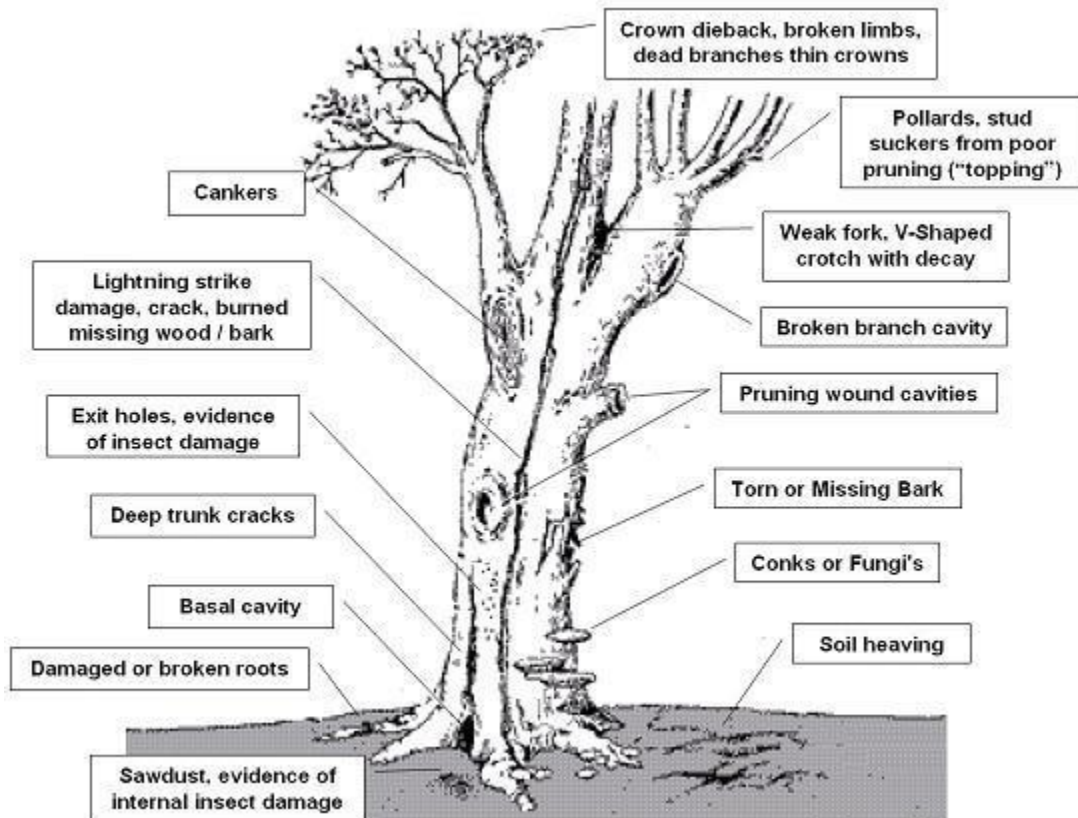


**Tree Retention Plan  
'Cityview'  
4413 Consolidation Ave., Bellingham WA  
Township 38N, Range 3E, Section 32  
Bellingham, WA 98225**



**Prepared by:  
Tree Guys Incorporated  
Patrick J. Sullivan  
International Society of Arboriculture  
Certified Arborist # PN-7123A  
Certified Tree Risk Assessor  
Bellingham, WA  
(360)920-6285  
February 15, 2020**

**February 15, 2020**

**Attn: Kim Weil, Planner  
City of Bellingham  
210 Lottie St.  
Bellingham WA 98225**

Kim,

As an ISA Certified Arborist, I am pleased to provide a Tree Retention Plan for 'Cityview'.  
The objectives of this Tree Retention Plan are as follows:

- Minimize clearing and grading (48.6% of site to remain undisturbed).
- Locate buildings and infrastructure to maximize tree retention.
- Map the site grading zone, in addition to the area that will remain native forest (tree retention).
- Show the fencing location and method used to protect the native forest critical root zones.
- Identify significant trees within striking distance of the construction zone to be removed.
- Provide an explanation for why these trees pose a safety risk.
- Locate utilities to ensure no conflicts with critical root zones.
- Propose locations and species for replacement trees.

We have accomplished our objectives by minimizing site disturbance, collecting accurate tree heights, DBH (diameter at breast height), and orientation of the tree sites in relation to both existing and planned homes, roads and paths with human activity. Applied to the environmental influences associated with the local area such as high wind events and saturated soils, we have good data for risk assessment. The overall goal is to maximize tree retention, improve safety by reducing risk, promote native species and improve aesthetics for the community.

