**Urban Forest Management Plan**

**Point Loma Nazarene University**

**2012-2023**



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**Urban and Community Forestry Program**

**Executive Summary**

What is an Urban Forest?

*“…The sum of all woody and associated vegetation in and around dense human settlements, ranging from small communities in rural settings to metropolitan regions.”[[1]](#endnote-1)*

The purpose of this Urban Forest Management Plan is to bring the important and historically rich asset of the campus urban forest into other disciplines of the University such as meeting sustainable goals and to be considered in any future construction projects. As there are many older trees on campus, some with historical significance[[2]](#endnote-2), it is important to consider their protection or replacement as the need for new buildings arise. The development of the plan is also to address the age and diversity of the urban forest and to realize the value of the trees on campus in addition to maintain the health of the trees under challenging conditions (hardscape and compaction on root zones).

During recent construction projects, many mature Torrey pine trees were removed. Their environmental significance was not realized and while there was an attempt to save a few, those few were removed five years later as they steadily declined from the impact of construction. In a more recent project, roots were tunneled under versus cut as a result of lessons learned from the other project. This resulted in increased cost of the project where if an Urban Forest Management Plan (UFMP) were in place, these costs could have been evaluated in the initial planning of the overall project. Having a UFMP in place will assist in long range planning for the university and provide guidelines for consistent funding and maintenance of the campus forest now and into the future.

The purpose of the investment in the urban forest is directly correlated to recruitment and retention of our students. The external environment ranked 26 out of 110 things liked about the university in a student poll. (Fall 2011 issue of Viewpoint magazine.) It provides a safe and pleasing atmosphere for student activities and studies while enhancing the many ocean views around campus.

The plan will also address the benefits of trees which impacts GHG (Greenhouse Gas)[[3]](#endnote-3), plays a large role in storm water run-off and provides shelter to buildings and shade on campus hardscape. This is in line with fulfilling the Climate Commitment plan signed by President Brower in 2007 and can be seen on this link: <http://www.presidentsclimatecommitment.org/about/commitment>

This plan addresses trees on Point Loma Nazarene University main campus. It does not include trees/shrubs in the adjacent canyons. A separate plan may encompass the canyon areas in the future.

**Why develop a plan now?**

There are several reasons for developing a UFMP now. For example, our mature trees are aging. A plan should be in place as to their replacement, if they should be replaced and with what species. Additionally, we have several heritage trees on campus, one of which sits in a future construction site. A plan should be in place as to the maintenance and disposition of these trees or other trees that may become impacted by construction or a biotic event such as possible pest or disease infestation. Finally, there is a funded program currently to assist staff with developing a strategic and comprehensive plan.

1. From Urban Forestry, Planning and Managing Urban Greenspaces by Robert W. Miller: 1988. New Jersey: Prentice Hall. [↑](#endnote-ref-1)
2. See Historical piece by Jim Payton, page #? [↑](#endnote-ref-2)
3. [Center for Urban Forest Research](http://www.fs.fed.us/psw/programs/cufr), [Urban Forests and Climate Change: Greenhouse Gas Reporting Protocol](http://www.fs.fed.us/ccrc/topics/urban-forests)

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   **Vision Statement**

   Point Loma’s vision is to sustain the thriving and diverse urban forest on the campus. It is a forest comprised of young and old, native and ornamental, historical and heritage trees. The forest is an integral part of the campus environment and one that is directly correlated to the recruitment and retention of our students. It provides aesthetic value to ocean views and plays a large role in environmental value. It impacts green house gas emissions (GHG), storm water run-off, shelters buildings and hardscape. Our trees are part of what is known as the “Wooded” area of the peninsula and the first stop for migratory birds and should be protected and maintained.

   **Mission Statement**

   Our mission statement is to enhance the quality of the living and working environment at Point Loma Nazarene University by promoting the benefits of trees and maintaining a sustainable urban forest through best management practices, collaboration and education.

   **HISTORY**

   The many and varied gardens that are located on the campus of Point Loma Nazarene University, in the Point Loma community of San Diego, had their beginnings in1896 when Theosophist Katherine Tingly moved the headquarters of the Theosophical Society and built "Lomaland" as a marvelous place of fascinating buildings and exotic gardens. The facility became an important source of music and culture for residents of San Diego between 1900 and 1920. The Society experimented widely with planting trees and crops, giving that formerly barren part of Point Loma its current heavily wooded character. They are credited with introducing the avocado to California.

   Many of the stately trees, located on the campus today, were planted by members of the San Diego Floral Association in the early days of the association’s work that was done in order to establish a public interest in trees. In 1904 the first Arbor Day was held in San Diego and more the 2500 school children participated in planting pine trees around city parks and private properties in an enthusiastic effort to beautify San Diego. That enthusiasm continued for a number of years after that.[1]

   A few people of renown to the horticulture, floral and garden communities of California have had an important influence on the gardens and trees planted here at PLNU. The primary founder of San Diego Floral Association and *California Garden* magazine was Alfred D. Robinson. Robinson moved to Point Loma, San Diego in 1903, where he purchased a 10-acre plot adjacent to “Lomaland”, because he was deeply interested in the Theosophical movement that was located on the “Lomaland” campus. Robinson, (known around the world for his work in hybridizing begonias), and the famous Kate Sessions would meet regularly to discuss plants, plan group plantings and to write articles for the *California Garden* magazine.

   In 1923 Kate Sessions wrote an article for Robinson’s magazine that noted that a tree at Rosecroft Gardens, (that was the name that Robinson gave to his 10-acre estate), was propagated by seed that had been sent to Santa Barbara by a member of the Roosevelt expedition named William Edward White. That seed was sent to Kate Sessions and she planted the first *Afrocarpus glacilior*  in San Diego at the Rosecroft garden. There are at least two such trees located on the PLNU campus that are large enough and old enough to be seedlings from that original tree. Those trees would then be first generation trees from one of the first original *Afrocarpus glacilior* to be on the North American continent.[2]

   Yet another famous horticulturalist, Lester Rowntree, lived on campus. Lester greatly influenced the modern day movement for the planting of native plants in California landscapes. Rowntree moved to, and lived on the campus of “Lomaland” in the early 1920’s. Lester lived with her brother on the Lomaland campus (a noted landscape painter, Leonard Lester) for about 5 years. Most of Leonard’s paintings are of the Lomaland campus’, (which is now PLNU campus), views and landscapes during the late 19th and early 20th centuries. Rowntree wrote many articles, gave lectures, and did a great deal of research in the native plant arena while living on the campus.[3]

   Many of the trees that can be found on campus today, are visible in Lester’s paintings and in many historical photographs of the Point Loma campus. Some of those paintings and many of the photographs are more than a century old, (a number of them are available for viewing on-line with a simple Google search).

   BIBLIOGRAPHY:

   Carter, Nancy Carol. "The Fern Pine's Voyage." *Pacific Horticulture* January/FebruaryMarch 2006: 7 - 11.

   Jones, Barbara S. *100 Year History of the San Diego Floral Association*. San Diego: San Diego floral Association, 2007.

   Rowntree, Lester. *Hardy Californians, A Woman's Life with Native Plants*. Berkeley and Los Angeles: University of California Press, 1936 & 2006.

   **Environment**

   **Point Loma** is a seaside community of [San Diego](http://en.wikipedia.org/wiki/San_Diego), [California](http://en.wikipedia.org/wiki/California). Geographically it is a hilly [peninsula](http://en.wikipedia.org/wiki/Peninsula) that is bordered on the west and south by the [Pacific Ocean](http://en.wikipedia.org/wiki/Pacific_Ocean), the east by the [San Diego Bay](http://en.wikipedia.org/wiki/San_Diego_Bay) and [Old Town](http://en.wikipedia.org/wiki/Old_Town_San_Diego_State_Historic_Park) and the north by the [San Diego River](http://en.wikipedia.org/wiki/San_Diego_River). Along with the [Coronado](http://en.wikipedia.org/wiki/Coronado,_California) peninsula, Point Loma separates San Diego Bay from the Pacific Ocean.

   Point Loma has an estimated population of 45,887 (including [Ocean Beach](http://en.wikipedia.org/wiki/Ocean_Beach,_San_Diego)), according to the 2000 Census. The 2008 population of the 92106 and 92107 ZIP codes is estimated at 48,285.[[1]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-0)

   Point Loma is historically important as the landing place of the first European expedition to come ashore in present-day California. The peninsula has been described as "where California began". Today Point Loma houses two major military bases, a national cemetery, a national monument, and a university, in addition to residential and commercial areas.

   **Local Geography** - On the west side of the peninsula there are sandstone cliffs along the ocean, called the Sunset Cliffs. Geologically these cliffs are known as the [Point Loma Formation](http://en.wikipedia.org/wiki/Point_Loma_Formation). They contain fossils, including dinosaur fossils, from the [Late Cretaceous](http://en.wikipedia.org/wiki/Late_Cretaceous) period, about 75 million years ago. The formation represents one of the few sites containing dinosaur fossils in the state of California. Overlying the Point Loma Formation is another Late Cretaceous deposit called the Cabrillo Formation, which crops out in various areas of Point Loma.[[8]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-7)[[9]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-8)

   The top of the peninsula is fairly flat, has an elevation of about 400 feet (120m), and is capped by much younger sandstone and conglomerate deposits from the [Pleistocene](http://en.wikipedia.org/wiki/Pleistocene) era, 1 million years or less in age. These flat-lying beds lie directly on top of the gently dipping Point Loma and Cabrillo formations.[[10]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-9) The gap in the sedimentary record, called an [Angular unconformity](http://en.wikipedia.org/wiki/Angular_unconformity), represents about 70 million years of non-deposition and/or erosion.

