

**RESOLUTION ADOPTING THE CITY OF WHITEWATER
URBAN FORESTRY MANAGEMENT PLAN**

WHEREAS, the City of Whitewater Urban Forestry Commission is a committee of the City of Whitewater Park and Recreation Board and is responsible for the preparation of an Urban Forestry Management Plan, and

WHEREAS, the Urban Forestry Commission has completed an Urban Forestry Management Plan, and

WHEREAS, the plan has been reviewed and accepted by the Park and Recreation Board, and

WHEREAS, the plan is a sound and valuable plan for the City of Whitewater for Urban Forestry Management.

Now, therefore, **BE IT RESOLVED**, that the Common Council of the City of Whitewater, Walworth and Jefferson Counties, hereby adopts the Urban Forestry Management Plan. The adoption of this plan establishes required standards for City staff and City employees, unless the City Forester gives specific direction based on his or her professional judgment to deviate from the plan.

Resolution introduced by Councilmember Binnie, who moved its adoption. Seconded by Councilmember Kienbaum.

AYES: Binnie, Singer, Kienbaum, Stewart.

NOES: Olsen

ABSENT: Butler, Winship.

ADOPTED: September 27, 2011.



Kevin M. Brunner, City Manager



Michele R. Smith, City Clerk

WHITEWATER URBAN FORESTRY MANAGEMENT POLICY (F.D.)
(TYPED 08-30-11 -- 1:30 P.M.)

INTRODUCTION

The city's urban forestry management plan is administered by the Park and Recreation Board in conjunction with the Urban Forestry Commission serving in an advisory capacity. It is the responsibility of the Parks and Recreation Director, the UFC, the City Forester and other department staff to provide for green sustainability in the community. The city staff, sometimes in conjunction with contracted professional services, is charged with the regulating and control of planting, transplanting, removal, maintenance, preservation and protection of public trees and shrubs in the city. Other areas of impact in maintaining a proper urban forestry plan in the community will also be addressed.

THE URBAN FORESTRY MISSION STATEMENT

The Urban Forestry commission shall serve as an advisory adjunct to the Whitewater Park and Recreation Board in the administration of the City's Urban Forestry program. This plan shall be carried out, in large part, by the City Forester and staff. The UFC shall also advise policy by referral from the City Manager, the Plan and Architectural Review Commission and the City Council.

The UFC shall advise a policy for the development of a green sustainability program. This policy will guide the care, preservation, planting, pruning, and removal of trees and shrubs along all city streets and public spaces. It shall also review an annual planting plan prepared by the city forester and carried out by city labor and/or volunteers as overseen by said forester.

The UFC shall also serve in an advisory capacity to the Park and Recreation Board, as well as the Plan and Architectural Review Commission and the City Council upon request, as the City preserves and grows its environmental base (i.e. parks, greenbelts, secondary environmental corridors, wetlands, woodlands, lakes, waterways, natural conservancies, and archeological sites).

I. UFC ANNUAL PLANTING POLICY

- A. The city Forester shall prepare an annual preliminary planting plan to be submitted to the UFC for review by the end of November. This plan, indicating budgeting and ordering needs for the tree program, may be modified by budget deliberations.
 - a. The planting plan shall state where large or small trees are appropriate. Small trees shall be used where overhead utilities exist, with their mature height compatible to clearance requirements. Large trees shall be used elsewhere unless unusual or special circumstances dictate otherwise. All varieties of trees used shall be approved and submitted by the city forester, in conjunction with UFC review.
 - b. The plan shall be based on a *quadrant* strategy, assuring an orderly and effective result. Only a property owner's request (within policy and

ordinance parameters), replacement of failed plantings, and special circumstances (new subdivision, park improvements, etc.) shall take precedence over this format.

- c. Trees shall be properly spaced, no nearer than *25 feet* from the point of intersection of public street right-of-way lines or *10 feet* from any driveway edge. New trees planted on private property by landowners to meet street planting requirements in cases that are first approved by the city forester, must be *five to twelve feet* behind sidewalks and must adhere to requirements of *Section 19.06.120 of the Whitewater Municipal Code*. Also, for information on plantings that were 'grandfathered' prior to January 1, 2007 see *regarding Amendments to Regulations for Landscaping Within Public Street Terrace Areas ... Sec. 1, Chapter 12.24.010(d); Sec. 3, (c), (d) of the Whitewater Municipal Code*.
 - d. City Utility Clearance shall be secured for all planting sites to insure maximum safety for planting. Holes should be three times the diameter of the root ball, or spread of roots in case of bare root trees or container trees. This should provide trees with enough worked earth for their root systems to be established. All banks of the hole shall be loosened by shovel and trees should be planted at their original soil level at the root collar.
 - e. Bare root trees shall be stored in regularly watered gravel beds until planted, since this technique will allow planting throughout the summer and early fall when circumstances warrant. This plan may be advantageous to staffing demands as well. Also, the needs of the specific varieties of trees whose viability require special procedures, such as "sweating", will be addressed prior to planting. (*Reference: See Appendix A and B*).
 - f. All newly planted trees shall be wood chip mulched and protected with at minimum *12 inch* plastic boots. Vandal prone trees (*shown in Appendix C*) shall be protected with sturdy tree guards the same day of planting or as soon as possible. These guards are to remain in place until the tree is at least *3 1/2 inches at the base*.
 - g. New trees shall be watered as part of the planting regimen the day they are planted and then regularly for the first two years after planting, utilizing techniques such as hose, water spikes, watering bags, etc. The goal is to ensure that newly planted trees receive the equivalent of *1 inch of rainfall* per week.
- B. Newly Improved Streets in New Subdivisions: Trees are to be planted on all newly improved streets on the area between the curb and the sidewalk. Refer to City Policy on Tree Planting fee.
- C. Reconstructed and Widened Streets: When trees are removed in preparation for reconstruction or widening of any established street, new trees will be planted provided that there is adequate space in the terrace to reasonably support tree growth. The City Forester shall determine the location of each tree to be planted and the species. It is recommended that a reconstruction or widening project implemented by the City

contain a 2% appropriation for forestry related items in the project area. ****Check tree condition for retention, removal or replacement at time of sidewalk inspection.* See also: *Chapter 12.04.01(d) of Whitewater Municipal Code, Sec. 2.VI.(7)(b)(c)(d).*

