April 12, 2012

Craig Christensen, P.E.
C.O.S. Project Manager
Community Development Division-Engineering Department
City of Sherwood
22560 SW Pine St.
Sherwood, OR 97140

E-mail: ChristensenC@sherwoodoregon.gov

Re: 8073-Area 48 Downstream Sanitary Upgrade Tree Inventory Plan and Arborist Tree Report

Dear Mr. Christensen:

The purpose of this letter and the attached "8073-Tonquin Employment Area Sanitary Upgrade" Tree Inventory Plan and Arborist Tree Report is to satisfy the requirements of the City of Sherwood Zoning and Development Code section 16.142.060. The report deals specifically with trees in the area of the proposed sanitary sewer line improvements located near and along the Portland and Western Railroad Right-of-Way and southwest Tualatin Sherwood Road (in sections 28 and 29 T2S, R1W, WM, City of Sherwood, Washington County, Oregon) as shown on the attached Tree Inventory Plan.

The trees located at the Area 48 downstream sanitary sewer upgrade site were examined on March 29th and 30th, 2012. Approximately 3600 lineal feet of sanitary sewer line is proposed to be upgraded, using construction methods of open trenching or trenchless technology such as pipe bursting, depending upon the site specific conditions and costs.

I am a Certified Arborist with a Bachelor's Degree from Oregon State University in Forest Engineering. I have worked in consulting forestry for over 24 years in the Pacific Northwest. I am also a Certified Arborist per the International Society of Arboriculture (Certificate number: PN-1908), a Certified Tree Risk Assessor per the Pacific Northwest Chapter of the International Society of Arboriculture (Certificate number: 197), and a Member of the American Society of Consulting Arborists. My resume is attached.

Please let me know if you have any questions.

Very Truly Yours,
AKS Engineering & Forestry, LLC

AMERICAN SOCIETY *of* CONSULTING ARBORISTS

CERTIFIED ARBORIST
KEITH JEHNKE
CERTIFICATE NUMBER PN-1908
EXPIRATION DATE: 6/30/2013

Keith Jehnke, PE, PLS, Principal;
Certified Arborist #PN-1908, Certified Tree Risk Assessor #192
Member, American Society of Consulting Arborists

Enclosures

KEITH R. JEHNKE, Certified Arborist, Certified Tree Risk Assessor, PE, PLS, Principal

ENGINEERING & FORESTRY

EDUCATION:
BS Forest Engineering
Oregon State University 1986
High Honors

BS Civil Engineering
Oregon State University 1986
High Honors

LICENSES:
International Society of Arboriculture Certified Arborist (PN-1908)

Certified Tree Risk Assessor, Pacific Northwest Chapter ISA (#197)

Professional Land Surveyor
- Oregon (#2619)
- Washington (#32582)
- Idaho (#14842)

Professional Civil & Environmental Engineer
- Oregon (#14971)
- Washington (#32582)
- Alaska (#CE-9452)

Certified Water Right Examiner
- Oregon (#302)

AFFILIATIONS
Pacific Northwest Chapter of the International Society of Arboriculture

Member American Society of Consulting Arborists

Society of American Foresters

City of Durham Planning Commission (2007-2010)

City of Durham City Council (2010-)

City of Durham's Representative on the City of Tigard Intergovernmental Water Board (2010-)

Professional Engineers of Oregon

Professional Land Surveyors of Oregon

National Society of Professional Engineers

Keith Jehnke has worked in the arborist and forestry profession for more than 24 years working extensively in Oregon, Washington and Alaska. Mr. Jehnke is a licensed Certified Arborist, Engineer and Land Surveyor. As an owner of AKS, Mr. Jehnke works with the clients and AKS staff to maintain communication and project planning. Mr. Jehnke has been Project Manager on numerous forest engineering, tree plan, civil engineering and forestry projects. His experience includes tree protection plans, evaluation of hazard trees, field inspection of excavation in tree root zones during construction, road layout and design, logging road layout, timber cruising (in Oregon, Washington and Alaska), appraisals, harvest unit layout, fish passage culvert design, small bridge design, hydrology analysis, and construction contract supervision and compliance. Some of his relevant project experience includes:

St. Cecilia Campus Improvements, Beaverton, Oregon: Mr. Jehnke provided the Certified Arborist services for this project from the initial tree evaluations, to the civil design process, through construction monitoring for the recent building additions.

Housing Authority of Portland. Demar Downs Apartments Landscape and Site Improvements, Portland, Oregon: Mr. Jehnke provided/is providing the Certified Arborist services for this project from the initial tree evaluations, to the civil design process, through construction monitoring on the 3 acre Demar Downs site.

O.N.S., Pokarney Place Planned Development, Lake Oswego, Oregon: Mr. Jehnke provided the Certified Arborist services for this project from the initial tree evaluations, to the civil design process, through construction monitoring for this 11-lot planned development.

Various Clients, Tree Plans and Expert Witness Testimony, Oregon, Washington: Mr. Jehnke has performed numerous tree plans for various public, site plan, and residential development projects for various jurisdictions including Vancouver, Beaverton, Durham, Lake Oswego, Portland, Happy Valley, and Sherwood.

City of Lake Oswego, Wastewater Line Extension, Lake Oswego, Oregon: Mr. Jehnke provided the Certified Arborists services for this project from the initial tree evaluations, to the civil design process, through construction monitoring for this 4,500 lineal foot sanitary sewer construction project.

Brown & Caldwell, City of Wilsonville Wastewater Treatment Plant Improvements, Wilsonville, Oregon: Mr. Jehnke provided Certified Arborist services for the evaluation of over 700 tree on the Wilsonville Wastewater Treatment Plant Site in preparation for a plant expansion.

8073-AREA 48 DOWNSTREAM SANITARY - TREE REPORT

The purpose of this Tree Report is to meet the intent of the City of Sherwood's Zoning and Development Code section 16.142.060. This report deals specifically with the proposed sanitary sewer upgrades located near and along the Portland and Western Railroad Right-of-Way and southwest Tualatin Sherwood Road (in sections 28 and 29 T2S, R1W, WM, City of Sherwood, Washington County, Oregon) as shown on the attached Tree Inventory Plan. This report covers the existing conditions of the trees on the site, as well as tree preservation, tree removal and tree pruning guidelines and specifications for the project. At this time the sanitary sewer improvements are not yet designed, so the only trees shown to be removed are trees that were determined to be a hazard due to structural defects.

Location:
The site is located in portions of Section 28 and 29, Township 2 South, Range 1 West, Willamette Meridian, City of Sherwood, Washington County, Oregon, being south of SW Tualatin Sherwood road . The trees in the area of the proposed improvements were visually evaluated and tagged and numbered, and are shown in the calculations in this Arborist Tree Report and in the attached Tree Inventory Plan.

This Arborist Tree Report consists of this written report and the Tree Inventory Plan.

