampant grower, needs lots of room; silvery leaves; natural hedge or border; wildlife planting; no pest

Fatsia japonica	Sh	WD	Х	Coarse texture; white flowers in fall; blue berries in winter:
				tropical accent; dark green foliage
Feijoa sellowiana	S	WD	Х	White flower in
Pineapple Guava				spring; edible fruit;
				pest free; good shrub
				massing or screen
Eortunalla ianonica	c	WD	v	Croomy frogrant
Kumanat	6	WD	Λ	flowers: edible fruit
Ilex cornuta	S/PSh	WD	X	Red or vellow fruit in
Chinese Holly	5/1 511	11D	11	fall: dark green
				leaves: scale a
				problem; specimen or
				foundation planting
Ilex cornuta	S/PSh	WD	Х	Orange-red berries;
"Burfordii"				rapid dense foliage;
Burford Holly				scale; specimen or
				foundation planting
Illicium anisaum	S/PSh	WD	Х	Coarse, aromatic
Japanese Anise Tree				leaves; pest-free;
				aromatic; specimen or
				foundation planting
Illicium floridanum	S/PSh	M-WD	Х	Moist to wet soil;
Florida Anise Tree				deep red flowers in
				spring; ornamental
	a mai			specimen
Illicium parviflorum	S/PSh	М	Х	Yellow green flowers
Star Anise				in June; aromatic
				leaves; interesting
				fruit; screen or hedge
Laugethee pepilifelie	Sh/DSh	М	v	White pipk flowers on
Elorida Leucothoe	511/1511	IVI	Λ	old wood: irregular
Tionda Ledeouioe				growth
Ligustrum japonicum	S/PSh	WD	x	Coarse texture: white
Iapanese Privet	5/1 511	WD .	24	flowers in spring: fast
supunese i nivee				growth.
				"Recurvifolium" and
				variegated form good
				as screen
Ligustrum japonicum	S/PSh	WD	Х	Dark green foliage;
"Rotundifolium"				columnar plant;
Curlyleaf Ligustrum				twisted; slow
				growing, easily
				pruned into tight
				spaces
Ligustrum lucidum	S/Sh	WD	Х	Coarse textured;
Waxleaf Privet				useful as screen or
				hedge; may be pruned
				into small tree; white
x . 1 . 1 .	0.00.01	ur-		flowers, blue fruits
Loropetalim chinense	S/PSh	WD	Х	Feathery white or

Evergreen Loropetalim				pink flowers in spring; irregular form; no pests; screen, shrub massing use
Lyonia ferruginea Fetterbush	S/PSh	М		Native; leathery leaves; pink flowers in spring
Lyonia lugustrina Fetterbush	S/PSh	WD		Same as above
Michelia figo Banana Shrub	S/PSh	WD		Banana scented cream flowers in April; fragrant accent or shrub boarder
Myrtus communis True Myrtle	S	WD	X	White flowers in spring; aromatic berries on females; fine textured specimen; hard to establish
Nerium oleander Common Oleander	S	WD	X	Red, pink yellow or white flowers in summer; toxic; specimen; shrub border, hedge or screen use
Photinia x "fraseri" Fraser Photinia	S	WD	X	New leaves red; upright growth for screen, hedge or tree form; problems with disease
Photinia glabra Redtip Photinia	S	WD	X	New leaves red; creamy white summer flowers; fruit in fall; use as hedge; do not plant near red brick; disease
Photinia serrulata Chinese Photinia	S	WD	X	New leaves coppery red; flowers in spring; red summer fruit; use as specimen for large area
Pineapple Guave (See Feijoa)				
Pittosporum tobira Pittosporum	S/PSh	WD	X	Interesting branch habit; variegated form; fragrant spring flowers; accent plant, shrub massing or hedge
Pyracantha koidzumi Formosa Firethorn	S/PSh	WD	X	Bright red fall, winter fruit; specimen, screen border; watch for scale; Cultivars; "San Jose" spreading; "Santa Cruz" in

