# TREE TECHNICAL MANUAL

THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

RECREATION AND PARKS
DEPARTMENT

~~May 2024~~ June 2025 - Redlined Version

**Tree Technical Manual**

~~May 2024~~June 2025 - Redlined Version

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# Definitions

The following definitions are provided as a resource for the reader. Where a conflict exists between the definitions provided in this manual and those found in the City Code or the Construction and Materials Specifications ("CMS"), the City Code and CMS prevail.

**American National Standards Institute (ANSI).** A private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system.

**Bracing.** Structural support for a tree via installing a long, threaded rod through branches or stems where they are weak and likely to split.

**Cabling.** Structural support for a tree via installing a cable in the upper crown of a tree.

**Caliper*.** The diameter of a tree that is measured at six inches (15 cm) above ground level for trees up to four-inch Caliper and 12 inches above ground level for larger sizes. This measurement is commonly used in the nursery industry to measure tree planting stock.

**Certified Arborist*.** An individual trained in the art and science of planting, caring for, and maintaining trees that has been certified by the International Society of Arboriculture (ISA).

**Condition.** When used in reference to a tree, condition describes a tree's overall health, structure, and form. It is used as part of tree assessment and appraisal and defined in the Guide for Plant Appraisal, 10th edition. The ratings (Good, Fair, Poor, Critical, Dead) are the standard used in arboriculture across the country, based on professional assessment by Certified Arborists or other Natural Resource Professionals.

**Contractor**.** The individual, firm, partnership, or corporation contracting with the City for performance of prescribed work, acting directly or through a duly authorized representative and qualified under the requirements of the contract documents.

**Cost Approach Method.** A method used by professional tree and plant appraisers to appraise larger trees using the Trunk Formula Technique. This technique extrapolates costs to purchase the largest commonly available nursery tree relative to the size of the appraised tree.

**Critical Root Zone (CRZ)*.** The area of soil extending from the tree trunk in which roots required for future tree health and survival are located. This area is defined as a circle with a minimum radius of 1.5 feet for every 1 inch in Diameter at Standard Height (DSH ).

**Department.** When used without clarification, the Recreation and Parks Department of the City of Columbus.

**Diameter at Standard Height (DSH)*.** The diameter of a tree measured at 4.5 feet above the existing grade.

**Director*.** The director of the Recreation and Parks Department of the City of Columbus, or any representative the director so designates.

**Embankment Dam.** A water impounding structure constructed from excavated natural materials.

**Emergency Maintenance.** Emergency Maintenance projects include, but are not limited to, repairs to a failed sewer line or removing a fallen tree from a power line, and can often occur

after business hours. Emergency Maintenance projects must occur within three days of an issue arising for health or safety reasons.

**Fee-in-Lieu.** A mitigation option establishing a per tree inch replacement rate for payment into the Tree Fund.

**Forestry.** Staff of the Forestry Section of the Recreation and Parks Department of the City of Columbus.

**Forestry Permit.** A permit issued by Forestry to a Contractor conducting work on or otherwise impacting a Public Tree.

**Guying.** A support system to stabilize newly planted trees, via anchor stakes driven into the ground.

**Hearing Officer.** An objective, independent person who is knowledgeable about the arboricultural industry and urban forestry who the Department contracts to serve on an as-needed basis for appeals of notices of violations and denials of variance requests.

**Invasive Trees.** Trees designated as invasive by the Ohio Department of Agriculture in Rule 901:5-30-01 Invasive Plant Species.

**Landfill cap.** Containment technology forming a barrier between disposed waste and the surface.

**Maintained Landscape.** An area that receives services to maintain and preserve the natural assets such as turf, trees, and other plant material. This includes but is not limited to tree lawns, tree wells, medians, street islands, and maintained areas of parks.

**Naturalized Area.** An area that receives minimal maintenance and is intended to primarily serve as habitat and space for natural regeneration. This includes but is not limited to forests, streambanks, pollinator habitats, and ravines.

**Natural Resource Professional.** A landscape architect, Certified Arborist, ~~horticulturalist~~Certified Professional Horticulturist, or other professional credentialed by an entity recognized by the Department as providing professional certification or accreditation.

**Nuisance Tree*.** A tree that may negatively impact other trees, people, or structures. This would include, but is not limited to, trees that are diseased, infested, structurally unsound, known Invasive Trees, or trees on the prohibited species list maintained by the Department.

**Occupant*.** The person or persons who are from time to time in possession of any house or other structure located on Private Property, or who are exercising dominion or control over any house or other structure located on Private Property.

**Park*.** All city parks, parklands, or waterways, as well as all other areas out granted or under lease, license, written or concession agreement.

**Plan Review.** Any process that a project undergoes to receive review and approval of plans from the City of Columbus, including the Columbus Building and Zoning Services Departments' One Stop Shop, City capital plan developments, and Department of Public Services' Right-of-Way permits procedures.

**Private Property*.** All real estate within the City of Columbus except real estate that is owned, leased, controlled or occupied by the United States government, state of Ohio, County governments, city of Columbus or any department or agency thereof.

**Property Owner*.** Presumed to be any one or more of the following:

(1) The Property Owner or owners in fee simple of a parcel of real estate including the life tenant or tenants, if any; or
(2) The record owner or owners as reflected by the current records in the Franklin or applicable County auditor's office; or
(3) The purchaser or purchasers of such real estate under any contract for the conditional sale thereof.

**Public Tree*.** Any tree growing on land owned by the City including lands defined as “public place”, “public street”, or “park.”

**Public Tree Impact.** Any work conducted on a Public Tree or within its Critical Root Zone.

**Public Tree Inventory.** A GIS-based database maintained by Forestry with data on individual Public Trees, including DSH, species, and Condition.

**Public Tree Plan.** Plan sheet(s) required for any plan with Public Trees located in the Work Limits. The Public Tree Plan sheets must be included in any relevant plans along with the date the sheets were generated. The Public Tree Plan shows all existing Public Trees within the Work Limits, noting proposed tree protection measures, recommendations for removal or preservation, and any new trees to be replanted.

**Right-of-Way*.** A general term denoting land, property, or the interest therein, usually in the configuration of a strip, acquired for or devoted to transportation purposes. Right of way includes the roadway, shoulders or berm, ditch and slopes extending to the right-of-way limits under the control of the federal, state, or local authority.

**Routine Maintenance.** Routine Maintenance projects include work like ongoing repairs to failing water lines, pruning trees away from power lines, or repairs to sewer manholes and are typically known about at least 14 days in advance.

**Tree.** When used by itself, means any woody plant which generally includes those having a single main stem which grows to a mature height of over ten (10) feet. Trees include both deciduous and evergreen species.

**Surgery.** The repair of damaged trees, including activities such as the removal of broken, dead, or diseased branches and the installation of support systems.

**Tree Appraisal.** An objective, unbiased estimate of the value of a tree. (See Appendix D for example).

**Tree Canopy.** The layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

**Tree Fund.** A City of Columbus trust fund, previously known as the Plant Material Fund, that receives deposits from the sale of wood or wood products from the maintenance or removal of trees, or funds generated from the reimbursement of damages for the injury or destruction of Public Trees.

**Tree ID.** The 6-digit number assigned to Public Trees in the Public Tree Inventory.

**Tree Mitigation.** Replanting, payment into the Tree Fund, or a combination of both that is required when a Public Tree is removed.

**Tree Protection Zone (TPZ)*.** The portion of the Critical Root Zone that must be protected during construction, as set forth in rules and regulations promulgated by the Director.

**Tree Tagging**. Placing an aluminum, numbered tag with an aluminum nail to a tree in order to label field-located trees on the Public Tree Plan.

**Tree Well.** An opening or cut-out area within a sidewalk where a tree may be planted.

**Trunk Formula Technique.** This technique extrapolates costs to purchase the largest commonly available nursery tree relative to the size of the appraised tree.

**Volunteer Tree.** A tree that grows on its own and was not intentionally planted.

**Work Limits**.** The farthest limits of the Contractor's responsibility on a project, including all temporary and incidental construction, with the exception of work zone traffic control devices required for maintenance of traffic.

** Defined in Chapter 912 of Columbus City Code.*

*** Defined in the City of Columbus Construction Manual and Specifications.*

# Section 1: Introduction

## 1.1 How to Use This Manual

This manual has been developed by the Department to aid other City departments, construction professionals and Property Owners in meeting the standards of care required for Public Trees.

**Columbus City Code Chapter 912: Trees and Shrubs** dictates and directs the standards of care for Public Trees. This manual has been promulgated as rules and regulations of the Director, as provided for by the authority conferred in Chapter 912.

Many other City Codes also require a standard of care in regards to Public Trees. These include:

- Columbus City Code Chapter 905.06 --Sidewalk, shared-use path and driveway entrance maintenance and repair
- Columbus City Code Chapter 4307.23 - Parks, school sites, playgrounds, and street trees
- Columbus City Code Chapter 3321.07 – Landscaping
- Columbus City Code Chapter 3372.707 - Landscaping and screening

All of these Code Sections are in place to ensure and promote preservation of the existing Tree Canopy cover within the City of Columbus.

This manual is designed to clarify tree preservation, installation, and maintenance requirements called for in the Columbus City Codes. These standards are based on best management practices (BMPs), which are widely accepted practices and standards used by industry professionals based on the best available research. The Department will periodically review and revise this manual as necessary, with opportunity for comment by other City departments.

**Timing of Effectiveness**

The provisions of this manual will be in full force and effect for:

1. Projects occurring outside Plan Review (as defined in Section 3.3) that occur on or after August 1, 2024.
2. Projects undergoing Plan Review (as defined in Section 3.2) if:

    - The plan for a public project (CIP/3P/UIRF/DOW/DOP/DOSD) has not yet submitted the first plan submission for review by August 1, 2024.
    - A private project has not yet submitted a final site compliance plan, a stormwater management and sanitary sewer plan (“CC”), or a street construction plan (“E”) OR has not yet had a preliminary site engineering meeting by August 1, 2024.
    - A project with previously signed plans has not been initiated by August 1, 2027 OR 12 months from final site compliance plan approval, whichever comes first.

Previous Tree Mitigation and protection requirements under the 2015 Executive Order will apply to public and private projects that have submitted for first review of final site compliance, CC (stormwater management and sanitary sewer) plan, or E (street construction) plan; or private projects that have held a preliminary site compliance meeting, or have previously signed plans by August 1, 2024.

## 1.2 Why Columbus Needs Trees

Public Trees are critical to Columbus residents' quality of life. Located along streets and in parks, these trees shade our sidewalks, filter our air and water, and store carbon. Trees in the urban environment, however, face a variety of environmental and physical stresses including pedestrian and vehicular traffic, soil compaction, road salt, air pollution, and drought.

The 2021 Columbus Urban Forestry Master Plan set **three goals for Columbus' urban forest.** First, as a long-term goal, Columbus is aiming for **a future Tree Canopy of 40%** by 2050. In the shorter term (by 2030), Columbus is striving to **stop net loss of Tree Canopy** while **prioritizing investments in equitable canopy.** All three goals are critical to achieving our vision for Columbus' urban forest. This manual, and the best practices contained within, plays an important role in advancing these goals.

## 1.3 Care of Columbus' Public Trees

All trees planted on the public right-of-way, in parks or on other City-owned property are under the jurisdiction of the Department as property of the City of Columbus and are protected by Columbus City Code Chapter 912. This manual does not apply to City-owned utility easements on Private Property.

**About City Street Tree Planting.** Forestry plants on average 3,000-4,000 street trees per year. These new street trees are planted to replace the trees removed because they are dead, dying, or hazardous–on average 1,500 trees per year. The new street trees fill vacant sites, in furtherance of Urban Forestry Master Plan goals.

## 1.4 How to Determine if a Tree is a Public Tree

A Public Tree is any tree located on property owned by the City of Columbus, which includes parks, right-of-way, and other City-owned land. Trees in permanent planters in the right-of-way are also considered Public Trees.

If you are unsure whether a tree is a Public Tree, please contact Forestry through 311, at 614-645-6640 or at Forestry@columbus.gov.

**Trees Growing On Property Lines.** The ownership of trees growing on the boundary line between Private Property and City of Columbus property is determined by the location of the majority of the trunk, to be determined as follows:

- Measure trunk diameter at 54 inches from the ground level, defined as Diameter at Stand Height (DSH)

- If the majority of the trunk is located on City property, the City of Columbus is responsible for the maintenance of the tree. Otherwise, the tree is the responsibility of the private landowner.

## 1.5 Questions

For questions on any of the processes or standards in this manual, contact Forestry via 311, at 614-645-6640 or Forestry@columbus.gov.

## 1.6 Penalties and Violations

Penalties for not obtaining a Forestry Permit, or for violations against any of the standards detailed in this manual, are subject to legal action by the City as provided for in City Codes Section 912.99.

# Section 2: Impact of Construction on Trees

Trees are critical city infrastructure and need to be protected from injury to ensure they reach maturity thereby providing the most services to the community. Construction near trees can impact a tree's health through damage to a tree's root structure, trunk, and crown. Typical negative impacts that may occur during construction include:

- mechanical injury to roots, trunk, or branches
- compaction of soil, which degrades functioning roots, inhibits new root growth, and restricts drainage
- changes in existing grade that can cut or suffocate roots
- raising or lowering the water table
- microclimate change, exposing sheltered trees to sun or wind
- sterile soil conditions, associated with stripping off topsoil.

Basic information on the impacts to roots, trunk and canopy are described below. This is provided to aid in understanding of the tree protection requirements found throughout this manual.

Urban environments are often constrained, especially in the Right-of-Way, and trees can come in conflict with other types of infrastructure. Recommended design strategies to consider to alleviate this conflict are described in Appendix F.

## 2.1 Root Damage & Tree Protection Zones

Tree roots are concentrated in the top 18 inches of soil and spread two to three times the width of the total Tree Canopy (Figure 1). Tree root damage is commonly associated with excavation and grade changes and can occur during improper excavation, opening wounds for disease and decay to begin. Fine roots are lost during topsoil removal, stressing trees. Additionally, structural support is lost by trenching too close to major roots, creating the possibility of total tree failure. Finally, bruising or crushing of roots by heavy equipment (creating soil compaction conditions) also occurs which can further stress a tree, even if not apparent above ground.

~~Figure 1. A proportionally accurate depiction of a root span, trunk, and canopy of a tree. Note that roots are shallow and span well beyond the dripline of the tree canopy. Image source: Wroclaw University of Environmental and Life Sciences~~

Soil containing roots are one of the primary areas to protect during construction. Two concepts must be considered for tree protection in construction:

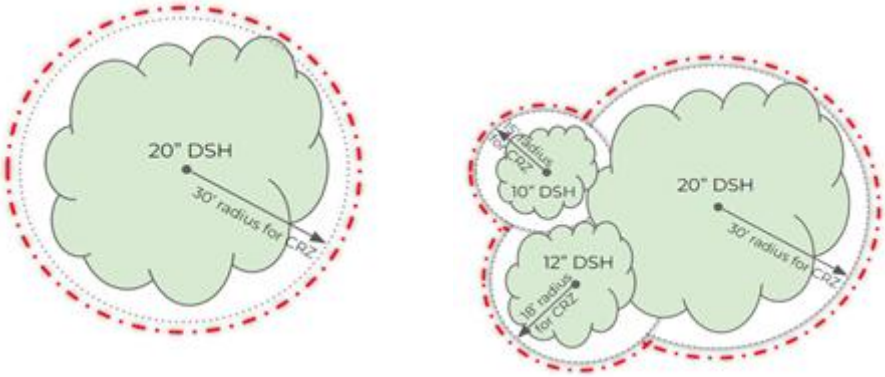
**2.1a Critical Root Zone (CRZ)** is the area of soil extending from the tree trunk in which roots required for future tree health and survival are located. This area can also be defined as a circle with a minimum radius of 1.5 feet for every 1 inch in trunk diameter at 4.5' (54") above ground, known as Diameter at Standard Height (DSH). No activity, whether construction or maintenance, should impact a Public Tree's CRZ without Forestry's prior approval.

| Tree Diameter (DSH) | Multiplier | Resulting Radius of CRZ from trunk |
|---|---|---|
| 4 inches | 1.5 | 6 feet |
| 8 inches | 1.5 | 12 feet |
| 20 inches | 1.5 | 30 feet |
| 40 inches | 1.5 | 60 feet |

**2.1b Tree Protection Zone (TPZ)** is the portion of the Critical Root Zone that must be protected during construction. The TPZ can be the outline of a single tree's Critical Root Zone (CRZ), or a combined set of CRZ areas, or in the case of street trees, the outline of a tree well or planter strip, as shown in the diagrams below. The TPZ must be protected during construction ~~(~~from the prohibited activities described in ~~more detail in~~ Section 6~~).~~ and may be accomplished by fencing, surface protection, trunk protection, or a combination. See Figure 2 for examples of TPZ and CRZ in different scenarios. Figure 2 should be used for illustration purposes only.