   The cliffs on the ocean side of the peninsula are sheer and are undergoing constant erosion due to wave action. On the east side the land slopes into San Diego Bay more gradually, so that homes and developments go right to the water’s edge. At the northern end of the peninsula the cliffs and hills become lower, disappearing entirely in Ocean Beach and the Midway area, where the San Diego River flows.

   Much of the Midway area is former marshland which has been filled in for development.[[11]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-10) In fact, the San Diego River used to flow through the Midway area into San Diego Bay, isolating Point Loma from San Diego. Because of fears that San Diego Bay might silt up, the river was diverted to its present course north of Point Loma by a levee built in 1877.[[12]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-11)

   There are several distinct neighborhoods in the Point Loma peninsula.[[14]](http://en.wikipedia.org/wiki/Point_Loma,_San_Diego#cite_note-13) The commercial and retail heart of the peninsula is called Point Loma Village. Its retail establishments serve local residents as well as yachting and sport fishing interests. The streets in Point Loma Village are lined with hundreds of [jacaranda](http://en.wikipedia.org/wiki/Jacaranda) trees as a result of community beautification efforts.

   Connected to Point Loma Village by a causeway is [Shelter Island](http://en.wikipedia.org/wiki/Shelter_Island,_San_Diego), which is actually not an island but a former sandbank in San Diego Bay. Shelter Island was developed in the 1950s after it was built up into dry land using material dredged from the bay. It is under the control of the [Port of San Diego](http://en.wikipedia.org/wiki/Port_of_San_Diego) and contains hotels, restaurants, marinas, and public parkland.

   The newest commercial and retail area is found at [Liberty Station](http://en.wikipedia.org/wiki/Liberty_Station), site of the former [Naval Training Center San Diego](http://en.wikipedia.org/wiki/Naval_Training_Center_San_Diego), which also has residential and educational sections.

   The [Midway](http://en.wikipedia.org/wiki/Midway,_San_Diego) district at the northern end of the peninsula, adjacent to the [San Diego River](http://en.wikipedia.org/wiki/San_Diego_River) and the [I-5](http://en.wikipedia.org/wiki/Interstate_5_in_California) and [I-8](http://en.wikipedia.org/wiki/Interstate_8_in_California) freeways, is primarily commercial and industrial with a few small residential developments.

   The hills above La Playa are known as the [Wooded Area](http://en.wikipedia.org/wiki/Wooded_Area) on the bay side of Catalina Boulevard (so called because of the many mature trees in the area), and the College Area on the ocean side (because of the proximity of [Point Loma Nazarene College](http://en.wikipedia.org/wiki/Point_Loma_Nazarene_College)). The [Sunset Cliffs](http://en.wikipedia.org/wiki/Sunset_Cliffs,_San_Diego) neighborhood is on the west side, above ocean bluffs, and is known for its views of the Pacific Ocean.

   The northwest corner of the peninsula, where the San Diego River flows into the ocean, is a separate community known as [Ocean Beach](http://en.wikipedia.org/wiki/Ocean_Beach,_San_Diego).

   The southern one-third of the Peninsula is entirely [federal](http://en.wikipedia.org/wiki/Federal_government_of_the_United_States) land, including [Naval Base Point Loma](http://en.wikipedia.org/wiki/Naval_Base_Point_Loma), [Fort Rosecrans National Cemetery](http://en.wikipedia.org/wiki/Fort_Rosecrans_National_Cemetery), and [Cabrillo National Monument](http://en.wikipedia.org/wiki/Cabrillo_National_Monument).

   **Climate** – Categorized as Semi-arid often referred to as Mediterranean or arid-mediterranean.

   Reference: M. Kottek; J. Grieser, C. Beck, B. Rudolf, and F. Rubel (2006). ["World Map of the Köppen-Geiger climate classification updated](http://koeppen-geiger.vu-wien.ac.at/pics/kottek_et_al_2006.gif) Because of our varied topography, canyons and building there are several micro-climates within the campus itself.

   **Temperatures** - Average monthly temperatures range from 57.3 °F (14.1 °C) in January to 72.5 °F (22.5 °C) in August. Late summer and early autumn are typically the hottest times of the year with temperatures occasionally reaching 90 °F (32 °C) or higher.

   Reference: National-Record High Temp: <http://www.met.utah.edu/jhorel/html/wx/climate/hitemp.html>

   Point Loma is influenced by fog or the marine layer typically in the mornings with sunshine in the afternoon. “May Gray” and “June Gloom” are local characterizations for the predominately gray skies during these months of the year. The air stays cool and damp during this time of “marine layer” fog/cloud cover.

   **Rainfall** – Along the coast, averages 10 inches. Falls mostly December through March.

   **Ecology** - Like most of southern California, the majority of San Diego's current area was originally occupied by [chaparral](http://en.wikipedia.org/wiki/Chaparral), a plant community made up mostly of drought-resistant shrubs. The endangered [Torrey Pine](http://en.wikipedia.org/wiki/Torrey_Pine) has the bulk of its population in San Diego in a stretch of protected chaparral along the coast. The steep and varied topography and proximity to the ocean create a number of different habitats within the city limits, including [tidal marsh](http://en.wikipedia.org/wiki/Tidal_marsh) and [canyons](http://en.wikipedia.org/wiki/Canyons). The chaparral and [coastal sage scrub](http://en.wikipedia.org/wiki/Coastal_sage_scrub) habitats in low elevations along the coast are prone to [wildfire](http://en.wikipedia.org/wiki/Wildfire), and the rates of fire have increased in the 20th century, due primarily to fires starting near the borders of urban and wild areas.[[42]](http://en.wikipedia.org/wiki/San_Diego#cite_note-FireVegetation-41)

   Reference 42: Wells, Michael L.; John F. O'Leary, Janet Franklin, Joel Michaelsen, and David E. McKinsey (November 2, 2004). ["Variations in a regional fire regime related to vegetation type in San Diego County, California (USA)"](http://www.springerlink.com/content/xx00155q65147l45/). *Landscape Ecology* (San Diego, CA 92182-4493, USA: Springer

   **Soil Characteristics**

   The native soil on campus is comprised mostly of the Carlsbad-Urban land complex and Marina loamy coarse sand. The typical profile is gravelly to loamy coarse sand 0-10 inches; loamy sand, loamy coarse sand 10-57 inches; sand, coarse sand 57-60 inches. In the parking area by Young Hall there is some fine sandy loam. For more detail, see Appendix B, Custom Soil Resource Report.

   With the construction of campus buildings over the years, many areas have been filled and terraced due to the slopes and hilly terrain. As a result, many of the native soils are buried under fill or have been removed during excavation.

   **Native Vegetation**

   Coastal sage scrub plants are typically low-growing, nonscleraphyllous (soft) shrubs with many brittle branches and are sometimes referred to as soft chaparral. The roots of these plants exploit the upper soil layers for moisture, allowing for rapid growth after winter rainfall. Their growing season is usually longer than that for typical chaparral plants. Some species survive the dry summers and autumns by utilizing water from their succulent vegetation or by dropping their water-demanding leaves. At this time these deciduous plants may appear as dried dead bundles only to spring back to life with green foliage during the rainy season.

   Typical species in this community are *Artemisia californica* (California sagebrush), *Eriogonum cinereum* (ashyleaf buckwheat), *E. elongatum* (long-stemmed buckwheat), *E. fasciculatum* (California or wild buckwheat), *Salvia apiana* (white sage), *S. mellifera* (black sage), *S. leucophylla* (purple sage), *Mimulus longiflorus* (bush monkeyflower), *Encelia californica* (bush sunflower), *Baccharis pilularis* (coyote brush), *Hazardia squarrosus* and *Isocoma menziesii* (sawtooth and coast goldenbush), *Malosma laurina* (laurel sumac), *Trichostema lanatum* (woolly blue curls), *Venegasia carpesioides* (canyon sunflower), *Lotus scoparius* (deerweed), *Eriophyllum confertiflorum* (golden yarrow), *Opuntia littoralis* (coast prickly pear), *Lupinus spp*. (lupines) and *Elymus canadensis* (Canadian wildrye). The South Canyon has the least disturbed collection of native plants on campus.

   The campus is also home to native *Pinus torreyana* (Torrey Pine) trees and a few *Wahingtonia filifera* (California Fan) palms.

   **Benefits of the Urban Forest**

   The USDA’s Center for Urban Forest Research sited in the University of California at Davis has discovered that 100 mature trees intercept 210,000 gallons of rainwater per year. This translates to: (a) less storm water runoff and, consequently, less money spent on storm water control, (b) reduced soil erosion and water pollution, and (c) cleaner (forest-soil-filtered) storm water discharges. All the foregoing are of immense importance to PLNU, given its hilly, sloping terrain and close proximity to the Pacific Ocean.

   From the standpoint of human health, the proper management of PLNU’s urban forest benefits the region with the removal of 280 tons of carbon dioxide and 1,873 pounds of pollutants from the atmosphere annually.

   According to a study conducted by the Human-Environment Laboratory of the University of Illinois at Urbana-Champaign, a tree-filled community, records a lower incidence of violence and vandalism, enjoys a safer and more sociable ambience, records lower stress levels in residents as well as affording them speedy recovery from ill-health.

