
HORTICULTURAL

Associates

Consultants in Horticulture and Arboriculture

TREE PRESERVATION AND MITIGATION REPORT

520 Doyle Park Drive
Santa Rosa, CA

Prepared for:

Bisbee Architecture and Design
629 Fourth Street, #A
Santa Rosa, CA 95404

Prepared by:

John C. Meserve
ISA Certified Arborist, WE #0478A
ISA Qualified Tree Risk Assessor/TRAQ
ASCA Qualified Tree and Plant Appraiser/TPAQ

November 25, 2020

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Mr. Nate Bisbee
Bisbee Architecture and Design
629 Fourth Street, #A
Santa Rosa, CA 95404

Re: Updated *Tree Preservation and Mitigation Report*, 520 Doyle Park Drive, Santa Rosa, California

Nate,

Attached you will find our updated *Tree Preservation and Mitigation Report* for the above noted site in Santa Rosa. A total of 31 trees were evaluated and this includes all trees that were present over 6 inches in trunk diameter measured at 4.5 feet above adjacent grade. This updated report is being provided because the original plan evaluated has been modified.

Each tree is identified in the field with a numbered aluminum tag placed on the trunk at approximately eye level.

All trees in this report was evaluated and documented for species, size, health, and structural condition. The *Tree Inventory Chart* also includes information about expected impacts of the proposed development plan and recommendations for action based on the plan reviewed. The *Tree Location Plan* shows the location and numbering sequence of all evaluated trees. Also included are *Pruning Guidelines*, *Tree Preservation Guidelines*, and a *Fencing Detail*.

This report is intended to be a basic inventory of trees present at this site, which includes a general review of tree health and structural condition. No in-depth evaluation has occurred on any tree, and assessment has included only external visual examination without probing, drilling, coring, root collar examination, root excavation, or dissecting any tree part. Failures, deficiencies, and problems may occur in these trees in the future, and this inventory in no way guarantees or provides a warranty for their health or structural condition. No other trees beyond those listed have been included in this report. If other trees need to be included it is the responsibility of the client to provide that direction.

EXISTING SITE CONDITION SUMMARY

The project site consists of an empty infill lot located between a residence and a medical building.

EXISTING TREE SUMMARY

Species native to the site include Coast Live Oak, Valley Oak, and Douglas Fir.

Native species which have been planted at or near the site include Coast Redwood, Black Walnut, and Western Red Cedar.

Non-native species include Cork Oak and Sweetgum.

DISCUSSION

Four Coast Redwoods and several Oaks are located on the north boundary line. These trees may straddle the property line and may be owned by both property owners. None appear to be preservable based on the plans reviewed, and further discussion may be necessary regarding ownership of the trees and their disposition as part of this development.

CONSTRUCTION IMPACT SUMMARY

The following is a summary of expected development impacts:

- (10) Trees that can be preserved
- (21) Trees that will require removal due to development impacts
- (31) Total trees included in this inventory

REQUIRED MITIGATION

Based on the 426 inches of trunk diameter proposed for removal you will be required to mitigate with 142 x 15 gallon replacement trees. Based on the small area available for landscaping, and use of the required mitigation trees, you may want to consider upgrading to fewer and larger sized replacement sizes. The City will accept one 24" box for every three 15 gallon trees, or one 36" box for every five 15 gallon trees. If using all 24" boxes that would be 49 replacement trees, or if using all 36" boxes it would be 29 replacement trees. Another alternative would be to pay in-lieu fees of \$100 per 15 gallon tree required for fees totaling \$14,200.

Mitigation inches are shown in the far right hand column of the attached chart.

Please feel free to contact me if you have questions regarding this report, or if further discussion would be helpful.

Regards,



John C. Meserve
ISA Certified Arborist, WE #0478A
ISA Qualified Tree Risk Assessor/TRAQ
ASCA Qualified Tree and Plant Appraiser/TPAQ



TREE INVENTORY CHART

TREE INVENTORY
520 Doyle Park Drive
Santa Rosa, CA

November 25, 2020

Tree #	Species	Common Name	Trunk (Diameter at 4.5')	Height (± feet)	Radius (± feet)	Health 1 - 5	Structure 1 - 4	Expected Impact	Recommendations	Mitigation Inches
860	<i>Quercus lobata</i>	Valley Oak	21	45	30	4	3	2	1, 6, 7, 8, 9, 13	0
861	<i>Quercus agrifolia</i>	Coast Live Oak	29	45	30	3.5	3	3	2	29
862	<i>Quercus agrifolia</i>	Coast Live Oak	16.5	35	16	4	3	3	2	16.5
863	<i>Quercus agrifolia</i>	Coast Live Oak	14	40	16	3.5	3	3	2	14
864	<i>Quercus agrifolia</i>	Coast Live Oak	5.5	30	15	2	3	3	2	5.5
865	<i>Quercus agrifolia</i>	Coast Live Oak	12	35	14	4	3	3	2	12
866	<i>Quercus agrifolia</i>	Coast Live Oak	7	20	14	3	3	3	2	7
867	<i>Quercus agrifolia</i>	Coast Live Oak	7	18	12	3	3	3	2	7
868	<i>Quercus lobata</i>	Valley Oak	40	50	32	3	2.5	3	2	40
869	<i>Quercus lobata</i>	Valley Oak	23.5	45	25	3	3	3	2	23.5
870	<i>Quercus agrifolia</i>	Coast Live Oak	10.5	40	14	4	3	3	2	10.5
871	<i>Quercus agrifolia</i>	Coast Live Oak	11.5	25	18	3	3	3	2	11.5
872	<i>Quercus agrifolia</i>	Coast Live Oak	35	35	20	4	3	3	2	35
873	<i>Quercus agrifolia</i>	Coast Live Oak	13.5	35	20	4	3	3	2	13.5
874	<i>Sequoia sempervirens</i>	Coast Redwood	38	120	20	4	3	3	2	38
875	<i>Quercus suber</i>	Cork Oak	4+4+5+6+7	15	12	3	3	3	2	26
876	<i>Sequoia sempervirens</i>	Coast Redwood	39	120	20	4	3	3	2	39