- D. Existing Improved Streets: Trees are to be planted on streets that have been improved in the past. The City by budget will pay for the planting of these trees. ****Check tree condition for retention, removal or replacement at time of sidewalk inspection.*
- E. Unimproved Streets: No trees shall be planted in the terrace area where no curb or sidewalk exists unless approved by the City Forester in conjunction with the UFC. (After January 1, 2007. See *Regarding Amendments to Regulations for Landscaping, Sec. 2.vI.(7)(b).*)
- F. Random – Special Requests for Street Trees: Approved trees may be planted by special request of the property owner in an approved location. The City will pay the cost of such trees. The limit on the number of arbitrary tree plantings will be set by budget each year. A list will be made of homeowners who would like a tree. The trees will be planted on a first-come, first-serve basis.
- G. Existing Terrace Trees Damaged: The cost of the replacement of dead or severely damaged trees will be borne by the individual who caused the destruction. If the tree dies for any other reason, the cost of replacement will be paid by the city.

TREE PLANTING STANDARDS

- A. Condition: All plant material shall conform to *American Standard for Nursery Stock, ANSI Z60.1, current edition.*
- B. Diameter of Tree Trunk: All trees planted along public streets must be of sufficient size to absorb the abuse and conditions common to street trees. Unless otherwise permitted by the City Forester, the minimum size will be 6 feet high and 1 ¼ inches – 1 ½ inches diameter.
The diameter size of the tree is established by measuring at DBH (Diameter Breast Height).
- C. Location: Generally, all street trees shall be planted midway between the sidewalk and curb, following all guidelines listed below.
- a. 25 feet from an intersection of two streets measure on the property line
 - b. 20 feet from a signal or power pole
 - c. 10 feet from a driveway edge
 - d. 10 feet from a fire hydrant
 - e. 6 feet from gas, water valves, etc.

- D. Parkway Width: No trees will be planted where the grassy terrace between the sidewalk and curb is less than 4 feet wide. The City Forester and UFC will consider requests for planting in narrower growing spaces in established neighborhoods.
- E. Planting Depth: The planting depth is determined by root collar. All new plantings should be placed so that the root collar is even with the soil surface or 1 to 3 inches above the surface.
- F. Spacing: Depending on growth characteristics of species, trees will be planted 30 or 35 feet apart unless otherwise approved by the City Forester and UFC.
- G. Transplanted Trees: When planting trees bare root, care must be taken to prevent unnecessary injury to roots. All broken roots should be pruned.

H. Tree Selection:

- 1. Select the right tree for the right place:
 - a. Carefully review all aspects of the site.
 - (1) Closely review the soil. Find out about the ability of moisture to drain through the soil.
 - (2) How much physical space is available above ground and below ground. Will the tree you want fit within this space at maturity? Don't plant a tree that will grow to a height of more than 30 feet under power lines.
 - (3) Consider environmental factors such as exposure to the sun, drying winds, and pollution.
 - b. Choose a tree species which matches, or is adaptable, to the growing conditions you have found during the site analysis.
- 2. Select a healthy tree from a reputable nursery.
 - a. Avoid plants that have damaged twigs, branches, trunk, or roots.
 - b. Is the tree well anchored in the pot or burlap root ball?
 - c. Do not buy plants that look unhealthy or have dried out roots.

I. Tree-Planting Procedures:

To plant the trees properly:

- 1. Prepare the site by digging a hole at least three times the diameter, and at least the depth of the root ball, or the full extent of the root system of bare root trees.

Leave a pedestal in the center of the hole to rest the root system on. (See figures 1 and 2 for the recommended size of planting hole, which is

considerably wider.) City Utility Clearance shall be secured for all planting sites to insure maximum safety for planting. Holes should be three times the diameter of the root ball, or spread of roots in case of bare root trees or container trees. This should provide trees with enough worked earth for its root system to be established. All banks of the hole shall be loosened by shovel and trees should be planted at their original soil level at the root collar.

2. Find the root collar and plant the tree even or slightly shallower than this point. It is recommended to remove burlap and/or wire prior to planting.
3. Use the soil removed from the hole as backfill. Discard any rocks and debris from the soil before backfilling.
4. Water the soil with a garden hose. Do not pack the soil down manually; water will do this naturally. Fill in voids with more soil after watering. New trees shall be watered as part of the planting regimen the day they are planted and then regularly for the first two years after planting, utilizing techniques such as hose, water spikes, watering bags, etc. The goal is to ensure that newly planted trees receive the equivalent of *1 inch of rainfall* per week.
5. Create a 2-4" deep mulch bed using wood chips. The mulch should not touch the trunk directly to prevent mold and bacteria from forming. Apply heavier at edges to create a "saucer" effect. All newly planted trees shall be wood chip mulched and protected with at minimum *12 inch* plastic boots. Trees planted in vandal prone areas shall be protected with sturdy tree guards the same day of planting or as soon as possible. These guards are to remain in place until the tree is at least *3 1/2 inches at the base*.
6. Staking: If you must stake, use a wide belt-like material when supporting the tree to avoid injuring the bark. Trees need to move in the wind, so allow some "play" in the support system to allow the trunk to sway without being uprooted.
7. Prune any broken, dead or dying limbs without damaging the branch collar at the time of planting. Routine pruning to train branching structure should be started one year after planting. Do not use pruning paint or wound dressing on the pruning cuts.
8. Wait until one year after planting to fertilize.
9. Provide training to any employee involved in tree planting.