1. **The number, species, size and location of trees to be cut;**-The sanitary sewer alignment is through General Industrial (GI) zoned land, adjacent to the Portland and Western Railroad right of way for a portion and within the Tualatin-Sherwood Road right of way for a portion. The timber types consist of a dense stocking of Oregon white oak with some scattered Douglas-fir in the lower areas near Rock Creek, mostly Douglas-fir up out of the wetlands, and Sweetgum street trees along SW Tualatin-Sherwood road. The project site varies from basically flat (0-7% slopes) to gentle slopes (10-20%). There are 176 trees 5 inches and greater in diameter breast height (dbh) on the site. Of these 176 trees, one is dead and three are defective in such a manner as to be considered a hazard and therefore all four hazard trees are proposed to be removed. Of the remaining 172 trees, a "to be determined" number will be removed in order to construct the sanitary sewer upgrade. Trees on the site include: Douglas-fir, Oregon white oak, Poplar, Pacific madrone, Bitter cherry, Birch and Sweetgum. The trees vary from a 52 inch dbh Douglas-fir (Pseudotsuga menziesii) to a 5" dbh Oregon white oak (Quercus garryana). See the attached Detailed Tree Inventory spreadsheet for more specific information. The tree numbers and locations of all of the trees are shown on the Tree Inventory Plan.

2. **The time and method of cutting or removal;**-The trees will be removed 1-4 weeks prior to the beginning of disturbance. The trees will be either felled with a chainsaw and the merchantable boles removed as logs, or they will be removed with excavators. Limbs and other non-merchantable materials will either be chipped and left on site for erosion control, or removed from the site. Stumps will either have the roots cut and then be pulled or they will be removed using a grinding machine.

3. **A site plan or sketch depicting where each individual tree to be removed and each tree to be preserved is located;**-The Tree Inventory Plan, outlines each tree location. The trees to be removed will be determined after the sanitary upgrades are designed. Any trees proposed to be preserved that will be near construction areas will need to be evaluated by the Project Consulting Arborist after the project is completed to re-evaluate the tree for possible construction damage or previously latent conditions that are now visible.

4. **A statement of the reason for cutting or removal;-** Tree removal will be necessary to accommodate the required sanitary sewer construction. In addition, some trees are also proposed to be removed due to various defects that threaten the stability of the tree. The reasons for the removal of each tree is outlined in the Detailed Tree Inventory Spreadsheet attached, under the "Reason for Removal" heading.

5. **Soils Information;-**The site contains Briedwell stony silt loam, 0 to 7 percent slopes, Cove clay, Huberly silt loam, Quatama loam, 0 to 3 percent slopes, Quatama loam, 3 to 7 percent slopes, Quatama loam, 7 to 12 percent slopes and Wapato silty clay loam. None of these soils are considered suitable for the production of commercial trees. These soils have effective rooting depths ranging from less than 20 inches in the Cove clay, to over 60 inches in the Quatama soils. Most of the trees on the site are in the Briedwell stony silt loam (effective rooting depth of 24-36 inches-moderate resistance to windthrow) and Quatama loams (effective rooting depth of 60 inches plus-large resistance to windthrow). A copy of pertinent portions of the USDA, Soil Conservation Service, Soil Survey of Washington County, Oregon is attached.

General Notes:
The total site contains 12.2+/- acres. The proposal is for the upgrade of approximately 3600 lineal feet of sanitary sewer line using either open trenching, trenchless technology, or some combination depending on the specific costs and site conditions.

There are a total of 176 trees in the project area. Of the 176 existing trees, 4 are considered Hazard trees, leaving 172 healthy trees. Of these 172 healthy trees, a number to be determined will be removed due to the construction of the sanitary sewer line.

Project		All Trees	Basal Area (sq. ft)	Healthy Trees	Basal Area (sq. ft.)
	Preserve	176	179.7	172	154.6
	Cut	(4)	(26.90)	(0)	(0)
	Total	172	154.6	172	154.6

WINDTHROW:

Windthrow is a natural phenomenon affecting trees. All trees can be susceptible to windthrow. Windthrow is the action of a tree being blown down. There are several different ways that windthrow occurs including:

1. "Stem" break, where the bole of the tree snaps well above the ground.
2. "Stock" break, where the bole snaps at ground level.
3. "Root" break, where the tree is uprooted by pivoting on broken roots close to the bole.
4. "Hinge" fall, where the tree is uprooted pivoting on the outer edge of the root plate.

Wind- Windthrow can be broken into two categories, catastrophic and endemic. Catastrophic windthrow occurs infrequently, on a large scale, when there are extraordinarily strong winds (see table below). During catastrophic storm events, trees are most often blown over in the general direction of the prevailing winds. Stem break failures are more common, especially on deep well drained soils. Endemic windthrow occurs more regularly, and on a smaller scale, being caused by numerous lower velocity windstorms that effect individual or small groups of trees that generally have some windthrow prone characteristics.

Catastrophic Wind Storm Events in the Portland Area over the Last 50 Years:

DATE:	MAXIMUM WIND SPEED IN THE PORTLAND AREA
October 12, 1962	112 mph
March 27, 1963	57 mph
October 2, 1967	70 mph
March 25-26, 1971	78 mph
November 13, 1981	71 mph
November 15, 1981	57 mph (gust)
December 12, 1995	75 mph
December 14-15, 2006	62 mph (gust)
November 12, 2007	46 mph

The majority of the destructive surface winds in Oregon come from the southwest. Very strong east winds may occur, but these are usually limited to small areas in the Columbia River Gorge. The much more frequent and widespread endemic winds are also from the southwest and are associated with storms moving onto the coast from the Pacific Ocean. If the winds are from the west, they are often stronger on the coast than in the interior valleys due to the north-south orientation of the Coast Range and Cascades. These mountain ranges obstruct and slow down the westerly surface winds.

The most destructive winds are those which blow from the south, parallel to the major mountain ranges. The Columbus Day Storm of 1962 was a classic example of a south wind storm.

Individual Tree Traits Affecting Windthrow-The individual tree traits affecting windthrow include height, crown size, diameter, shape of bole, and tree health. Taller trees are subject to larger wind forces due to both the larger turning moment and the greater wind velocities higher above the ground. Trees with large dense crowns catch more wind than trees with smaller less dense crowns. As the wind speed increases, the force on the tree stem increases by the square of the wind speed, meaning that if the wind speed doubles, the force on the stem increases by four times . The height to diameter at breast height (4.5 feet above the uphill side of the tree) ratio is also an indicator as a conical trunk is stronger than a cylindrical trunk. A height to diameter ratio of 60 or less (a more conical shaped bole) is considered more wind firm, and a height to diameter ratio of 100 or more (a tall, skinny, "telephone pole" shaped bole) is less wind firm. Individual tree defects, including bole rot and root rot, also increase the chances of windthrow. Dominant and co-dominant trees (the larger trees in an even aged stand) are less susceptible to windthrow than the smaller suppressed trees. Trees less than 60 feet tall are also generally more wind firm. The strength and elasticity of the boles of different species of trees can vary, with those with stronger more elastic boles being more windthrow resistant. The greater the rooting depth, the greater the rooting area, and the larger the size and greater the number of roots, all increases the windthrow resistance. Other items being equal, older trees also have a greater chance of windthrow. Individual trees within a stand can have widely differing windthrow resistance due to the variations in the above characteristics.