				prostrate form; "Low
				Dense" is mounding;
				Victory has showy
Dealth is to a such a list.	C /DC1	WD	V T 1	dark red berries
Raphiolepis umbellate	S/PSn	WD	X 101.	Fragrant pink or white
Majestic Beauty				nowers in spring;
Indian Hawthorne				slow growing; salt
				tolerant; specimen;
Transformer	DCL	WD	T . 1	Ioundation planting
Ternstroemia	PSn	WD	101.	white flowers; red
gymnantnera				fruit in late summer;
Cleyera				often confused with
X 7'1	0./01			Cleyera japonica
Viburnum	S/Sh		WD	Large dark green
macrophyllum				leaves; upright; shrub
Viburnum				borders, hedge use;
				may be damaged in
	a m at			extreme cold
Viburnum	S/PSh	WD	X	Large glossy leaves;
odoratissimum				white flowers; red-
Sweet Viburnum				black fruit
Viburnum suspensum	S/PSh	WD	X	Dark green foliage,
Vibrunum				pest free; shrub border
				or foundation
				planting; may be
				damaged by extreme
				cold
Viburnum tinus	S/PSh	WD	X, M	White to pink flowers
Laurus tinus				in winter; upright;
				border or screen; may
				be damaged by
				extreme cold – use in
				protected areas
Yucca aloifolia	S/PSh		X	White flowers in
Spanish Bayonet				summer; pest free;
				spiny leaves;
				specimen or
				protective screen use

SHRUB SPECIES LIST (LARGE, DECIDUOUS)

Shrubs 8 - 12 feet in height - All shrubs in this table are 2.5 points each.

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Althea (see Hibiscus)				
Baccharis halimofolia		Tol.	Х	Native to salt
S				marshes and dry
Groundsel Bush/Salt				uplands; showy white

Myrtle				flowers in fall; natural borders; salt tolerance
Cassia splendida Cassia	Sun	WD	X	Yellow flowers in fall; may dieback when cold; (Also Cassia corymbosa and others are good for fall color
Cephalanthus occidentalis Button Bush	Sun	WD	Mod	Cream flowers; irregular form; wet, natural areas
Chimonanthus praecox Wintersweet	S/PSh	WD	Х	Fragrant yellow flowers in January; dark green leaves; shrub border use
Deutzia scabra Fuzzy Deutzia	S	WD		White flowers in May; tall and erect; shrub border or specimen; background for other plantings
Exochorda racemosa Pearl Bush	S/PSh	WD	Х	White flowers in spring; mass planting use
Forsythia x intermedia Border Forsythia	S	WD	Х	Yellow flowers in early spring; good along banks; specimen planting; rapid growth; prune old canes annually; no pests
Hibiscus syriacus S Althea Rose of Sharon	WD			Grown for flowers; white, rose, lavender, pink in summer; use in shrub border; cut back in spring for increased bloom
Hydrangea quercifolia Oak Leaf Hydrangea	PSh	M, WD		Native with coarse oak like leaves; large white flowers in spring; red fall color "Snow Queen" is upright cultivar
Hex ambigua Carolina Holly	S/PSh	WD		Translucent red fruit; not common in nurseries
Kolkwitzia amabilis Beautybush	S	WD	X	Pink flowers in spring; prune regularly to maintain shape; shrub border use; pest free
Rhododendron	PSh	WD		Early flowering;

alabamense Alabama Azalea				fragrant white with gold flowers:
Rhododendron	PSh	WD		Mid to late
arborescens				flowering; fragrant
Sweet Azalea				white flowers
Rhododendron	PSh	WD	М	Fragrant gold flowers
atlanticum				0 0
Florida Azaleas				
Rhododendron	PSh	WD	М	Fragrant early pink
canascens				flowers; native; to 8'
Piedmont or Florisa				height and width
Pinxter				
Rhododendron	PSh	WD	М	Very later orange red
prunifolium				flowers
Plumleaf Azalea				
Rhododendron	PSh	WD	М	Later fragrant white
serrulatum				flowers
Hammock Sweet				
Azalea				
Rhododendron				
speciosum				
Oconee Azalea				
Rhododendron	PSh	М		Mid season; fragrant
viscosum				white flowers
Swamp Azalea				
Rosa laevigata			Х	State Flower; blooms
Cherokee Rose				in April
Viburnum nudum	S/PSh	Tol		Flossy foliage;
Possumhaw				colorful fruit and fall
Viburnum				foliage
Viburnum	S/PSh	Tol.	Х	Creamy flowers in
prunifolium				May; dark green
Blackshaw Viburnum				foliage; bronze red
				fall color; blue fruit
				in fall; fast growing