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TREE INVENTORY
520 Doyle Park Drive
Santa Rosa, CA

November 25, 2020

Tree #	Species	Common Name	Trunk (Diameter at 4.5')	Height (± feet)	Radius (± feet)	Health 1 - 5	Structure 1 - 4	Expected Impact	Recommendations	Mitigation Inches
877	<i>Sequoia sempervirens</i>	Coast Redwood	30.5	120	20	4	2	3	2	30.5
878	<i>Sequoia sempervirens</i>	Coast Redwood	33	120	20	4	3	3	2	33
879	<i>Quercus agrifolia</i>	Coast Live Oak	8	15	12	4	3	3	2	8
880	<i>Quercus agrifolia</i>	Coast Live Oak	9+7.5	18	15	4	3	3	2	16.5
881	<i>Liriodendron tulipifera</i>	Tulip Tree	10	35	12	4	3	3	2	10
882	<i>Pseudotsuga menziesii</i>	Douglas Fir	31	120	18	4	2.5	1	1, 6, 7, 8, 9, 11	0
883	<i>Pseudotsuga menziesii</i>	Douglas Fir	29	120	18	4	3	1	1, 6, 7, 8, 9, 11	0
884	<i>Quercus agrifolia</i>	Coast Live Oak	24	45	30	4	3	1	1, 6, 7, 8, 9, 11	0
885	<i>Pseudotsuga menziesii</i>	Douglas Fir	36	120	25	4	3	1	1, 6, 7, 9, 11	0
886	<i>Thuja plicata</i>	Western Red Cedar	46	120	25	4	3	1	1, 12	0
887	<i>Liquidambar styraciflua</i>	Sweetgum	19	40	20	4	3	2	1, 6, 7, 8, 9	0
888	<i>Sequoia sempervirens</i>	Coast Redwood	±48	120	20	4	3	2	1, 6, 7, 9, 11	0
889	<i>Quercus agrifolia</i>	Coast Live Oak	±40+12+24	45	25	4	3	2	1, 6, 7, 9, 11	0
890	no tree #890	X	X	X	X	X	X	X	X	X
891	<i>Juglans nigra</i>	Black Walnut	±24	50	18	4	3	1	1, 12	0
									Total Inches	426

426 total trunk inches being removed, divided by 6 and multiplied by 2 = 142 x 15 gallon replacement trees

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KEY TO TREE
INVENTORY CHART

KEY TO TREE INVENTORY CHART

Tree Number

Each tree has been identified in the field with an aluminum tag and reference number. Tags are attached to the trunk at approximately eye level and the *Tree Location Plan* illustrates the location of each numbered tree.

Species

Each tree has been identified by genus, species and common name. Many species have more than one common name.

Trunk

Each trunk has been measured, to the nearest one half inch, to document its diameter at 4 feet above adjacent grade. Trunk diameter is a good indicator of age, and is commonly used to determine mitigation replacement requirements.

Height

Height is estimated in feet, using visual assessment.

Radius

Radius is estimated in feet, using visual assessment. Since many canopies are asymmetrical, it is not uncommon for a radius estimate to be an average of the canopy size.

Health

The following descriptions are used to rate the health of a tree. Trees with a rating of 4 or 5 are very good candidates for preservation and will tolerate more construction impacts than trees in poorer condition. Trees with a rating of 3 may or may not be good candidates for preservation, depending on the species and expected construction impacts. Trees with a rating of 1 or 2 are generally poor candidates for preservation.

- (5) Excellent - health and vigor are exceptional, no pest, disease, or distress symptoms.
- (4) Good - health and vigor are average, no significant or specific distress symptoms, no significant pest or disease.
- (3) Fair - health and vigor are somewhat compromised, distress is visible, pest or disease may be present and affecting health, problems are generally correctable.
- (2) Marginal - health and vigor are significantly compromised, distress is highly visible and present to the degree that survivability is in question.
- (1) Poor - decline has progressed beyond the point of being able to return to a healthy condition again. Long-term survival is not expected. This designation includes dead trees.

Structure

The following descriptions are used to rate the structural integrity of a tree. Trees with a rating of 3 or 4 are generally stable, sound trees which do not require significant pruning, although cleaning, thinning, or raising the canopy might be desirable. Trees with a rating of 2 are generally poor candidates for preservation unless they are preserved well away from improvements or active use areas. Significant time and effort would be required to reconstruct the canopy and improve structural integrity. Trees with a rating of 1 are hazardous and should be removed.

- (4) Good structure - minor structural problems may be present which do not require corrective action.
- (3) Moderate structure - normal, typical structural issues which can be corrected with pruning.
- (2) Marginal structure - serious structural problems are present which may or may not be correctable with pruning, cabling, bracing, etc.
- (1) Poor structure - hazardous structural condition which cannot be effectively corrected with pruning or other measures, may require removal depending on location and the presence of targets.

