GEORGIA FORESTRY
COMMISSION

How to Conserve Natural Resources on Construction Sites

Table of Contents

INDEX FOR DIAGRAMS

Introduction

As a builder, your goal is to construct a home in a timely manner and sell the home to make a profit. To reach that goal, you have to consider the needs of the homeowner and you must comply with various local and state construction regulations. Juggling these agendas gets complicated, primarily because they involve the use and protection of natural resources at the construction site.

Understanding the Home Buyer

Today's home buyer is better educated about natural resource issues and pays more attention to the land on which a house is built. Therefore, the decision to purchase is based on the features of the house and the lot. Buyers are analyzing the size of the lot, aesthetics and view, existing vegetation and trees, slope stability, and lawn maintenance. If, for example, a lot was chosen for its trees and beautiful vegetation, the buyer would be disturbed to discover that the trees and shrubs were cleared or damaged during construction.

Home construction can be a more profitable business if you ask the same questions during construction that a potential customer will ask when considering the home:

- Are there healthy trees on-site to provide shade, energy efficiency, and added value?
- Is there a buffer between neighboring properties that provides privacy?
- Is the lawn established?
- Will the landscaping require much maintenance?
- How were adjacent lots and neighbors affected by the construction activity?
- Is drainage adequate?

While it is critically important to address these issues in your construction plan, when building custom homes it is equally important to discuss these issues with the owner. Educating the homeowner up front is less expensive and time consuming than returning to the site after the job has been completed to fix unexpected damage.

Do you face these tough questions?

What is the simplest way to comply with Georgia's Erosion and Sediment Control Law?

What are the costs and benefits of saving vegetation instead of clearing the lot?

What is the best way to dispose of excess trash and construction debris?

Do natural resource issues have an impact on the bottom line?

Do you know the answers?

Preventing Damage to the Site

Damage to natural resources is a common and often unavoidable consequence of building a home.

The natural site,whether forest, pasture, or field, was a stable environment. The trees, shrubs, and grasses had adapted; the rainfall could penetrate the soil; and insects and animals naturally enriched the soil. A balance existed between vegetation, wildlife, soil, and water. Construction disturbs this natural balance. Soil horizons are disturbed and compacted. Valuable microbes, insects, and wildlife are displaced. Grading, trenching, piling, and excavating remove or damage nearby vegetation, change the soil structure, alter natural drainage patterns, and increase soil erosion potential.

Fortunately, as a home builder, you can control many of these damaging factors to ensure that the customer is satisfied, that the lot is stable and attractive, and that natural resource damage has been minimized. By building homes with calculated planning, you also may avoid expensive cleanup costs and fines and earn a reputation for natural resource protection.

Erosion Control

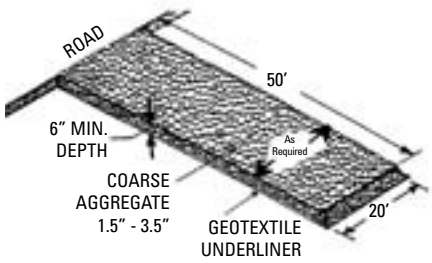
The Concern

Bare soil on a construction site is vulnerable to rain, wind, traffic, and sunlight. When left unprotected, bare soil loses its fertility, resists revegetation efforts, and requires intensive fertilization and weed control.

Bare soil also invites erosion problems. Large gullies can develop in one storm event. Regrading and reshaping the damaged areas can add significant expense to the construction project. When soil moves off the construction site and into adjacent properties, creeks, and drainage systems; both nature and the neighbors become upset. Sediment can raise stream beds, alter stream channels, and cause flooding.

Erosion and sediment control during construction is a wise choice for the environment and for your budget. It will preserve the long-term health of the soil while offering immediate protection to adjacent properties and waters.

STONE PAD SPECIFICATIONS



The Solutions

Construction Exits

Stone-lined construction exits are mandated by state law. Stone pads must be at least 20 feet wide and 50 feet long. They are required at each outlet where construction vehicles can leave the site and track soil onto public right-of-ways. A geotextile underliner is required, topped by stone aggregate, size 1.5 to 3.5 inches, at a depth of 6 inches. Periodic top dressings will help maintain proper depth.

Silt Fences

Silt fences are designed to control sheet erosion—not concentrated flows. They can effectively detain sediment that washes from a slope surface of .25 acre or smaller. When using wire reinforced fence, the drainage area should not exceed .5 acre. Also use silt fences around storm sewer inlets.

Use filter fabric unless construction will be completed in 3 months or less; then a hay bale fence may be sufficient. Page 3 illustrates proper techniques.

Barriers should be inspected after each rain. When bulges occur or when sediment accumulates halfway up the fence height, the sediment must be removed. Unmaintained silt fences are useless and fines may be imposed.

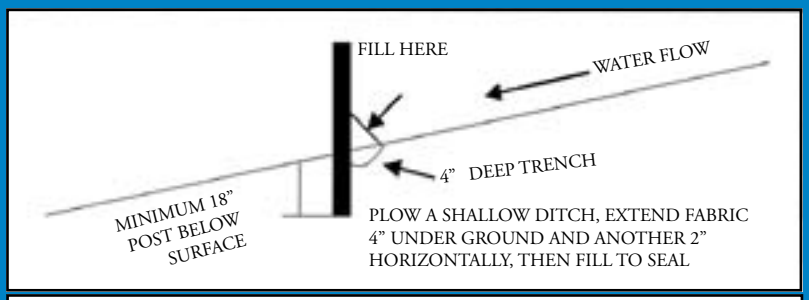
Using silt fences on roadside shoulders is often ineffective because of traffic from utility trucks, delivery trucks, and subcontractors. Grading and mulching these areas more effectively controls erosion.

A LOOK AT THE LAW

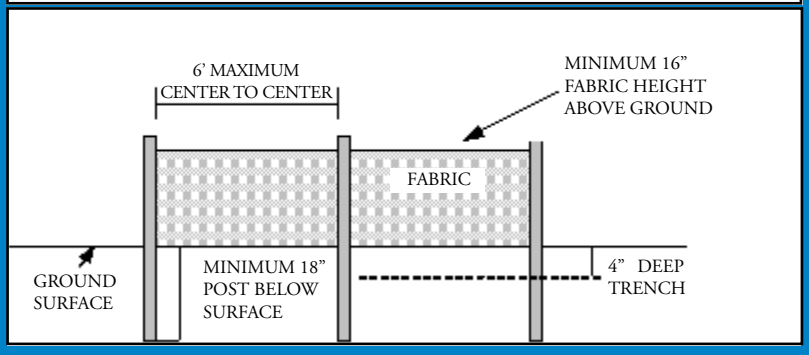
State law requires an Erosion and Sediment Control Plan for proposed construction sites larger than 1 acre, for small sites that are part of a larger development, and for sites located within 200 feet of state waters. These plans must be approved and filed with your local permitting department before the site is disturbed. Local issuing authorities may have local ordinances that exceed the minimum requirements of the state law. Always check with your local issuing authority before you begin.

Slopes for Which Sediment Fence is Applicable	Maximum Slope Length
< 2%	100 ft.
2 to 5%	75 ft.
5 to 10%	50 ft.
10 to 20 %	25 ft.
> 20%	15 ft.