**Single Tree in Open Space Setting**

**Multiple Trees in Open Space Setting**




**Street Tree in Tree Lawn**

TPZ is the exposed areas (soil and roots not under concrete) of the CRZ on public land.

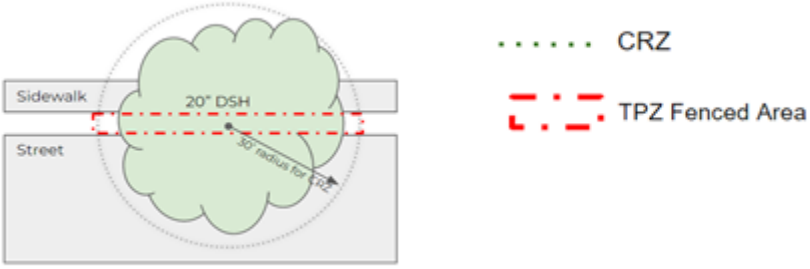



Figure 2. Examples of Tree Protection Zones (TPZ) and Critical Root Zones (CRZ) in multiple scenarios.

## 2.2 Trunk Damage

Careless movement of construction equipment and storage of building materials often cause wounds to tree trunks and root collars. Wounds in a tree's bark create entry points for disease. A healthy tree is capable of sealing off small wounds and localizing injury. However, stressed trees are not able to easily seal the damaged area, especially if the wound is large. See examples of trunk damage in Figures 3 and 4, below.

Figure 3: Trunk damage from nearby construction activities. Image courtesy of Eli Morgan.

Figure 4: Beech tree in Beechwold Nature Preserve with trunk damage from nearby construction. Truck parked in CRZ is also compacting soil and roots.

## 2.3 Crown and Branch Damage

Damage to the crown, or the branches of a tree, can happen in a number of ways. Breaks and scrapes during site clearing and improper pruning that leaves branch stubs create entry points for disease and decay. Losing a substantial amount of leaves will stress the tree because it can no longer produce enough energy.

# Section 3: Forestry Permits

A permit is required from Forestry in order to impact a Public Tree. Impacting a Public Tree means conducting any work on a Public Tree or within its CRZ. This includes, but is not limited to, cutting above or below the ground, cutting of roots, planting, tree removal, stump grinding, spraying, fertilizing, bracing, cabling, pruning, or any kind of Surgery work on the tree, as well as any intrusion in the CRZ (see prohibited activities listed in Section 6.1a).

While all projects that impact a Public Tree require a Forestry Permit, the requirements to receive a permit varies depending on the type of proposed project:

- projects that go through City of Columbus Plan Review, or
- projects that occur outside of City Plan Review.

More information about the City of Columbus' ~~One Stop Shop process can be found here: https://www.columbus.gov/bzs/building-plan-review/Plan-Review/~~permitting processes can be found here: https://portal.columbus.gov/Permits/Default.aspx

More information about the City of Columbus' Right-of-Way Permit process can be found here: https://new.columbus.gov/Business-Development/Get-a-Permit/Get-a-Right-of-Way-Permit

## 3.1 Forestry Staff Involvement

Forestry staff shall be involved in any project that has Public Trees within its Work Limits. Contact Forestry 614-645-6640 or at Forestry@columbus.gov.

Forestry staff involvement includes:

- Invitation to pre-design and preconstruction meetings
- Opportunity to review scopes of improvement
- Notification of project start dates
- Opportunity to verify site conditions
- Inspection of tree installations and tree protection measures
- Final inspection walk-throughs and project close-out
- Monitoring one-year warranty periods of newly planted trees and preserved trees

**For all Public Tree plantings,** Forestry staff must approve the Public Tree Plan and proposed tree species, quantities, locations, and plant material. Note that if the plantings are not required as part of mitigation, no inspection fees are incurred. (See Section 7 for tree planting standards).

**For tree protection,** Forestry staff must approve proposed tree protection measures for Public Trees within Work Limits, either as a condition of the Public Tree Plan or the permit. Note that no inspection fees are incurred for tree protection (see Section 6 for tree protection standards).

**For Tree Mitigation (replacements or Fee-in-Lieu)**, Forestry staff must approve proposed mitigation for tree removals resulting in Fee-in-Lieu, replantings, or both (described in Section 5). Note that mitigation replantings require an additional fee to cover site inspections (see Section 5.5).

**Inspection Timelines.** Typical Forestry response times are inspections within two weeks for planned work, within 72 hours for modifications, and within 24 hours for emergency work.

## 3.2 Projects Undergoing Plan Review

Any projects processed through City of Columbus Plan Review that propose impacting Public Trees must receive a Forestry Permit after receiving approval via a signature from a Department plan reviewer on the entire plan set. This includes plans processed via the Columbus Building and Zoning Departments' One Stop Shop, City capital plans, and Department of Public Services' Right-of-Way permits. Tree Mitigation (detailed in Section 5) applies to any tree removals resulting from these projects.

For each project:

- Plans must include a Public Tree Plan (see Section 4) approved by Forestry before the Department will approve the plans.
- Project owners or their Contractors must apply for a Forestry Permit ~~after plan approval~~once Notice to Proceed has been issued for the construction.
- The project owner must pay all applicable mitigation fees (see Section 5.3), including the inspection fee (see Section 5.5) if mitigation replantings are proposed, before the Forestry Permit can be issued.
- Forestry staff should be involved (as described throughout Section 3.1) throughout the course of the project.

## 3.3 Projects Occurring Outside Plan Review

Projects that happen outside of the Plan Review process include Routine Maintenance by City departments and utilities, as well as Emergency Maintenance.

### ~~3.3a: Routine Maintenance by City Departments or Private Utilities~~

~~Routine Maintenance projects can include work like regular or ongoing repairs to failing water lines, pruning trees away from power lines, or repairs to sewer manholes.~~

### 3.3a Annual Permits for Routine and Emergency Maintenance

To streamline workflow, City departments ~~or~~, private utilities, and private businesses may obtain an annual permit from Forestry, as advance permission to conduct necessary Routine Maintenance or Emergency Maintenance that impacts Public Trees. If a Routine Maintenance or Emergency Maintenance project is not known 14 days in advance, the permit holder must notify Forestry as soon as possible before the work is to take place. The Forestry Permit can contain provisions for both Routine and Emergency Maintenance projects.

If an annual Forestry Permit is valid and current, site-specific Public Tree Plans are not required for Routine Maintenance or Emergency Maintenance projects. In these cases, Forestry will serve as the required Natural Resource Professional and will conduct inspections on the Public Trees that will be or were impacted as a result of the ~~proposed~~ work.

As a condition of this permit, the permit holder agrees to contact Forestry a minimum of 14 days prior to the proposed date of work for Routine Maintenance, including all necessary information on the location and need for the Public Tree Impact, so that Forestry staff can inspect the project site. Forestry staff will guide and inspect necessary tree protection ~~and inspect to ensure tree protection is occurring according to set specifications~~.

As a condition of this permit, the permit holder agrees to share tree-specific information with Forestry regarding Emergency Maintenance, including the date of work, location and nature of work, tree ID from City Public Tree Inventory, and size (DSH). This information shall be communicated monthly to Forestry.

### 3.3b: Routine Maintenance by City Departments or Private Utilities

Routine Maintenance projects can include work like regular or ongoing repairs to failing water lines, pruning trees away from power lines, or repairs to sewer manholes.

Tree Mitigation (~~replacement or Fee-in-Lieu,~~ detailed in Section 5) applies to any tree removals resulting from Routine Maintenance, on a schedule communicated by Forestry to the permit holder.

### 3.~~3b~~3c: Emergency Maintenance by City Departments or Private Utilities

Emergency Maintenance projects include repairs such as to a failed sewer line or the removal of a fallen tree from a power line that can occur after business hours. For the purposes of this manual, Emergency Maintenance consists of projects that must occur within three days of an incident due to health or safety reasons.

~~To streamline workflow, City departments or private utilities may obtain an annual permit from Forestry, as advance permission to conduct necessary Emergency Maintenance that impacts Public Trees. The Forestry Permit can contain provisions for both Routine and Emergency Maintenance projects.~~

~~If an annual Forestry Permit is valid and current, site-specific Public Tree Plans are not required for Emergency Maintenance projects. In these cases, Forestry will serve as the required Natural Resource Professional and will conduct inspections on the Public Trees that were impacted as a result of the emergency work.~~

~~As a condition of this permit, the permit holder agrees to share tree-specific information with Forestry, including the date of work, location and nature of work, tree ID from City Public Tree Inventory, and size (DSH). This information shall be communicated quarterly to Forestry.~~

Tree Mitigation (~~replacement or Fee-in-Lieu,~~ detailed in Section 5) applies to any tree removals resulting from Emergency Maintenance and should occur on a schedule communicated by Forestry to the permit holder.

### 3.~~3c~~3d: Maintenance by Property Owners on Private Property that Impacts Public Trees

Private Property maintenance projects that could have a potential negative impact on a Public Tree, such as a repair to a water or sewer line, sidewalk, or driveway, must receive a no-cost permit in advance from Forestry.

If the repair must be done immediately because it is a health or safety emergency, the Property Owner may apply for the permit after the work is completed. In the case of Emergency Maintenance, Property Owners must apply for a Forestry Permit within 10 business days of the repair. Property Owners should notify Forestry as soon as an emergency impacts a Public Tree.

Mitigation will be required in accordance with Section 5.4g.

### 3.~~3d~~3e Property Owner Requesting to Conduct Work on a Public Tree

Other activity by adjacent Property Owners that will require a permit include tree planting, removal, pruning, or any other work within the CRZ of a Public Tree.

The Property Owner must hire a Certified Arborist, who will in turn apply for the Forestry Permit. After an application is received from the Certified Arborist, a Forestry arborist will review the application and inspect the tree and/or site to determine approval or denial of the request. If approved, the Forestry Permit will detail the type and method of work along with a set of conditions and specifications that shall be adhered to. If denied, no work shall be conducted on the Public Tree.

To inquire about obtaining a permit, contact the City 311 Service Center at 614-645-3111, visit 311.columbus.gov, or contact Forestry at 614-645-6640 or at Forestry@columbus.gov.

## 3.4 Working Outside of Permit Scope

Any impacts to Public Trees that were not included in the original Forestry Permit shall require a new Forestry Permit to capture the additional work.

## 3.5 Variances

The City recognizes that there may be individual projects involving special or unusual challenges such that strict adherence to the Manual will result in an undue hardship. An applicant may apply for a variance with regard to any requirement of this manual pursuant to the following terms.

### 3.~~4a~~5a Standard for Granting a Variance

All applicants must make a good faith effort to comply with the Manual. The good faith effort requires, at a minimum, developing a Public Tree Plan that is in compliance with the Manual if the project undergoes Plan Review. If the project does not undergo Plan Review, a Public Tree Plan is not required. The Department recognizes that there are special circumstances related to individual site conditions that may make compliance with the Manual an undue hardship. If such conditions exist, the applicant may pursue a variance.

### 3.~~4b~~5b Process to Request a Variance

To obtain a variance for a project undergoing Plan Review, the applicant must submit two site development plans: one that demonstrates full compliance, one that is the preferred alternative, and a narrative describing how and why full compliance is an undue hardship.

To obtain a variance for a project outside Plan Review, the applicant must only provide the narrative.

The application narrative should support determining that the full compliance alternative is impracticable. Such information can include but is not limited to technical challenges of meeting the requirements of the Manual and projected loss of revenue.

A request for a variance from this Manual must be submitted in writing to Forestry; applicants may submit via email to Forestry@columbus.gov and include their site development plans and request application narrative.

### 3.4c5c Review Process for Variances

The request will be reviewed by Forestry staff and may involve a field visit to inspect the specific site. Forestry staff will recommend the application be approved or denied to the City Forester. The City Forester will act on the staff recommendation within 10 business days of receiving it and relay the decision to the applicant in writing. If the applicant is adversely affected by the decision, they may appeal as provided for in Section 3.6.

## 3.56 Notice of Violation for Private Nuisance Trees

The issuance of notices of violation for private Nuisance Trees will follow City Codes Section 912.09.

### 3.5a6a Private Nuisance Trees

It shall be unlawful for any Property Owner to permit to stand on the owner's property any tree, shrub, or plant material that has been deemed a public nuisance without promptly abating the nuisance. A tree, shrub, or plant material may be deemed a public nuisance when the Director finds any one of the following conditions to exist:

(A) any portion interferes or has the potential to interfere with any public street, park, or public place.

(B) any portion restricts the flow of pedestrian or vehicular traffic or visibility of any public street, park, or public place.

(C) any portion obstructs the view of any streetlight, traffic control device, traffic control signal, or public street intersection.

(D) it is sufficiently damaged, diseased, disfigured, or constitutes a risk to the public or to other trees, shrubs, and plant material on public property.

### 3.5b6b Private Nuisance Tree Emergencies

In the event that a private Nuisance Tree is causing an immediate health or safety emergency, such as a vision obstruction blocking a stop sign, Forestry may abate the issue within the public right-of-way. In many cases, this means pruning the obstructing branch back to the property line. Forestry then documents the work done by leaving a door hanger at the property. If an issue remains that can only be addressed by entering Private Property, the Director may refer the issue to the City of Columbus Code Enforcement Division of the Building & Zoning Services Department.

### 3.5c6c Notice of Violation

If it is determined by the Director that a nuisance condition exists, then the Director may give notice of a violation to the owner or occupant of the Private Property. Such notice shall:

(1) Be in writing.

(2) Include a reference to the Section of Code that has been violated.

(3) Inform the owner that the nuisance must be abated, the method of abatement/corrective action, and deadline to complete abatement activity allowing reasonable time for the performance of any act it requires.

(4) Provide notice that Forestry will perform abatement activities if not conducted by the owner to the satisfaction of the Department or by the deadline.

(5) Include a method to appeal.

(6) Be served by any one of the following methods:

(a) Personal service; or

(b) Certified mail; or

(c) Residential service; or

(d) Publication; or

(e) Regular mail service to an address that is reasonably believed to be either a place of residence or a location at which the owner regularly receives mail; or

(f) Posting the notice of violation on or in the property, except that if a structure is vacant, then the notice shall be posted on the structure and one of the above methods of service shall also be used.

## 3.~~6~~7 Appeals

Notices of violation for Private Property Nuisance Trees and denials of variance requests may be appealed in writing to a Hearing Officer.

### 3.~~6a~~7a Selection of a Hearing Officer

The Department shall contract with an objective, independent person who is knowledgeable about the arboricultural industry and urban forestry to serve as the Hearing Officer on an as-needed basis for appeals of notices of violations and denials of variance requests pertinent to this Manual.

### 3.~~6b~~7b Appeal of Notice of Violation

A notice of violation for a private Nuisance Tree may be appealed to a Hearing Officer by the filing of a notice of appeal with the department within fifteen (15) days of service of the notice of violation.

### 3.~~6c~~7c Appeal of Denial of Variance Request

The denial of a variance request may be appealed to a Hearing Officer by the filing of a notice of appeal with the department within fifteen (15) days of service of the notice of denial.

### 3.~~6d~~7d Hearing of Appeals

Upon the filing of a timely notice of appeal, the Hearing Officer shall conduct a hearing on the appeal within forty-five (45) days unless a continuance is requested by either party and granted by the Hearing Officer. At such hearing, the burden shall be on the Director to prove by a preponderance of substantial, reliable, and probative evidence to support the denial of the variance or that the tree, shrub, or plant material identified in the notice of violation is a public nuisance. The Hearing Officer shall render its decision in writing, including findings of fact and conclusions of law, within five (5) days of the date of the hearing. The decision of the Hearing Officer may reverse, modify, or affirm the order and action of the Director.

### 3.~~6e~~7e Appeals of Hearing Officer Decision

Decisions of the Hearing Officer issued pursuant to this section may be appealed to the environmental division of the Franklin County Municipal Court pursuant to Ohio Revised Code Chapter 2506.

# Section 4: Public Tree Plan

The Public Tree Plan ~~is a~~are plan ~~sheet(s)~~sheets that ~~is~~are required for any plan with Public Trees located in the Work Limits. Public Tree Plans may be required if a Public Tree's CRZ is located in the Work Limits. The Public Tree Plan sheets must be included in ~~any~~the relevant ~~plans~~plan along with the date they were generated. The Public Tree Plan shows all existing Public Trees and Public Tree CRZs within the Work Limits, noting proposed tree protection measures, recommendations for removal or preservation, and any new trees to be replanted. All tree information should be collected by a Natural Resource Professional and recorded on the site plan and in a data table, including the mitigation fees to be paid (if applicable).

The Public Tree Plan will be used during a project's design phase ~~and will~~to ensure the accuracy of any Fees-in-Lieu or inspection fees that will be incurred. It will also be used to conduct on-site inspections throughout the project.

## 4.1 Natural Resource Professional Required

Tree information on a Public Tree Plan must be provided by a Natural Resource Professional. If a project owner proposes a professional outside of the professional categories in the definition who the project owner feels is qualified to collect this information, Forestry must approve.