****Additional Care:** Pruning, mulching and fertilizing should be provided as **needed**.

II. RECOMMENDED STREET TREES

A. **Acceptable Street Tree List (Appendix C - to be updated annually)**

B. **Unacceptable Street Tree List (Appendix D - to be updated annually)**

New Varieties: As new varieties of trees are found for street tree use, special instructions may be given for their planting that require modification of the standards.

MAINTENANCE AND CARE OF NEWLY PLANTED TREES

- A. Fertilizing: Fertilization of newly planted trees in the first year is not recommended. Typically a tree can be fertilized once it has become established, usually 2 or 3 years after planting; however, most homeowners will provide this when they fertilize their turf. Remember only healthy established trees are to be fertilized and, if done properly, can be a beneficial activity. Fertilizing an established tree when growth is slow and vigor is low, which is indicated by off-color leaves or needles and by abnormal loss of foliage, will sink the stressed tree even deeper into stress. **Stressed trees should be watered and otherwise left undisturbed until they recover.** Fertilizer should be applied preferably in the early spring before leaves appear. A general purpose fertilizer containing nitrogen and potash is recommended.
- B. Mulching: A layer of wood chip mulch around the base of the tree will help conserve the soil moisture, help protect the tree from lawn mower damage, and reduce competition from grass for nutrients. The mulch should not be piled around the trunk as the heat generated may damage the bark. The mulch should be approximately 4" thick at the perimeter, creating a "saucer" effect towards the trunk. All newly planted trees shall be wood chip mulched and protected with at minimum 12 inch plastic boots. Vandal prone trees (*shown in Attachment B*) shall be protected with sturdy tree guards the same day of planting or as soon as possible. These guards are to remain in place until the tree is at least 3 ½ inches at the base.
- C. Tree Pruning: No pruning should occur at the time of planting. Pruning at this time will reduce the amount of stored energy that the tree contains and could cause added stress to the tree. But, the following year a pruning schedule can begin.
- D. Tree Staking: When staking, use wide bands of nylon strap, carpet, or inner-tubes to support the tree. Make sure that the tree has a small amount of room to move.
- E. Watering: Newly planted trees require 1" (10 gallons) of water per week during the growing season to maintain health. The City and property owner should work together to provide adequate moisture to trees. The city should use local media to promote watering during dry periods. New trees shall be watered as part of the planting regimen the day they are planted and then regularly for the first two years after planting, utilizing techniques such as hose, water spikes, watering bags, etc. The goal is to ensure that newly planted trees receive the equivalent of 1 inch of rainfall per week.

III. PUBLIC TREE MAINTENANCE POLICY

In the City of Whitewater, 4 sections shall be established to increase efficiency by reducing crew travel time to a minimum. To establish an orderly way of pruning trees, a "Rotation Pruning Schedule" will be put into operation. With this pruning system, public trees are thoroughly pruned for low hanging branches, deadwood, and clearance of branches overhanging buildings.

CRITERIA FOR THE SELECTIVE REMOVAL OF PLANT PARTS

- A. Sanitation: Remove dead or diseased branches.
- B. Traffic Clearance: Provide for a 10' optimum clearance over sidewalk and lawn areas and a 14' optimum clearance over street level to be exceeded only in unusual circumstances on a tree by tree basis with authorization by the City Forester and/or a certified arborist under the direction of the City Forester.

Cutting or pruning heights shall be determined by using a valid instrument of measurement.

Only necessary pruning of small and large branches shall be done. Minimum pruning is the goal in order to preserve as much of the tree as possible. The maximum cutting heights shall not be determined by where the branch is attached to the trunk since these branches arch upward from the trunk. The branches hanging down may be cut off, but not the main branch when it itself does not interfere with pedestrians or vehicles.

- C. Light Clearance: Remove the minimum amount of branches to allow for an adequate street lighting pattern on pavement.
- D. Trees in Long Grass Areas (creek banks, some parks, etc.): No pruning of living branches shall be done unless extenuating circumstances require review by the City Forester for action. Branches shall be allowed to grow near ground level as nature intended.
- E. Storm Damage Repair: Preserve as much of the tree as possible, and train new growth for the future.
- F. Building Clearance: Remove interfering branches to a maximum of 6' clearance of a problem area.
- G. Transplanted Trees: Pruning of live tissue should be avoided at time of transplanting and should be left for the following year. The exception: removing dead or broken branches, which should be done when planting.
- H. Intersection Visibility: Utilize traffic clearance guidelines, in addition, no new tree shall be planted within 25' of the "inside" intersection of the roads closest to the tree site.
- I. Evergreens: Evergreens in parks and other public areas shall not have any branches removed except for pedestrian or vehicle considerations. Pruning of evergreens shall not be done to accommodate lawn mowing. Instead, grass shall be removed or mulched heavily in

order to eliminate mowing under evergreens. Branches on the sides of an evergreen that does not affect traffic should be, in most cases, left intact.

- J. Problems in the exercise of this policy shall be brought to the Urban Forestry Commission for review.