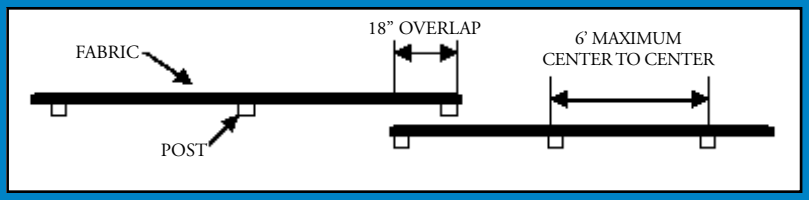
Silt Fence Specifications



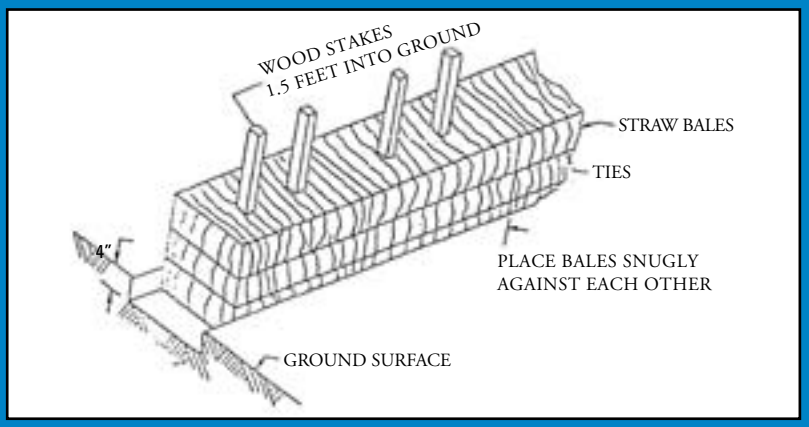
◁ **Installation Techniques**
(side view)



◁ **Construction Specifications**
(cross section)



◁ **Overlap Specifications**
(top view)



◁ **Straw Bale Specifications**
(side view)

Notes:
- ❑ specs are for Type B fence
- ❑ use 22" D.O.T. approved fabric
- ❑ use wood or steel posts
- ❑ designed for flow rate of 25 gallons / min / ft^2

Protective Vegetation

By preserving natural vegetation on a construction site you can adopt nature's cost-free method of preventing erosion.

Natural vegetation filters runoff, prevents sediment from washing into streams and water supplies, provides shelter for wildlife, and improves soil percolation. Vegetated lots also impress home buyers. They provide privacy from neighbors, increase the value of the land, and make the home more energy efficient.

Vegetative Buffers

A healthy vegetative buffer will minimize streambank erosion and trap pollutants before they wash into the water. Without a buffer, sediment accumulates in the channel—changing the flow and dynamics of the stream and creating stagnant pools of trapped water.

Buffer strips are life zones where plants and animals live and feed. Vegetation is essential for maintaining the cool water temperatures that hold oxygen and best sustain aquatic life.

State law requires a 25-foot undisturbed vegetative buffer between the construction site and any adjacent stream, lake, wetland, or drainageway. On steep slopes or near large clearings, a 50- to 100-foot buffer zone will be more effective. Consider the runoff potential when deciding if your site needs more protection than the minimum standard. Some local issuing authorities require buffers larger than 25 feet. Always check before disturbing the land.

The EPD occasionally grants variances to the buffer requirement. If your site is part of a large development, check with the local inspection department to see if a variance has been issued before submitting individual site plans for erosion and sediment control review.

Mulch and Temporary Vegetation

Mulch and temporary vegetation should be used to stabilize soil while development is under way and to protect the soil's ability to support a permanent vegetative cover. They also can provide excellent erosion control on non-active sites.

In months too hot, dry, or cold to establish vegetation, or in areas where vegetation is not wanted, mulch can provide adequate protection for bare soil. Specific rates, depths, and mulching materials are listed on page 21.

Temporary vegetation, or annual plants, are those that complete their life cycle in one season or year. They are quick to germinate and usually don't require the immediate application of fertilizers or lime. Grasses are frequently recommended because they provide a uniform cover quickly. However, temporary grasses are very adept at using soil nutrients and can deplete the soils' supply. When temporary grasses are permanently replaced, additional fertilizer will be needed.

As with permanent species, temporary covers include varieties that grow primarily during cool temperatures (65°-75° F) and varieties that grow best at warm temperatures (85°-95° F). For species and recommended seeding dates, see chart on page 16.

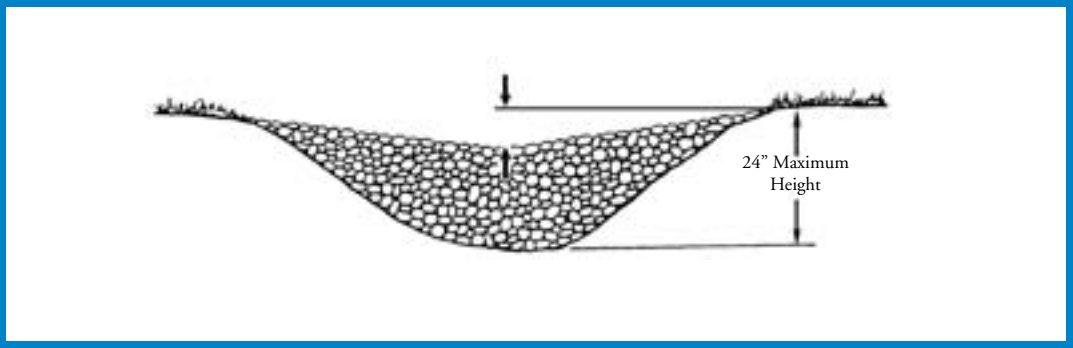
In some cases, mulches will be used to protect soil for later seeding. Here, nitrogen (20-30 lbs. per acre) should be added to aid decomposition. In other situations, mulch combinations are applied for durability. Hydroseeding, for example, can use wood cellulose in combination with wheat straw to protect the seed and soil for several months during a dormant season.