In the case of small-scale projects that have six (6) or less Public Trees within Work Limits, Forestry staff will serve as the Natural Resource Professional.

## 4.2 Elements of the Public Tree Plan

A Public Tree Plan must include three elements: a general notes page, a site plan, and corresponding tree data tables. If no Public Trees are located in the project's Work Limits, a note must be added to the plan set indicating this.

### 4.2a General Notes and Standard Drawings

All Public Tree Plans must include a standard page showing general notes, tree protection and tree planting details, and a legend for the site plan.

### 4.2b Site Plan

The site plan information may be included on another plan sheet, such as a landscaping plan, if it is legible and complete. It is up to the project owner's discretion if the information may be shown on another plan sheet or if it should be placed on its own sheet.

**About the City of Columbus Public Tree Inventory**

The City of Columbus maintains a GIS-based inventory of all existing street trees. This inventory is publicly available and shall serve as a resource for location and species of street trees. The inventory data do not take the place of a natural resources professional surveying the trees in the field, but the inventory should be consulted and represented visually in Project Tree Plans.

The site plan must be drawn to scale and include the following:

- Natural Resource Professional contact information.
- Work Limits (boundaries of construction work, proposed grade changes if applicable and cross-sections).
- Location of existing and/or proposed utilities.
- All Public Trees growing within Work Limits, labeled with a Public Tree Inventory ID number OR a Tree Tag number~~. If the Public Tree is already geolocated in the Public Tree Inventory, use the number assigned to the asset. If the trees are not yet geolocated in the Public Tree Inventory, Tree Tagging is required and the number from the tags should be listed on the plan. The tree tag number comes from field tagging work, which requires geolocation (mapping) and physically tagged trees in the field by the Natural Resource Professional.~~ (see Section 4.3).
- Outline of the Tree Protection Zone (location and detail, per Section 2.1).
- Trees proposed for removal are marked with an X.
- Location of proposed replacement trees (with an ID number), taking into account spacing requirements in Section 7.6.
- Data table (see below).

## 4.2c Data Tables

Up to three (3) corresponding data tables provide further details on the trees, mitigation efforts, and preservation measures. All data must be collected by the Natural Resource Professional.

### Table 1 - Existing Tree Data Table

Must include:

- Protected and removed trees
- Tree tag number if tree is not in Public Tree Inventory, corresponding to site plan OR Columbus Public Tree Inventory ID number if available (see inset)
- Botanical name
- Common name
- Diameter at Standard Height (DSH)
- Condition (good, fair, poor, dead )
- Critical Root Zone (CRZ)
- Action (Do not disturb, To be removed, etc.)
- Mitigation required (Y/N)
- Other notes (including reason for removal)
- Item 1: Total Removed Inches
- Item 2: Total Inches to be Mitigated

### Table 2 - Proposed Tree & Mitigation Data Table

Must include:

- Key (corresponding to species label on site plan)
- Quantity
- Size
- Botanical name
- Common name
- Stock (B&B, container, bare root)
- Total inches by species
- Sheet number where tree is located on a site plan
- Total number of trees to be planted
- Item 2: Total Inches to be Mitigated
- Item 3: Total Inches Provided
- Tree Fund Payment ~~(Item 2 - Item 3 * $260/inch)~~
    - Fee-in-Lieu (item 2 - item 3 * $260)
    - Replanting Inspection Fees (if applicable)
    - Total Tree Fund Payment

Table 3 - Standard Pay Items

- CMS Item Number (see Appendix E for references to CMS Items)
- Item Description
- Unit
- Quantity
- Sheet Number

### ~~4.3~~4.3 Tree Tagging vs. Tree ID

If the Public Tree is already geolocated in the Public Tree Inventory, use the number assigned to the asset–its Tree ID. If the trees are not yet geolocated in the Public Tree Inventory, Tree Tagging may be required and the number from the tags should be listed on the plan.

The tree tag number comes from field tagging work, which requires geolocation (mapping) and physically tagged trees in the field by the Natural Resource Professional. The Project Owner or their Contractor is responsible for the purchase of necessary materials for Tree Tagging.

Street trees are not required to be physically tagged. Any street tree that is not yet in the Public Tree Inventory will be added by Forestry and assigned a Tree ID for use in the Public Tree Plan.

Tree Tagging is necessary for work occurring in naturalized areas with large quantities of Public Trees and a combination of protection and removals. Forestry may waive Tree Tagging requirements in naturalized areas if there are a small number of Public Trees or if all trees are receiving the same treatment (tree protection or removal).

## 4.4 Suggested Steps to Create a Public Tree Plan

To create a Public Tree Plan, the following steps are suggested for the Natural Resource Professional to follow:

1. Consult the Columbus Public Tree Inventory to determine if Public Trees are already inventoried (contact Forestry for data at Forestry@columbus.gov).

2. Inspect, inventory, and ~~tag (if not inventoried~~identify (via Tree Tag or Tree ID) the Public Trees on site that are within Work Limits.

3. Recommend removal or preservation for each tree (on site plan and in table).

4. Recommend tree protection measures for each preserved tree, in accordance with this Manual (on site plan and in table).

# Section 5: Tree Mitigation

Because of the value of trees in Columbus, and in an effort to achieve City urban forestry goals, the City of Columbus takes removal of Public Trees seriously. For this reason, if a removal is approved, steps will be required to make up for the loss of that tree – a practice that is termed **Tree Mitigation.**

Mitigation can take the form of replanting, payment into the Tree Fund, or a combination of both.

The preference of the City is to replant on site. If it is not possible to replant on site due to site limitations, planting at other approved locations on public property, Fee-in-Lieu, or a combination of both are possible with the approval of Forestry.

Tree Mitigation required in Chapter 912 and detailed in this manual is intended to be a floor, not a ceiling. This manual does not preclude other City departments from imposing more stringent requirements than those detailed here.

In addition to the cost to replant trees for mitigation, there are additional fees associated with any replanting, set by Forestry to account for multiple inspections that must occur throughout the project (see Section 5.5).

Regardless of mitigation requirements, a permit is always required to impact a Public Tree.

## 5.1 Determination of Mitigation Requirements

The Public Tree Plan must include suggested mitigation. However, as part of the approval process, Forestry staff provide the final determination of the required mitigation. This will occur through the permitting process (see Section 3), with the goal of maintaining and growing Columbus' Tree Canopy (see Section 1).

There are some adjustments to mitigation rates for specific situations, including Invasive Trees, trees in Parks, large-scale projects and more. These are detailed in Section 5.4.

## 5.2 Tree Replacement Rate of Inch-for-Inch

If replacement mitigation is required, the rate of tree replacement will be inch for inch, meaning the number of replacement trees' Caliper inches shall collectively add up to the total DSH trunk inches of the tree(s) removed.

**Examples of Tree Replacement Quantities:**

1. A red maple street tree that will be removed has a DSH of 4 inches. The replacement tree will be four inches in diameter, so one four-inch tree is sufficient mitigation for the removed tree. Two two-inch Caliper trees would also be appropriate replacements.

2. A pin oak tree to be removed in a park has a DSH of 21 inches. The replacement trees will be two inches in diameter, so 11 trees must be planted to replace the original pin oak.

3. An invasive Callery pear growing in a tree pit that will be impacted by a construction project has a DSH of 12 inches. Because it is an Invasive Tree growing in a maintained landscape area, it will be mitigated for half of its inches. Three two-inch

Caliper trees will mitigate the removed tree. See Section 5.4c on Invasive Tree Mitigation.

4. An Invasive Tree-of-heaven growing in a city-owned forest has a DSH of 18 inches. Because it is in a naturalized area and is invasive, its removal does not require tree replacement. See Section 5.4c on Invasive Tree Mitigation.

Note the following additional replacement requirements:

- **Size Minimum.** Replacement trees are to be a minimum of two inches in Caliper or larger at the time of installation.

- **Species Selection.** All replacement trees shall be selected from the most recently approved Recommended Street Tree List (see Appendix B), or otherwise approved by Forestry. Species shall factor in planting site dimensions (see Section 7.6). Selection of species will also take into account efforts to improve tree species diversity based on other species in place in the surrounding area, following the 10-20-30 Rule. The 10-20-30 Rule is a guideline to reduce the risk of catastrophic tree loss due to pests or disease. The Rule recommends an urban tree population include no more than 10% of any one tree species, 20% of any one tree genus, or 30% of any tree family.

- **Location.** All tree(s) will be replaced within the Work Limits where they were removed. When not feasible due to functional limitations, a new site on public property may be proposed with Forestry approval. Proposed tree locations should be the closest available tree planting opportunities to the relative project site. The planting opportunities will be primarily in Right-of-Way sites.

## 5.3 Payment When Replacement Is Not Possible: Fee-in-Lieu

When it is not feasible to replace the Public Trees that have been approved for removal, the secondary mitigation option of a Fee-in-Lieu of planting will apply to the extent allowed by law. These funds will be deposited in the Tree Fund and used in accordance with the purposes of that fund. The following will be used to determine the Fee-in-Lieu amount:

A fee of **$260 per removed inch** shall be assessed. This value will be reviewed periodically to assess changes in planting costs and average appraisal values. The Department reserves the right to appraise any Public Tree at a different value at its discretion, and may do so in cases when the condition, species, and unique characteristics of the Public Tree would result in a significantly different value than the established Fee-in-Lieu. In the case of appraisals, Forestry will use the Cost Approach - Trunk Formula Technique described in Appendix D.

**Examples of Fees-in-Lieu:**

1. A red maple street tree that will be removed has a DSH of 4 inches. Its Fee-in-Lieu would be four inches multiplied by $260/inch for a total of $1,040.

2. A pin oak tree to be removed in a park has a DSH of 21 inches. Its Fee-in-Lieu would be 21 inches multiplied by $260/inch for a total of $5,460.

3. An invasive Callery pear growing in a tree pit that will be impacted by a construction project has a DSH of 12 inches. Because it's an Invasive Tree growing in a maintained landscape area, it will be mitigated for half of its inches. Its Fee-in-Lieu would be six inches multiplied by $260/inch for a total of $1,560. See Section 5.4c on Invasive Tree Mitigation.

4. An Invasive Tree-of-heaven growing in a City-owned forest has a DSH of 18 inches. Because it is in a naturalized area and is invasive, its removal does not require a Fee-in-Lieu payment. See Section 5.4c on Invasive Tree Mitigation.

Required standards for tree removal can be found in Section 9: Tree Removal Standards.

## 5.4 Mitigation Rate Specifics

There are minimums, exceptions, or adjustments to be made to mitigation rates, whether replacement or Fee-in-Lieu, depending on a number of factors. Any deductions to Tree Mitigation must be determined and approved by Forestry.

### 5.4a Minimum Size Thresholds

The size of tree that requires mitigation will vary, depending on whether it is in a maintained landscape area or naturalized area. Forestry will determine if a City-owned property is to be considered a naturalized area or maintained landscape for mitigation purposes.

- **Maintained Landscape Areas.** ~~Trees with a 2" Caliper or above~~Any trees growing in mowed turf areas on City property shall be mitigated. Examples of landscaped areas include but are not limited to street trees in tree lawns or tree pits, street islands, and maintained areas of public parks.

- **Naturalized Areas.** Trees with 4" DSH or above growing in city-owned natural areas shall be mitigated. Examples of naturalized areas include but are not limited to forested areas, woodlots, and conservation parkland.

### 5.4b Large-Scale Project Mitigation: Wooded Areas over Two Acres

A 100% census inventory is required for all contiguous wooded areas that are two acres or less, referring to the forested area and not the entire parcel. All trees four inches DSH or larger must be surveyed according to 5.4a.

For contiguous wooded areas that exceed two acres in size, ~~Forestry will first determine average tree diameter. For areas with larger-diameter trees averaging at least 15" DSH,~~ the ~~monetary value will be determined per-acre based on the saw timber value~~project owner shall inventory a minimum 10% of the wooded area~~. Saw timber value will be calculated using~~, divided into 1/10 acre sample plots. The Natural Resource Professional is responsible for the inventory and the ~~species listed~~ fee-in ~~the most recent Ohio Timber Price Report. For areas with smaller-diameter trees averaging 14" DSH or below, the~~-lieu analysis.

The USDA Forest Service's iTree Eco tool ~~will~~shall be used to calculate the value of the ecological benefits of the existing trees per acre. Carbon sequestered annually in trees, air pollution removed annually, and avoided runoff shall be used to calculate the value. This monetary value will be used as the Fee-in-Lieu payment. Should the project owner prefer

replanting and it is deemed feasible by Forestry, Forestry will calculate the number of trees that should be replanted by dividing the monetary value by the average cost of a nursery tree.

### 5.4c Invasive Tree Species

Mitigation rates for Invasive Trees will be adjusted in the following ways:

- In maintained landscape areas, Invasive Trees shall be mitigated at a discount: replanting at 50% of the DSH inches; 50% of the fee-per-inch; or appraisal at a reduced value as determined by Forestry.

- In naturalized areas, Invasive Trees will not be required to be mitigated.

The rationale to mitigate trees in maintained landscapes at a discount is because: 1) Invasive Trees nonetheless provide benefits to residents, including carbon storage, shade, and air and water filtration; 2) These trees were deliberately planted in the past, before they were considered invasive, so residents should not lose out on tree replacements because the trees are now invasive; and 3) If these trees were not mitigated, then whole streets or park areas could be devoid of trees like Callery pear, with no consideration to replant.

### 5.4d Trees in Parks

Trees growing on City-owned property that is managed by the Department may require additional steps or deviation from these guidelines altogether to preserve the parkland and the benefits trees provide to the parkland. Impacts to trees are prohibited by City Code Section 919.09, unless the person has the right to do so–via approval by the Director. Therefore, additional consideration may be required for requested tree removals in Parks.

### 5.4e Dead, Dying, or Hazardous Trees

Any tree that is determined to be dead, dying, or hazardous by Forestry will not require any mitigation. -The Natural Resource Professional must explain why a Public Tree qualifies for this exemption, if dying or hazardous. The NRP can submit photos by email to supplement as desired.

### 5.4f Volunteer Trees Causing Current or Potential Damage to Public Infrastructure

In the specific circumstances detailed below, Volunteer Trees will not be required to be mitigated. Regardless of mitigation requirements, ~~a permit is~~Volunteer Trees must be inventoried and an explanation of the proposed mitigation exemption included in the Existing Tree Data Table. A Forestry Permit is also still required to impact any Public Tree.

1. **Landfill Caps.** Plants with deep root systems may be detrimental to the function of a Landfill Cap system, and Ohio EPA Division of Materials and Waste Management discourages establishing trees on landfill caps.

   Volunteer Trees growing on or within ten (10) feet of the landfill cap may be removed without incurring mitigation as part of the maintenance of the infrastructure.

2. **Bridges.** All bridge elements, including abutments, piers, wingwalls, girders, decks, and culverts (above or below ground) are included. Trees growing in the embankment above the culvert or in the berm area adjacent to bridge elements can cause deterioration of the structure. Preventative maintenance recommended by the Ohio Department of

Transportation recommends removal of trees from bridge abutments. Volunteer Trees growing on or within ten (10) feet of the bridge element may be removed without incurring mitigation as part of the maintenance of the infrastructure.

3. **Dam embankments.** An embankment dam is a water impounding structure constructed from excavated natural materials. The Federal Emergency Management Agency states that trees can interfere with safe operation of dams and can cause dam failure, due to their extensive root systems that can destabilize the dam through loosening embankment soils and providing paths for erosion.

   Embankments, areas adjacent to spillway structures, vegetated channels, and other areas associated with a dam require continual maintenance of the vegetal cover. Volunteer Trees growing on embankments or within ten (10) feet of the embankment may be removed without incurring mitigation as part of the maintenance of the infrastructure.

4. **Clearance for Public Infrastructure Operation and Maintenance.** Volunteer Trees growing within ten (10) feet of traffic control signs, traffic signals, street signs may be pruned to allow access for City staff or City contractors to operate and maintain the infrastructure. Volunteer Trees growing within ten (10) feet of manholes, guardrail, roadside berms, roadside ditches, or the road surface of an alley may be pruned or removed without incurring mitigation to allow access for City staff or City contractors to operate and maintain the infrastructure.

### 5.4g: Private Property Owners Impacting Public Trees for Immediate Repair of Utility Infrastructure

If a Private Property Owner undertakes repair of utility infrastructure that causes impacts to an adjacent Public Tree, the owner must receive a permit from Forestry in accordance with Section 3.3c. If the repair is Emergency Maintenance to utility infrastructure impacting an owner-occupied, single-family residence, the Department will waive mitigation requirements.

