TCIA (ASC A300) (Tree Care Industry Association) Revision BSR A300-202x
A300 Tree Care Standards
(revision, redesignation and consolidation of ANSI A300 Part 1-2017
ANSI A300 Part 2-2018
ANSI A300 Part 3-2013
ANSI A300 Part 4-2014
ANSI A300 Part 5-2019
ANSI A300 Part 6-2012 (R2018)
ANSI A300 Part 7-2018
ANSI A300 Part 8-2019
ANSI A300 Part 9-2017
ANSI A300 Part 10-2016)

A300 Tree Care Standards
for trees, shrubs, palms, and other woody landscape plants

Secretariat
Tree Care Industry Association, Inc.

Upon approval by ANSI, this consolidated standard will be published by:
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Foreword This foreword will not be considered part of the revised, redesignated, and consolidated American National Standard (ANSI) A300-202x, upon approval by ANSI.

ANSI A300 is a set of consensus standards for the care of trees, shrubs, palms, and other woody landscape plants. The standards apply to arborists, urban foresters, horticulturists, landscape architects, and others who care for or manage these plants for property owners, property managers, businesses, governments, and utilities. They may serve as the basis for work specifications, training, best practices, regulations, and other measures of performance. Although the standards should be used to develop specifications for work assignments, they are not intended to be used as work specifications in and of themselves. Applying the standards will require the addition of measurable criteria based on individual tree and site characteristics. ANSI A300 standards are not intended to apply to agriculture, horticultural production, or silviculture.

Individual and collections of urban trees provide significant benefits to tree owners and communities. Specifying work that complies with ANSI A300 standards will improve the quality of care, enhance the benefits, and reduce risk that trees pose to people and property. However, unlike most manufacturing and construction standards, A300 standards apply to a service, which in turn is applied to a living resource. As such, they must be flexible enough to accommodate the varying characteristics of individual plants and management objectives while still providing meaningful guidance to service providers.

Prior to creation of these standards, tree care guidance in the United States was disparate and often in conflict. Recognizing this concern, green industry associations, government agencies, and tree care companies came together in 1991 to develop American National Standards based on a systematic approach and grounded in science. The National Arborist Association (now the Tree Care Industry Association, TCIA) became the ANSI-accredited Standards Development Organization (SDO) and formed the Accredited Standards Committee (ASC) A300. TCIA continues to oversee the development of ANSI A300 standards as secretariat.

In 1995, Part 1, *Pruning* was published as the first ANSI A300 Standard. This was followed by Part 2 *Fertilization* (1998, now *Soil Management*); Part 3, *Cabling and Bracing* (2000, now *Supplemental Support Systems*); Part 4, *Lightning Protection* (2002); Part 5*, Management of Trees and Shrubs During Site Planning, Site Development, and Construction* (2005); Part 6, *Transplanting* (2005, now *Planting and Transplanting*); Part 7, *Integrated Vegetation Management* (2006); Part 8, *Root Management* (2013); Part 9, *Tree Risk Assessment* (2011); and Part 10, *Integrated Pest Management* (2016).

In 2022, the ASC consolidated the ten separate ANSI A300 parts into a single document, which will continue to be periodically revised. During consolidation, the ASC reviewed each part to ensure that terms and language were used consistently, and that the structure and flow of each part reflected the process typically followed in the field. Each part contains a flow-chart to illustrate the process.

ASC A300 meets regularly to review and revise ANSI A300 standards, and to develop new parts if necessary. Per ANSI requirements, the ASC operates with respect to openness, transparency, due process, and consensus. The committee includes broad-based industry representation with knowledge and technical expertise from residential and commercial tree care, utility, landscape, and nursery industries; municipal and federal government; the public; and others. As standards are developed and revised, drafts are submitted for public comment. All public comments are considered by the committee.

This draft is a public review document. The public review period starts on December 30, 2022 and ends on February 13, 2023. This document is not approved as a draft for trial use.

How to file a public review comment: Official public comments must be entered on the TCIA website portal, located on the TCIA website (scroll down):
https://www.tcia.org/TCIA/Build_Your_Business/A300_Standards/Current_Projects.aspx

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Comments must be filed before the deadline of 11:59 PM Eastern Standard Time (EST) on Febuary 13, 2023 in order to be considered, no exceptions will be made for late comments. You will be asked to register to gain access. Responses to official comments will be provided. Comments may be forwarded to ASC A300 members and/or the TCIA secretary, however comments that are forwarded to ASC A300 members or the TCIA Secretary and are not entered online will not be recorded as official comments and a response will not be provided. If you require an official response, you must post your comments on the TCIA website portal.

Information requests regarding this document must be forwarded to: rrouse@tcia.org, A300 Secretary, c/o Tree Care Industry Association, Inc. 670 N. Commercial St. Suite 201 Manchester NH 03101.

ASC A300 approval of this draft does not imply that all committee members voted for its release for public review.

The ASC A300 had the following members as of December 30, 2022:

Sam Hill, Chair
(Sam Hill Tree Care)

Bob Rouse, Secretary
(Tree Care Industry Association, Inc.)

Organizations Represented	**Name of Representative**
AmericanHort	Craig Regelbrugge
American Society of Consulting Arborists	Andrew Mertz Ryan Thomas (Alt.)
American Society of Landscape Architects	Vacant
Asplundh Tree Expert Company	Stephen Hilbert Geoff Kempter (Alt)
Bartlett Tree Expert Company	Wayne Dubin Dr. Thomas Smiley (Alt.)
Davey Tree Expert Company	Dr. AD Ali David Bargerstock (Alt.)
International Society of Arboriculture	Dr. Richard Hauer Rhonda Wood (Alt.)
Professional Grounds Management Society	Gene Pouly Mark Hoenigman (Alt.)
Arbor Day Foundation (ADF)	Peter Smith
National Association of Landscape Professionals (NALP) SavATree	Vacant JP McDonnell Mike Galvin (Alt)
Society of Commercial Arborist	Steve Chisholm Jr Torrey Young (Alt)

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Society of Municipal Arborists	Sam Oludunfe Gordon Mann (Alt.)
Tree Care Industry Association	Tom Mugridge
Tree Care Industry Association – Associate Members (Vendors)	
	Patrick Anderson Roger Mellick (Alt)
USDA Forest Service	Jill Johnson
Utility Arborist Association	William Haws James Cooley (Alt.)

Additional organizations and individuals:
Tim Bushnell - Past Chair (Observer)

Mission: To develop consensus performance standards for the professional management of trees, shrubs and other woody plants.

Vision: ANSI A300 standards will be the foundation for work specifications, training materials, quality protocols, and regulations for the management of trees, shrubs, palms, and other woody landscape plants.

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1 ANSI A300 standards

1.1 Scope

ANSI A300 performance standards cover the care and management of **trees**, **shrubs**, **palms**, and other woody landscape plants.

1.2 Purpose

ANSI A300 standards are intended for the development of work practices, written **specifications**, best practices, regulations, and other guidance documents.

1.2.1 These standards may be excerpted or incorporated by reference; however, they are not intended to be adopted in their entirety into laws and regulations or as work specifications without additional information and clarification (A reference to an annex to be developed will be placed here – *Annex X Specification writing guideline*).

1.3 Application

ANSI A300 standards shall apply to any person or entity engaged in the management of trees, shrubs, palms, or other woody plants, including federal, state or local agencies, utilities, **arborists**, consultants, arboricultural or landscape firms, horticulturalists, landscape architects, and managers or owners of property.

1.3.1 ANSI A300 standards shall not apply to commercial agricultural, horticultural production, or silviculture unless this standard, or a portion thereof, is expressly referenced in other standards or specifications.

2 Safety

2.1 This performance standard shall not take precedence over applicable industry safe work guidelines, regulations, and standards.

2.2 Performance, including operations in proximity to energized conductors, shall comply with applicable Federal Occupational Safety and Health Administration (OSHA) standards, ANSI Z133, and state and local laws and regulations as they apply.

3 Normative references

The following standards contain provisions, which, through reference in the text, constitute provisions of this American National Standard. All standards are subject to revision, and parties to agreements based on this American National Standard shall apply the most recent edition of the standards indicated below.

ANSI Z133 *for Arboricultural Operations – Safety Requirements* [1]

29 CFR 1910, *Occupational Safety and Health Standards (General Industry)* [2]

16 U.S.C. §§703-711, *Migratory Bird Treaty Act* [3]

16 U.S.C. 1531-1544, *Endangered Species Act* [3]

[1)] Available from the International Society of Arboriculture, www.isa-arbor.org

[2)] Available from U.S. Department of Labor, www.osha.gov

[3)] Available from U.S. Fish and Wildlife Service, www.fws.gov

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4 General (*Clause 4 General* applies to the whole A300 standard)

4.1 Inspection

Information related to the tree(s) and site shall be obtained prior to developing work specifications. Specific clauses of this standard may have additional inspection requirements and recommendations.

4.1.1 This inspection shall not be considered a tree risk assessment.

4.1.2 The location of utilities and other obstructions both below and above ground shall be considered prior to starting operations. Utilities and other obstructions may include:

Gas;

Electric;

Communications;

Water and sewer;

Drainage; and

Signage.

4.2 Work-site inspection

4.2.1 In addition to required safety procedures, the **arborist** or **qualified professional** performing the work should conduct a visual inspection of the tree and site to identify conditions that would affect the scope of work.

4.2.2 This inspection shall not be considered a tree risk assessment.

4.2.3 Conditions that would affect, or are outside of, the scope of work should be reported to an immediate supervisor or to the **client**.

4.2.4 When the scope of work is limited by property boundaries, easements, or other constraints, inspection of plants or parts of plants outside of the assigned scope of work shall not be required.

4.3 Objectives

4.3.1 One or more objective(s) shall be specified as detailed in the individual clauses of this standard.

4.4 Work Specifications

4.4.1 Work specifications shall be developed before proposing or commensing any tree care operation.

4.4.2 Work specifications should be written and administered by an arborist or other qualified professional.

4.4.3 Tree care operations shall be performed by arborists or other qualified professionals who, through related training and on-the-job experience, are familiar with the standards, practices, and hazards of **arboriculture** operations and equipment.

4.5 Work practices

4.5.1 Equipment and tools used in tree care operations shall be maintained according to manufacturers' recommendations.

4.5.2 Work practices that damage living tissue, other plants or property, beyond the scope of normal work practices, shall be avoided.

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4.5.3 Damage to nearby plants, other parts of the tree, people, or property should be avoided.

4.5.4 All tree work shall be in compliance with minimum approach distance (MAD) - Table 1 in ANSI Z133 for overhead, energized conductors.

4.5 Tools and equipment

4.5.1 Tools shall be appropriate for the job.

4.5.2 Equipment and tools shall be used and maintained according to manufacturer's recommendations.

4.5.3 Saws, pruners, shovels, drill bits, chisels, and other cutting tools shall be maintained sharp.

4.5.4 Climbing spurs shall not be used when pruning, installing, or inspecting supplemental support systems, lightning protection systems, or conducting other tree care operations.

4.5.5 Hydraulic equipment shall be calibrated to deliver an accurate dose of material to the targeted plant.

4.5.6 Spray equipment should provide adequate agitation to keep products mixed and in suspension.

4.5.7 Cable grips used for tensioning shall be designed for use with the type of cable.

4.6 Monitoring and Maintenance

4.6.1 A **monitoring** interval should be recommended.

4.6.2 Maintenance recommendations shall be made to the client.

4.6.2 Scheduling of monitoring and maintenance shall be the responsibility of the client.

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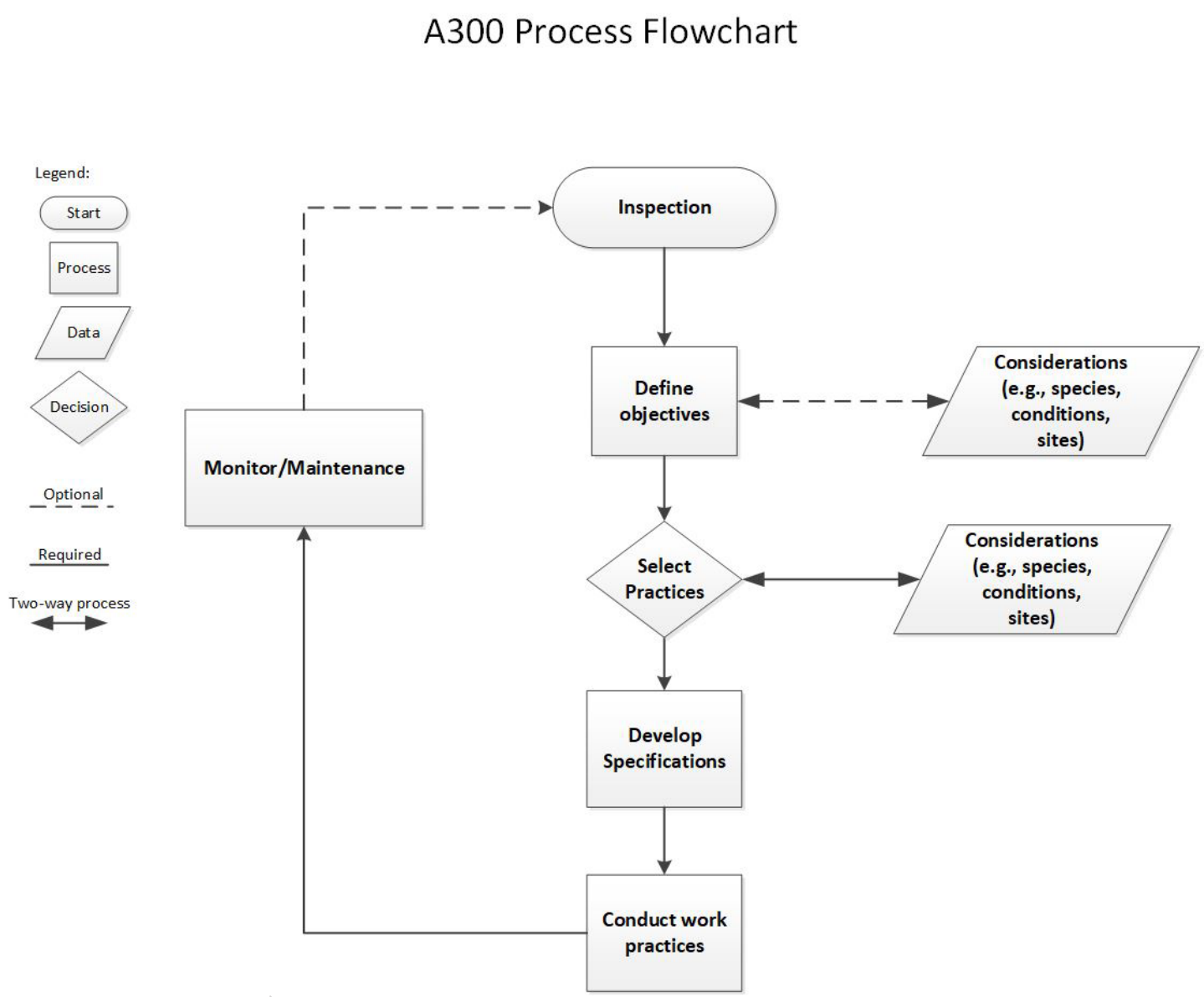


Fig. 4 A300 conceptual process flowchart

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5 Pruning standards

5.1 All requirements in *Clause 4 General* shall apply to Clause 5.

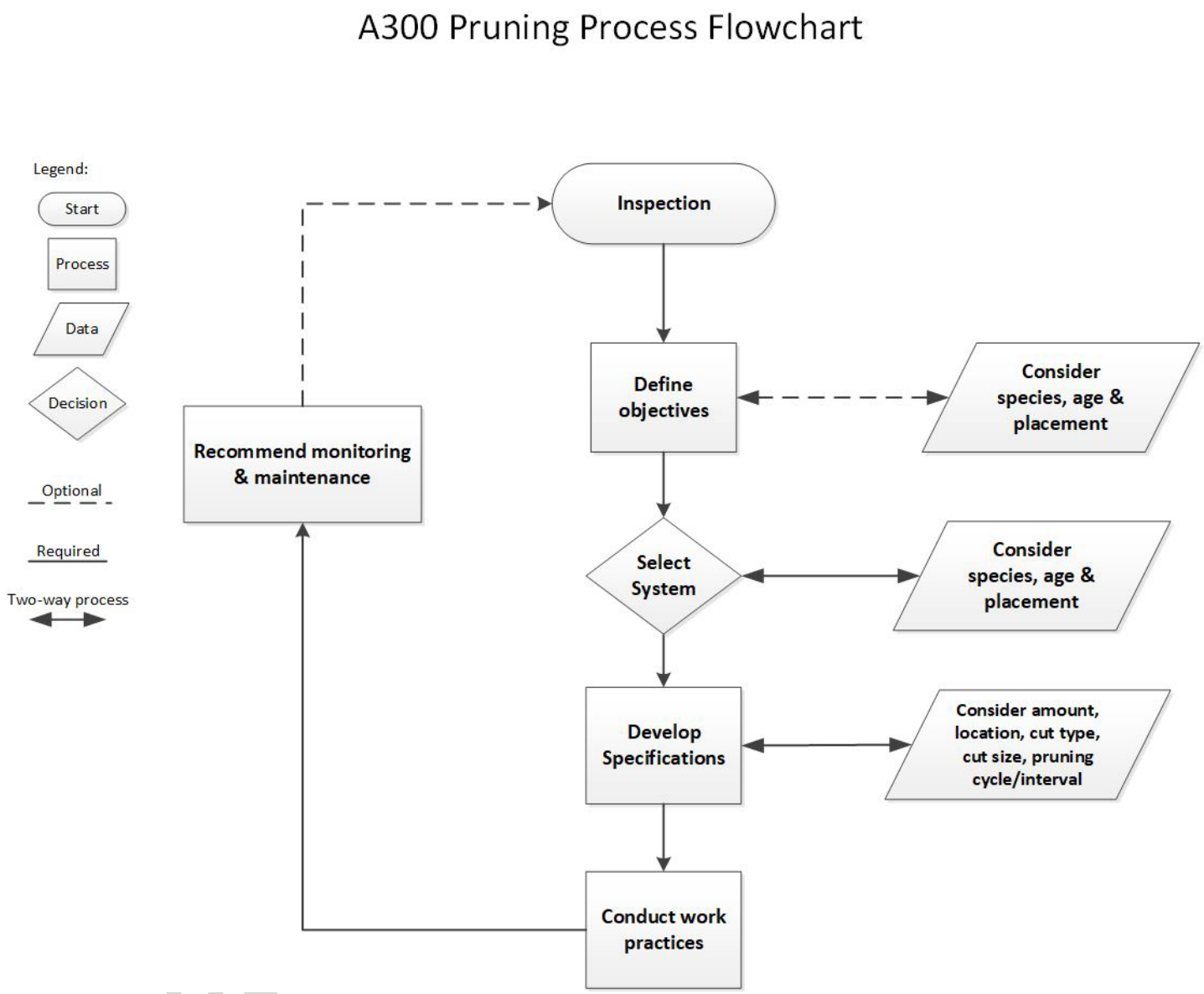


Fig. 5 Pruning process flowchart.

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5.2 Inspection

5.2.1 Trees to be pruned shall be inspected prior to conducting work.

5.3 Pruning objectives

5.3.1 Objectives may include:

Manage risk (see *Clause 13 Tree Risk Assessment* and *Clause 7 Supplemental Support Systems*).

Manage health (see *Clause 6 Soil Management* and *Clause 14 IPM*)

Develop structure. Examples include:

Improving **branch** and **trunk** architecture;

Promoting or **subordinating** certain **stems** or branches;

Promoting desirable branch spacing;

Promoting or discouraging growth in a particular direction (**directional pruning**);

Minimizing future interference with traffic, lines of sight, infrastructure, or other plants;

Restoring plants following damage; and,

Rejuvenating shrubs.

Provide clearance. Examples include:

Promoting safe and reliable **utility** services;

Minimizing current interference with traffic, lines of sight, infrastructure, or other plants;

Providing access to sites, buildings, or other structures; and,

Complying with regulations.

Manage size or shape.

Improve aesthetics.

Manage production of fruit, flowers, or other products (see *subclause 1.3.1* for exceptions).

Manage wildlife habitat.

5.3.2 The **pruning system**, plant health, growth habit, structure, species characteristics, expected response, and the ability of a plant to sustain the amount of pruning proposed shall be considered when establishing pruning objectives.

5.3.3 Pruning systems

5.3.3.1 A pruning system should be specified to achieve the desired long-term form of the plant.

5.3.3.2 Consideration shall be given to the ability of the plant to respond to the selected pruning system.

5.3.3.3 A **natural system** should be specified to maintain characteristic growth habit and adaptations (e.g., prior pruning, storm damage).

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5.3.3.3.1 A **natural system** should allow for changes in appearance resulting from pruning when achieving certain specified objectives. Examples include:

Reducing crown or branches;

Raising crowns;

Developing or improving structure;

Providing clearance;

Improving tree health;

Mitigating risk; and,

Enhancing views.