PRUNING SPECIFICATIONS

- Pruning shall follow ANSI A300 Guidelines (Appendix A)
- All cuts should be made sufficiently close to the branch collar so that wood growth can readily start under normal conditions (Appendix B)
- Safety considerations are followed at all times during the operation and may include blocking off of street with barricades.
- All girdling roots visible to the eye, where practicable, should be treated with one of the following: Cutting of root at either end, notching of root in center with chisel, or removing the root without injury to bark or parent stem.
- Topping of trees is prohibited. If trees must be reduced in size the drop crotch pruning method shall be used.
- Climbing spurs must not be used during pruning operations.
- All wires are to be considered as "HOT" or "LIVE": any branches that are within 10' of an energized line should not be pruned. Call the appropriate utility for assistance, if necessary. Any branches that accidentally fall against or hang on wires must be removed by the appropriate utility. Failure by the utility to comply will result in the City contracting for the work and billing the utility accordingly.

PRUNING OPERATIONS

A. Section Pruning:

1. The City is divided into four quadrants. These trees will be pruned in rotation on a maximum 5 year cycle basis. All public trees are to be pruned as needed in accordance with previously mentioned criteria and specifications.
2. Vehicle and pedestrian traffic must be fully warned of potential danger in work areas.
3. Trees found to be in unsafe condition, or that require major repair, are to be reported immediately to the City Forester.
4. Private citizens are to be treated with respect and courtesy at all times, regardless of conditions/conflicts.
5. At the end of each working day, all limbs, branches, twigs, and debris shall be picked up before leaving work area.
6. No equipment shall be left at the work site overnight.
7. Report all unusual situations or conditions to the City Forester.

B. Spot Pruning:

1. Pruning for special purpose: Safety, light clearance, traffic clearance, building clearance, house moving, and construction. These are special assignments and should be handled as such.
2. Contact with property owners shall be made before work assignment. The City will utilize local media sources to notify residents work will be commencing in the designated areas.

TREE REMOVAL POLICY

- A. 1. Reason for Removal: Trees located in the terrace (the area between sidewalk and curb or between street lanes), parks, and other public property are removed when they are dead, dying, dangerous, injurious to public improvements, or condemned because of Dutch Elm Disease and other diseases. The cost of removal will then be assumed by the City including the cost of stump removal.
2. The City Forester will determine removal of undesirable tree species based on the following criteria. The property owner has the right to appeal removal decisions to the City Forester and UFC.

TREE REMOVAL CRITERIA

<u>Situations</u>	<u>Points</u>
(a) Sidewalks raised up by roots (1" or less 5 pts., over 1" - 10 pts)	_____
(b) Driveway approach raised up by roots (1" or less 5 pts., over 1" - 10 pts)	_____
(c) Curb and gutter raised up by roots (1" or less 5 pts., over 1" - 10 pts)	_____
(d) Tree Condition (hazardous - 40 pts., decline - 20 pts., topped - 10 pts., Health - 0 points)	_____
(e) Terrace width (less than 5' - 20 pts., 7' or less - 10 pts., 8' or more - 0 pts.)	_____
(f) Tree Obstruction (sewer pipe replacement - 10 pts, new driveway entrance - 8 pts., Intersections, driveways, etc., obstructing view of traffic - 20 pts. Excessive damage to roots due to construction - 20 pts., no obstruction - 0 pts.)	_____

*Utility Conflicts are the responsibility of the utility; the City will remove trees with 40+ points.

B. Storm Calls – Priority Trimming: Consideration of safety to life and property is of prime importance when trees have been damaged by storms.

- * 1st Priority – calls involving people in danger.
- * 2nd Priority – calls involving obstruction of major streets.
- * 3rd Priority – calls involving obstruction of local streets.
- * 4th Priority – calls involving obstruction of sidewalks.
- * 5th Priority – calls involving other public property.

1. Only authorized personnel will be used on storm calls.
2. No work will be performed on the site where electrical wires are down, damaged, or broken.
3. The appropriate utility company must be called if any wires are damaged or broken.
4. If damage has occurred to private property, report it to the proper authorities before leaving the scene.
5. After dark, calls require special caution.
6. Communication with the Police Department and the Department of Public Works can greatly improve the priority in storm damage incidents. (Radio communication)
7. Employees will be subject to call at any time for special assignments and/or emergency work.
8. All limbs, branches, twigs, wood, and other debris should be neatly piled so that no interference with sidewalk, driveway, or gutter occurs.

C. Location:

1. Check location and description of tree on work order before starting removal.
2. Check surrounding area for wires, cars, fences, toys, children or other possible problems.

D. Clean Up:

1. Work site cleanup shall be the same as the pruning operations.
2. Wood from the work site shall be transported to the City compost site or removed by the contractor if the abutting property owner does not want the wood.

IV. TREE PROTECTION POLICY (GENERAL)

In construction areas the cost of Tree Protection is paid by the contractor. Remediation must be performed to the satisfaction of the City Forester. If city crews perform the work, they shall also be responsible to the City Forester.

A. Bridging, Tunneling, Drilling, Etc.: The protection of trees shall involve bridging, tunneling, drilling or boring underneath the existing trees. The surface area directly adjacent to the tree shall not be disturbed under the following guidelines except for sidewalks, curbs, gutter and drive-way approaches.

1. **3" DBH (Diameter Breast Height) trees or less** – two feet on either side of tree with a

minimum three foot depth.