### ~~5.4h: Mitigation for Annual Permits~~

~~For permit holders with annual permits, inspection fees will be charged for individual projects. However, the permit holder may conduct mitigation mass planting efforts across planting seasons in accordance with Sections 3.3a and 3.3b.~~

### ~~5.4i~~5.4h: Mitigation Credits for Voluntary Tree Plantings

Should a project owner plant Public Trees above and beyond any regulatory requirements, including mitigation, those tree plantings are considered voluntary. Those trees may be considered for mitigation credits, to count for mitigation on a project that occurs ~~within~~no later than 18 months ~~of~~after the planting date. In order to be considered for mitigation credits, Forestry must receive geolocations of each tree along with all information required in Section 4.2b Data Table and be in good condition at the end of the warranty period.

## 5.5 Inspection Fees for Mitigation Replantings

When Tree Mitigation involves replacement tree plantings, Forestry staff must review plans, consult on species/quantity/location of new plantings, and perform up to five field inspections throughout the project's life cycle, as well as complete reporting and data management. This

necessary work requires inspection fees, which are in addition to the Fee-in-Lieu mitigation explained in 5.3. The fee will be assessed on any replanting, whether it occurs at the removal site or on other City property.

Fees are established based on typical staff hours required and will be deposited into the Tree Fund. These fees will be updated periodically by Forestry to capture increased staff costs.

| **Replanted Tree Quantities** | **Inspection Fee** |
|---|---|
| 1-19 | $700 |
| 20-49 | $1,342 |
| 50-99 | $3,079 |
| 100-150 | $4,629 |
| Each 50 trees above 150 | $671 per 50 trees |

# Section 6: Tree Protection Standards

Tree protection during construction is critical to the longevity of the urban forest. For this reason, any Public Tree must be preserved and protected from any damage during construction. Trees can experience significant damage during construction, affecting roots, trunk and crown, and those impacts may not appear for years after construction ends.

## 6.1 Tree Protection Measures

Tree protection measures are required when Public Trees are to be preserved during a construction project. For projects undergoing Plan Review, tree protection measures must be proposed by the Natural Resource Professional and detailed within the Public Tree Plan. For projects outside Plan Review, Forestry will determine the necessary tree protection measures for the permit holder to be in compliance.

The following pages provide best practices and standards for protection. These can be separated into pre-construction, during construction, and post-construction.

## 6.1a Protection Pre-Construction

Any work in CRZ should be done by hand-operated equipment, or the smallest mechanized equipment necessary. Use of a vacuum truck is preferred over an excavator, to avoid damage to roots.

Pre-construction, the Tree Protection Zone (TPZ) must be determined (see Section 2.1). ~~This area~~

The TPZ must ~~then~~ be protected by fencing off the area with signage (see Appendix C) prohibiting access to the TPZ at all times. A Forestry inspector will ensure the fencing is compliant with the requirements.

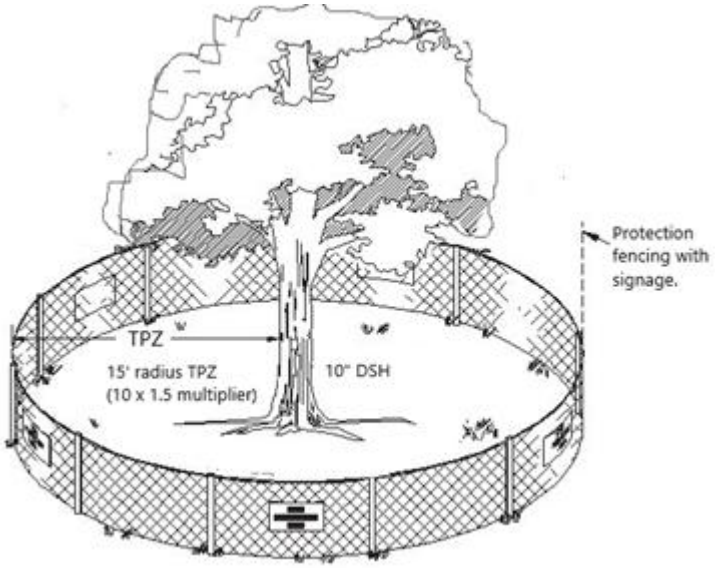



Figure 5. Tree protection fencing example.

**Fencing.** Fencing must be installed around trees along the established TPZ to exclude any construction equipment or materials (Fig.5 & 6). Fencing must be in place for the duration of the construction phase, though for short-term projects, where work within the TPZ will last 45 cumulative calendar days or less across the duration of the project, Forestry shall conduct an inspection and the project may receive relief from fencing requirements. Projects with activities in the Public Tree's TPZ lasting for more than 45 calendar days must install fencing. In the event that a tree's CRZ extends onto Private Property, the project owner is not expected to install fencing on the portion on Private Property.

Fencing requirements:

- Fencing material must be sufficient to prevent intrusion of construction equipment or materials.
- Fencing must last the length of the project and be maintained throughout the project.
- Fencing shall be flush with the initial undisturbed grade.
- Fencing shall be a minimum of 40" high.
- Fencing material shall be a minimum of heavy duty snow fence with steel poles installed every 8 to 10 feet. Tension wire must be used at top and bottom of fencing.
- Other fence materials can include wire fence, silt fence, or chain link fence depending on the project and the Public Tree location. Silt sock or straw wattle is preferred to silt fence, to avoid excavation/trenching in CRZs.
- Fencing shall be solidly anchored to the ground.
- Consider providing a gate in the fencing if access to the TPZ will be needed for mowing.
- Maintain the fencing in place until the City authorizes removal.

Public Trees that are damaged due to improper or insufficient tree protection are covered by a warranty (Section 6.4) and subject to Tree Mitigation.

For street trees, the fencing should be installed along the edge of the tree lawn or right-of-way that is unpaved. Fencing installation should consider the door swing of parked vehicles. Ensure

that sight lines and pedestrian access are not impeded by this fencing, as well as emergency access to fire hydrants, power poles, manholes, and other utility infrastructure.

Figure 6: Tree protection fencing for a street tree in a tree well. Source: DeepRoot.com

**Signage.** Tree Protection Signs (see examples in Appendix C) must be attached to the fencing every 50' or centered if less than 50'. Signage must be attached at regular intervals to the fencing and visible from all directions. DO NOT affix signs to trees themselves.

**No Activity in Protected Root Zone Area Without Forestry Permit.** No construction activity shall occur within the protected zone of any tree without a Forestry Permit. If construction activities are desired in those areas, Forestry shall be given at least 24-hour notice prior to the anticipated commencement of construction activities.

The following activities are prohibited within the Tree Protection Zone without a Forestry Permit:

- Dumping of construction waste
- Storage of materials, such as building supplies, soil, waste items, vehicles, or equipment
- Parking vehicles
- Trenching
- Changing soil grade or drainage patterns to the tree(s)
- Compacting soil with vehicle or equipment traffic
- Installing pavement of any kind
- Attaching anything to trees using nails, crews and/or spikes; or,
- Causing injury by fire or excessive heat.

~~Any landscaping done in the CRZ subsequent to the removal of the fencing shall be accomplished by hand operated equipment or, when not feasible to be done by hand, shall be conducted with the smallest mechanized equipment necessary.~~

## 6.1b Protection During Construction

During the construction period, protection must be maintained for the ground surface, tree trunk and branches, and supplemental irrigation provided if any traffic or construction activities are to extend into the TPZ of any Public Tree in the Work Limits.

**Surface Protection.** If traffic and construction activities must encroach into the TPZ, it must be permitted by Forestry in advance as part of the Public Tree Plan or via a Forestry inspection for maintenance projects. Surface protection is only required in the TPZ if traffic or construction activities encroach into the TPZ, and it must only cover the area of the TPZ that is at risk of impact; for example, the vehicular path. The following actions must be taken to disperse the vehicular load and surface compaction to protect the roots. If wood chip mulch is required, it

must be applied either manually (by hand), blown-in via a mulch blower, or with a small mini-skid steer weighing no more than 2000 lbs.

Surface protection measures include one or more of the following:

- Applying 6-12” of wood chip mulch
    - If the TPZ is located within a floodplain, mulch may be substituted with ground protection mats
- Laying ¾-inch plywood over 4 x 4 wood beams over a 6” layer of wood chip mulch
- Using steel plates
- Using ground protection mats. Rubber ground protection mats require 6” of mulch underneath. Pressure-dispersing mats and timber mats do not require a layer of mulch underneath. Alternate surface protection must meet Forestry approval.

**Trunk Protection.** To avoid any trunk damage, wood planks should be installed around the trunk of the tree, following these specifications:

- Install 2-inch-thick wood planks around the trunk of the tree with ¼” or greater closed-cell foam pads between the trunk and planks; see Figure 7.
- The height of the wood planks shall be 4 feet minimum, or match the height of the vehicle clearance, whichever is greater.
- Use textile straps (i.e. ratchet straps) to bind the planks in place.
- DO NOT drive fasteners into the tree.
- If the protective planks are to be in place for longer than 6 months, loosen and adjust the planks every 3 months to allow for growth.

Figure 7: Example of tree trunk protection during construction. Source: National Park Service

**Supplemental Irrigation.** Trees can become stressed nearby and within construction sites, especially during the growing months. Irrigating to provide adequate water to respond to that stress is critical to the health of the tree.

- If construction activities are conducted within the TPZ during the months of May through September for more than 45 cumulative calendar days, supplemental irrigation must be provided. This can be done through hand watering or another regular source of water.
- Trees shall be irrigated to provide at least 1 inch of water applied once a week directly to the root system using a slow delivery method that allows for adequate infiltration.

- The water delivery method shall be identified on the Public Tree Plan.
- All trees to be preserved through construction shall be monitored for signs of drought stress. Signs of drought stress include leaf curling or rolling, leaf drop, early fall color, dieback on leaders (esp. in conifers). If signs of drought stress persist or worsen after providing regular irrigation, promptly notify Forestry.

**Arranging for Clearance.** If existing tree branches limit access to needed equipment, these branches must be proactively managed to avoid unnecessary damage. This can be done through pruning or tie-up of branches, depending on the extent of clearance needed. Descriptions of pruning and tie-up methods follow.

- *Pruning.* If pruning branches, the crown raising method of pruning (see Section 8 for details on this method) shall be applied to achieve clearance. Typical vehicular clearance is 14.5 feet over vehicular trafficked areas. For pedestrian access, typical clearance is 8 feet over sidewalks. No more than 25% of the Tree Canopy may be pruned.
- *Tie-Up.* Where excessive pruning (more than 25% of Tree Canopy) would be necessary for construction clearance, temporary tie-up of lower limbs may be considered appropriate so long as the limbs are not structurally damaged. Limbs should not be tied up for more than 24 hours (see Figure 8).

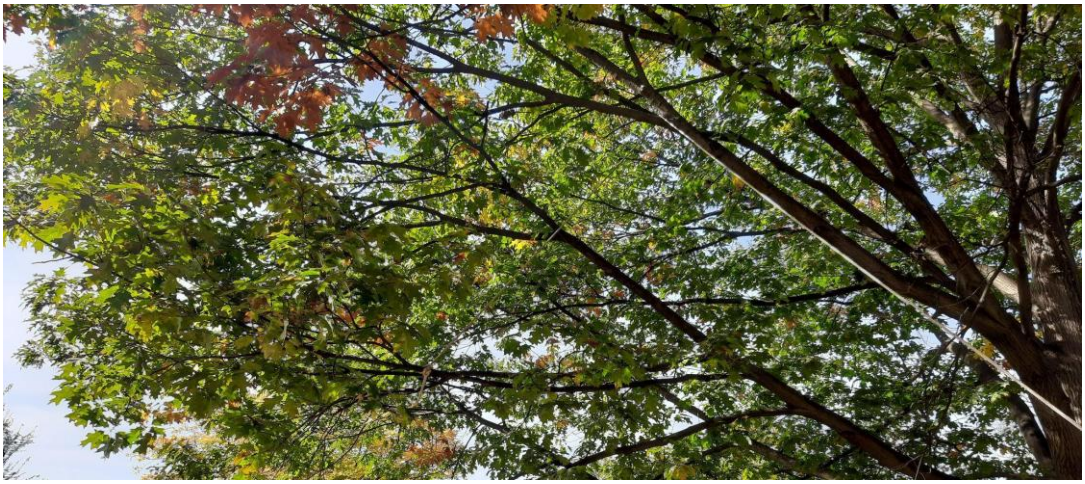
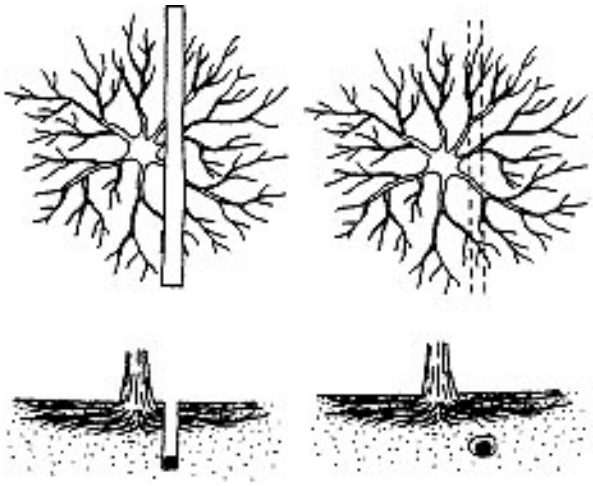


Figure 8: Temporary tie-up of lower limb of a Public Tree in a Columbus park.

**Tunnel Rather than Trench.** Trenching is not allowed in TPZ without a Forestry Permit as it cuts off a large portion of the protected tree's roots, while tunneling (or boring) under the tree does virtually no damage (see Figure 9). Because most roots live in the top 18 inches of soil, a

tunnel two feet underground often does little damage. However, placing the tunnel three to four feet deep is safer.

- All soil disturbance must occur at a minimum depth of two feet below grade and one to two feet away from the tree's center to avoid any taproot.
- The insertion point must be located outside the defined TPZ of each tree
- The diameter of the tunnel must not exceed ~~seven (7~~twelve (12) inches.



~~Figure 9: Trenching vs. Tunneling. Trenching near a tree (left) can kill almost half its roots. A tunnel or boring (right) in the same place will do virtually no damage to the tree. Source: Missouri Extension~~

### 6.1c Protection Post-Construction

All tree protection fencing and wood chip mulch shall be removed at the completion of the project. Any removal of chips must be done by hand. Site restoration work in cases of soil compaction for protected trees should include vertical mulching with an air spade for protected trees.

Post-construction monitoring shall be conducted by Forestry during the one-year tree protection warranty period.

A Forestry arborist will conduct a site inspection of all trees retained through construction both at project completion during the final walk-through and at the end of the warranty period. Should any protected tree die or be deemed dying or hazardous due to the construction, mitigation will be required for the loss of the protected tree.

## 6.2 Reporting of Injury to Tree

The project owner shall report any damage or injury to protected Public Trees from construction during the project duration the same day it occurs to Forestry.

## 6.3 Warranty for Tree Preservation

Trees protected during construction will be monitored by Forestry staff for impacts to health for a minimum of one year following final acceptance of the project. Project owners are responsible for mitigation if Forestry determines the tree is hazardous or dying at the end of the warranty period as a result of the construction. Forestry staff will document the construction damage in the event that a protected tree does not survive, and if a permit holder violated the conditions of the permit, mitigation will be required. If replanted mitigation trees have to be replaced at the end of the warranty period, they must survive an additional year warranty period.

# Section 7: Tree Planting Standards

## 7.1 Planting and Young Tree Establishment Standards

Tree planting and young tree establishment shall be performed and specified according to the ANSI A300 Standards Part 6, along with the planting details found in the following sections. These standards apply to planting of all Public Trees, whether or not they are required as Tree Mitigation. According to Chapter 912, any and all work to maintain, plant, or remove a tree shall be conducted by Certified Arborists or by people working under the supervision of a Certified Arborist.

## 7.2 Tree Size Classes

Forestry classifies tree species as large, medium, or small based on their height at maturity, as well as their mature width.

- **Large trees** grow to a height of 50' or taller.
- **Medium trees** grow to a height of 35-50'.
- **Small trees** grow to a height of less than 35'.

## 7.3 Species Selection

Project owners shall hire a qualified Natural Resource Professional to propose diverse tree species appropriate to the space. All species selection must be approved by Forestry. If tree species change during construction, those substitutions must also be approved by Forestry.

While native tree species are encouraged to be used where appropriate, due to the harsh site conditions along streets, including soil type, water availability, air pollution, and road salt, they are not appropriate for all sites. The Department prioritizes the use of native species in parks.

No tree with a mature height over 25' should be planted beneath overhead utilities. Refer to MIS-58: Minimum Tree Clearance for Downtown, Urban and Rural Areas.

## 7.4 Nursery Stock Standards

Trees to be installed must be healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. If plant material is unavailable from local sources, the proposed source shall originate from states immediately adjacent to Ohio or further north. Plant material must be sourced from no further south than Zone 7a of the USDA Plant Hardiness Zone Map (PHZM). At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability, and health for the expected life of the tree. Additionally, trees must be protected from deterioration during delivery and storage. Adequately protect trees from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.

## 7.5 Timing of Planting

Spring plantings may occur from March 1 to May 31. Fall plantings may occur from September 15 through December 31. Forestry staff must approve planting times if they vary from those indicated, prior to planting.