5.3.3.4 Pollarding (system)

5.3.3.4.1 A pollarding system **may** be specified to maintain crown size and achieve a desired aesthetic.

5.3.3.4.2 Trees selected for pollarding should be of an appropriate size, species, and age.

5.3.3.4.3 Pollarding shall not be initiated on mature trees.

5.3.3.4.4 A plan shall be made for the periodic removal of **shoots**.

5.3.3.4.5 To initiate pollarding, **heading** cuts should be made at specified heights or locations in the crown, after which no additional heading cuts should be made.

5.3.3.4.6 Existing **pollard heads** should not be damaged or removed. Shoots growing from the pollard heads should be removed at an appropriate time, usually during the dormant season.

5.3.3.4.7 Shoots should be removed at intervals of three years or less. The recommended shoot removal interval should be determined by species, plant health, climate, and design intent.

5.3.3.4.8 Existing pollarded trees should be maintained as pollards.

5.3.3.5 Topiary (system)

5.3.3.5.1 A topiary system may be specified to develop a distinct form or desired shape, such as a hedge.

5.3.3.5.2 Plants selected for a topiary system should be of an appropriate size, species, and age.

5.3.3.5.3 The shape of the topiary should be determined and specified prior to the start of pruning.

5.3.3.5.4 Selective pruning and **shearing** should be performed as needed to develop and/or maintain the desired shape.

5.3.3.6 Espalier (system)

5.3.3.6.1 An espalier system may be specified to develop and/or maintain plants in a **planary form**.

5.3.3.6.2 Plants selected for an espalier system should be of an appropriate size, species, and age.

5.3.3.6.3 Branches that extend outside the desired plane of growth shall be pruned and/or tied back.

5.3.3.6.4 Ties shall be replaced or adjusted as needed to prevent stem or branch girdling.

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5.3.3.7 Pleaching (system)

5.3.3.7.1 A pleaching system may be specified to achieve a desired form through pruning, interweaving and tying branches to one another, or to a frame.

5.3.3.7.2 Plants selected for a pleaching system should be of an appropriate size, species, and age.

5.3.3.7.3 When pleaching is initiated, branches not included within the desired form should be reduced, removed, or tied to other branches or a frame.

5.3.3.7.4 New shoots not growing within the desired form should be periodically pruned, or tied or woven into the desired form.

5.3.3.7.5 Ties shall be replaced or adjusted as needed to prevent stem or branch girdling.

5.4 Pruning specifications (see *Fig. 5.1* and a reference to an annex to be developed will be placed here – *Annex X Specification writing guideline*)

5.4.1 Pruning specifications shall include:

Physical location of the plants to be pruned;

Pruning objectives;

Type of parts to be removed (e.g., living or dead branches, fruit, mistletoe); and,

Plan for removal, disposal, or repurposing of pruning by-products.

5.4.2 Pruning specifications should include:

Pruning system;

Pruning cut types (e.g. removal, reduction, heading, shearing);

Estimated **pruning amount** (e.g., percent range of foliage or crown, number of branches to be removed);

Size range (e.g., diameter, length) of parts to be removed;

Location in crown of parts to be removed (may include Images or figures); and,

Other information as necessary (e.g., time frame for work implementation, topiary shape, clearance distances, desired views, lines of sight, identification of obstacles or hazards (e.g., utilities, structures).

5.4.3 Pruning operations should remove no more living material than what is necessary to achieve specified objectives.

5.4.4 Species, size, age, condition, and site shall be considered when specifying the location and amount of living material to be removed.

5.5 Pruning Practices

5.5.1 Pruning cuts should be the smallest diameter and fewest number required to meet the specified objective.

5.5.2 Branches shall be precut when necessary to avoid splitting of the wood or tearing of the bark (see *Fig. 5.5.2*).

Fig. 5.5.2 A pre-cut branch

5.5.3 When removing a branch with a narrow angle of attachment, the cut should be made from the outside of the branch to prevent damage to the remaining branch or stem (see *Fig. 5.5.3*).

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Fig. 5.5.3 Removing a branch with narrow angle of attachment

5.5.4 When removing a branch or stem which has included bark, the cut should be made as close as possible to the point where the bark of the stems contact without damaging the remaining stem (see *Fig. 5.5.4*).

Fig. 5.5.4 Removing a branch which has included bark

5.5.5 When removing a dead branch or stem, the final cut shall be made beyond living tissue, without leaving a dead **stub** (see *Fig. 5.5.5*).

Fig. 5.5.5 Removing a dead branch

5.5.6 The final pruning cut should leave adjacent bark firmly attached.

***5.5.*7** Interior and lower branches should be retained when compatible with objectives and system.

5.5.7.1 The majority of **reduction** and removal cuts of live branches should be made in the outer crown.

5.5.8 A **flush cut** is not an acceptable pruning practice (see *Fig. 5.5.8*).

Fig. 5.5.8 A flush cut, not an acceptable practice

5.5.9 Branch removal cuts

5.5.9.1 A branch removal cut shall be made without cutting into the **branch bark ridge** or **branch collar**, or leaving a stub (see *Fig. 5.5.9.1*).

Fig. 5.5.9.1 A branch removal cut

5.5.9.2 When a branch collar is not apparent, the branch removal cut shall be made without cutting into the branch bark ridge or, **parent stem**, and shall not leave a stub (see *Fig. 5.5.9.2*).

Fig. 5.5.9.2 A branch removal cut when a branch collar is not apparent

5.5.10 Reduction cuts

5.5.10.1 A reduction cut should only be made to a live lateral branch or codominant stem when it can be expected to sustain the remaining branch or stem.

5.5.10.1.2 The remaining lateral branch should typically be at least one-third the diameter of the stem or branch being removed.

5.5.10.2 A reduction cut should be made at a slight angle to the remaining branch or codominant stem, without damaging the branch bark ridge and without leaving a stub (see *Fig. 5.5.10.2*).

Fig 5.5.10.2 A reduction cut

5.5.11 Heading cuts

5.5.11.1 A heading cut should only be made when necessary to conform with certain pruning systems (e.g., Initiation of a pollarding system, topiary pruning), or to accomplish specific pruning objectives. Examples include:

Structural development on young plants;

Mitigating risk, where reduction to a suitable lateral branch is not practical, where no such branch is present, or where cutting to such a branch does not achieve the objective;

Restoration of damaged plants as an alternative to tree or branch removal;

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Rejuvenation of shrubs;

To avoid making an unneccessarily large branch removal cut where an appropriate lateral branch is not present; and,

Conserving or creating wildlife habitat.

5.5.11.2 A heading cut should only be made when it can be expected that the remaining lateral(s) or shoots that grow from retained buds are able to sustain the remaining branch or stem.

5.5.12 Shearing cuts

5.5.12.1 Shearing may be performed to accomplish specified objectives within the topiary system.

5.5.12.2 Shearing should be performed on appropriate species and at intervals that minimize negative effects on plant health.

5.5.12.3 Shearing cuts should only be made to stems capable of generating new shoots.

5.5.12.4 Reduction cuts should be considered after shearing when necessary.

5.5.13 Rigging or other equipment should be used to control and lower heavy plant parts to the ground.

5.5.14 Climbing spurs shall not be used when entering and climbing trees for the purpose of pruning or other tree maintenance, except in situations where other means are impractical, such as:

Remote/rural utility rights-of-way;

When branches are more than throw-line distance apart and there is no other means of climbing the tree;

When the outer bark is thick enough to prevent damage to the inner bark or **cambium**; and,

Emergency operations.

5.5.15 Cut or detached branches shall be removed from the **crown** upon completion of pruning, at times when the tree would be left unattended, or at the end of the workday, unless otherwise specified in the scope of work.

5.5.16 When pruning has a high potential to spread pests, appropriate precautions should be taken (see *Clause X*, *Integrated Pest Management*).

5.5.17 When pruning has a high potential to result in sunscald, a temporary protective covering for vulnerable areas of bark should be considered.

5.6 Wound treatment

5.6.1 Wound treatments should be used only when necessary to prevent the spread of pests or for other specified reasons.

5.6.2 Wound treatments that damage the plant shall not be used.

5.6.3 When treating damaged bark, only loose or damaged tissue shall be removed.

5.7 Clearance pruning

5.7.1 Branches growing toward specified **clearance areas** should be reduced to lateral branches or removed to parent stems growing outside and/or away from the clearance area.

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5.7.2 When a minimum clearance distance is required, a branch removal or reduction cut should be made beyond the specified clearance distance at a suitable branch **union**.

5.7.2.1 When a reduction cut cannot be made to a suitable lateral branch, and to avoid an unneccesarily large pruning cut at the parent stem, a heading cut should be considered.

5.7.3 When frequent or excessive pruning is required to achieve objectives due to species, growth habit and/or location, alternatives such as relocation, treatment with growth regulators, or removal and replacement with an appropriate plant, should be considered.

5.8 Lion tailing

When pruning trees using the natural system, the removal of interior lateral branches that results in a concentration of foliage at branch ends shall not be considered an acceptable pruning practice.

5.9 Topping

Reduction of tree size by cutting to stubs without regard for long-term tree health or structural integrity, shall not be considered an acceptable pruning practice.

5.10 Mechanical branch cutting

5.10.1 Mechanical cuts should avoid stem wounding and be made outside the branch collar and bark ridge.

5.10.2 **Mastication**, the indiscriminate grinding of tree and shrub parts into smaller pieces by heavy equipment, shall not be considered an acceptable branch cutting practice.

5.11 Pruning palms, cycads, and plants with similar form

5.11.1 Dead, damaged, or loose **fronds** should be pruned when necessary to reduce risk or improve aesthetics.

5.11.2 Fronds should be removed by making a cut close to the **petiole** base without damaging living trunk tissue.

5.11.3 Living fronds should not be removed except to provide clearance.

5.11.4 Fruits that pose an unacceptable risk or nuissance, or flowers leading to the development of such fruits, should be removed.

5.11.5 Palms that could grow into and damage or interfere with electric utility or other infrastructure should be pruned, relocated, or removed.

5.11.6 Yellowing fronds that are not diseased or infested should be retained, except when they pose safety or aesthetic concerns.

5.11.6.1 Diseased or infested palms should be treated, or fronds removed, when necessary to reduce the spread of pests and/or to protect the health of the palm (see *Clause 14, Integrated Pest Management*).

5.11.7 If all or most fronds are damaged (e.g., following high winds or frost), damaged green fronds that do not pose unacceptable risk should be retained until new fronds develop.

5.11.8 To ensure worker safety, removal of **palm frond skirts** shall be performed from the top down.

5.11.9 When removing dead petiole bases (skinning, peeling, shaving, debooting), living trunk tissue should not be damaged.

5.11.10 When palm pruning practices have a high potential to spread pests, appropriate precautions shall be taken.

5.11.11 Climbing spurs should not be used to climb live palms.

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5.11.12 Disposal of pruning by-products should be specified per *subclause 7.11 Removal, disposal or repurposing.*

5.12 Bamboo

5.12.1 Culms and branches shall be pruned by making cuts just above **nodes**, without leaving a stub (see *Fig. 5.12.1*).

Fig. 5.12.1 Bamboo pruning cut location

5.13 Emergency pruning operations

5.13.1 Exemptions to the non-safety related clauses of this standard shall be allowed during emergencies, including those declared by federal, state, and local governments, and utilities or other critical service providers, when services must be restored.

5.13.2 Following the emergency, restoration pruning should be considered.

5.14 Removal, disposal, or repurposing

5.14.1 A plan for removal, disposal or repurposing of pruning by-products shall be specified (A reference to an annex to be developed will be placed here, Annex X – *Urban forest products flowchart*).

5.14.2 Disposal of pruning by-products shall comply with applicable regulations, including quarantines.

5.14.3 Pruning by-products should be repurposed when feasible (eg. creating mulch, firewood, wood products).

5.15 Monitoring and maintenance

5.15.1 At the completion of the work, the jobsite should be inspected by an arborist or qualified professional to ensure the work specifications were achieved.

5.15.1 Monitoring intervals should be recommended and based on the objectives, pruning system, plant health, site/location, species, and growth rate *(see subclause 4.6)*.

5.15.2 Monitoring and maintenance scheduling shall be the responsibility of the client.

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6 Soil Management a. Assessment, b. Modification, c. Fertilization, and d. Drainage standards

6.1 All requirements in *Clause 4 General* shall apply to Clause 6.

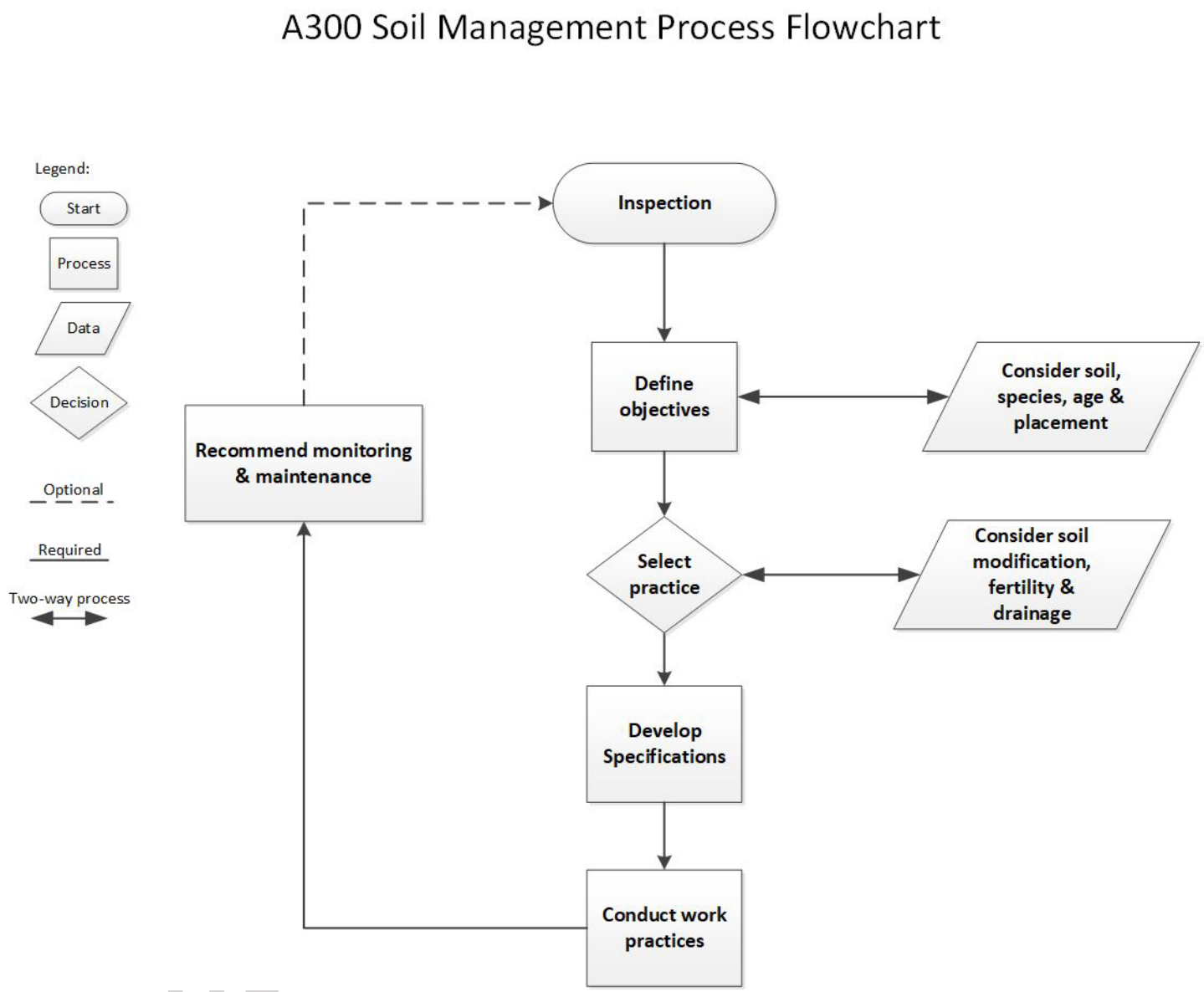


Figure 6 Recommended procedural flowchart for soil management operations.

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6.2 Inspection

6.2.1 Prior to making recommendations or developing specifications, the plant, site and/or soil shall be assessed.

6.3 Soil Assessment

6.3.1 Soil assessment should include the evaluation of one or more of the following:

Site topography (surface drainage);

Soil profile;

Soil drainage (infiltration and percolation);

Depth to water table;

Presence of impermeable layers;

Soil texture;

Bulk density;

Salts;

Nutrients and pH; and,

Organic matter content.

6.3.2 Samples collected for soil **nutrient analysis should be representative of the site (see Annex xx).**

6.4 Soil Management objectives

6.4.1 Objectives should include, but are not limitedto, one or more of the following:

Assess soils to identify problems to improve tree health or avoid future problems;

Manage soil **organic matter** content;

Mitigate soil compaction;

Reduce plant competition;

Correct **nutrient** deficiencies;

Moderate soil temperatures;

Improve **soil structure**;

Manage soil moisture content;

Manage soil biology; and,

Reduce soil erosion.

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6.5 Soil Management specifications

6.5.1 Specifications for soil assessment and/or management should include:

Objectives of the assessment or treatment;

Location of the plant(s) and/or site;

Assessment or treatment methodology; and,

Details of the assessment or treatment, such as:

Type, number, and depth of soil samples;

Depth of treatment;

Materials and rates to be applied;

Treatment area;

Type and depth of mulch;

Fertilizer type, analysis, and rate, and areaof application;

Soil moisture condition at the time of treatment;

Location, depth, covering (e.g., fabric, gravel), and type of drainpipe; and,

Time period to conduct the assessment or treatment.

6.6 Soil Management practices

6.6.1 Specified soil management practices should include, but are not limited to, one or moreof the following:

Assessing soil conditions;

Soil modification;

Adding amendments;

Tilling (cultivating) soil;

Amending **mulch**;

Applying fertilizers; and,

Altering drainage.

6.6.2 Soil Management work practices

6.6.2.1 Products and equipment shall be used in accordance with federal, state, and local regulations and should be used in accordance with manufacturers' recommendations.

6.6.2.2 To achieve the specified objective(s), site factors shall be considered, including proximity to waterways, past soil management practices, slope, and irrigation.

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6.6.2.3 Plant conditions such as disease, insect infestations, and herbicide damage shall be considered prior to treatment.

6.6.2.4 Practices that reduce natural leaf litter accumulation within the root zones of plants should be avoided unless it is harmful to the plant

6.7 Soil Management a. Soil Modification practices

6.7.1 Soil modification shall include one or moreof the following:

Addition of **soil amendments**;

Tilling; and/or,

Modifying mulch.

6.7.2 Soil amendments

6.7.2.1 If soil organic matter is outside of the desirable range, treatment should be recommended.

6.7.2.2 To slowly increase organic matter content, organic materials should be applied to the soil surface such as **organic mulch**.

6.7.2.3 To quickly increase organic matter content, composted organic materials should be incorporated into the soil.

6.7.2.4 To promote plant establishment, organic matter should be incorporated uniformly into the soil volume where root growth is desired.

6.7.2.5 When amending the soil of established plants, soil amendments should be incorporated using techniques that minimize root damage such as hydraulic injection, **vertical mulching**, or air-tilling techniques.

6.7.2.6 **Composts**, when used as soil amendments, should be tested by a qualified laboratory for chemical properties, such as pH, **salt index**, organic-matter content and carbon-to-nitrogen ratio.

6.7.3 Soil tilling (cultivation)

6.7.3.1 Soil tilling should include one or more of thefollowing methods:

Mechanical tilling such as with a tractor-pulled plow, rototiller, shovel, or hard rake;

Holes vertically augured into the soil;

Pneumatic soil loosening under high-pressure air; and/or,

Hydraulic soil loosening under high-pressure water.

6.7.3.2 Mechanical tilling should not be used within the **critical root zone** of trees.

6.7.3.3 Pneumatic soil tilling should be considered the preferred method to mitigate compacted soil within the root zones of plants.

6.7.3.4 **Compacted soils** should be moist but not saturated before being loosened using pneumatic excavation tools.

6.7.3.5 Soil amendment should be incorporated during tillage.

6.7.4 Mulching

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6.7.4.1 **Coarse wood-chip mulch** that is fresh or partially composted should be preferred for surface application.

6.7.4.2 Wood-chip mulch from a tree species known to cause an **allelopathic** response in the plants being mulched, contaminated by a transmittable disease, or containing seeds of undesirable plant species should be avoided.

6.7.4.3 If the objective is to improve soil structure and/or improve soil organic matter content, plastic sheeting shall not be used as mulch or under mulch.

6.7.4.4 If the objective is to improve soil structure and/or improve soil organic matter content, **geotextile fabric** should not be used under mulch.