2. **3" to 8" DBH trees** -- four feet on either side of tree with a minimum three foot depth.
 3. **8" DBH trees and over** -- five feet on either side of tree with a four foot minimum depth.
- B. Depositing Material Near Trees: No person shall place or maintain upon the ground in a public street or right-of-way of the City of Whitewater stone, cement, lumber, or other substance or material which shall impede the free passage of water and air to any tree or the base of said shrub or an area not less than 4 feet square (4'X4'). Before depositing any such materials near to trees or shrubs, the person depositing said material shall place such guards around the trees and shrubs as shall effectually prevent injury to them, at a minimum the width of the terrace area surrounding the tree.
- C. Moving of Buildings: When moving a building, the contractor must notify the Park, Recreation, and Forestry Department 48 hours before the start of moving the building. If any trimming is necessary as the building is being moved, the City Forester will coordinate the trimming, and costs will be absorbed by the contractor.
- D. Root Care: Exposed tree roots shall be covered with a clean backfill as soon as possible following curb and gutter removal. Root foundations must remain adequate to withstand heavy windstorms.
- E. Sidewalk, Driveway, and Curb and Gutter Removal: Caution should be used during removal to avoid any unnecessary damage to the tree or its root system.
1. Roots requiring removal shall be cut by means of mechanical root cutting machines.
 2. Root systems on the sidewalk or driveway side of the tree shall be cut no deeper than 9 inches below the finished grade of the new walk and not more than 5 inches from the edge of the new walk or driveway.
 3. Root systems on the curb side shall be cut not more than 12 inches behind the back of the new curb and not more than 18 inches in depth when constructing new curb and gutter.
- F. Tree Replacement: The City Forester may remove and replace any tree damaged by a Contractor, at the Contractor's expense. The Contractor (or property owner if the Contractor fails to pay) shall pay the cost of purchasing and planting the new tree. If the costs are not paid within 30 days, the costs shall be assessed against the property as a special charge.
- G. Trunks and Limbs: At least 48 hours before start of construction, the contractor shall call the City Forester to discuss problems of overhanging branches that might be damaged in spite of his exercising care in construction. Trees shall be protected with wood slats or snow fence at the drip line, a minimum of 4 feet from trunk of tree, where contractor's operation may scar the trunk or compact the root zone of the tree. The contractor shall exercise care to assure tree trunk and limbs are not damaged by its operation.

Damage to branches of the trees due to the contractor's negligence will be repaired and billed to the contractor by the Department of Parks, Recreation and Forestry.

V. TERRACE TREE PROTECTION POLICY

1. For all street reconstruction projects, identify terrace trees which need to be protected during construction. Trees which are to be protected should be clearly indicated on the drawings for the street reconstruction project. It should also be noted that it may not be possible to save all terrace trees when significant widening and/or regrading is required to meet the goals of the project. Further, the species, size, location and health of an existing terrace tree may influence whether or not a tree should be protected. Where terrace trees cannot be protected, suitable replacement terrace trees should be included in the project scope. The City Forester and Director of Public Works should be involved in this process.
2. The project specifications should include a summary of the tree protection provisions that are expected and required during the construction phase of the project. A penalty for non-compliance by the Contractor should be considered.
3. The agenda for preconstruction conferences should include discussion of tree protection requirements. This should include review of the trees shown to be protected on the drawings as well as various methods of tree protection.
4. The following possible tree protection provisions should be considered:
 - a. Prior to the start of construction, trees which are to be protected should have plastic fencing wrapped around the trunk of the tree to a minimum height of 4 feet. Wood planking should be strapped to the fencing to create a protective barrier. Fencing and planking shall not damage tree bark or branches.
 - b. Where it is evident that tree pruning will be required to accommodate construction activity (low branches, etc.) all pruning should be done prior to the start of construction using appropriate equipment and tools.
 - c. Establish a tree protection zone (TPZ) for each tree to be protected. For example, the TPZ may be defined as a 1 foot radius for each inch of tree diameter. Install plastic fencing around the tree at the edge of the TPZ, excluding street and sidewalk areas.
 - d. Storage of construction materials and equipment shall be prohibited in the TPZ, including street and sidewalk areas.
 - e. Removal of existing curb and gutter and sidewalk within the TPZ should be done using methods which minimize disturbance of soil and root mass around terrace trees. For example, this may need to be accomplished with a mini-excavator or broken apart with a jack hammer and removed by hand.
 - f. When sidewalk replacement within the TPZ is required, the existing sidewalk should be removed utilizing hand methods indicated above. The depth of excavation of the existing soils under the existing sidewalk should be minimized (if required at all) to avoid root damage. Place new sidewalk over existing base/soil materials within the TPZ.

- g. Minimize excavation and base placement within the TPZ. Excavate only enough width behind the new curb and gutter to allow concrete forms to be placed.
- h. Place mulch around the root area of protected trees and keep moist until backfilling is complete.
- i. Hand form and pour concrete curb and gutter and sidewalk within the TPZ.
- j. All terrace tree roots damaged during excavation should be pruned.
- k. Backfill disturbed areas within the TPZ as soon as possible using appropriate soil materials/mixtures.

APPENDIX A

**The Missouri Gravel Bed:
A User Friendly System for Handling Bare Root Nursery Stock**

The Missouri Gravel Bed (MGB) is a method of handling bare root nursery stock in which dormant plants are placed in the spring with their roots in an irrigated bed of gravel and held for up to 6 months before planting bare root (in full leaf) in the landscape. It is not a growing method, but can be used by growers, retail and landscape nurseries, arborists or City Foresters to extend the planting or potting season and to greatly simplify the handling of bare root stock. It also shows promise as a method for heeling in B&B stock. The key to MGB is that root growth in gravel is very fibrous and, unlike mulch or sand, very few roots are damaged when plants are pulled from the gravel.

The MGB was hatched at the University of Missouri Horticulture Research Center about 1985. In the initial test, 20 of 20 4-6 foot bare root, bush Washington hawthorn trees survived after field planting in mid-summer, after 8 weeks with their roots in aerated water. While aerated water grows good roots, it does not provide any support, creating problems in plant handling. Thus, studies since 1986 have used irrigated, creek gravel as a root growth medium.

