



A Systematic Approach to Building With Trees

**TREE CITY USA®
BULLETIN**

No. **20** Editor: Dr. James R. Fazio • \$3.00

Where trees exist on land that is to be developed, it makes good sense both economically and environmentally to preserve these assets. A systematic approach and proven techniques can protect trees during construction and into the future. The result is higher property values and a more pleasant place to live or work.

On a hot summer day, there are few things more valued at a shopping mall than a parking space in the shade. In that same community, homes with large, healthy trees will sell faster and at prices 10 to 15 percent more than homes with few or no trees.

Why, then, would anyone develop land and needlessly destroy trees? Reasons vary, but topping the list are ignorance of the values that are lost, a tradition of clearing land before

building, and lack of information about how to save trees during construction. The purpose of *Bulletin No. 20* is to help change this unfortunate situation and point the way toward making trees and development compatible.

Built-in quality or a long, long wait ... large trees make the difference. Property owners and developers who plan around existing trees can benefit from higher values as well as contribute to the stewardship of our environment.



Arbor Day Foundation®
100 Arbor Avenue • Nebraska City, NE 68410

Who Can Use This Process?

There are many levels of application for using a systematic approach to building with trees, just as there is more than one system. The process suggested here is simplified enough that it could be used by an individual who cares about trees, has a few wooded acres, and plans to build a single-family dwelling. With a little help from the references listed at arborday.org/bulletins or an urban forestry consultant specializing in construction projects, a more detailed version of the process could be used by large-scale developers, builders, architects, landscape architects, and real estate managers who want to produce a better product.

Knowledge of a systematic approach should also be a valuable tool for community planners, urban foresters, arborists, tree board members, elected officials, civic leaders, and any concerned citizen looking for ways to protect valued trees without stopping development or placing undue hardships on private enterprise.

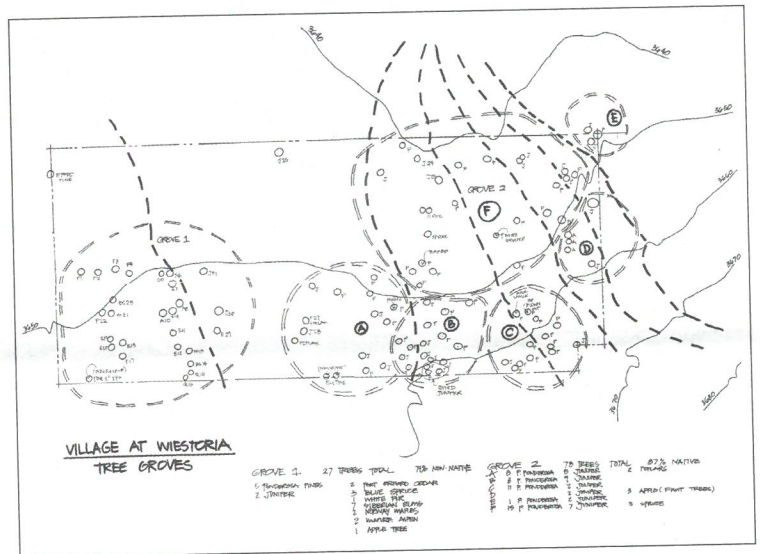


Step 1: Tree Stand Delineation

Tree stand delineation is a general accounting of existing vegetation, both in quantity and quality. With a knowledge of the general use planned for the land in mind, it is then important to do this step before a conceptual plan is formalized. In that way, the tree stand delineation can influence the placement of roads, buildings, ponds, parking lots, and the very ambiance of the project.

On a map of the same scale to be used later in the construction phase, outline and describe:

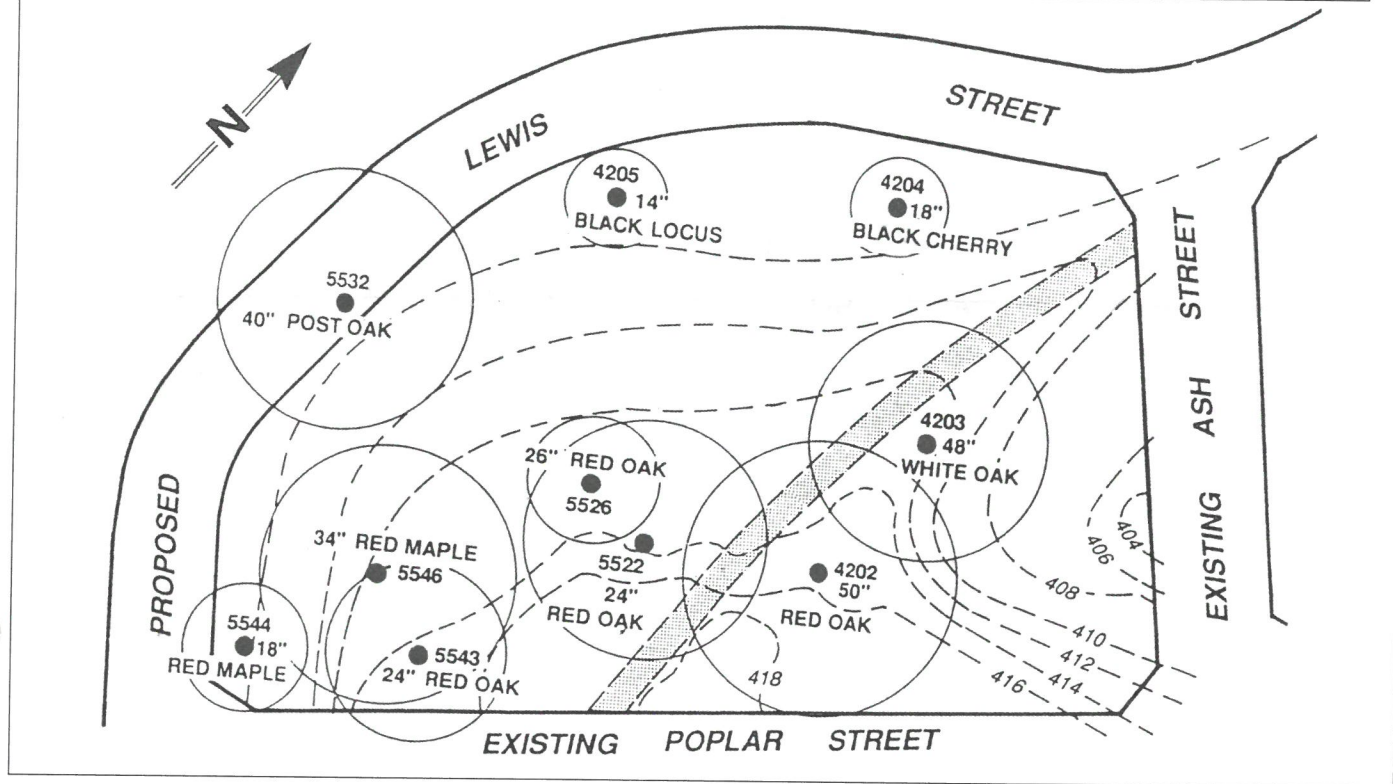
- Groups of similar trees (stands)
- Individual trees of significance because of size, age, history, beauty (specimen trees)
- Hazard trees (remove before construction begins)
- Open fields
- Scenic vistas
- Important wildlife habitat and corridors
- Ponds, creeks, and other wetlands
- Other important natural or historic features



People, soils, and trees form the inseparable triangle that will determine the success or failure of your project. Therefore, soil characteristics should also be considered at this step. Learn all you can from the county soil map available locally from the USDA Natural Resources Conservation Service and do some test digging of your own. Determine if the topsoil is worth stripping from the construction zone and saving for landscaping, and use a map overlay to highlight areas of particularly rich or poor soil and steep or erodible slopes.

A tree stand delineation map provides an overview of the trees, other natural attributes, and the limitations of a building site. By using a topographic base map, contour lines add valuable insights about elevations, slopes, steepness, and drainage patterns.

