★ **Roll Call Number**

Agenda Item Number
49F

Date September 14, 2009

MOTION TO RECEIVE AND FILE THE COMMUNITY DEVELOPMENT DIRECTOR'S POLICY REGARDING TREE PROTECTION DURING DEVELOPMENT ACTIVITIES

WHEREAS, there is pending before the City Council an ordinance to enact a new Article X to Chapter 42 to be known as the Tree Removal and Mitigation Ordinance, which references a policy to be adopted by the Community Development Director regarding the measures to be taken during development activities to protect existing mature trees and canopied areas identified for preservation in an approved tree removal and mitigation plan; and,

WHEREAS, the Community Development Director has adopted the attached publication from the University of Minnesota Extension Service titled "Protecting Trees from Construction Damage: A Homeowner's Guide" by Gary R. Johnson, 1999 Revised Edition, as the Community Development Department's official policy concerning the measures to be taken during development activities to protect existing mature trees and canopied areas identified for preservation in any approved plan.

(Council Communication No. 09- 663)

MOVED by _____ to receive and file.

FORM APPROVED:

Roger K Brown
Roger K. Brown
Assistant City Attorney
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COUNCIL ACTION	YEAS	NAYS	PASS	ABSENT
COWNIE				
COLEMAN				
HENSLEY				
KIERNAN				
MAHAFFEY				
MEYER				
VLASSIS				
TOTAL				

MOTION CARRIED APPROVED

Mayor

CERTIFICATE

I, DIANE RAUH, City Clerk of said City hereby certify that at a meeting of the City Council of said City of Des Moines, held on the above date, among other proceedings the above was adopted.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal the day and year first above written.

_____ **City Clerk**

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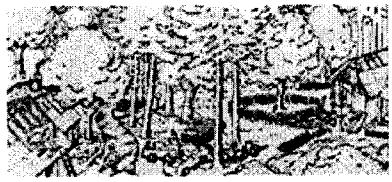
FO-06135 Revised 1999

To Order



Protecting Trees from Construction Damage: *A Homeowner's Guide*

Gary R. Johnson

This is a revision of the original publication authored by Nancy L. Miller, David M. Rathke,and Gary R. Johnson, and is dedicated to the memory of David M. Rathke.

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Are you planning to build or remodel a home? Are your city's streets, curbs, sidewalks, and buried utilities about to be widened, modernized, or replaced? Before you start, consider the impact of construction on plants.

Trees and shrubs contribute to property values by enhancing appearance, reducing noise, cutting energy costs, screening unsightly views, and attracting songbirds and other wildlife. Unfortunately, plants meant to be part of a home's permanent landscape often are needlessly damaged or killed during construction. Careful planning and coordination with a tree-care specialist and your builder can reduce damage and save you the trouble and expense of treating or removing injured plants.

This publication explains some things that landowners can do to minimize the impact of construction on trees. It describes landscape protection plans, special construction techniques, symptoms of damage, and treatment strategies. Although the information presented focuses on trees, it also can be applied to protecting shrubs.

Hiring a Tree Care Specialist

Each construction site has its own unique set of soil, tree species, and building process conditions. For this reason we recommend that you get advice from a professional urban forester or arborist *with experience in protecting trees from construction damage*. This person will be familiar with the growth characteristics and common problems faced by tree species in your area. He or she can help you evaluate plant health and the likely impacts of construction activities.

For your own protection:

- hire only professionals who are part of an established business listed in the phone book
- ask for references
- make sure the person you hire carries insurance for property damage, personal liability, and workers compensation.

Membership in the National Arborist Association, Minnesota Society of Arboriculture, or International Society of Arboriculture or certification from the International Society of Arboriculture are good indicators of reputable businesses.

Check with your local Extension office, or contact the local chapter of the International Society of Arboriculture (217-355-9411) for a directory of tree-care companies with certified arborists.

The Root of the Matter . . .

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Trees can be damaged or killed by a wide variety of construction activities. Some practices lead to obvious injuries such as broken branches or torn bark. Open wounds of

this type deplete a plant's energy resources and provide entry points for insects, or for diseases such as oak wilt.