If you have any questions concerning the attached Tree Retention Plan, please feel free to contact me.  
Thank you.

Patrick Sullivan  
Certified Arborist #PN-7123A  
Certified Tree Risk Assessor  
(360) 920-6285



## Introduction

This Tree Retention Plan is based on my site visits on January 25 and 31, as well as February 6 and 8, 2020. Please refer to the attached document titled 'Tree Retention Plan', referred to throughout this report as 'The Map'.

The Map contains key information:

- Location of buildings and infrastructure, designed to minimize clearing and ensure no conflicts with the critical root zones of the retained native forest.
- Location of survey flags and silt fencing to clearly identify the grading zone boundary, as well as protect the critical root zones of the undisturbed trees.
- Location and species of replacement trees.
- Clear outline/shading to identify both the grading/construction zone (51.4%) and the retained native forest (48.6%).
- Location of trees recommended for removal within the retained native forest.

Survey flags have been placed on site (see The Map, outline of grading/construction zone) running north/south for approximately 590', then shifting west, running east/west for approximately 400'. This inner portion of this flagged area represents the grading boundary of the project. Trees located within 100' of the grade line or located one and one half the distance of the trees' heights have been carefully assessed. Sixty five trees with DBH greater than 6" were assessed within this zone as 'possible', 'probable' or 'imminent' risk for failure (see Table 1). Therefore their removal and replacement is recommended.

Native trees to be planted range in height at maturity from 15'-40' and are listed below. A total of 65 trees (Table 1) are to be removed, therefore 130 (2:1) replacement trees will be planted:

- (30) Western Crabapple (*Malus fusca*) 9'-40'
- (52) Red Osier Dogwood (*Cornus stolonifera*) 6'-20'
- (37) Excelsa Western Red Cedar (*Thuja plicata excelsa*) 15'-35'
- (11) Vine Maple (*Acer circinatum*) 16'-26'

The subject trees have been marked in the field with metal tags ranging from C1 to C65. Metal tags have been placed facing towards the planned development when feasible. Blue and green flagging has been staple hammered into the main stem behind the metal tag. The trees have been blazed and painted blue for further ease of location and identification.

The tree information contained in Table 1 reflects the condition of the trees at the time of inspection on January 31, 2020. The inspection is limited to visual examination of the subject trees without excavation, probing, dissection, climbing or coring unless explicitly specified.

Table 1 is the tree inventory of the trees within 'striking distance' of the development edge. Tree dendrology, species, health and general condition are noted in the table. Tree data has been collected using a crew of five persons, clinometers, laser range finders, compass and Spencer's Logger's Tape Measures. The attached Map identifies the location of these trees.

## Methods

Evaluation of tree health and structure has been conducted utilizing the International Society of Arboriculture (ISA) Visual Tree Assessment (VTA) methods. The basis behind VTA is the identification of symptoms, which the tree produces in reaction to an area of weakness or an area of mechanical stress. A tree reacts to mechanical and physiological stresses by growing more vigorously to reinforce weak areas. Using the ISA tree risk assessment method, we can assign potential probability of failure to a tree. This method has been adopted from the U.S. Forest Service risk assessment approach and is currently considered the present standard of care.

## Background

4413 Consolidation Ave is located inside Bellingham city limits in Area 17 of the Puget Neighborhood, east of Interstate 5. The parcel is northwest of Lookout Mountain, west of Lake Whatcom and east of Bellingham Bay. It has a western aspect with partial views of the bay and San Juan Islands. The total area of the site is 485,694 square feet or 11.15 acres. Proposed site disturbance area is 249,407 SF (51.4%). This portion of the parcel is shown on the Map as a shaded area. 236,287 SF (48.6%) of the site will remain undisturbed. This area is identified on the Map as the 'Tree Retention Area'.

The topography of the site varies. The southwest quadrant is relatively flat with a grade of 5-10%. The northeast quadrant contains the steepest slopes ranging from 30-45%. Two wetlands ('A' and 'B' see Critical Areas Report) with associated wetland buffers are mapped on the northern portion of the attached Site Plan.

The City of Bellingham Aerial Imagery Viewer allows us to look at past activities on the property. In 1950 the parcel was part of a larger tract of land consisting of approximately 90% mature conifer, 10% hardwood. The property appears to have been logged sometime in the mid-1960s. Homes and neighborhoods began to encroach in the mid-1970s. In the late 1980s skid trails from past harvest can be observed while homes began to encroach from the east and west. In the early 2000s, clearing and construction due west of the site (Nevada St.) created a distinctive forest edge. The area to the southeast was cleared and graded for construction of homes on 46th St. The subject parcel now has neighborhoods directly to the east and west. The south property line borders the Consolidation Ave. right-of-way, and a privately owned parcel with a mature Douglas Fir tree stand. To the north lies a City owned Reserve Tract (Wetland 'A'), containing a hardwood/conifer forest.