RATING CHART							
#	SPECIES	DBH	HEALTH	CANOPY	ROOTS	OTHER	RECOMMENDATION
5532	POST OAK	40"	FAIR	GOOD	GOOD		SAVE, POSSIBLE AERATION SYSTEM
5546	RED MAPLE	34"	FAIR	GOOD	GOOD		SAVE
5543	RED OAK	24"	FAIR	GOOD	GOOD		SAVE
5544	RED MAPLE	18"	EXCELLENT	GOOD	GOOD		SAVE, ROOT ZONE IN PROPOSED STREET
5526	RED OAK	26"	POOR	POOR	POOR		REMOVE
5522	RED OAK	24"	FAIR	GOOD	GOOD	EXISTING PAVING	SAVE
4202	RED OAK	50"	FAIR	EXCELLENT	GOOD	EXISTING PAVING	SAVE
4203	WHITE OAK	48"	GOOD	EXCELLENT	GOOD	EXISTING PAVING	SAVE, STEEP SLOPE NEARBY
4204	BLACK CHERRY	18"	GOOD	GOOD	GOOD		REMOVE, NEAR END OF LIFE
4205	BLACK LOCUST	14"	FAIR	POOR	POOR		REMOVE, POOR CANOPY SHAPE



Step 2: Tree Survey

This step may be combined with Step 1, especially on smaller properties. However, this survey will be used in the engineering phases of the project, whereas tree stand delineation is intended to aid conceptual design.

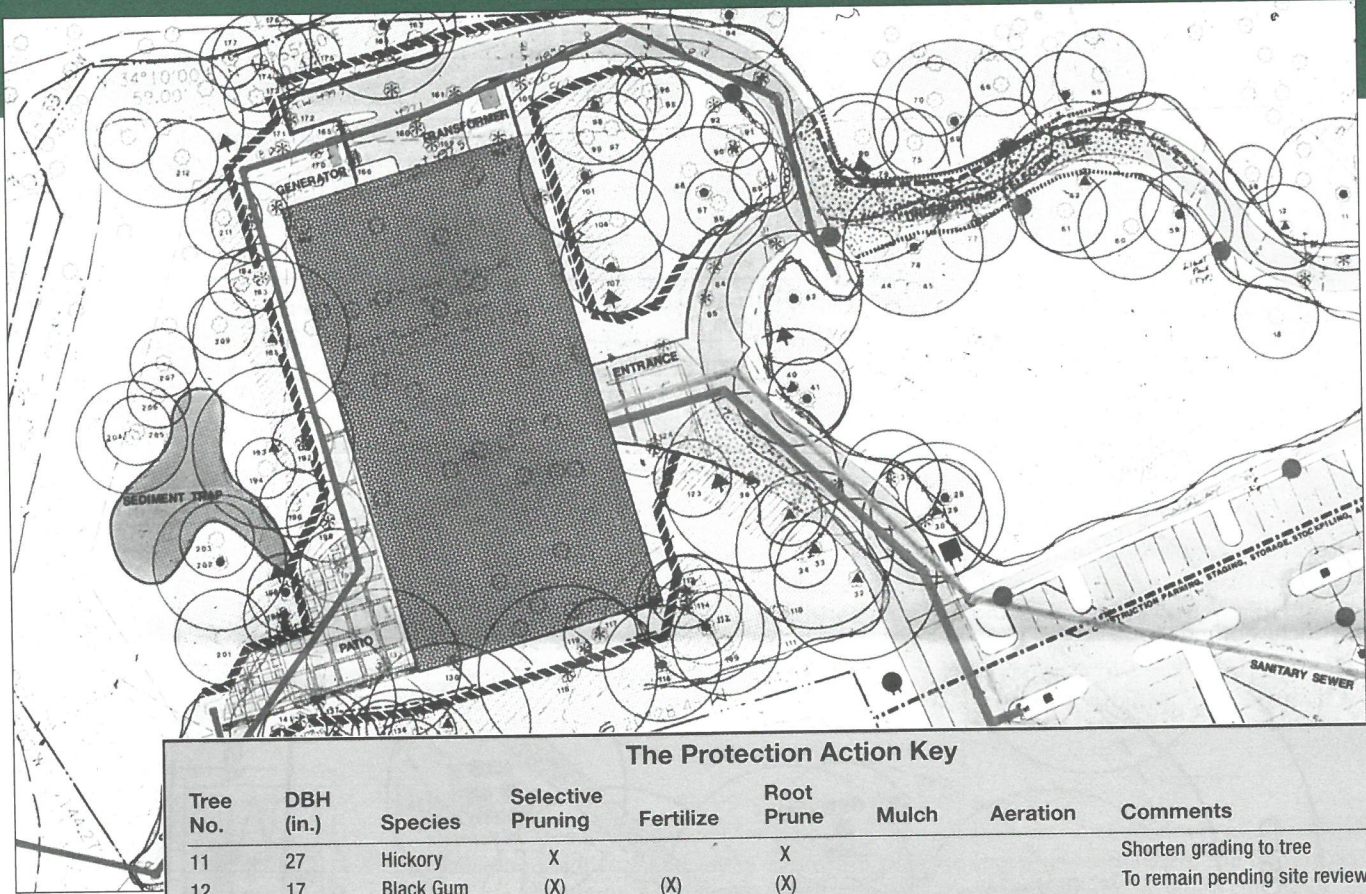
The tree survey is more detailed and precise. It locates all trees that will be impacted by construction. And since root zones are the key to a tree's survival, it shows these areas as circles around each tree. Traditionally, the critical root zone has been considered synonymous with a tree's dripline. In reality, roots often extend far beyond the dripline. Doing an investigative dig to follow key roots outward from the base on sample trees will yield valuable clues to the root patterns on a particular site. Another method is to estimate 1 foot of radius for each inch of trunk diameter breast high. Root zones should be enlarged accordingly on the tree survey map.