The proximity of adjacent trees and the growth pattern and history of those trees also greatly affects the chances of windthrow. Trees are generally windthrow resistant if they are open grown from a young age. Well stocked even-aged stands of second growth (generally Douglas-fir) on a good growing site rely on the group of trees to work together to withstand winds. This is provided by interlocking root systems, inter-tree crown damping during swaying, and dense crowns to reduce wind penetration. Younger stands are typically more wind firm than older stands.

The soils characteristics that affect windthrow are depth, drainage, soil structure, and the resulting shear strength. Deep soils allowing root penetration of greater than 3 feet to a restricting layer are more windthrow resistant as they allow a greater root soil mass. Shallow soils allowing root penetration of 1 foot or less are less wind firm. Dry soils generally have greater shear strength than wet soils. Well drained soils are drier more often and therefore more windthrow resistant. Poorly drained soils also restrict root growth and are more windthrow prone.

The characteristic of the root systems also greatly affects resistance to windthrow. Large lateral roots (greater than 0.2 inches) predominantly determine the resistance to overturning provided by the root system. The overall strength of a root is proportional to the fourth power of its diameter, hence when a root splits evenly into two branches; its overall strength is cut in half. Trees with a root mass of larger roots provide more resistance to overturning than those with smaller roots. Increased anchoring strength also results from the intermingling of the trees root systems with the root systems of adjacent trees. As the tree grows and catches more wind, the root system responds by adding more root mass.

Topography-The topography aspects that affect windthrow include the wind exposure and the wind direction, speed, and turbulence. Certain types of topography can “compress” wind streamlines (causing higher winds) including flowing through narrow valleys, over hills and ridges, and around shoulders. In the lee side of large ridges and even small hills, a turbulent wake develops eddies that can have strong vertical velocities that can lead to wind damage.

Weather Conditions-Both the overturning stress placed on the tree and the likelihood of windthrow is greatly affected by the wind speed, the number and strength of gusts, and the overall windstorm duration. Longer duration storms allow more time for swaying boles to break roots, increasing the chance of overturning with every weakened root. Saturation of the soil by rain also increases the likelihood of windthrow due to the reduction in root to soil adhesion and soil shear strength.

Windthrow Hazard Evaluation-A completely quantitative method to evaluate the windthrow hazard for a particular tree is not possible because there is not enough information available about the response of different species, crown classes, tree heights, bole shape, etc. to high winds. While you cannot make a quantitative prediction, you can make an evaluation based on qualitative traits of the specific tree and its growing site. Each tree has factors affecting its resistance to overturning. It also has factors effecting the total wind force acting on the tree. The interplay between these factors determines the overall windthrow hazard.

Field Evaluation-When evaluating trees and groups of trees for their windthrow “risk”, various elements of the individual tree, surrounding trees, soils, topography, and predominant storm wind direction are qualitatively evaluated based upon observations, experience, and the physical principles of the windthrow process in order to determine a general hazard classification for the likelihood of windthrow.

Other items evaluated during the site visit are evidence of recent windthrown trees, evidence of root or butt rots, and the presence of "pit and mound" micro-topography. Pit and mound micro-topography is caused by root break and hinge fall windthrown trees creating a "pit" where the tree pulled out of the ground, and a "mound" adjacent, where the dirt settles off the root wad over time. Evidence of past windthrow events can be a good predictor of future windthrow events.

Wind Force Factors:

Element Evaluated:	Ratings: High Hazard	Moderate Hazard	Lower Hazard
Location:	Topographically exposed locations, crests, saddles, upper slopes, lee of ridges		Topographically protected locations (valley bottoms, mid-slope trees)
Tree Group Edge Boundaries:	Tree edge faces the prevailing storm winds	Tree edge is parallel to the prevailing storm winds	Tree edge is on lee side of the prevailing storm winds
Height:	Taller	Intermediate	Shorter
Crown Size/Density:	Large/Dense		Small/Open

Resistance to Overturning Factors:

Element Evaluated:	Ratings: High Hazard	Moderate Hazard	Lower Hazard
Taper/Butt Flare:	Low Taper/No Butt Flare		High Taper/Large Butt Flare
Rooting/Soil Depth:	16 Inches or Less	Greater Than 16 inches & Less Than 32.5 inches	32.5 Inches or More
Root Rot Present:	Evidence of Root Rot		No Evidence of Root Rot
Soil Drainage:	Poorly Drained Soils		Well Drained Soils
Structural Integrity of Tree	Tree has a Structural Defect Compromising Its Ability to Resist Overturning		Tree has no Structural Defects

HIGH RISK TREES-Have a high wind force and low resistance to overturning.

MODERATE RISK TREES-Have a low wind force and low resistance to overturning, a high wind force and a high resistance to overturning, and moderate wind force and a moderate resistance to overturning.

LOW RISK TREES-Have a low wind force and a high resistance to overturning.

In addition to the above, other indicators can be used to refine the individual tree windthrow rating.

Other Indicators:

Element Evaluated:	Ratings: High Hazard	Moderate Hazard	Lower Hazard
Existing Windthrow on Site:	Moderate to Extensive Windthrow	Minor Windthrow	No Windthrow
Windthrow In Neighboring Recently Exposed Trees:	Moderate to Extensive Windthrow	Minor Windthrow	No Windthrow
Pit & Mound Micro-topography:	Evidence of Pit & Mound topography		No Evidence of Pit & Mound Topography

THIS SITE'S WINDTHROW POTENTIAL:

The tree stocking on this site varies from a medium to well stocked two-aged stand comprised of Oregon white oak in the understory and Douglas-fir in the over story, to sparse individual street trees in the SW Tualatin-Sherwood Road right-of-way, to no trees within the wetland area. The medium to well stocked two-aged stand turns to a uniform Oregon white oak stand as you approach from the north and are near Rock Creek in the wetlands area. The poorly drained wetlands area has weak holding potential and the saturated soil leads to shallow rooting depth which increases that area's windthrow potential.

The site contains Briedwell stony silt loam, Cove clay, Quatama loam, Huberly silt loam, Quatama loam and Wapato silty clay loam. These soils have an effective rooting depth ranging from under 20 inches in the Cove clay soils (wetland area) to over 60 inches in the Quatama soils along the Tualatin-Sherwood Road. The deep soils lead to a lower windthrow potential due to the deep rooting depth giving additional stability. Trees in the shallower rooting depth wetland area would have a greater risk of windthrow.

Generally, the soils on the site are not timber soils and the tree boles generally have a lot of taper making these trees generally more windfirm. The High Windthrow Risk trees on this site have structural defects compromising their ability to resist the wind.