## Existing Conditions on Site

Trees observed on site consist of Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), big leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera*), paper birch (*Betula papyrifera*), and bitter cherry (*Prunus emarginata*). Timber composition consists of a mature conifer/hardwood mix of about 30% conifer, 70% hardwood, typical for an unmanaged partially harvested stand of trees. Western hemlock has not been observed on site but may be present.

Douglas fir is the over story cohort. Tree heights range from 80' to 114' measured. Many conifer stumps are on site and indicate at least two entries for past timber harvest activities. Two conifer individuals have blown over with vibrant green needles\*, indicating this occurred in the past few months, most likely a function of the high volume of rain and associated wind patterns for the season. Branch failures are evident as well throughout the stand. Failed branch sizes observed range from 0.25-3 inch in diameter.

\*It should be noted that one of these large conifers landed directly over the existing public trail in the Consolidation ROW.

The hardwoods display very similar tree architecture and growing patterns consistent with a growing site with high competition. First, the lack of taper, or change in diameter over the length of the trunk, branch and roots. This is important in the distribution of mechanical stress. When a tree height to diameter ratio is large or extremely slender, that tree part is more prone to failure. The second factor is the live crown ratio--the height of the entire tree compared to the vertical extent of the live crown. Low live crown ratios commonly develop where trees grow in dense stands. Trees with poor taper and low live crown ratios are less likely to have uniform growth increments along the trunk. This is due to the amount of energy produced by the small amount of living crown.

Hardwoods were harvested from this site many years ago. The stumps have been left behind with no herbicide treatments resulting in basal shoots or a "coppicing" effect. Coppiced stems are characteristically curved at the base. This curve occurs as the competing stems grow out from the stump in the early stages of the life cycle, then upward toward the sky as the canopy closes. A basal shoot is a plant growing not from a seed but via a meristem from the root at the base or at a certain distance of a tree or shrub. Coppiced wood is a fast growing wood. The attachment at the meristem usually creates a small bark covered angle, a known area of weakness. Stem failure associated with coppicing is evident on site.

## **Tree Risk Assessment**

Tree risk management must adapt to multiple, often conflicting needs. The goal of tree evaluation and risk management is to preserve the greatest number of trees outside of or near the development area, within acceptable safety requirements. Tree hazard potential is a function of tree species, size, defects and targets. Targets are people, property or activities that can be injured, damaged or disrupted by a tree.

Identifying individual defects that lead to a high probability of failure and taking the least disruptive action to correct the potential for failure is recommended. It is impossible to maintain trees free from risk. Levels of risk can be quantified through likelihood of failure. Tree risk assessment has four categories for likelihood of failure:

1. Improbable- Not likely to fail during normal weather conditions and may not fail in many severe weather conditions.
2. Possible- Failure could occur but is unlikely during normal weather conditions.
3. Probable- Failure may be expected during normal weather conditions.
4. Imminent -Failure has begun and most likely to occur in the near future.

A primary goal of tree risk assessment is to provide information about the level of risk posed by a tree over a specific time period. This is accomplished by two determinations:

1. The likelihood of failure and evaluation of the structural conditions that may lead to failure, the potential loads on the tree, and the trees' adaptations to weakness.
2. An evaluation of the likelihood that a tree or branch could strike people or property. Assessing the targets' potential damage can assist in creating an estimate of the consequences of failure.

## Recommendations

Wind and the transfer of energy to trees is a primary issue. Wind energy is absorbed by standing trees either by dissipation within the tree, or is transferred down to the roots and soil. Leaf and twig movement dissipate most low wind energy. An increase in wind velocity will increase the size of branch structure that will experience movement. When wind forces are high enough to bend the trunk, greater amounts of energy are transferred down to the soil through the trunk and root system. When a tree lacks interior branching, there is less dissipation of energy within the crown, allowing more force to transfer to the trunk, leading to high amounts of stress in the trunk and root system. Most wind storms originate out of the south by southwest. Strong winds can also derive from the north by northeast. Most construction projects require the removal of trees. When trees are cleared, remaining tree canopies have a larger “sail” effect. Larger “sail” effect coupled with periodically inundated soils may lead to failure.