In this step, each tree is located with surveyors' or foresters' instruments, given a number that is keyed to its location on the map, and described in list form showing species, diameter, and the tree's condition.

A map resulting from the tree survey identifies and briefly describes all trees of importance, shows critical root zones, and notes preliminary recommendations. Ideally, each tree's base elevation is also shown so that the potential impacts of grade changes can be easily determined.

Look for Opportunities to Transplant

During data collection for tree stand delineation and the tree survey, be alert for opportunities to move trees to appropriate open areas on the site, out of building and road locations. Develop an inventory of transplantable trees by species, sizes, and conditions and note their locations on an overlay. Rearrangement of trees or even the building of a forest in open space offers possibilities that are often overlooked.



The Protection Action Key

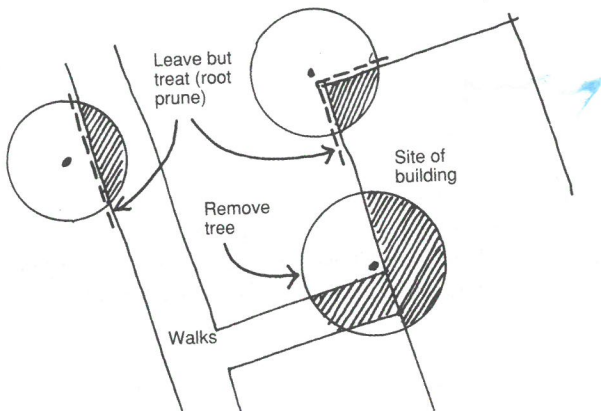
Tree No.	DBH (in.)	Species	Selective Pruning	Fertilize	Root Prune	Mulch	Aeration	Comments
11	27	Hickory	X		X			Shorten grading to tree
12	17	Black Gum	(X)	(X)	(X)			To remain pending site review
28	15	Maple	X	X	(X)			
29	24	Red Oak	(X)	(X)	(X)	(X)		To remain pending site review
30	20	White Oak	X		X			Retaining wall

The tree conservation plan combines the location of trees, site improvements, and prescriptions for each tree. The plan becomes part of the construction documents and must be respected by all who work on the site.

Step 3: Tree Conservation Plan

With tree data clearly shown on a base map, planners, architects, and engineers can develop a grading plan and propose the location of roads, driveways, utility corridors, and other improvements where they will have the least impact on existing vegetation.

When site improvements are added to the tree survey map, other decisions can also be made. For example, by



using an overlay and coloring the portion of root zones that will be destroyed by construction, recommendations can be made for the removal of trees that will be severely impacted by losing more than 50 percent of their roots.

Tree protection zones can also be easily delineated (areas that will be fenced off during construction), as can all trees that will lose portions of their roots (and need to be root pruned ahead of time). This map is also the place to show storage and parking zones, cement truck wash-out areas, soil stockpiles, and other details essential to saving trees.

Development of the tree conservation plan is a time of give and take with the designers and engineers. Then, when all compromises and adjustments have been made, design procedures are added or appended to the map.