The worst damage, however, often remains hidden underground. Roots are one of the most vital parts of a tree. They are responsible for nutrient and water uptake, store energy, and anchor the plant. Because they are so important, it is critical that you protect roots that lie in the path of construction.

Trees are never the same shape below ground as they are above, so it is difficult to predict the length or location of their roots. Typically, however, approximately 90-95 percent of a tree's root system is in the top three feet of soil, and more than half is in the top one foot. The part of this root system in which construction damage should be avoided is called the Protected Root Zone (PRZ).

One common method used to identify the PRZ is to define it as the "dripline"--the area directly below the branches of the tree (Figure 1). However, many roots extend beyond the longest branches a distance equal to two or more times the height of the tree. For this reason you should protect as much of the area beyond the dripline as possible.

Unfortunately, on most sites space is limited and this rule must be bent. Just how close an activity can come without seriously threatening the survival of a tree depends on the species, the extent of damage, and the plant. s health. Some healthy trees can survive after losing 50 percent of their roots. However, other species are extremely sensitive to root cutting, even outside the dripline.

Table 1 shows the relative sensitivity of various tree species to root disturbance. If possible, disturb no more than 25 percent of the roots within the dripline for any tree, protect intermediate species to the dripline, and allow extra space beyond the dripline for sensitive species. For all trees, avoid needless or excessive damage. A qualified tree-care specialist can help you determine how much root interference a particular tree can tolerate.

When dealing with trees that have been growing in the forest or that naturally have a narrow growth habit, an approach called the "critical root radius" is more accurate than the dripline method for determining the PRZ. This is particularly true for columnar trees and for those where competition has reduced the canopy spread.

To calculate critical root radius, begin by measuring the diameter at breast height (dbh). This is done by measuring the tree's trunk diameter (thickness) at a point 4.5 feet above the ground. The measurement should be done in inches. For each inch of dbh, allow for 1.5 feet of critical root radius for sensitive trees, or 1.0 feet for tolerant trees. For example, if a tree's dbh is 10 inches, then its critical root radius is 15 feet (10 x 1.5 = 15). The PRZ is an area around the tree with a diameter of 30 feet (2 x radius), and is the area in which a critical amount of the tree's roots may be found. Whenever possible, isolate this area from construction disturbance (see Figure 2).

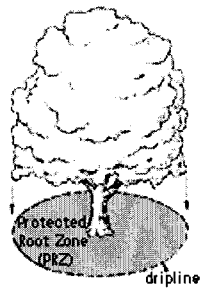

Figure 1. *One common method used to define a tree's protected root zone (PRZ) is to consider it to be the part of the roots that lie directly below its branches within an area known as the* ***dripline****.*

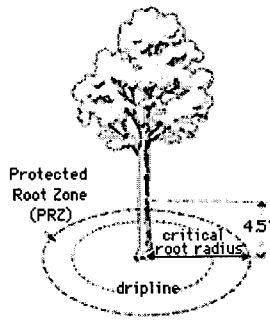

Figure 2. *Approximate a tree's* ***Protected Root Zone*** *by calculating the critical root radius (crr). First, measure the tree diameter in inches at breast height (DBH). Then multiply that number by 1.5 or 1.0. Express the result in feet.*
Example:
dbh=8 inches
8 X 1.5 =12
crr=12 feet

Measure diameter (width)=dbh

dbhX 1.5=critical root radius for older, unhealthy, or sensitive species

or *dbh X 1.0=critical root radius for younger, healthy, or tolerant species*

Table 1. Tree Characteristics

Species	Root Severance[6]	Soil Compaction & Flooding[6]	Soil pH Preference[8]	Mature Tree Height (feet)[8]	Mature Crown Spread (feet)[8]	Hazard Tree Rating*[7]	Damage-Causing Roots	Landscape Value**[1]
Northern white cedar	Tolerant	Tolerant	6.0-8.0	40-50	10-20	Low	.	High
Balsam fir	Tolerant	Tolerant	4.0-6.0	40-60	20-35	Medium	.	Medium