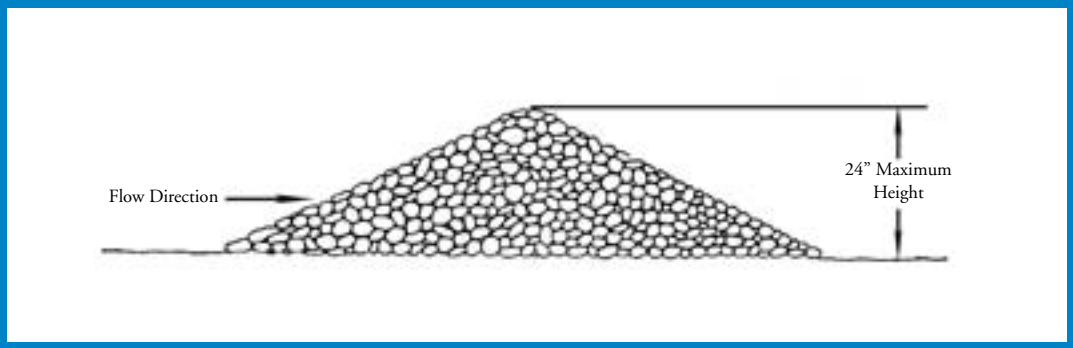
A LOOK AT THE LAW

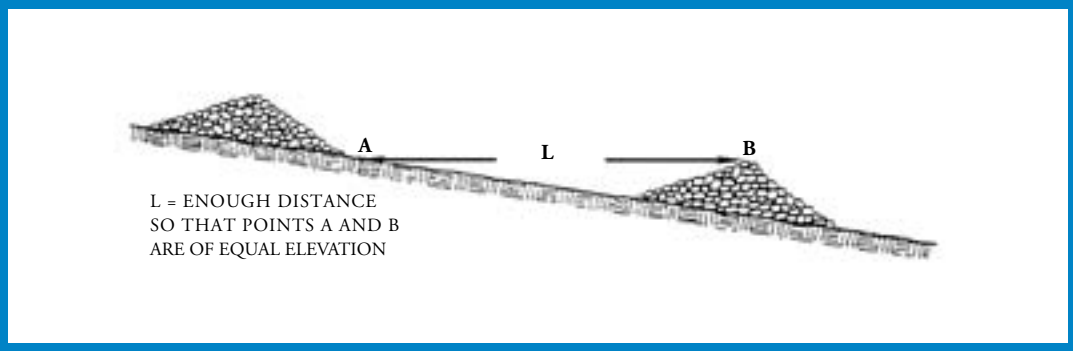
In order for builders to be in compliance with the state's Erosion and Sediment Control Law, these requirements must be met:

1. Conserve, protect, and restore natural vegetation before, during, and after construction.
2. Stripping of vegetation from the site must be kept to a minimum.
3. Temporary vegetation or mulching must be used on critical areas during construction to prevent erosion.
4. Permanent vegetation must be installed prior to completing the project.
5. A 25-foot undisturbed vegetative buffer must be left adjacent to any state waters. Disturbing the buffer will result in fines and costly restoration work.

Stone Check Dams







To stop concentrated flows on slopes that drain 5 acres or less, install a series of rock check dams. Place graded, size 2- to 10-inch stone the entire width of a ditch or drainageway so that the center is lower than the edges. (See middle diagram.) Stone piles should not exceed 24 inches in height. A series of check dams should be spaced apart so that the toe of the uphill dam is at the same elevation as the top of the downhill dam. Do not install check dams in streams.

Drainage

Runoff—The Concern

When subdivisions are developed; impervious surfaces like roofs, driveways, and roads dramatically alter the land's ability to absorb rain water. An impenetrable surface will prevent water from percolating into the soil upon impact. The water then moves rapidly across hard surfaces toward low-lying areas. Natural drainageways that existed on the property prior to development might not be able to handle the increased flows. Erosion and maintenance then become problems in drainage easements, typically along property lines between homes.

The Solutions

Both runoff and erosion can be minimized by routing water along stable drainage paths. Downspouts from rooftops and gutters should drain on a side of the home where there is good soil infiltration but low erosion potential. Otherwise the water should be piped to a safe location, like a drainageway.

A vegetated drainageway should be no steeper than 5 percent, transporting the runoff from a small section of land (less than 2 acres) to a non-erosive outlet such as a street, detention structure, storm drain, or properly designed channel. When transporting runoff to non-erosive outlets, select the most direct route. If water drains across multiple properties, erosion is more likely.

The stability of a drainageway will be determined by the size, slope, and vegetative cover of the drainage basin as well as the size, slope, and cover of the drainageway itself. Generally, a sodded surface provides adequate stability to a small drainageway.

Riprap may be necessary in larger drainage channels. When installing riprap in a channel, place a geotextile material under the rock to prevent erosion. The rock should be well-graded and the average rock size should be large enough to withstand expected velocities. The thickness of the rock layer should be twice the average rock size.

Ponding Water—The Concern

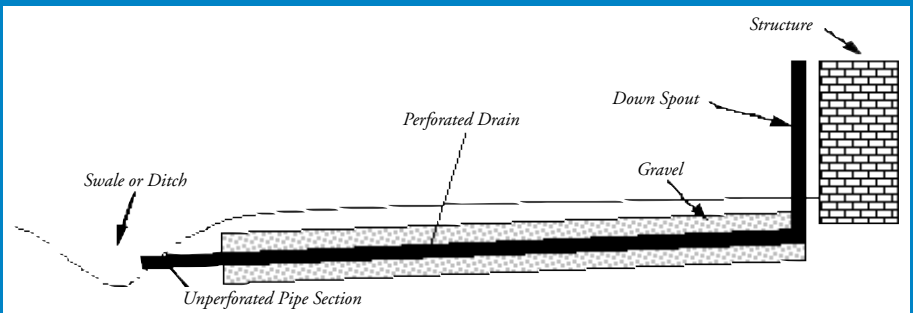
Lack of natural drainage can make a potential construction site very expensive to develop. Look for key indicators: evidence of ponded water, periodic flooding, or a high water table. Proper planning to identify and avoid these areas will save time and money.

If you select a site where excessive water is evident, it is your responsibility to identify the drainage problems and ensure that you are in compliance with applicable floodplain and wetland laws. On a site that is wet or that drains slowly, you also may have difficulty obtaining a septic system permit.

The Solutions

If water only ponds on the site immediately after a heavy rain, the slope must be adjusted to improve runoff. Establishing a minimum grade of 1 foot drop per 100 feet of slope will

Subsurface Drainage Systems



If the site does not allow for regrading or installing diversions; or if surface depressions, a high water table, or hydric soils are present; an underground drainage pipe may be necessary. Pipe grades should be gentle enough to allow water to enter but provide enough fall to drain readily. The water should empty into an existing drainage ditch or curb inlet where possible.

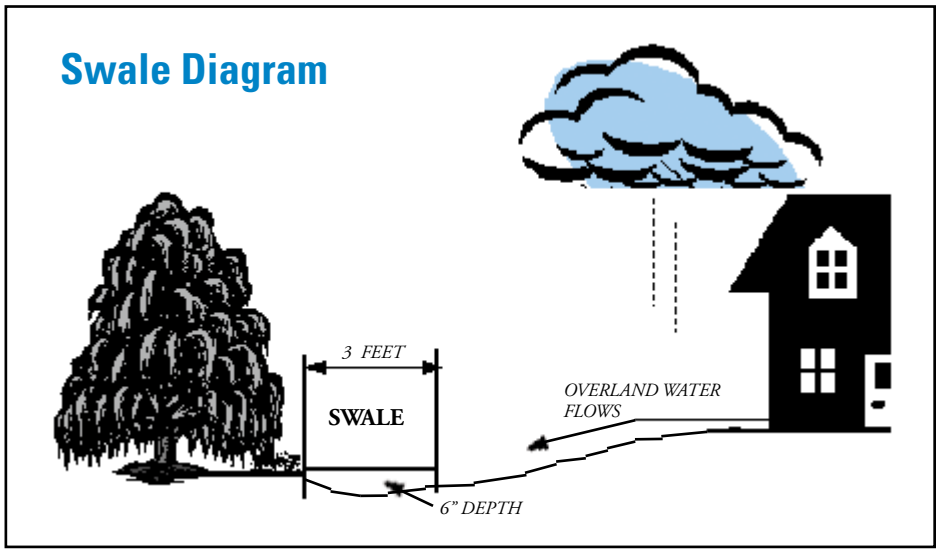
Hydric soils are saturated, poorly drained soils that have the ability to hold water near the soil surface. Hydric soils are found along riparian areas, wetlands, flood plains, and in low-lying areas and depressions.