SHRUB SPECIES LIST (MEDIUM EVERGREEN)

Shrubs 3 – 8 feet in height - All shrubs in this table are 3.0 points each

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Abelia grandflora	S/Sh	WD		Pink white flowers in
Glossy Abelia hedge				June; bronze winter
				foliage; medium
				border or background
				planting; attracts
				butterflies
Aucuba japonica	Sh	WD		Shade; rapid growth;
Japanese Aucuba				pest free; coarse
Gold Dust Plant				texture; cultivars with
				gold color; variegated

Azalea species "Red Ruffle"; "Hino de Girl"; "Snow"; "Coral Bells" etc	S/PSh	WD		
Berberis julianae Wintergreen Barberry	S/PSh	WD		Yellow blooms in spring; blue fruits; bronze/wine red leaves in winter; thorny; good barrier plant or hedge
Cephalotaxus Harringtonia "Drupacea"	PSh/Sh	WD		Drooping branches with dark green foliage; ground cover or foundation planting
Euonymus japonica Evergreen Euonymus	S/Sh	WD		Compact form in sun; variegated leaves in some cultivars; susceptible to scale; pests, disease; limit use
Gardenia jasminoides Cape Jasmine Hedges	S/PSh	WD		Fragrant white flowers in summer; pests; scale, whitefly; borders, specimen planting
Ilex cornuta "Burfordii Nana" Dwarf Burford Holly	S/PSh	WD		Glossy foliage; red fruits; good screen, hedge use
Ilex cornuta "Carissa" Carissa Holly	S/Sh	WD		Hedge, edging; dense dwarf form
Ilex cornuta "Needlepoint" Needlepoint Chinese Holly	S	WD		Long, narrow twisted leaves; fast growth; dense foliage
Ilex cornuta "Rotunda" Dwarf Chinese Holly	S/Sh	WD		Glossy, spiny foliage; tolerates hot, dry areas; tough plant; no pruning needed
Ilex crenata "Compacta" Roundleaf Holly	S/Sh	WD		Dark green foliage; no fruit; pests; foundation planting
Ilex crenata "Helleri" Heller's Holly	S/Sh	WD		Low spreading shrub with fine texture; scale; pests
Ilex glabra Inkberry	S/Sh	Tol	Х	Broad leaf; upright form; black berry; naturalistic plantings
Ilex vomitoria "Nana" Dwarf Youpon Holly	S/Sh	WD	Х	Taller than I. v. "Stokes"; same as above
Ilex vomitoria "Stokes"	S/Sh	WD	Х	Smaller than I. v. "Nana"; compact

Dwarf Schillings Holly				shape; no pruning; some pests; drought resistant; fine texture
Leucothos axillaris Coastal Leucothos	Sh/PSh	Acid		White or pink flowers in April; dark foliage; graceful form; mass plantings; acid conditions
Lyobnia lucids Fetterbush	S/PSh		М	Same as above
Jasminum mesnyii Primrose Jasmine	S	WD		Mounding habit; pale yellow, semi double flowers
Juniperus chinesis Juniper	S	WD	X	Silvery blue to gold foliage; rapid growth; horizontal Chinese spreading; pests are a problem; "Armstrong"; "Blue Vase"; "Hetzi"; "Glauca"; "Hills Blues"; "Mint Julep"; "Old Gold"; and "Pfitzeriana" are preferred cultivars
Ligustrum sinense "Variegata" Variegated Chinese Privet	S/Sh	WD		Variegated forms available; weedy growth habit; pests
Mahonia bealei Leatherleaf Mahonia	PSh/Sh	WD		Yellow flowers in March; blue grape like clusters of berries; Holly like leaves; specimen, foundation planting
Mahonia fortunei Chinese Mahonia	PSh/Sh	WD		Dark purple berries; moderate growth rate; specimen
Nandina domestica Heavenly Bamboo	S/PSh	WD		Bamboo like foliage; cut out old canes; reddish foliage in winter; red berries in fall; white flowers in summer
Pittosporum tobira "Wheeler's Dwarf" Dwarf Pittosporum	S/PSh	WD		Small white fragrant flowers; shiny dark green leaves; dense foliage; cold damage; "Laura" is a variegated form
Pyracantha coccinea Scarlet Firethorn	S	WD		Orange red berries in fall; fast growth; thorns are toxic; pest problems; white flowers in spring;