Development Impacts

Considering the proximity of construction activities, type of activities, tree species, and tree condition - the following ratings are used to estimate the amount of impact on tree health and stability. Most trees will tolerate a (1) rating, many trees could tolerate a (2) rating with careful consideration and mitigation, but trees with a (3) rating are poor candidates for preservation due to their very close proximity to construction or because they are located within the footprint of construction and cannot be preserved.

- (3) A significant impact on long term tree integrity can be expected as a result of proposed development.
- (2) A moderate impact on long term tree integrity can be expected as a result of proposed development.
- (1) A very minor or no impact on long term tree integrity can be expected as a result of proposed development.
- (0) An unknown impact on long term tree integrity is expected depending on the location of this tree in relationship to actual grading and construction.

Recommendations

Recommendations are provided for removal or preservation. For those being preserved, protection measures and mitigation procedures to offset impacts and improve tree health are provided.

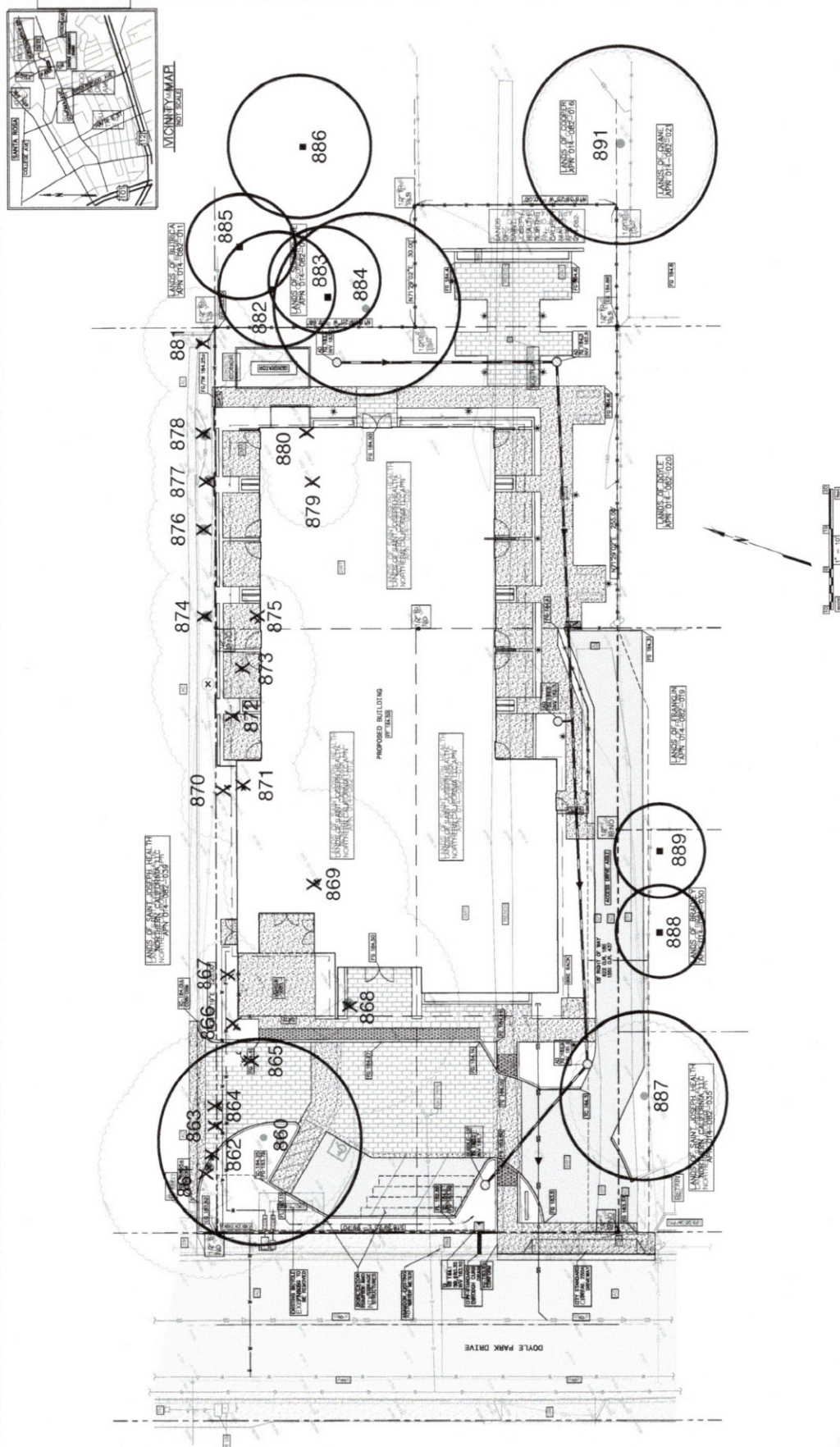
- (1) Preservation appears to be possible.
- (2) Removal is expected due to the significant development impacts of development.