Over the past 20 years, many species have been tested in the MGB including ornamental pears, redbuds, flowering dogwood, lindens, maples, crabapples and roses. A test in 1994 at Sherman Nursery, Charles City IA, expanded the number of species tested to well over 30. Sjulín Nursery, Hamburg IA, has evaluated the performance of 100 species of shrubs as well, reporting no injury to roots of plants left in the gravel during a winter (down to -25 degrees F). Overall, the survival of MGB plants has been as good as or better than that expected for container grown or B&B materials. In a recent study, 2-inch caliper ash trees showed 100% survival when field planted bare root, in full leaf in July from a gravel bed. A current project will evaluate the performance of 4-inch caliper oaks field planted bare root in late summer after a holding period in gravel.

There is nothing high tech about MGB. All that is required is a layer of gravel deep enough to cover the roots and a time-clock-controlled irrigation system. Plants are simply placed with their roots in the gravel in spring and allowed to grow until time to plant. A surface application of slow release fertilizer has proven effective in keeping the plants green. Under Missouri conditions, roses did well using a drip system set to come on for 3 minutes every 4 hours between 10 AM and 6 PM even during a hot, dry period in July. Once the growth flush has hardened a bit, the watering frequency can be cut back to perhaps 3 minutes three times a day. The irrigation time clock should, of course, be adjusted occasionally based on plant appearance. Craig Pisarkiewicz of MPR supply in St. Louis has developed a drip irrigation kit for an MGB system including a time clock and solenoid valve and all of the required irrigation tubing and fittings.

Retail customers may be hesitant at first to buy plants with their roots right out in the open. However, the main reason why MGB works so well is that actively growing roots are placed in direct contact with the soil in which they will grow in the landscape (no interface problems as with container and B&B stock). When plants are removed from the

gravel, spraying the roots with water and putting them in a plastic bag is sufficient if the plants will be planted within a day or two (assuming they are not left in the station wagon in the Mall parking lot). If the top growth is very soft, it may be advisable to wrap whole plants or bundles of plants in a sheet of plastic. Five or six times as many MGB plants will fit in a car as container plants of the same size. A bucket of water poured in the hole at planting time is often the only care required once the plants are in the ground.

Construction and Management of a Missouri Gravel Bed

The beds can be constructed in modules using gravel 1/2 inch sized and smaller with about 10% sand (passing a #10 screen), 14 to 18 inches deep. Standard pea gravel works well. Railroad ties or dimension lumber can be used to make the bed look tidy. A drip irrigation system works well, with lines spaced 1 foot apart and running the length of the bed from a header across the bed width. Emitters (1 gph) are spaced at 12 inches in the line. An irrigation kit, including a filter, pressure regulator, solenoid, time clock and all required fittings can be ordered from MPR Supply, St. Louis, MO 1-800-369-7257. Before calling, determine the width and length of your bed and the irrigation length and interval you plan to use. Also, note your water source, since this will determine the type of filter required. To reduce water usage and runoff, the gravel bed can be underlain with plastic on a slope to allow collection of irrigation water in a sump at the low end. Irrigation lines can then be pressurized by a sump pump, activated by a time clock. If using this approach, be sure to run a water supply line to the sump with a float valve to replenish water lost to evaporation and transpiration. Recent research results indicate that incorporating about 20% calcined clay into the gravel greatly reduces the irrigation requirement and may eliminate the need for a recirculating system.

Bed Management:

Plants are placed in the bed by digging a trench in the gravel and then shoveling gravel back over the roots. It is helpful to wet the gravel before making the trench. Spacing of plants in the bed will depend on plant size. Staggered rows work well for trees with 6-8' trees as close as 16 inches in the row. Up to 100 plants can be placed in a 100 square foot module including trees and shrubs. It is best to get the bed set up by mid April to allow for good root development before the onset of hot temperatures. Until plants leaf out, watering is not critical. Water the plants in well by hand and then set the time clock to water once a day for about 5 minutes. When the plants have begun to flush, set the time clock to irrigate about 3 or 4 minutes every 4 hours during the daylight hours. Later, when the growth has slowed, the irrigation frequency can be reduced to once or twice per day. Let the plants be your guide. Slow release fertilizer granules applied to the surface of the gravel will keep plants green. A material that contains sulfur will help counteract the effects of irrigating with alkaline water. Use a rate similar to that for topdressing container stock but apply 3 times at monthly intervals. When removing plants from the gravel, lay the plants on a piece of plastic and spray them with water. A bundle of five or ten plants can be wrapped up and tied with twine. If the bundle is not opened and is kept in a cool place, the plants can be kept for several days before planting. Dipping the roots in hydrogel does not seem to provide any real benefit and may actually interfere with root growth in some cases. It is best to just check occasionally and spray the roots with water

if they begin to dry out. Later in the season, after the top growth has hardened, the roots can be placed in a bag and the tops left exposed.

When planting, the only critical thing is that a few gallons of water be added to the planting hole immediately after planting. This is often the only care required, as the roots can begin taking up water from the backfill soil immediately and are not subject to drought stress due to drying of a soil ball.

Uses for the Missouri Gravel Bed

The Missouri Gravel Bed is currently being tested by city parks and urban forestry professionals in St. Charles MO and Overland Park KS as a tool to reduce cost and improve survival in tree planting programs. It is a natural extension of the methods for bare root tree planting developed by Dr. Nina Bassuk in Ithaca, NY. (<http://www.hort.cornell.edu/department/faculty/bassuk/whi/index.html>). Dr. Bassuk has shown that bare root street trees planted while still dormant perform as well as or better than balled and burlapped trees of the same size. MGB allows one to take advantage of the lower cost and lighter weight of bare root stock without being restricted to planting during the dormant season.