Wind damage can range from broken twigs and limbs to the uprooting of the entire tree. Changing wind dynamics may create issues affecting stand stability as well as individual tree stability. Therefore, it is imperative to assess trees outside of the construction zone, but within striking distance of the project.

Failure occurs when load exceeds load carrying capacity. Expected loads on the residual stand will originate from wind, snow, rain and ice. Tree crown, shape, foliage density and soils must be considered for potential load bearing. Identifying zones of weakness that can magnify the stress is important. Trees on site with tall height and narrow diameters are levers for wind forces. This effect can multiply the force, especially if zones of weakness are present. An unbalanced crown and low live crown ratios under wind loads can twist the tree creating torsion. Torsion stress can create tree part failure or vertical cracks in the trunk.

The large Douglas firs on site are remnants of the original stand of trees. Most of the individuals have been removed years ago, creating space for pioneer species to become established. The large conifer display good tree canopy architecture, good tree vigor, and good root system establishment. Co-dominant stems, broken tops and crown dieback has not been observed. Some trunk defect has been documented in Table 1, which is most likely the result of tree strikes from adjacent tree failure.

Wind exposures and wind loads will increase on these dominant trees. The forest timber type is indicating this increase in loads has occurred in the past, with timber harvest activities. The large Douglas fir outside of the grading area should be retained for vertical structure, wildlife activities and aesthetic appeal. However, six large Douglas fir trees have been identified (see Table 1, C3-C8) within striking distance of the project. All six have been assigned ‘Possible’ for likelihood of failure. Due to the heights and leans the probability of impact is high. Due to the size and volume of these mature trees the consequences of failure is significant. Tree risk assessment is in place to protect humans and personal property. For these six trees, a 2/3 reduction of tree height to lower risk and retain portions of the main stem for wildlife activity is highly recommended.

If the City decides to retain these trees in their current state, they should be monitored on an annual or bi annual basis once construction begins. Annual or bi-annual visits can transition to five year increments at the discretion of the City and/or Arborist. Tree risk assessment matrix assigns a risk rating of moderate to these trees.

The hardwoods observed on site (see The Map, and Table 1) are either pioneer species that moved in after land disturbance or coppiced stumps from past harvest activities. Tree structure and canopy architecture indicate rapid growth with an emphasis on tree height due to adjacent tree competition. The result is tall trees with small diameters coupled with different tree defects listed in Table 1. The tall trunks with very low live crown ratios create a fulcrum/lever effect when under loads from wind, rain, snow and ice. Tree risk assessment matrix assigns a risk rating of high to these trees.

The tree species, planting sites and current condition on site dictates three potential options to mitigate for future hazards:

1. Remove all hardwood trees per Table 1, and replace them with native ornamental trees that will not exceed 20-30 feet in height.
2. Also, per Table 1, top the conifer trees to a certain height. Topping these conifers at an old age will terminate the life of the tree and lower the risk. Topping is a practice that should not be implemented until all other options have been considered for risk mitigation.
3. Allow the six large Douglas fir trees noted above to remain. Monitor on an annual or bi-annual basis once construction begins.\*
4. No action. Not recommended

\*Tree Guys, Inc. assumes no liability for these trees

The project site plan has 3 additional areas that have been observed for tree retention. The first is the future outdoor common area (within the construction zone) to be located along the west boundary and the southwest corner. Trees in this area have been observed for possible retention of native species, vertical structure and aesthetics. A high percentage of these trees display similar height/diameter ratios and low live crown ratios, creating more fulcrum/lever load bearing issues. Due to the proximity to existing homes and the planned common space, I do not recommend retaining any tree in this area.

In the area between tree C42 Black Cottonwood and C43 red alder, there is a dog haired stand of hardwoods struggling to become established (within the Tree Retention Area, see The Map). This area is at the foot of the steepest slopes on the property. Poor tree growth is most likely from rocky, low site production soils. As a result, there are many hardwood individuals lacking significant tree heights and well under 6 inches in diameter. If left to grow, these trees will carry similar tree characteristics as the mature hardwood rated as high in risk. I recommend removing all short trees within 30-40 feet of the surveyed grade line and replanting native understory species in the same location that can survive in poor soils.

Finally, 23 trees (C43-65) within Wetland B and/or it's buffer are listed as 'Possible, Probable, or Imminent' for failure. Per Table 1, I recommend removal of these trees and a replacement ratio of 2:1 per Page 3 of this report. Replacement trees should be planted outside of the wetland/buffer.