Water filters into a drain pipe through perforations in the pipe's surface. It also can be channeled into the pipe from drop inlets that join perpendicularly. Inlets are useful in low areas or depressions where water will collect. Cover each entrance with gravel and a protective grate.

Perforated drain pipes can be used against foundation walls and basements to collect water or to drain saturated areas. Perforated pipe should be at least 4 inches in diameter and be surrounded by 12 inches of gravel. Where possible, install perforated pipes 1 to 4 feet below the surface.

be adequate. Allow adequate surface drainage around all sides of the house. Fill low areas with soil material that has a good infiltration rate and divert surface runoff away from that area. In addition to grading and filling, a drainage swale or diversion may be needed to transport water to a non-erosive outlet.

By design, a swale should be at least 3 feet wide across the top, at least 6 inches deep, and the surface should be sodded for protection against erosion. (See illustration.) The diversion must also incorporate just enough downhill slope to prevent ponding inside the swale.



If wetness problems are not corrected after implementing these surface drainage methods, subsurface drainage systems like French drains, drainage tile, or dry wells may be necessary. (See illustration on page 6.) Keep in mind that subsurface drainage systems should only be used to compliment good surface drainage. Never substitute a subsurface system for proper grading and filling. Subsurface drainage systems, in general, are more expensive and eventually require maintenance or replacement.

When ponded water or saturated soils are a continual hindrance, the problem may be caused by soil type or a high water table; both of which are permanent problems. These conditions indicate the site is not suitable for a home.

Construction Debris

The Concern

New homeowners often complain about emerging sinkholes in their yard. These hazardous areas can range in size from a shallow depression to a major cavity. More times than not, these cavities and sunken areas are caused by decayed debris that was buried while the home was being built.

Construction does create debris: unused building materials, drywall, siding, wood, packing materials, shrink wrap, paint cans, and vegetation. By the end of the project, this debris accumulates and should be hauled to a safe site, not dangerously buried near or under the new home.

Although you may be allowed to legally bury certain types of construction debris in certain metro counties, buried pits are not the wisest choice. Buried debris eventually causes a sinkhole or an underground cavity that can be expensive to repair. You may be legally liable if restricted materials are discovered in the buried pit or if a building has been erected on top of the pit. Even with the advent of burning and landfill restrictions, you still have disposal alternatives. Consult your local regulating authority about the various requirements and consider these options.

The Solutions

Knowing that options exist for specific types of debris disposal can help you educate your crews about how to stockpile construction waste.

Vegetative and Woody Debris

- Plant materials can be ground into chips or a compost-like material and used at the construction site.
- Chips can be spread on road shoulders prior to seeding or sod placement, used to protect exposed soil before and after utility placement, or spread as a protective mulch over bare areas of the lot for erosion control.
- Tree roots can be protected from damage and soil compaction by mulching over the root zone.
- Chips can be stockpiled and used after construction to mulch landscape beds, shrubs, and islands around trees.
- Some vegetation management companies are accepting woody materials and reselling compost.
- Lumber and wood trimmings can be chipped along with the plant materials or set aside for composting.

Brick, Concrete, and Inert Materials

- Some municipalities allow this material to be buried on-site or included in fill material. Consult your issuing authority for local regulations.
- To safeguard yourself and the homeowner, only bury inert materials in a reasonable location and thoroughly cover and compact the site to prevent settling or sloughing. Always disclose the location of buried debris to the homeowner.
- Unused bricks and chunks of concrete can be broken up and placed below pipe outlets for erosion control at the home site. Recycled products are an inexpensive alternative to riprap.
- Inert materials are often accepted at construction demolition landfills. Contact your solid waste department, development authority, or local recycling center for a list of drop sites and acceptable items.

Other Non-biodegradables

- Paint cans, drywall, and pressure treated lumber may be considered hazardous material and should never be buried on-site. Occasionally a construction demolition landfill will make arrangements to accept these materials. Local recycling centers should also be contacted. If they reject your non-biodegradables, they can refer you to the nearest hazardous material drop site.
- For convenience, designate a central collection point or a series of lots within the subdivision where recyclables can be stockpiled.

A LOOK AT THE LAW

1. If brick, concrete, or inert materials are buried at the home site, you are required to report the location and contents of the buried pit to the Environmental Protection Division and record it on the property deed.
2. No portion of a bury pit or waste disposal area can be located within 100 feet of any property lines or enclosed structures.

Energy Conservation

Besides the shade and beauty that trees add to a lot, home buyers also want trees for their energy conservation value. Well-placed trees can offer savings up to 30 percent on cooling bills and 15 percent on heating. To maximize this benefit, consider the location of established trees when determining where the home will be built and then landscape the property for energy efficiency.

Best Locations for Trees

Summer offers the greatest energy saving potential. If trees shade the walls, windows, and roof along the south side of a house, the inside temperature will be naturally cooler. Deciduous trees work best in this location because their canopy provides summer shade while in winter they drop their leaves and allow sun rays to warm roofs and siding and filter through the windows.

Winter savings also result when a natural buffer protects the home from cold north winds. Evergreen trees and shrubs that have dense foliage—like cedar, juniper, cypress, and pine—make an effective windbreak for the north side of a home. Ideally the east, south, and west facades should be free of evergreens so that winter sun can warm the walls and roof.

Incorporating Energy Conservation into the Building Plan

1. Determine what direction each wall of the house will face.
2. Check the lot for existing evergreen and deciduous trees, noting how their height might help or hinder energy efficiency.
3. Develop a plan to plant or remove trees based on energy efficiency.
4. Market the home as one treescaped for energy conservation and beauty.

Conserving Trees

Homeowners are attracted to trees because of their shade and beauty. And they are willing to pay more, just to have trees on their lot. Real estate trends indicate that well-placed, mature trees will increase the value of a home by 7 to 15 percent. That financial gain can be yours if you learn how to safeguard trees so that they won't be damaged by construction.

Selection

Before the site plan is drawn, visit the site with a certified arborist and decide which trees are fit to be saved. Chain saw operators usually are not as qualified to make this type of decision.

The grading and foundation work will require at least a 15-foot construction area adjacent to the house. When considering trees near the 15-foot mark, compute the size of the tree's root zone. The root zone is critical to the tree's survival. (See "Why is the root zone so important?" on page 11.)

A tree that grew to maturity with the protection of surrounding trees should not be left standing alone. This tree may not have developed a root system that can withstand high winds.

Planning

On the site plan, identify heavy impact areas like construction travel paths, parking lots, and street locations. Note the placement of homes, drives, and underground utilities. Do not save trees that will be damaged by these installations.

Avoid tree roots when routing utility trenches to the houses. Plan grading activity so that cut and fill operations and soil piles are kept away from existing trees. Identify trees that need protective barriers.

Protection

Trees should be fertilized and watered before construction begins to help them resist stress.

Construct a simple barrier for each tree or grouping to protect the trunks and root systems. This reduces damage from heavy equipment and trucks. Wood, plastic, or chain link fencing would be suitable. Install the barrier fence a distance of 2 feet away from the trunk for every inch diameter of that tree's diameter breast height (dbh). The barrier will protect a portion of the tree's root zone.

Roots are easily damaged. Spread a 10 to 12 inch layer of wood chips over the portion of the root zone that extends beyond the barrier and into the path of construction traffic to lessen the impact of heavy equipment. One pass by one vehicle can compact the soil by 75 percent, crushing shallow roots and preventing water infiltration.