6.7.4.5 Mulch shall not be placed against tree trunks or cover tree **root flares**.

6.7.4.6 Mulch should be applied over as much of the root zone as practical.

6.7.4.7 Mulch should be applied and maintained at a depth of 2-4 inches (5-10 cm).

6.7.4.8 Excess, **anaerobic,** or contaminated mulch should be removed and replaced with a more appropriate mulch and/or to a shallower depth.

6.7.4.9 The ignitability of mulches shall be considered.

6.8 Soil Management b. Fertilization practices

6.8.1 Soil modification to improve nutrient uptakeshall be considered prior to or in conjunction with fertilization.

6.8.2 Soil and/or foliar nutrient analysis, visual assessment of the plant, and/or knowledge of local plant growth shall be used as the basis for fertilizer recommendations.

6.8.3 Fertilizer specifications should include:

Type (e.g., name, quick or slow release);

Fertilizer analysis;

Time frame for application;

Method of application (e.g., soil injection, soil incorporation);

Application area; and,

Fertilizer rate (lbs./1000 sq. ft., kg/ m^2).

6.8.4 The preferred fertilizer should be a **slow- or controlled-release** product with a low salt index.

6.8.5 When fertilizing new transplants and plants sensitive to salt, a fertilizer with a low salt index should be used.

6.8.6 When the soil pH is outside the optimal range, applications of preferred materials to adjust the soil pH should be considered.

6.8.7 The preferred material used to lower soil pH should be elemental sulfur.

6.8.8 Adjusting soil pH in **calcareous soil** should be considered impractical.

6.8.9 The preferred material used to raise soil pH should be limestone.

6.8.10 When soil pH adjustments are specified for new plantings, they should be performed prior to plant installation.

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6.8.11 The soil pH should be determined periodically and adjusted when it is outside the desirable range for the species.

6.8.12 Soil incorporation or **soil injection** should be the preferred methods to apply fertilizers.

6.8.13 Fertilizer applications

6.8.13.1 Timing of fertilizer applications

6.8.13.1.1 Fertilizer applications should be made during the growing season, unless a slow- or controlled-release fertilizer is used.

6.8.13.2 Fertilizer formulations and rates

6.8.13.2.1 Fertilizer analysis and application rates should be specified based on:

Objectives;

Condition of the plant;

Age of the plant;

Local knowledge;

Nutrient analysis;

Site conditions; and/or,

Plant species.

6.8.13.2.2 Inaccessible surfaces shall not be included in fertilizer rate calculation.

6.8.13.2.3 Application rates should avoid leaching into groundwater.

6.8.13.2.4 When performing maintenance fertilization,fertilizers with higher **ratios** of P_2O_5 should be avoided.

6.8.13.2.5 Slow- or controlled-release fertilizers shouldbe applied at rates between 2 and 4 pounds of actual nitrogen per 1000 ft^2 (1 to 2 kg N/100 m^2)per application and should not exceed 6 pounds of actual nitrogen per 1000 ft^2 (2.9 kg N/100 m^2) within12 months.

6.8.13.2.6 **Quick-release fertilizers** should be appliedat rates between 1 and 2 pounds of actual nitrogen per 1000 ft^2 (0.5 to 1 kg N/100 m^2) per application and shall not exceed 4 pounds of actual nitrogen per 1000 ft^2 (2 kg N/100 m^2) within 12 months.

6.8.13.3 Fertilization area

6.8.13.3.1 The fertilization area shall consider expected root location, root accessibility, fertilization objectives, plant species, and site conditions.

6.8.13.3.2 For most trees and shrubs, the treatment area should be from near the trunk to near or just beyond the **drip line**.

6.8.13.3.3 For fastigiate (columnar form) trees andunusual situations, the method for determining the treatment radius should be calculated by multiplyingthe plant's stem diameter at 4½ feet (1.4 m) above ground, measured in inches (cm), by 1 to 1½ (0.12 to 0.18) to determine the radius, expressed in feet (m), from the trunk of the plant.

For example, a 15-inch (38.1 cm) dbh tree would have a fertilization area radius of 15 to 23 feet (4.6 to 6.9 m).

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6.8.13.4 Fertilizer application methods

6.8.13.4.1 Soil incorporation or soil injection should be the preferred methods to apply fertilizers.

6.8.13.4.2 Fertilizers and soil amendments selected to adjust soil pH should be incorporated or injected into the upper 4 to 8 inches (10 to 20 cm) of the soil.

6.8.13.4.3 Fertilizer shall be uniformly distributed within the defined fertilization area.

6.8.13.4.4 Damage to the buttress roots during fertilization should be avoided.

6.8.13.4.5 Soil surface application

6.8.13.4.5.1 Surface applied fertilizers shall be watered in.

6.8.13.4.5.2 Surface application of fertilizers should not be applied when and where runoff is likely.

6.8.13.4.6 Sub-surface dry fertilization

6.8.13.4.6.1 Holes shall be evenly spaced within the defined treatment area.

6.8.13.4.6.2 Hole depth, diameter, and spacing shall be specified. Holes should be 2 to 4 inches (5 to 10 cm) in diameter, spaced 12 to 36 inches (30 to 91 cm) apart, and 4 to 8 (10 to 20 cm) inches deep, and filled no closer than 2 inches (5 cm) from the soil surface.

6.8.13.4.6.3 The fertilizer shall be evenly distributedamong the holes.

6.8.13.4.7 Sub-surface liquid fertilizer injection

6.8.13.4.7.1 Injection sites shall be evenly spaced within the defined treatment area.

6.8.13.4.7.2 Injection site spacing and depth shall be specified. Injection sites should be 12 to 36 inches (30 to 91 cm) apart, and 4 to 8 inches (10 to 20 cm) deep, not to exceed 12 inches (30 cm) deep.

6.8.13.4.7.3 Fertilizer shall be evenly distributed among the injection sites.

6.8.13.4.8 Foliar applications, trunk injections, implants and alternative fertilization techniques

6.8.13.4.8.1 Foliar applications, trunk injections, or **implants** shall be used only when soil application of fertilizer is impractical or ineffective in achieving fertilization objectives.

6.8.13.4.8.2 When applying foliar fertilizer, the fertilizer solution should be sprayed to thoroughly cover the foliage at a stage of growth when it can be absorbed.

6.8.13.4.8.3 Timing of injection/implant application should be at the plant growth stage to achieve fertilization objectives.

6.8.13.4.8.4 Injection and implant products should be applied in the root flare or as low as practical in the trunk.

6.8.13.4.8.5 Injection and implant holes shall be made as small and shallow as practical for the application equipment being used.

6.8.13.4.8.6 Application intervals should be timed to optimize results with minimal negative effect to the plant.

6.8.13.4.8.7 Hardness, pH, and **salinity** of the water used for **trunk injection** should be considered.

6.8.13.4.8.8 Small diameter trees and drought-stressed trees should not be treated with injections or implants.

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6.8.13.4.8.9 Drill bits used to create injection/implant sites should be sharp, designed to cut green wood, and sized for the injection device.

6.9 Soil Management c. Drainage practices

6.9.1 Treatments to mitigate drainage problems should include, but are not limited to, one or more of the following:

Reduce soil compaction;

Application of organic mulch;

Deep cultivation of impermeable layers;

Grade changes;

Construction of **swales** and ditches; and,

Installation of drainpipes.

6.9.2 Soil drainage improvement as a treatment prior to plant installation should be preferred.

6.9.3 Where drainage is restricted, and it is not practical to mitigate the conditions, species tolerant of wet soils should be selected.

6.9.4 When improving drainage is not practical, planting on soil mounds or **berms** should be preferred.

6.9.5 Drainage systems should be installed when necessary to prevent water from accumulating behind **retaining walls**.

6.9.6 Drainage systems shall have sufficient slope to achieve the drainage desired.

6.9.7 Mitigation of impenetrable soil layers

6.9.7.1 When impenetrable soil layers interfere with drainage, they should be mitigated.

6.9.7.2 When practical and when root systems will not be significantly damaged, impenetrable layers should be mitigated by subsoil plowing or ripping prior to planting.

6.9.7.3 To improve drainage around existing plants, auguring holes through impenetrable layers to a more permeable layer should be considered.

6.9.8 Mitigation/adjustment of surface drainage

6.9.8.1 When soil drains slowly or water accumulates such that it could damage plants, surface drains (e.g., **French drains**, swales, ditches, culverts, berms) should be considered to divert water from trees or landscaped areas.

6.9.9 Mitigation/adjustment of subsurface drainage

6.9.9.1 Subsurface drainage pipes should be installed in sites where drainage is slow, the water table is close to the surface, or water has accumulated by retaining walls or foundations.

6.9.9.2 Subsurface drain pipes shall be installed to an adequate depth to meet the objective.

6.9.9.3 The subsurface drain type (e.g., French drains, perforated pipes) and design (e.g., location, depth, slope, exit location) shall be specified.

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6.9.9.4 French drains should be excavated to the depth needed to ensure favorable root-zone conditions and be filled with coarse, uniform-sized gravel.

6.9.9.5 If geotextile fabric is used, it should be rated for the soil texture.

6.10 Monitoring and maintenance

6.10.1 At the completion of the work, the jobsite should be inspected by an arborist or qualified professional to ensure the work specifications were achieved.

6.10.2 Monitoring intervals should be recommended and based on the objectives.

6.10.3 Monitoring and maintenance scheduling shall be the responsibility of the client.

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7 Supplemental Support Systems standards

7.1 All requirements in *Clause 4 General* shall apply to Clause 7.

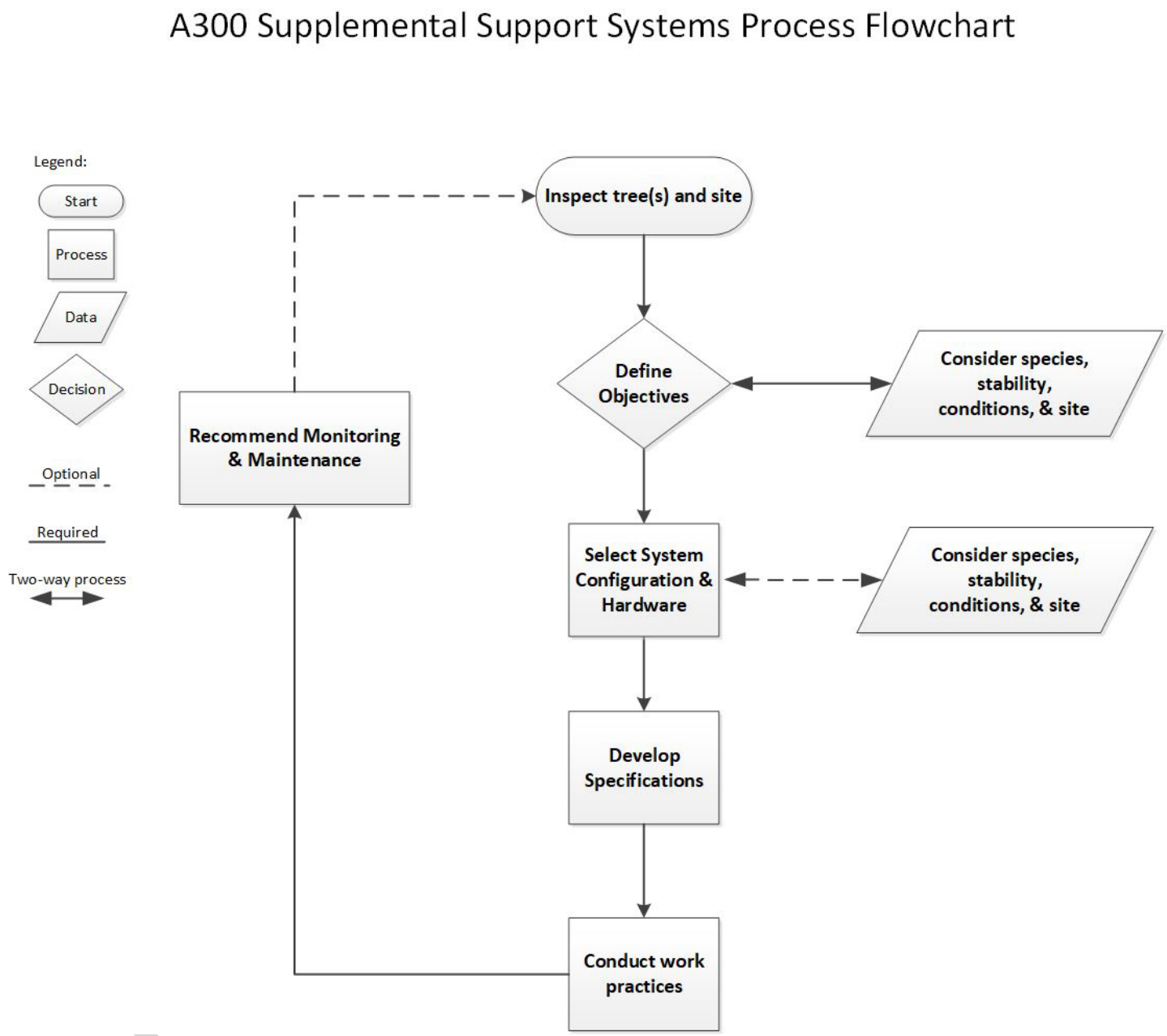


Fig. 7 Supplemental Support Systems process flowchart

7.2 Inspection

7.2.1 The tree and site shall be visually inspected prior to developing work specifications.

7.3 Supplemental Support Systems objectives

7.3.1 Objectives should include one or more of the following:

Limit the movement of codominant stems or branches to reduce the likelihood of failure;

Support overextended branches;

Reduce the likelihood of a whole tree failure;

Reinforce cracks in stems or branches;

Restrict movement of rubbing branches.

Protect a new transplant from windthrow; and,

Support branches or leaning stems to provide clearance.

7.4 Supplemental Support Systems specifications

7.4.2 Specifications for support systems should include:

Tree location;

Objective(s);

System type (e.g., cable, brace, prop, stake, or guy);

Components and configuration:

System (e.g., direct, triangular, hub and spoke cable system);

Materials (e.g., number, sizes, and types of components);

Type of terminations (e.g., through or dead-end anchors, eyebolts, etc.); and,

Anchor point locations;

Time frame for installation;

Monitoring interval; and

Other information as necessary (e.g., prop color, protecting guys, etc.)

7.5 Supplemental Support Systems practices

7.5.1 Necessary pruning should be performed prior to installing a tree supplemental support system.

7.5.2 Anchors and braces should not be installed into significantly decayed areas.

7.5.3 Steel cables or guys in trees with existing lightning protection conductors, shall be bonded to the lightning protection system (see *Clause 8 Lightning Protection System*).

7.5.4 Steel hardware shall be corrosion resistant (e.g. galvanized or stainless steel).

7.5.5 Synthetic fiber cable systems shall be ultra-violet (UV) light resistant.

7.5.6 Wire rope clamps should not be used to form terminations in cables larger than 1/8 inch (3 mm).

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7.5.7 The filling of cavities shall not be considered a support system.

7.6 Installation practices

7.6.1 Holes should not be drilled closer together than the diameter of the branch or trunk at the plane of installation, or *a distance of 12 inches (30 cm), which ever is less.*

Figure 7.6.1 Brace positioning

7.6.2 The diameter of the hole shall not be greater than 1/6 the diameter of the branch, or trunk at the point of installation.

7.6.3 Longitudinal alignment of anchors and/or braces closer than 12 inches (30 cm) should be avoided.

7.6.4 Anchor(s) should be installed in alignment with the cable and termination hardware to avoid side loading.

Figure 7.6.4 Cable and hardware alignment

7.6.5 Only one termination shall be attached to an anchor.

7.6.6 Lag-thread hardware shall only be installed in sound wood that is less than 10 inches (25 cm) in diameter.

7.6.7 Lag hooks shall only be used when they can be seated to the full length of the threads.

7.6.8 Lag hooks shall be installed to prevent the cable termination from coming loose.

7.6.9 Bark should not be damaged beyond the scope of the work during installation of the lag hook.

7.6.10 The hole for the lag-thread hardware shall be 1/16" to 1/8" (1.5-3 mm) smaller than the diameter of the lag.

7.6.11 Holes for through-hardware should be no greater than 1/8" (3 mm) of the diameter of the hardware being installed.

7.6.12 When installing through-hardware, heavy-duty or heat-treated, round steel washers shall be installed between the nut(s) and the wood or according to manufacturers' recommendations.

Fig. 7.6.12 Washer installation

7.6.13 Washers shall not be countersunk into the wood.

7.6.14 Fasteners for threaded hardware, such as nuts, amon eyes, and turnbuckles, shall be secured to prevent loosening.

7.6.15 Excess portion of the through-hardware shall be removed.

7.6.16 Termination hardware shall be the appropriate size and type for the cable to be installed.

7.6.17 Terminations formed by eye-splice configurations shall incorporate thimbles.

7.6.18 Dead-end grip terminations shall only be used on cable that meets the specifications of *ASTM A-475*.

7.6.19 Dead-end grip terminations shall incorporate extra heavy-duty wire rope thimbles - Type III, that meet the performance specifications of federal standard *FF-T276b*.

7.6.20 All hardware within a system shall meet or exceed the minimum strength required to achieve the objective.

7.6.21 Installations shall follow manufacturers' recommendations.

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7.7 Cabling

7.7.1 The cabling system should include one or more of the following configurations:

Direct

Triangular

Box

Hub and Spoke

Figure 7.7.1A Direct system with one cable and one direct system with two cables

Figure 7.7.1B One triangular system and two triangular system

Figure 7.7.1C Box system

Figure 7.7.1C Hub and spoke system

7.7.1.1 The triangular system should be prefered when maximum support is required.

7.7.1.2 The box system should only be used when minimal direct support is needed.

7.7.2 Cabling installation

7.7.2.1 Support cables should be taut following installation.

7.7.2.2 For codominant and upright stems, anchor(s) should be installed at or near a point two-thirds (2/3) of the length/height of the branch or leader, measured from the union to be supported,

Fig. 7.7.2.2 Cable location and position

7.7.2.3 The angle of cable installation should be perpendicular to an imaginary line bisecting the angle between the tree parts being cabled.

Figure 36.2.2.1 Cable installation angle

7.7.2.4 For over-extended, weakly attached, or excessively large lateral branches, cable, termination, and anchors shall be selected so their breaking strength exceeds the weight of the branch.

7.7.2.5 The cable should be anchored on the branch at the estimated center of mass, typically between 40 and 50% of the distance from the point of branch attachment on the trunk, and the tips of the branch.

7.7.2.6 The cable angle should be 45 degrees or greater from horizontal.

7.7.2.7 Eyebolt anchors should be installed perpendicular to the branch or stem or angled to align with the cable.

7.7.2.8 If existing cables are to be replaced, they shall not be removed until the new system is installed.

7.8 Bracing

7.8.1 Bracing system specifications details should include one or more of the following configurations:

Single

Parallel

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Alternating

Crossing

Figure 7.8.1A Single brace system

Figure 7.8.1B Parallel brace system

Figure 7.8.1C Alternating brace system

Figure 7.8.1D Crossing brace system

7.8.2 Bracing installation

7.8.2.1 When installing both a brace rod and a cable, the stems should be tensioned with a hand winch (come-along) or cable before installing the brace rod.

7.8.2.2 When installing a brace rod in a non-split union, the preferred location should be approximately equal to the diameter of the largest branch, above the union.

7.8.2.3 The exact position of the brace rod should be adjusted based on wood strength and branch structure.

7.8.2.4 Bracing systems using multiple rods should have at least one rod installed above the union.

Fig. 7.8.2.4 Rod installed above the union

7.8.2.5 Hardware shall be of sufficient strength to meet the objective.

7.8.2.6 Brace rods shall be terminated with heavy duty washers and nuts.

7.9 Propping

7.9.1 Propping systems should include one or more of the following configurations:

I-prop

A-prop

H-prop

Fig 7.9.1A I-prop

Fig. 7.9.1B A-prop

Fig. 7.9.1C H-prop

7.9.2 Props shall be of sufficient strength to hold the intended load.

7.9.3 Props shall be fastened to the branch or stem in a manner that minimizes damage and restriction of plant growth.

7.9.4 The branch or stem shall be secured to prevent it from falling off the prop.

7.9.5 Props shall be anchored to the ground.

7.10 Guying established trees

7.10.1 Guying established trees should include one or more of the following configurations:

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Tree-to-tree

Tree-to-ground

Figure 7.10.1A Tree-to-ground guying

Figure 7.10.1B Tree-to-tree guying

7.10.2 Tree-to-ground guys shall be prefered.

7.10.3 Guys should be attached to the tree at or above a point one-half the height of the tree to be supported.

7.10.4 Guys should be visually identified, marked, and/or protected.

7.10.5 Guying installation

7.10.5.1 Permanent guys shall be attached to the tree with dead-end hardware or through-hardware.

7.10.5.2 Temporary guys should be considered when there is an immediate or short term need for supplemental support.

7.10.5.3 Tree-to-ground guying

7.10.5.3.1 Guys shall be secured to a ground-anchor(s) sufficient to achieve the objective.

7.10.5.3.2 Ground-anchor(s) should be placed no closer to the trunk than two-thirds the distance from the ground to the height of the lowest point of attachment in the tree, adjusted for slope and site conditions.