## 7.6 Site Selection

Guidelines on spacing for Tree Planting sites follows:

- **Tree lawn widths:** Large trees require a 7' minimum tree lawn width. Medium trees require 5' tree lawn width. Small trees require 3' minimum tree lawn width.

- **Overhead obstructions**: A tree's mature height should be used to determine appropriate species when there are overhead obstructions such as power lines. No tree with a mature height over 25' should be planted beneath overhead utilities. Refer to MIS-58: Minimum Tree Clearance for Downtown, Urban and Rural Areas.

- **Spacing.** Generally, large trees should be planted a minimum of 40' apart, although spacing can vary depending on species. Medium trees should be planted a minimum of 30' apart. Small trees should be planted a minimum of 20' apart.

- Additional preferred spacing requirements follow:

| **Object** | **Minimum separation from tree trunk (feet)** |
|---|---|
| Large class tree | 40 |
| Medium class tree | 30 |
| Small class tree | 20 |
| Raised objects in parks, such as curbs, parking stops, poles, benches, trash cans, and tables | 10 |
| Light poles | 10 from edge of mature canopy |
| Power Poles | 25 |
| Street Intersections | 30 |
| Driveways | 10 |
| Alleys | 10 |
| Stop signs | 50, unless approved by Forestry |
| Street signs | 10 |
| Fire hydrants | 10 |

| | |
|---|---|
| Utility taps | 6 |

## 7.7 Utilities Protection

To protect existing utilities, paving and other facilities from damage caused by landscaping, contact Ohio Utility Protection Service (OUPS) at 811 before doing any work.

## 7.8 Installation Specifications

Planting specifications for the actual installation of a tree depends on the type of tree being planted: container, balled and burlapped, or bare root.

### 7.8a Installation specifications for nursery trees of <u>all formats</u>:

- If a tree is to be planted in a confined planter pit or sidewalk area, the planting hole shall be excavated to a minimum of 30-inches deep by the width of the exposed area. In all other areas, excavate the hole's width a minimum of two times the diameter of the root ball, and deep enough to allow the root ball of the container to rest on firm soil. Scarify the sides and the bottom of the pit. Do not place sand or gravel in the planting hole.
- The top of the intact root ball should be level with the surrounding grade.
- Remove all rope, tags and tree wrap from trunk and limbs.
- Use the same soil to fill the planting hole as was removed. Use no amendments. Amending the soil is an older practice that is no longer recommended because the tree can be more reluctant to root into the surrounding soil, which prevents or delays the establishment of the tree into its new planting location.
- Fill the planting hole by half, gently tap soil, and water to remove air pockets. Continue filling, tapping and watering until the soil is at grade.
- Use remaining soil to build a watering berm just outside the planting hole.
- For trees planted on a slope, the grade of the back of the planting hole (on the high side of the slope), must match the required planting grade, as shown in the image below. The lower end of the slope planting area must be built up to the root ball grade. See Figure 10 for a diagram of a tree planting on a slope.

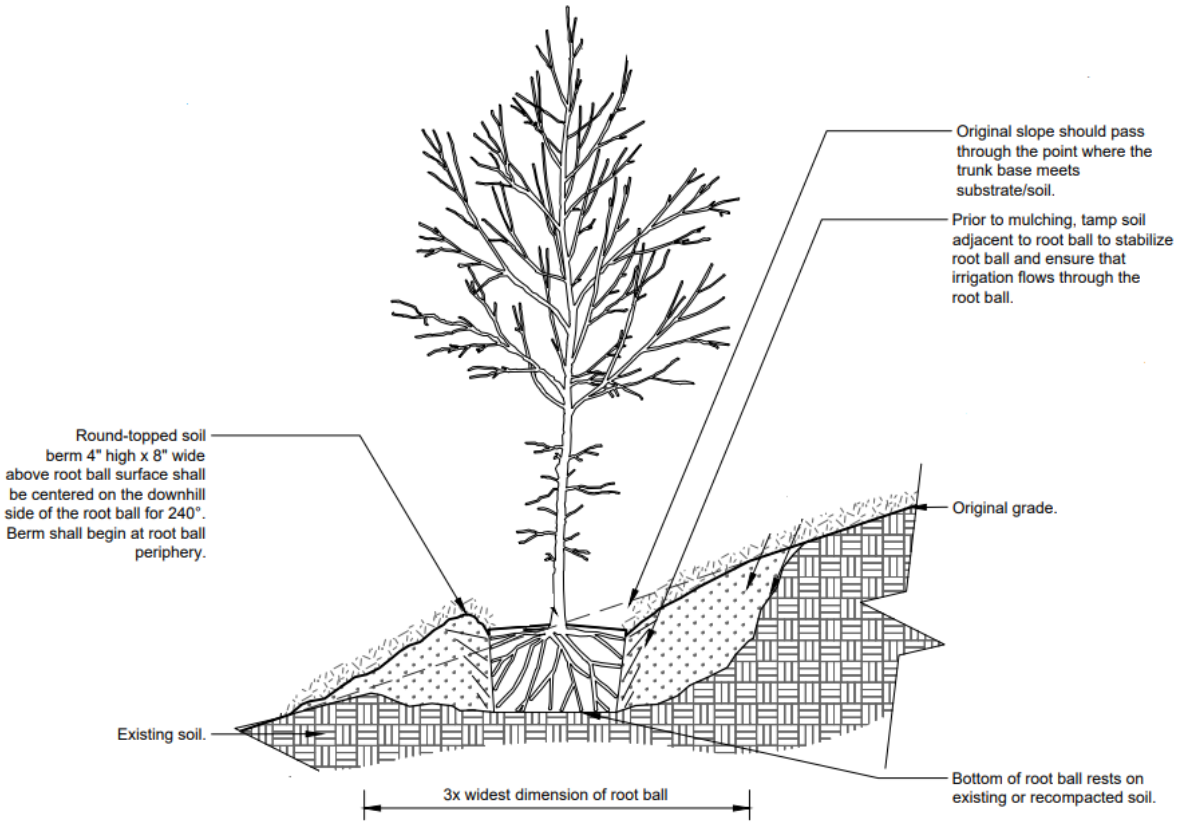



Figure 10: Diagram for Tree Planting on a slope. Source: ISA

## 7.8b Additional specifications for nursery trees in <u>containers:</u>

- Trees in containers often have roots that circle the container and must be addressed at the time of planting. Tree should be removed from the container and the rootball shaved (see below), before placing it in the planting hole.

  *About Rootball Shaving.* The outer surfaces of ALL container trees (sides and bottom of the root ball) must be shaved or scarified to remove all circling, descending, and matted roots. This can be performed using saws, knives, sharp shovels, or other suitable equipment that is capable of making clean cuts on the roots. Shaving or cutting should remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

- Trees should be lifted by the container or by supporting the bare root ball. Trees should not be lifted by the trunk or limbs.
- Loosen the root ball from the container and place in the planting hole.
- If containerized trees are provided by the Forestry, return all empty containers to Forestry.

## 7.8c Additional specifications for nursery trees in <u>ball & burlap (B&B)</u>:

- Plant during the dormant season, after leaf fall in the autumn and before bud break in the spring.

- Neither plastic twine, nor plastic or synthetic burlap, shall be used on any B&B stock. Jute twine and burlap shall be used.
- Trees to be held on site longer than 24 hours before planting should be held in the shade or with enough mulch to cover the root ball. The root ball should be sufficiently watered to prevent drying.
- Trees provided by Forestry should be planted within 24 hours of delivery or pick up.
- Check the root ball for soil added above the root flare by the nursery at time of digging. If present, remove added soil to the root flare.
- Trees should be moved by handles on the basket or by strapping placed around the root ball. Trees should not be lifted by the trunk or limbs.
- Find the root flare and ensure it is placed at ground level. In areas with poor drainage, the tree may be planted with the root flare 1-2" above grade. In no instance should the root flare be placed below grade.
- Do not loosen any of the burlap, twine or wire basket until after the tree is situated in the planting hole.
- Once the tree is in the planting hole, remove all surface level burlap and twine. Peel back wire basket away from top, leaving basket in place overall, but cut wires around top 6"-8" of sides, or top one-third of root ball, to ease future root growth. It is important to leave part of the wire basket to maintain the integrity of the root ball during transplanting.

## 7.8d Additional specifications for nursery trees that are <u>bare root:</u>

- Provide established and well-rooted field-grown plants. Harvest bare root plant while the plant is dormant and a minimum of 4 weeks prior to leaf out (bud break).
- The root spread of the harvested plants shall conform to American National Standards Institute (ANSI) Z60 Standards Part 1 for nursery grown bare root plants for each size and type of plant.
- Bare root stock shall be protected from drying out at all times. Roots must be covered and packed in moist straw, sawdust, or other suitable moisture-holding packing material.
- Keep the trees in a cool dark space for storage and delivery. If daytime outside temperatures exceed 70 degrees F, utilize a refrigerated storage area with temperature between 35 and 50 degrees.
- Planting holes can be slightly shallower than for container or ball and burlap trees, only requiring a diameter to match the spread of the roots to the correct depth. Dig hole to a depth so the located trunk flare, at the first order lateral root, matches finished grade. Spread all roots out radial to the trunk in the prepared hole making the hole wider where needed to accommodate long roots. Direct root tips away from the trunk. Prune any broken roots removing the least amount of tissue possible. Maintain the trunk vertical while backfilling soil around the roots. Lightly tamp the soil around the roots to eliminate voids and reduce settlement.

### 7.8e Additional specifications for planting in tree wells (cut-out areas within a sidewalk):

- New tree's root flare elevation must be between 3" to 5" below sidewalk grade to allow for reinstallation of tree grate.
- Once grates are re-installed, pea gravel must be applied to fill the remaining space from the top of soil to the top of the tree grate.

## 7.9 Finishing Installation

Once the tree has been installed and the planting hole has been filled, the tree should be immediately mulched, staked and watered thoroughly.

- *Mulch.* Immediately after planting, smooth out all grades between plants before mulching. Apply 2-3 inches of mulch, covering the entire planting bed area. Do not pile any mulch against the trunk of the tree; the trunk flare must be exposed. Place no mulch within 2" of the trunk. For trees planted in lawn areas the mulch must extend to a 2' radius around the tree covering the soil berm. Use only shredded hardwood mulch. The mulch shall be either un-dyed, brown or black as specified in the project material list. Substitutions will only be accepted with prior written permission from Forestry and will not be made on-site, at the time of installation.
- *Watering.* Water trees and plants within the first 24 hours of initial planting and not less than once per week until project completion. The tree must receive at least 10 gallons of water per 1" tree Caliper per week during the first growing season. During the warranty period, water as needed to keep each plant alive. Gator bags or other watering accessories may be used but must be removed during the winter months, and removed permanently after the warranty period. Use standard watering horticultural procedures to ensure vitality of the newly planted trees. To measure the volume of water provided, water flow meters and rain gauges may be used.
- *Staking.* Staking and guying should only be used in areas of high wind or when trees will not stand on their own. When guying is not required, staking alone may be used to reduce lawnmower damage. Trees should be guyed loosely enough to allow the trunk to sway from the base. All guying materials should be removed within one year.
    - Tree guying is to be flat woven polypropylene material, 3/4 inch wide, with 900 pound break strength.
    - Stakes shall be 2 inch by 2 inch hardwood stakes free of knots (or approved equal) or steel posts, and of lengths appropriate to the size plant required to adequately support the plant.
    - Underground staking like a deadman system (where required on the drawings) shall be 4 inch by 4 inch by 4 feet long wood (or approved equal). Wood shall NOT be treated for rot protection.
    - Submit manufacturer's product data for approval.
- ~~*Mower*~~*Trunk Guards.* ~~Mower~~Trunk guards are ~~recommended but not~~ required on trees planted in an area surrounded by lawn~~.~~ and should conform to the Tree Planting Detail.

## 7.10 Post-Planting Care and Tree Establishment Warranty Period

It is the responsibility of the installing party to maintain and care for the new tree for a **one year warranty period,** beginning at the date of final acceptance of the project.

- Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
- Keep all tree planting areas free of weeds. Hand-remove all weeds; chemical herbicides are not permitted.
- Refresh mulch once during the warranty period to maintain complete coverage, but do not over mulch. At no time shall the overall mulch thickness be greater than 4 inches. Do not apply mulch against any trunks.
- Remove any staking and ties at the end of the warranty period.
- At the end of the warranty period, any trees that did not survive must be replaced by the installing party.
- For warranty periods that end when the trees are dormant in winter, the inspection to determine tree survival should occur in early fall (September) or in spring (May) to observe trees while they have leaves.

# Section 8: Tree Maintenance Standards

Any tree maintenance performed, whether tree pruning or tree health care, must be done in accordance with the standards detailed below. According to Chapter 912, any and all work to maintain, plant, or remove a tree shall be conducted by Certified Arborists or by people working under the supervision of a Certified Arborist. This is different from the Natural Resource Professional (Section 4.1) who simply collects information and recommends tree protection measures; in this section, the actual tree care must be done by or supervised by a Certified Arborist.

## 8.1 Pruning

Proper pruning of landscape trees improves their structural strength, maintains their health, enhances beauty, and increases their value.

### 8.1a When to Prune

Pruning Public Trees must occur in accordance with ANSI A300 Standards (tree care practice industry standards) Part 6 Pruning Standard and ANSI Z133 Part 1 Safety Standard. Pruning becomes advisable under the following circumstances:

- **Defects.** Trees have crossing branches, weak branch unions, or other defects.
- **Deadwood.** Branches are dead, dying, decayed, or potentially hazardous.
- **Clearance.** Lower branches interfere with people or vehicles, or block visibility of signs.
- **Utilities.** Branches are growing into buildings or utility wires.
- **Storm Damage.** Limbs have been broken by storms.

### 8.1b Pruning Around Utilities

All employees pruning trees in areas where there are utility lines present must be “Qualified Line Clearance Tree Trimmer Trainees” or "Qualified Line Clearance Tree Trimmers" as defined in ANSI Standard Z-133.1.

Project owner must:

- Locate and identify existing underground and overhead services and utilities within Work Limits, including contacting the Ohio Underground Protection Service (OUPS - Ohio 811).
- Provide adequate means of protection of all utilities and services.
- Perform all work in accordance with the requirements of the applicable utility company or agency involved.
- Immediately report and repair utilities damaged during site work operations.

## 8.1c Defining Pruning Cuts

Pruning cuts are defined here, and shown in Figure 11 below.

- A **branch removal cut** (previously termed a "thinning cut") removes a branch at its point of origin on the trunk while retaining the branch collar and branch bark ridge.
- A **reduction cut** (previously called "cutting to a lateral") shortens a limb to a lateral branch large enough to resume growth of the pruned limb, typically at least one-third the diameter of the branch or stem being removed (review image below).
- **Heading** and **stub cuts** result in exposed areas of the tree that can't heal, and are thus prohibited.

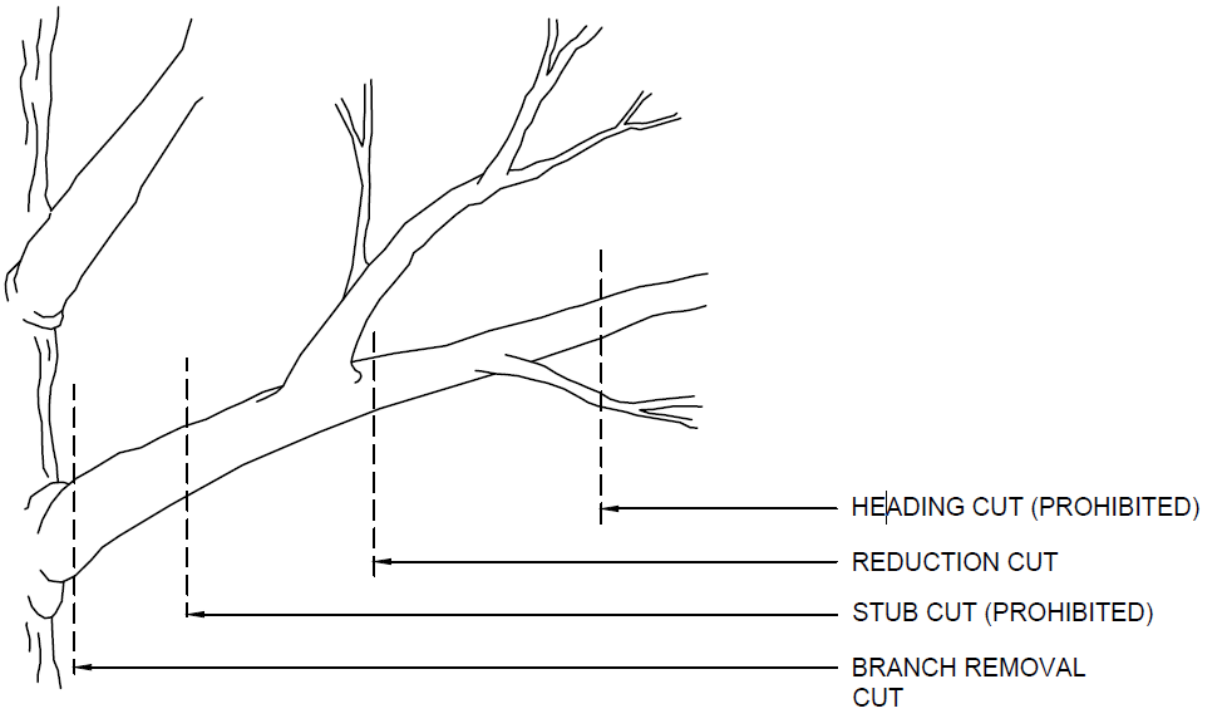



Figure 11: Depiction of location on branch of pruning cut types. Note that appropriate angles per ANSI A300 standards are still required.