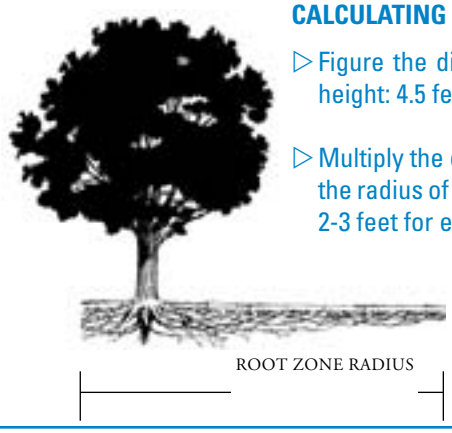
Grading

The cutting or lowering of grade will change the way subsurface water flows to a tree and may lessen the amount of water available. Cutting a grade near a tree also severs roots. If roots are damaged, cut them squarely and cleanly. If grading is expected to cause root disturbance, schedule root pruning prior to grading.

Changing the slope near a tree can either divert or increase the flow of water to the root zone. This is particularly critical when water availability to the fine roots at the edges of the root zone is altered.

Increasing grades by adding soil layers is also dangerous. In Georgia's clay soils, up to 90 percent of a tree's nutrient absorbing roots lie in the top 12 inches of soil. Below that level the pore space diminishes, as does oxygen. By adding as little as 4 inches of soil, oxygen around the nutrient absorbing roots will decrease to a non life-supporting level, damaging the tree.

CALCULATING THE ROOT ZONE



Source: National Arbor Day Foundation

- Figure the diameter of the trunk in inches (at breast height: 4.5 feet above ground).
- Multiply the diameter breast height (dbh) by 3 to learn the radius of the root zone (roots extend radially about 2-3 feet for every inch of the trunk's diameter).
- If construction impacts more than 30 percent of the total root zone, the crown will show signs of dieback.

Trenching

Most building codes require utilities to lie below the average depth of tree root systems. However, trenching to depths in excess of 12 inches can remove a significant portion of those roots. Tunneling should be considered as an option when high value trees are being affected.

Unlikely Survivors

As time progresses, a tree that exhibits one or more of these characteristics is more likely to die or structurally fail than an unimpacted tree:

- Bark removed more than one-third of the way around the trunk
- Bark removed from the root collars at the base of the tree
- More than 30 percent of the root zone cut off or damaged
- More than 40 percent of the root zone buried under 12 inches or more of new fill soil
- Trunks with serious insect or disease problems

Why is the root zone so important?

Tree damage that occurs above ground is obvious. Unfortunately, on a construction site, underground tree damage is more common. Depending on the severity of the damage and the species of tree, construction related damage may not be obvious until the home is occupied for 2 or 3 years. Death could result up to 7 years later. Therefore it is critical to recognize that the below ground portion of a tree—the root zone—is the critical area to protect.

The vertical weight of a tree is supported by the roots closest to the trunk. A tree with a 10 inch dbh, for example, would be supported by those roots within a 4 to 6 foot radius of the trunk. Roots farther out are for absorbing nutrients and providing stability against the wind. If construction activity crushes or severs roots close to a tree, the tree will become structurally unsound and unsafe to leave standing.

The above ground distribution of branches may or may not reflect the below ground distribution of roots. Expect at least equal, if not greater, volume of a tree to extend below the soil in the root zone.

A tree's roots are often grafted to other tree roots nearby. When one tree is pushed or pulled from the ground the roots of adjacent trees are often torn, ripped, and damaged. A torn root has a more difficult time healing than a torn branch because it is surrounded by soil pathogens. Tree roots don't heal, they seal. The tree will give up the damaged area for lost and seal it from disease and insect attack.

Remember, if you damage a tree's root zone and it dies, most homeowners will expect you to return to the site and remove the dead tree. And tree removal can be expensive once the house is completed and the landscaping is established.

Restoring Vegetation

The Concern

When natural vegetation and topsoil are removed during construction, the land becomes vulnerable. The enriched organic layer of the soil is missing, habitat for wildlife has disappeared, and erosion is likely. Restoring topsoil and a vegetative cover prevents erosion, improves wildlife habitat, and enhances natural beauty.

The Solutions

There are seven principles that can serve as a check list to ensure that proper horticultural practices are being applied during the planning and revegetation processes. This simple guide will help you safeguard the environment and please the new homeowner.

1. Sound planning and design
2. Soil analysis
3. Appropriate plant selection
4. Practical turf area selection
5. Efficient irrigation
6. Mulching
7. Maintenance

Native Plants

Consider natural options when revegetating the site. Native trees, shrubs, ground covers, vines, and grasses are far better suited and easier to grow than imported plants. Native species are listed in Appendix B on pages 17, 18, & 19.

Preparing a Seedbed

Before planting grass seed, the soil must be loose enough for water infiltration and root penetration. Break up the top 2 to 4 inches to alleviate compaction. Then add at least 4 inches of topsoil from the stock pile where it was stored. Using original topsoil is critical on sites where the soils are shallow or have severe limitations. Topsoil should be free of stones, roots, and other debris. Incorporate lime and fertilizer as you progress. Then smooth the area so the seedbed is firm enough to hold moisture.

Selecting and Broadcasting Seed

Seeding is often the fastest and most economical method of revegetation. Choose a warm season or cool season grass according to time of planting. Warm season grasses grow vigorously during spring, summer, and early fall but will become brown and dormant during the winter. In contrast, cool season grasses germinate better during the winter, but also provide year-round coverage. See the chart on page 16 to select a grass that is appropriate for your planting date.

There are several methods of planting grass seed. Cyclone seeders, drop spreaders, grain drills, cultipackers, and hydroseeders all provide the uniformity that is necessary. For steep slopes, either hydroseed or use a grade stabilization fabric to stabilize the soil and hold the seed in place.

Mulching

Mulch is a key ingredient in the seed germination process. It protects the seed from washing away, prevents soil crusting, reduces evaporation, and provides insulation against rapid temperature changes.

Seeded areas should be mulched within 24 hours. (See chart on page 21 for mulching materials and rates.) Because sunlight must filter through and encourage plant growth, only cover 75 percent of the ground surface with mulch.

Installing Turf

Some grasses do not produce viable seed and must be sprigged or sodded. Sodding is expensive, but it does create an instant lawn. Before installation, wet the soil surface thoroughly. Place sod strips tightly together to avoid cracks. Then irrigate thoroughly and roll to ensure good sod-to-soil contact.

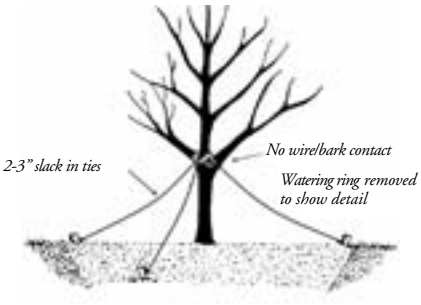
Apply about .25 inch of water daily until sod is well rooted into the soil. Once the roots are established, apply 1 to 2 inches of water per sprinkling when grass approaches the wilting stage. If water runs off the sodded area, too much water is being applied.