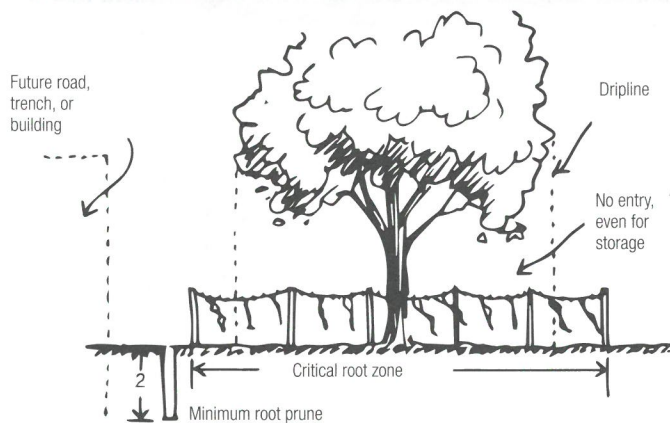
The design procedures section is similar to a legend, except it lists those trees to be removed and prescribes what is required to protect each tree that is to remain on the site. These prescriptions then become part of a legal document. They are part of the official construction maps that are forwarded to planning commissions for approval and subcontractors for bidding on the project. Signature blocks for the owner and contractors will help ensure the items are read and accepted.

Step 4: Construction Administration

Construction administration is the on-site protection and care of the trees selected to remain. Many of the available techniques are shown in the mini-directory on page 7, with the sequencing of a few of the more common methods listed below.

Pre-construction

- Remove “non-save” trees. Cut rather than push over with dozers to protect roots of nearby “save” trees.
- Prune limbs in the way of improvements. Crown reduction to lower wind resistance may also be necessary on trees that have their root zones reduced.
- Fertilize, water, aerate, and otherwise aid tree health.
- Fence specimen trees and groups of trees. Where root loss will occur, root prune 1 foot beyond the fence using a vibrating knife or narrow trencher — always with sharp blades to make clean cuts. Backfill immediately and cover with 3 inches of mulch.



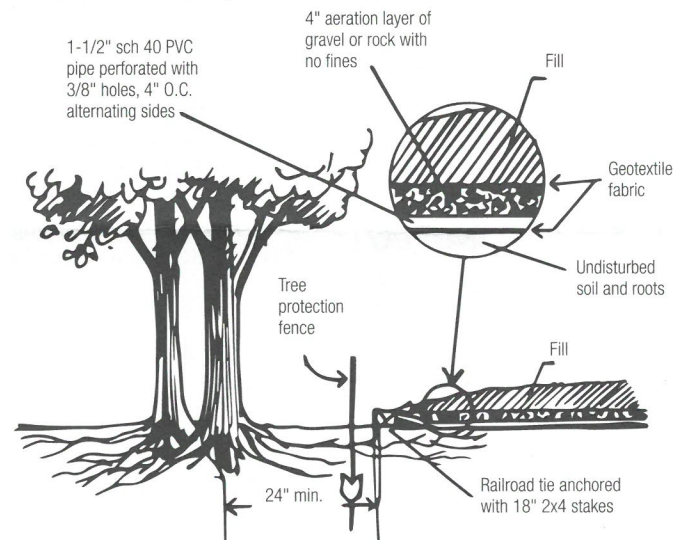
- Install siltation fences to keep soil from disturbed areas out of the root zones of trees to be saved. Even an inch or two of silt can slowly smother tree roots.
- Place neat, high-quality signs to designate wash-out areas, parking, topsoil storage, and similar areas. They should also be used to explain fenced-off areas. The owner's name or company logos should be included.
- Supervise clearing activities in the construction zones. Use on-site chips as mulch to prevent soil compaction of root zones. An 8- to 16-inch layer is needed where there will be machinery traffic.



Quality signs communicate the seriousness of protecting trees during construction.

Construction

- Supervise the installation of devices such as retaining walls, drain pipes, aeration systems, and others called for in the tree conservation plan.



Aeration beneath fill, streets, and parking lots will help trees survive construction.

- Be present during operations such as trenching, excavation near trees, and other stages of construction likely to affect trees.
- Promptly report infractions to the appropriate construction official and, if possible, correct. Assess fines for damage or tree death using the standard tree value formula available from the International Society of Arboriculture.