White fir	Tolerant	Sensitive	4.0-6.5	50-75	10-20	Medium	.	High
Tamarack	Tolerant	Tolerant	4.0-7.5	50-75	15-25	Medium	.	High
White pine	Tolerant	Sensitive	4.5-6.5	80-100	50-80	Medium	.	High
Jack pine	Tolerant	Sensitive	4.5-6.5	30-80	20-30	High	.	Low
Red pine	Tolerant	Sensitive	4.5-6.0	50-80	20-40	(Medium)	.	Medium
Scotch pine	(Tolerant)	(Sensitive)	4.0-6.5	60-100	30-50	Medium	.	Medium
Eastern redcedar	Tolerant	Sensitive	4.7-7.8	40-50	10-20	Low	.	Low
Black spruce	Tolerant	Tolerant	3.5-7.0	30-70	15-30	(Medium)	.	Low
Colorado spruce	Intermediate	Tolerant	4.6-6.5	50-100	20-30	Medium	.	High
White spruce	Tolerant	Intermediate	4.5-7.5	40-80	20-30	Medium	.	Medium
Black ash	Tolerant	Tolerant	4.1-6.5	40-70	30-60	(Medium)	.	Medium
Green ash	Tolerant	Tolerant	6.0-7.5	30-60	30-50	Medium	.	Low
White ash	Tolerant	Intermediate	5.0-7.5	70-80	50+	(Medium)	.	Medium
Bigtooth aspen	Tolerant	Sensitive	4.8-6.3	50-75	20-35	Medium	Yes	Low
Quaking aspen	Tolerant	Sensitive	4.8-6.5	40-60	20-35	Medium	Yes	Low
Blue beech	Sensitive	Sensitive	6.5-7.5	20-30	15-20	Low	.	High
Paper birch	Intermediate	Sensitive	5.0-8.0	50-70	30-50	Medium	.	Medium
River birch	Tolerant	Tolerant	4.0-6.5	40-70	30-50	Low	.	High
Yellow birch	Intermediate	Sensitive	4.5-8.0	50-70	25-50	Medium	.	Medium
Boxelder	Tolerant	Tolerant	6.5-7.5	40-60	35-50	High	Yes	Low
Ohio buckeye	Intermediate	Intermediate	6.1-6.5	30-50	30-40	Medium	Yes	Medium
Butternut	Sensitive	Intermediate	6.6-8.0	40-60	50-60	(Medium)	.	Medium
Catalpa	Intermediate	Tolerant	6.1-8.0	50-80	30-50	Medium	.	Medium
Black cherry	Intermediate	Sensitive	6.0-7.5	50-70	40-50	Low	.	Low
Kentucky coffeetree	Intermediate	Intermediate	6.5-7.5	50-80	40-50	Low	.	High
Eastern cottonwood	Tolerant	Tolerant	5.5-8.0	80-100	80-100	High	Yes	Low
Red-osier								