Careful consideration has been given to each of the trees shown to be preserved. Each tree has been visually examined for its individual structural defects and windthrow characteristics, and this information is summarized in the "Detailed Tree Inventory" spreadsheet which is attached.

TREE PROTECTION NOTES

Methods that will maximize tree survival during and after construction-
The following items are included in addition to items on the tree plan drawings.

Designing for Tree Preservation:
Designing for tree preservation means that trees are considered an important project feature. The goal of tree preservation is to have trees remain safe assets to the site for years to come. Trees that are preserved must be carefully selected to make sure that they will survive the construction impacts, adapt to the new environment, and perform well in the new landscape. An assessment of suitability for preservation evaluates tree health, structure, age, and species factors. The consultant gathers information on the individual trees, and makes recommendations as to which trees are suitable for preservation, and how much undisturbed space they will require. The consultant also provides specific guidelines regarding grading, drainage, trenching, protected areas, root pruning, etc.

Tree Characteristics and Their Suitability for Preservation:
Trees vary in their suitability for preservation both on the basis of their inherent characteristics, and their future response to construction impacts. Trees that are structurally unstable, in poor health, or are unlikely to survive construction impacts could be a dangerous liability to future neighborhoods. A good tree preservation plan will call for the pre-construction removal of trees likely to die or to become a tree with a higher than acceptable risk of failure after construction. The factors to be evaluated are:

Tree Health-Healthy, vigorous trees are better able than non-vigorous trees to tolerate construction related stresses such as root removal, changes in grade, changes in soil moisture, and soil compaction. These healthy trees are also better able to adapt to the changed site conditions that occur after development.

Tree Structure-Trees with defects such as decayed wood, poor crown structure from past manual "topping" or natural broken tops, and co-dominant trunks with poor attachments are not suitable for preservation in areas where people or property could be injured or damaged. Such defects cannot be treated and may lead to failure.

Species-Although trees require protection to avoid injury, species vary widely in their ability to withstand damage and changes in their environment.

Tree Age-As a tree ages, its capacity to overcome injury, adapt to changes in its site environment, and to resist pests declines. For these reasons, mature and over-mature trees are less able to tolerate construction impacts and remain healthy than are young and semi-mature trees. Young vigorous trees are better able to generate new tissue and adapt to a new environment than old trees.

Tree Size/Height-Larger, taller trees are capable of hitting targets a greater distance away from the tree, and causing greater damage. Taller trees also provide a larger wind "sail", catching more wind and being more prone to being blown down in a large storm. Coupling this "sail" effect with the structural weakening of root removal/disturbance can lead to a higher than acceptable blow down risk.

Tree Location-The best candidates for preservation are single trees that developed as individual specimens, as they typically have uniform canopies and well tapered trunks. Trees that grow in groups do not function well as individuals. They often have tall, poorly shaped trunks, irregularly shaped crowns, and are prone to failure and decline when their neighbors are removed.

The arboricultural consultant weighs each of the above factors, and makes recommendations as to which trees are likely to thrive and be a long term asset to the new development, as well as recommendations to remove those trees that will likely have an unacceptable risk of failure and become a liability in the new development.

Guidelines for the Area Required to Preserve a Tree:
In order to preserve a tree, an area around that tree must be protected to ensure that the tree is not physically damaged, and that the roots are protected. A method to calculate this area, utilizes the diameter at breast height (dbh), species, and age. The dbh is multiplied by a factor (the factor is based on the tree age and the species tolerance for disturbance) from 0.5 feet radius to 1.5 feet radius (from the trunk-often 1 foot radius per inch dbh is used for an average), and this area is called the "Optimal Tree Protection Zone". The general guidelines for preservation are that you do not want to disturb more than 1/3 of this area, but that with healthy vigorous trees, up to 50% of the area could be disturbed.

How to Preserve Trees During Construction:
The portion of the "Optimal Tree Protection Zone" that is being protected must be fenced off (with a "substantial" fence). Within this area, no soil disturbance, including stripping is permitted. The natural grade is to be maintained, and no storage or dumping of materials, parking, etc. will be allowed within this zone without the approval of the arboricultural consultant. This tree protection fence should remain in place through the construction of the dwellings.

Excavation Within the "Optimal Tree Protection Zone":
Where there is excavation proposed within an "Optimal Tree Protection Zone" (outside of the protected zone fenced off above), it will be important for the contractor to prune the roots along the excavation lines. These roots should be pruned in the following manner:

- Excavation in the top 24" of the soil in the critical root zone area should begin at the excavation line that is closest to the tree.
- The excavation should be done by hand/shovel or with a back-hoe and a man with a shovel, pruning shears and a pruning saw.
- If done by hand, all roots 1" or larger should be pruned at the excavation line.
- If done with a backhoe (most likely scenario), then the operator needs to start the cut at the excavation line and carefully "feel" for roots/resistance. When there is resistance, the man with the shovel hand digs around the roots and prunes the roots larger that 1" diameter.
- The backhoe is to remain off of the tree roots to be saved at all times.
- The work will be done under the supervision of the Project Consulting Arborist.

The above system works well and can be done fairly quickly. The key is to avoid pulling on the roots larger than 1" diameter, potentially resulting in damage to roots between the excavation line and the tree.

How Trees Die:
Natural tree death is frequently a slow and complex process generally with a gradual decline involving a number of factors. Most trees die from one of three causes: (1) structural failure, (2) environmental degradation, or (3) pest infestation. Generally, trees die from a combination of factors. Trees weakened by changes in their environment (such as construction impacts) become more susceptible to infestation by disease and insects. Most individual trees survive for only a fraction of the potential lifespan of the species. Soil compaction, changes in grade, mechanical injury, changes in the environment around the tree, and changes in drainage may not kill the tree of themselves, but they may so weaken the tree that death by another cause occurs. Prevention of stress and the maintenance of health are the key elements of tree longevity.

What is "Tree Topping", and How Does It Damage a Tree?
Tree topping is a pruning technique to reduce the height by cutting the central leader. This method of pruning is very detrimental to trees and not considered a good practice. Trees are generally topped by unknowledgeable pruners in order to lower the height of the tree and minimize the chance of windthrow by reducing the tree's wind profile. The large stub of a topped tree has a difficult time forming callus over the wound. The terminal location of these cuts, as well as their large diameter, prevents the tree's chemically based natural defense system from doing its job. The stubs are highly vulnerable to both insect invasion and the spores of decay fungi. If decay is already present, topping will speed the spread of the disease. The tree reacts to the topping cut by producing multiple shoots below the cut. These shoots develop from buds near the surface of the topping cut. Unlike normal branches that develop in a socket of overlapping wood tissues, these new shoots are anchored only in the outermost layers of the bole. These new shoots grow quickly, and are prone to breaking, especially during windy conditions. For all of these reasons, trees that have been topped pose a danger to life and safety and are recommended for removal.