These tree recommendations address both individual and groups of trees. Most of the trees are secondary successional species that grow fast and large. Fast growing hardwood is not as structurally sound as slow growing conifer wood. The planting of a conifer tree in an urban environment should only be considered if the planting site is appropriate. In this case it is not, as conifer trees can grow to be of large stature on the landscape and can provide for many potential hazards over time.

## **Terms and Conditions**

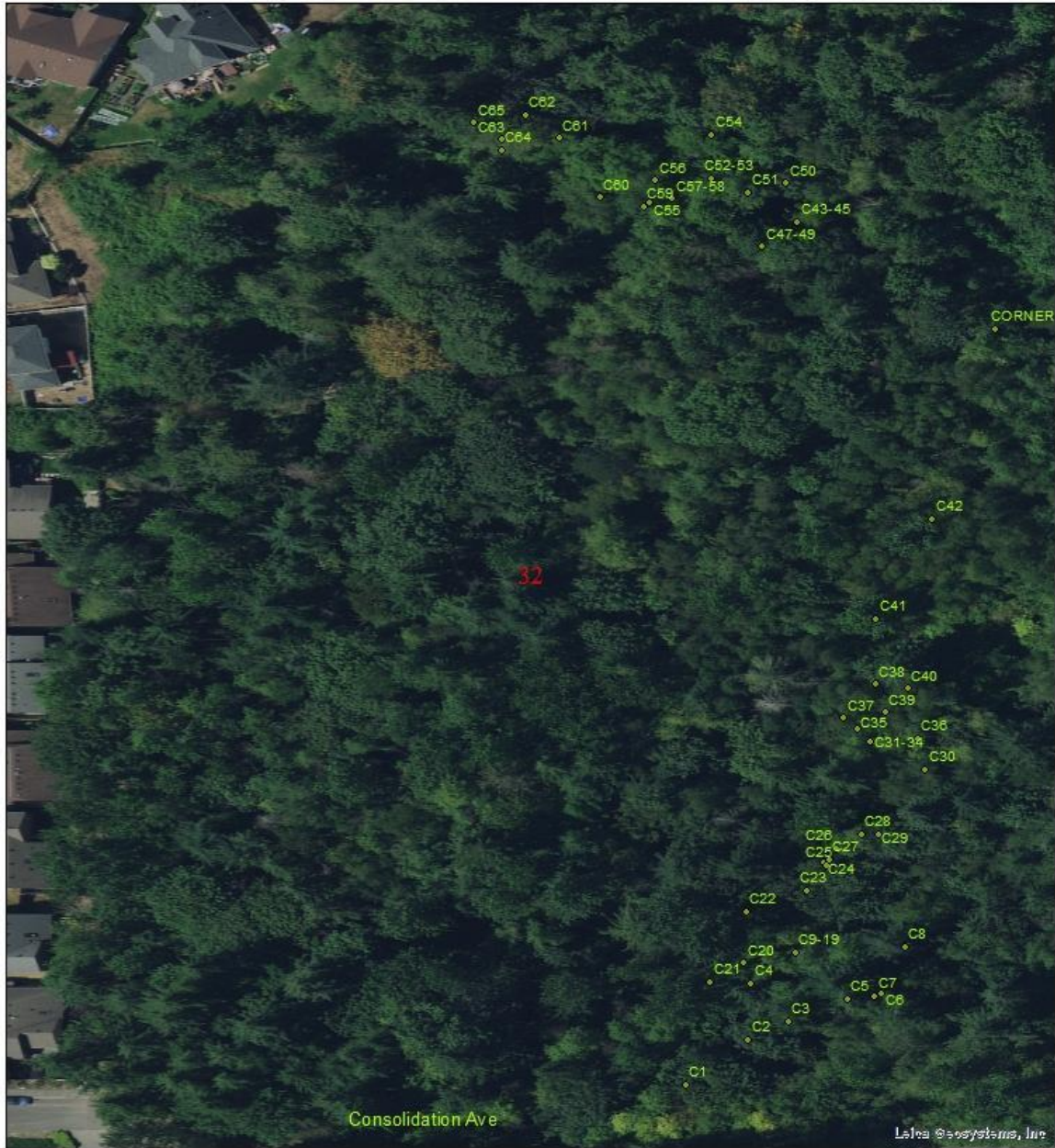
1. Care has been taken to obtain all information from reliable sources. The consultant can neither guarantee nor be responsible for the accuracy of information provided by others.
2. Any legal description provided to the consultant will be assumed to be correct. No responsibility will be assumed for matters legal in character.
3. Missing pages or alteration of any report invalidates the entire report.
4. Possession of a report does not imply right of publication without the prior expressed written or verbal consent of the consultant.
5. Sketches, diagrams, graphs and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.
6. Unless expressed otherwise, the information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection.
7. Inspection is limited to visual examination of accessible items on this property without dissection, excavation, or probing.