   Economically speaking, judicious forest management which employs the right tree in the right place saves up to 34% of annual air conditioning costs, makes parking lots 3 degrees Fahrenheit cooler in summer months, prolongs the life of parking lots, makes the interior of parked cars 30 degrees Fahrenheit cooler, and saves 25% of winter heating costs.

   \_\_\_\_\_\_\_\_\_\_\_

   Except where indicated otherwise, the benefits of urban forest trees cited in this section are based on extracts from Temperate Interior West Tree Guide: Benefits, Costs, and Strategic Planting*,* General Technical Report # PSW-GTR-206 by Kelaine E. Vargas, et al, November 2007, Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

   **Program Management**

   **Actions/Tools**

   The day-to-day management of PLNU’s urban forest, including the sustainable planning, coordination of and approval for tree removal and tree planting, protection, maintenance and care of trees in the university’s urban forest for environmental, social, and public health benefits for the campus community, shall remain vested in the Horticulture and Grounds Manager. In all cases of catastrophic events involving trees, the Horticulture and Grounds Manager, Landscape Project Supervisor and Campus Arborist shall be the first responders.

   **Tree Inventory**

   A tree inventory spotlights individual trees rather than whole stands. The system is a method of obtaining and organizing information about the number, condition (of health), and distribution of urban trees. Information that is accurate, accessible, and simple is one of the best tools for making planning and management decisions. With tree inventory information, program resources can be allocated appropriately among the various tree management functions, work can be scheduled for maximum efficiency, and financial decision-makers can evaluate various work plan proposals by comparing expected results with projected budgets. The university has a tree inventory computerized program currently. As a tool for managing our urban trees, it should be updated, supported by campus ITS department and used regularly.

   **Safety** is a large concern at PLNU, taking in to account the number of students, faculty, staff, and public visitors that occupy and/or travel through the campus daily. Proactive forest management that minimizes risks to life and damage to facilities as well as optimizes benefits is crucial. Maintaining our campus tree inventory enables staff to track the history of trees and mitigate any potential hazards. Currently the campus tree inventory only encompasses main campus. The trees located in the canyons have not been inventoried. It is recommended that they be included in the inventory and when that is conducted, will include the same attributes as that of the current inventory.

   These attributes are:

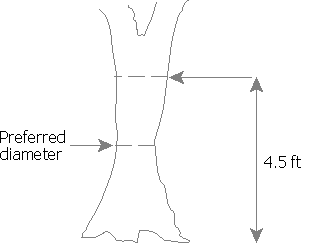
   • **Mapping coordinates.** X and Y coordinate locations (latitude and longitude). Each tree and planting site will be located using GIS maps and/or GPS equipment.

   • **Location.** The tree’s physical location in relation to public Right of Way, important facilities, and/or public space will be recorded.

   • **Species.** Trees will be identified by *genus* and *species,* and by common name.

   • **Diameter.** Tree trunk diameter will be recorded. It will be measured at breast height (DBH) unless otherwise noted. This shall be to the nearest 1 inch.

   (Simplified guide to measuring DBH from Guidelines for Developing and Evaluating Tree Ordinances at phytospere.com are as follows.)

   1. The tree tapers in such

   a way that the diameter at a point

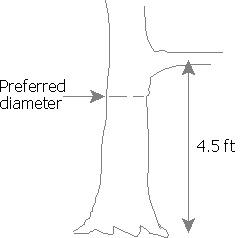
   below 4.5 ft is actually smaller than

   the diameter at 4.5 ft. Measure

   diameter at the smallest point and

   record the height at which diameter

   was measured on the data sheet.

   1. Tree has branches or bumps which

   interfere with DBH measurement.

   measure DBH below the branch or bump.

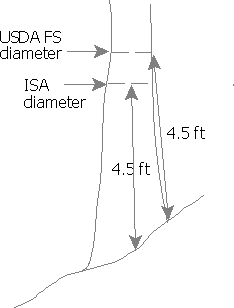
   Measure the diameter that would be

   closest to the expected DBH if branches

   or other irregularities were not present.

   Record the height at which the diameter

   is measured.

   1. Vertically growing tree on a slope.

   Probably the easiest method is to measure

   diameter 4.5 ft from the ground on the upper

   side of the slope and is used by the US Forest

   service. ISA (International Society of Arbori-

   culture) Tree Appraisal Manual says to measure

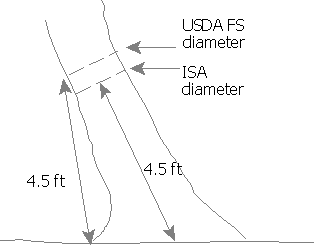
   4.5 ft from the midpoint of the trunk along the

   slope. Finding the location of the trunk midpoint

   is probably subject to more error than finding

   the upper side of the trunk, so the USFS method

   is likely to be more consistent than that of ISA.

   1. Tree leans. There are several commonly

   accepted ways to find the DBH height. The

   USFS measures 4.5 ft up the stem in the

   direction of the lean. Some references e.g.

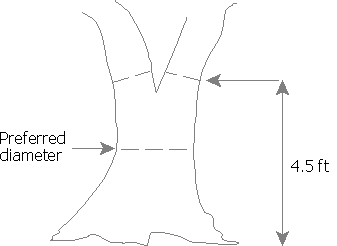
   ISA say to measure 4.5 ft from the midpoint

   of the lean. As noted under 3 above, the

   USFS method is probably less prone to

   error and more readily repeatable by

   different observers.

   1. Tree forks below DBH or near DBH. The

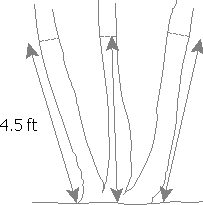
   measurement is recorded at the narrowest

   part of the main stem below the fork. The

   height of the DBH measurement and the fork

   should be noted (e.g., 3ft diameter @ 2ft

   (Forks @ 4ft)).

   6. Tree splits into several trunks close to ground

   level. Measure DBH of each trunk separately,

   using the principals shown in categories 1-5

   above. The DBH for the tree is found by taking

   the square root of the sum of all squared

   stem DBHs.

   • **Observations.** General observations referring to a tree’s health, structure, and location will be made.

   • **Clearance Requirement.** Trees, which are causing or may cause visibility or clearance difficulties for pedestrians or vehicles, will be identified, as well as those trees blocking clear visibility of signs or lighting.

   • **Hardscape Damage.** Damage to sidewalks and curbs by tree roots are noted. Notes on potential fixes for the problem are encouraged (redesign options, etc).

   • **Overhead Utilities.** The inventory indicates whether overhead conductors or other utilities are present at the tree site that could result in conflicts with the tree.

   • **Notes.** Additional information regarding disease, insect, mechanical damage, etc can be included in this field.

   * **Condition.** In general, the condition of each tree will be recorded in one of the following categories adapted from the rating system established by the International Society of Arboriculture:
     + Excellent 100%
     + Very Good 90%
     + Good 80%
     + Fair 60%
     + Poor 40%
     + Critical 20%
     + Dead 0%

   • **Required maintenance.** A summary of scheduled maintenance works and time frames.

   • **Maintenance history.** Provision shall be made for recording maintenance history of each tree.

   **Tree Inventory Field Data Sheet**

   Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

   Surveyor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Weather: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