- (3) Removal is recommended due to poor health or hazardous structure.
- (4) This tree may or may not be preservable based on information available at this time. Further analyze impacts following completion of a topographic survey to verify exact tree location.
- (5) Removal is recommended due to poor species characteristics.
- (6) Install temporary protective fencing at the edge of the dripline, or edge of approved construction, prior to beginning grading or construction. Maintain fencing in place for duration of all construction activity in the area.
- (7) Maintain existing grade within the fenced portion of the dripline. Route drainage swales and all underground work outside the dripline.
- (8) Place a 4" layer of chipped bark mulch over the soil surface within the fenced dripline prior to installing temporary fencing. Maintain this layer of mulch throughout construction.
- (9) Prune to clean, raise, or provide necessary clearance. Prune to reduce branches that are over-loaded, over-extended, largely horizontal, arching, or have foliage concentrated near the branch ends, per International Society of Arboriculture Pruning Standards.

Pruning to occur by, or under the supervision of, an Arborist certified by the International Society of Arboriculture. Pruning Standards are attached to this report.

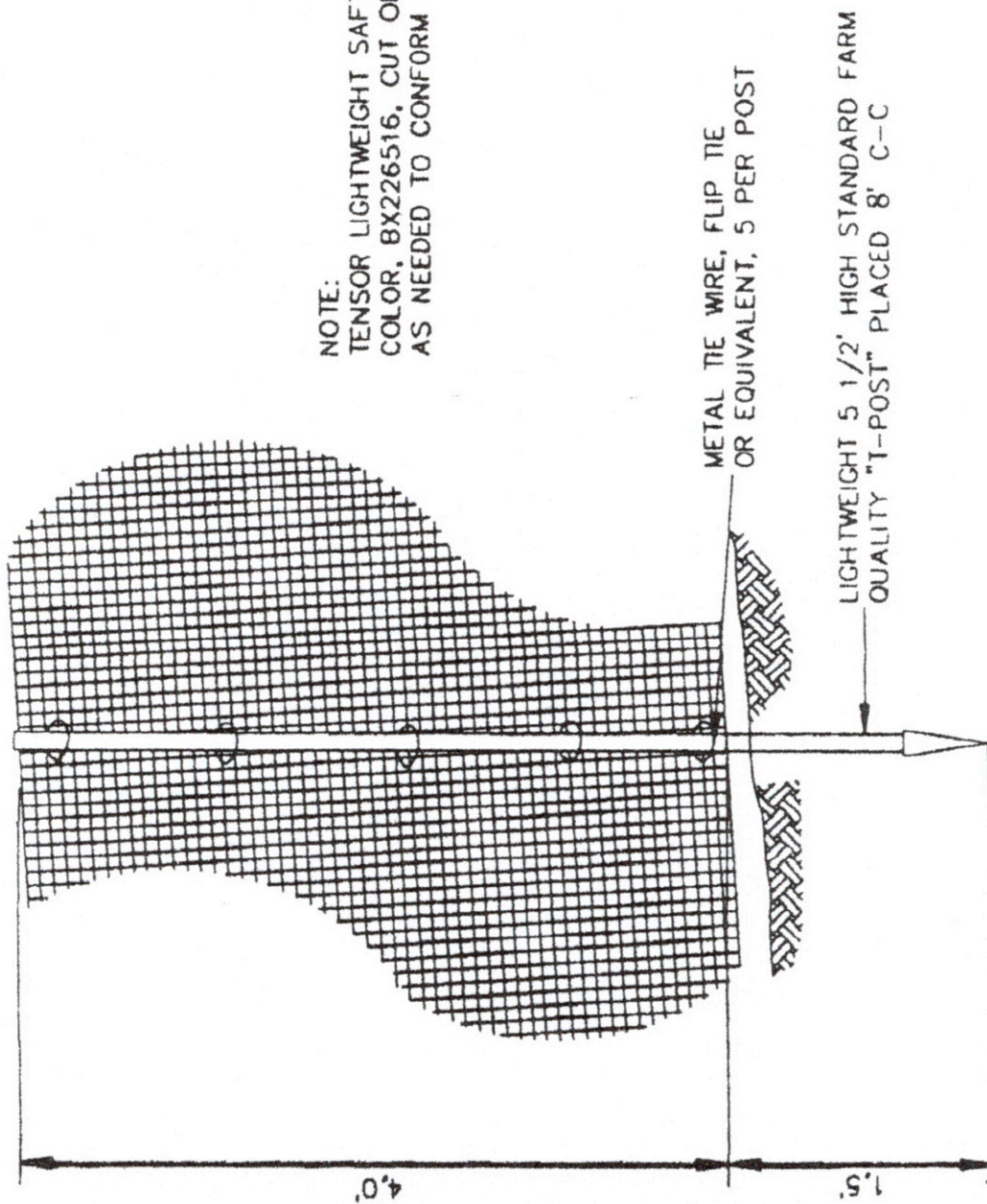
- (10) This tree is causing significant damage to the neighboring offsite curb, gutter, and asphalt paving.
- (11) This is an offsite tree that overhangs the subject property.
- (12) This is an offsite tree that does not overhang the subject property.
- (13) Use of an aerated paving material within the dripline of this tree is required. Minimize all base material compaction. Eliminate all trenching within dripline. Aggressively protect during construction.

TREE LOCATION PLAN



TREE LOCATION AND NUMBERING PLAN
520Doyle Perk Drive
Santa Rosa, CA

TREE FENCING DETAIL



NOTE:
 TENSOR LIGHTWEIGHT SAFETY GRID, ORANGE
 COLOR, BX226516, CUT OR FOLD AT POSTS
 AS NEEDED TO CONFORM TO SLOPING TERRAIN.

