

Guidelines for Tree Preservation in Construction Zones

Construction Site Management

Preservation of existing mature trees before, during, and after new construction and redevelopment is beneficial for a number of reasons, including:

- To sustain both the function and value of existing trees and tree canopy.
- To promote public safety and reduce liability by carefully maintaining the health of preserved trees.
- To contain costs associated with site restoration.
- To reduce or avoid soil compaction and degradation.
- To avoid physical injury to existing trees.
- To avoid root injury to trees.
- To protect soils and the hydraulic integrity of the entire site.
- To protect existing irrigation, utilities, and underground drainage.
- To prevent sediment-laden and/or polluted runoff from entering drainage systems and water bodies (streams, wetlands, lakes, bays).

Best Management Practices (BMPs)

PreConstruction

- The project manager shall know and understand the development and building regulations concerning trees and vegetation in the area.
- The project manager shall ensure that irrigation and drainage systems are operable and adequate.
- The project manager shall ensure all temporary erosion sediment control measures are in place prior to groundbreaking.
- The project arborist will be responsible for decisions related to vegetation on-site before, during, and after construction.

- The project arborist shall perform a site inventory of all existing trees in order to record the variety, location, size, and health of each tree. Site inventory includes determining size, species, numbers, and numbers of trees/plants on-site.
- Trees that require removal or pruning to accommodate future structures and construction equipment should also be identified.
- The project arborist shall submit a Tree Protection Plan (TPP) that identifies all significant trees that will remain on the project site.
- The TPP will indicate the Tree Protection Zone (TPZ) for each tree as (at a minimum) the greater of: 6', or by multiplying each tree's diameter at 4.5' above existing grade (DBH) by a factor of one to determine the diameter, in feet, of the area above and below ground to be protected.
- The TPZ may exceed the Critical Root Zone (CRZ), which is not less than half the distance between the trunk and the outer edge of the tree's canopy, or drip line, but the TPZ may not be smaller than the CRZ.
- The TPP will contain the expected tree protection techniques that will be used on the project.
- The TPP will also list a timetable for project meetings with the project team, including a preconstruction meeting and the schedule for the project arborist monitoring.
- Prior to approval of the TPP, the City shall collect an assurance device in the form of a deposit equal to the tree appraisal value of all protected trees as determined under the methods established by the Council of Trees and Landscape Appraisers, *Guide for Plant Appraisal* (9th Edition or most current).

Construction Site Preparation

- Staging areas for equipment shall be established far enough from existing trees to ensure adequate protection of the root zone.
- Entry and exit routes shall be established and fenced off with chain link or construction fencing. When planning routes, avoid utility access corridors.
- Irrigation and drainage systems shall be protected from damage unless plans call for renovation of such systems.

- Prior to beginning construction activities, the project arborist will supervise and verify the following tree protection measures are in place and comply with the approved TPP:
 1. A 6" layer of coarse mulch or wood chips is to be installed within the TPZ of protected trees. Mulch shall be kept 12" away from the trunk.
 2. Trunks of trees shall be protected with a single wrap of Geocomposite. Geocomposite shall be double sided, Geonet core with nonwoven covering (such as Tenax Tendrain 770/2), or equivalent. Tree trunks will be protected with wrap consistent with Figure 19.
 3. Trees that have been identified in the site inventory as posing a health or safety risk may be removed or pruned by no more than 1/3, subject to approval of the required permit by the Planning Division. Pruning of existing limbs and roots shall only occur under the direction of the project arborist.
 4. A protective barrier shall be installed around the Tree Protection Zone (TPZ). The fence shall be construction of 6' high chain link. Posts shall be 2" in diameter, driven 2' into the ground. The distance between posts shall be not more than 10'. The enclosed area is the TPZ and shall have a warning sign displayed prominently at 20' (maximum) intervals along the fence. The warning sign shall be a minimum 8.5"x11" and clearly state the following: "WARNING—Tree Protection Zone" (Figure 18). Fencing may be moved within the TPZ if authorized by the project arborist *and* City staff but not closer than the drip line from the trunk of any tree.
 5. Movable barriers of chain link fencing secured to cement blocks may be substituted for "fixed" fencing if the project arborist *and* City staff agree that the fencing will need to be moved to accommodate certain phases of construction. Moving TPZ fencing shall be prohibited without authorization from the project arborist *and* City staff.
 6. Should temporary access into the TPZ be approved, an additional layer of approved tree matting shall be placed over the CRZ.
 7. Tree Growth Regulators (TGR) may be used as approved by the project arborist *and* City staff. Paclobutrazol soil applied TGR (Cambistat® or equivalent) shall be applied to indicated trees by a qualified applicator. Applications shall follow manufacturer's label and applicable laws. TGR reduces canopy growth and increases fibrous root system growth over two to

three years. This can increase tolerance to drought, stress, and improve absorption of nutrients and moisture during the stress recovery period.