dogwood	Tolerant	Intermediate	6.1-8.5	8-10	10-12	(Low)	.	Medium
American elm	Tolerant	Intermediate	5.5-8.0	70-100	70-150	Medium	Yes	Low
Slippery elm	(Tolerant)	(Intermediate)	6.6-8.0	60-70	40-60	Medium	Yes	Low
Hackberry	Tolerant	Intermediate	6.6-8.0	30-130	50+	Low	.	High
Hawthorn	Intermediate	Intermediate	6.0-7.5	20-40	20-30	Low	.	High
Bitternut hickory	Intermediate	Intermediate	6.0-6.5	40-75	30+	(Medium)	.	Medium
Honeylocust	Tolerant	Intermediate	6.0-8.0	50-75	50-75	Medium	Yes	Medium
Ironwood	Sensitive	Sensitive	6.1-8.0	25-50	20-30	(Low)	.	High
Basswood	(Intermediate)	Sensitive	5.5-7.3	70-100	50-75	(High)	.	Medium
Black locust	Tolerant	Sensitive	4.6-8.2	30-60	20-50	(Medium)	.	Low
Red maple	Tolerant	Tolerant	4.5-7.5	50-70	40-60	Medium	Yes	High
Silver maple	Tolerant	Tolerant	5.5-6.5	60-90	75-100	High	Yes	Low
Sugar maple	(Intermediate)	Sensitive	5.5-7.3	60-80	60-80	Medium	Yes	High
Mountain ash	Tolerant	Intermediate	4.0-7.0	15-25	15-25	Medium	.	High
Black oak	Sensitive	Sensitive	6.0-6.5	50-80	50-70	(Medium)	.	High
Bur oak	(Tolerant)	Intermediate	4.0-8.0	70-80	40-80	Low	.	High
Northern pin oak	Sensitive	Sensitive	5.5-7.5	50-75	30-50	(Medium)	.	Medium
Red oak	Tolerant	Sensitive	4.5-7.0	60-80	40-50	(Medium)	.	High
Bicolor oak	(Intermediate)	Tolerant	6.0-6.5	60-70	40-50	Low	.	High
White oak	Sensitive	Sensitive	6.5-7.5	60-100	50-90	Low	.	High
Wild plum	Tolerant	Sensitive	6.5-6.6	20-25	15-25	Low	.	Medium
Serviceberry	Intermediate	>Sensitive	6.1-8.5	6-35	6-15	>(Low)	.	>High
Black walnut	>Sensitive	Intermediate	6.6-8.0	70-100	60-100+	Medium	.	Medium
Black willow	Tolerant	Tolerant	6.5-8.0	30-60	20-40	High	Yes	>Low

1: Hightshoe, 1988; 2: Minnesota Association of Soil and Water Conservation Districts Forestry Committee, 1986; 3: Matheny and Clark, 1991; 4: Minnesota Society of Arboriculture, 1996.

Values in parentheses reflect the authors' or technical advisors' opinions.

***Hazard Tree Rating** refers to the relative potential for a tree to become hazardous. For a tree to be considered hazardous, a potential "target" (e.g., a house, a sidewalk, or other trees) must be present. A high hazard tree rating does not imply that the tree will always fail.

****Landscape Value** refers to the relative value of each species in Minnesota based on hardiness, form, color, growth habits, flowering and

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fruiting characteristics, structural strength, longevity, insect and disease resistance, maintenance requirements, and general desirability.

Plan Ahead!

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You'll save time and money if you develop a landscape protection plan before construction begins. Careful planning will help you avoid the expense and heartache of later repairing or removing trees located too close to construction activities.

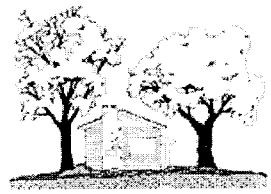

Figure 3. Careful planning may avoid the creation of hazardous tree situations such as damaged trees located too close to the house or dangerous overhanging limbs.

These steps will help you create a successful landscape protection plan:

1. **Mark construction zone boundaries.** Obtain a complete set of site development plans, including the proposed location of buildings, drive-ways, sidewalks, and utility lines. Ask the builder or architect to mark areas where heavy equipment will be used, where soil will be permanently added or removed and to what depth, and where fill and building materials will be temporarily stockpiled. Use a measuring tape, stakes, and string to temporarily mark the boundaries of construction activities on the site.

2. **Inventory trees on the site.** Record the location, size, and health of each tree. Wilted leaves, broken or dead limbs, trunk rot, and thin tops are all symptoms of stress. Trees that are overmature, display poor form, lean heavily over future buildings, or have severe insect or disease problems (Figure 3) should be marked for removal prior to construction. Also mark trees that need prun-ing to make room for future structures and construction equipment.

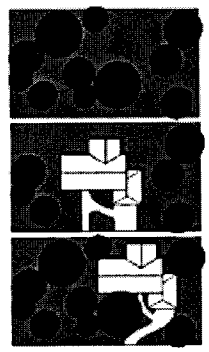

Figure 4. You may be able to save some trees by siting the new construction away from the center of the lot.