TREE PROTECTION FENCING DETAIL

TREE PRESERVATION GUIDELINES

TREE PROTECTION GUIDELINES FOR CONSTRUCTION AROUND PRESERVED TREES

TREE PROTECTION ZONE

The Tree Protection Zone is illustrated on the Improvement Plans and represents the area around each tree, or group of trees, which must be protected at all times with tree protection fencing. No encroachment into the Tree Protection Zone is allowed at any time without approval from the project arborist, and unauthorized entry may be subject to civil action and penalties.

The protected area beneath the canopy of each tree will be designated by the project arborist as the Tree Protection Zone at a location determined to be adequate to ensure long term tree viability and health. The Tree Protection Zone may not be consistent with the canopy dripline in many locations.

TREE PROTECTION FENCING

Prior to initiating any construction activity on a construction project, including demolition, vegetation or approved tree removal, grubbing, or grading, temporary protective fencing shall be installed at each site tree or group of trees. Fencing shall be located at the edge of the Tree Protection Zone as specifically designated by the project arborist.

Fencing shall be minimum 4' height at all locations, and shall form a continuous barrier without entry points around all individual trees, or groups of trees. Barrier type fencing such as *Tensar* plastic fencing is recommended, but any fencing system that adequately prevents entry will be considered for approval by the project arborist. The use of post and cable fencing is not acceptable.

Fencing shall be installed in a professional manner using standard quality farm 'T' posts that are placed no more than 8 feet on center. Fencing shall be attached to each post at 5 locations with plastic electrical ties. Fencing shall be stretched tightly between posts in all locations. See fencing detail.

Fencing shall serve as a barrier to prevent encroachment of any type by construction activities including equipment, building materials, storage, outhouses, or personnel.

All encroachment into the fenced Tree Protection Zone must be approved in writing and supervised by the project arborist. Fencing relocation from original placement must also be approved in writing and be approved by the project arborist. Approved Tree Protection Zone encroachment may require additional

mitigation or protection measures that will be determined by the project arborist at the time of the request.

Contractors and subcontractors shall direct all equipment and personnel to remain outside the fenced area at all times until project is complete, and shall instruct personnel and sub-contractors as to the purpose and importance of fencing and preservation. All contractors and subcontractors are notified by this specification that there will be no exceptions without prior written approval.

Fencing shall be upright and functional at all times prior to demolition and grading and through completion of construction in the specific area of protected trees. If the project is to occur in phases fencing may be removed as each phase is completed.

GRADING AND TRENCHING

Any construction activity that necessitates soil excavation in the vicinity of preserved trees shall be avoided where possible, or be appropriately mitigated under the guidance of the project arborist. All contractors must be aware at all times that specific protection measures are defined, and non-conformance may generate stop-work orders.

The designated Tree Protection Zone is defined around all site trees to be preserved. Fences protect the designated areas. No grading or trenching is to occur within this defined area unless so designated by the Improvement Plan, and where designated shall occur under the direct supervision of the project arborist.

Trenching should be routed around the Tree Protection Zone whenever possible. Where trenching has been designated within the Tree protection Zone, utilization of underground technology to bore, tunnel or excavate with high-pressure air or water will be specified. Hand digging will be generally discouraged unless site conditions restrict the use of alternate technology.

All roots greater than one inch in diameter shall be cleanly hand-cut as they are encountered in any trench or in any grading activity. The tearing of roots by equipment of any type shall not be allowed. Mitigation treatment of pruned roots shall be specified by the project arborist as determined by the degree of root pruning, location of root pruning, and potential exposure to desiccation. No pruning paints or sealants shall be used on cut roots.

Where significant roots are encountered mitigation measures such as supplemental irrigation and/or organic mulches may be specified by the project arborist to offset the reduction of root system capacity.

Retaining walls are effective at holding grade changes outside the area of the Tree Protection Zone and are recommended where necessary. Retaining walls shall be constructed in post and beam or drilled pier construction styles where they are necessary near or within the Tree Protection Zone.

Placement of fill soils is generally discouraged within the Tree Protection Zone, but in some approved locations may be approved to cover up to 30% of this area. The species and condition of the tree shall be considered, as well as site and soil conditions, and depth of fill. Retaining walls should be utilized to minimize the area of fill within the Tree Protection Zone. Type of fill soil and placement methods shall be specified by the project arborist.

Grade changes near or within the Tree Protection Zone shall be designed so that surface drainage will not be diverted toward or around the root crown in any manner. Grade shall drain away from root crown at a minimum of 2%. If grading toward the root collar is unavoidable, appropriate surface and/or subsurface drain facilities shall be installed so that water is effectively diverted away from root collar area.

Approved fill soils within the Tree Protection Zone may also be mitigated using aerated gravel layers as specified by the project arborist.

Tree roots will be expected to grow into areas of soil fill, and quality of imported soil shall be considered. Fill soil shall be site topsoil that closely matches that present within the root zone area. When import soil is utilized it must be the same or slightly coarser texture than existing site soil, should have a pH range comparable to site soils, and generally should have acceptable chemical properties for appropriate plant growth. A soil analysis is required prior to soil importation to evaluate import soil for these criteria.

Grade reduction within the designated Tree Protection Zones shall be generally discouraged, and where approved, shall be conducted only after careful consideration and coordination with the project arborist.

Foundations or footings of any type within the Tree Protection Zone shall be constructed using design techniques that eliminate the need for trenching into natural grade. These techniques might include drilled piers, grade beams, bridges, or cantilevered structures.