## 8.1d Proper Pruning Technique

Proper pruning practices remove a branch while protecting the branch collar, which is essential for wounds to close (also called natural target pruning).

To promote quick closing of a pruning wound, always use the precut method when removing a branch over 1 inch. -This pruning method protects the branch collar and prevents tearing the bark. -Disinfect pruning equipment between cuts.

As shown in Figure 12, the first cut (~~A~~1) ensures the limb does not tear down into the trunk bark when removed, the second cut (~~B~~2) removes the majority of limb weight, and the last step (~~C/D~~3) achieves the final finished cut that can most easily heal over the coming months.

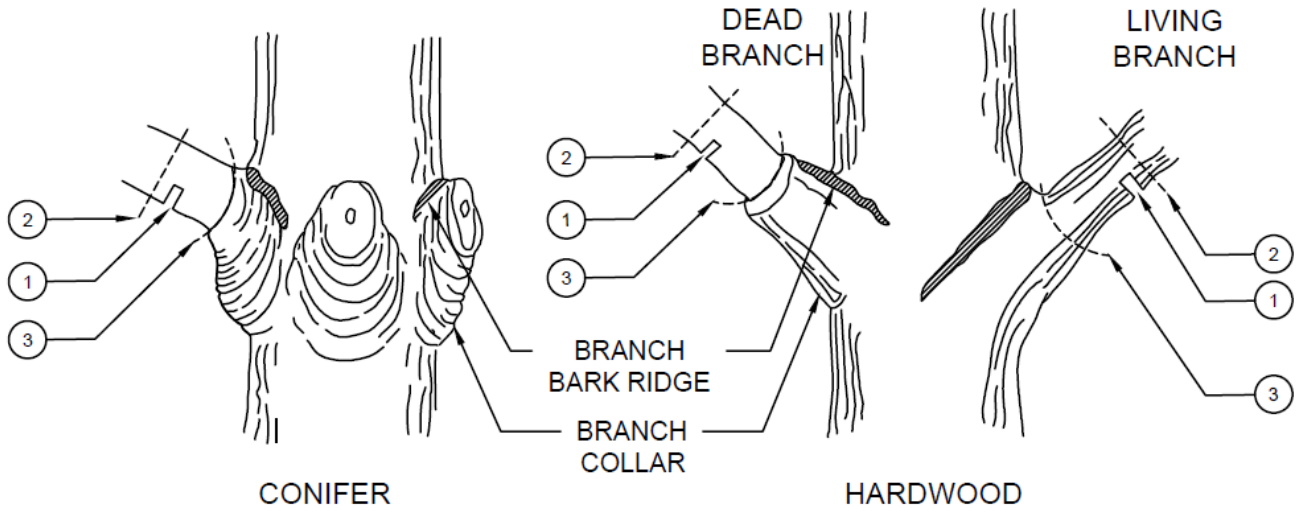



Figure 12: Precut method in tree pruning.

Do not leave a stub and do not cut flush against a trunk. Use sharp tools and keep wounds as small as possible, clean, and smooth.

## 8.1e Young Tree Pruning

Young trees should be pruned three to five years after initial installation. These few cuts at an early age can have significant impacts on the longevity and success of the tree over the coming decades. See Figure 13 for a diagram of young tree pruning. Follow the below steps to prune a young tree.

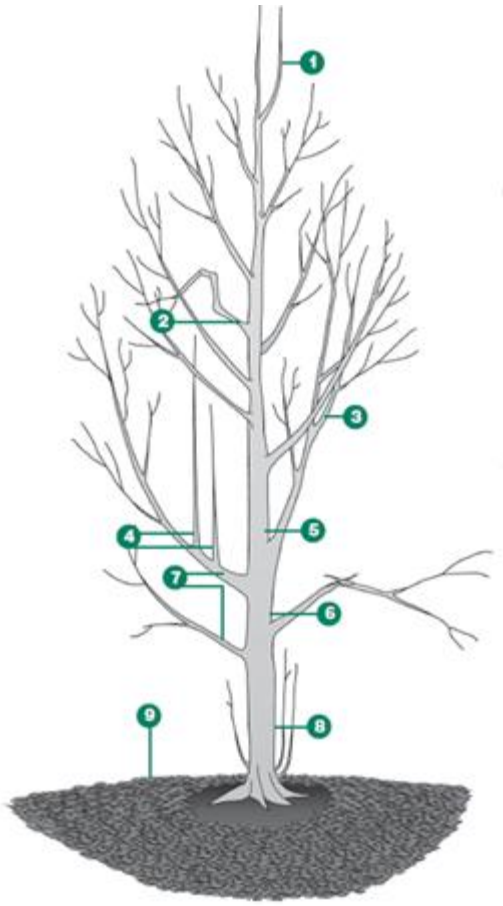



Figure 13: Diagram for young tree pruning.

1. Identify competing leader(s). If there are competing leaders present, remove or prune back the less vigorous branch(es) to prevent potential structural weaknesses.

2. Prune any malformed branch.

3. Remove any crossing branch, which will affect the other branch's growth and create an undesirable form.

4. Remove no more than one-third of water sprouts (upright sucker growth in the crown of tree) in any one year.

5. If branch attachment is narrower than is common for the species, remove the branch while the tree is young.

6. Prune any broken or badly damaged branch.

7. Younger trees have lower branching at installation than what is tolerated on larger, older trees. As the tree grows, those lower branches are able to be removed and are termed temporary branches. Prune temporary branches back with reduction cuts or remove them completely over time. Removing these branches over the first few years provides clearance for signs, vehicles (min. 14 feet over roadway), and pedestrians (min. 8 feet over walkways).

8. If possible, twist and yank out suckers when young instead of cutting to decrease chance of resprouting.

9. Apply 2 to 3 inches of composted mulch at the tree base. Keep mulch 2 inches away from the trunk to prevent the chance of rot.

### 8.1f Mature Tree Pruning

By the time a tree reaches maturity, providing it has had its maintenance needs met throughout its life, it should only need pruning for specific purposes such as:

- **Managing risk.** Removing dead or dying limbs 1 inch and larger in diameter or limiting branch end weight to aid in retaining tree structure.
- **Clearance.** Removing or reducing branches from infrastructure.
- **Restoration.** Pruning post-storm damage.

Protect and preserve the tree's natural form. Pruning a mature tree excessively or incorrectly can cause more harm than good. Every vigorous branch removed reduces photosynthesis and the manufacture of sugar. Any cuts allow decay organisms to enter the wound.

### 8.1g Pruning Prohibitions

- Climbing irons or spikes may NOT be used on any tree that is scheduled for pruning.
- Trees shall be raised to no more than one third the height of the tree, according to the ANSI A300 BMP for tree pruning. Exceptions will be made to clear infrastructure. None of these actions shall render the tree unbalanced or harmed.

## 8.2 Plant Health Care

Any plant health care such as treatment of a disease or pest, or application of fertilizer, must be approved by Forestry and applied by a Certified Arborist with a pesticide applicator’s license.

# Section 9: Tree Removal Standards

Any tree removals and stump grindings performed must conform to the most current revision of the ANSI Standard A300(Part 1) and Standard Z-133.1: “Safety Requirements for Pruning, Trimming, Repairing, Maintaining, Removing Trees and for Cutting Brush.” According to Chapter 912, any and all work to maintain, plant, or remove a Public Tree shall be conducted by Certified Arborists or by people working under the supervision of a Certified Arborist. (Tree removals are evaluated by the criteria in Appendix A).

## 9.1 Tree Removal

If a tree to be removed ~~does not have roots or branches extending into the CRZ of a protected tree, no specific requirements for removal are required.~~ :

- ~~However, if a tree to be removed~~ has roots or branches that extend into the CRZ of a protected tree, ~~the~~
- is adjacent to City or utility infrastructure, or
- is over 12” DSH

The following applies:

- Removal shall not be attempted by demolition or construction personnel, grading or other heavy equipment.
- A Certified Arborist or a tree care worker working under the direction of a Certified Arborist shall remove the tree carefully in a manner that causes no damage above or below ground to trees that remain.

Tree crowns shall be stripped before removal unless conditions permit felling; no trees or trunks shall be felled onto pavement. All trunks shall be removed flush with the ground, in preparation for stump grinding. Work shall also include removal of all basal sprouts, brush, and weeds within three feet of the stump, and the stump itself.

With Forestry approval, exceptions may be made in natural areas to leave a portion of the standing dead trunk if failure of the remaining trunk poses minimal risk to its surroundings.

Climbing irons or spikes may only be used on a tree that is scheduled for removal.

All limbs and trunks shall be removed and controlled as necessary to prevent damage or injury to people, utilities, buildings, property, pavement, and other trees. No wood, debris, etc. shall remain on site or in the public right-of-way, past the end of the work day. Assure minimum interference with streets, sidewalks, and adjacent facilities by prompt removal of debris.

## 9.2 Stump Removal

Requirements for stump grinding vary based on the proximity to other living trees.

### 9.2a General Stump Grinding

Stump removal in general involves the grinding of stump and roots to a minimum depth of 18 inches. All above-ground root material must be removed and backfilled with City-approved topsoil to grade, the area tamped to settle the soil, and seeded with approved grass seed. The Contractor shall remove and legally dispose of all remaining sawdust and debris.

## 9.2b Stump Grinding Adjacent to Living Trees

Stumps to be removed within 36” of a living adjacent tree should be ground only to a depth of 2”, to avoid impacting the anchor roots of the adjacent tree.

# Appendices

## Appendix A: How a Removal Application is Evaluated

Arborists issuing an approval for removal use a set of data collected via a site inspection and evaluation rationale to determine whether a removal will be permitted.

**Data Considered.** Requests for Public Tree removals will be based on the following data:

- **Size.** The diameter of the tree trunk to be removed will be measured 4.5 feet above grade (Diameter at Standard Height, DSH) and expressed in inches.

- **Location.** The tree's location is evaluated by its ability to support the tree (vigor) and consideration of its placement within the surrounding landscape.

- **Condition.** The Condition of a tree is assessed using the following factors:
    - Health: vigor, foliage size and color, leaf density, presence of absence of pests, twig growth rate, amount of twig or branch dieback, and wound closure
    - Structure: indicators of decay (cavities, wounds, cankers, etc.), roots (exposed, uplifted, grade change, girdling, etc.), trunk (deviation from vertical, co-dominant, cracks, seams, ~~miss~~missing bark, etc.), and crown (symmetry, multiple attachments, poor branch attachment, dieback, etc.)
    - Form: type (rounded, oval, columnar, pyramidal, vase, weeping, horizontal, irregular), shape, silhouette, atypical, aesthetic appeal

- **Species.** Tree species will be evaluated by considering the durability and prospective life span of the subject tree.

**Evaluation Rationale.** Because the ultimate goal is to preserve as many trees as possible, healthy Public Trees will typically not be approved for removal. However, at times, there will be unavoidable impacts that make preservation unrealistic. A Public Tree may be approved for removal if a Forestry representative determines that:

- Tree is dead, dying, or poses a threat to public safety.
- Tree contains a structural problem (split trunk, split branching unions, poor branch attachments, etc.) that could result in failure and result in damage to adjacent properties or to residents.
- Necessary work/utility/roadway improvements required around the tree will kill the tree or render the tree hazardous.
- Tree is infested with an epidemic insect or disease where recommended control is not applicable and removal is necessary to prevent transmission of the insect of disease to other trees.
- The preservation of the tree, when adjacent property is developed, is not cost effective.

The site inspection results will provide a tree assessment and determine if removal is approved with required mitigation.

If a tree is determined to be dead, dying, seriously diseased, or otherwise represents a hazard to public safety through the site inspection, its removal will be approved and not result in any required Tree Mitigation.

# Appendix B: Recommended Street Tree List - Adopted March 2024

This document is a guide for tree planting in Columbus. It includes recommended tree species and varieties (cultivars) for the public streets of Columbus. This list is not exclusive and other species, varieties or cultivars may be planted with the approval of Forestry. All tree plantings on public property require a Forestry Permit.

Site design and evaluation are critical. Trees should be selected based on their compatibility with sites, and with design objectives in mind. Maintenance expectations, public safety, aesthetics, and urban forest diversity are among the considerations weighed by the City. For public safety reasons, evergreens, weeping and multi-stem forms are generally not permitted as street trees and are omitted from this list. Trees may also be prohibited based on fruit characteristics, invasive potential, cold hardiness, and other factors.

The City promotes genetic biodiversity in its urban forest. Forestry staff generally follow the "10/20/30" benchmark for species/genus/family. This may also influence what is permitted and planted at times in the City. Parking lots may present special challenges to tree health. Species suitable for use in parking lots are denoted with an asterisk *.

All sites must be reported to the Ohio Utilities Protection Service at 811 prior to planting. To apply for a permit to plant a tree on city property or in the public street right of way, contact Forestry at 614.645.3765 or call 311.

***This list was adopted in March 2024 and is valid until replaced.***

## B.1 Small-Sized Trees (35' or less in height)

Spacing: 20' between trees. Minimum tree lawn size: 3' wide, or pit of 3'x 4'.

| Scientific Name | Trade / Common Name | Cultivar Name(s) | Mature Size (HxW) | Notes | Native | Acceptable Under Electric Wires |
|---|---|---|---|---|---|---|
| *Acer buergerianum* | Trident Maple | | 25' x 20' | Oval | No | No |
| *Acer ginnala* | Flame Amur Maple<br>Beethoven Amur Maple<br>Mozart Amur Maple | 'Flame'<br>'Betozam'<br>'Mozam' | 20' x 20'<br>20' x 15'<br>20' x 15' | Single stem only | No | Yes |
| *Acer grandidentatum* | Rocky Mountain Glow<br>Big Tooth (Canyon) Maple | 'Schmidt' | 25' x 20' | | North America | No |

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|---|---|---|---|---|---|---|---|
| *Acer griseum* | Paperbark Maple | | 25' x 20' | Special permission needed | No | Yes | |
| *Acer tataricum* | Hot Wings Tatarian Maple<br>Pattern Perfect Tatarian Maple<br>Rugged Charm Tatarian Maple | 'GarAnn'<br>'Patdell'<br>'JFS-KW2' | 20' x 24'<br>25' x 20'<br>20' x 15' | | No | Yes | |
| *Aesculus pavia* | Red Buckeye | | 20' x 20' | | Ohio | Yes | |
| *Amelanchier arborea* | Cumulus Serviceberry | 'Cumulus' | 25' x 25' | Single stem only | North America | Yes | |
| *Amelanchier arborea* | Lustre Serviceberry | 'Rogers' | 20' x 15' | Single stem only | North America | Yes | |
| *Amelanchier arborea* | Spring Flurry Serviceberry | 'JFS-Arb' | 28' x 20' | Single stem only | Ohio | No | |
| *Carpinus betulus* | Columnar European Hornbeam<br>Frans Fontaine Hornbeam | 'Fastigiata'<br>'Frans Fontaine' | 35' x 20'<br>35' x 15' | Narrow canopy | No | No | |
| *Cercis canadensis* | Eastern Redbud | Various cultivars available | 25' x 30' | Wide canopy – requires minimum 8' tree lawn | Ohio | Yes | |
| *Chionanthus virginicus* | White Fringetree | | 20' x 20' | Single-stem only | Ohio | Yes | |
| *Cornus mas* | Corneliancherry Dogwood | 'Golden Glory' | 20' x 15' | Single stem only | No | Yes | |
| *Cornus kousa* | Kousa Chinese Dogwood | Various cultivars available | 20' x 20' | Hybrids also considered | No | Yes | |
| *Crataegus virdis* | Winter King Hawthorn | 'Winter King' | 20' x 25' | Wide – 8' minimum tree lawn | North America | Yes | |
| *Halesia carolina* | Wedding Bells Silverbell | 'Wedding Bells' | 20' x 15' | Upright / oval form | North America | Yes | |
| *Heptacodium miconioides* | Seven-Son Flower Tree | | 25' x 15' | Single stem only | No | No | |
| *Maackia amurensis* | Amur Maackia | | 30' x 20' | | No | No | |
| *Magnolia virginiana* | Henry Hicks Sweetbay Magnolia<br>Moonglow Sweetbay Magnolia | 'Henry Hicks'<br>'Jim Wilson' | 20' x 20'<br>25' x 15' | Single stem only | North America | Yes | |