Development Impacts Affecting Preserved Trees:
Construction of the site improvements generally consists of cut and fill (grading), construction of retaining walls, trenching for the wet and dry utilities, coring of roads, and placement of aggregate and pavement. During the

construction, adjacent soil areas outside of the grading and excavation can be compacted by heavy equipment driving over it. The grading and placement of utility trenches (and subsequent pipe bedding), and retaining walls can also affect the local water table.

The placement of landscaping can require excavation and the installation of irrigation systems. During this work, adjacent soil areas outside of the work area can be compacted by equipment driving over it.

Future Condition of Trees on the Site:
The characteristics of the individual tree are a guide to how well that tree will respond to site disturbance. Larger trees have correspondingly larger root zones. Older trees are less resilient to disturbance than younger trees. Unhealthy trees are less resilient to disturbance than healthy trees. Douglas-fir trees are tolerant of a small amount of fill, but intolerant of poor drainage. Western red cedar trees are intolerant of fill and changes in the water table/soil moisture conditions. Western hemlock trees are prone to windthrow and decay, and intolerant of cuts or fills. This site is composed of predominantly Oregon white oak, Douglas-fir, and Sweetgum with some scattered minor species (bitter cherry, birch, bigleaf maple, poplar).

The amount of disturbance on this site will be determined by the construction methods chosen. Portions of the sanitary line may be placed conventionally by trenching while other portions may be replaced using trenchless methods such as pipe-bursting. The extent of the project's impact on the trees will be determined by the amount of excavation required to place the pipe and develop adequate pits for any trenchless method chosen.

Tree Inventory:

The vegetation on the property consists of: trees, shrubs, small trees, and forbs including:

Common Name	Scientific Name
misc. grasses	
Douglas-fir	*Pseudotsuga menziesii*
bigleaf maple	*Acer macrophyllum*
Oregon white oak	*Quercus garryana*
Sweetgum	*Liquidambar styraciflua*
Pacific madrone	*Arbutus menziesii*
Bitter cherry	*Prunus emarginata*
Poplar species	*Populus spp.*
Poison oak	*Toxicodendron diversilobum*

Potential for Tree Preservation- There are significant opportunities for tree preservation through the use of trenchless technology in placing the sanitary line. The City of Sherwood will be working with the Contractor to determine which method of placement is to be used. Care will need to be taken when working adjacent to trees to be preserved in order to disturb as few roots as possible during the excavation. Portions of the site have few trees while other areas have dense trees. After the construction is complete the Project Consulting Arborist shall reevaluate the trees to be preserved for construction damage and latent defects that have become apparent after construction.

Methods that will ensure the survival during and after construction-

The following items are included in addition to items on the tree plan drawings.

GENERAL

1. Install tree protection fence as directed by the Project Consulting Arborist prior to the clearing phase. Fence location is to be verified by the Project Consulting Arborist. Fence must remain in place throughout the duration of construction or any activity potentially injurious to trees to be retained. Any necessary intrusion into the tree protection area must be approved and directed by the Project Consulting Arborist. Erect prior to commencement of clearing and demolition work and remove only after all work potentially injurious to trees and other plants is complete. Fence shall be placed as far from trees as is practical, but in no instance closer than one foot behind required construction limits. Fence shall be 4' visibility plastic on steel posts placed no further than 6' apart extending no less than 4-1/2' above the ground, kept taut at all times.

2. Stumps of trees removed within twenty feet of those designated to be retained must be ground below grade, not grubbed. Root pruning prior to stump removal may be an acceptable alternative as approved and directed by the Project Consulting Arborist.

3. All retained trees located within fifty feet of construction limits must be pruned to ANSI A-300 Crown Cleaning standards for deadwood removal (safety pruning) and interior crown thinning on evergreen specie for wind throw reduction. Thinning must not exceed fifteen percent live tissue (branch) removal. Individual trees with extreme windthrow characteristics may be removed for safety reasons after consultation with the City.

4. Site clearing and construction activities in close proximity to tree protection areas must be monitored by the Project Consulting Arborist.

5. Additional site specific or therapeutic care requirements may be recommended based on site monitoring visits by the Project Consulting Arborist.

6. Protect all trees form stockpiling, material storage, vehicle parking and driving within the tree drip line or tree protection fence area.

7. Protect all plant growth including root systems of trees and plants from:

    A. Dumping of refuse.
    B. Chemically injurious materials and liquids.
    C. Noxious materials in solution caused by run-off and spillage during mixing and placement of construction materials and drainage from stored materials.
    D. Continual puddling of running water.

8. Restrict vehicular and foot traffic to prevent compaction of soil over root systems.

EXCAVATION AROUND TREES

1. Excavate within root zone of trees to be preserved only where indicated and acceptable to the Project Consulting Arborist.

2. Excavate around tree roots of trees to be preserved within tree root zone only under the direction of the Project Consulting Arborist.

3. Where trenching for utilities is required within root zones of trees to be preserved, do not cut main lateral support roots. Cut smaller roots which interfere with installation of new work; use sharp pruning tools.

4. Where excavating for new construction is required within root zones of trees to be preserved, hand excavate to minimize damage to root systems. Use narrow tine spading forks and comb soil to expose roots. Relocate roots in backfill areas whenever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking.

5. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots of trees to be preserved approximately 6 inches back from new construction.

6. Do not allow exposed roots of trees to be preserved to dry out before permanent backfill is placed; provide temporary earth cover, pack with wet peat moss or 4 layers of wet untreated burlap and temporarily support and protect from damage until permanently relocated and covered with backfill.

GRADING AND FILLING AROUND TREES

1. Maintain existing grade within root zones of trees to be preserved unless otherwise indicated or acceptable to the Project Consulting Arborist.

2. Lowering Grades: Where existing grade is above new finish grade shown around trees to be preserved, under direction of Project Consulting Arborist, carefully hand excavate within root zones to new grade. Cut roots exposed by excavation to approximately 3 inches below elevation of new finish grade.

3. Raising Grades: Permitted only as acceptable to the Project Consulting Arborist.

Arborist Disclosure Statement

Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the health of trees, and attempt to reduce the risk of living near trees. The Client and Jurisdiction may choose to accept or disregard the recommendations of the arborist, or seek additional advice.

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments, like medicine, cannot be guaranteed.

Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate all trees.