TREE DAMAGE

Any form of tree damage which occurs during the demolition, grading, or construction process shall be evaluated by the project arborist. Specific mitigation measures will be developed to compensate for or correct the damage. Fines and penalties may also be levied.

Measures may include, but are not limited to, the following:

- pruning to remove damaged limbs or wood
- bark scoring to remove damaged bark and promote callous formation
- alleviation of compaction by lightly scarifying the soil surface
- installation of a specific mulching material
- supplemental irrigation during the growing season for up to 5 years
- treatment with specific amendments intended to promote health, vigor, or root growth
- vertical mulching or soil fracturing to promote root growth
- periodic post-construction monitoring at the developer's expense
- tree replacement, or payment of the established appraised value, if the damage is so severe that long term survival is not expected

MULCHING

Trees will generally benefit from the application of a 4 inch layer of chipped bark mulch over the soil surface within the greater root zone area. Ideal mulch material is a chipped bark containing a wide range of particle sizes. Bark mulches composed of shredded redwood, bark screened for uniformity of size, or chipped lumber are not acceptable. Rock and gravel mulches are also not acceptable due to their minimal benefit.

Chipped bark mulch may not originate from any tree infected with, or exhibiting symptoms of, Sudden Oak Death (SOD) due to the potential of infecting existing site trees.

TREE PRUNING AND TREATMENT

All recommendations for pruning or other treatments must be completed prior to acceptance of the project. It is strongly recommended that pruning be completed prior to the start of grading to facilitate optimum logistics and access.

All pruning shall be conducted in conformance with International Society of Arboriculture pruning standards, and all pruning must occur under the direct supervision of, an arborist certified by the International Society of Arboriculture.

PRUNING STANDARDS

ISA

PRUNING STANDARDS

Purpose:

Trees and other woody plants respond in specific and predictable ways to pruning and other maintenance practices. Careful study of these responses has led to pruning practices which best preserve and enhance the beauty, structural integrity, and functional value of trees.

In an effort to promote practices which encourage the preservation of tree structure and health, the W.C. ISA Certification Committee has established the following Standards of Pruning for Certified Arborists. The Standards are presented as working guidelines, recognizing that trees are individually unique in form and structure, and that their pruning needs may not always fit strict rules. The Certified Arborist must take responsibility for special pruning practices that vary greatly from these Standards.

I. Pruning Techniques

- A. A thinning cut removes a branch at its point of attachment or shortens it to a lateral large enough to assume the terminal role. Thinning opens up a tree, reduces weight on heavy limbs, can reduce a tree's height, distributes ensuing invigoration throughout a tree and helps retain the tree's natural shape. Thinning cuts are therefore preferred in tree pruning.

When shortening a branch or leader, the lateral to which it is cut should be at least one-half the diameter of the cut being made. Removal of a branch or leader back to a sufficiently large lateral is often called "drop crotching."

- B. A heading cut removes a branch to a stub, a bud or a lateral branch not large enough to assume the terminal role. Heading cuts should seldom be used because vigorous, weakly attached upright sprouts are forced just below such cuts, and the tree's natural form is altered. In some situations, branch stubs die or produce only weak sprouts.

- C. When removing a live branch, pruning cuts should be made in branch tissue just outside the branch bark ridge and collar, which are trunk tissue. *(Figure 1)* If no collar is visible, the angle of the cut should approximate the angle formed by the branch bark ridge and the trunk. *(Figure 2)*
- D. When removing a dead branch, the final cut should be made outside the collar of live callus tissue. If the collar has grown out along the branch stub, only the dead stub should be removed, the live collar should remain intact, and uninjured. *(Figure 3)*
- E. When reducing the length of a branch or the height of a leader, the final cut should be made just beyond (without violating) the branch bark ridge of the branch being cut to. The cut should approximately bisect the angle formed by the branch bark ridge and an imaginary line perpendicular to the trunk or branch cut. *(Figure 4)*
- F. A goal of structural pruning is to maintain the size of lateral branches to less than three-fourths the diameter of the parent branch or trunk. If the branch is codominant or close to the size of the parent branch, thin the branch's foliage by 15% to 25%, particularly near the terminal. Thin the parent branch less, if at all. This will allow the parent branch to grow at a faster rate, will reduce the weight of the lateral branch, slow its total growth, and develop a stronger branch attachment. If this does not appear appropriate, the branch should be completely removed or shortened to a large lateral. *(Figure 5)*
- G. On large-growing trees, except whorl-branching conifers, branches that are more than one-third the diameter of the trunk should be spaced along the trunk at least 18 inches apart, on center. If this is not possible because of the present size of the tree, such branches should have their foliage thinned 15% to 25%, particularly near their terminals. *(Figure 6)*
- H. Pruning cuts should be clean and smooth with the bark at the edge of the cut firmly attached to the wood.
- I. Large or heavy branches that cannot be thrown clear, should be lowered on ropes to prevent injury to the tree or other property.
- J. Wound dressings and tree paints have not been shown to be effective in preventing or reducing decay. They are therefore not recommended for routine use when pruning.