Post-construction

- Remove fences and signs.
- Prune any damaged trees; water and fertilize as necessary.
- Do any final clearing of undesirable trees or shrubs by hand.
- Inspect periodically to spot correctable problems and to learn more about what worked and what did not.

Acknowledgment

Much of this issue is based on the pioneering work of Steve Clark and Associates Inc. of Bethpage, Tennessee.

Communication — Essential in All Steps

Communication is truly the key to success in saving trees during construction. It is not listed here as a separate step in the process because it is an essential part of every step.

Equally as important is having a designated person responsible for doing the communicating and overseeing tree protection from start to finish. On private projects, this may be the owner, but a better approach is to retain a consultant to act on behalf of the owner. On public projects, the designated individual may be the community forester, campus arborist, or other tree expert who represents the administration.

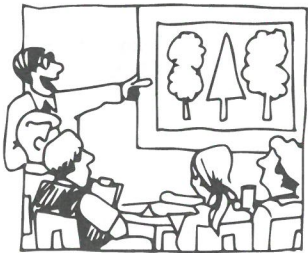
"People always want to know the secrets of our success as consultants. I'm willing to share this with you because the real secret is our ability and willingness to communicate."

— Steve Clark, late president
Steve Clark and Associates Inc.



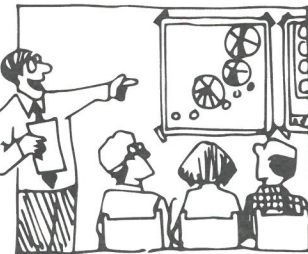
Conceptual

During tree stand delineation and the tree survey, take key people on a walk through the property. Point out to individuals, such as partners in an ownership, institution administrators and the construction manager, how existing trees can enhance the finished product (homes, mall, new campus building, etc.). Stir the imagination and create a sense of excitement that will result in determination to take the necessary steps to save trees.



Design

Using the tree stand delineation map, it is necessary to convince planners and architects, and later the engineers and utility managers, to place improvements where the impact on trees will be at a minimum. At the first design meeting, a brief slide show or video can be used to visually walk all parties through the property, pointing out what might be saved and describing techniques that can be used to ensure the trees will survive.



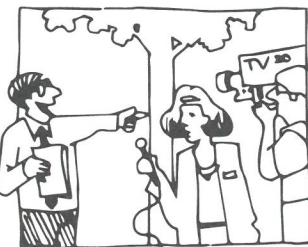
Pre-construction

It is essential to hold a meeting with all foremen, sub-contractors, and others who will work on the site. It is best to start the meeting with an introduction by the property owner or other authority figure to establish the seriousness of protecting trees. Next is the slide show or video again, a review of the tree conservation plan, then an on-site walk to review what has been prescribed for each tree and how the construction team must work together to bring about the desired outcome. The dollar values of the trees should be discussed emphatically.



Construction

Workers must be contacted right at the beginning of construction. Surveyors, well-drillers, and earth core samplers are the first on site and can do irreparable damage to vegetation if not contacted. Dozer operators and truck drivers also need to be recruited to do their share. A friendly, respectful approach is essential, with the intent of showing all workers the importance of their part in the project and the necessity of observing signs, fences, and rules. Education about the importance of root zones is also a key objective, as well as making sure the dollar value of trees is clearly understood.



Publicity

Publicity during and after the project will enhance sales and encourage others to build with trees. Local newspaper coverage, on-site interpretive signs, designation of the property as an Urban Wildlife Sanctuary (See *Bulletin No. 13*), and applying for awards are a few ways to get extra mileage from your efforts to make existing trees a part of development.