Planting Trees

Because trees grow above and below ground, avoid planting large trees within 15 feet of any structure, driveway, sidewalk, underground utility, or overhead wires. Select species that are suited to the site and soil conditions. A variety of trees are available with different height and crown characteristics. Consult your local Forestry Commission office, Cooperative Extension Service agent, or county arborist for recommendations.

Don't invest money in a large tree if you are not willing to invest the time to plant it properly. Trees measuring 3 inches or more in caliper are expensive and require more time to plant. Consider that a 2-inch caliper tree, properly planted, could easily outgrow a 3-inch tree in a few years because the larger tree would lose more roots when transplanted.

Don't plant a new tree as an erosion control measure. The root systems take years to develop.

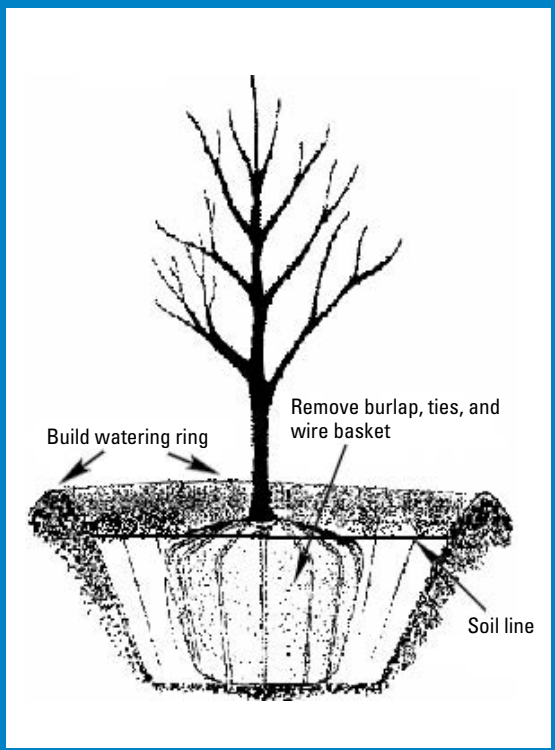


Trees less than 2 inches in caliper will not need to be staked unless the location is very windy. Stake larger trees according to the illustration.

Proper Tree Planting Technique

Now that you have selected the sites and species, proper planting will ensure the tree's survival. The key is to create a planting space that will encourage the root system to grow as fast and as far as possible.

1. The planting area should be tilled to a depth of 6 to 8 inches (deeper if the soil is compacted) for an area of 10 times the diameter of the root ball.
2. Excavate a hole 2 to 3 times the diameter of the root ball and no deeper than the ball or container. Leave the soil at the base of the hole compacted.
3. Remove the container, cut girdling roots, and place tree in the hole. Make sure the tree sits no deeper than existing soil line. One to two inches higher is better than low. For Ball and Burlap trees (B&B), place tree in the hole. Again, make sure the tree rests no deeper than existing soil line (better one to two inches above) then remove all ties and strapping, wire basket, and burlap.
4. Backfill the hole with native soil lightly packing the soil and watering as you go to eliminate any air pockets. Construct a watering ring at the outer edge of the planting hole (note: this ring will be removed in a year or two) and mulch to a depth of 2 to 3 inches with composted wood chips. Keep mulch 2 to 3 inches away from the tree trunk.
5. Stake tree only if wind throw is an issue allowing for at least 3 inches "slack" in tie wires. Never allow bare wires to contact bark. Remove staking after the first growing season.



Source: Adapted from International Society of Arboriculture

Planning and Scheduling

In a business where many details are unpredictable—the weather, your subcontractors, delivery dates, and inspections—calculated planning can be one of your fixed assets.

Your ability to plan and sequence construction activities will yield many benefits: compliance with local regulations, proper erosion control on the site, up-front solutions and less maintenance, controlled costs, and no fines. And in the end the consumer also benefits. A well-planned project produces a home that is finished on-time and on-budget; a home that is aesthetically pleasing and marketable.

Getting Started

- ▷ On the site plan, mark the boundaries for land disturbance. Highlight protected areas like flood plains, buffers, and wetlands. Use existing vegetative buffers as a cost-saving measure, especially on the downhill borders.
- ▷ Select locations for stockpiling soil, construction materials, wood chips, and construction debris.
- ▷ Consider convenience and land disturbance when locating construction entrances, driveways, and construction parking areas.
- ▷ Predict slopes of rooftops, driveways, and other impervious surfaces and develop safe channels for storm runoff.
- ▷ Have an erosion control plan for graded areas before grading begins. Plan for minimal land disturbance. Mark locations where erosion control devices will be installed.
- ▷ Have the soil tested to determine what will be needed to ensure growth of grasses, plants, and trees.

Installations

- ▷ Install silt fencing, entrance pads, and other erosion control measures prior to any grading activity. Use a knowledgeable contractor. Develop a schedule for inspections and maintenance.
- ▷ Identify tree root zones and buffers to be protected and install fencing or other necessary measures.

Clearing and Grading

- ▷ Begin clearing the land as soon as key erosion control and protective barriers are in place. Grading should follow clearing so that protective ground cover can be reestablished immediately. Do not leave soils bare and exposed for extended periods.
- ▷ Heavy mulch or temporary vegetation should be used to stabilize disturbed land that will sit idle for 15 or more days.
- ▷ Reshape earthen fills as needed to prevent overflows. Construct temporary diversions prior to forecasted storms. Use the spoil from utility trench excavations to divert flows from higher areas.
- ▷ Instruct the contractor to remove all construction debris before final grading begins. Incorporating debris into the topsoil encourages erosion.
- ▷ Leave vegetative buffers on sites set aside for borrow or disposal. Stockpile woody debris here for chipping. Use the chips on-site for mulch or erosion control.

Coordination

- ▷ Minimize conflict between construction and utility crews by defining their schedules and limitations. Instruct subcontractors to follow the master plan for piling of materials, parking, and erosion control.

Final Stabilization

- ▷ Immediately after reaching final grade, install permanent vegetation according to your vegetation plan. (Refer to charts in the Appendix.) Plant trees and shrubs before establishing turf. Avoid placing landscape plants in low spots, near down spouts, or in a runoff channel.

Finishing Touches

- ▷ Ensure that each disturbed surface has been permanently stabilized, including borrow and disposal areas. Clean sediment from basins and traps. Remove temporary structures like sediment fences and stabilize any remaining bare soil. Landscape last.