7.10.5.4 Tree-to-tree guying

7.10.5.5 Anchor-tree(s) shall be inspected for structural integrity to meet the objective.

7.10.5.6 Guy anchors should be installed in the lower half of the anchor-tree(s).

7.11 Supporting newly installed landscape plants

7.11.1 Supports should not be installed on new transplants unless necessary.

7.11.2 Systems should include one or more of the following configuration types:

Prop

Guy

Stake

Root ball anchor

Fig. 7.11.2A Prop

Fig. 7.11.2B Guy

Fig. 7.11.2C Stake

Fig. 7.11.2D Root ball anchor

7.11.3 Temporary systems shall be preferred.

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7.11.4 Guys should be attached at or above a point one-half the height of the tree.

7.11.5 Guys should be visually identified, marked, and/or protected.

7.11.6 Supports shall be attached using a method that minimizes damage to the tree.

7.11.7 A minimum of two guys or props should be installed at an angle sufficient to support the tree.

7.11.8 For trees with a trunk diameter over 10-inches, guys should be installed in accordance with *subclause 7.10.*

7.11.9 Supports shall be secured to ground anchors sufficient to achieve the objective.

7.11.10 Stakes and guy anchor stakes should be installed vertically.

9.11.11 Supports shall be removed when they are no longer needed.

7.12 Monitoring and maintenance

7.12.1 The client, owner or owner's agent shall be notified of the need for periodic monitoring and maintenance.

7.12.2 Scheduling monitoring and maintenance shall be the responsibility of the tree owner.

7.12.3 Monitoring should include visual inspection of the supplemental support system, its components, and the tree.

7.12.3.1 The tree should be inspected for changes in defects or conditions such as decay, lean, and compromised structural integrity.

7.12.3.2 Systems should be inspected for appropriateness of current location in the tree, angles, changes in effectiveness, and contact with the tree.

7.12.3.3 System components should be inspected for one or more of the following: wear, corrosion, degradation, tension, anchor settling, changes in effectiveness, and clearance distances.

7.12.4 If problems are detected they should be corrected or the system should be repaired, replaced, or modified.

7.12.5 Temporary support systems should be removed within one year, when they are interfering with tree growth, or when they are no longer needed.

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8 Lightning Protection System standards

8.1 All requirements in *Clause 4 General* shall apply to Clause 8.

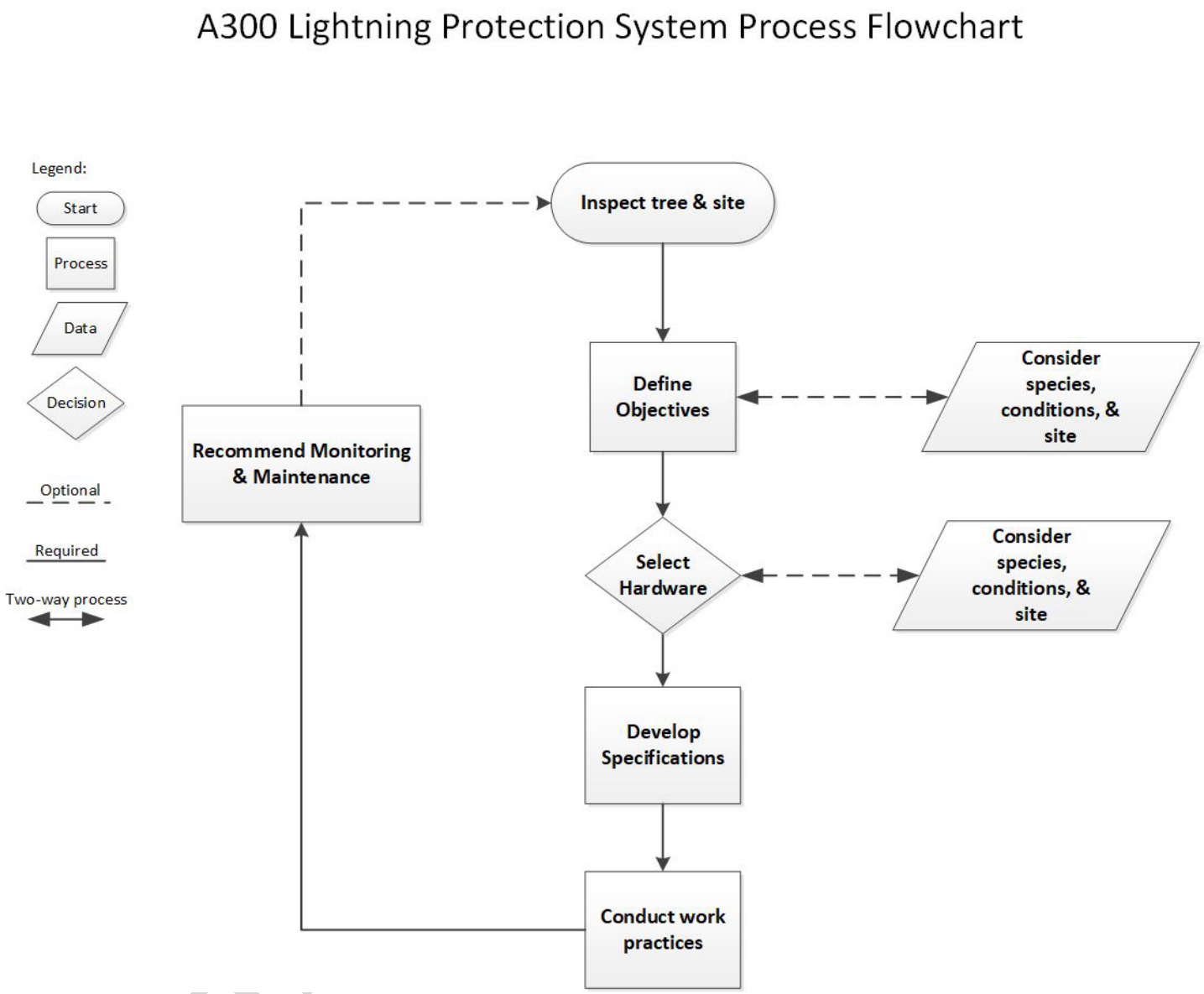


Fig. 8. Tree lightning protection process flow chart.

8.1 Inspection

The tree and site shall be visually inspected prior to developing specifications.

8.2 Tree lightning protection objectives

8.2.1 Objectives for a lightning protection system should include, but are not limited to:

reduce the likelihood of serious damage to trees;

reduce the likelihood for side flash, fire, or step potential; and,

modify or repair of an existing tree lightning protection system.

8.2.2 Protected trees shall not be considered a safe haven by people, or for animals, and are not intended to protect household electronics or other household items from damage due to a lightning strike.

8.3 Lightning Protection System specifications

8.3.1 Specifications for lightning protection systems should include:

Location of the tree;

Objective;

System design:

Number and size of the conductor(s) that will be installed;

Location of the conductors within the tree;

Type, number, and location of air terminal(s);

Conductor damage protection, if applicable; and,

Location and type of grounding electrode.

Time frame for system installation:;

Monitoring interval; and,

Other information as necessary.

8.4 Lightning Protection System practices

8.4.1 Components of tree lightning protection systems shall be made of commercial electrical grade copper, or a copper alloy with similar resistance to corrosion as copper; stainless steel; bronze; or clad using one of these metals.

8.4.2 Metals that form an electrolytic couple shall not be used in combination.

8.4.3 Conductors

8.4.3.1 Conductors shall be solid wire, symmetrical rope-lay, smooth-twist, or loose-weave cable.

8.4.3.2 Conductors shall be at least 14 strands of 17 American Wire Gauge (AWG) copper wire or, when using a solid conductor, it shall have an equivalent cross-sectional area.

8.4.3.3 In areas where the lightning protection system is likely to be vandalized or otherwise subjected to mechanical damage, the system should be installed within a PVC conduit or otherwise protected.

8.4.4 Air terminals, connectors, and fasteners

8.4.4.1 All hardware shall be the correct size for the conductors.

8.4.4.2 Blunt-tipped air terminals with a diameter between 5/8” (16 mm) and ¾” (20 mm) in diameter shall be preferred.

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8.4.4.3 Connectors shall be constructed so that a minimum of 1½ inches (38 mm) of each conductor can be secured within the fitting.

8.4.4.4 Connectors should be installed so as to withstand a pull of 200 pounds (890 N).

8.4.4.5 Crimp-type connectors shall have at least two 1/8-inch (3.2 mm) high projections on the interior surface.

8.4.4.6 Fasteners shall be of substantial construction to secure the conductor to the tree.

8.4.5 Grounding electrodes

8.4.5.1 Ground rods shall be a minimum ½-inch (13 mm) diameter and not less than 8 feet (2.4 m) long and shall be made of copper-clad steel, solid copper, stainless steel, or stainless steel clad. Multiple shorter sections of ground rod shall be an acceptable alternative if the total length is at least 8 feet (2.4 m).

8.4.5.2 Ground-rod clamps shall have a minimum of two bolts, machine screws, or cap screws for applying compression to the conductor and ground rod.

8.4.5.3 Ground-rod clamps shall have a length that makes contact with the ground rod for a minimum distance of 1½ inches (38 mm) measured parallel to the axis of the ground rod.

8.4.5.4 Copper ground plates shall have a minimum thickness of 0.032 inch (0.8 mm) and a minimum surface area of 2 square feet (0.19 m^2).

8.5 Installation

8.5.1 Above-ground system

8.5.1.1 Air terminals shall be located on distal portions of the trunk or branches as far out as practical within the crown.

8.5.1.2 Conductors should be installed so that no aerial portion of the tree is farther than 35 feet (10.7 m) from a conductor or air terminal.

8.5.1.3 Conductors with an air terminal installed on branches shall connect to the conductor located on the trunk or directly to a ground rod.

8.5.1.4 Conductors should be installed as a continuous length, without splices, from the air terminal to the ground electrode or trunk conductor.

8.5.1.5 No bend of a conductor shall form an included angle of less than 90 degrees or have a radius of bend less than 8 inches (20 cm).

8.5.1.6 Conductors should be installed taut.

8.5.1.7 Fasteners shall be installed to the tree at intervals no greater than 6 feet (1.8 m).

8.5.1.8 Connectors shall be used to form end-to-end, side-by-side, or Y splices in conductors.

8.5.1.9 Metal tree support cables, permanent metal guys, or metal conduit shall be bonded to the lightning protection system.

8.5.1.10 Bimetallic or other appropriate connectors shall be used to connect metals that form an electrolytic couple, such as when bonding galvanized steel cables or guys to the tree lightning protection system.

8.5.2 Below-ground system

8.5.2.1 Grounding electrode installation should not damage roots greater than 2 inches (5 cm) in diameter.

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8.5.2.2 Conductors shall extend away from the tree at a minimum depth of 8 inches (20 cm), except when impenetrable conditions do not allow. Maximum contact with the earth shall be achieved.

8.5.2.3 Ground-rod clamps that are compliant with UL 467 shall be used to connect the ground rod to the conductor.

8.5.2.4 Grounding electrode(s) should not be located within 2 feet (61 cm) of a structure's foundation or other known underground installation.

8.5.2.5 A single ground rod shall extend into the earth to a minimum depth of 9 feet (2.7 m) except as specified in *subclause 8.5.2.10*.

8.5.2.5.1 A minimum of 8 feet (2.4 m) of total ground rod length shall be installed.

8.5.2.5.2 When installing a ground rod in sandy or gravelly soils a minimum of 16 feet (4.9 m) of total ground rod length shall be installed.

8.5.2.6 The entire grounding system shall be in close contact with the earth.

8.5.2.7 The method of grounding shall be specified as one of the following types:

Single Ground Rod electrode

Multiple Grounding electrode

Horizontal Grounding electrode

Fig. 8.5.2.7A Single Ground Rod electrode

Fig. 8.5.2.7B Multiple Grounding electrode

Fig. 8.5.2.7C Horizontal Grounding electrode

8.5.2.8 Single ground rod electrode

8.5.2.8.1 A single ground rod should be installed a minimum of 10 feet (3 m) from the trunk.

8.5.2.8.2 For trees with a diameter at breast height (DBH) greater than 40 inches (102 cm), the ground rod distance should be a minimum of three times the DBH. For example, with a 60-inch (152 cm) DBH tree, the ground rod should be no closer than 15 feet (4.5 m) to the trunk.

8.5.2.9 Multiple grounding electrode

8.5.2.9.1 A multiple grounding electrode or horizontal grounding electrode shall be used when the full length of the ground rod cannot be driven into the soil.

8.5.2.9.2 When using ground rods as in-line or Y configurations in sandy or gravelly soils, the rods should be located a minimum distance of 18 feet (5.5 m) from each other and 10 feet (3 m) from the tree trunk.

8.5.2.9.3 When using copper ground plates as in-line or Y configurations in sandy or gravelly soils, the plates shall be located a minimum distance of 10 feet (3 m) from each other and from tree trunk.

8.5.2.10 Horizontal grounding electrode

8.5.2.10.1 A horizontal grounding electrode shall be used when ground rods cannot be driven at least 2 feet (61 cm) deep.

8.5.2.10.2 A horizontal grounding electrode should be terminated with a ground plate.

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8.5.2.10.3 Conductors shall be installed in trenches extending away from the tree as follows:

A) For sandy or gravelly soil, a minimum of 24 feet (7.3 m) long.

B) For all other soils, a minimum of 12 feet (3.7 m) long.

8.5.2.10.4 The ground plate should be installed 8 inches (20 cm) or deeper below the soil surface, except when impenetrable conditions do not allow. Maximum contact with the earth shall be achieved.

8.6 Monitoring and Maintenance

8.6.1 Lightning protection systems should be periodically inspected for maintenance needs.

8.6.2 The client, owner or owner's agent shall be informed of the need for periodic inspection and maintenance of the system.

8.6.3 Scheduling inspections shall be the responsibility of the client, owner, or owner's agent.

8.6.4 Inspection should include the above-ground conductor, fastener and connector corrosion, cuts, damage, over-growth, and tautness.

8.6.5 The arborist or qualified professional shall recommend damaged parts be replaced or repaired.

8.6.6 Conductors should be refastened before they are enveloped by the tree.

8.6.7 The upper end of the conductor should be extended when the system no longer provides the intended protection.

8.6.8 When new parts are installed, they shall be bonded to or be installed in contact with the accessible portions of the existing system.

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9 Management of Trees and Shrubs during Site Development and Construction standards

9.1 All requirements in *Clause 4 General* shall apply to Clause 9.

9.2 Objectives for Management of Trees and Shrubs during Site Development and Construction

9.2.1 Objectives may include:

Protecting trees, shrubs, other plants, and soil on the development site to reduce loss during and after construction;

Complying with regulations regarding tree preservation on construction sites;

Identifying the tree resources present on a development site;

Minimizing conflicts between trees and new infrastructure;

Developing a plan to minimize damage to trees, shrubs, other plants and soil;

Integrating existing trees with new landscape;

Developing post-construction landscape management plans;

Increasing property values; and,

Enhancing aesthetics, ecosystem services and environmental benefits.

9.3 Management of Trees and Shrubs during Site Development and Construction specifications

9.3.1 The arborist and client should agree on:

Phases of development in which the arborist will be involved;

Arborist responsibilities at each phase;

Location/area to be included;

Schedule of visits; and,

Type, timing and recipient of reports.

9.3.2 Additional specifications may be included based on the recommendations associated with each of the following phases of development, *subclauses 9.4 through 9.9.*

9.4 Planning phase

9.4.1 During the planning phase, trees and other resources within the client specified area should be evaluated to provide information to improve design and protection.

9.4.2 Resources should be evaluated to provide information to improve designs and tree preservation.

9.4.3 Trees adjacent to the site that may be adversely affected by the construction or may affect the construction activity should be included in the evaluation.

9.4.4 Resource evaluation should include:

Project ownership, budget, and scope;

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Regulatory/ordinance requirements, if applicable;

Review of preliminary plans and specifications; and,

Identification of individual or groups of trees, shrubs and/or woody plants on the site;

9.4.5 The resource evaluation may include a tree/plant inventory.

9.4.6 Inventory specifications should include:

Area to be inventoried;

Resources to be inventoried (e.g., species of trees, shrubs, soil)

Data to be collected;

Recommendations to obtain additional information or perform advanced assessment

If a tree risk assessment will be conducted, the methodology shall be specified;

Time frame for data collection;

Type of report to be provided (e.g., oral, written, map, plan);

Due date of report; and,

To whom the report should be submitted.

9.4.7 Tree inventory data should include:

Identification/tag number;

Location (e.g., map reference or coordinates);

Species;

Size (e.g., trunk diameter, crown spread, height);

Condition (e.g., health, structure, form);

Suitability for preservation;

Status as defined by applicable regulations (e.g., heritage, historic); and,

Additional factors as specified.

9.4.8 The resource evaluation report specifications should include:

Area to be evaluated;

The type of report to be provided (e.g., oral, written, map, plan);

Time frame for data collection;

Due date of the report; and,

To whom the report should be submitted.

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9.4.9 Relevant resource inventory information should be integrated into the site design.

9.5 Design phase

9.5.1 An inventory of trees and other resources should be specified and conducted, if this was not completed in the planning phase. Information from the inventory should be used to develop a tree protection report.

9.5.2 Tree protection report should include:

Objectives;

Tree inventory data;

Suitability for preservation;

Estimation of the construction impacts to tree;

Recommended action for each tree (e.g., retained, transplanted or removed);

Required or recommended mitigation for trees to be removed (when appropriate);

Recommendations for care of retained trees (e.g., pruning to provide clearance for construction, pruning to improve structure, root pruning, work procedures);

Procedures for protecting trees, other plants and soil areas (e.g., location of tree protection zone [TPZ] fences, mulch);

Irrigation recommendations for preserved trees during all phases;

Identification of the appropriate times to implement tree protection procedures;

Code and tree health consequences for non-compliance; and,

Additional items as specified.

9.5.3 When a tree protection plan sheet is required or desired, it should be developed using the tree protection report.

9.5.4 When appropriate, design changes or alternative building methods should be recommended to avoid root loss and/or soil compaction.

Figure 9.4.2 Figure to be modified per BMP revision. Current figure adapted with permission from Best Management Practices, Managing Trees During Construction. 2008. Fite, Kelby and Smiley, E. Thomas. Copyright 2008, International Society of Arboriculture, Champaign, IL.

9.6 Pre-construction phase

9.6.1 Tree protection objectives, plans, specifications, and consequences for non-compliance should be communicated to the project manager, property owner and relevant contractors.

9.6.2 Tree protection procedures should be implemented and barrier(s) shall be installed according to the tree protection plan.

9.6.3 Tree pruning for clearance should be performed by an arborist or other qualified professional.

9.7 Construction phase

9.7.1 During the construction phase, the following should occur:

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Implementation of tree protection plan;

Monitoring the site on the specified schedule;

Documenting or reporting as specified in the scope of work, such as:

Compliance with tree protection plan;

Monitoring plant health, soil moisture, change in tree risk status, and/or tree damage;

Changes or damage to the tree-protection zone (TPZ) barriers;

Documentation and communication of severely damaged plants and mitigation for minor damage; and,

Additional factors as specified.

9.8 Landscape phase

9.8.1 Implementation of the tree protection plan shall be continued through the landscape phase.

9.8.2 Monitoring should continue through the landscape phase, as specified in the scope of work.

9.8.3 TPZ barriers and temporary irrigation systems should be removed, when appropriate, in conjunction with the installation of the landscape and permanent irrigation.

9.8.4 Tree and root damage shall be minimized during installation of the landscape plants, hardscape, irrigation, drainage, and lighting.

9.8.5 Mitigation of damaged plants should be recommended and/or implemented.

9.9 Post-construction phase

9.9.1 Tree protection plan implementation shall be continued through the post-construction phase.

9.9.2 Monitoring should be continued through the post-construction phase, as specified in the scope of work.

9.9.3 Mitigation of damaged plants should be recommended and/or implemented.

9.9.4 A maintenance plan should be specified for both retained and newly installed trees, shrubs, and other woody plants and should consist of one or more of the following:

Pruning (see *Clause 5*);

Soil nutrient and compaction management (see *Clause 6*);

Maintenance/removal of tree support systems (see *Clause 7*);

Lightning Protection System (see *Clause 8*);

Planting and Transplanting (see *Clause 10*);

Root Management (see *Clause 12*)

Tree Risk Assessment (see *Clause 13*)

Integrated Pest Management (see *Clause 14*);

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Soil moisture management and adjustment of irrigation as plants grow; and,

Reducing tree and shrub population density as they grow.

9.10 Management of Trees and Shrubs during Site Development and Construction practices

9.10.1 Tree protection zone

9.10.1.1 A tree protection zone (TPZ) shall be specified around all trees, shrubs, and other plants, and soil areas designated for retention and protection.

9.10.1.2 Defining the TPZ may be two-step process:

1) Define the Calculated TPZ based on tree size, age and condition; and,

2) Identify the location of the Specified TPZ based on the Calculated TPZ and site-specific limitations.