3. **Select the trees to be saved.** Examine the site carefully and note how each tree fits into the future landscape. Keep in mind that the builder may be able to shift the location of a building, utility line, or driveway. Although local ordinances differ, driveways and utility lines don't always have to be straight, and homes don. t always have to be in the center of the lot (Figure 4). If considerable damage to the tree's root system within the PRZ is inevitable, you should seriously consider changing the original design, adding protection measures, or removing the tree before construction begins.

4. **Protect the trees you plan to save.** Develop a map with the builder or architect showing the location of trees to be protected and the safest route for access to the building zone. Then install bright orange polypropylene fencing and post "Off Limits" signs at the PRZ of the trees you plan to save (Figure 5). Your primary objective is to protect delicate root systems, so provide your trees with as much space as possible. Make sure all construction workers know that nothing inside this area is to be raked, cut, stored, or otherwise disturbed. A landscape protection contract signed by the builder and all contractors will help ensure compliance. Take several photographs of the site before construction begins to document the protection methods used and the condition of individual trees.

5. **Prepare the trees for construction disturbance.** You'll boost your trees' chance for survival if you make sure they're as healthy as possible before construction begins. Regularly water the trees if rainfall is not adequate. Fertilize them if soil tests or deficiency symptoms indicate they are nutrient stressed. (For soil test information, contact your county extension agent or call the University of Minnesota's Soil Testing Lab at 612-625-3101.) Prune branches that are dead, diseased, hazardous, or detrimental to the plant's natural form.

6. **Protect and preserve the soil for future tree planting.** Apply a layer of wood chips at least six inches thick over areas that will be used for traffic or materials storage during construction. If these areas become part of the new landscape, the wood chips will prevent the soil from becoming too compacted.

7. **Monitor the construction process.** Visit the site periodically and inspect the trees. Irrigate the PRZ of the trees regularly-- never let trees become water-stressed. Your

presence alerts workers of your concern for the careful treatment of the trees. Should damage occur, begin repairs as soon as possible. Immediately inform the builder of any violations in the landscape protection contract and photograph the damage. Insist that protective fences remain in place until all construction workers have left the site.

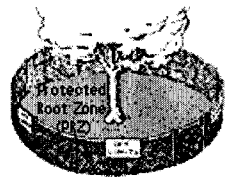

Figure 5. Put up fences and signs around trees you want to save to alert construction workers to damage potential.

8. **Make a final inspection of the site.** After construction has been completed, evaluate the condition of the remaining trees. Look for indications of damage or stress. It may take several years for severe problems to appear. Careful monitoring and preventive treatment (e.g., watering) may help minimize damage.

9. **Commit to long-term maintenance.** Trees will not recover from construction damage in one or two years. Mulch as much of the PRZ as you can tolerate and plant understory shrubs and perennials within the mulched areas. Irrigate the PRZ regularly for several years--never let the trees become water-stressed. Have an arborist inspect the trees every year or two for several years to determine if pruning, fertilization, and/or pest/disease control tactics are necessary.

Tree selection tips . . .

- Save the best and chip the rest. Use those wood chips to provide a blanket of protection over the root systems of trees that can be saved. It is expensive for the builder to work around trees, and it also is expensive to remove damaged trees after construction has been completed.
- Understand the characteristics of your trees or get the advice of someone who does. If you know about your trees you can help insure their survival and improve the future site appearance of the site.
- Select tree species that fit the spatial constraints of the site (Table 1), remembering that trees grow throughout their lives. Be sure to consider overhead powerlines.
- Young, small trees tend to survive disturbance better than old, large trees. Large trees almost never survive within five feet of a new building and should not be kept.
- Healthy young trees that fall in the construction zone may be saved by transplanting.
- Don't put all your eggs in one basket! Save a mixture of tree species to safeguard your landscape against contagious diseases or insects.
- Improve tree survival by saving groups of trees rather than individuals.