APPENDIX

Appendix A - Seeding Rates for Temporary & Permanent Cover

Best Planting Month	Temporary Cover	Types	Rate per Acre		Permanent Cover	Types	Rate per Acre	
			Seeded Alone	Added To Mix			Seeded Alone	Added To Mix
January	Ryegrass, Annual	C,P,M	40 lbs.	---	Unhulled Bermuda	C	10 lbs.	8 lbs.
	Rye	C,	3 bu.	.5 bu.	Sericea Lespedeza	C,P,M	75 lbs.	75 lbs.
	Lespedeza, Annual	2,C	30 lbs.	25 lbs.	Pensacola Bahia	C,P,M	60 lbs.	30 lbs.
February	Ryegrass, Annual	C,P,M	40 lbs.	---	Unhulled Bermuda	P	10 lbs.	8 lbs.
	Lespedeza, Annual	2,C,P,M	30 lbs.	25 lbs.	Sericea Lespedeza,	1,2,C,P,M	75 lbs.	75 lbs.
					Pensacola Bahia	C	60 lbs.	30 lbs.
March	Ryegrass, Annual	C,P,M	40 lbs.	---	Hulled Bermuda	CP	10 lbs.	8 lbs.
	Lespedeza, Annual	2,C,P,M	30 lbs.	25 lbs.	Sericea Lespedeza	1,2,C,P,M	60 lbs.	40 lbs.
	Sudangrass	C,	60 lbs.	---	Fescue	M	50 lbs.	40 lbs.
					Pensacola Bahia	C,P	60 lbs.	30 lbs.
April	Lespedeza, Annual	2,P,M	30 lbs.	25 lbs.	Hulled Bermuda	C,P	10 lbs.	8 lbs.
	Brown Top Millet	C,P,M	40 lbs.	15 lbs.	Sericea Lespedeza	1,2,C,P,M	60 lbs.	40 lbs.
	Sudangrass	C,P,M	60 lbs.	---	Switchgrass	C,P,M	10 lbs.	7 lbs.
					Fescue	M	50 lbs.	40 lbs.
					Pensacola Bahia	C,P	60 lbs.	30 lbs.
May and June	Brown Top Millet	C,P,M	40 lbs.	15 lbs.	Hulled Bermuda	C,P	10 lbs.	8 lbs.
	Sudangrass	C,P,M	60 lbs.	---	Sericea Lespedeza	1,2,C,P,M	60 lbs.	40 lbs.
					Switchgrass	C,P,M	10 lbs.	7 lbs.
					Pensacola Bahia	C,P	60 lbs.	30 lbs.
July	Rye	M	3 bu.	.5 bu.	---		---	---
	Sudangrass	P,M	60 lbs.		Pensacola Bahia	C,P	60 lbs.	30 lbs.
August	Ryegrass	C,P,M	40 lbs.	---				
	Rye	P,M	3 bu.	.5 bu.				
September	Wheat	C,P,M	3 bu.	.5 bu.	Fescue	P,M	50 lbs.	30 lbs.
	Oats	C,P,M	4 bu.	1 bu.	Sericea Lespedeza	2,C,P	75 lbs.	30 lbs.
	Ryegrass	C,P,M	40 lbs.	---	Crown Vetch	2,P,M	15 lbs.	15 lbs.
	Rye	C,P,M	3 bu.	.5 bu.				
October thru December	Wheat	C,P,M	3 bu.	.5 bu.	Unhulled Bermuda	C,P	10 lbs.	8 lbs.
	Ryegrass, Annual	C,P,M	40 lbs.	---	Sericea Lespedeza	2,C,P,M	75 lbs.	75 lbs.
	Rye	C,P,M	3 bu.	.5 bu.	Fescue	P,M	50 lbs.	30 lbs.

Types:
Region Types: C - Coastal Plain, P - Piedmont, M - Mountain
Seed Types: 1 - Seed should be scarified, 2 - Inoculate seed

Appendix B - Recommended Overstory Trees (Grow to > 40 Ft. in Ht.)

Scientific Name	Common Name	Height (Ft.)	Spacing (Ft.)	Sun/Shade	Drainage
Acer barbatum	Southern Sugar Maple	50-60	50	S - PS	M
Acer rubrum	Red Maple and hybrids	50-60	25	S - PS	M - D
**Acer saccharum*	Sugar maple	50-60	50	P - SH	M
**Betula nigra*	River Birch	45-70	40	S - PS	M
**Carya illinoensis*	Pecan	60-70	50	S	W - M
**Carya ovata*	Shagbark Hickory	60-80	50	S	D
**Castanea mollissima*	Chinese Chesnut	40-60	40	S	M - D
**Fagus grandifolia*	American Beech	60-90	50	P - SH	W - M
Fraxinus pennsylvanica	Green Ash	60-80	40	S	W - M
Ginkgo biloba	Ginko, grafted	50-80	40	S	M - D
**Liquidambar styraciflua*	Sweetgum	70-90	50	S	M - D
**Liriodendron tulipifera*	Yellow-poplar	80-100	40	S	W - M
**Magnolia grandiflora*	Southern Magnolia	60-80	50	S - PS	M - D
Metasequoia glyptostroboides	Dawn Redwood	60-90	25	S - PS	M - D
**Nyssa aquatica*	Swamp Tupelo	30-50	30	S - PS	W - M
**Nyssa sylvatica*	Black Gum	30-50	30	S - PS	M - D
**Platanus occidentalis*	American Sycamore	75-100	60	S	M - D
Quercus accutissima	Sawtooth Oak	40-60	40	S	M - D
Quercus alba	White Oak	60-100	50	S	D
Quercus coccinea	Scarlet Oak	70-80	40	S	D
Quercus falcata	Southern Red Oak	70-80	40	S	D
Quercus nigra	Water Oak	50-80	50	S	M - D
Quercus phellos	Willow Oak	80-100	50	S	M - D
Quercus palustris	Pin Oak	60-70	40	S	D
Quercus prinus	Chesnut Oak	60-70	40	S	D
Quercus shumardi	Shumard Oak	45-75	50	S	D
Sophora japonica	Japanese Pagodatree	50-75	40	S - PS	M - D
Taxodium disticum	Bald Cypress	50-80	40	S	W - M - D
Ulmus parvifolia	True Chinese Elm	40-60	40	S - PS	M - D
Zelkova serrata	Japanese Zelkova	50-80	40	S	M - D

*Indicates not suitable for parking lot islands

Key: **S** - Sun, **PS** - Part Sun, **SH** - Shade, **W**- Wet, **M** - Moist, **D** - Dry

Note: 1. Notes above assume **proper tree to site location** and **proper planting techniques** and **moderately well drained soils.**

2. This list is not intended to be all inclusive but to point to logical landscape selections.

Appendix B (cont.)- Recommended Understory Trees (Grow to<40 Ft. in Ht.)

Scientific Name	Common Name	Height (Ft.)	Spacing (Ft.)	Sun/Shade	Drainage
Acer buergerianum	Trident Maple	20-30	25	S - PS	M - D
Acer barbatum (floridanum)	Florida Maple	20-25	25	S - PS	M - D
Amelanchier arborea	Serviceberry	15-35	20	S	D
Carpinus caroliniana	American Hornbeam	25-45	25	P - SH	M
Cercis canadensis	Eastern Redbud	20-30	30	S - PS	W - M
Cercis chinensis	Chinese Redbud	15-25	20	S	M - D
Chionathus virginicus	Fringe Tree	15-25	20	S	M
**Cornus species*	Dogwood	15-30	25	SH	M- D
Cotinus coggygria	Common Smoketree	20-25	20	S	D
Crataegus phaenopyrum	Washington Hawthorne	20-25	20	S - PS	M - D
Koelreuteria bipinnata	Bougainvillea	20-30	20	S	M
Koelreuteria paniculata	Panicled Goldenraintree	30-40	25	S	D
Lagerstroemia hybrids	Crapemyrtle hybrids	15-25	15	S	D
**Maclura pomifera*	Osage-orange	30-50	30	S	M - D
**Magnolia x soulangiana*	Saucer Magnolia	20-30	20	S	W - M
**Magnolia virginiana*	Sweetbay Magnolia	15-25	20	S - PS	M - D
**Magnolia stellata*	Star Magnolia	15-20	15	S - PS	M
Malus species	Flowering Crabapple	15-25	15	S	M - D
**Ostrya virginia*	Ironwood	30-40	25	S - PS	M - D
**Oxydendrum aboreum*	Sourwood	25-40	20	S - PS	M - D
Pistachia chinensis	Chinese Pistache	25-30	20	S	M - D
Pyrus hybrids	Improved flowering Pear	25-40	25	S	M - D
Sassafras albidum	Sassafras	30-40	20	S - PS	M - D
Vitex agnus-castus	Chastetree	10-15	15	S	M - D

*Indicates not suitable for parking lot islands

Key: **S** - Sun, **PS** - Part Sun, **SH** - Shade, **W**- Wet, **M** - Moist, **D** - Dry

Note: 1. Notes above assume **proper tree to site location** and **proper planting techniques** and **moderately well drained soils.**

2. This list is not intended to be all inclusive but to point to logical landscape selections.

Appendix B(cont.)-Recommended Evergreen Overstory Trees (Grow to > 40 Ft. in Ht.)