				espaliers on walls
Raphiolepis indica	S/PSh	WD		White or pink flowers
Indian Hawthorne				in spring; rounded
				leaves; shrub borders,
				foundation plantings
Yucca gloriosa	S	WD	Х	Greenish white
Spanish Dagger				flowers in Sept.;
				spiny blue green
				leaves; salt tolerant;
				barrier, specimen, or
				accent plants

SHRUB SPECIES LIST (MEDIUM DECIDUOUS)

Shrubs 3 – 8 feet in height - All shrubs in this table are 1.5 points each

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Buddleia alternifolia	S	WD	Х	Old fashioned plant
Butterfly Bush				with sprays of
				flowers; attracts
				butterflies
Buddleia davidii	S	WD		White, pink, red or
Butterfly Bush				purple flowers all
				summer; accent plant
				or shrub border;
				attracts butterflies
Callicarpa Americana	S/PSh	WD		Clusters of purple
color American				berries arranged
Beautyberry				around stem; difficult
				to blend with other
				plants; naturalistic
				plantings.
Callicarpa japonicum	S/PSh	WD		White berried plant
Japanese Beautyberry				with smaller leaves,
				drooping form;
				naturalistic borders.
Calycanthus floridus	S/Sh	WD		Fragrant purple
Sweetshrub				flowers in spring;
				brown fruit; pest

Cassia corymboa Flowery SennaSWDXShowy golden flowery sennaFlowery SennaSWDXShowy golden flowers in summer- fall; fast growth; pest free; spectimen plant; winter dieback possibleChaenomeles japonica Flowering QuinceS/PShWDWhite, pink or red flowers in winter- early spring; old flowers in winter- early spring; pest free; scola in shub border; "Trexas Searlet" - bright red; Old free, eolor in shub border; "Trexas Searlet" - bright red; Old frashioned plantChaenomeles speciosa Flowering QuinceS/PShWDRed, white, orange or pink flowers in winter- early spring; pest free; color in shub border; "Trexas Searlet" - bright red; Old frashioned plantClethm almifolia Sweet PepperbushPSh/ShMWhite flowers in summer; moist soil; pest free; shub border, naturalized area use; looks good in winter.Hydrangea macrophylla SweetspireSh/PShMDUarge, peony-shaped flower lowers in summer; moist soil; pest free; shub border, naturalized area use; looks good in winter.Hydrangea Japanese Kerria Japanese KerriaSh/PShMDWhite, reappears in syning; Heary's Gamet has excellent colorKerria japonica Japanese KerriaS/PShWDWhite fragrantish soil; good red fall color; mass planings; Heary's Gamet has excellent color.Lantana camara LantanaSTolXBlooms from spring to fall color; mass planings; Heary's Gamet has excellent color.Lonicera Ingruntisima Winter Horeystucke <td< th=""><th></th><th></th><th></th><th></th><th>free; shrub border</th></td<>					free; shrub border
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Honeysucklepests; specimenSpiraea prunifoliaS/ShWDWhite flower sprays	fragrantissima Winter				flowers in winter; no
Spiraea prunifolia S/Sh WD White flower sprays	Honeysuckle				pests; specimen
	Spiraea prunifolia	S/Sh	WD		White flower sprays