For More information, contact Chris Starbuck, 1-31 Ag Bldg, MU, Columbia MO 65211, starbuckc@missouri.edu

Also, see http://horticulture.missouri.edu/starbuck/mgb/mgb_home.htm

APPENDIX B

SWEATING NURSERY STOCK

We feel it is important to emphasize the process of "sweating" nursery stock. As we go through the following procedures and instructions, we will use Hackberry as an example.

Most of the bareroot transplanting problems with Hackberry can be overcome with a little extra care and precaution. To begin with, the buds on bareroot Hackberry become very hard and dormant. Favorable conditions are required to induce them to break dormancy. Basically, there are two ways of accomplishing this goal. The first and easiest is the use of a polyhouse for potting and forcing. The second process is known in nursery terms as "sweating".

In order to "sweat" bareroot Hackberry, lay the trees down and cover them with wet packing material followed by a sheet of plastic. Temperature should preferably be between 45 and 70 degrees F. Once the buds have begun to swell, which should be within a few days, the trees are ready to pot or plant. As you can see, it is a relatively simple process...but the key to success is to have the proper conditions afterwards.

The "sweating" procedure has been misunderstood at times because if the right conditions are not present after completing the "sweating" process, all the good of "sweating" is negated. What is needed after the "sweating" process is to have warm, humid, outdoor conditions. This is absolutely essential to successfully "sweat" Hackberry or any other bareroot item. Generally, this is the case in Iowa after the first part of May. Therefore, if you delay your outdoor planting of Hackberry until then, your success should be greatly enhanced and, conversely, the earlier in the spring season you plant, the poorer your results are apt to be because of the cold temperatures and low humidity.

We recommend "sweating" these varieties of nursery stock before planting: Amelanchier, Birch, Mulberry, Flowering Pear, Hackberry, Ironwood, Oaks, Redbud, Weeping Willow, Hawthorn, Pagoda Dogwood, Variegated Dogwood, Spreading Cotoneaster, Barberry, Potentilla, Tamarisk and Roses. In areas with low humidity, such as the western states, you should consider "sweating" these varieties as well: Ash, Locust and Lindens.

BAREROOT NURSERY STOCK HANDLING GUIDE

Sweating of Nursery Stock:

Most tree and shrub species can be stored bareroot all winter under refrigeration and develop normally once transplanted out in the spring. There are a few species though, whose buds become extremely dormant during refrigerated storage. These species must be forced into breaking bud before they are planted, or they will simply remain dormant in the ground, and eventually die.

The process to force species out of dormancy and into bud break before planting is called "sweating". The main goal is to increase the humidity and temperature surrounding the stock to force the buds to swell. There are three methods commonly used.

Method 1 - Place the plants in a warm, humid environment such as a greenhouse until they break bud. If you do not have access to such a facility method 2 or method 3 are equally effective.

Method 2 - Use straw or burlap. Place one or two layers of burlap, straw, or similar material on the floor of a garage or shed that can be maintained at a temperature between 60-70°F. Even a shady location outside can be used if the proper temperature range can be maintained.

- Lay the plants side by side on the burlap or straw and moisten them if they appear dry. Avoid letting the plants become too wet.
- Completely cover the bundles with several layers of damp burlap, straw or similar material and moisten the covering with water.
- Check the plants daily to see if they have broken bud. Also check to see that the covering is kept moist and that no mold has developed. (If mold develops, rinse off with clear water, and shake off excess moisture.)

Method 3 - Use the shipping box your plants arrived in.

Unpack order upon arrival, saving wet packing material and the poly sheet used to line the box.

- Soak roots of the species requiring sweating in water overnight. Hold the sweating box in an area protected from sun, wind, heating and freezing, ideally with temperatures between 60°F and 70°F.
- Place the poly sheet back in the box, remoisten packing material and place in box. Shake excess water off plants and place them on top of wet packing material.
- Secure poly sheet over the plants to hold moisture in, close box and check every day or so, keeping packing material moist and watching for bud swell and mold formation. If surface mold begins to form, rinse off with clear water, shake off excess water and return plants to box.

Plant your stock when the buds begin to swell or after about 14 to 21 days depending on temperatures (lower temps delay bud break). Sweating plants before planting is relatively easy and usually only takes a few days.

Far more important to the plants survival is when to begin sweating. Sweating forces new growth, after which the plants may be vulnerable to frost damage and to drying out. Species requiring sweating should be kept in a cool place that doesn't freeze, until the danger of frost has passed and adequate irrigation is available in the field. If sweated plants are transplanted too early or when it is too dry, all the care taken to break their buds may be wasted as the new growth freezes or dries.

*** Please keep in mind that plants may be partially or completely sweated during shipment if temperatures are warm while stock is in transit. If buds have begun to swell on arrival, indicating that plants have broken dormancy, further sweating is not required.**

- APPENDIX C -

Recommended Street Tree List

The following is a list of trees that are considered acceptable for planting in the road right of way. This list will be evaluated periodically and species may be added or removed from this list as seen fit.