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|---|---|---|---|---|---|---|---|
| *Magnolia x* | Galaxy Hybrid Magnolia | 'Galaxy' | 30' x 15' | | No | No | |
| *Malus x* | Prairifire Crabapple | 'Prairifire' | 20' x 15' | | No | Yes | |
| *Malus x* | Adirondack Crabapple | 'Adirondack' | 18' x 8' | Columnar canopy | No | Yes | |
| *Malus x* | Red Jewel Crabapple | 'Jewelcole' | 25' x 15' | | No | No | |
| *Malus x* | Golden Raindrops Crabapple | 'Schmidtcutleaf' | 20' x 15' | Prone to Fireblight | No | Yes | |
| *Malus x* | Royal Raindrops Crabapple | 'JFS-KW5' | 20' x 15' | | No | Yes | |
| *Parrotia persica* | Vanessa Persian Ironwood | 'Vanessa' | 28' x 15' | | No | No | |
| *Prunus x* | Okame Flowering Cherry | 'Okame' | 25' x 25' | | No | Yes | |
| *Prunus x* | Snow Goose Flowering Cherry | 'Snow Goose' | 25' x 20' | | No | Yes | |
| *Prunus x* | First Lady Flowering Cherry | 'First Lady' | 27' x 14' | | No | No | |
| *Prunus x* | First Blush Flowering Cherry | 'JFS-KW14' | 25' x 12' | | No | No | |
| *Prunus x* | Newport Plum | 'Newport' | 20' x 20' | | No | Yes | |
| *Prunus cerasifera* | Crimson Pointe Plum<br>Krauter Vesuvius Plum | 'Cripoizam'<br>'Krauter Vesuvius' | 25' x 10'<br>20' x 15' | | No | Yes | |
| *Prunus sargentii* | Columnar Sargent Cherry<br>Pink Flair Cherry | 'Columnaris'<br>'JFS-KW58' | 35' x 15'<br>25' x 15' | | No | No | |
| *Prunus serrulata* | Amanogawa Cherry<br>Kwanzan Cherry | 'Amanogawa'<br>'Kwanzan' | 20' x 6'<br>25' x 20' | | No | Yes | |
| *Prunus subhirtella* | Autumn-Flowering Cherry | 'Autumnalis Rosea' | 30' x 25' | | No | No | |
| *Styrax japonicus* | Pink Chimes Snowbell<br>Spring Showers Snowbell<br>Snowcone Snowbell | 'Pink Chimes'<br>'Spring Showers'<br>'JFS-D' | 15' x 15'<br>20' x 15'<br>20' x 15' | | No | Yes | |
| *Syringa reticulata* | Ivory Silk Japanese Tree Lilac | 'Ivory Silk' | 20' x 20' | | No | Yes | |
| *Syringa pekinensis* | Beijing Gold Peking Lilac<br>China Snow Peking Lilac<br>Great Wall Peking lilac | 'Zhang Zhiming',<br>'Morton'<br>'WFH2' | 20' x 20'<br>20' x 20'<br>20' x 12' | | No | Yes | |

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|---|---|---|---|---|---|---|---|
| *Taxodium distichum* | Lindsey's Skyward Bald Cypress | 'Skyward' | 25' x 10' | Columnar | North America | No | |
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## B.2 Medium-Sized Trees (35 – 50' in height)

Spacing: 30' between trees. Minimum tree lawn width of 5', or pit 5'x 5'.

| Scientific Name | Trade / Common Name | Cultivar Name(s) | Mature Size (HxW) | Notes | Native | Acceptable Under Electric Wires |
|---|---|---|---|---|---|---|
| ~~*Acer campestre*~~ | ~~Metro Gold Hedge Maple~~<br>~~Queen Elizabeth Hedge Maple~~ | ~~'Panacek'~~<br>~~'Evelyn'~~ | ~~35' x 20'~~<br>~~35' x 35'~~ | | ~~No~~ | ~~No~~ |
| *Acer x freemanii* | Armstrong Freeman maple | 'Armstrong II' | 45' x 15' | Columnar | Ohio | No |
| *Acer truncatum x platanoides* | Crimson Sunset Maple<br>Norwegian Sunset Maple<br>Pacific Sunset Maple<br>Urban Sunset Maple | 'JFS-KW202'<br>'Keithsform'<br>'Warrenred'<br>'JFS-KW187' | 35' x 25'<br>35' x 25'<br>30' x 25'<br>35' x 20' | | No | No |
| *Acer miyabei* | Rugged Ridge Maple<br>State Street Maple | 'JFS-KW3AMI'<br>'Morton' | 45' x 40'<br>40' x 30' | | No | No |
| *Aesculus x carnea* | Briotii Red Horsechestnut<br>Ft. McNair Red Horsechestnut | 'Briotii'<br>'Ft. McNair' | 30' x 35'<br>32' x 30' | | No | No |
| *Betula populifolia* | Grey Birch | | 30' x 15' | | Ohio | No |
| *Carpinus betulus* | Emerald Avenue European Hornbeam | 'JFS-KW1CB' | 40' x 28' | | No | No |
| *Carpinus caroliniana* | Native Flame American Hornbeam | 'JFS-KW6' | 30' x 20' | | Ohio | No |
| *Carpinus caroliniana* | American Hornbeam | | 25' x 20' | | Ohio | No |

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|---|---|---|---|---|---|---|
| *Cercidiphyllum japonicum* | Katsuratree | | 40’ x 30’ | | No | No |
| *Cladrastis kentukea* | American Yellowwood<br>Perkins Pink Yellowwood | ‘Perkins Pink’ | 40’ x 40’<br>30’ x 30’ | | Ohio | No |
| *Corylus colurna* | Turkish Filbert (Hazel) | | 45’ x 35’ | | No | No |
| *Eucommia ulmoides* | Hardy Rubbertree | | 45’ x 45’ | | No | No |
| ~~*Koelreuteria paniculata*~~ | ~~Goldenraintree~~ | | ~~30’ x 30’~~ | | ~~No~~ | ~~No~~ |
| *Maackia amurensis* | MaacNificent Amur Maackia | ‘JFS-Schichtel1’ | 30’ x 25’ | | No | No |
| *Maclura pomifera* | White Shield Osage Orange | ‘White Shield’ | 35’ x 35’ | Male, no fruit or thorns | Ohio | No |
| *Magnolia x soulangiana* | Saucer magnolia | ‘Alexandrina’ | 30’ x 25’ | Wide & low canopy; tree lawn width of 10’ minimum | No | No |
| *Nyssa sylvatica* | Firestarter Black Gum<br>Green Gable Black Gum<br>Wildfire Black Gum | ‘JFS-Red’<br>‘NSUHH’<br>‘Wildfire’ | 35’ x 18’<br>40’ x 25’<br>40’ x 25’ | AKA Tupelo, requires slightly acidic, organic soils | Ohio | No |
| *Ostrya virginiana* | American Hophornbeam (Ironwood)<br>Autumn Treasure American Hophornbeam | ‘JFS-KW5’ | 35’ x 25’<br>40’ x 20’ | | Ohio | No |
| *Quercus robur* | Skyrocket English Oak | ‘Fastigiata’ | 45’ x 15’ | Columnar | No | No |
| *Sassafras albidum* | Sassafras | | 40’ x 30’ | | Ohio | No |
| *Ulmus x** | Frontier Elm<br>Triumph hybrid Elm<br>Patriot hybrid Elm | ‘Frontier’<br>‘Morton Glossy’<br>‘Patriot’ | 40’ x 30’<br>50’ x 45’<br>50’ x 40’ | | No | No |
| *Zelkova serrata** | Musashino Zelkova | ‘Musashino’ | 45’ x 15’ | Columnar | No | No |

** Species tolerates parking lot conditions.*

## B.3 Large-Sized Trees (50’ or more in height)

Spacing: 40' between trees. Minimum tree lawn width of 7’, or pit 8’x 8’.

| Scientific Name | Trade / Common Name | Cultivar Name(s) | Mature Size (Height / Width) | Notes | Native | Acceptable Under Electric Wires |
|---|---|---|---|---|---|---|
| *Acer x freemanii* | Autumn Blaze Freeman Maple<br>Sienna Glen Freeman Maple | 'Jeffersred'<br>'Sienna' | 55' x 40'<br>50' x 35' | All prone to surface rooting | Ohio | No |
| *Acer nigrum* | Black Maple | 'Greencolumn' | 50' x 20' | Columnar | Ohio | No |
| *Acer rubrum* | Autumn Flame Red maple<br>Redpointe Red Maple<br>Sun Valley Red Maple | 'Autumn Flame'<br>'Frank Jr.'<br>'Sun Valley' | 35' x 35'<br>45' x 30'<br>40' x 35' | All prone to surface rooting | Ohio | No |
| *Acer saccharum* | Sugar maple | 'Endowment'<br>'Legacy'<br>'Commemoration'<br>'Green Mountain' | 50' x 20'<br>50' x 35'<br>50' x 35'<br>50' x 40' | Columnar | Ohio | No |
| *Betula lenta* | Sweet or Black Birch | | 50' x 40' | | Ohio | No |
| *Betula nigra* | River Birch<br>Heritage River Birch<br>Dura-Heat River Birch | 'Cully'<br>'BNMTF' | 50' x 40<br>, | Not for alkaline soils; single stem only | Ohio | No |
| *Celtis occidentalis** | Common Hackberry | 'Prairie Pride'<br>'Magnifica' | 45' x 45'<br>50' x 40' | | Ohio | No |
| *Fagus grandifolia* | American Beech | | 50' x 40' | Not very urban tolerant | Ohio | No |
| *Fagus sylvatica* | European Beech<br>Rivers Purple Beech | 'Riversii' | 50' x 40'<br>50' x 40' | | No | No |
| *Ginkgo biloba** | Autumn Gold Ginkgo<br>Princeton Sentry Ginkgo | 'Autumn Gold'<br>'Princeton Sentry' | 45' x 35'<br>40' x 15' | Male cultivars only; 'Sentry' is columnar | No | No |
| *Gleditsia triacanthos var. inermis** | Imperial Honeylocust<br>Skyline Honeylocust<br>Sunburst Honeylocust | 'Impcole'<br>'Skycole'<br>'Suncole' | 40' x 35'<br>45' x 35'<br>40' x 35' | Thornless varieties only | Ohio | No |
| *Gymnocladus dioicus* | Espresso Kentucky Coffeetree | 'Espresso-JFS' | 50' x 35' | Male cultivars preferred (seedless) | Ohio | No |

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|---|---|---|---|---|---|---|---|
| *Liriodendron tulipifera* | Tulip Tree<br>Emerald City Tulip Tree | 'JFS-OZ' | 60' x 30'<br>55' x 25' | | Ohio | No | |
| *Metasequoia glyptostroboides* | Dawn Redwood<br>Gold Rush Dawn Redwood | 'Ogon' or 'Gold Rush' | 70' x 50'<br>50' x 20' | | No | No | |
| *Platanus x acerifolia** | Bloodgood London Planetree<br>Exclamation Planetree<br>Columbia Planetree | 'Bloodgood'<br>'Morton Circle'<br>'Columbia' | 50' x 40'<br>55' x 35'<br>50' x 40' | Anthracnose resistant | No | No | |
| *Quercus alba* | White Oak | | 60' x 60' | | Ohio | No | |
| *Quercus bicolor* | Swamp White Oak (Bicolor) | | 50' x 50' | | Ohio | No | |
| *Quercus imbricaria* | Shingle Oak | | 50' x 40' | Needs acidic soils | Ohio | No | |
| *Quercus lyrata* | Overcup Oak | | 50' x 50' | Needs acidic soils | Ohio | No | |
| *Quercus macrocarpa* | Bur Oak | | 60' x 50' | | Ohio | No | |
| *Quercus montana* | Chestnut Oak | | 50' x 40' | Tolerates dry sites | Ohio | No | |
| *Quercus phellos* | Willow Oak | | 50' x 35' | Zone 6 | North America | No | |
| *Quercus rubra* | Northern Red Oak | | 75' x 75' | | Ohio | No | |
| *Quercus shumardii* | Shumard Oak | | 60' x 45' | | Ohio | No | |
| *Taxodium distichum** | Bald Cypress<br>Shawnee Brave Bald Cypress | 'Mickelson' | 60' x 35'<br>55' x 20' | Columnar | North America | No | |
| *Tilia americana* | Boulevard American Linden<br>Redmond Linden (Basswood) | 'Boulevard'<br>'Redmond' | 50' x 30'<br>35' x 25' | | Ohio | No | |
| *Tilia cordata* | Corinthian Littleleaf Linden<br>Greenspire Littleleaf Linden | 'Corzam'<br>'Greenspire' | 45' x 15'<br>45' x 30' | | No | No | |
| *Tilia tomentosa* | Green Mountain Silver Linden<br>Sterling Silver Linden | 'PNI 6051'<br>'Sterling' | 45' x 35'<br>45' x 35' | | No | No | |
| *Ulmus americana** | Jefferson American Elm<br>Valley Forge American Elm | 'Jefferson'<br>'Valley Forge' | 70' x 50'<br>70' x 70' | | Ohio | No | |

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|---|---|---|---|---|---|---|---|
| *Ulmus hybrids** | Patriot hybrid Elm | 'Patriot' | 50' x 40' | | No | No | |
| *Zelkova serrata* | Green Vase Japanese Zelkova | 'Green Vase' | 45' x 30' | | No | No | |
| ** Species tolerates parking lot conditions.* | | | | | | | |

## B.4 Special Use Trees

Species for special use areas and trial plantings.

| Scientific Name | Trade / Common Name | Cultivar Name(s) | Mature Size (HxW) | Notes | Native | Acceptable Under Electric Wires | Minimum Tree Lawn Size |
|---|---|---|---|---|---|---|---|
| *Celtis occidentalis* | Prairie Sentinel Hackberry | 'JFS-KSU1' | 45' x 12' | Columnar | Ohio | No | Per City Forester Approval |
| *Eucommia ulmoides* | Emerald Pointe Hardy Rubber Tree | 'Empozam' | 40' x 15' | Columnar | No | No | Per City Forester Approval |
| *Liquidambar styraciflua* | Slender Silhouette Sweetgum | 'Slender Silhouette' | 60' x 8' | Few to no seed pods; very columnar | Ohio | No | Per City Forester Approval |
| *Quercus robur x Q. alba* | Skinny Genes hybrid Oak | 'JFS-KW2QX' | 45' x 10' | Columnar | No | No | Per City Forester Approval |
| *Quercus robur x Q. bicolor* | Streetspire hybrid Oak | 'JFS-KW1QX' | 45' x 14' | Columnar | No | No | Per City Forester Approval |
| *Quercus robur x Q. bicolor* | Regal Prince hybrid Oak | 'Long' | 45' x 8' | Very columnar | No | No | Per City Forester Approval |
| *Quercus robur x Q. bicolor* | Kindred Spirit hybrid Oak | 'Nadler' | 30' x 6' | Very columnar | No | No | Per City Forester Approval |
| *Quercus robur x Q. alba* | Crimson Spire hybrid Oak | 'Crimscmidt' | 45' x 15' | Columnar | No | No | Per City Forester Approval |

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|---|---|---|---|---|---|---|---|---|---|
| | *Quercus bicolor* | Beacon Swamp White Oak | 'Bonnie and Mike' | 40' x 15' | Columnar | Ohio | No | Per City Forester Approval | |
| | | | | | | | | | |

## B.5 Prohibited and Restricted Species

Species not generally permitted or recommended for street tree use; use in parks or open spaces may be acceptable.

| Scientific Name | Trade / Common Name | Cultivar Name(s) | Approximate Mature Size (HxW) | Notes | Native | Acceptable Under Electric Wires | |
|---|---|---|---|---|---|---|---|
| *Acer negundo* | Box Elder | | Up to 50' x 40' | Weak structure, invasive tendencies, do not plant | Ohio | No | Do not plant |
| *Acer platanoides* | Norway Maple | | Up to 60' x 40' | Do not plant | No; Invasive, do not plant | - | Do not plant |
| *Acer saccharinum* | Silver maple | | Up to 80' x 50' | Weak structure, do not plant in ROW's or near structures and hard surfaces (aggressive roots) | Ohio | No | Requires extra-large space, without active recreation, buildings or hard surfaces nearby |
| *Ailanthus altissima* | Tree of Heaven | | Up to 75' x 50' | Weak structure, invasive | No; Invasive, do not plant | No | Do not plant |
| *Asimina triloba* | Paw Paw | | Up to 20' x 20' | Do not plant on ROW's. For parks, colonizer for natural areas | Ohio | Yes | |
| *Carya illinoinensis* | Northern Pecan | | Up to 100'x 70'or more | Do not plant on ROW's or near buildings. Park use ok. | North America | No | |
| *Catalpa speciosa* | Northern Catalpa | | Up to 60' x 40' | Do not plant on ROW's. Park use ok. | Ohio | No | |
| *Diospyros virginiana* | Persimmon | | 50' x 30' | Do not plant on ROW's. Colonizer for natural areas | Ohio | No | |
| *Fraxinus spp.* | Ash | | Up to 80' x 50' | If EAB resistant hybrid is found. Do not plant without City Forester permission. | Most Ohio; some exotic | No | 8'x8' is a minimum |
| *Ginkgo biloba* | Ginkgo (female) | | Up to 50' x 35' | Do not plant females or varieties that are not seedless. | No | No | Do not plant |