'Plena'			in spring; rapid
Bridalwreath Spiraea			growth; informal use
Spiraea thunbergii	S/PSh	WD	White flowers in
Baby's Breath Spiraea			January-February;
			informal plantings
Spiraea vanhouttei	S/Sh	WD	White flowers in
Vanhoutte Spiraea			April; graceful
			specimen or border
			planting.
Tetrapanax	PSh	WD	Large, coarse
papyriferus			leaves; greenish
Rice Paper Plant			flowers in fall;
			winterkill; accent or
			specimen plant;
			suckers from roots
Vaccinium ashei	S	WD	Large, edible fruit;
Rabbiteye Blueberry			white bellshaped
			flowers in May;
			organic acid soil;
			shrub border or
			specimen
V. corymbosum			
V. stamineum			Purple fruit
			Deerberry

SHRUB SPECIES (SMALL EVERGREEN)

Shrubs to 3 feet in height - All shrubs in this table are 1.0 points each

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Alexandrian-Laurel				
(See Danae)				
Ardisia crenata	Sh	WD		Autumn red berries;
Coralberry				loose upright form
				with twisted leaves;
				seeds itself
Ardisia japonica	Sh	WD		Dark green foliage
Japanese Ardisia				for ground cover use
Aucuba japonica	Sh	WD		Scarlet berries on
'Nana' Dwarf Aucuba				female plants; need
				males and females
				for bloom/fruit; no
				pests; accent or
				border plant in shade.
Azalea (See also				
Rhododendron				
Berberis thunbergii	S/PSh	WD		Semi-"evergreen"
Barberry)				with reddish foliage;
				'Rose Glow' and
				'Crimson Pygmy' are
				good cultivars with
				rosy foliage

Buxus Harlandii	S/PSh	WD		Fine texture; low
Harland Boxwood				hedge or edging:
				requires pruning:
				upright growth
Buyus microphylla	S/Sh	WD		Dark rich green
'Japonico' Japonoso	5/511	WD		park field green
Japonica Japanese				color, mulch to
Littleleaf Box				provide moisture;
				pests; prune
				regularly; substitute
				for regular Boxwood;
				hedges.
Cephalotaxus	Sh/PSh	WD		Dark green foliage,
Harringtonia				upright: hedges.
'Prostrata' Plum Yew				foundation planting
Conradina canescens	S/PSh	WD	x	Sandy soil: blue-gray
Divia Posomary	5/1 511	WD	1	loovos: shrub bordor
Dixie Roseniary				Coostol duno notivo
				Coastal dulle harve;
				aromatic foliage;
				endangered.
Cuphea hyssopifolia	S/PSh	WD	X	White or purple tiny
Mexican Heather				flowers; small leaves;
				self-seeds; borders,
				edges.
Danae racemosa	Sh	WD		Arching stems; dark
Alexandrian Laurel				corners
Daphne odora	Sh/PSh	WD		Fragrant flowers in
Winter Daphne				February: dark green
				or variegated
				leaves: slow growing:
				fungal problems
Euonymus fortunoi'	S/DSh	WD		Climbing shrub or
Padicens'	5/1 511	W D		childing shild of
Naulcalls Winterserver				gioundcover,
wintercreeper				Susceptible to scale
				pests; avoid wet soil;
				fungal diseases.
Euonymus japonicus	S/Sh	Tol		Erect, dense foliage;
Dwarf Japanese				Susceptible to scale,
Euonymus				fungus; edging
Gardenia jasminoides	S/PSh	WD		Fragrant white
'Radicans'				flowers in June
Dwarf Gardenia				susceptible to scale,
				white fly:
Hypericum calycinum	S/PSh	WD		Reseeds: vellow
St. John's Wort	6/1 611			flowers in late
bt. John's Wort				summer-fall: native
Iasminum floridanum	PC/DCh	WD		Glossy leaves vellow
Showy Jasmina	1 5/1 511	WD		flowers:
Nonding domastics	C /DC1-	WD		Small white flamous
Ivanuma domestica	S/PSN	WD		Sinan white nowers;
Harbour Dwart				red berries; compact
Inandina				form of nandina;
				dense mound of
				toliage; pest free
Nandina domestica	S/PSh	WD		Red fall color;
'Atropurpurea Nana'				mounded growth;