SMALL TREES (Below 30' Maximum Height) – Acceptable trees for terraces with overhead power lines and/or if terrace is 3-5 feet wide. May be planted in wider terraces.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<i>Acer ginnala</i>	Amur Maple (Tree Form)	
<i>Acer tataricum</i>	Tatarian Maple	
<i>Amalanchier x. grandiflora</i>	Serviceberry	'Autumn Brilliance'
<i>Carpinus caroliniana</i>	American Hornbeam	
<i>Crataegus crusgalli inermis</i>	Cockspur Thornless Hawthorne	
<i>Maackia amurensis</i>	Amur Maackia	
<i>Malus spp.</i>	Flowering Crabapple	'Bob White', 'David', 'Harvest Gold', 'Indian Summer', 'Prairiefire', 'Red Baron', 'Red Jade', 'Snowdrift', 'Spring Snow'
<i>Ostrya virginiana</i>	Ironwood	
<i>Prunus cerasifera</i>	Newport Plum	
<i>Prunus nigra</i>	Princess Kay Plum	'Princess Kay'
<i>Prunus virginiana</i>	Canada Red Chokecherry	'Canada Red'
<i>Syringa pekinensis</i>	Peking Lilac	'China Snow'
<i>Syringa reticulata</i>	Japanese Tree Lilac	'Ivory Silk', 'Summer Snow'

MEDIUM TREES (30'-45' Maximum Height) – Acceptable trees for terraces that are 5-8 feet wide. May be planted in wider terraces.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<i>Acer truncatum x platanoides</i>	Shantung Maple	'Pacific Sunset', 'Norwegian Sunset'
<i>Corylus corluna</i>	Turkish Filbert	
<i>Phellodendron amurense</i>	Amur Corktree (male)	'Macho'
<i>Pyrus calleryana</i>	Callery Pear	'Autumn Blaze', 'Cleveland Select'
<i>Sorbus alnifolia</i>	Korean Mountain Ash	

- APPENDIX C -

Recommended Street Tree List (cont.)

LARGE TREES (Above 45' Maximum Height) – Acceptable trees for terraces 8 foot and wider.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<i>Acer x freemanii</i>	Freeman Maple	'Autumn Blaze', 'Marmo', 'Celebration'
<i>Acer miyabe</i>	Miyabe Maple	'State Street'
<i>Acer platanoides</i>	Norway Maple	'Deborah', 'Emerald Lustre', 'Royal Red', 'Superform'
<i>Acer saccharum</i>	Sugar Maple	'Green Mountain', 'Fairview', 'Goldspire', 'Legacy'
<i>Aesculus hippocastanum</i>	Horsechestnut	'Baumannii'
<i>Aesculus x carnea</i>	Ruby Red Horsechestnut	'Briotii'
<i>Celtis occidentalis</i>	Hackberry	'Prairie Pride', 'Windy City'
<i>Cercidiphyllum japonicum</i>	Katsuratree	
<i>Eucommia ulmoides</i>	Hardy Rubber Tree	
<i>Gingko biloba</i>	Gingko (male)	'Autumn Gold', 'Magyar', 'Princeton Sentry'
<i>Gleditsia triacanthos inermis</i>	Thornless Honeylocust	'Imperial', 'Shademaster', 'Skyline', 'Sunburst'
<i>Gymnocladus dioica</i>	Kentucky Coffeetree	'Espresso', 'Prairie Titan'
<i>Liriodendron tulipifera</i>	Tuliptree	
<i>Quercus alba</i>	White Oak	
<i>Quercus bicolor</i>	Swamp White Oak	
<i>Quercus macrocarpa</i>	Bur Oak	
<i>Quercus robur</i>	English Oak	'Skymaster', 'Regal Prince'
<i>Quercus rubra</i>	Red Oak	
<i>Quercus muehlenbergii</i>	Chinkapin Oak	
<i>Cladrastis kentuckea</i>	Yellowwood	
<i>Tilia americana</i>	American Linden	'Legend', 'Redmond'
<i>Tilia cordata</i>	Littleleaf Linden	'Fairview', 'Glenleven', 'Greenspire', 'Prestige'
<i>Tilia tomentosa</i>	Silver Linden	'Sterling'
<i>Ulmus x</i>	Hybrid Elm	'Accolade', 'Homestead', 'Pioneer', 'Regal'

- APPENDIX D -

Unacceptable Street Tree List

The following is a list of trees that are considered unacceptable for planting in the road right of way. Species on this list may be planted in park or open space settings in the right location and situation. This list will be evaluated periodically and species may be added or removed as seen fit.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Reason</u>
	All Evergreen Species Not on Recommended List	Obstruct visibility
<i>Acer negundo</i>	Boxelder	Weak wooded, attracts boxelder bug
<i>Acer rubrum</i>	Red Maple	Intolerant of alkaline soils
<i>Acer saccharinum</i>	Silver Maple	Weak wooded, aggressive roots, heavy seed crop
<i>Betula spp.</i>	Birch	Susceptible to insects and disease, intolerant of disturbed sites
<i>Carya spp.</i>	Hickory	Littering fruit
<i>Catalpa spp.</i>	Catalpa	Littering fruit
<i>Fraxinus spp.</i>	Ash	Emerald Ash Borer
<i>Ginkgo biloba (female)</i>	Ginkgo (female)	Messy and smelly fruit
<i>Juglans spp.</i>	Walnut	Littering fruit
<i>Malus sylvestris</i>	Common Apple	Fruit tree
<i>Morus spp.</i>	Mulberry	Littering fruit
<i>Populus spp.</i>	Poplar, Cottonwood	Weak wooded, aggressive roots, heavy seed crop
<i>Prunus serotina</i>	Black Cherry	Fruit tree
<i>Prunus domestica</i>	Garden Plum	Fruit tree
<i>Pyrus communis</i>	Common Pear	Fruit tree
<i>Quercus palustris</i>	Pin Oak	Intolerant of alkaline soils
<i>Robinia pseudoacacia</i>	Black Locust	Weak wooded, thorns, invasive
<i>Salix spp.</i>	Willow	Weak wooded, aggressive roots
<i>Sorbus americana</i>	American Mountainash	Susceptible to insects and disease
<i>Sorbus aucuparia</i>	European Mountainash	Susceptible to insects and disease
<i>Ulmus pumila</i>	Siberian Elm	Weak wooded, aggressive roots