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Patrick Sullivan  
ISA Certified Arborist PN-7123A



Appendix 1  
Consolidation Ave Tree Risk Map  
1:1200  
February 2020



## **Tree Defect Definitions**

Co-dominant stems – When a diameter of a branch and its parent limb are similar, the union may be weak. Weight distribution, stem orientation and branch arrangement will affect the branch union, making it more likely or less likely to fail.

Included bark – Branch unions with acute angles create bark that is embedded between the branch and its parent limb or between two co-dominant stems. This union can capture soil, moisture and organic material which all promote decay. Likelihood of failure is largely dependent on orientation of the tree canopy, wind and snow loads. For many species of trees, included bark is considered to bring probable to imminent failure.

Adventitious branches – Can also be considered epicormic shoots or watersprouts, which are produced after storm damage or topping. The union of these branch attachments is weaker due to their lack of holding wood that has formed. Epicormic branching adjacent to any decay that is developing will further reduce the strength of the attachment.

Tree Architecture – Growth and branching characteristics can affect the distribution of the load of the crown, wind and snow loads and the structural integrity of the tree. There are many characteristics to consider.

Tree lean - The angle of the trunk measured from vertical. Soil conditions and root system movement should be considered. The likelihood of failure of a recently leaning tree is often probable to imminent. Corrected leans are considered to have a possibility of failure from improbable to possible.

Unbalanced canopy – Trees with evenly distributed branching patterns distribute loads evenly along the main stem, reducing the probability of failure. Asymmetric crowns can contribute to failure when other defects are present.

Overextended branching – Extending outside the normal crown area, branches experience higher loads during wind, freezing rain and snow events. They are more likely to fail during these events. Horizontal branches tend to be stronger than upward angled branching.

Root System Damage–No organ is more vital to a healthy tree than roots. Roots expand laterally beyond the tree crown, but do not extend to depths equal to the tree height. Feeder roots, which are responsible for water and nutrient absorption, occur primarily within the upper six to eight inches of soil. When roots are severed, decayed, undermined or restricted they may provide less anchorage, lowering tree stability.

**Table 1. Tree Talley and Tree Characteristics.**

Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C1	Big Leaf Maple	61	11, 10, 12, 7, 7, 12, 6	Main stem was removed years ago resulting in a coppicing effect. Seven main stems exist leaning in multiple directions with dead stem individuals in the clump. Main stem attachments weak from included bark and rapid growth of response wood. Larger than normal root flare indicates potential root decay. Location is 5' east of the grade line. Critical root zone will be impacted. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Significant Recommendation: Full tree removal
C2	Big Leaf Maple	69	21	Tree canopy damage in the top one third of the tree. Response growth associated with damage is growing to the east. Response growth is oversized water sprouting due to initial injury. Main stem of the tree leans west. Dead limbs observed in canopy. Live crown ratio 65%. Location is 45' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Significant Recommendation: Full tree removal
C3	Douglas Fir	104	27	Heavy pistol butt with a lean to the NW, 45' from the grade line. Live crown ratio 45%. Location is 45' east of the grade line. Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Reduce height to 40' to mitigate severe impacts, leave main stem for wildlife activity.
C4	Douglas Fir	80	19	Main stem damage at 30'. Three lead stems, two are co-dominant. Live crown ratio 70%. Location is 13' east of the grade line. Root zone impacts most likely to occur with grading and excavation. Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Reduce height to 40' to mitigate severe impacts, leave main stem for wildlife activity.
C5	Douglas Fir	115	28	Pistol butt and tree lean 8 degrees to the west. Lack of anchoring roots on the east quadrant of the root flare. Live crown ratio 70%. Location is 66' east of the grade line. Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Reduce height to 50' to mitigate severe impacts, leave main stem for wildlife activity.

Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C6	Douglas Fir	112	23	Tree lean is 10 degrees to the west by northwest. Lack of anchoring roots in the east quadrant of root flare. Live crown ratio 60%. Epicormic branch growth observed indicating main stem weakness due to past damage. Location is 63' east of the grade line. Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Reduce height to 50' to mitigate severe impacts, leave main stem for wildlife activity.
C7	Douglas fir	62	12	Heavy lean of 28 degrees with corrective growth in upper reaches of live canopy. Live crown ratio 60%. Location is 80' east of the grade line. Likelihood of Failure: Possible Likelihood of Impact: Low Consequences of Failure: Minor Recommendation: Reduce height to 30' to mitigate severe impacts, leave main stem for wildlife activity.
C8	Douglas Fir	114	26	Tree lean is 8 degrees to the west. Live crown ratio 65%. Location is 89' east of the grade line. Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Reduce height to 65' to mitigate severe impacts, leave main stem for wildlife activity.
C9	Red Alder	54	6	Poor height/diameter ratio. Live Crown ratio 15%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 30' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C10	Red Alder	70	6	Poor height/diameter ratio. Live Crown ratio 15%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 30' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal

Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C11	Red Alder	75	9	Poor height/diameter ratio. Live Crown ratio 20%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 20' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C12	Red Alder	70	8	Poor height/diameter ratio. Live Crown ratio 15%. High likelihood of wind failure. Tree leans to the south 6-8 degrees. Location is 30' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C13	Red Alder	75	8	Poor height/diameter ratio. Live Crown ratio 20%. High likelihood of wind failure. Tree leans to the west 4-6 degrees. Location is 28' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C14	Red Alder	82	10	Poor height/diameter ratio. Live Crown ratio 25%. High likelihood of wind failure. Tree leans to the west 4-6 degrees. Location is 20' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C15	Red Alder	61	10	Dead standing tree Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C16	Red Alder	30	5	Dead standing tree Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal

Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C17	Red Alder	45	8	Dead standing tree Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C18	Red Alder	61	7	Dead standing tree Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C19	Red Alder	44	6	Dead standing tree Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C20	Black Cotton wood	94	14	Poor height/diameter ratio. Live Crown ratio 35%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 2' east of the grade line. Critical root zone will be destroyed by earthwork and grading. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C21	Red Alder	78	13	Poor height/diameter ratio. Live Crown ratio 50%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 26' east of the grade line. Critical root zone will be destroyed by earthwork and grading. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C22	Big Leaf Maple	78	13	Poor height/diameter ratio. Live Crown ratio 40%. High likelihood of wind failure. Tree leans to the west 6-8 degrees. Location is 16' east of the grade line. Critical root zone will be destroyed by earthwork and grading. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal or reduce height to 10' to mitigate severe impacts, leave main stem for wildlife activity.

Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C23	Big Leaf Maple	67	18	<p>Root collar damage with associated response growth in the xxxx quadrant.</p> <p>Co-dominant stem with included bark stem failure, broken top.</p> <p>Root collar damage in the south west quadrant</p> <p>Live Crown ratio 50%.</p> <p>Tree leans to the west 4-6 degrees.</p> <p>Location is 29' east of the grade line.</p> <p>Likelihood of Failure: Probable</p> <p>Likelihood of Impact: High</p> <p>Consequences of Failure: Severe</p> <p>Recommendation: Reduce height to 20' to mitigate severe impacts, leave main stem for wildlife activity.</p>
C24	Big Leaf Maple	70	24	<p>Top lead of the tree broken off and lodged in the canopy.</p> <p>Parent limb has become the new top of tree creating vigorous response growth with poor structural attachments.</p> <p>Live Crown ratio 30%.</p> <p>Tree leans to the west 6-8 degrees.</p> <p>Location is 44' east of the grade line.</p> <p>Likelihood of Failure: Probable</p> <p>Likelihood of Impact: High</p> <p>Consequences of Failure: Severe</p> <p>Recommendation: Full Tree Removal or reduce height to 15' to mitigate severe impacts, leave main stem for wildlife activity.</p>
C25	Red Alder	67	6	<p>Poor height/diameter ratio.</p> <p>Live Crown ratio 15%. High likelihood of wind failure.</p> <p>Tree leans to the west 6-8 degrees.</p> <p>Location is 35' east of the grade line.</p> <p>Likelihood of Failure: Probable</p> <p>Likelihood of Impact: High</p> <p>Consequences of Failure: Severe</p> <p>Recommendation: Full Tree Removal</p>
C26	Cherry	70	13	<p>Co-dominant stems with inclusion bark.</p> <p>Vertical inclusion cracks observed at knee and breast height.</p> <p>High number of dead attached branches.</p> <p>Poor height/diameter ratio.</p> <p>Live Crown ratio 15%. High likelihood of wind failure.</p> <p>Tree leans to the west 0-1 degrees.</p> <p>Location is 36' east of the grade line.</p> <p>Likelihood of Failure: Probable</p> <p>Likelihood of Impact: High</p> <p>Consequences of Failure: Severe</p> <p>Recommendation: Full Tree Removal</p>
C27	Cherry	59	6,6,7,6	<p>Main stem was removed years ago resulting in a coppicing effect. Four main stems.</p> <p>Poor height/diameter ratio. Live Crown ratio 25%. High likelihood of wind failure</p> <p>Tree leans to the south, north, east, west 0-3 degrees.</p> <p>Location is 15' east of the grade line.</p> <p>Likelihood of Failure: Probable</p> <p>Likelihood of Impact: High</p> <p>Consequences of Failure: Severe</p>