   **Condition Rating: Comment Key: Hazard Key:**

   **4**: Excellent (textbook perfect) **TG**: Existing Target **IN**: Included Attachments **NH**: No Hazard

   **3**: Good (good but a few defects) **LN**: Lean **PS**: Pests **LH**: Low Hazard

   **2**: Fair (OK, but some defects) **MT**: Multiple Trunks **DS**: Disease **MH**: Moderate Hazard

   **1**: Poor (decline, many defects) **CD**: Co-dominant Trunk **SP**: Sap/Gum Flow **SH**: Severe Hazard

   **0**: Dead **CA**: Cavities & Decay **CK**: Cankers/Galls

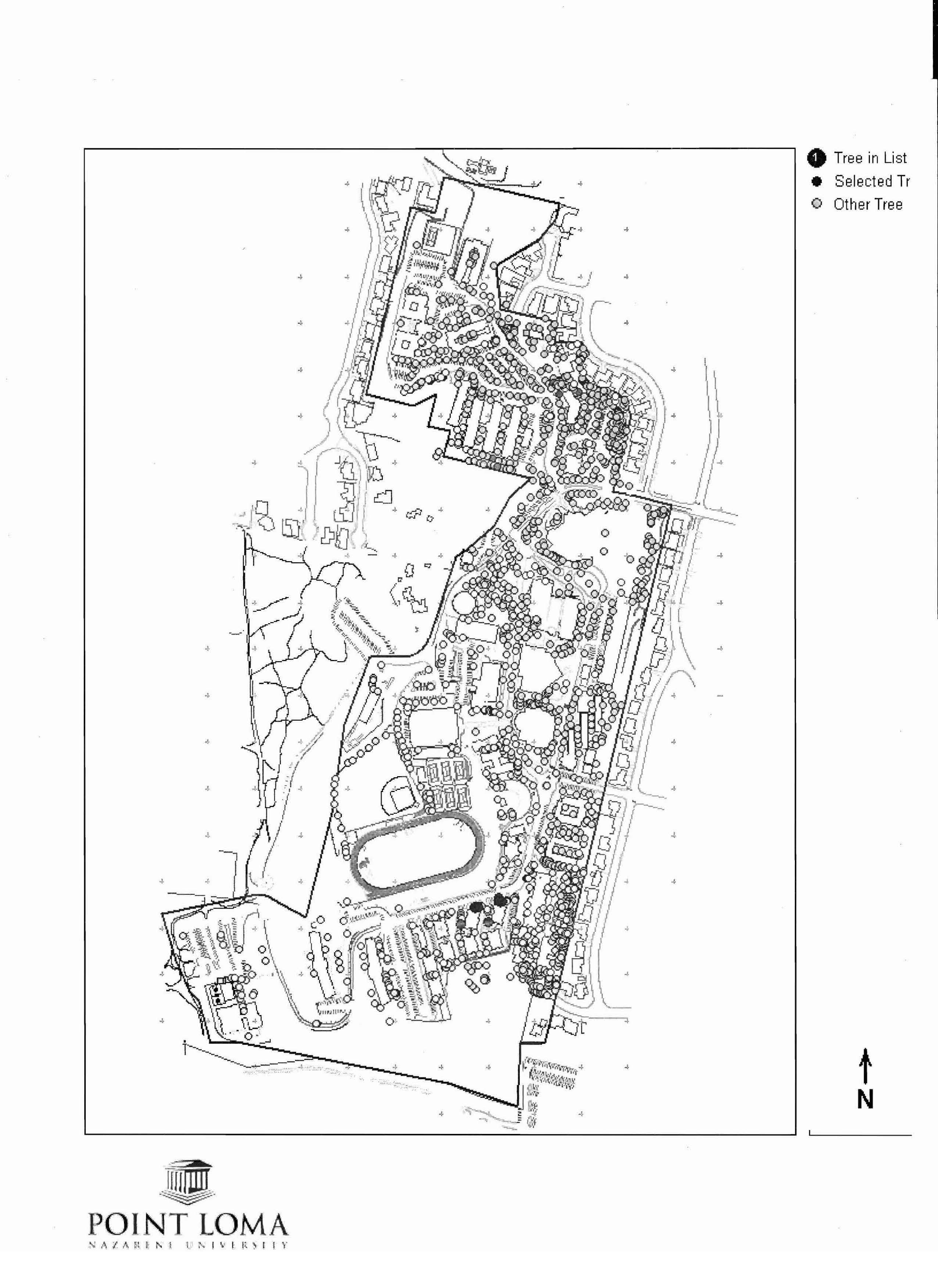
   **CR**: Cracks **HV**: Heaving Soil

   **HA**: Hangers **RT**: Root Problem/Girdling

   **DB**: Dead Branches/Dieback **TR**: Wetted Trunk

   **OTH**: Other (please indicate as clearly as possible)

   **NOTE: Data recorded on this form consists of purely subjective delineations based on external indicators only; additional observation and analysis will be required to produce more accurate conclusions and more proper recommendations on management and/or abatement.**

   **Protection of Trees during Construction**

   The objective of this section is to reduce the negative effects of construction on trees to a less than significant level. Land development, one of the greatest causes of tree decline and death in urban areas, is a complex process and is even more challenging when trees are involved. The long-term goal of the Urban Forestry Management Plan is urban forest sustainability. This describes the maintenance of social, recreational, ecological and economic functions of trees and their benefits over time. Stewardship of naturally occurring and planted trees is a central element in forest sustainability. Concerns about tree health and structure, preservation during development and redevelopment, species and site selection, quality of planting stock, standards of performance, and maintenancepractices on campus, and recycling are integral to a sustainable urban forest.

   Tree protection should not begin subsequent to construction. If preservation measures are delayed or ignored until construction begins, the trees may be destined to fail. Because in most cases construction effects to trees cannot be completely eliminated, the goal for our facilities planners and designers is to keep injury to trees to a minimum and allow building projects to proceed at the same time. Successful tree preservation occurs when designers, construction personnel, and project managers are **committed to tree preservation**.

   All trees cannot and should not be preserved. Trees that are structurally unstable, in poor health, or unable to survive the effects of construction become a liability to the project and should be removed. A realistic tree preservation program acknowledges that conflicts between trees and infrastructure development may sometimes result in the removal of some trees and also recognizes the detrimental effect to the project and community when trees die after construction is completed.

   Successful tree preservation occurs when construction impacts to trees are minimized or avoided altogether. The challenge is to determine when impacts will be too severe for the tree to survive, not only in the short term, but also in the long term. There are no quantitative methods to calculate this critical level. Determining the optimum tree protection zone provides a guideline, although trees sometimes survive and flourish with smaller protection areas.

   The following are the 3 guiding principles for tree preservation:

   • The acknowledgement that not all trees are in excellent health or have good structural stability.

   • Tree preservation cannot be the responsibility of the Horticulture and Grounds staff alone. Each development participant must understand that his or her activities and decisions influence the success of tree preservation efforts. Each development participant is encouraged to read the set of guidelines defining the University’s *Tree Pruning and Tree Removal Policy* and *Protection of Trees during Construction Guidelines* (Sections \_\_\_\_ and \_\_\_\_ of this Forest Management Plan).

   • The ability of an arborist to cure construction injury is very limited, so the focus of preservation efforts is the *prevention* of damage.

   Following the above principles will increase the chance for success and reduce the possibility that trees will die. Efforts at preservation must include acknowledgement of the tree and its ecological support system.

   Capital improvement projects, in-house construction projects, lawn and sport field renovations, and even the addition of a few sprinkler lines affect trees. Trees are important assets and tree locations are required to be plotted on plans for all projects.

   **Planning and Designing for Capital Improvement Projects**

   All design teams shall be given a set of guidelines defining the University’s *Tree Pruning and Tree Removal Policy* and *Protection of Trees during Construction Guidelines* (Sections \_\_\_\_ and \_\_\_\_ of the Forest Management Plan), to ensure that trees are accounted for from project initiation forward.

   A) Survey before Planning: The survey must accurately plot the trunk locations within the project site. Include construction staging areas and delivery routes.

   B) Plan and Design with Knowledge of Trees: The health and structural confirmation of the surveyed trees must be evaluated in order to anticipate how well they will respond to development. The evaluation must describe the character of trees and their suitability for preservation at a level of detail appropriate for the project and phase of planning. An arboricultural or forestry consultant must be obtained for this evaluation.

   C) Plan with a Vision: Disturbance of any tree by construction activities may negatively affect its physiological processes, and cause depletion of energy reserves and decline in vigor, often resulting in tree death. Typically this does not manifest until many years after the tree is disturbed. Preservation of mature trees during construction has limitless benefits to the success of a project. When new trees are planted, consideration should be given to species diversity and appropriateness of location. To prevent destructive clearance pruning in future years, keep in mind the ultimate canopy and root spread.

   D) Plan for all Aspects and Entire Duration of Project: Construction projects are multi-level and often require participation of various construction trades and subcontractors. It is important to plan for tree protection with an understanding of construction dynamics. Trees must be protected in the staging area, construction employee parking area, adjacent properties, as well as on the actual construction site.

   **Managing In-House Construction Projects**

   The in-house Projects/Construction team should be given a set of guidelines that define the Physical Plant’s *Tree Preservation* and *Tree Protection* procedures (Sections \_\_\_\_ and \_\_\_\_ of this Forest Management Plan), and to assure that trees are accounted for from project initiation forward.

   A) Survey before Planning: For all in-house projects, contact the Horticulture and Grounds Department for an accurate survey of trees on the job site.

   B) Plan and Design with Knowledge of Trees: In order to better understand the condition of the affected trees, the Horticulture and Grounds Department will make available the results of the tree evaluation. This evaluation will provide the in-house Construction team with knowledge of the resources and the anticipated construction tolerance of the affected trees.

   C) Plan with a Vision: Obtain information about trees and minimize negative impacts on the urban forest. Conduct all projects with tree preservation in mind.

   D) Plan for all Aspects and for the Entire Duration of the Project: Trees must be protected in the staging area, construction employee parking area, and during demolition and grading. Arrange with the Campus Arborist for trees to be watered and for the soil to be protected from compaction.

   **Pre-Construction Requirements**

   **Tree Protection and Preservation Plan**

   Prior to the commencement of a development project, the Campus Arborist must be assured that if any activity of the project is within the dripline of *Protected Trees* (all trees 6” dbh and above) or any campus *Heritage Trees,* a site specific tree protection plan is prepared. The following six steps shall be incorporated as part of the Tree Protection and Preservation Plan:

   A) Site Plan: For all projects, site plans must indicate accurately plotted trunk locations and the driplineareas of all trees or group of trees to be preserved within the development area. Additionally, for all *Protected Trees(including Heritage Trees)* the plans shall accurately show the species, trunk diameter, the dripline and clearly identified *tree protection zones.* The type of protective fencing shall be specified and indicated with a bold dashed line.

   B) Protective tree fencing for all categories of *Protected Trees*: Fenced enclosures shall be erected around trees to be protected. This will achieve 3 primary goals:

   (1) To keep crowns and branching structure clear from contact by equipment, materials, and activities;

   (2) To preserve roots and soil condition in an intact and non-compacted state; and

   (3) To identify the *Tree Protection Zone* in which no soil disturbance is permitted and activities are restricted, unless otherwise approved by the Campus Arborist.

   All trees to be preserved shall be protected with physical barriers approved by the University’s Horticulture and Grounds Manager. Tree barriers shall be erected before demolition, grading, or construction begins and remain until final inspection of the project. There shall be a “Warning” sign prominently displayed on each protective fence. The sign shall be a minimum of 8.5 inches x 11 inches and clearly state the following:

   ***TREE PROTECTION ZONE***

   **This Barrier Shall Not Be Removed.**

   **Warning: Critical Root Zone, No Encroachment.**

   All work within the *Tree Protection Zone* requires approval of the Campus Arborist.