Scientific Name -	Common Name	Height (Ft.)	Spacing (Ft.)	Sun/Shade	Drainage
**Pinus strobus*	White pine	60-80	40	S - PS	M - D
**Pinus taeda*	Loblolly Pine	60-80	25	S	D
**Pinus virginiana*	Virginia Pine	40-60	25	S	D
**Juniperus virginiana*	Eastern Red Cedar	40-60	25	S	D
**Cryptomeria japonica*	Japanese Cryptomeria	50-70	40	S	M
**Cunninghamia lanceolata*	Common Chinafir	50-70	30	S - PS	M
Cupressocyparis leylandii	Leyland Cypress	60-70	15	S	M - D

Recommended Evergreen Understory Trees (Grow to < 40 Ft. in Ht.)

Scientific Name -	Common Name	Height (Ft.)	Spacing (Ft.)	Sun/Shade	Drainage
Ilex x attenuata	Savannah Holly	15-30	15	S - PS	M - D
Ilex decidua	Decidious Holly	20-30	15	S - PS	M - D
Ilex x Nellie R. Stevens	Nellie R. Stevens Holly	15-35	15	S	M - D
Ilex x opaca	American Holly	20-40	15	S	M - D
Ilex vomitoria	Yaupon Holly	15-20	10	S	W - M - D
Myrica cerifera	Waxmyrtle	10-20	15	S - PS	W - M

Additional Comments

*Indicates not suitable for parking lot islands

Key: **S** - Sun, **P** - Part Sun, **S** - Shade, **W**- Wet, **M** - Moist, **D** - Dry

Note: 1. Notes above assume **proper tree to site location** and **proper planting techniques** and **moderately well drained soils.**

2. This list is not intended to be all inclusive but to point to logical landscape selections.

Source information:

Manual of Woody Landscape Plants - Dirr, Michael

Guide to Southern Trees - Harrar, Ellwood

Landscape Plants for Georgia - UGA Cooperative Extension Service

Appendix C - Native Plants for Revegetation

Ground Covers

Common Name (Scientific Name)	Height	Spacing	Sun or Shade	Bloom Color
Christmas Fern *(Polystichum acrostichoides)*	18" to 24"	2'	shade or part sun	none
Eared Coreopsis *(Coreopsis auriculata)*	16" to 24"	1'	sun to p.m. shade	yellow to gold

Shrubs

Common Name (Scientific Name)	Height	Spacing	Sun or Shade	Bloom Color
American Beautyberry *(Callicarpa americana)*	4' to 6'	6' to 8'	sun to shade	magenta fruit
Dwarf Wax Myrtle *(Myrica cerifera pumila)*	3' to 4'	4'	sun to part shade	none
Golden St. John's Wort *(Hypericum frondosum)*	3' to 4'	3' to 4'	sun to part shade	yellow to gold
Oconee Azalea *(Rhododendron flammeum)*	6'	6'	part shade to shade	scarlet
Piedmont Azalea *(Rhododendron canescens)*	8'	6' to 12'	sun to shade	pink to white
Red Texas Sage (Salvia greggii)	3'	3' to 4'	sun to part sun	red
Sweet Pepperbush *(Clethra alnifolia)*	3' to 6'	4' to 6'	sun to shade	white to pink
Virginia Sweetspire *(Itea virginica)*	3' to 4'	3' to 4'	shade to part sun	white

Vines

Common Name (Scientific Name)	Height	Spacing	Sun or Shade	Bloom Color
Carolina Yellow Jasmine *(Gelsemium sempervirens)*	climbing	8'	sun to part shade	yellow
Climbing Hydrangea *(Decumaria barbara)*	climbing	1 tree per 10' wall	shade and part sun	white
Crossvine *(Bignonia capreolata or Anisostichus c.)*	climbing	ground: 4' wall: 8' to 29'	sun to part shade	red & yellow or all red
Red Trumpet Honeysuckle *(Lonicera sempervirens)*	climbing	ground: 2' wall: 8'	part sun to full sun	red

Appendix D - Mulching for Erosion Control

Mulching Material	Rate Without Seed	Depth
Dry straw/hay	5 tons/acre 300 lbs/1000 sq ft	6-10" depth
Pine bark	6-9 tons/acre 400 lbs/1000 sq ft	4-6" depth
Wood waste/sawdust/chips	various	2-3" depth
Seed bearing Lespedeza hay	3 tons/acre 138 lbs/1000 sq ft	use October thru January

Appendix E - Additional References

Reference Book	Publisher
Georgia Model Urban Forest Book & *Community Tree Planting and Establishment Guidelines*	Georgia Forestry Commission 6835 James B. Rivers Drive Stone Mountain GA 30083
Georgia Field Office Technical Guide, Section 4, USDA-NRCS Handbook, June 1997.	USDA Natural Resources Conservation Service 355 East Hancock Avenue, Box 13 Athens GA 30601-2769
Manual for Erosion and Sediment Control in Georgia, Fifth Edition, 2000 (ammended)	State Soil & Water Conservation Commission PO Box 8024 Athens GA 30603
Identification, Selection, and Use of Southen Plants For Landscape Design	Odenwald, Niel & James Turner, 1996 Claitor's Publishing Division Baton Rouge LA 70826-1333
Principles and Practice of Planting Trees and Shrubs, 1997	International Society of Arboriculture PO Box 908 Urbana IL 61801
Resolving Tree-Sidewalk Conflicts, Tree City USA Bulletin No. 3.	National Arbor Day Foundation 100 Arbor Avenue Nebraska City NE 68410
Soil Bioengineering for Upland Slope Protection, USDA-NRCS Engineering Handbook, Chapter 18, October 1992.	Consolidated Forms and Distribution Center 3222 Hubbard Road Landover MD 20785
Streambank Stabilization—Georgia Guide, September 1994.	State Soil & Water Conservation Commission PO Box 8024 Athens GA 30603
A Streambank Stabilization and Management Guide, 1986.	Pennsylvania State Bookstore PO Box 1365 Harrisburg PA 17105
Xeriscape: A Guide to Developing a Water-Wise Landscape, Cooperative Extension Service, 1992.	Cooperative Extension Service UGA College of Ag and Environmental Sciences Athens GA 30602

P. O. Box 819
Macon, GA 31202
Toll-free 1-800-GA-TREES
www.gatrees.org

An Equal Opportunity Employer and Service Provider