9.10.1.3 The Calculated TPZ should be defined based on:

Species tolerance to construction activities;

Tree size, (e.g., trunk diameter); and,

Relative age, and health.

9.10.1.4 The Calculated TPZ radius should be 6-18 times the trunk diameter (DBH).

9.10.1.5 When the minimum Calculated TPZ radius cannot be achieved, appropriate mitigation shall be recommended.

9.10.1.6 TPZ barriers shall be installed in the specified locations and temporarily moved only for specified and approved activities.

9.10.1.7 Signs should be posted to alert equipment operators and contractors about the protected status of the TPZ.

9.10.1.8 Activities prohibited within the TPZ should include, but are not limited to:

Grade changes (e.g. soil cuts, fills);

Activities that could compact the soil;

Trenches;

Root cuts;

Pedestrian and equipment traffic that could compact the soil or physically damage roots;

Parking vehicles or equipment;

Burning of brush and woody debris;

Storing soil, construction materials, petroleum products, water, or building refuse; and,

Disposing of wash water, fuel or other potentially damaging substances.

9.10.1.9 TPZ fencing should only be temporarily moved for specified and approved activities.

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9.10.1.10 A temporary irrigation system should be installed within the TPZ and operating schedule specified, if included in the scope of work.

9.10.1.11 Mulch or other soil-compaction-protection materials appropriate for the proposed construction activities shall be installed within the TPZ if there will be entry into the TPZ.

9.10.1.12 Mulch depth shall be sufficient to achieve the objective.

9.10.1.13 Mulch depth shall be specified and maintained during the construction process.

9.10.1.14 Unwanted vegetation within the TPZ should be removed manually, mulched, or treated with a herbicide that will not damage the tree.

9.10.2 Tree protection zone barriers

9.10.2.1 Specified TPZ barriers shall be installed in the pre-construction phase and maintained through the construction phase.

9.10.2.2 Specifications for TPZ barriers should include, but are not limited to:

The type of barriers (e.g., chain link fence, wood fence, berms, buffer trees);

Height of barriers; and

Method of anchoring barriers.

9.10.3 Construction practices to minimize tree damage

9.10.3.1 Excavation and construction equipment shall be kept out of the TPZ without approval by the arborist or qualified professional and with appropriate mitigation.

9.10.3.2 Excavation and construction equipment shall be selected, positioned, and operated to avoid damage to tree roots, branches, and trunks.

9.10.3.2.1 If clearance is inadequate for equipment access, lower branches should be lifted with ropes, cables or straps, supported with props, or pruned.

9.10.3.3 Exhaust and excessive heat from equipment shall be diverted away from foliage, branches, and trunks.

9.10.3.4 Prior to soil excavation near trees, roots should be pruned or cleanly cut at the excavation limit, outside the TPZ.

9.10.3.5 During soil excavation, the least destructive methods should be used to minimize damage to roots greater than two inches (5 cm) in diameter, see *Clause 12*.

9.10.3.6 During soil excavation, root pruning shall be preferred over cutting, chopping, tearing or ripping.

9.10.3.7 Where practical, root pinning/stapling and directional changes should be considered to minimize root damage.

9.10.3.8 Exposed roots should be covered and kept moist.

9.10.4 Utility practices to minimize tree damage

9.10.4.1 Utilities that cannot be routed outside the TPZ should be installed by tunneling or other methods to avoid root damage.

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9.10.4.2 Utilities should be installed as far as practicable from existing trees to avoid future tree damage during utility repair.

9.10.4.3 Utilities should be routed in a common trench or conduit or grouped as closely as permitted.

9.11 Monitoring and maintenance

9.11.1 Monitoring and maintenance should continue through the post construction phase as specified according to *subclause 9.9*.

9.11.2 Following completion of all phases of construction the site should transition to an ongoing monitoring and maintenance program.

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10 Planting and Transplanting standards

10.1 All requirements in *Clause 4 General* shall apply to Clause 10.

10.2 Inspection

10.2.1 A site inspection shall be conducted to develop a **suitability and feasibility assessment** prior to developing work specifications.

10.2.2 Trees to be transplanted shall be inspected by a qualified professional to develop the suitability and feasibility assessment.

10.2.3 The suitability and feasibility assessment should include:

Site characteristics;

An evaluation of potential conflict with utilities (overhead and underground), lines of sight, buildings, and other infrastructure;

Species characteristics and requirements;

An evaluation of invasiveness;

Existing on-site plant(s) size, health, and root issues; and

Protection needs of other plants on the site (see *Clause 9*).

10.3 Objectives

10.3.1 The objectives may include:

Aesthetics;

Ecosystem services;

Air pollution mitigation;

Carbon sequestration;

Erosion mitigation;

Habitat;

Public health;

Shade/energy conservation;

Water management;

Meet regulatory requirements;

Preservation;

Resolve conflicts with planned use or existing infrastructure;

Screening;

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Sentimentality/commemoration; and

Site restoration.

10.4 Specifications

10.4.1 Specifications for planting and transplanting shall be based on the suitability and feasibility assessment.

10.4.2 Written specifications for planting and transplanting should include:

Objective(s);

10.4.3 Written specifications for planting and transplanting shall include:

Identification of species, quality, and number of plants to be planted or location of the specimen(s) to be transplanted;

Location of planting site(s);

Planting/transplanting system and stock: **bare root**, **ball and burlap**, **container**, or **tree spade**;

Root ball dimensions of tree(s) (e.g., diameter and height, container size)

Plant acceptance criteria and timing of acceptance inspection;

Excavating and lifting methods;

Moving and storage methods;

Plant and site preparation requirements (e.g., **root pruning**, irrigation, turf removal);

Installation requirements:

Planting hole dimensions (e.g., shape, width/diameter, depth)

Removal of root ball support materials;

Backfill material;

Initial watering requirements;

Mulch type, depth, and area; and

Support system;

Start and completion dates; and

Post planting care (e.g., duration and activities).

10.4.4 Plant acceptance criteria should be written.

10.4.4.1 Plant acceptance criteria should include:

Species and cultivar;

Compliance with insect and disease regulatory requirements;

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Height and/or **trunk diameter**;

Root ball dimensions (e.g., shape, width/diameter, height, container size);

Condition (e.g., health, structure, form);

Root collar (or **root initiation zone** in palms) visibility (e.g., height above **grade**, soil depth over root collar);

Root ball moisture requirement;

Presence of existing or potential **stem girdling roots**; and

Other issues impacting survival potential.

10.5 Practices

10.5.1 Plant acceptance

10.5.1.1 Plant material should be inspected prior to acceptance.

10.5.1.2 Trees that do not meet the acceptance criteria should be rejected.

10.5.2 Timing

10.5.2.1 Season and phenology shall be considered.

10.5.3 Root ball size (general)

10.5.3.1 The objective and plant species, size, and condition should be considered when determining the root ball size.

10.5.3.2 The root ball shall be large enough to ensure establishment. Considerations for root ball size should include:

Species transplant tolerance;

Plant health;

Soil characteristics;

Climate and environmental conditions (e.g., wind, moisture, temperature);

Tree size (e.g., height and trunk diameter);

Tree anchoring requirements;

Handling and access limitations;

Planting space limitations; and,

Planting hole parameters.

10.5.4 Root ball size (except palms)

10.5.4.1 Trunk diamter shall be measured at 6 inches (15 cm) above the base of the root collar for trees up to 4-inch (10 cm) diameter at that height. Trees greater than 4 inches (10 cm) **caliper** at 6 inches (15 cm) above the base of

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the root collar shall be measured at 12 inches (30 cm) above the base of the root collar. Trees greater than 8-inch (20 cm) caliper at 12 inches (30 cm) above the base of the root collar shall be measured at 54 inches (**diameter at breast height [DBH]**, 137 cm) above the base of the root collar (soil grade).

10.5.4.2 Trees and shrubs with a trunk diameter less than or equal to 8 inches (20 cm) shall meet the minimum root ball size presented in the ANSI Z60.1 American Standard for Nursery Stock.

10.5.4.3 Trees larger than 8 inches (20 cm) trunk diameter and less than or equal to 16 inches (40 cm) should have a minimum root ball width (diameter) of 10 inches (25 cm) for every inch (2.54 cm) of trunk diameter.

10.5.4.4 Trees larger than 16 inches (40 cm) trunk diameter should have a minimum root ball width (diameter) of 8 inches (20 cm) for every inch (2.54 cm) of trunk diameter.

10.5.4.5 The height of the root ball shall be measured from the base of the root collar to the bottom of the ball. If the root collar is not visible, excess materials (e.g., soil, mulch) shall be removed.

Figure 10.5.4.5 Root collar location (also called root-stem transition zone or trunk flare)

10.5.5 Root ball size (palms)

10.5.5.1 Trunk diameter shall be measured immediately above the root initiation zone for single-trunked palms and should exclude persistent leaf bases.

10.5.5.2 Root ball width (diameter) shall be specified based on species and tolerance**.**

10.5.5.3 The minimum root ball width (diameter) shall equal the measurement of the trunk diameter plus 6 to 24 inches (15 cm to 61 cm) based on species and tolerance.

10.5.6 Excavating and lifting the plant

10.5.6.1 Utility locations shall be considered prior to excavation.

10.5.6.2 Pneumatic and hydraulic excavation methods should be considered.

10.5.6.3 Excavation operations should not intrude into the final root ball.

10.5.6.4 The trunk should be centered in the root ball.

10.5.6.5 Adjustments shall be made for differences between slope gradients of the current and planned site.

10.5.6.6 Plant(s) should be lifted by the root ball unless bare root.

10.5.7 Moving and storing

10.5.7.1 Storage and moving conditions should be favorable for maintaining plant health. Consideration should be given to:

Humidity;

Dormancy;

Temperature;

Light exposure;

Covering and supporting during transportation;

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Root ball moisture; and,

Other factors, as necessary.

10.5.7.2 Desiccation and physical injury to the plant(s) shall be minimized.

10.5.8 Site preparation

10.5.8.1 Soil and site modifications determined in the suitability and feasibility assessment should be made prior to or in conjunction with planting.

10.5.8.2 Planting hole depth shall result in the base of the root collar being at, or slightly above, final grade.

10.5.8.3 The soil directly beneath the root ball should be undisturbed or prepared to minimize settling.

10.5.8.4 The planting hole width shall be based on soil density, texture, and structure at the site as determined in the feasibility and suitability assessment.

10.5.8.5 Installation of a soil drainage system should be considered (see *Clause 6*).

10.5.8.6 On sites with high quality soil, the planting hole width should be large enough to facilitate planting.

10.5.8.7 On sites with poor quality soil (e.g., compacted, poorly drained), the planting hole width should be increased as necessary to encourage plant establishment, survival, and longevity.

10.5.8.8 The sides of the planting hole should be scarified when necessary.

Fig. 10.5.8A Example planting hole.

Fig. 10.5.8B Example of an adjustment for slope gradients

10.5.9 Installation

10.5.9.1 Circling, girdling, and kinked roots should be pruned or redirected away from the trunk.

10.5.9.2 Excess soil or other material over the root collar shall be removed.

10.5.9.3 The base of the root collar shall be at, or slightly above, the final grade.

10.5.9.4 **Root ball support materials** should be entirely removed prior to backfilling.

10.5.9.5 Non-biodegradable fabric and plastic containers shall be removed from the root ball.

10.5.9.6 Single-stemmed plants should be vertical unless otherwise specified.

10.5.9.7 Bare root plants should be installed so root systems are distributed throughout the **backfill**.

10.5.9.8 Containers shall not be removed by pulling or leveraging the trunk of the tree.

10.5.10 Backfill and mulch

10.5.10.1 Backfill should consist of the excavated soil, similar soil, or amended soil to meet a specific requirement.

10.5.10.2 The addition of **soil amendments** should be based on the feasibility and suitability assessment.

10.5.10.3 Backfill should be installed to the finished grade.

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10.5.10.4 Backfill should be compacted sufficiently to limit root ball movement and settling but not to a density that inhibits root growth.

10.5.10.5 Water shall be applied to saturate the backfill and root ball at the time of planting.

10.5.10.6 Organic mulch should be applied to the perimeter of the planting hole, but not touching the root collar or trunk.

10.5.10.7 Mulch depth should not inhibit water infiltration or tree growth.

10.5.10.8 Temporary support systems may be installed (see *Clause 7*).

10.6 Monitoring and Maintenance

10.6.1 The client, owner, or owner's agent shall be notified of the need for post-planting monitoring and maintenance.

10.6.1.1 It shall be the responsibility of the client, owner, or owner's agent to provide post-planting monitoring and maintenace.

10.6.2 Post-planting maintenance should be specified for an appropriate period of time based on the region, site conditions, and species.

10.6.3 Post-planting maintenance should consist of, but is not limited to:

Soil moisture management (see *Clause 6*);

Mulching (see *Clause 6*);

Protection from mechanical injury, animals, competing vegetation, or other issues;

Integrated pest management (see *Clause 14*);

Pruning (see *Clause 5*); and

Maintenance and removal of tree support systems (see *Clause 7*) and **trunk protection**.

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11 Integrated Vegetation Management standards

11.1 All requirements in *Clause 4 General* shall apply to Clause 11.

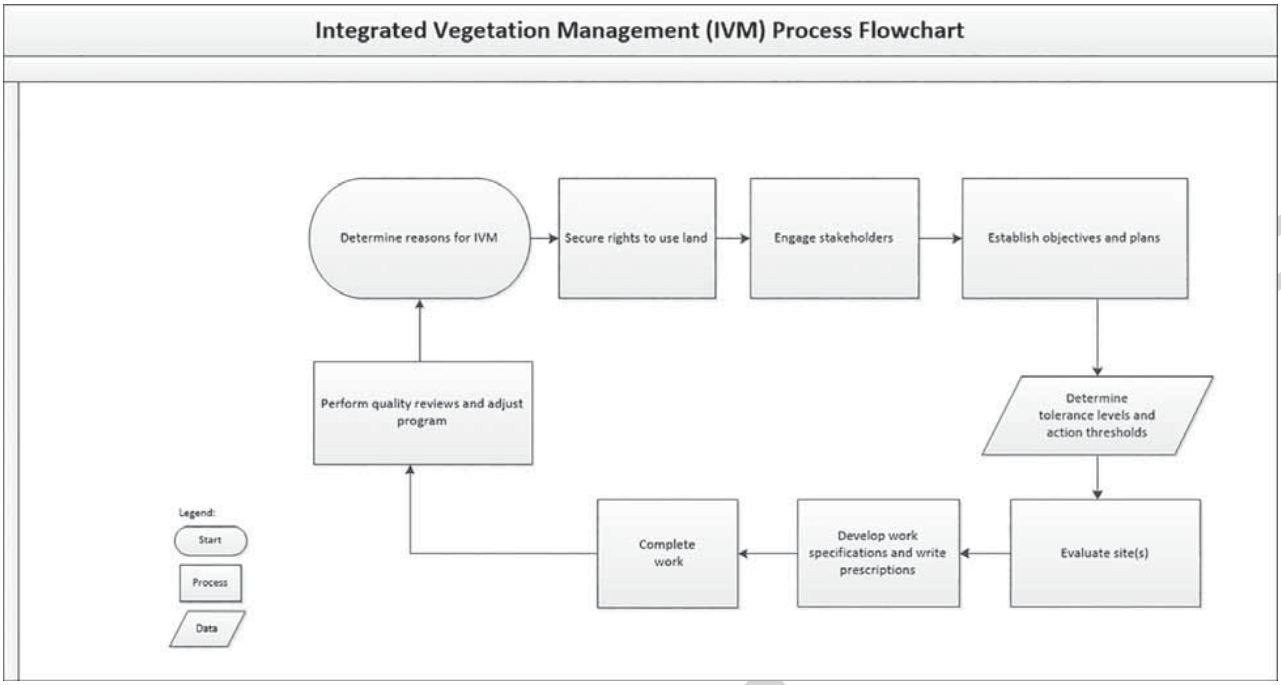


Fig. 11 IVM process flowchart

11.2 Inspection

11.2.1 Site information shall be obtained prior to developing work specifications.

11.3 Objectives

11.3.1 Objectives may include one or more of the following:

Comply with regulations;

Control noxious weeds and invasive species;

Enhance public and worker safety;

Ensure lines of site or desired views;

Improve aesthetics;

Maintain utility service reliability;

Manage pollinator and wildlife habitat;

Provide access to sites;

Reduce maintenance costs;

Reduce risk of wildfire; and,

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Restore ecological and/or environmental benefits.

11.3.2 Consideration shall be given to long-term vegetation management requirements.

11.3.3 Management and planning objectives

11.3.3.1 **Integrated Vegetation Management (**IVM) management plans shall be established, and shall take into account:

Existing biological, ecological, cultural resources;

Economic factors; and,

Applicable laws and regulations.

11.3.3.2 IVM program management plans shall include overarching goals, objectives, processes, and procedures.

11.4 IVM specifications

11.4.1 IVM specifications should be based on safety, effectiveness, sustainability, environmental impact, security, expected ecological effects, economics, applicable regulations, and intended use(s) of the site.

11.4.2 Site characteristics shall be evaluated, and should include elements such as:

Accessibility;

Adjacent land use;

Cultural resources;

Existing compatible and incompatible vegetation;

Expected growth rates;

Fire risk;

Past treatments;

Sensitive, rare, threatened or endangered species;

Soils;

Topography; and/or,

Water resources.

11.4.3 Treatments should be specified to encourage sustainable, compatible vegetation and to reduce or eliminate incompatible vegetation.

11.4.4 IVM specifications should include:

Location of treatment sites;

IVM objectives;

Action thresholds and tolerance levels, e.g. species, stem density, height, etc.;

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Methods and treatments to be used;

Time frame for completion;

Recordkeeping process; and/or,

Other information as necessary, (e.g. recycling/ reuse of herbicide containers, sensitive site considerations, stakeholder engagement, etc.).

11.5 Practices

11.5.1 Right of Use

11.5.1.1 The right to use IVM methods on lands, sites and facilities to achieve stated management objectives shall be established.

11.5.2 Communications and stakeholder engagement

11.5.2.1 Internal and external stakeholder concerns shall be considered when establishing objectives and evaluating treatment options.

11.5.2.2 Communication with stakeholders should be proactive and should include information about proposed IVM activities.

Fig. 11.5A The Integrated Vegetation Management (IVM) Tactical Process

11.5.3 Determine tolerance levels

11.5.3.1 Acceptable tolerance levels and action thresholds for incompatible vegetation shall be established.

11.5.3.2 Tolerance levels and action thresholds should be based on levels of incompatible plant pressure and characteristics such as:

Species;

Growth rates;

Density;

Current height;

Location; and,

Condition.

11.5.3.3 If conditions reach the action threshold, IVM methods should be implemented. If conditions reach the tolerance level, IVM methods shall be implemented.

11.5.4 IVM treatment methods

11.5.4.1 A variety of methods should be considered for each site and more than one method may be implemented for each site.

11.5.4.2 Methods to consider should include selective or non-selective controls:

Biological;

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Chemical;

Cultural;

Prescribed Fire; and/or,

Physical.

11.5.4.3 Efficacy of methods in achieving stated objectives shall be considered.

11.5.4.4 Methods used should promote sustainable, compatible plant communities that exert biological controls.

11.5.4.5 Methods used should minimize negative effects to ecosystems.

11.5.4.6 Selective methods should be preferred.

11.5.4.7 Non-selective methods should be considered as an initial step toward developing selective management on the site.

11.5.4.8 Non-selective methods should be used only when selective methods are impractical.

11.5.4.9 Non-selective methods that do not account for site and plant conditions shall not be considered acceptable management strategies.

11.5.4.10 Where site reclamation is necessary, such as areas with dense incompatible vegetation, non-selective methods should be considered.

11.5.4.11 Biological methods

11.5.4.11.1 Biological methods should be preferred as a long-term strategy.

11.5.4.11.2 Biological methods may be naturally occurring or introduced.

11.5.5.11.3 Biological methods should encourage the establishment of sustainable, compatible ecosystems and discourage the growth and establishment of incompatible and undesirable vegetation.

11.5.4.12 Chemical methods

11.5.4.12.1 Chemical methods should be used to manage incompatible species and/or reduce growth.

11.5.4.12.2 Preference should be given to chemical treatments that pose minimal risk to non-target organisms.

11.5.4.12.3 Appropriate chemical methods should be used to transition plant communities to sustainable, compatible species by facilitating biological controls.

11.5.4.12.4 Chemicals shall be applied according to product labels.

11.5.4.12.5 Consideration shall be given to reducing the amount of chemicals utilized over time.

11.5.4.12.6 Consideration should be given to the selection of chemicals and methods to reduce the development of resistance in target vegetation.

11.5.4.13 Cultural methods

11.5.4.13.1 Cultural methods should be encouraged when appropriate.

11.5.4.13.2 Prescribed fire should be considered where appropriate.

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11.5.4.13.3 Prescribed fire shall not be used in situations where unintended ignition or other inherent hazards exist.