During Construction

During the construction phase, the project arborist should inspect the site on a regular basis to ensure the TPP is being adhered to and report any conflicts or deviations to the City Planner or City representative. The project arborist also needs to be available at the site to monitor construction activities that require encroachment within the TPZ, such as grading or trenching. It may also be necessary to have other key project team members available to monitor these activities.

The project arborist shall specify to construction personnel that the following conditions shall be avoided:

- Allowing runoff or spillage of damaging materials into the area below any tree canopy.
- Storing construction materials or portable toilets, stockpiling of soil, or parking or driving vehicles within the TPZ.
- Cutting, breaking, skinning, or bruising roots, branches, or trunks without first obtaining authorization from the project arborist.
- Allowing fires under and adjacent to trees.
- Discharging exhaust into foliage.
- Securing cable, chain, or rope to trees or shrubs.
- Trenching, digging, or otherwise excavating within the CRZ or TPZ of the tree(s) without first obtaining authorization from the project arborist.
- Applying soil sterilizers under pavement near existing trees.

The project arborist shall provide periodic inspections during construction. Four-week intervals should be sufficient to access and monitor the effectiveness of the TPP and to provide recommendations for any additional care or treatment. Inspections that are more frequent may also be required based on the approved TPP.

The following activities should be observed and inspected by the project arborist during the construction phase to ensure compliance with the approved TPP:

- Only excavation by hand or compressed air shall be allowed within the TPZ of trees. Machine trenching shall not be allowed.
- In order to avoid injury to tree roots, when a trenching machine is being used outside of the TPZ of trees, and roots are encountered smaller than 2", the wall of the trench adjacent to the trees shall be hand-trimmed, making clear, clean cuts through the roots. All damaged, torn, and cut roots shall be given a clean cut to remove ragged edges, which promote decay. Trenches shall be filled within 24 hours. Where this is not possible, the side of the trench adjacent to the trees shall be kept shaded with four layers of dampened, untreated burlap, wetted as frequently as necessary to keep the burlap wet. Roots 2" or larger, when encountered, shall be reported immediately to the project arborist, who will decide whether the contractor may cut the root as mentioned above or shall excavate by hand or with compressed air under the root. All exposed roots are to be protected with dampened burlap.
- Where possible, route pipes outside of the TPZ of a protected tree to avoid conflict with roots.
- Where it is not possible to reroute pipes or trenches, the contractor shall bore or tunnel beneath the TPZ of the tree. The boring shall take place not less than 3' below the surface of the soil in order to avoid encountering "feeder" roots. All boring equipment must be staged outside of the TPZ.
- All grade changes adjacent to the TPZ of a significant tree shall be supervised by the project arborist. Cuts or fills of soil adjacent to the TPZ will have a retaining wall system installed as approved by the project arborist and City staff.
- Any damage due to construction activities shall be reported to the project arborist and City staff within six hours so that remedial action can be taken.
- The project arborist shall be responsible for the preservation of the designated trees. Should the builder fail to follow the tree protection specifications, it shall be the responsibility of the project arborist to report the matter to City staff as an issue of noncompliance.

Additionally, it is the responsibility of the project manager to ensure compliance with the following activities:

- Construction shall be monitored regularly to ensure compliance with specifications. Work shall be stopped if construction site management BMPs are not being followed by the contractor.

- Cement washout pits and chemical holding areas shall be located away from tree protection areas, streams, and wetlands.
- Contractor parking and material storage shall be limited to already impacted areas away from tree roots.
- Site offices and equipment shall not encroach into tree protection areas.
- Refueling and maintenance areas shall be kept away from trees, native soils, water bodies, and drainage systems. Fuel spills will not be tolerated on construction sites.
- To the extent possible, construction equipment shall be kept away from all on-site vegetation, especially those within designated protection areas.

PostConstruction

The postconstruction phase does not end when the equipment leaves and the new tenants move in. Important follow-up monitoring of the protected trees will help ensure their survival and identify signs of early stress.