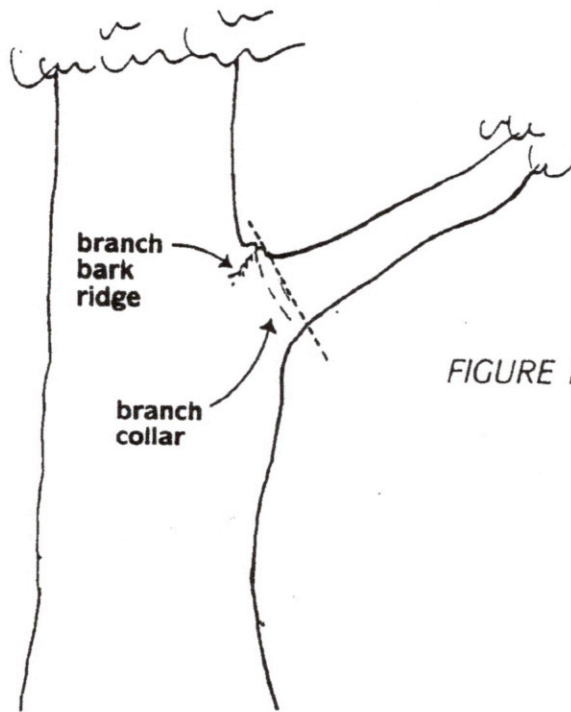


FIGURE 1. When removing a branch, the final cut should be just outside the branch bark ridge and collar.

FIGURE 2. In removing a limb without a branch collar, the angle of the final cut to the branch bark ridge should approximate the angle the branch bark ridge forms with the limb. Angle AB should equal Angle BC.

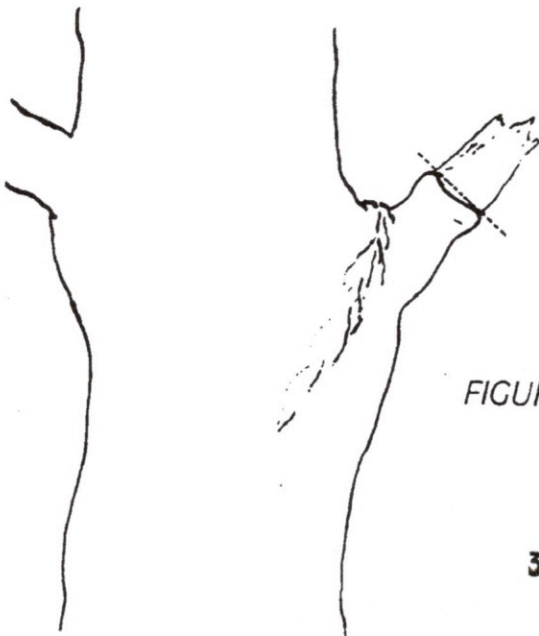
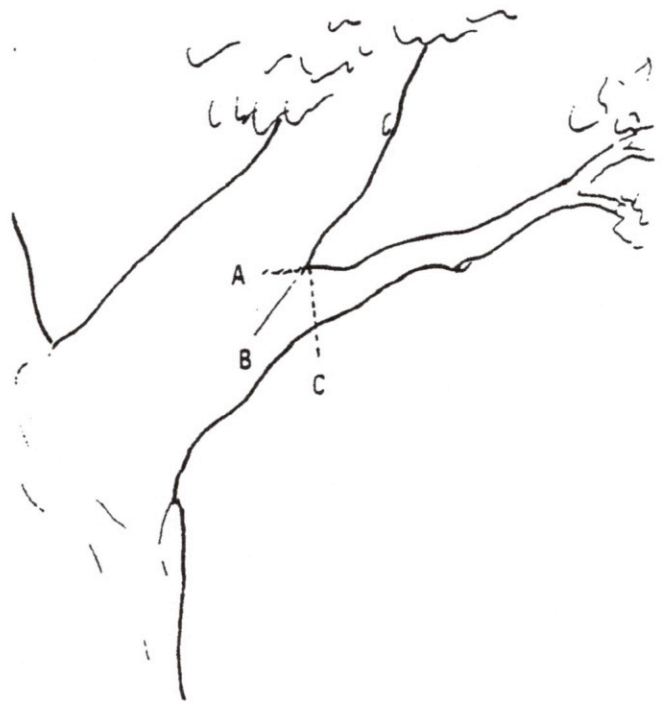


FIGURE 3. When removing a dead branch, cut outside the callus tissue that has begun to form around the branch.