111.5.4.14 Physical methods

11.5.4.14.1 Manual methods should be used for selective removal of incompatible species.

11.5.4.14.2 Mechanical methods should be considered when non-selective maintenance cutting is required.

11.5.4.14.3 Mechanical methods should be considered for selective removal of dense stands of incompatible species.

11.5.5 IVM application

11.5.5.1 Treatments shall be implemented according to individual site characteristics.

11.5.5.2 Large areas should be divided into management units.

11.5.5.2.1 Management units within a project should be clearly delineated based on-site and vegetation conditions.

11.5.5.2.2 Individual site prescriptions and treatments may be extended into other geographic areas where conditions are consistent.

11.5.5.3 Incompatible vegetation not eliminated should be pruned or relocated.

11.5.5.4 Selective methods should be utilized in proximity to surface water resources.

11.5.5.5 Cut stumps with the potential for re-sprouting should be treated.

11.5.5.6 Tools and equipment shall be maintained in proper working condition and shall be used according to manufacturers' recommendations.

11.6 Monitoring and maintenance

11.6.1 Post-treatment site evaluations shall be performed to monitor the efficacy and appropriateness of control methods and treatments used.

11.6.2 Work records for each management unit should be maintained as benchmarks for future evaluations.

11.6.3 Site-specific corrective actions should be implemented if warranted.

11.6.4 Management plans should be dynamic, periodically reviewed, and program improvements should be implemented.

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12 Root Management standards

12.1 All requirements in *Clause 4 General* shall apply to Clause 12.

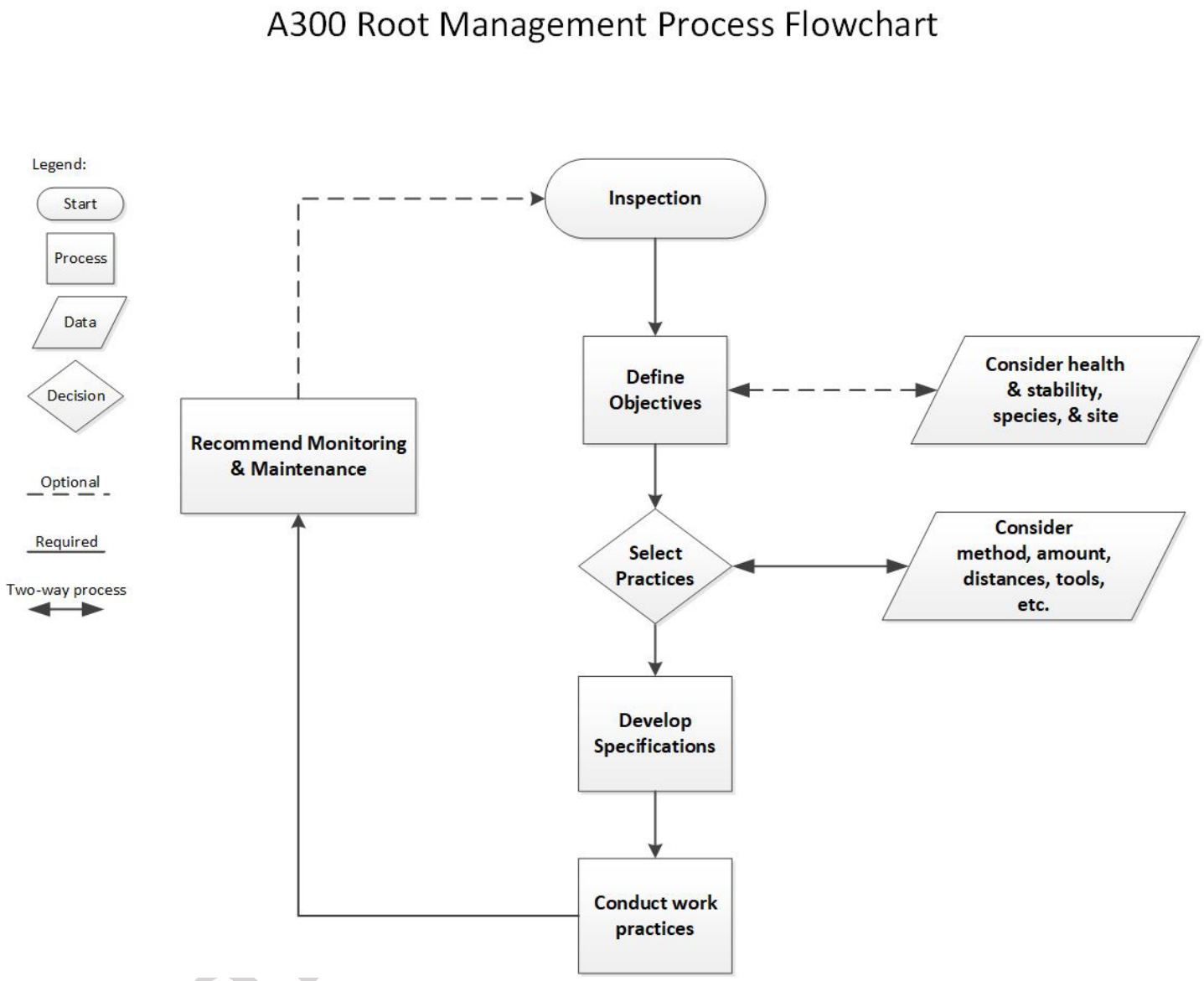


*Fig. 12 Root management process flowchart***12.2 Inspection**

12.2.1 A plant and site inspection shall be performed prior to developing specifications.

12.2.2 The inspection shall be used to assess suitability for root management.

12.3 Objectives

12.3.1 Root management objectives may include one or more of the following:

Locating and inspecting the trunk and/or roots;

Identifying and correcting tree health issues;

Preventing, minimizing, or mitigating infrastructure interference and/or damage;

Preventing or correcting root system defects;

Preventing and/or mitigating damage to the trunk or roots during construction;

Protecting roots from mechanical damage; and

Managing other uses of the area.

12.3.2 When establishing root management objectives, the arborist or qualified professional shall consider the likelihood of post-treatment tree decline and destabilization.

12.3.3 When establishing root management objectives, the arborist or qualified professional should consider:

Potential benefits;

The intended use of the site;

Regulations;

Site conditions (e.g., topography; soil quality, volume, moisture);

Distance to infrastructure;

Species characteristics and tolerance;

Environmental factors;

Timing of treatment; and,

Tree age and condition (e.g., health, structure, form).

12.4 Root Management specifications

12.4.1 Specifications shall include:

Location of the tree;

Objectives; and,

Method of root management;

12.4.2 Specifications should include:

Details of root management method;

Depth of excavation;

Location of excavation/cuts;

Type of root cuts (e.g., selective or nonselective);

Changes in grade;

Tools and equipment to be used;

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Time frame for work implementation;

Post-root management care;

Type of inspections and treatments;

Inspection interval and duration; and,

Other information as necessary.

12.5 Root Management practices

12.5.1 Root management practices should include, but are not limited to, one or more of the following:

Inspection of a burried trunk, flare, root collar, or roots;

Selective root pruning;

Non-selective root cutting; and,

Directing or redirecting root growth.

12.5.2 Root pruning tools shall be selected to meet the objective while minimizing damage to the plant.

12.5.3 Tools used shall be maintained according to manufacturer's recommendations.

12.5.4 Wounds should not be treated, except to manage desiccation or pests.

12.5.5 Cuts should result in a smooth surface whenever possible.

12.5.6 When treating injured roots, only loose or damaged tissue should be removed.

12.5.7 Trunk, flare, and/or root inspection

12.5.7.1 Inspection should include, but is not limited to, one or more of the following:

Root location;

Soil against the trunk and root collar;

Girdling of the root collar or stems by roots or other materials;

Decay or damage;

Pests;

Response growth; and

Graft unions.

12.5.7.2 Mulch, soil, hardscape, and other materials should be removed as needed to allow for the inspection.

12.5.7.3 Small adventitious roots that interfere with excavation or examination should be moved or pruned.

12.5.7.4 Adventitious roots should be considered for retention.

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12.5.7.5 Temporary protection of newly exposed roots and stem tissue shall be considered to protect against desiccation and pests.

12.5.7.6 Post-root management treatment should be recommended based on the diagnosis (see *subclause 12.6*).

12.5.7.7 If significant structural defects are observed, a risk assessment should be recommended (see *Clause 13*).

12.5.7.8 The root collar should remain visible after inspection.

12.5.8 Root pruning and root cutting

12.5.8.1 When mitigating or avoiding infrastructure damage, only roots causing or likely to cause damage should be pruned.

12.5.8.2 When root removal is unavoidable**,** selective pruning shall be the preferred method.

12.5.9 Root pruning (selective)

12.5.9.1 Roots should be exposed using minimally damaging excavation method prior to pruning.

12.5.9.2 A pruning cut that removes a root at its point of origin should not cut into the trunk or parent root.

12.5.9.3 The pruning cut should be the smallest diameter that meets the objective.

12.5.9.4 The final cut should result in a flat surface with adjacent bark firmly attached.

12.5.10 Root cutting (non-selective)

12.5.10.1 When non-selective root cutting is necessary, roots shall be cut as far from the trunk as practical.

12.5.10.2 Minimum distance from the trunk for root cutting should be adjusted according to trunk diameter, species tolerance to root loss, tree age, health, and site condition.

12.5.10.3 Root cutting distances from the trunk shall be adjusted for disease management, root location, tree species and condition, and, site and soil conditions.

12.5.10.4 Roots should be cut with equipment that minimizes cracking the wood and tearing the bark.

12.5.10.5 Heavy equipment should be located outside the root cut line or remain on existing pavement or on a soil-protecting surface.

12.5.10.6 Temporary staging areas for excavated soil should be located at a safe distance on the side of the trench furthest from the trunk.

12.5.10.7 Upon completion of non-selective root cutting, damaged roots should be pruned in accordance with *subclause 12.5.9* where practical.

12.5.11 Girdling roots and other materials

12.5.11.1 Roots or other materials that encircle or girdle the trunk or a buttress root should be considered for redirecting or removal.

12.5.11.2 Girdling roots and material targeted for removal should be exposed before cuts are made.

12.5.11.3 Encircling or girdling root providing more benefit than damage or potential damage should be retained.

12.5.11.4 The trunk and buttress roots shall not be unnecessarily damaged.

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12.5.11.5 If one or more large girdling roots are present, progressive root pruning over a specified period should be considered.

12.5.12 Managing the direction of root growth

12.5.12.1 Root redirection methods shall include, but are not limited to, one or more of the following:

Installing, and/or maintaining root barriers;

Installing, and/or maintaining root channels;

Removing or mitigating impermeable surfaces above the roots;

Penetrating or mitigating impermeable layers below the roots;

Directing adventitious roots that arise from stem or branch tissue to suitable conditions;

Directing circling or girdling roots in a radial direction; and,

Covering or treating surface roots.

12.5.12.2 Managing the direction of root growth shall be preferred over root pruning or cutting.

12.5.12.3 Managing the direction of root growth shall be considered following root pruning.

12.5.12.4 Use and installation of root management devices should follow manufacturers' recommendations.

12.5.12.5 Root barriers should be installed as far from tree trunks as possible.

12.5.12.6 Roots that grow over the root barrier should be pruned on the tree trunk side of the barrier.

12.5.12.7 Surface roots should be managed by removing or replacing or reducing soil density in accordance with *Clause 6* or raising the grade with porous soil, sand, or mulch to meet the objective.

12.6 Monitoring and maintenance

12.6.1 Recommendations for monitoring and maintenance should be made to the client.

12.6.2 Recommendations should be based on type of root management and tree and site conditions.

12.6.3 Recommendations for monitoring and treatment should include:

Type of inspections;

Inspection frequency and duration; and,

Type of treatments.

12.6.4 Recommendations for the type of monitoring and maintenance should consist of, but are not limited to, one or more of the following practices:

Risk assessment and management;

Soil moisture management;

Mulching;

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Integrated pest management;

Pruning;

Soil management;

Installation/maintenance/removal of tree support systems;

Lightning protection; and,

Application of growth regulators, fertilizers and /or biological soil treatments.

12.6.5 Scheduling monitoring and maintenance shall be the responsibility of the tree owner.

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13 Tree Risk Assessment a. Tree Failure standards

13.1 All requirements in *Clause 4 General* shall apply to Clause 13.

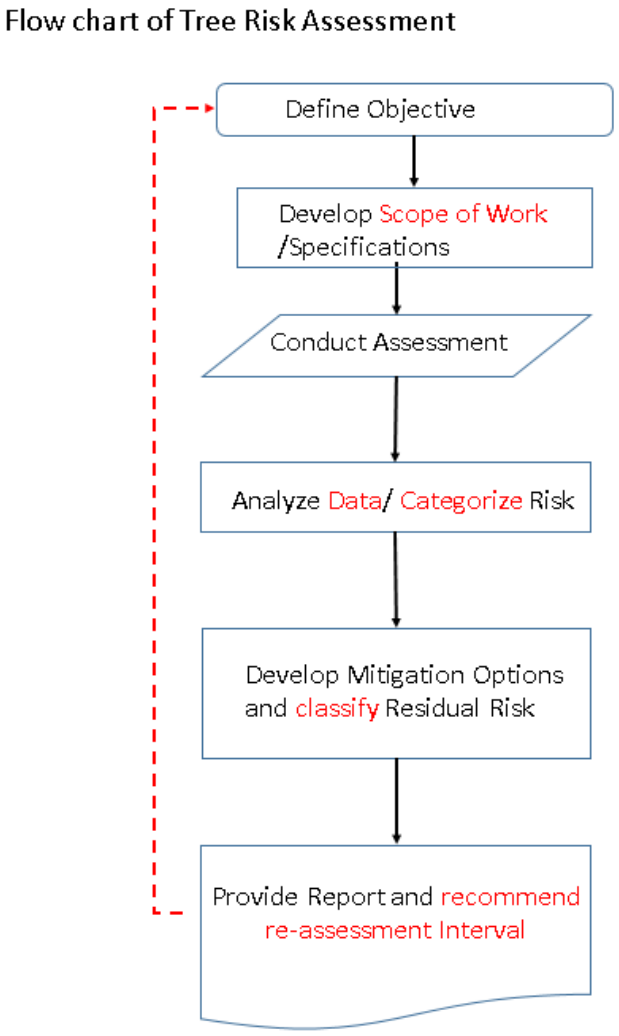


Fig. 13 Tree Risk Assessment process flowchart

13.2 Inspection

13.2.1 Tree risk assessment specifications may be developed prior to inspecting the tree and site.

13.2.2 Work site inspection

13.2.2.1 Trees to be assessed at Level 1 should be viewed remotely or in person.

13.2.2.2 Trees to be assessed at Level 2 or Level 3, shall be visually inspected in person.

13.3 Objectives

13.3.1 The objective of tree risk assessment shall be to assess the risk associated with the failure of a tree or tree part, its potential for impacting a target, and the likely consequences.

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13.3.2 Tree risk assessors shall have sufficient training and experience to provide the specified level and details of the tree risk assessment.

13.3.3 Tree risk assessors should consult with the client to assess site use, and identify significant known and foreseeable **targets** within the likely **target zone.**

13.3.3 The tree risk assessor shall consider the likelihood of a tree failure impacting a target and the likely severity of the consequence.

13.3.4 Tree risk assessor should inform the client that not all **defects** or conditions that predispose a tree or tree part to failure are detectable and not all tree failures are predictable.

13.3.5 It shall not be the tree risk assessor's responsibility to select and implement the mitigation, schedule repeat or advanced assessments, or to schedule future monitoring and maintenance, unless included in the scope of work

13.4 Tree Risk Assessment specifications

13.4.1 Specification for tree risk assessment shall include:

The tree risk assessment methodology to be used;

The time frames of the assessment Tree location and/or tree selection criteria; and,

Level of risk assessment.

13.4.2 Specifications for tree risk assessments should include, but are not limited to:

Objective of the assessment;

Details of risk assessment, including tools and techniques to be used;

When the assessment will be conducted;

Type of report (e.g., verbal, written) to be developed;

To whom the report should be presented; and,

Due date of report.

13.4.3 Tree risk assessors shall not be required to assess trees other than those specified in the scope of work.

13.4.4 Tree risk assessors shall not be required to perform a higher level of assessment than specified in the scope of work.

13.5 Levels of Tree Risk Assessment

13.5.1 Level 1: Limited Visual Tree Risk Assessment

13.5.1.1 The tree(s), targets, conditions of concern (if any) to be considered, and perspective of the assessment, (e.g., one-sided, ground-based, vehicular, or from an aircraft) shall be specified.

13.5.2 Level 2: Basic Tree Risk Assessment

13.5.2.1 Basic tree risk assessments shall include a 360 degree ground based inspection around the tree.

13.5.2.2 Basic assessments shall consider defects and conditions that affect tree failure.

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13.5.2.2.1 Conditions can include **tree species failure profiles**, loads on the tree or tree parts, growth that has occurred in response to loads, and site factors that affect the potential for failure and impact.

13.5.2.3 Simple tools may be used at the discretion of the risk assessor or shall be used as specified in the scope of work.

13.5.3 Level 3: Advanced Tree Risk Assessment

13.5.3.1 Advanced tree risk assessments shall include the use of specialized tools or techniques not included in a Level 1 or 2 assessment.

13.5.3.2 Tools or techniques used in a Level 3 assessment shall be specified in the scope of work.

13.5.4 Obvious tree defects shall be considered at all levels of assessment.

13.5.5 The tree risk assessor should recommend a higher level or different method assessment if the assessor cannot sufficiently determine the severity of conditions or defects within the parameters of the specified assessment.

13.6 Risk analysis and reporting

13.6.1 The assessor shall analyze the data collected from the tree, site, and target assessment.

13.6.2 Level 1 assessments shall not require a risk rating.

13.6.3 Reports shall be provided to the client as specified.

13.6.4 Reports shall include the tree location, target(s), time frame, date of inspection, and level of risk assessment when applicable.

13.6.5 Reports should include:

Objective of the assessment;

Identification of the assessor(s) and their qualifications;

Tree species;

Part(s) of the tree assessed;

Description of the methodology used;

Tree risk assessment data;

Risk rating for the tree or tree part(s) (Level 2 or Level 3 only);

Risk mitigation options and/or recommendations;

Recommendation for additional assessment(s), when appropriate;

Residual risk for any recommended mitigation;

Recommendations for monitoring and follow-up; and,

Statement of the limitations of the inspection and assessment methodology.

13.6.5.1 Recommendations to mitigate risk should contain a statement that not all risk associated with trees can be eliminated.

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13.7 Monitoring and maintenance

13.7.1 Monitoring, mitigation, and future maintenance recommendations should be made based on the objective, targets, current level of risk, mitigation recommendation, and residual risk.

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14 Integrated Pest Management standards

14.1 All requirements in *Clause 4 General* shall apply to Clause 14.

14.2 Inspection

14.2.1 A plant and site inspection shall be performed prior to developing specifications.

14.2.2 The inspection should be used to assess suitability for an IPM program.

14.3 Integrated Pest Management (IPM) objectives

14.3.1 IPM objectives shall be established and adjusted based on client input using the information obtained during the plant and site assessment.

14.3.2 Objectives should include but are not limited to:

Improving aesthetics;

Protecting plants from excessive damage;

Environmental protection;

Ecological sustainability; and,

Managing pests.

14.4 Specifications

14.4.1 Specifications should be based on the plant and site assessment, a determination of a condition(s) to address, and the desired outcome.

14.4.2 Specifications should include:

Plant(s) selected for the program;

Plant location(s) (e.g., front yard, backyard, around buildings, entire campus, etc.);

Objectives;

Program type (e.g., organic, hybrid, traditional);

Plant size as related to treatments;

Number, timing, and intervals of monitoring visits;

Time frame for monitoring reports and end-of-season report, and method of delivery (e.g., verbal, written, invoice);

Person designated to receive the reports; and,

Program evaluation.

14.5 Reporting

14.5.1 The type and timing of report (oral, written) required shall be specified.

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14.5.2 Written monitoring reports should consider:

Date of inspection;

Key plants & key pests;

Locations;

Observations;

Treatments (including target pests);

Material formulation and dilution rates as appropriate;

Customer interaction and response; and,

General safety observations.

14.6 IPM practices

14.6.1 Communication

14.6.1.1 Communication with the client, owner, or owner's agent and adjacent property owners shall follow federal, state, and local regulations.

14.6.2 IPM strategy

14.6.2.1 A management strategy for achieving the objectives should be established considering the plant and site assessment, and the client's preferences and limitations.

14.6.2.2 The management strategy shall be based on IPM principles and practices.

14.6.2.3 Nonselective treatments that do not consider the pest situation, client expectations, and site and plant conditions shall not be considered an acceptable management strategy when using an IPM approach.