   A) Type I Tree Protection Barrier is for trees to be preserved throughout the duration of the project. The fences shall enclose the entire area under the canopy dripline or *Tree Protection Zone,* if specified by the Campus Arborist. If fencing must be located on paving or concrete that will not be demolished, an appropriate grade level concrete base may support the posts.

   B) Type II Tree Protection Fence is for trees situated in small planting areas, where only the planting area is enclosed with the required chain link protective fencing. The walkways and traffic areas are left open to the public.

   C) Type III Tree Protection Fence is for trees in small tree wells, building site planters or sidewalk planters. Trees shall be wrapped with 2 inches of orange plastic fencing from the ground to the first branch and overlaid with 2-inch thick wooden slats that are bound securely (slats shall not be allowed to dig into the bark). During installation of the plastic fencing, caution shall be used to avoid damaging branches. Major scaffold limbs may also require plastic fencing as directed by the Campus Arborist.

   No storage of material, topsoil, vehicles, or equipment shall be permitted within the fenced area throughout the entire duration of the construction project.

   **Verification of tree protection**

   The project contractor or construction supervisor shall verify in writing that all preconstruction tree preservation conditions have been met as follows:

   * Tree fencing installed
   * Erosion control secured
   * Tree pruning completed
   * Soil compaction preventive measures installed
   * Tree maintenance schedule established.

   The Project Manager, the Project Inspector, and the Campus Arborist must sign this verification.

   **Pre-construction meetings**

   The Campus Arborist shall attend all pre-construction meetings to ensure that everyone fully understands previously reviewed procedures and tree protective measures concerning the project site, staging areas, hauling routes, watering, contacts, etc.

   **The Tree Protection Zone**

   Each tree to be retained shall have a designated *Tree Protection Zone,* identifying the area sufficiently large enough to protect it and its roots from disturbance. The *Tree Protection Zone* shall be shown on all site plans: Demolition, Grading, Irrigation, Electrical, Landscape, etc. Improvements or activities such as paving, utility and irrigation trenching, including other ancillary activities, shall occur outside the *Tree Protection Zone* unless otherwise specified. The protection fence shall serve as the *Tree Protection Zone.*

   **A) Activities prohibited within the *Tree Protection Zone* include:**

   * Parking vehicles or equipment, storage of building materials, refuse, or excavated soils, or dumping poisonous material on or around trees and roots. Poisonous materials include but are not limited to paint, petroleum products, concrete, stucco mix, dirty water or any material that may be harmful to tree health
   * The use of tree trunks as backstops, winch supports, anchorages, as temporary power poles, signposts or other similar functions
   * Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, or other miscellaneous excavations without prior approval of the Campus Arborist
   * Soil disturbance or grade change
   * Drainage or hydrological changes.

   **B) Activities permitted or required within the *Tree Protective Zone* include:**

   Mulch: During construction, wood chips may be spread within the *Tree Protection Zone* to a two to four inch depth, leaving the trunk clear of mulch. This will minimize inadvertent soil compaction and moisture loss. Mulch shall be ≤ 2-inch unpainted, untreated shredded wood or other approved material.

   Root Buffer: When areas under the tree canopy cannot be fenced, a temporary buffer is required and shall cover the root zone and remain in place at the specified thickness until the final grading stage. The protective buffer shall consist of shredded wood chips spread over the roots at a minimum of 6 inches in depth (keeping the trunk clear of chips), and layered by ¾ inch quarry gravel to stabilize the ¾ inch plywood sheets laid on top. Steel plates can also be used.

   Irrigation, Aeration, fertilization, mycorrhizae treatments or other beneficial practices that have been specifically approved for use within the *Tree Protection Zone.*

   **C) Erosion Control:**

   If a tree is adjacent to or in the immediate proximity to a grade slope of 8% (23 degrees) or more, approved erosion control or silt barriers shall be installed outside the Tree Protection Zone to prevent erosion within the zone.

   **Tree Pruning and Removal**

   Prior to construction, various trees may need to be pruned away from structures or proposed construction activity. ***Construction or contractor personnel shall not attempt pruning.*** Only personnel approved by the Campus Arborist can perform pruning operations.

   A) Removal of trees adjacent to trees that are to remain requires a great amount of finesse. Only personnel approved by the Campus Arborist shall engage in tree removal.

   B) Removal of trees that extend into branches or roots of protected trees shall not be attempted by the demolition or construction crew, or by grading or other heavy equipment. Before removing tree stumps, the project manager shall determine if roots are entangled with trees that are to remain. If so, these stumps shall have their roots severed before extracting them.

   **Activities and Demolition near Trees during Construction**

   Soil disturbance or other damaging activities within the Tree Protection Zone is prohibited unless approved by the Campus Arborist and mitigation for specific injuries is implemented. **No encroachment within 10 feet of a trunk will be permitted without the prior notification and approval of the University’s representative.**

   **Soil Compaction**

   Soil compaction is the largest single factor responsible for the decline of trees on construction sites. The degree of compaction depends on several factors: amount and type of pressure applied, presence and depth of surface organic litter, soil texture and structure, and soil moisture level.

   The greatest increase in soil density occurs during the first few equipment passes over the soil, which underscores the importance of implementing protective measures before the project begins and equipment arrives at the site. To distribute traffic weight, mulch and temporary root buffers can be used. The following techniques can lessen compaction: vertical mulching, soil fracturing, core venting, and radial trenching. Do not compact soil to higher density than needed: to 95% Proctor density (moisture – density) in improved areas for asphalt or concrete pavements, and not to exceed 85% in unimproved open landscape areas that use water jet compaction.

   **Grading Limitations within the Tree Protection Zone**

   Lowering the grade around trees can have an immediate and long-term effect on trees. Typically, most roots are within the top 3 feet of soil, and most of the fine roots active in water and nutrient absorption are in the top 12 inches.

   * Grade changes within the *Tree Protection Zone* are not permitted.
   * Grade changes outside the *Tree Protection Zone* shall not significantly alter drainage.
   * Grade changes under specifically approved circumstances shall not allow more than 6 inches of fill soil or allow more than 4 inches of existing soil to be removed from natural grade, unless mitigated.
   * Grade fills over 6 inches or impervious overlay shall incorporate an approved permanent aeration system, permeable material, or other approved mitigation.
   * Grade cuts exceeding 4 inches shall incorporate retaining walls or an appropriate transition equivalent.

   **Trenching, Excavation and Equipment Use**

   Trenching, excavation or boring within the *Tree Protection Zone* shall be limited to activities approved by the Campus Arborist. Explore alternatives for trenching outside the root zone. Avoid exposing roots during hot, dry weather. Backfill trenches as soon as possible with soil and soak with water the same day. Small roots can die in 10 to 15 minutes and large roots may not survive an hour of exposure. If the trench must be left open all roots must be kept moist by wrapping them in peat moss and burlap. If trenching is unavoidable, the following distances shall be maintained:

   |  |  |  |
   | --- | --- | --- |
   | Trunk Diameter  (measured at 4½ feet above natural grade) | Distance from both sides of the Trunk | Recommended Tunnel Depth for Utilities |
   | Up to 6 inches  6-9 inches  10-14 inches  15-19 inches  Over 19 inches | Past dripline  6 feet  10 feet  12 feet  15 feet. | 1½ feet  2½ feet  3 feet  3½ feet  4 feet |

   A) Root Severance: No roots measuring 2 inches or greater in diameter shall be cut without the approval of the Campus Arborist. Tunneling under roots is the approved alternative. Prior to excavation for foundation/footing/walls, or grading or trenching within the *Tree Protection Zone,* roots shall be severed cleanly one-foot outside the *Tree Protection Zone* to the depth of the planned excavation. When roots must be cut, they shall be cut cleanly with a sharp saw to sound wood and flush with the trench site.

   B) Excavation: Any approved excavation, demolition, or extraction of material shall be performed with equipment that is placed outside the *Tree Protection Zone*. Hand digging, hydraulic, or pneumatic excavation are permitted methods for excavation within the *Tree Protection Zone.*

   C) Heavy Equipment: Use of backhoes, Ditch Witches, steel tread tractors or other heavy vehicles within the *Tree Protection Zone* is prohibited unless approved by the Campus Urban Forester. If allowed, a protective root buffer is required.

   **Tunneling and Directional Drilling**

   Approved trenching or pipe installation within the *Tree Protection Zone* shall be accomplished by hand, by air-spade, or by mechanically boring a tunnel under the roots with a horizontal directional drill, using hydraulic or pneumatic air excavation technology. In all cases, install the utility pipe immediately, backfill with soil and soak with water within the same day. Tunneling under the root system can greatly reduce both damage to the tree and the cost to repair landscape and other features destroyed in the trenching process. There are times, such as when working in rocky soils and slopes, when tunneling is not a reasonable alternative.

   **Alternative Methods for Hardscape to Prevent Root Cutting**

   The following remedies should be considered as an alternative to severing tree roots:

   * Grinding a raised walkway or concrete pad
   * Ramping the walkway surface over the roots or lifted slab with pliable paving.
   * Routing the walkway around tree roots
   * Employing permeable paving materials (e.g., decomposed granite), interlocking pavers, or flagstone walkways on sand foundations.

   Using Alternative Base Course Materials

   Engineered structural soil mix is an alternative material for hardscape areas near trees. More information can be found at [www.amereq.com](http://www.amereq.com).