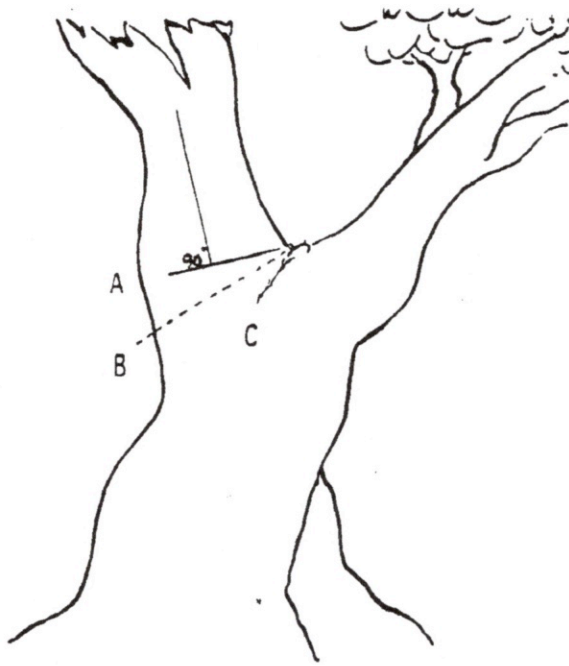
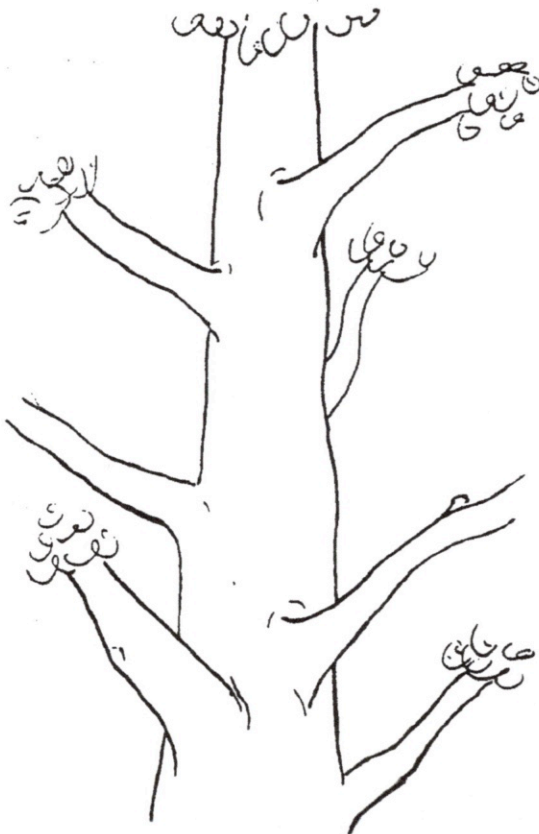


FIGURE 4. In removing the end of a limb to a large lateral branch, the final cut is made along a line that bisects the angle between the branch bark ridge and a line perpendicular to the limb being removed. Angle AB is equal to Angle BC.

FIGURE 5. A tree with limbs tending to be equal-sized, or codominant. Limbs marked B are greater than $\frac{3}{4}$ the size of the parent limb A. Thin the foliage of branch B more than branch A to slow its growth and develop a stronger branch attachment.



FIGURE 6. Major branches should be well spaced both along and around the stem.



II. Types of Pruning — Mature Trees

A. CROWN CLEANING

Crown cleaning or cleaning out is the removal of dead, dying, diseased, crowded, weakly attached, and low-vigor branches and watersprouts from a tree crown.

B. CROWN THINNING

Crown thinning includes crown cleaning and the selective removal of branches to increase light penetration and air movement into the crown. Increased light and air stimulates and maintains interior foliage, which in turn improves branch taper and strength. Thinning reduces the wind-sail effect of the crown and the weight of heavy limbs. Thinning the crown can emphasize the structural beauty of trunk and branches as well as improve the growth of plants beneath the tree by increasing light penetration. When thinning the crown of mature trees, seldom should more than one-third of the live foliage be removed.

At least one-half of the foliage should be on branches that arise in the lower two-thirds of the trees. Likewise, when thinning laterals from a limb, an effort should be made to retain inner lateral branches and leave the same distribution of foliage along the branch. Trees and branches so pruned will have stress more evenly distributed throughout the tree or along a branch.

An effect known as "lion's-tailing" results from pruning out the inside lateral branches. Lion's-tailing, by removing all the inner foliage, displaces the weight to the ends of the branches and may result in sunburned branches, watersprouts, weakened branch structure and limb breakage.

C. CROWN REDUCTION

Crown reduction is used to reduce the height and/or spread of a tree. Thinning cuts are most effective in maintaining the structural integrity and natural form of a tree and in delaying the time when it will need to be pruned again. The lateral to which a branch or trunk is cut should be at least one-half the diameter of the cut being made.

D. CROWN RESTORATION

Crown restoration can improve the structure and appearance of trees that have been topped or severely pruned using heading cuts. One to three sprouts on main branch stubs should be selected to reform a more natural appearing crown. Selected vigorous sprouts may need to be thinned to a lateral, or even headed, to control length growth in order to ensure adequate attachment for the size of the sprout. Restoration may require several prunings over a number of years.

II. Types of Pruning — Mature Trees (*continued*)

E. CROWN RAISING

Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas. It is important that a tree have at least one-half of its foliage on branches that originate in the lower two-thirds of its crown to ensure a well-formed, tapered structure and to uniformly distribute stress within a tree.

When pruning for view, it is preferable to develop "windows" through the foliage of the tree, rather than to severely raise or reduce the crown.

III. Size of Pruning Cuts

Each of the Pruning Techniques (Section I) and Types of Pruning (Section II) can be done to different levels of detail or refinement. The removal of many small branches rather than a few large branches will require more time, but will produce a less-pruned appearance, will force fewer watersprouts and will help to maintain the vitality and structure of the tree. Designating the maximum size (base diameter) that any occasional undesirable branch may be left within the tree crown, such as $\frac{1}{2}$ ", 1" or 2" branch diameter, will establish the degree of pruning desired.

IV. Climbing Techniques

- A. Climbing and pruning practices should not injure the tree except for the pruning cuts.
- B. Climbing spurs or gaffs should not be used when pruning a tree, unless the branches are more than throw-line distance apart. In such cases, the spurs should be removed once the climber is tied in.
- C. Spurs may be used to reach an injured climber and when removing a tree.
- D. Rope injury to thin barked trees from loading out heavy limbs should be avoided by installing a block in the tree to carry the load. This technique may also be used to reduce injury to a crotch from the climber's line.