14.6.2.4 Targeted treatments shall be considered an acceptable management strategy.

14.6.2.5 The management strategy should specify action thresholds that initiate implementation of management methods.

14.6.2.6 Action thresholds should be based on the following:

Pest populations, physiological injury to the plant, plant aesthetics;

Client pest tolerances;

Preferential use of cultural or biological treatments when effective;

Presence of beneficial organisms;

Stage of plant development;

Seasonal weather conditions; and

Site inspection frequency.

14.6.3 Monitoring Program

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14.6.3.1 Monitoring frequency should be established.

14.6.3.2 Monitoring visits should include on-site or remote inspections of key plants.

14.6.3.3 Monitoring should include, but is not limited to:

Plant phenology and climate conditions;

Timing/intervals;

Pest identification, population, and life stage(s) presents;

Plant and site conditions;

Evaluation of the results of previous IPM activities and treatments;

Observation of and potential for natural or biological control of the pest; and,

Client communications and expectations.

14.6.3.4 A decision to treat shall be made by the arborist, IPM manager, or IPM specialist based on the results of monitoring and evaluation of the pest population and the action threshold.

14.6.3.5 When a decision to treat is made, the arborist, IPM manager, or IPM specialist shall choose treatments from management methods in accordance with the objectives and the management strategy.

14.6.3.6 Efficacy of management method(s) should be considered.

14.6.4 IPM methods

14.6.4.1 IPM methods should include:

Biological (e.g., predator/parasite conservation/augmentation);

Cultural (e.g., pruning, soil modifications, mulching, irrigation);

Physical/Mechanical (e.g., physical removal of pest, trapping, barriers);

Chemical (e.g., organic pesticides, reduced-risk pesticides, traditional pesticides); and,

No treatment (e.g., monitoring without treatment).

14.6.4.2 Plants that are not performing well on the site and/or require a high level of pest management should be considered for replacement. Preference should be given to replacement with species or varieties that are resistant to pests.

14.6.4.3 Conservation, introduction, and/or augmentation of natural predators and parasites of pests on the site should be considered.

14.6.4.4 Installing plant species that promote predators and parasites of pests should be considered.

14.6.4.5 Cultural approaches to maintaining plant health such as, but not limited to, pruning, improving soil conditions, mulching, and irrigation should be considered.

14.6.4.6 When specified, pruning shall be performed according to *Clause 5*.

14.6.4.7 When specified, soil and root treatments shall be performed according to *Clauses 6 and 12*.

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14.6.4.8 Use of physical/mechanical management methods such as, but not limited to, physical removal of a pest, use of barriers, and trapping should be considered.

14.6.4.9 If organic materials are specified, arborists or IPM managers should specify the type and formulation to be used, and the organic certification system applicable.

14.6.4.10 When a chemical treatment is specified/used, preference should be given to the use of materials with minimal threat of adverse impact to non-target organisms.

14.6.4.11 The arborist, IPM manager, or IPM specialist should consider the following criteria when selecting chemical treatments:

Sensitivity of the site or adjacent site;

Label requirements or restrictions;

Legality of use on the site and for the targeted pest(s);

Risk related to client and applicator safety and environmental impact;

Efficacy against targeted pest(s);

Toxicity (initial and residual) to target and non-target organisms; and,

Delivery system requirements.

14.6.4.12 Chemical treatments shall be used in accordance with federal, state, and local laws and regulations.

14.6.4.13 Pesticide spray drift shold be minimized by selection of appropriate spray equipment, calibration, spray adjuvant, and pressure.

14.6.4.14 Selective treatments to individual plants or parts of plants should be preferred.

14.6.4.15 Chemical treatments should be selected or rotated to reduce the risk of pest resistance.

14.7 Monitoring and maintenance (program evaluation)

14.7.1 The IPM program evaluation should assess the efficacy of treatments in relation to the objectives established.

14.7.2 Evaluation of treatments should be used to adjust and improve the IPM program.

14.7.3 The results of the IPM program evaluation shall be reported to the client as specified

1**4.7.4** New or additional recommendations should be made based on the monitoring findings, and the objectives.

14.7.5 Tree risk assessments, if required, shall be performed according to *Clause 13*.

14.7.6 When specified an end-of-program/season report should consider:

Activities, accomplishments, and/or challenges;

Status report of key plants and key pests from initial plant and site assessment;

The pest and plant conditions during implementation;

The pest and plant conditions at program completion;

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Treatments, materials applied to key plants or key pests on the site;

Materials applied during the program period;

Customer interaction, including pest tolerances and expectations;

Recommendations for the next season; and,

Other general site, safety, or landscape observations.

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15 Definitions (Definitions will be considered part of the ANSI A300 standards)

15.x	*Term*	*Definition*	*Clause*
.1	**action threshold**	(1, IVM) A level of incompatible plant pressure (e.g., species, density, height, location or condition) where vegetation management treatments should occur to prevent conditions reaching the tolerance levels. (2, IPM) The point at which the pest threatens the stated IPM objectives and requires the implementation of a management tactic.	11, 14
.2	**advanced tree risk assessment (syn. Level 3)**	A tree risk assessment performed to provide detailed information about specific tree parts, defects, site conditions, targets, consequences, or other factors relevant to the tree risk assessment.	13
.3	**adventitious root**	Root arising from parts of a root, branch, or stem.	12
.4	**aerial assessment**	An assessment of all or part of the crown from a position aloft.	13
.5	**aggregate**	Materials such as sand, gravel, or rock, often used under paved surfaces, as backfill, or for other purposes.	12
.6	**air terminal**	The highest aerial component(s) of a lightning protection system intended to provide lightning strike attachment point.	8
.7	**allelopathy**	Inhibition of plant growth or development that is induced by chemicals made by a competing plant.	6
.8	**alternating brace**	Alternating bracing consists of two or more rods installed in directional alignment but not vertical alignment.	7
.9	**alternative building methods**	one or more construction techniques that reduce damage to trees such as cantilevered buildings, grade beams, foundation bridging.	9
.10	**American Wire Gauge (AWG)**	A standardized sizing system for electrical wire.	8
.11	**Amon-eye nut**	Drop-forged eye nut, used to fashion through-hardware anchor(s).	7
.12	**anaerobic**	Pertaining to the absence of oxygen.	6
.13	**anchor**	Hardware installed to affix and/or terminate a cable or guy to the tree, ground, or other device.	7
.14	**anchor-tree**	A tree used to provide supplemental support in a guying installation.	7
.15	**arboriculture**	The art, science, technology, and business of commercial, public, and utility tree care.	5
.16	**arborist**	An individual engaged in the profession of arboriculture who, through experience, education, and related training, possesses the competence to provide for, or supervise the management of, trees and other woody plants.	9
.17	**arborist trainee**	An individual undergoing on-the-job training to obtain the experience and the competence required to provide for, or supervise the management of, trees and woody plants. Such trainees shall be under the direct supervision of an arborist.	12

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.18	**attachment point**	The place where the lightning flash connects (attached) to the lightning protection system.	8
.19	**backfill**	Media (e.g., excavated soil, amended soil, soil mix) used to fill the remainder of the planting hole after the root ball is installed.	10
.20	**ball and burlap**	Plants prepared for relocation by digging around the root ball and then wrapping and securing the root ball in burlap or other material.	10
.21	**bare root**	Plants prepared for relocation by digging around the root ball and removing most of the soil or growing media from the root ball.	10
.22	**basic tree risk assessment (Level 2)**	A tree risk assessment that includes a 360-degree, ground-based visual inspection of the tree crown, trunk, trunk flare, aboveground roots, tree related site conditions, and significant targets. The assessment may include the use of common hand tools.	13
.23	**berm**	(1) A large, raised soil area (measured in feet) on which plants are installed; (2) A temporary, small ring of soil (measured in inches) around a newly installed plant used to retain water, also referred to as a tree ring.	6
.24	**bimetallic connector**	A connector consisting of two or more types of metals intended to reduce the likelihood of forming an electrolytic couple.	8
.25	**biological management**	Management of pests using predators, parasites, and disease-causing organisms. Biological management may be naturally occurring or introduced.	14
.26	**biological methods**	Management of vegetation by establishment and conservation of compatible, stable plant communities using competition, allelopathy, animals, insects, or pathogens.	11
.27	**bond**	Electrical connection between a conductive object and a component of a lightning protection system intended to reduce electrical potential differences.	8
.28	**bonding conductor**	A conductor that connects a conductive object, metal tree support, cable, guy, or a metal conduit to the lightning protection system.	8
.29	**box cable**	Box cabling consists of connecting four or more tree parts in a closed series.	7
.30	**bracing**	The installation of lag-thread screw or machine-thread steel rods in branches, leaders, or trunks to provide supplemental support.	7
.31	**branch**	A shoot or stem arising from another branch or stem.	5
.32	**branch bark ridge**	The raised strip of bark on the top and side of a union where the branch and parent stem meet.	5
.33	**branch collar**	The area of swelling at the union between a parent stem and a smaller branch.	5
.34	**bulk density**	Mass (weight) of dried soil per unit volume (g/cm3); often used as a measure of soil compaction.	6
.35	**burlap**	A loose-weave fabric that is used to protect plant parts and/or add support to root balls during planting and transplanting operations. May be natural (untreated and biodegradable), chemically treated with preservatives,	10

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		combined with synthetic fibers, or made entirely of synthetic fibers (not biodegradable).	
.36	**buttress**	Portion of the flare that projects outward from the lower trunk	12
.37	**buttress roots**	Roots at the base of the trunk that help support the tree.	13
.38	**cable**	1) Zinc coated strand per ASTM A-475 for dead-end grip applications. 2) Wire rope or strand for general applications. 3) Synthetic-fiber rope or synthetic-fiber webbing for general applications.	7
.39	**cable grip**	A mechanical device that temporarily grasps and holds a wire rope or strand cable during installation.	7
.40	**cable-end termination**	Hardware designed to anchor cables installed through a branch or stem.	7
.41	**cabling**	The installation of a steel wire rope, steel strand, or synthetic-fiber system within a tree between branches or leaders to provide supplemental support.	7
.42	**calcareous soil**	Soil containing a high level of calcium carbonate.	6
.43	**caliper**	Stem width (diameter) measured at a specified height.	10
.44	**callus**	Undifferentiated, non-lignified tissue, usually developed in response to wounding.	12
.45	**cambium**	Meristematic tissue that gives rise to xylem, phloem, and new cambium.	5
.46	**canker**	localized diseased area on stems, roots, and branches. Often shrunken and discolored.	12
.47	**chemical methods**	Management of incompatible vegetation using herbicides or plant growth regulators.	11
.48	**chemical treatments**	Management of pests using pesticides, pheromones, or insect growth regulators.	14
.49	**circling root**	A root that encircles all or a portion of a trunk or root ball but does not contact the trunk.	10
.50	**clamp-type connector**	Connector fittings that use one or more bolts or screws to secure the connection.	8
.51	**clean**	Arboricultural term used to describe selective pruning to remove one or more of the following.	5
.52	**clearance area**	specified area from which vegetation is to be removed.	5
.53	**client**	A person, corporation, or other entity who has hired the qualified professional.	5
.54	**client, owner, or owner's agent**	A person, corporation, or other entity who has hired the qualified professional.	10
.55	**climbing spurs**	Sharp, pointed devices strapped to a climber's lower legs used to assist in climbing trees (syn. climbers, climbing spikes, gaffs).	5

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.56	**coarse wood-chip**	Average wood particle size of ¾ inch (18 mm) to 1.5 inches (31mm) in the long axis.	6
.57	**codominant stem/codominant branch**	Two or more stems or branches of similar diameter originating from the same union.	5
.58	**compacted soil**	A soil with a high bulk density, lacking structure and macro porosity characterized by restricted water infiltration and percolation (drainage) and limited root penetration.	6
.59	**compartmentalization**	Physiological process that creates the chemical and physical boundaries that act to limit the spread of disease and decay organisms.	7
.60	**compatible vegetation**	Plant forms consistent with management objectives.	11
.61	**compost**	A stabilized product resulting from the biological decomposition of organic material.	6
.62	**conductor**	A copper cable or wire used in a lightning protection system intended to carry the lightning current to ground.	8
.63	**connector**	A part of the lightning protection system used to connect conductors to each other or to metallic installations.	8
.64	**connector clamp**	A multi-purpose bolt clamp that is used to bond conductors, or bond a conductor to a ground terminal or tree supplemental support system, and meets the specifications of ANSI/UL-96.	7
.65	**construction phase**	A stage of the development process when the building, roads, and infrastructure are installed and site improvements, are made.	9
.66	**container**	A flat, pot, tub, box, bag, basket, or other enclosure, usually made of plastic, fiber, wood, ceramic, or metal, used to grow or hold one or more plants, or plants that have been grown, moved, or stored in a container.	10
.67	**controlling authority**	An agency, organization, or corporate entity with the legal authority and/or obligation to manage individual trees or tree populations.	13
.68	**crimp-type connector**	A cast or stamped connector used to connect conductors in either an end-to-end, side-by-side, or Y configuration.	8
.69	**critical root zone**	The minimum volume of roots necessary for tree health and stability.	6
.70	**crossing**	Crossing bracing consists of two or more rods installed in a non-aligned pattern.	7
.71	**crown**	Upper part of a tree, measured from the lowest branch, including all the branches and foliage.	12
.72	**culm**	the stem of a grass or sedge, including, for the purposes of this standard, the woody, hollow aerial stem of bamboo.	5
.73	**cultural management methods**	Methods used to reduce pest populations by making conditions unfavorable for pests or more favorable for plant growth.	14

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.74	**cultural methods**	Compatible land uses that preclude the growth of incompatible vegetation, e.g. agricultural systems such as crops and pastures, parks or other managed landscapes.	11
.75	**dead-end brace**	A brace formed by threading a lag-thread screw rod directly into the limb, leader, or trunk, but not through the side opposite the installation.	7
.76	**dead-end grip**	A manufactured wire wrap designed to form a termination in the end of 1 X 7, left hand lay cable that meets the specifications of ASTM A-475 for zinc coated strand.	7
.77	**dead-end hardware**	Anchors or braces that are threaded directly into the tree but not through the side opposite the installation. Dead-end hardware includes but is not limited to lag hooks; lag eyes; and, lag-thread screw rod.	7
.78	**decay**	(v.) Decomposition of woody tissues by microorganisms. (n.) Wood that is decomposed.	12
.79	**defect**	A feature, condition, or deformity of a tree that may weaken structure or stability and could contribute to tree failure.	13
.80	**design phase**	A stage of the development process in which decisions about the location, size and shape of the building and other infrastructure are documented on a site plan.	9
.81	**development**	The process of converting land for the installation of infrastructure or structures or to make other improvements.	9
.82	**Diameter at breast height (DBH)**	Measurement of trunk diameter measured at 4.5 feet (1.37 m) above ground.	9
.83	**direct cable**	Direct cabling consists of a single cable between two tree parts, e.g., two branches, two stems, or a trunk and a branch.	7
.84	**directional pruning**	Selective removal of branches to guide and/or discourage growth in a particular direction.	5
.85	**dripline**	The soil surface area delineated by the branch spread of a single plant or group of plants.	6
.86	**electrolytic couple**	Contact between metals that are not galvanically compatible, causing an accelerated degradation (corrosion or oxidation) in the presence of moisture. An example is the combination of a copper conductor and a zinc galvanized support cable.	8
.87	**espalier**	A pruning system that trains plants to grow within a plane, such as along a wall, trellis or fence.	5
.88	**evaluation**	1) The process of comparing the current or predictable pest population to the action threshold to determine the need for treatment. 2) The process of assessing the results of the IPM program.	14
.89	**eye bolt**	A drop-forged, closed-eye bolt.	7

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.90	**eye splice**	A closed-eye termination formed into common grade cable by bending it back on itself and winding each wire around the cable a minimum of two complete turns.	7
.91	**failure (tree failure)**	Breakage of stem or branches, or loss of mechanical support in the root system.	13
.92	**fastener**	An attachment to secure a conductor to a tree.	8
.93	**fertilization**	The application of essential elements to the soil or plant.	6
.94	**fertilizer**	A material containing one or more of the elements essential for plant growth, development, or reproduction.	6
.95	**fertilizer analysis**	The composition of a fertilizer expressed as a percentage by weight of total nitrogen (N), available phosphoric acid (P_2O_5), soluble potash (K_2O), and other nutrients.	6
.96	**fertilizer ratio**	The ratio of total nitrogen (N), available phosphoric acid (P_2O_5), and soluble potash (K_2O); e.g., the ratio of a 30-10-10 fertilizer is 3:1:1.	6
.97	**field capacity**	The maximum water content of a soil after drainage due to the force of gravity.	6
.98	**fill**	Soil, sand, gravel, rocks, or other material placed over the existing soil surface to raise the finished grade.	12
.99	**flare (trunk flare, root flare)**	The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots.	12
.100	**flush cut**	A pruning cut that removes the branch bark ridge and/or branch collar, damaging the trunk or parent branch.	5
.101	**foliar application**	The application of a material to plant leaves.	6
.102	**French drain**	A trench filled with gravel or rock that may contain perforated pipe at the bottom to direct surface or ground water away from an area.	6
.103	**frond**	A leaf of a palm.	5
.104	**geotextile fabric**	A permeable fabric used to separate or stabilize soil.	6
.105	**grade**	Ground level.	10
.106	**ground plate**	A grounding electrode in the form of a copper plate.	8
.107	**ground rod**	A copper-clad steel, solid copper, stainless steel, or stainless-steel clad rod used to form a grounding electrode.	8
.108	**grounded**	Connected to earth or to a conductive material that is connected to earth.	8
.109	**grounding electrode**	The portion of a lightning protection system – such as a radial conductor, ground rod, or ground plate – that is installed for the purpose of providing electrical contact with the earth.	8
.110	**ground-rod clamp**	A fitting that is specifically designed to connect a conductor to a ground rod.	8

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.111	**guying**	The installation of a steel cable or synthetic-fiber cable system between a tree and an external anchor to provide supplemental support.	7
.112	**gypsum**	The common name for calcium sulfate used to supply calcium or to amend soils with a high sodium content.	6
.113	**hardness**	An attribute of water, related to high content of dissolved calcium and magnesium.	6
.114	**hardscape**	Built infrastructure such as pavement, sidewalks, curbing, storm drains, walls, and footings.	12
.115	**heading**	Pruning cut that removes a branch or stem between nodes (leaving a stub), to a bud, or to a live branch typically less than one-third the diameter of the branch or stem being removed.	5
.116	**hub and spoke cable**	Hub and Spoke cabling consists of a center attachment (hub) with spans (spokes) of cable radiating to three or more leaders.	7
.117	**hydraulic (soil loosening, injection)**	Using water pressure to loosen the soil or apply a soil amendment or fertilizer.	6
.118	**impermeable layer**	Soil layers that fully or partially restrict water, air movement, and/or root growth, such as hardpans, plow pans, rock, abrupt textural changes, or retaining walls (also referred to as impenetrable layer).	12
.119	**implant**	A capsule or other device that is inserted into the xylem of a tree.	6
.120	**incompatible vegetation**	Plant forms that are inconsistent with management objectives.	11
.121	**infiltration**	The entry of water into a soil.	6
.122	**infrastructure**	Inert material such as pavement, sidewalks, curbing, storm drains, walls, and footings.	12
.123	**integrated pest management (IPM)**	A sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools, in a way that minimizes health, environmental, and economic risks. Choice of tactics is based on effectiveness, environmental impact, site characteristics, safety, economics, and client expectations and preferences.	14
.124	**integrated vegetation management (IVM)**	A system of managing plant communities in which compatible and incompatible vegetation are identified, action thresholds are considered, treatment methods are evaluated, and selected treatments are implemented to achieve specific objectives.	11
.125	**IPM manager**	An individual who possesses necessary credentials and experience, and has supervisory oversight for developing IPM policy and programs.	14
.126	**IPM specialist**	An individual who possesses necessary credentials and experience for implementing IPM programs.	14
.127	**IPM specialist trainee**	An individual undergoing IPM training to obtain experience, competency and credentials and is under the supervision of an arborist, IPM manager, or IPM specialist.	14