A Mini-Directory of Tree Protection Techniques



TREE CITY USA®

IMPACT TO TREE	CONSTRUCTION ACTIVITY	METHODS/TREATMENTS TO MINIMIZE DAMAGE
Branch and trunk damage	Injury from equipment	Fence trees to enclose low branches and protect trunk. Report all damage promptly so arborist can treat appropriately.
	Pruning for vertical clearance for building, traffic, and construction equipment	Prune to minimum height required prior to construction. Consider minimum height requirements of construction equipment and emergency vehicles over roads. All pruning should be performed by an arborist, not by construction personnel.
	Felling trees in construction area	Require that trees being removed be felled away from, rather than into, tree protection zones.
Root damage or loss	Stripping site of organic surface soil	Restrict stripping of topsoil around trees. Any woody vegetation to be removed adjacent to trees to remain should be cut at ground level by hand and not pulled out by equipment, or root injury to remaining trees will result.
	Digging into topsoil layer and killing roots while loading piles of soil, sand, gravel, etc.	Store outside fenced protection zones and away from root zones. Place plastic tarp, straw, plywood, or geotextile material beneath pile.
	Lowering grade, scarifying, preparing subgrade for fills, structures	Use retaining walls with discontinuous footings to maintain natural grade as far as possible from trees. Excavate to finish grade by hand and cut exposed roots with a saw to avoid root wrenching and shattering by equipment, or cut with root pruning equipment. Soil beyond cut face can be removed by equipment sitting outside the dripline of the tree.
	Subgrade preparation for pavement	Use paving materials requiring a minimum amount of excavation (e.g., reinforced concrete instead of asphalt). Design traffic patterns to avoid heavy loads adjacent to trees (heavy load-bearing pavements require thicker base material and subgrade compaction). Specify minimum subgrade compaction under pavement within root zone. Install aeration pipes if necessary.
	Excavation for footings, walls, foundations	Design walls/structures with discontinuous footings and pier foundations; excavate by hand near major roots. Avoid slab foundations; use post-and-beam footings.
	Trenching for utilities, drainage	Coordinate utility trench locations with installation contractors. Consolidate utility trenches by hand in areas with roots larger than 1 inch diameter. Tunnel under woody roots rather than cutting them. Curve trenches rather than using straight lines.
Unfavorable conditions for root growth; chronic stress from reduced root systems	Fill dirt over roots	Avoid adding soil over root zone. If unavoidable, insert aeration pipes per directions in <i>Arboriculture</i> by Richard Harris.
	Compacted soils	Fence trees to keep traffic and storage out of root area. In areas of engineered fills, specify minimum compaction (usually 85 percent) if fill will not support a structure. Provide a storage yard and traffic areas for construction activity well away from trees. Protect soil surface from traffic compaction with 12" to 14" of wood chip mulch. Following construction, vertical mulch compacted areas. Install aeration vents.
	Spills, waste disposal (e.g., paint, oil, fuel)	Post notices on fences prohibiting dumping and disposal of waste around trees. Require immediate cleanup of accidental spills.
	Concrete wash-out and waste dumping	Designate wash-out area. Dig pit and remove after construction, if necessary.
	Soil sterilants (herbicides) applied under pavement	Use herbicides safe for use around existing vegetation and follow directions on the label.
Impervious surface over soil surface		Use pervious paving materials (e.g., interlocking blocks set on sand). Install aeration vents in impervious paving.
Inadequate soil moisture	Rechannelization of stream flow; redirecting runoff; lowering water table; lower grade	In some cases it may be possible to design systems to allow low flows through normal stream alignments and provide bypass into storm drains for peak flow conditions. Provide supplemental irrigation in similar volumes and seasonal distribution as would normally occur.
Excess soil moisture	Underground flow backup; raising water table	Fills placed across drainage courses must have culverts placed at the bottom of the low flow so that water is not backed up before rising to the elevation of the culvert. Study the geotechnical report for ground water characteristics to see that walls and fills will not intercept underground flow.
	Lack of surface drainage away from tree	Where surface grades are to be modified, make sure that water will flow away from the trunk, i.e., that the trunk is not at the lowest point. If the tree is placed in a well, drainage must be provided from the bottom of the well.
	Irrigation of exotic landscapes	Some species cannot tolerate frequent irrigation required to maintain lawns, flowers, and other shallow-rooted plants. Use free form mulch areas, avoid landscaping under those trees, or utilize plants that do not require irrigation.
Increased exposure	Thinning stands, removal of undergrowth	Save groups or clusters of trees when working with species that perform poorly in the open or as single trees. Maintain the natural undergrowth.
	Excessive pruning	Prune sparingly, especially in stands of shade-tolerant species. Remember, leaves manufacture the food needed for root growth and recovery from shock.