The applicant shall arrange with the project arborist for the long-term care and monitoring of preserved trees by complying with the following conditions:

- Complete postconstruction tree maintenance, including pruning, mulching, fertilization, irrigation, and soil aeration where necessary.
- Remove, by hand, all soil and root protection material such as wood chips, gravel, and plywood.
- Provide for remediation of compacted soil by methods such as aeration or vertical mulching.
- In the absence of adequate rainfall, apply at least 1' of water per week in the CRZ by deep watering.
- Fertilize trees with slow-released phosphorus, potassium, calcium, magnesium, and other macro- and micro-nutrients as indicated by a soil test, but wait at least one year to apply any nitrogen.
- Fertilize lightly with slow-release nitrogen after one year, and then make annual light nitrogen applications for the next three to five years.

- Inspect trees annually for at least three and up to five years after construction to look for changes in condition and signs of insects or disease and to determine maintenance needs.
- Remove trees that are badly damaged or are in irreversible decline as determined by the project arborist *and* City staff.
- Continue to protect not only the large, established trees on the site but also those newly planted in the landscape.
- Maintain TPP during the installation of new landscaping.
- Provide annual inspection reports to the City.
- Review TPP prior to the installation of landscaping and walkways/sidewalks.

Mitigating Tree and Infrastructure Conflicts

Conflicts may occur when tree roots grow adjacent to paving, foundations, sidewalks, or curbs (hardscape). Improper or careless extraction of these elements can cause severe injury to the roots and instability or even death of the trees. The following alternatives must first be considered before root pruning within the TPZ of a tree.

Removal of Pavement or Sidewalk

Removal of existing pavement over tree roots shall include the following precautions: break hardscape into manageable pieces with a jackhammer or pick and hand-load the pieces onto a loader. The loader must remain outside the TPZ on undisturbed pavement or off exposed roots. Do not remove base rock that has been exploited by established absorbing roots. Apply untreated wood chips over the exposed area within one hour, then wet the chips and base rock and keep moist until overlay surface is applied.

Replacement of Pavement or Sidewalk

An alternative to the severance of roots greater than 2" in diameter should be considered before cutting roots. If an alternative is not feasible, remove the sidewalk, as stated above, cut roots with a sharp, clean saw, as approved by the project manager or project arborist, and replace sidewalk using #3 dowels at the expansion joint if within 10' of a protected tree. Use wire mesh reinforcement if within 10' feet of the trunk of a tree.

Alternative Methods to Prevent Root Cutting

- Grinding a raised sidewalk edge.
 - Ramping the walking surface over the roots or lifted slab with pliable paving.
 - Routing the sidewalk around the tree roots.
 - Install boardwalk, flexible paving, or rubberized sections.
1. New sidewalk or driveway design should consider alternatives to conventional pavement and sidewalk materials. Substitute permeable materials for typical asphalt or concrete overlay, subbase, or footings to consider are permeable paving materials (such as ECO-Stone or RIMA pavers), interlocking pavers, flexible paving, wooden walkways, and brick or flagstone walkways on sand foundations.
 2. Avoid tree and infrastructure conflicts and associated costs by the following planting practices:
 - Plant deep-rooting trees that are proven to be non- or minimally invasive.
 - Over soil that shrinks and swells, install a sidewalk with higher strength that has wire mesh and/or expansion slip joint dowel reinforcement.
 - Fracture soil with an air spade and backfill with sand prior to planting to promote deep rooting and improved drainage.
 - Install root barrier only along the hardscape area of the tree and allow roots to use open lawn or planter strip areas.
 - Dedicate at least 10' linear planting space for the growth of each new tree.
 - Provide a dedicated irrigation system or zone for the tree so the trees do not have to compete and are not dependent on the turf and shrub irrigation.
 - Avoid planting trees over underground drainage systems where root intrusion will impede function of the system.

1. Alternative Base Course Materials: When designing hardscape areas near trees, the project architect or engineer should consider the use of recommended base course material such as an engineered structural soil mix. An approved structural soil mix will allow a long-term, cost-effective tree and infrastructure compatibility that is particularly suited for the following types of development projects:
 - Repair or replacement of sidewalk greater than 40' in length
 - Planting areas that are designed over structures or parking garages
 - Confined parking lot medians and islands or other specialized conditions as warranted

Training

- The project arborist should provide training to all construction personnel to ensure they understand all construction site BMPs.
- The construction supervisor and architect should have current training and education dealing with construction site management. This training should include topics regarding protecting trees and erosion control on construction sites.