Dwarf Nandina				cupped leaves
Rosmarinus officinalis Rosemary	S/PSh	WD	X	Green fragrant leaves; blue or white flowers; poor soil; lime needed
Ruscus aculeatus Butchers broom	S/Sh	WD	X	Red berries when male and female plants present; tolerates drought and neglect; pest free.
St. John's Wort (See Hypericum)				
Santolina chamaecyparissus Lavender Cotton S		WD		Yellow flowers midsummer; silver- gray foliage; aromatic clumps
Santolina virens Green Santolina	S	WD		Finely textured green leaves; poor sandy soils; borders
Serissa foetida Serissa	S	WD		White flowers in spring-summer; fine texture; sandy soil; pest free; variegated form; massings or accents
Serissa foetida 'Variegata'				See above
Variegated Serissa Skimmia japonica	PSh/Sh	WD		Fragrant white flowers in spring; scarlet berries in fall;
. Japanese Skimmia				need male and female plants; mounded form; moist, rich, acid soil; pest free; foundation and shrub massing
Yucca filamentosa Adam's Needle	S	WD	X	White flowers in summer; stiff blades; barrier, accent plant.

SHRUB SPECIES LIST (SMALL DECIDUOUS)

Shrubs under 3 feet in height - All shrubs on this table are 0.5 points each

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Almond, (See				
Prunus)				
Deutzia gracilis	S/PSh	WD		White flowers in
Slender Deutzia				spring; pest resistant;
				slow growing
				Accent; shrub
				massing
Euonymus	PSh	WD		Irregular form; native
americanus				plant good for natural
Strawberry Bush				plantings;
				strawberry-like fruit
Fothergilla gardenii	S/PSh	WD		White fragrant
Dwarf Bottlebrush				flowers in April-
				May; yellow fall
				color; mass plantings
				or naturalistic
				settings.
Jasminum nudiflorum	S/Sh	WD		January-February
Winter Jasmine				bloom with yellow
				flowers; fountain-like
				form; pest free; plant
				on banks, trailing
				over walls, etc.
Plumbago capensis	S	WD	Х	Pale blue flowers in
Plumbago				summer and fall;
				profuse bloomer;
				'Alba' is white flower
Prunus glandulosa	S	WD		White or pink flower
Flowering Almond				in spring; accent or
				specimen plant
Punica granatum	S	WD	X	Orange-red flowers
'Nana' Dwarf				in summer; red fruit
Pomegranate				in fall; salt tolerant
				hedges, borders or
				container use.

ERGREEN GROUND COVER

All plants on this table are .10 points per plant @ 1 gal.

Botanical Name	Sun	Soil	Drought Tolerant	Comments
Common Name				
Ajuga reptans	S/Sh	M, WD		Deep green to bronze
Bugleweed				foliage; grows by
				stolons; Grows 6"
				high; plant 8-12"
				apart. Crown rot.
Artemisia abrotanum	S	WD	X	Gray-green foliage
Southernwood				with feathery texture;

			prune annually; Grows to 36" or more; space 12-15" apart.
Aspidistra elatior Cast-iron Plant	Sh	Tol	Dark green leaves grow erectly from ground; spreads by stolons; Grows to 24" high; plant 12" apart.
Asplenium platyneuron Ebony Spleenwort	S/Sh		Calcium Small fern with black stems; Grows 6" high; space 12" apart; prefers some calcium in soil and some shade
Chrysogonum virginianum Goldenstar	PSh	WD	Yellow daisy flowers in spring; grow in sandy loam; Grows to 6" high; Space plants 8" apart.
Cyrtomium falcatum Holly Fern	PSh/Sh	М	Dark green foliage; compact clumps; reseeds freely; Grows to 24"; Space plants 3' apart.
Daylily (See Hemerocallis)			
Galium odoratum Sweet Woodruff	Sh	М	Tiny white flowers in spring; delicate whorled leaves; moist acid soil; good with bulbs; Grows 3-4"; Plant 6" apart.
Ginger, Wild (See Hexastylis)			
Hedera canariensis Algerian Ivy	Sh/PSh	WD	Green or variegated ('Canary Cream') leaves; shear annually; vigorous; Grows to 18"; Plant 18" apart.
Hedera helix English Ivy	Sh/PSh	WD	Glossy green leaves, some with color; Vigorous; grows to 18" high; Plant 12" apart or less.
Hemerocallis hybrida Daylily	S/PSh	WD	Flowers in red, coral, orange, yellow; bloom spring through September, depending upon variety; Mulch, water and fertilizer required; Grows to 18"; Plant 18-30"