   **Tree Maintenance during Construction**

   Providing adequate maintenance can mitigate stressful changes that occur to a tree’s environment during construction. To remain vigorous the tree needs to maintain stored carbohydrates and preserve the effectiveness of its growth regulators. It is recommended that large projects provide:

   **Irrigation**

   Providing supplemental irrigation for trees under water stress may be the single most important treatment needed to reinvigorate them. Irrigation should be designed to wet the soil within the *Tree Protection Zone* to the depth of the root zone and to replace that water once it is depleted. Light, frequent irrigation should be avoided. Create a six-inch berm around trees at the edge of the *Tree Protection Zone* and fill with no more than six inches of mulch. Fill the basin with water. Irrigation should wet the top two to three feet of soil to replicate similar volumes and normal seasonal distribution.

   **Soil Compaction Mitigation**

   To prevent negligent encroachment into the *Tree Protection Zone,* trees to be preserved during construction must have the specified type of protection fences in place at all times*.* Removal of fences, even temporarily, to allow deliveries or equipment access is not allowed unless approved by the Campus Arborist and a root buffer is installed. The root buffer components (mulch, gravel and plywood) must be maintained continually to ensure its effectiveness against soil compaction.

   **Dust Control**

   During periods of extended drought, wind or grading, trunks, limbs and foliage should be sprayed with water at the end of workday to remove accumulated construction-engendered dust.

   **Damage to Trees**

   Reporting Injury to Trees

   Any damage or injury to trees shall be reported as soon as possible to the Project Manager or/and the Project Inspector, and always to the Campus Arborist. The Campus Arborist needs to be aware of an injured tree in order to monitor its recovery or progress. Injuries to roots and branches must be repaired immediately.

   **Contractor(s) Subject to Penalties**

   If a tree designated to remain is removed or irreversibly damaged as determined by the Campus Arborist, a contractor will be required to install a replacement tree matching in size, quality and variety, using a Tree Care contractor designated by the Campus Arborist. If an acceptable replacement tree is not available, the contractor will be required to pay damages to the University for the value of the damaged tree in accordance with the guidelines set forth below.

   |  |  |  |
   | --- | --- | --- |
   | **S/N** | **Diameter Class (inches)** | **Cost/Tree ($)** |
   | **1** | 1 - 5 | $3,000.00 |
   | **2** | 6 - 12 | $7,500.00 |
   | **3** | 13 - 18 | $15,000.00 |
   | **4** | Over 18 | Add $1,200.00/caliper inch |

   A penalty will be assessed for tree limb damage at **$200** (Two Hundred Dollars) per inch of limb diameter for any limb larger than 1½ inches in diameter, measured where the limb should be pruned to make a proper thinning cut.

   **Fines are doubled when a grove or specimen tree meant to be retained or protected is damaged or removed without the Campus Arborist’s prior approval.**

   Additionally, a liable Contractor shall replace any vegetation (other than trees) that died or sustained injury from the result of the Contractor's negligence to provide adequate required vegetation protection, pruning, or maintenance during the course of construction operations, as evaluated by the University's Representative. Compensation shall be awarded to the University as follows:

   1. Contractor shall thoroughly remove damaged vegetation at no cost to the University, and at the direction of the University's Representative.
   2. Contractor shall furnish and install five (5) gallon container stock minimum (as applicable) of the same form, species, and in the same quantity as vegetation that was damaged, at the direction of the University's Representative.
   3. The University's Representative shall make the final judgment on whether trees and/or vegetation have been damaged by the Contractor during the execution of the Work, and their decision is final.
   4. Warranty of Replacement Plant Material: Contractor shall warrant that all replacement plant materials shall be healthy and in flourishing condition of active growth at the end of the warranty period of 1 calendar year from the date of final acceptance.

   **Departments Subject to Fines**

   In the event of damage to above- or below-ground parts of urban forest trees at any time, the Campus Arborist shall conduct an investigation to determine the cause of the damage. If it is found that damage was caused due to the error, negligence, or willfulness of a University department, then that University department will be required to pay the same damages imposed on Contractor Subject to Penalties.

   **Employees Subject to Discipline**

   In the event of damage to above- or below-ground parts of campus trees at any time, the Campus Arborist shall conduct an investigation to determine the cause of the damage. If it is found that damage was caused due to the error, negligence, or willfulness of a University employee, then that employee will be subject to appropriate disciplinary action.

   **Tree Planting**

   **Campus Urban Forest Restocking**

   During the Tree Inventory exercise, vacant planting sites will be identified by nearby facilities. The size of the site is designated as small, medium, or large (indicating the ultimate size that the tree will attain), depending on the growing space available and the presence of overhead utility lines.

   **Choice of Trees**

   In all cases of tree planting, the guiding principle shall be to install the right tree, in both form and function, in the right place. **When specifying trees for planting on PLNU’s campus, consideration shall be given to tree species recommended for Southern California.** All proposed trees shall be in compliance with established PLNU design guidelines.

   **Tree Species Diversity Planting Requirements**

   The Campus Arborist will review plans to ensure species diversity (i.e. to avoid creating monocultures, or areas of plantings made up of only one species of trees). Monocultures are undesirable because if a certain species is prone to a particular disease or is more susceptible to storm damage or temperature extremes, then it is likely the entire stand could die or be destroyed by a single disease or weather event. Creating planting areas of several species creates a more diverse, and therefore more resilient, urban forest.

   Factors to be considered in acceptable and successful tree planting include the long term health of the tree in its location and its compatibility with adjacent uses as well as design considerations.

   In consideration of the financial impact realized by PLNU Horticulture and Grounds budget, it is important that long term maintenance of proposed trees be considered prior to their selection.

   Any tree species known to have an aggressive or rampant root system shall not be planted along campus streets to avoid damage to sidewalks, utilities and curbs or buildings.

   **Planting distances/spacing requirements**

   No large or medium tree species shall be planted within any power or utility easements or under overhead utility distribution lines if the average mature height of the tree is greater than the lowest overhead wire.

   Tree selection shall take into consideration requirements for future height clearances. As they grow, trees will need to be pruned to provide pedestrian clearance of at least 7 feet over sidewalks, and vehicular clearance of 10 feet over roads.

   **Supply of Tree Planting Stock**

   Since the first step in avoiding *future* hazard trees is to plant high quality stock, poor stock trees will not be approved for planting in any part of the campus regardless of whether the trees are meant to complete in-house projects or supplied by contractors in association with facility development.

   All trees delivered to PLNU for planting shall be inspected and approved by the Campus Arborist or his/her representative *before* installation. It is required that contractors or tree suppliers provide a minimum of two working days notice to the Campus Arborist for all inspections. For the reason that poor planting stock will end up costing much more money in the long run because of increased maintenance requirement and shorter life span, the University shall not neglect to exercise the right to reject poor quality trees upon delivery. The supplier(s)/contractor(s) shall bear the cost of transporting such rejected tree stock from the campus.

   All trees supplied by contractors in association with facility development shall be guaranteed for 1 year from acceptance after planting.

   While inspecting trees delivered to PLNU for planting, the Campus Arborist or his/her representative shall look for the following:

   ***PROPER IDENTIFICATION***

   All trees shall be true to name as ordered or shown on the planting plans and shall be labeled individually or in groups by species and cultivar (where appropriate).

   ***TREE HEALTH***

   As typical for the species/cultivar, trees shall be healthy and vigorous, as indicated by:

   * foliar crown density
   * length of shoot growth (throughout crown)
   * size, color and appearance of leaves
   * uniform distribution of roots in the container media
   * appearance of roots
   * absence of twig and/or branch dieback
   * relative freedom from insects and diseases

   **Note**: some of these characteristics cannot be used to determine the health of deciduous trees during the dormant season.

   ***CROWN***

   **Form**: Trees shall have a symmetrical form as typical for the species/cultivar and growth form.

   **Central Leader**: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the central leader should not have been headed. However, in cases where the original leader has been removed, an upright branch at least ½ (one-half) the diameter of the original leader just below the pruning point shall be present.

   **Note:** This section applies to single trunk trees grown with normal straightness, as typically used for street or landscape planting. This specification does not apply to plants that have been specifically cultured in the nursery or selected for unusual or unique shape, such as contorted forms, topiary forms, espalier forms, multi-stem, or clump forms.

   **Evaluating trunk and branch structure**

   **Trunk structure:** Shade trees that are large at maturity, and most evergreen trees, with the best quality have a dominant or central leader or trunk up to the top of the canopy. Shade trees of lesser quality have two or more leaders or trunks; they could split apart as they grow older. Small ornamental trees can have several trunks.

   * Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.
   * The trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.
   * Trunk diameter at 6" (six inches) above the soil surface shall be within the diameter range shown for each container size below:

   |  |  |  |  |
   | --- | --- | --- | --- |
   | Container Size | Soil Volume in Gallons (approx) | Trunk Diameter (in) | Soil Level from Container Top (in) |
   | # 5 | 0.6 | 0.5 to 0.75 | 1.25 to 2 |
   | # 15 | 3.3 | 0.75 to 1.5 | 1.75 to 2.75 |
   | 24-inch box | 10.5 | 1.5 to 2.5 | 2.25 to 3 |

   **Branch structure:** The better quality, large-maturing shade trees have all branches less than about two-thirds of the trunk diameter (below left). Poor quality shade trees have larger upright branches (below right). Trees such as crape myrtle and other small-maturing trees can have several trunks.