Minimize the Impact of Construction Activities

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In addition to protecting the PRZ, there are other ways in which you can reduce the impact of construction activities on your trees. Some of these are relatively simple; others can be extremely expensive. Carefully consider the importance of each tree to the future appearance of the site and consult a tree-care specialist before deciding whether protective

measures are worth the cost.

Site Clearing

When you remove a large number of trees, you expose the remaining plants to new conditions. Sudden increases in amounts of sunlight and wind will shock many of your trees. It is not uncommon to find scorched leaves, broken branches, and uprooted trees after a site is cleared. Although some of these problems are temporary, they may compromise tree health when coupled with additional construction damage.

Figure 6. *A root system bridge will help protect trees in the path of construction vehicles.*

You can avoid sun and wind stress by saving groups of trees rather than individuals. When possible, remove the unwanted plants in winter after the leaves have fallen. Dormant plants are less susceptible to damage, and frozen ground helps protect roots. Bulldozers should not be used to remove trees near plants to be preserved. Heavily wooded sites should be gradually thinned over two to three years to reduce removal shock on remaining plants. This is especially important in dense pine, spruce, or fir forests.

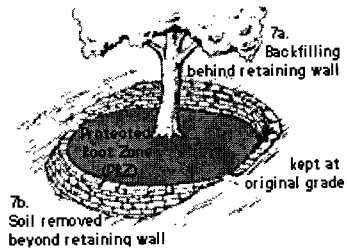

Figure 7. *If you change the grade within the root zone, use retaining walls to keep as much of the original grade as possible.* ***a)****backfilling;* ***b)*** *cutting.*

Soil Damage

Soil compaction is the single largest killer of urban trees. Tree roots need loose soil to grow, obtain oxygen, and absorb water and nutrients. Stockpiled building materials, heavy machinery, and excessive foot traffic all damage soil structure. Lacking good soil aeration, roots suffocate and tree health declines.

Prevent soil compaction by carefully selecting storage areas and traffic routes (the future driveway is a good choice for both) and installing protective fences and signs. If you can. t reroute traffic, install root system bridges with steel plates suspended over railroad ties or spread several inches (six inches or more) of wood chips on the soil within the PRZ (Figure 6). Trees that are pruned or removed during the construction process should be chipped on site and the chips used for soil preservation tactics such as this. Heavy mixing trucks can be kept off tree roots by transporting concrete from the truck through conveyor pipes.

Improper handling or disposal of materials used during construction also can harm roots. For example, wood products treated with pentachlorophenol and creosote can be deadly to tree roots; CCA-treated timber (greenish color) is a better alternative. Ask the builder about the materials to be used on the site and read product labels. Chemical spill damage can be prevented by filling gas tanks, cleaning paintbrushes and tools, and repairing mechanical equipment well outside tree PRZs. Insist that all building debris and chemical wastes be hauled away for proper disposal, and not burned or buried on the site.

Finally, avoid changes in soil pH (acidity). Increases in pH are particularly dangerous to many species (Table 1). Alkaline clays or limestones should not be used for fill or paving, and concrete should be mixed on a thick plastic tarp or outside the site. Mixing trucks should never be rinsed out on the site.

Grade Changes

Moving large amounts of soil within the PRZ usually kills a tree. Except where absolutely necessary, avoid disruptions to the natural contour of the site or shift them well outside the PRZ.

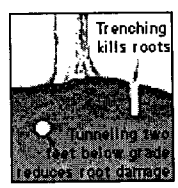

Figure 8. *Protect roots from damage when laying utility lines by tunneling rather than trenching.*

Soil additions compact the soil around a tree and often raise the water table. You may be able to protect compaction-tolerant trees (Table 1) from additions of six inches or less of soil by using a porous fill within the PRZ. Porous fill can be made by mixing one part loam, one part coarse sand, and one part shredded bark.

Deeper fills require more expensive measures. A retaining wall beyond the PRZ may protect some trees (Figure 7a). These walls preserve much of the original root system and