				apart
Hexastylis arifolium	Sh/PSh	WD		Small red flower in
Wild Ginger				spring; organic, moist
				soil; shade Grows to
				10"; Plant 12" apart.
Holly Fern (See				
Cyrtomium)				
Ivy (See Hedera)				D1 6 1
Juniperus conferta	S	WD	X	Blue-green foliage;
Shore Juniper				sandy soil; salt
				tolerant; mites;
				Grows to 16"; Space
				3 apart; Blue Pacific
				is blue-green, low-
				growing; Compacta
T	C	IUD	V	is light green color.
Juniperus horizontalis	5	WD	А	Silver blue color;
Creeping Juniper				fast-growing; flat
				training nabit; neat
				tolerant; wiltonii is
Inninama nno annh an a	C	WD	v	Mounding habits
Jumperus procumbens	3	WD	Λ	mounding habit;
Ivalla				cascades, Glows to
Liriona musaari	S/Sh	WD		Dark groop grouplike
Big Blue Liriopo	5/511	WD		loavos: Blue or white
Big Blue Linope				flower spike in
				summer: Grows to
				12". Plant 12" apart:
				'Big Blue ' 'Evergreen
				Giant ' 'Monroe
				White ' 'Webster's
				Wide Leaf' and
				'Silvery Sunspot' are
				recommended
				cultivars.
Liriope spicata	Sh/PSh	WD		Dark blue-green
Creeping Lily Turf				grasslike leaves;
				Violet flower spike in
				summer; Grows to
				10"; Spreads rapidly,
				not for borders.
Pachysandra	Sh/PSh	WD		Green or silver-edged
terminalis Japanese				leaves for shade;
Pachysandra flower				insignificant white
				Grows to 4"; space 5"
				apart
Mitchella repens	Sh	WD		Dark green leaves;
Partridge Berry				red berries; trailing
				native plant; Grows
				to 3" high; plant 4"
				apart
Ophiopogon jaburan	S	WD		Variegated tall
Snakebeard				grasslike leaves; sun-
				tolerant

Ophiopogon japonicus Mondo Grass	Sh/PSh	WD	Dark green grasslike leaves; Grows to 6"; space 4-6".
Phlox divaricata Woodland Phlox	S/PSh	WD	Blue flowers in spring; delicate plant; Grows to 8"; Plant 6" apart.
Phlox pilosa Downy Phlox	S/PSh	WD	Pink, blue or white flowers in spring; Grows to 15"; Plant 6" apart
Phlox stolonifera Creeping Phlox	SP/Sh	WD	White, blue or pink flowers in spring; plant with bulbs; Grows to 12"; plant 6" apart
Phlox subulata Moss Phlox	S/PSh	WD	Violet, blue or white flowers in spring; crown rot; Grows to 6"; plant 4" apart
Polystichum acrostichoides Christmas Fern	Sh/PSh	WD, M	Evergreen, lacy foliage; Grows to 3'; Plant 12" apart
Trachelospermum asiaticum Japanese Star Jasmine	Sh/PSh	WD	Creamy white flowers in late spring, fragrant; dark green foliage; grows to 12"; plant 3' apart.
Vinca major Bigleaf Periwinkle	Sh/PSh	WD	Blue flowers in spring; larger leaves than V. minor; Vigorous; Grows to 12"; plant 12" apart
Vinca minor Common Periwinkle	Sh/PSh	WD	Blue flowers in spring; not as heat tolerant or igorous as V. major; Grows to 8"; plant 8" apart.