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|---|---|---|---|---|---|---|---|---|
| *Juglans nigra* | Black Walnut | | Up tp 100' x 80', but normal is 70' x 60' | Do not plant on ROW's or near buildings. Park use ok. | Ohio | No | | |
| *Koelreuteria paniculata* | Goldenraintree | | 30' x 30' | Invasive tendencies, do not plant | No | No | | |
| *Liquidambar styraciflua* | Sweet Gum | | Up to 60' | Do not plant on ROW's or near hard surfaces, unless fruitless. 8' minimum tree lawn required | Ohio | No | 8'x8' is a minimum | |
| *Maclura pomifera* | Osage Orange | | Up to 40' x 40' | Do not plant on ROW or near buildings (fruit) | Ohio | No | | |
| *Malus* | Apple | Edible fruit bearing varieties | Up to 25' x 25' | Do not plant on ROW's. For parks, requires City Forester permission only. | Depends on variety | Yes | | |
| *Morus alba* | White Mulberry | | Up to 30' x 45' | Weak structure, invasive tendencies | No | No | Do not plant | |
| *Morus rubra* | Red Mulberry | | 45' x 40' | Fruit issues, weak | Ohio | No | Do not plant | |
| *Populus* | Poplars (Cottonwood) | | 70' x 40' | Aggressive roots and weak structure | Ohio | No | | |
| *Pyrus communis* | Pear | Edible fruit bearing varieties | Up to 20' x 20' | Do not plant on ROW's. For parks, requires City Forester permission only | No | | | |
| *Pyrus Calleryana* | Callery Pear | All cultivars | Up to 45' | Do not plant - illegal in Ohio. | No; Invasive, do not plant | - | Do not plant | |
| *Prunus persica* | Peach | Edible fruit bearing varieties | Up to 25' x 20' | Do not plant on ROW's. For parks, requires City Forester permission only | No | Yes | | |
| *Quercus acutissima* | Sawtooth Oak | | Up to 45' x 50' | Do not plant on ROW's, messy fruit, and on invasive watch list. | No | No | Do not plant | |
| *Salix sp* | Willow | | Up to 70' x 70' | Aggressive roots, vision obstruction, special purpose trees | Some are, some are not | No | | |

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|---|---|---|---|---|---|---|---|---|---|
| | *Ulmus pumila* | Siberian elm | | Up to 70’ x 50’ | Invasive; weak | No | No | Do not plant | |
| | | | | | | | | | |

Columbus Recreation and Parks Forestry Section will not plant any invasive species on the official Ohio Department of Agriculture list. We work closely with the Ohio Department of Natural Resources, Division of Forestry and communicate about potentially invasive species so that we are aware of any new developments that come in ahead of revisions to the ODA list.

## Appendix C: Tree Protection Signage Example

The following shows an example of tree protection signage, referenced in Section 6.1a.

# Appendix D: Tree Valuation Formula: Cost Approach - Trunk Formula Technique

The primary method of mitigation calculation is $260/inch. However, Forestry has the ability to appraise trees instead of the Fee-in-Lieu. A Public Tree Plan preparer may request an appraisal, but it is up to the discretion of Forestry. If a Tree Appraisal is conducted, Forestry will use the Trunk Formula Technique.

The Trunk Formula Technique appraises larger trees in the landscape within the Cost Approach. Used by professional appraisers, this technique extrapolates costs to purchase the largest commonly available nursery tree relative to the size of the appraised tree. The form used by Forestry arborists is below, from the latest edition of the *Guide for Plant appraisal* released by the Council of Tree and Landscape Appraisers.

## Reproduction Method
## Trunk Formula Technique

Client name _____ Date _____ Case # _____

Phone _____ E-mail _____

Address _____

**Subject tree**

Species _____

1. Trunk diameter* (D) _____ @ _____
2. Cross-sectional area (line 1)$^2$ × 0.7854 _____ in$^2$
3. Condition rating _____ %

   Health _____

   Structure _____

   Form _____
4. Functional limitations _____ _____ %
5. External limitations _____ _____ %

**Replacement tree**

Species _____

6. Trunk diameter* (D) _____ @ _____
7. Cross-sectional area (line 6)$^2$ × 0.7854 _____ in$^2$
8. Replacement tree cost Source: _____ $_____

**Calculations**

9. Unit tree cost (line 8 / line 7 or RPAC) $_____
10. Basic reproduction cost (line 2 × line 9) $_____
11. Depreciated reproduction cost^ (line 10 × line 3 × line 4 × line 5) $_____

**Additional costs**

Cleanup _____ $_____

Replacement tree installation _____ $_____

Aftercare _____ $_____

12. Total additional costs $_____
13. Total reproduction cost (line 11 + line 12) $_____
14. Rounded $_____

* Diameter and cross-sectional area may be replaced with plant area, volume, or height as appropriate.
^ Apply depreciation if it is appropriate for the assignment.

# Appendix E: References to Construction & Materials Specifications

The below items from the City of Columbus Construction & Materials Specifications are relevant to projects with Public Trees in the Work Limits.

https://www.columbus.gov/utilities/contractors/Construction---Materials-Specifications/

101.3 Definitions

107.11 Protection and Restoration of Property

107.12 Contractor's Use of the Project Right-of-Way or other City-owned Property

201 Clearing and Grubbing

655 Tree Protection

657 Tree Well Construction

661 Planting Trees, Shrubs, and Vines

666 Pruning Existing Trees

# Appendix F: Sidewalk Tools, Strategies, and Alternatives for Consideration

The below are intended to be a resource for project owners in the City. The items in this appendix are not required to be implemented.

## F.1 Sidewalk Design

**Full Sidewalk**
Full sidewalks extend from the back of the curb to the edge of the right-of-way. Tree pits should be installed whenever possible on full sidewalks (Figure G1).

Figure G1. Full Sidewalks.
Photo Credit: Eric Fischer (https://commons.wikimedia.org/wiki/File:Fence_and_trees_(37977120831).jpg),

**Tree Well/Pit**
An area within a full sidewalk where the pavement has been removed to accommodate tree planting. (Figure G2).

Figure G2. Tree Pit/Well.
Photo Credit: Wil540, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>

**Tree grates**

Tree grates, often constructed of metal, are installed to cover the tree well and allow pedestrian access through the space (Figure G3).

Figure G3. Tree grate.
Photo Credit: Eric Fischer
(https://commons.wikimedia.org/wiki/File:Double_tree_grate_(41077871680).jpg)

**Contiguous Open Tree Beds**

Contiguous open tree beds are connected and have exposed soil and mulch that can help provide adequate soil volume and space for trees to grow (Figure G4). These planting beds can be curbed or at grade; curbed beds can provide some protection from snow and ice melting products and other elements that may damage trees.

Figure G4. Contiguous Open Tree & Landscape Bed
Photo: sfbetterstreets.org

**Continuous Tree Lawns**

A strip of grass or vegetation between the sidewalk and street, which features trees (Figure G5). To support tree planting in Columbus, the tree lawn must be a minimum of 4-feet wide.

Figure G5. Continuous Tree Lawns.
Photo Credit: Nyttend, Public domain, via Wikimedia Commons
Full URL:
(https://commons.wikimedia.org/wiki/File:Republic_offices_in_Columbus,_trees_along_sidewalk.jpg)

**Bump Outs**

A landscape bump-out/curb extension is a vegetated area that extends into the street, to provide a growing space for trees and plants (Figure G5). These spaces can be used to beautify a streetscape while providing greater stormwater retention and slowing traffic at the bump-out location. Bump outs should be marked in a way to alert drivers of vehicles and snow plows of its presence.

Figure G5. Bump out.
Photo Credit: Mds08011.

**Meandering/Reroute Sidewalk**

A meandering sidewalk is strategically curved to provide more space between the tree and sidewalk (Figure G6).

Figure G6: Meandering sidewalk.
Photo Credit: Payton Chung from DCA, USA
(https://commons.wikimedia.org/wiki/File:Meander_(2285176783).jpg)

**Bridging**

Bridging sidewalks over roots facilitates root growth by raising the sidewalk with concrete piers or a base layer for support (Figure G7).

Figure G7. Sidewalk bridging over tree roots.
Photo: Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida

**Permanent planter**

Decorative planters are containers of varying shapes and sizes that allow for trees and other vegetation to be planted on sites that cannot support trees in-ground (Figure G8). Planters must provide adequate soil volume for the root growth of a small tree species. Soil is the key buffering agent in insulating the trees' roots against winter temperatures, therefore the largest possible planter option should be considered. Tree species will experience a wider range of temperature extremes being in above ground planters. Therefore, species selected for planters should be one-to-two USDA zones hardier (for Columbus, that would be hardiness zones 4 or 5) to increase winter survival potential. Selected species should also be tolerant of drought and restricted or limited soil volume.

Figure G8. Permanent tree planter
Source: New York City DOT - Street Design Manual, https://www.nycstreetdesign.info/furniture/planter

## F.2 Soil Engineering & Alternative Materials

### Soil Cell Systems

Soil cells are engineered systems that help transfer the weight and force of a sidewalk while creating areas of uncompacted soils for tree root growth (Figure G9). The cell systems can be interlocked (depending on manufacturer) and expanded to meet the specific needs of the project. To install soil cells, existing soils are excavated to the desired depth, the area is then compacted, and the soil cell units are installed, filled with un-compacted soil, and topped with the desired hardscape or pavement material. Due to the amount of excavation needed in order to make room for this system, soil cells are best suited for new construction areas or for areas where existing trees will not be impacted. Soil cells provide the greatest amount of un-compacted soil volume. Examples of soil cell systems include Silva Cells and Stratavault Soil Cells.

Figure G9. Stratavault Soil Cells. Photo: CityGreen.com

### Pavement Suspension Systems

Pavement suspension systems were originally designed to suspend hardscape and pavement on soils that lacked the structural cohesion and qualities to support it. One adaptive and beneficial use for trees is in construction of new or expansion of roadways, walkways, and other pavement areas where trees currently exist. Instead of excavating areas to install beds of compaction-suitable material, pilings are driven in a systematic grid and topped with formwork where the desired pavement is installed. The pilings transfer the weight of the pavement down into the ground similar to piling foundations in building construction. The benefit of the system is that the pilings are driven into the ground with minimal disruption to existing tree root systems. An example of this system is the Cupolex system.

### Structural Soil

Structural soils are a specific, usually patented, soil mix that combines clay loam soil with various sized crushed stones (aggregates) and a hydrogel (binding agent), that can be compacted under pavement to give structural support. The aggregates allow for compaction of the structural soil, while creating gaps between the aggregate material for the clay loam soil and tree roots to grow. While it does not create the most optimum conditions for tree growth (when compared to soil cells), structural soils are best suited for compacted areas beneath hardscape improvements that are completely surrounded by large amounts of un-compacted soils and pervious areas. An example of a structural soil manufacturer/provider is the patented structural soil mix patented by Cornell University, termed CU-Structural Soil.

**Pervious concrete**

Mixture of cement, coarse aggregate, and water, using little or no fine aggregate to leave voids that allow water to pass through.

**Permeable interlocking concrete pavers**

Pavers with voids at the joints that create openings for water to pass through (Figures G11 and G12).

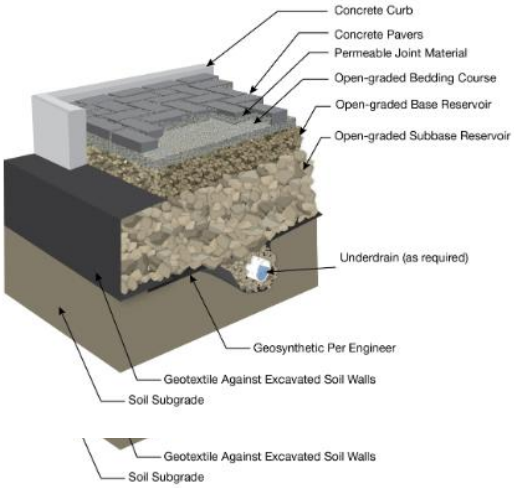

Figure G11. Permeable concrete paver detail
Photo: Portland Cement Association

Figure G12. Permeable Pavers around trees, Hoboken, NJ
Photo: Bruce Ferguson

https://wiki.sustainabletechnologies.ca/wiki/Permeable_pavements

**Rubber/non-concrete sidewalks**

Recycled materials can be used to accommodate tree root growth, frost heave, and foot and vehicular traffic without damage (Figure G13). Santa Monica, CA uses pervious and flexible rubber pavement produced from recycled tires for an ADA compliant walking surface over tree roots that have previously caused sidewalk damage.

Figure G13. Rubber sidewalk near tree. Source: Rubberway (rubberway.com)

## F.3 Remedial Strategies to Address Existing Sidewalk Damage

Although proper planning is the key to avoiding sidewalk conflicts, there are methods of remediation that can be used to mitigate existing issues.

**Bridging**
Raising the sidewalk with concrete piers or a base layer for support – see Section H.1.

**Ramping**
Adding asphalt, concrete, or an alternative material to smoothly join the lifted sidewalk with the original grade (Figure G14).

**Grinding**
Grinding down the edges of a sidewalk to lessen a lift.

**Jacking up**
Pumping grout into a sidewalk's sub-base can create a smooth transition between edges.

**Expanding tree pits**
Removing damaged sidewalk and increasing soil volume for the tree's roots to grow.

**Tree Removal**
Removing a tree causing sidewalk
damage should always be considered the last possible option and should be weighed against the current condition of the tree, the value/benefit it provides to the community, the cost of remediation, and the view/opinion of adjacent Property Owners. See Appendix A for more on evaluation criteria for tree removal.

## F.4 Preventative Strategies to Avoid Sidewalk Damage

Strategic sidewalk design along with the use of engineered soils and alternate materials should be coupled with simple planning approaches – most of which have little or no associated costs.

**Choosing appropriate species**
Some species have more aggressive root systems than others. Choosing the appropriate species based on the site conditions and available space can help reduce hardscape conflicts.

**Root barriers**
Root barriers can be used alongside hardscapes to deflect roots and direct them to grow deeper into the soil. They are made from plastic, fabric, or any impermeable durable material that can withstand burial in soil for an extended period of time; materials are sometimes infused with herbicides. Root barriers must be at least 18” deep, and the top must be above soil grade to be effective. In compacted soils, and soils with a high water table, roots may grow under the barrier and up the other side, but in well-drained soil, roots may remain at deeper depths longer.

**Setback plantings**
Setback trees are planted beyond the public Right of Way (BROW) on Private Property. BROW plantings may be the best or only option depending on the sidewalk or site’s condition. This approach requires coordination with Property Owners, as the City only performs work within the public ROW.

**Incentives for Private Property**
Providing an option for residents to plant a tree on their property for a subsidized, low, or no cost may increase their level of participation.

## F.5 Using an Air Spade

Air spading is a method used in arboriculture to excavate soil around a tree without damaging its roots. The process uses compressed air to break up and remove soil, allowing arborists, landscapers, or other professionals to access the tree's root system without the risk of cutting or tearing the roots, as might happen with traditional digging tools. An air spade is a specialized tool that directs a high-velocity stream of air into the soil. It looks somewhat like a large, metal wand connected to a compressor.

**Examples of when and air spade may be used:**

- ***Soil Excavation:*** The air spade is used to blow soil away from the roots, breaking up compacted soil without harming the delicate root structures.

- ***Root Inspection***: Air spading is often used when there's a need to inspect a tree's roots for disease, damage, or other issues. By removing the soil, arborists can get a clear view of the root system.

- ***Root Pruning***: If damaged or diseased roots are found, they can be pruned without further excavation. The air spade allows for precise access.

- ***Soil Aeration:*** Compacted soil can be detrimental to tree health, limiting access to water, nutrients, and oxygen. Air spading can break up compacted soil, improving conditions for the tree.

- ***Transplanting:*** If a tree needs to be moved, air spading can be used to free the root system with minimal damage, making transplantation more successful.

- ***Adding Soil Amendments***: After inspecting and possibly pruning the roots, soil amendments can be added to improve soil quality, and then the soil can be replaced.

- ***Utility Work***: Sometimes, air spading is used in urban environments to access utilities that are near trees, allowing workers to reach pipes or cables without damaging nearby trees.

Air spading is considered a best practice in situations where root access is needed, as it minimizes stress and damage to the tree. The use of an air spade requires specialized equipment and professional expertise, and is typically done by trained arborists or other tree care professionals.