Detailed Tree Inventory for Area 48

NO. 3108

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
11963	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11964	8	Pacific madrone (Arbutus menziesii)	0.35	Crooked, lean, ok	2	Preserve	B	1	0.35
11965	20	Douglas-fir (Pseudotsuga menziesii)	2.18	Butt swell, sweep, ok	2	Preserve	B	1	2.18
11966	20	Douglas-fir (Pseudotsuga menziesii)	2.18	Butt swell, sweep, ok	2	Preserve	B	1	2.18
11967	35	Oregon white oak (Quercus garryana)	6.68	Included bark, scars, co-dominant, ok	2+	Preserve	B	1	6.68
11968	6	Oregon white oak (Quercus garryana)	0.20	OK	1	Preserve	C	1	0.20
11969	36	Douglas-fir (Pseudotsuga menziesii)	7.07	Butt swell, sweep, ok	2	Preserve	B	1	7.07
11970	7	Maple (Acer spp.)	0.27	Conks, decay, watch	2+	Preserve	B	1	0.27
11971	15	Douglas-fir (Pseudotsuga menziesii)	1.23	Some pitch, ok	2	Preserve	B	1	1.23
11972	7	Douglas-fir (Pseudotsuga menziesii)	0.27	Scar, some pitch, suppressed, ok	2	Preserve	B	1	0.27
11973	5	Douglas-fir (Pseudotsuga menziesii)	0.14	Suppressed, ok	1	Preserve	C	1	0.14
11974	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11975	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11976	8	Douglas-fir (Pseudotsuga menziesii)	0.35	Slight lean, ok	1	Preserve	C	1	0.35
11977	8	Douglas-fir (Pseudotsuga menziesii)	0.35	Slight lean, ok	1	Preserve	C	1	0.35
11978	5	Pacific madrone (Arbutus menziesii)	0.14	OK	1	Preserve	C	1	0.14
11979	14	Oregon white oak (Quercus garryana)	1.07	OK	1	Preserve	C	1	1.07
11980	33	Douglas-fir (Pseudotsuga menziesii)	5.94	Scar, heavy pitch, decay, watch	3	Hazard	A	0	0.00
11981	5	Pacific madrone (Arbutus menziesii)	0.14	OK	1	Preserve	C	1	0.14
11982	18	Douglas-fir (Pseudotsuga menziesii)	1.77	Scar, heavy pitch, decay, watch	2+	Preserve	B	1	1.77
11983	7	Pacific madrone (Arbutus menziesii)	0.27	OK	1	Preserve	C	1	0.27
11984	5	Pacific madrone (Arbutus menziesii)	0.14	Lean, ok	1	Preserve	C	1	0.14
11985	16	Douglas-fir (Pseudotsuga menziesii)	1.40	Butt swell, scar, vines, ok	2	Preserve	B	1	1.40
12005	8	bigleaf maple (Acer macrophyllum)	0.35	Slight lean, ok	1	Preserve	C	1	0.35
12006	11	Douglas-fir (Pseudotsuga menziesii)	0.66	Large scar, lean, ok	2	Preserve	B	1	0.66
12007	9	Douglas-fir (Pseudotsuga menziesii)	0.44	Lean, large scar, broken top, codominant stems, ok	2+	Preserve	B	1	0.44
12008	17	Douglas-fir (Pseudotsuga menziesii)	1.58	Lean, broken top, codominant stems, ok	2+	Preserve	B	1	1.58
12009	8	Douglas-fir (Pseudotsuga menziesii)	0.35	Slight lean, ok	1	Preserve	C	1	0.35
12010	23	Douglas-fir (Pseudotsuga menziesii)	2.89	Lean, sweep, some pitch, ok	2+	Preserve	B	1	2.89
12011	10	Oregon white oak (Quercus garryana)	0.55	Lean, ok	2+	Preserve	B	1	0.55
12013	5	Oregon white oak (Quercus garryana)	0.14	OK	2	Preserve	B	1	0.14
12015	15	Oregon white oak (Quercus garryana)	1.23	Healthy	1	Preserve	C	1	1.23
12016	25	Douglas-fir (Pseudotsuga menziesii)	3.41	Butt swell, crooked, lean, ok	2+	Preserve	B	1	3.41
12017	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
12018	8	Douglas-fir (Pseudotsuga menziesii)	0.35	OK	1	Preserve	C	1	0.35
12019	6	Douglas-fir (Pseudotsuga menziesii)	0.20	OK	1	Preserve	C	1	0.20
12020	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
12021	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
12027	5	Oregon white oak (Quercus garryana)	0.14	Lean, codominant stems, ok	1	Preserve	C	1	0.14
12028	11	Oregon white oak (Quercus garryana)	0.66	Scar, decay, slight lean, ok	2+	Preserve	B	1	0.66

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
12029	14	Oregon white oak (Quercus garryana)	1.07	Crooked, ok	2	Preserve	B	1	1.07
12030	24	Douglas-fir (Pseudotsuga menziesii)	3.14	Some pitch, some sweep	2	Preserve	B	1	3.14
12031	20	Douglas-fir (Pseudotsuga menziesii)	2.18	Healthy	1	Preserve	C	1	2.18
12034	12	Oregon white oak (Quercus garryana)	0.79	Healthy	1	Preserve	C	1	0.79
12035	9	Oregon white oak (Quercus garryana)	0.44	Rock rolled against trunk, curved bole, ok	2	Preserve	B	1	0.44
12036	9	Oregon white oak (Quercus garryana)	0.44	OK	1	Preserve	C	1	0.44
12041	7	Poplar species (Populus spp.)	0.27	OK	1	Preserve	C	1	0.27
12042	8	Poplar species (Populus spp.)	0.35	OK	1	Preserve	C	1	0.35
12046	8	Oregon white oak (Quercus garryana)	0.35	OK	1	Preserve	C	1	0.35
12047	8	Oregon white oak (Quercus garryana)	0.35	OK	1	Preserve	C	1	0.35
12048	5	Oregon white oak (Quercus garryana)	0.14	Lean, ok	1	Preserve	C	1	0.14
12049	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12050	8	Oregon white oak (Quercus garryana)	0.35	OK	1	Preserve	C	1	0.35
12057	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12058	15	Oregon white oak (Quercus garryana)	1.23	OK	1	Preserve	C	1	1.23
12059	7	Oregon white oak (Quercus garryana)	0.27	Curved bole, ok	2	Preserve	B	1	0.27
12060	13	Oregon white oak (Quercus garryana)	0.92	Slight lean, ok	2	Preserve	B	1	0.92
12061	5	Oregon white oak (Quercus garryana)	0.14	Crooked, ok	1	Preserve	C	1	0.14
12063	6	Oregon white oak (Quercus garryana)	0.20	Crooked bole, ok	2	Preserve	B	1	0.20
12064	12	Douglas-fir (Pseudotsuga menziesii)	0.79	Slight lean, butt swell, ok	2	Preserve	B	1	0.79
12065	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12066	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12067	10	Oregon white oak (Quercus garryana)	0.55	codominant stems, OK	1	Preserve	C	1	0.55
12068	19	Douglas-fir (Pseudotsuga menziesii)	1.97	Some sweep, ok	2	Preserve	B	1	1.97
12069	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12070	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12071	6	Oregon white oak (Quercus garryana)	0.20	OK	1	Preserve	C	1	0.20
12072	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12073	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12074	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14
12076	11	Oregon white oak (Quercus garryana)	0.66	Healthy	1	Preserve	C	1	0.66
12077	10	Oregon white oak (Quercus garryana)	0.55	Healthy	1	Preserve	C	1	0.55
12078	13	Oregon white oak (Quercus garryana)	0.92	Healthy	1	Preserve	C	1	0.92
12079	11	Oregon white oak (Quercus garryana)	0.66	OK	1	Preserve	C	1	0.66
12080	12	Oregon white oak (Quercus garryana)	0.79	OK	1	Preserve	C	1	0.79
12081	13	Oregon white oak (Quercus garryana)	0.92	Slight lean, ok	1	Preserve	C	1	0.92
12082	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12083	10	Oregon white oak (Quercus garryana)	0.55	OK	1	Preserve	C	1	0.55
12084	9	Oregon white oak (Quercus garryana)	0.44	OK	1	Preserve	C	1	0.44
12085	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12086	5	Oregon white oak (Quercus garryana)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
12087	5	Oregon white oak (Quercus garryana)	0.14	OK	1	Preserve	C	1	0.14