   Desirable Undesirable

   Trees with extensive defects in branches such as cracks and included bark (below) represent lesser quality than trees free of these potential problems. Included bark can be seen between the two arrows below. Branches with bark inclusions are weakly attached to the tree and can split easily.

   **Potential Main Branches**: Branches shall be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species.

   * Potential main branches shall be evenly spaced and have appropriate space between them.
   * Branches shall be no larger than 2/3 (two thirds) the diameter of the trunk, measured 1" (one inch) above the branch.
   * The attachment of scaffold branches shall be free of included bark.

   **Temporary branches**: Unless otherwise specified, small "temporary" branches should be present along the lower trunk below the first potential permanent branch, particularly for trees less than 1-1/2" (one and one-half inches) in trunk diameter. Temporary branches should be distributed around and vertically along the lower trunk. They should be no greater than 3/8" (three-eighths inch) in diameter and no greater than ½ (one-half) the diameter of the trunk at the point of attachment. Heading of temporary branches is usually necessary to limit their growth.

   ***ROOTS***

   * The trunk, root collar (root crown) and large roots shall be free of circling and/or kinked roots. Soil removal near the root collar may be necessary in order to verify that circling and/or kinked roots are not present.
   * The tree shall be well rooted in the container. When the trunk is carefully lifted both the trunk and root system shall move as one.
   * The upper-most roots or root collar shall be within 1" (one inch) above or below the soil surface. The soil level should be within 2' (two inches) of the top of the container (see table above, under “Trunk Structure”).
   * When the container is removed, the root ball shall remain intact.
   * The root ball periphery should be free of large circling and bottom-matted roots. There should be a well developed root system, but not a dense mass from being pot-bound.
   * The root ball size should be suitable to the height of the tree (see *American Standard for Nursery Stock*).
   * On grafted or budded trees, there shall be no suckers from the root stock.
   * If balled and burlapped, only natural burlap or wire baskets are allowed.

   All plants must conform to the current edition of the *American Standard for Nursery Stock ANSI Z60.1*.

   ***MOISTURE STATUS***

   At time of inspection and delivery, the root ball shall be moist throughout, and the tree crown shall show no signs of moisture stress, as indicated by wilt. Roots shall show no signs of being subjected to excess soil moisture conditions, as indicated by root discoloration, distortion, death, or foul odor.

   **Planting Site Preparation**

   Soil preparation and conditioning: All debris, wood chips, pavement, concrete and rocks over 2 inches in diameter shall be removed from the planting pit to a minimum of 24-inch depth, unless specified otherwise.

   **Planter pit preparation**

   • Trees in a confined planter pit or sidewalk area: The planting hole shall be excavated to a minimum of 30 inches deep x the width of the exposed area. Scarify the sides of the pit. Soil beneath the rootball shall be compacted to prevent settling.

   • Trees in all other areas:

   a). Mark out a planting area 2 to 3 times wider than the rootball diameter (the wider the better). Loosen this area to about 8 inches deep. This will enable the tree to extend a dense mat of tiny roots well out into the soil in the first one to ten weeks in the ground.

   b). Excavate the hole’s width a minimum of two times the diameter of the container, and deep enough to allow the root ball of the container to rest on firm soil with the top of the root ball even with the grade. Scarify the sides and the bottom of the pit.

   **Drainage**

   Adequate drainage must be provided to the surrounding soil for the planting of new trees. If the trees are to be planted in impermeable or infertile soil and water infiltration rates are less than two (2) inches an hour, then one of the following drainage systems or other approved measures must be implemented:

   * French drain, a minimum of three feet in depth
   * Drain tiles or lines beneath the trees
   * Auger six drain holes at the bottom perimeter of the planting pit, at a minimum of four (4) inches in diameter, twenty-four (24) inches deep and filled with medium sand or fine gravel.

   Aeration tubes for trees: Trees planted in sidewalk planter pits, planting strip, parking islands, or medians shall use 4-inch diameter perforated aeration piping (rigid or flexible), circling the bottom of the planter connected to a ‘T’ fitting to two riser tubes with grated caps and wrapped with filter fabric. This detail shall be shown on the approved landscape plans.

   **Planting the Tree**

   After the hole has been prepared as described above, the tree is ready to be planted.

   Container grown tree: Pull the container away from the root ball. Don't pull the tree out by its trunk. Container grown trees often have circling or girdling roots running along the edge of the rootball. If they exist in this area, cut them and spread them apart. Place the root ball in the center of the hole and adjust the tree so it is straight and at the proper level. Make any adjustments prior to filling the hole with dirt.

   Ball and burlapped tree: Rest the root ball in the center of the hole, and reshape the hole so the tree will be straight and at the proper level. After adjusting the tree, pull the burlap and any other material away from the sides and top of the root ball. Do not remove the burlap from the bottom. If you adjust or lift the tree after the burlap has been removed, you run the risk of damaging the root system.

   Tree planting detail graphic:

   Backfill soil, amended soil: Backfill with the original soil unless the original soil has been removed or the soil is poor. If soil must be amended, it shall be the most appropriate soil mix as directed by a Landscape Architect or a Certified Arborist, and in consultation with the Campus Arborist.

   Filling the hole: Fill the tree hole until is half full. Flood the hole with a slow hose or tamp gently with your foot to firm the soil. Repeat until the hole is full. Do not press the soil too firmly, only firm enough to hold the tree upright. Backfilling with soil and water or gently tamping will remove large air pockets.

   Construction of a berm or dam: Construct a small berm or dam three (3) feet in diameter around the tree. The berm should be approximately three (3) inches high.

   Mulching: Cover the entire loosened area of soil with 2 to 4 inches of mulch composed of shredded wood or bark in the entire planting area. Mulch will be placed one to two inches away from the trunk of the tree.

   **Staking or Guying**

   Bamboo stakes, if any, will be removed. Staking or guying is to prevent movement of the lower trunk and root system until the new tree establishes strong anchorage. Movement of the top is desirable and will strengthen the tree. The stakes will be installed 12-18 inches in undisturbed soil outside of the planting hole. Depending on height and size of the tree, stakes shall be six, eight, or ten feet tall. Trees shall be staked with 3 lodgepole stakes. Stakes shall not be taller than the first main branches of the tree nor rub against tree trunks.

   Tree ties will be located near the lowest main branch on the tree. Check a staked or guyed tree monthly during the growing season and after storms or strong wind. The system will be snug, but not to the point of making an impression on the stem or trunk. If that happens, the tie or wire around the trunk shall be loosened. No tree shall be staked any longer than absolutely necessary. One or two growing seasons is all that is needed.

   Miscellaneous Materials

   The following materials shall be used unless otherwise specified:

   Tree stakes. 2-inch diameter lodgepole stakes (A) or 2”x2” wooden stakes, arranged in a triangle, are the acceptable materials for protective staking of young trees. The R2 Staking System (B) shall be used for 15 gallon and 24-inch box size trees. It is a reusable screw-in auger-type steel stake with an adjustable anti-rotational tab and pin device that prevents the stake from turning or becoming loose in the ground.

   Tree Ties. Cinch ties, made of rubber, are the acceptable ties for use with lodgepole stakes

   Mulch. All newly planted trees shall be mulched with 2-4 inches of organic mulch. Mulch should never be placed against the trunk of a tree. There should be a space of 1-2 inches between the trunk and mulch. Mulch should cover the entire tree planting hole. No volcano mulching is allowed.

   Root Control Barriers. Use along all public sidewalks, and indicate on approved plans and drawings.

   Tree grates. Where sidewalk width is less than 8 feet and new trees will be installed in a tree well, metal tree grates may be used as approved by the Campus Arborist. Minimum size grates shall be 4’ x 4’ unless otherwise specified. All tree grates shall be mounted in frames inset into a concrete foundation within the sidewalk or surface material, and shall be flush with the surrounding surface.

   **Pruning Newly Planted Trees**

   Young trees are pruned to allow for proper growth through the years. If the tree is of high quality stock, it should need little pruning. It is no longer common practice to automatically trim a certain percentage of limbs from a newly planted tree. The tree needs as much foliage as can be available to assure rapid growth and desirable leaf structure. This includes refraining from “limbing up” and topping.

   **Pruning guidelines**

   **All tree pruning operations must be in full conformity with ANSI A300 Standards for Tree Care Operations**.

   Scaffolding/permanent branches: Identify the scaffolding/permanent branches. The lowest permanent branch should have a diameter of one-half or less of the trunk diameter where the branch attaches to the trunk. The vertical spacing of permanent scaffold branches should equal a distance 3% of the tree's eventual height. Thus, a tree that will be 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk. Avoid allowing two scaffold branches to arise one above the other on the same side of the tree. Maintain radial balance with branches growing outward in each direction.

   Limb removal: The following may be removed -

   * Torn, damaged, dead branches: Remove the branch just outside of the branch collar.
   * Double Leaders: Maintain a dominant trunk for at least six-eight feet without a major fork. If the trunk divides into two or more relatively equal stems, favor one strong stem and remove the others. Cut one stem back to a lateral branch.
   * Rubbing branches: Eliminate branches that are rubbing or will soon rub against another branch.
   * Crowding: Give each branch room to grow with minimal competition for sunlight. When possible, have major lateral branches evenly spaced eight to ten inches apart along the trunk. If the tree by its nature would lose too much foliage in the process of eliminating crowding, maintain at least half the foliage on branches in the lower 2/3 of the tree.
   * Narrow Branch Angles/Included Bark: Remove one branch if the angle is 40% or narrower or if it appears that the bark from the branch is becoming pinched between the branch and the trunk.
   * Sprouts and Suckers: Remove sprouts and suckers.
   * Temporary branches: Leave temporary branches that are not competing with permanent, scaffolding branches.