.128	**IVM documentation**	Records of the IVM program, along with supporting information, and continuous improvement measures incorporated over time.	11
.129	**IVM maintenance plan**	A detailed tactical, project-specific plan that identifies resources, requirements, and schedules for vegetation maintenance.	11
.130	**IVM management plan**	A high-level strategic plan describing all elements of a vegetation-management program.	11
.131	**key pest**	A pest that frequently results in unacceptable damage and typically requires treatment.	14
.132	**key plant**	1) A plant that frequently experiences unacceptable pest damage. 2) A plant of value to the client.	14
.133	**lag eye**	Lag-thread, drop-forged, closed-eye anchor.	7
.134	**lag hook (J-hook)**	Lag-thread, J-shaped anchor.	7
.135	**lag thread**	A coarse screw thread designed for securing into wood.	7
.136	**lag-thread hardware**	Anchors or braces with lag-threads. Lag-thread hardware includes, but is not limited to; lag eyes, lag hooks, and lag-thread screw rod.	7
.137	**lag-thread screw rod**	Lag-thread, steel rod, used for dead-end and through-brace installations.	7
.138	**landscape phase**	A stage of the development process in which the landscaping is installed, including hardscape, irrigation, planting soil, landscape lighting, and plants.	9
.139	**lateral branch**	A shoot or stem growing from a larger (parent) branch.	5
.140	**layering**	the growth of roots from branch tissue in contact with the soil.	12
.141	**leader**	A main trunk or stem that dominates all or a portion of the crown. Trees and shrubs may have one leader or several individual leaders.	5
.142	**limited visual assessment (Level 1)**	A visual assessment from a defined perspective (such as, a one-sided ground-based, vehicular, or from an aircraft) of an individual tree or a population of trees, to assess risk to specified targets from obvious defects or specified conditions.	13
.143	**line of sight**	The line of vision to a specific view element (syn. sightline).	5
.144	**lion tailing**	The use of branch removal cuts to remove interior lateral branches, resulting in a concentration of growth at branch ends.	5
.145	**machine-thread**	A fine screw thread designed for fittings (such as hardware nuts).	7
.146	**machine-thread rod**	A machine-thread steel rod used for through bracing installation.	7
.147	**main conductor**	A conductor that connects an air terminal(s) to the grounding electrode.	8
.148	**management strategy**	a plan to achieve objectives within established	14

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.149	**manual methods**	Management of vegetation using hand-operated tools, such as handsaws and small power tools.	11
.150	**mechanical methods**	Management of vegetation using equipment-mounted saws, mowers, or other such devices.	11
.151	**mechanical pruning**	Pruning with heavy equipment (not hand-held) fitted with power saws or other cutting devices (e.g., saws mounted on booms or suspended from a helicopter).	5
.152	**mitigation**	(1) Improving or alleviating unfavorable conditions; (2) The process of diminishing risk.	12, 13
.153	**monitoring**	A systematic inspection of the managed landscapes conducted at regular intervals to determine the types of pests, their numbers, the amount of damage caused by pests, the presence of beneficial organisms, and the effectiveness of treatments.	14
.154	**mulch**	A material applied to the soil surface to protect the soil, deter erosion, moderate soil temperature, conserve moisture, inhibit weeds or improve soil structure.	12
.155	**mulch, organic**	A material with plant or animal origin applied to the soil surface.	6
.156	**multiple grounding electrode**	A grounding system composed of two or more grounding electrodes, such as a radial conductor, ground rod, or ground plate.	8
.157	**natural (pruning system)**	A pruning system intended to maintain the tree's characteristic growth pattern and adaptations.	5
.158	**node**	Slightly enlarged portion of a stem (or branch) where shoots arise.	5
.159	**non-selective methods**	Management of all vegetation within a prescribed area without regard to species compatibility.	11
.160	**non-selective treatments**	Methods used to manage pests without consideration of an IPM approach. (e.g., cover sprays, broadcast applications)	14
.161	**non-target organism**	An organism that is not intentionally targeted by a pest management strategy.	14
.162	**nutrient**	element or compound required for growth, reproduction, or development of a plant.	6
.163	**organic matter**	A material derived from a living organism or its byproduct.	6
.164	**organic pesticide**	A pesticide made from naturally occurring ingredients. Organizations and agencies certify materials as meeting their requirements for use of the term *organic*.	14
.165	**palm**	Monocotyledonous plant of the Aracacaea family, generally with one or more unbranched trunks, with fronds emanating from a meristem at the top of the trunk.	5
.166	**palm frond skirt**	One or more year's accumulation of dead and drooping fronds at the bottom of the canopy and along the trunk.	5

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.167	**parallel brace**	Parallel bracing consists of two or more rods installed in vertical and directional alignment.	7
.168	**parasite**	An organism living in or on another living organism (host) from which it derives nourishment to the detriment of host, sometimes killing the host.	14
.169	**parent stem/branch**	A tree trunk, main stem, leader or branch from which other smaller branches grow.	5
.170	**peen**	The act of bending, rounding, or flattening the fastening end(s) of through-hardware for the purpose of preventing a nut from “backing-off.”	7
.171	**percolation**	The ease with which water passes through the soil profile.	6
.172	**perforated pipe**	A pipe with holes in its wall allowing water to move into the pipe.	6
.173	**pest**	Living organism including animal, insect, mite, fungus, bacteria, virus, nematode, or an undesirable plant that interferes with or threatens plant health or aesthetics.	14
.174	**pesticide label**	legally enforceable information provided about a pesticide, including written, printed, or graphics on or attached to the pesticide or device or any of its containers or wrappers.	11
.175	**petiole**	The stalk of a leaf or frond.	5
.176	**pH**	A measurement of the hydrogen ion concentration (acidity or alkalinity) of a solution.	6
.177	**physical / mechanical management method**	Physical removal of pest or by use of equipment.	14
.178	**planary form**	Shape that conforms to a geometric plane.	5
.179	**planning phase**	A stage of the development process in which building and engineering needs, topography, and site-use requirements are considered.	9
.180	**plant / site assessment**	A systematic determination of the landscape parameters, plant species, pest populations, key plants, key pests, and site conditions.	14
.181	**plant pressure**	An expression of risk created by incompatible plants growing in conflict with vegetation-management objectives for a site, typically expressed in terms of clearance, height, density, species and/or other factors.	11
.182	**planting**	The process of installing plants into the landscape.	10
.183	**planting/transplanting system**	The process used in producing trees in the nursery or digging them in the field, resulting in bare root, ball and burlap, container (e.g., pot, box, wire basket), or tree spade plants.	10
.184	**pleaching**	Pruning system that trains one or more plants to achieve a desired shape or form through a combination of pruning and interweaving or tying small branches to one another, or to a pre-formed frame.	5
.185	**pneumatic (soil loosening, injection)**	Using pressured air to loosen the soil or apply a soil amendment or fertilizer.	6

.186	**pollard head**	Response growth that forms a knob or swelling at sprout removal sites on trees maintained within a pollarding pruning system.	5
.187	**pollarding**	A pruning system that maintains crown size by initial heading of branches on young trees, followed by removal of shoots to their point of origin at appropriate intervals without disturbing the resulting pollard head.	5
.188	**post-construction phase**	A stage of the development process in which construction and clean-up ceases, and the site is transitioned into use and maintenance.	9
.189	**pre-construction phase**	A stage prior to development phase during which the layout of the building, roads, and utility routes are defined, demolition and tree removals are conducted, and tree-protection barriers are typically installed.	9
.190	**predator**	An organism that preys on another organism.	14
.191	**prescribed fire**	A planned, controlled fire, used to meet management objectives.	11
.192	**prop**	The installation of a rigid support placed between a trunk and/or branch and another supporting structure.	7
.193	**pruning**	The selective removal of plant parts to achieve defined objectives.	5
.194	**pruning amount**	Quantity of plant parts removed at one pruning, expressed in terms of a number of branches or other parts removed, and/or percentage of the crown or buds removed on an entire tree or specific branches.	5
.195	**pruning system**	Process used to achieve the desired long-term form of the plant.	5
.196	**qualified professional**	An individual who, because of training and experience, has demonstrated the ability to perform assignments safely and effectively, and, where required, is properly credentialed in accordance with federal, state or local laws and regulations.	9
.197	**quick-release fertilizer**	A fertilizer that is immediately available to the plant.	6
.198	**raising**	Arboricultural term referring to pruning of branches to provide vertical clearance below the crown.	5
.199	**reclamation**	Reestablishment of IVM objectives in areas not actively maintained.	11
.200	**reduced-risk pesticide**	A designation by the U.S. Environmental Protection Agency (EPA) that includes pesticides with the following attributes: low impact on human health, low toxicity to non-target organisms, low potential of ground water contamination, low use rates, low pest resistance potential, and compatibility with Integrated Pest Management practices.	14
.201	**reduction**	Arboricultural term referring to decreasing branch length, or plant height and/or spread.	5
.202	**reduction cut**	A pruning cut that removes the larger of two or more branches or stems, or one or more codominant stem(s), to a live lateral branch, typically at least one-third the diameter of the stem or branch being removed.	5
.203	**rejuvenation**	Removal of overmature, dead or dying stems of a shrub, near the ground, to stimulate new stem development.	5

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.204	**remote/rural location**	Undeveloped or sparsely populated area, including areas of agricultural and forest land, not in direct association with dwellings or development.	5
.205	**removal cut, branch**	A pruning cut that removes the smaller of two branches at a union, or a parent stem, without cutting into the branch bark ridge or branch collar or leaving a stub.	5
.206	**residual risk**	Risk remaining after mitigation.	13
.207	**resource evaluation**	The process of assessing the soils, trees, shrubs, and/or other woody plants present on or near the site and determining potential challenges, opportunities, and construction impacts.	9
.208	**response/responsive growth**	Wood growth that may increase the strength or stability of a tree in response to a defect or condition.	13
.209	**restoration**	Pruning to redevelop structure, form, and appearance of topped or damaged woody plants.	5
.210	**retaining wall**	A structure built to stabilize a slope and keep soil in place.	6
.211	**right-of-use**	Legal authority to utilize property.	11
.212	**risk**	The combination of the probability of an event and its consequence.	13
.213	**risk analysis**	Systematic use of information to identify sources and to estimate risk.	13
.214	**risk assessment**	The process of risk identification, analysis, and risk evaluation.	13
.215	**risk assessment methodology**	The framework of the risk assessment, such as “a Level 2 Basic Assessment using a ground based visual assessment and the qualitative assessment techniques described in the ISA BMP for Tree Risk Assessment.”	13
.216	**risk mitigation**	The process of reducing risk.	13
.217	**root ball**	The root mass retained with the plant after digging or removal from a container. It may or may not contain soil or other growing media.	10
.218	**root ball support materials**	Pots, boxes, wire baskets, burlap, wire mesh, or twine that surround the root ball and trunk.	10
.219	**root barrier**	A device designed to direct root growth.	12
.220	**root channel**	An underground system used to direct root growth and increase soil volume.	12
.221	**root collar**	The transition zone between the trunk and root system (also called root-stem transition zone or trunk flare).	10
.222	**root collar examination**	The process of exposing and assessing the root collar.	12
.223	**root cutting**	Severing roots non-selectively.	12
.224	**root initiation zone**	In palms, the region of the trunk from which roots emerge.	10
.225	**root pruning**	Severing roots selectively.	12

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.226	**root, buttress**	A major lateral root radiating from the base of the trunk.	12
.227	**root, circling**	A root that encircles all or a portion of a trunk but does not contact it.	12
.228	**root, girdling**	A root that encircles all or a portion of a trunk and contacts the trunk or a buttress root.	12
.229	**root, surface**	A lateral root that is visible above grade.	12
.230	**salinity**	The concentration of dissolved salts in water.	6
.231	**salt index**	A measure of the salt concentration that fertilizer produces in the soil solution. The higher the salt index, the more likely plant damage will occur.	6
.232	**scope of work**	A description of the work activities, deliverables, and timeline a vendor must execute in performance of specified work for a client.	14
.233	**selective management**	Methods used to manage specific pests using an IPM approach.	14
.234	**selective methods**	Management of incompatible vegetation within a prescribed area while retaining compatible vegetation.	11
.235	**shall**	As used in this standard, denotes a mandatory requirement.	9
.236	**shearing**	Cutting leaves, shoots and branches to a desired plane, shape or form, using tools designed for that purpose, as with topiary.	5
.237	**shoot**	New stem or branch growth.	5
.238	**should**	As used in this standard, denotes an advisory recommendation.	9
.239	**shrub**	Woody perennial plant, usually with several stems that may be erect or close to the ground, generally smaller than a tree.	5
.240	**side flash**	Current that jumps from a lightning struck tree or object to a nearby tree, person, or object.	8
.241	**single brace**	Single bracing consists of one installed rod.	7
.242	**site history**	Evidence of past events, site changes, disturbances and/or site management activities or uses that may affect tree risk.	13
.243	**slow-release fertilizer**	A fertilizer containing plant nutrients in a form that delays availability for plant uptake after application, or extends availability to the plant.	6
.244	**soil aeration**	The process of improving air exchange in the soil.	6
.245	**soil amendment**	A material added to the soil that improves physical, chemical and/or biological properties.	6
.246	**soil injection**	Using pneumatic or hydraulic means to apply an amendment or fertilizer into the soil.	6
.247	**soil modification**	Physically or chemically altering soils to improve conditions for plant growth.	6

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.248	**soil profile**	A vertical view of the soil showing its horizons or layers.	6
.249	**soil structure**	Soil classification characteristic of how soil particles bind together (aggregate), creating voids between the aggregates.	6
.250	**soil texture**	Soil classification characteristic of the relative size (fineness or coarseness) of soil mineral particles, specifically the proportions of sand, silt, and clay.	6
.251	**soil volume**	The volume of soil available to trees and other woody plants that is available for root development.	12
.252	**sounding**	The process of striking a tree with a mallet or similar tool and listening for tones that may indicate certain conditions.	13
.253	**specifications**	A document stating a detailed, measurable plan or proposal for provision of a product or service.	9
.254	**spot treatment**	A treatment localized on a plant, a portion of a plant, or a small group of plants.	14
.255	**stabilize**	To support a tree in a new location or after root or soil failure.	7
.256	**stake**	A tree support system used on new transplants that attaches a vertical post to the tree trunk to limit movement.	7
.257	**stakeholder**	A person or group that has an interest in, or is affected by, an activity or decision. External stakeholders are outside a business or project. Internal stakeholders work within an organization or project.	11
.258	**standard, ANSI A300**	The performance parameters established by industry consensus as a rule for the measure of extent, quality, quantity, value, or weight used to write specifications.	9
.259	**stem**	A dominant leader or branch bearing buds, foliage, and giving rise to other branches and stems.	5
.260	**stem girdling root**	A root that compresses a stem.	10
.261	**structural development pruning**	Pruning to influence the orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems.	5
.262	**stub**	Portion of a branch or stem remaining after an internodal cut or branch breakage.	5
.263	**subordination**	The removal of the end of a branch or stem to reduce leaf surface area, and to slow its growth relative to its parent, or to other branches or stems.	5
.264	**subsurface application**	The application of a material below the soil surface.	6
.265	**sucker**	Vigorous upright epicormic shoot that arises from latent buds below soil level or the graft union.	5
.266	**suitability and feasibility assessment**	An assessment of the site and tree or species to determine size, health, root issues, potential conflicts, species requirements, and site characteristics (e.g., soil texture, soil moisture, drainage, topography).	10

.267	**supplemental support system**	A system designed to provide additional support or limit movement of a tree or tree part.	7
.268	**surface application**	The application of a material above the soil surface.	6
.269	**swale**	A low tract of land frequently created to manage water runoff.	6
.270	**target**	People, property, or activities that could be injured, damaged, or disrupted by a tree failure.	13
.271	**targeted treatment(s)**	Pest management procedures that focus on a host plant and targeted pest.	14
.272	**taut**	Tightened to the point of eliminating visible slack.	7
.273	**temporary guy**	A guy system that is intended to be removed from the tree after a short period, often one to two years.	7
.274	**termination**	A device or configuration that secures the end of a cable to the anchor in a cabling or guying installation.	7
.275	**termination hardware**	Hardware used to form a termination. Termination hardware includes but is not limited to dead-end grips, thimbles used in eye-splice configurations, cable-end terminations, and swage-stop terminations.	7
.276	**thimble**	An oblong galvanized or stainless-steel fitting with flared margins and an open-ended base.	7
.277	**thinning**	An arboriculture term used to describe selective pruning to reduce density of branches and foliage.	5
.278	**threaded-steel rod**	A machine-thread, steel rod used for through-brace installations.	7
.279	**through-brace**	A brace formed by installing hardware completely through a branch, leader, or trunk.	7
.280	**through-hardware**	Anchors, cables, or braces that pass completely through the branch, leader, or trunk, secured with nuts and heavy-duty washers or cable-end termination.	7
.281	**tillage**	The mechanical manipulation of the soil to alter the soil's structure.	6
.282	**time frame**	The specified duration for which the risk assessment is applicable.	13
.283	**tolerance level**	The maximum allowable incompatible-plant pressure e.g., species, density, height, location, or condition, without unacceptable consequences.	11
.284	**topiary**	A pruning system that uses a combination of pruning, supporting, and training branches to orient a plant into a desired shape.	5
.285	**topography**	The physical relief or terrain, such as hills, ridges, swales, drainage, slope, and aspect – that influence water movement and drainage, soil depth, soil moisture content, exposure to sunlight, wind, and other factors.	6
.286	**topping**	Reduction of tree size by cutting live branches and leaders to stubs, without regard to long-term tree health or structural integrity.	5

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.287	**tracing**	The removal of loose, damaged tissue from in and around a wound.	5
.288	**transplanting**	The process of relocating an existing plant into the landscape.	10
.289	**treatment**	Application of one or more methods to achieve objectives.	11
.290	**tree**	A woody perennial plant with a single or multiple trunks which typically develop a mature size of over several inches' diameter and 10 or more feet in height.	5
.291	**tree**	A woody perennial plant with a single or multiple trunks, which typically develop a mature size of over several inches' diameter, and 10 or more feet in height.	9
.292	**tree inventory**	A map, plan, and/or list that describes tree attributes such as location, species, size, and/or condition.	9
.293	**tree protection plan**	The recommendations described in the tree-protection report intended to ensure survival of trees, shrubs, and other wood plants.	9
.294	**tree protection plan sheet**	A technical drawing that depicts the recommendations described in the tree protection report.	9
.295	**tree protection report**	A document describing current attributes, needs, and recommendations for preventing and mitigating damage to trees, shrubs or other woody plants on sites impacted by construction to ensure survival.	9
.296	**tree protection zone (TPZ)**	A defined area intended to protect the tree, roots, and soil.	9
.297	**tree protection zone barriers**	Devices such as fencing, berms, trees, or shrubs with signage, installed to define and limit access to tree protection zones, or soil protection areas, as appropriate to accomplish the tree protection plan.	9
.298	**tree risk**	The likelihood of a tree failure impacting a target and the likely severity of the consequences.	13
.299	**tree risk assessment**	A systematic process used to identify, analyze, and evaluate tree risk.	13
.300	**tree risk assessment methodology**	The procedure and terminology that will be used for the tree risk assessment. An example of a commonly used tree risk assessment methodology is presented in the ISA BMP for Tree Risk Assessment.	13
.301	**tree risk assessor**	An arborist or other qualified professional with training and experience in the practice of tree risk assessment.	13
.302	**tree spade**	Digging equipment used to transplant large trees employing large, steel spades driven by hydraulics, or plants dug employing large, steel spades driven by hydraulics.	10
.303	**tree species failure characteristics**	Recurring patterns of tree failure within a given tree species.	13
.304	**tree species failure profile**	Documented recurring patterns of tree failure within a given tree species.	13

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.305	**tree-to-ground guy**	A guy configuration in which at least one cable is connected between the tree to be supported and a ground anchor.	7
.306	**tree-to-tree guy**	A guy configuration in which at least one cable is connected between the tree to be supported and an anchor tree.	7
.307	**trenching**	To dig a furrow or ditch.	6
.308	**triangular cable**	Triangular cabling consists of connecting tree parts in combination of threes.	7
.309	**trunk**	The main or primary stem or stems of a tree.	5
.310	**trunk diameter**	Stem width measured at a specified height.	10
.311	**trunk injection**	A technique where material is applied directly into the xylem of a tree.	6
.312	**trunk protection**	Material installed around the trunk to prevent damage.	10
.313	**turnbuckle**	A drop-forged, closed-eye device for adjusting tension.	7
.314	**undesirable plant**	An invasive species of plant, noxious weed, or otherwise unwanted plant that may or may not be compatible with the intended use of the site.	11
.315	**union**	Junction of branches, stems, or leaders.	5
.316	**utilities**	Facilities associated with services such as telephone, data, CATV, electricity, gas, steam, energy transmission and distribution, water and sewage, and transportation.	12
.317	**utility**	A public or private entity that delivers a public service, such as electricity, gas, or communications.	5
.318	**vegetation manager**	An individual engaged in the profession of vegetation management who, through appropriate experience, education, and related training, possesses the competence to provide for or supervise an integrated-vegetation-management program.	11
.319	**vertical mulching**	Filling vertical holes in the soil with materials to improve aeration, moisture characteristics, or to increase nutrients.	6
.320	**vine**	A woody perennial plant that typically lies along the ground, or that rises above the ground by attaching to other plants or objects with tendrils or by twining.	5
.321	**wetting agent**	Chemical substances that increase the spreading and penetrating properties of a liquid.	6
.322	**wire rope clamp**	A clamp consisting of a “U” bolt, bracing plate, and fastening nuts.	7
.323	**wood-chip mulch**	A material placed on the soil surface composed of ground wood, bark and leaves usually generated by sending tree parts through a wood chipping machine.	6
.324	**wound**	Damage to plant tissue caused by pests, pruning, mechanical damage, or other natural forces.	12

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.325	**written reports**	Memos, emails, work proposals, work orders, letters, or booklet reports that provide information to achieve the stated objective.	13

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