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
12088	26	Oregon white oak (Quercus garryana)	3.69	Slight lean, ok	1	Preserve	C	1	3.69
12089	16	Oregon white oak (Quercus garryana)	1.40	Slight lean, ok	1	Preserve	C	1	1.40
12090	6	Oregon white oak (Quercus garryana)	0.20	Slight lean, ok	1	Preserve	C	1	0.20
12095	7	Oregon white oak (Quercus garryana)	0.27	Codominant stems, ok	1	Preserve	C	1	0.27
12096	10	Oregon white oak (Quercus garryana)	0.55	Codminant stems, ok	1	Preserve	C	1	0.55
12097	8	Oregon white oak (Quercus garryana)	0.35	Codminant stems, ok	1	Preserve	C	1	0.35
12101	11	Oregon white oak (Quercus garryana)	0.66	Crooked, lean, ok	2	Preserve	B	1	0.66
12102	16	Oregon white oak (Quercus garryana)	1.40	OK	1	Preserve	C	1	1.40
12103	6	Bitter Cherry (Prunus emarginata)	0.20	Crooked, ok	1	Preserve	C	1	0.20
12104	18	Oregon white oak (Quercus garryana)	1.77	Exposed roots, sucker limb, ok	1	Preserve	C	1	1.77
12127	7	Oregon white oak (Quercus garryana)	0.27	Slight lean, ok	1	Preserve	C	1	0.27
12133	10	Oregon white oak (Quercus garryana)	0.55	codominant stems, OK	1	Preserve	C	1	0.55
12136	8	Oregon white oak (Quercus garryana)	0.35	Roots under water, ok	2	Preserve	B	1	0.35
12141	22	Oregon white oak (Quercus garryana)	2.64	Roots under water, peeling bark, scar, ok	2	Preserve	B	1	2.64
12143	8	Oregon white oak (Quercus garryana)	0.35	Lean, ok	1	Preserve	C	1	0.35
12144	10	Oregon white oak (Quercus garryana)	0.55	Broken top, lean, ok	1	Preserve	C	1	0.55
12150	12	Oregon white oak (Quercus garryana)	0.79	Roots under water, ok	2	Preserve	B	1	0.79
12155	12	Oregon white oak (Quercus garryana)	0.79	Broken top, ok	1	Preserve	C	1	0.79
12176	18	Oregon white oak (Quercus garryana)	1.77	DEAD	1	Preserve	C	1	1.77
12280	6	Poplar (Populus spp.)	0.20	OK	1	Preserve	C	1	0.20
11534	24	Douglas-fir (Pseudotsuga menziesii)	3.14	Included bark, codominant stems, slight lean, ok	2+	Preserve	B	1	3.14
11535	10	Douglas-fir (Pseudotsuga menziesii)	0.55	OK	1	Preserve	C	1	0.55
11536	6	Douglas-fir (Pseudotsuga menziesii)	0.20	OK	1	Preserve	C	1	0.20
11537	9	Douglas-fir (Pseudotsuga menziesii)	0.44	OK	1	Preserve	C	1	0.44
11538	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11539	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11540	6	Douglas-fir (Pseudotsuga menziesii)	0.20	OK	1	Preserve	C	1	0.20
11541	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11542	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11543	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11544	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11545	14	Douglas-fir (Pseudotsuga menziesii)	1.07	OK	1	Preserve	C	1	1.07
11546	6	Douglas-fir (Pseudotsuga menziesii)	0.20	Slight lean, ok	1	Preserve	C	1	0.20
11547	11	Douglas-fir (Pseudotsuga menziesii)	0.66	OK	1	Preserve	C	1	0.66
11548	8	Douglas-fir (Pseudotsuga menziesii)	0.35	Scar, pitch, ok	2	Preserve	B	1	0.35
11549	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11550	18	Douglas-fir (Pseudotsuga menziesii)	1.77	codominant stems, included bark, ok	2	Preserve	B	1	1.77
11551	17	Douglas-fir (Pseudotsuga menziesii)	1.58	codominant stems, included bark, pitch, ok	2	Preserve	B	1	1.58
11552	36	Douglas-fir (Pseudotsuga menziesii)	7.07	Large conks, pitch, watch	3	Hazard	A	0	0.00
11553	38	Douglas-fir (Pseudotsuga menziesii)	7.88	Heavy pitch, slight lean, decay, watch	3	Hazard	A	0	0.00
11554	7	Pacific madrone (Arbutus menziesii)	0.27	Heavy lean, codominant stems	2	Preserve	B	1	0.27
11555	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
11556	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11557	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11558	5	Douglas-fir (Pseudotsuga menziesii)	0.14	OK	1	Preserve	C	1	0.14
11559	9	Douglas-fir (Pseudotsuga menziesii)	0.44	OK	1	Preserve	C	1	0.44
11560	7	Douglas-fir (Pseudotsuga menziesii)	0.27	Sweep, ok	1	Preserve	C	1	0.27
11561	5	Douglas-fir (Pseudotsuga menziesii)	0.14	Suppressed, ok	1	Preserve	C	1	0.14
11562	8	Pacific madrone (Arbutus menziesii)	0.35	Heavy lean, ok	2+	Preserve	B	1	0.35
11563	5	Pacific madrone (Arbutus menziesii)	0.14	Heavy lean, crooked, ok	2+	Preserve	B	1	0.14
11564	7	Pacific madrone (Arbutus menziesii)	0.27	Heavy lean, ok	2+	Preserve	B	1	0.27
11565	30	Douglas-fir (Pseudotsuga menziesii)	4.91	Pitch, poor root area due to railroad grade, ok	2	Preserve	A	1	4.91
11566	11	Douglas-fir (Pseudotsuga menziesii)	0.66	Some lean, on steep slope above railroad grade, ok	2	Preserve	B	1	0.66
11567	6	Douglas-fir (Pseudotsuga menziesii)	0.20	OK	1	Preserve	C	1	0.20
11568	52	Douglas-fir (Pseudotsuga menziesii)	14.75	Pitch, scar, decay, watch	2+	Preserve	A	1	14.75
11569	28	Douglas-fir (Pseudotsuga menziesii)	4.28	DEAD	3	Hazard	A	0	0.00
11570	33	Douglas-fir (Pseudotsuga menziesii)	5.94	Pitch, exposed roots, ok	1	Preserve	C	1	5.94
11571	16	Douglas-fir (Pseudotsuga menziesii)	1.40	Some pitch, slight lean, ok	1	Preserve	C	1	1.40
11572	9	Douglas-fir (Pseudotsuga menziesii)	0.44	Some pitch, slight lean, ok	1	Preserve	C	1	0.44
11573	11	Douglas-fir (Pseudotsuga menziesii)	0.66	Sweep, cable scar, slight lean, ok	1	Preserve	C	1	0.66
11664	9	Douglas-fir (Pseudotsuga menziesii)	0.44	OK	1	Preserve	C	1	0.44
11665	5	Poplar species (Populus spp.)	0.14	OK	1	Preserve	C	1	0.14
11666	30	Douglas-fir (Pseudotsuga menziesii)	4.91	Kinked butt, some pitch, ok	2	Preserve	B	1	4.91
11667	30	Douglas-fir (Pseudotsuga menziesii)	4.91	Butt swell, ok	1	Preserve	C	1	4.91
11668	22	Douglas-fir (Pseudotsuga menziesii)	2.64	codominant stems, pitch, butt swell, ok	2	Preserve	B	1	2.64
11669	19	Douglas-fir (Pseudotsuga menziesii)	1.97	Growing tight to another tree, ok	2	Preserve	B	1	1.97
11670	8	Douglas-fir (Pseudotsuga menziesii)	0.35	Broken top, crooked, slight lean	1	Preserve	C	1	0.35
11671	5	Poplar (Populus spp.)	0.14	Slight lean, ok	1	Preserve	C	1	0.14
11672	7	Douglas-fir (Pseudotsuga menziesii)	0.27	OK	1	Preserve	C	1	0.27
11673	18	Douglas-fir (Pseudotsuga menziesii)	1.77	Healthy	1	Preserve	C	1	1.77
11674	7	Bitter Cherry (Prunus emarginata)	0.27	OK	1	Preserve	C	1	0.27
11675	7	Bitter Cherry (Prunus emarginata)	0.27	OK	1	Preserve	C	1	0.27
11676	6	Bitter Cherry (Prunus emarginata)	0.20	Scar, ok	1	Preserve	C	1	0.20
10274	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, ok	1	Preserve	C	1	0.27
10276	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, ok	1	Preserve	C	1	0.27
10278	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, ok	1	Preserve	C	1	0.27
10281	8	Sweetgum (Liquidambar styraciflua)	0.35	Topped, scar, ok	1	Preserve	C	1	0.35
10283	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, scar, ok	1	Preserve	C	1	0.27
10285	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, codominant stems, ok	2	Preserve	B	1	0.27
10287	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, ok	1	Preserve	C	1	0.27
10289	7	Sweetgum (Liquidambar styraciflua)	0.27	Topped, scars, ok	1	Preserve	C	1	0.27
10291	6	Sweetgum (Liquidambar styraciflua)	0.20	Topped, ok	1	Preserve	C	1	0.20
10836	13	Sweetgum (Liquidambar styraciflua)	0.92	Topped, ok	1	Preserve	C	1	0.92
10838	12	Sweetgum (Liquidambar styraciflua)	0.79	Topped, scars, decay, codominant stems, ok	2	Preserve	B	1	0.79