   **Transplanting Trees.**

   Transplanting large trees is difficult, expensive, and requires expertise and equipment. Preapproval from the Campus Arborist and periodic inspections will be required for the transplanting of a tree deserving of such treatment.

   When transplanting trees eight (8) inches in diameter and larger from existing landscapes, it is important to select healthy, vigorous trees, dig an appropriate size root ball, select a site that is consistent with the tree’s cultural needs, provide a saucer shaped planting hole approximately three times the root ball width, and then protect the root ball, trunk, and crown during lifting, transportation, and storage.

   The most important and hardest part in tree transplanting is creating and implementing a multi-year aftercare program, providing adequate moisture to the root ball.

   When a tree is dug for transplanting, as much as 90% of its root system is left behind, severed in the process of digging for transplanting. The tree has a hard time relying on 5-10 percent of its root system doing the work of the 90 percent that was lost. Until it is well established, the root system will have difficulty supplying enough water to the leaves. This stress impacts vigor of the tree and also exposes the tree to the risk of being vulnerable to pests and diseases. The tree is also less able to adapt to or withstand drought, extreme cold, and drying winds.

   **Considerations for Successful Tree Transplanting**

   Proper attention to the following issues should assist in providing a successful transplanting. Considering the size of the important trees being transplanted, a professional arborist is required to assist in the process.

   Site: Before transplanting make sure the tree is a good match for the new site.

   Timing: Recommended timing for transplanting trees is during the dormant season, when the tree is not trying to support its leafy crown.

   Health of tree: Select a tree that is in good health and shape and has no major defects in its trunk branch structure.

   Success rate: Different species have different success rates in transplanting.

   Tree size: Most commonly transplanted trees range in size from 5-15 diameter inches.

   **Transplanting process**

   Digging up the tree: Dig up a wide root ball with appropriate depth and wrap burlap material with wire and twine to save intact as much of the root ball as possible. A rule of thumb for trees over six inches in diameter is that a root ball = 10 inches in diameter for every inch of tree trunk diameter measured at 4 ½ feet above the ground. In other words, a 10 inch tree should have a 100 inch diameter rootball. Likewise, the ball depth should be about 60% of the ball diameter. The same 10 inch tree should have a 60 inch depth.

   While smaller trees can be transplanted using a tree spade or other specialty equipment/techniques, larger trees will require mechanical digging equipment and appropriate hoists and heavy equipment for moving the tree.

   Transporting the tree

   During transportation, the tree crown should always be covered with tarp to protect the tree from drying out and windburn.

   After transplanting

   Keep the root ball moist at all times. Anticipate watering three times a week or, in very hot weather, every day. Continued watering should be monitored and may be required for several years.

   **Do not prune newly transplanted trees to reduce crown and compensate for root loss. That will only further weaken the tree.**

   Mulch the transplanted tree with 2-4 inches of organic mulch to cover root ball.

   The process of regenerating a normal root system will take several years, especially for large trees. Immediately after transplanting, the tree will be susceptible to extreme stress. Moisture is a critical factor in new root growth. Soil structure (compacted soil, etc) and soil temperature also impact the growth of roots.

   (Abridged from “Transplanting Trees”, by Patrice Peltier and Gary W. Watson. Arbor Age, January-March 2000.)

   **APPENDICES**

   **APPENDIX A: DEFINITIONS**

   For the purposes of this Forest Management Plan, the following definitions apply. Additional definitions may be found in the Management Plan.

   **Certified Arborist** is an individual who has demonstrated knowledge and competency through obtainment of the current International Society of Arboriculture arborist certification, or who is a member of the American Society of Consulting Arborists.

   **Compaction** means compression of the soil structure or texture by any means that creates an upper layer that is impermeable. Compaction is injurious to roots and the health of a tree.

   **Dangerous** **tree** see Hazardous tree.

   **Dead tree** means a tree that is dead or that has been damaged beyond repair or is in an advanced state of decline (where an insufficient amount of live tissue, green leaves, limbs or branches, exists to sustain life) and has been determined to be such by a the Campus Arborist or an independent Certified Arborist. If the tree has been certified dead, removal is permitted as defined in the Management Plan.

   **Disturbance** refers to all of the various activities from construction or development that may damage trees.

   **Excessive Pruning** means removing in excess, one-fourth (25 percent) or greater, of the functioning leaf, stem or root area. Pruning in excess of 25 percent is injurious to the tree and is a prohibited act. Excessive pruning typically results in the tree appearing as a ‘bonsai’, ‘lion’s-tailed’, ‘lolly-popped’ or overly thinned.

   *Unbalanced Crown.* Excessive pruning also includes removal of the leaf or stem area predominantly on one side, topping, or excessive tree canopy or crown raising. Exceptions are when clearance from overhead utilities or public improvements is required or to abate a hazardous condition or a public nuisance.

   *Roots.* Excessive pruning may include the cutting of any root 1½ inches or greater in diameter and/or severing in excess of 25 percent of the roots.

   **Hazardous Tree** refers to a tree that possesses a structural defect which poses an imminent risk if the tree or part of the tree would fall on someone or something of value (target).

   *Structural defect* means any structural weakness or deformity of a tree or its parts. A tree with a structural defect can be verified to be hazardous by a certified arborist and confirmed as such by the Campus Arborist. The Campus Arborist retains discretionary right to approve or amend a hazardous rating, in writing, and recommend any action that may reduce the condition to a less-than significant level of hazard. If the tree has been determined to be hazardous, removal of the tree is permitted as provided for in the Management Plan.

   **Heritage Trees** are trees that are awarded special status due to their age, size, rarity or other factors.

   **Injury** means a wound resulting from any activity, including but not limited to ‘excessive pruning’, cutting, trenching, excavating, altering the grade, paving or compaction within the tree protection zone of a tree. Injury shall include bruising, scarring, tearing or breaking of roots, bark, trunk, branches or foliage, herbicide application or poisoning, or any other action leading to the death or permanent damage to tree health.

   **Management Plan** means this Forest Management Plan.

   **Protective Tree Fencing** means a temporary enclosure erected around a tree to be protected at the boundary of the tree protection zone. The fence serves three primary functions: 1) to keep the foliage, crown, branch structure and trunk clear from direct contact and damage by equipment, materials or disturbances; 2) to preserve roots and soil in an intact and non-compacted state; and 3) to identify the tree protection zone in which no soil disturbance is permitted and activities are restricted. (Covered in Forest Management Plan)

   Root Buffer means a temporary layer of material to protect the soil texture and roots. The buffer shall consist of a base course of tree chips or mulch spread over the root area to a minimum of 6-inch depth.

   **Site Plan** means a set of drawings (e.g. preliminary drawings, site plan, grading, demolition, building, utilities, landscape, irrigation, tree survey, etc.) that show existing site conditions and proposed landscape improvements, including trees to be removed, relocated or to be retained. Site plans shall include the following minimum information that may impact trees:

   • Surveyed tree location, species, size, dripline area (including trees located on adjacent area that overhang the project site) and protected trees within 30-feet of the project site.

   • Paving, concrete, trenching or grade change located within the tree protection zone.

   • Existing and proposed utility pathways.

   • Surface and subsurface drainage and aeration systems to be used.

   • Walls, tree wells, retaining walls and grade change barriers, both temporary and permanent.

   • Landscaping, irrigation and lighting within dripline of trees, including all lines, valves, etc.

   • Location of other landscaping and significant features.

   • All of the final approved site plan sheets shall reference tree protection instructions.

   **Soil Compaction** means the compression of soil particles that may result from the movement of heavy machinery and trucks, storage of construction materials, structures, paving, etc. within the tree protection zone. Soil compaction can result in atrophy of roots and potential death of the tree, with symptoms often taking 3 to 10 years to manifest.

   **Soil Fracturing** means the loosening of hard or compacted soil around a tree by means of a pneumatic soil probe that delivers sudden bursts of air to crack, loosen or expand the soil to improve the root growing environment.

   **Target** is a term used to include people, vehicles, structures or something subject to damage by a tree.

   **Note:** A tree may not be a hazard if a “target” is absent within the falling distance of a tree or its parts (e.g., a defective tree in a non-populated area away from pathways may not be considered a hazard)

   **Trenching** means any excavation to provide irrigation, install foundations, utility lines, services, pipe, drainage or other property improvements below grade. Trenching within the Critical Root Zone (CRZ) is injurious to roots and tree health and is prohibited, unless approved. If trenching is approved within the CRZ, it must be in accordance with instructions and table outlined in this Management Plan.

   **Verification of Tree Protection** means the development Project Manager shall verify to the Campus Urban Forester, in writing, that all preconstruction conditions have been met (tree fencing, erosion control, pruning, etc.) and are in place. An initial inspection of protective fencing and written verification must be submitted to the Campus Urban Forester **prior** to demolition, grading or any construction work.

   **Vertical Mulching** means augering, hydraulic or air excavation of vertical holes within a tree’s root zone to loosen and aerate the soil, typically to mitigate soil compaction. Holes are typically penetrated 4 to 6 feet on center, 2 to 3 feet deep, 2 to 6 inches in diameter and backfilled with either perlite, vermiculite, peat moss or a mixture thereof.

   **APPENDIX B**

   **APPENDIX C** [↑](#endnote-ref-3)