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
10840	13	Sweetgum (Liquidambar styraciflua)	0.92	Topped, ok	1	Preserve	C	1	0.92
10843	13	Sweetgum (Liquidambar styraciflua)	0.92	Topped, scars, slight decay, ok	2	Preserve	B	1	0.92
10845	15	Sweetgum (Liquidambar styraciflua)	1.23	Topped, scars, included bark, ok	2	Preserve	B	1	1.23
10847	12	Sweetgum (Liquidambar styraciflua)	0.79	Topped, scars, ok	1	Preserve	C	1	0.79
10850	12	Sweetgum (Liquidambar styraciflua)	0.79	Exposed roots, scars, a growth, ok	2	Preserve	B	1	0.79
10852	14	Sweetgum (Liquidambar styraciflua)	1.07	Scar, ok	1	Preserve	C	1	1.07
10190	7	Birch (Betula spp.)	0.27	OK	1	Preserve	C	1	0.27
10191	7	Birch (Betula spp.)	0.27	Scars, ok	1	Preserve	C	1	0.27
10192	6	Birch (Betula spp.)	0.20	OK	1	Preserve	C	1	0.20
10193	9	Birch (Betula spp.)	0.44	Scars, ok	1	Preserve	C	1	0.44
Totals	1,970		179.74					172	154.58

Total # of Existing Trees=	176	**Total # of Trees to be Removed=**	4
Total # of Hazard Trees=	4	**Total # of Non-hazard Trees to be Removed=**	0
Total Existing Basal Area (Sq Ft)=	179.74	**Total Basal Area (Sq Ft) to be Removed=**	25.2
Total Non-Hazard Basal Area=	154.58		
Total # of Trees To Be Retained=	172	**^^Total Inches of Trees to be Mitigated per City Code=**	0
Total Non-Hazard Inches=	1,835		
Total Basal Area (Sq Ft) Retained=	154.58	^^Assumes that hazard trees do not require mitigation.	
Total Inches of Trees to Be Retained=	1,835		
% of Non-Hazard Total Inches to Be Retained=	100.0%		

HAZARD RATING	****Windthrow Rating:**	***** SAVE/REMOVE:**
1=LOW RISK	A=Least Windthrow Resistant	1= SAVE
2=MODERATE RISK	B=Moderate Windthrow Resistance	0=REMOVE
3=HIGH RISK	C=Most Windthrow Resistant	
4=EXTREME RISK		

****Hazard-These trees either pose an immediate danger to life and safety, are diseased or defective in a manner that threatens their continued viability, or will become a danger to life and safety due to disease or defects after the project is "built out".

NOTE: The trees in the areas of the proposed improvements were evaluated and are shown on the plans, on this spreadsheet, and are included in the calculations shown. There are additional trees outside the development area that are shown on the plans, but are not included in this spreadsheet or the calculations, and trees on TL 200 that are well outside the project area that were neither surveyed nor evaluated.

AKS Survey Reference #	Total DBH (In)	Tree Species	Basal Area (sq. feet)	Condition/Comments	Hazard Rating 1-4*	Reason for Removal	Wind-throw Rating**	***Save/ Remove	Basal Area Left
Arborist Disclosure Statement:									
Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the health of trees, and attempt to reduce the									
risk of living near trees. The Client and Jurisdiction may choose to accept or disregard the recommendations of the arborist, or seek additional advice.									
Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand.									
Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time.									
Likewise, remedial treatments, like medicine, cannot be guaranteed. Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk.									
The only way to eliminate all risk associated with trees is to eliminate all trees.									
At the completion of construction, all trees must once again be reviewed to evaluate their hazard rating. Land clearing and removal of adjacent trees can expose previously unseen defects									
and otherwise healthy trees can be damaged during construction									