				Recommendation: Full Tree Removal
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C28	Birch	60	11	Dead standing tree No lean Location is 51' east of the grade line. Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C29	Red Alder	80	11	Poor height/diameter ratio. Live Crown ratio 25%. High likelihood of wind failure. Tree leans to the west 8-10 degrees. Location is 40' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C30	Cherry	74	9,10,8,6, 8,6	Main stem was removed years ago resulting in a coppicing effect. Tree growing from nurse stump with burn scars. Six main stems originating from coppiced stump with included attachments. Poor height/diameter ratio. Live Crown ratio 25%. High likelihood of wind failure. Tree leans to the west 10-12 degrees. Location is 68' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal, preserve nurse stump
C31	Red Alder	61	6	Dead standing tree Location is 46' east of the grade line. Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C32	Red Alder	74	6	Poor height/diameter ratio. Live Crown ratio 10%. High likelihood of wind failure. Tree leans to the northwest 10-12 degrees. Location is 44' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal



C33	Red Alder	72	7	Poor height/diameter ratio. Live Crown ratio 15%. High likelihood of wind failure. Tree leans to the northwest 4-6 degrees. Location is 38' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C34	Red Alder	75	9	Poor height/diameter ratio. Live Crown ratio 15%. High likelihood of wind failure. Tree leans to the west 0-2 degrees. Location is 36' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C35	Cherry	61	7	Poor height/diameter ratio. Dead alder is leaning heavily on the stem. Live Crown ratio 25%. High likelihood of wind failure. Tree leans to the west 0-2 degrees. Location is 20' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C36	Cherry	75	10	Dead standing tree leaning on live trees Tree leans to the west 60 degrees. Location is 58' east of the grade line. Likelihood of Failure: Imminent Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C37	Cherry	70	11,7,8,8	Main stem was removed years ago resulting in a coppicing effect. Four main stems. Poor height/diameter ratio. Live Crown ratio 25%. High likelihood of wind failure. Tree leans to the north and west 0-2 degrees. Location is 20' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C38	Cherry	65	6,6,7	Coppiced main stem with three main stems. Poor height/diameter ratio. Live Crown ratio 20%. High likelihood of wind failure. Tree leans to the west 10 degrees. Location is 1' east of the grade line. Critical root zone will be impacted. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal

C39	Cherry	65	8,8	<p>Coppiced main stem with three main stems.  Poor height/diameter ratio. Vines in tree canopy.  Live Crown ratio 15%. High likelihood of wind failure.  Tree leans to the north and west 10 degrees.  Location is 10' east of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C40	Cherry	60	10	<p>Poor height/diameter ratio.  Live Crown ratio 20%. High likelihood of wind failure.  Tree leans to the southwest 4 degrees.  Location is 20' east of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C41	Black Cotton wood	83	19	<p>Root collar damage with response growth in the southeast quadrant.  Poor height/diameter ratio.  Live Crown ratio 35%. High likelihood of wind failure.  Tree leans to the north and west 0-2 degrees.  Location is 2' east of the grade line. Critical root zone impacted.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C42	Black Cotton wood	90	32	<p>Root collar damage with response growth.  Failed main stem with co-dominant stems, broken top.  Live Crown ratio 40%. High likelihood of wind failure.  Tree leans to the north and west 0-2 degrees.  Location is 10' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C43	Red Alder	65	12	<p>Root collar is compromised by inundating stream flow, saturated soils and erosion.  Tree damage from wind throw in the north quadrant of the main stem.  Live Crown ratio 40%.  Tree leans to the south 10-12 degrees. Heavy lean is from tree damage.  Location is 20' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>

C44	Red Alder	65	9	<p>Main stem damage from wind throw, dead wood on main stem.          Poor height/diameter ratio.          Live Crown ratio 40%.          Tree leans to the north and west 0-3 degrees.          Location is 30' north of the grade line.          Likelihood of Failure: Probable          Likelihood of Impact: High          Consequences of Failure: Severe          Recommendation: Full Tree Removal</p>
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C45	Big Leaf Maple	42	7	<p>Root collar damage with response growth.          Co-dominant stems, one is dead.          Live Crown ratio 60%. High likelihood of wind failure.          Tree leans to the south 22 degrees.          Location is 20' east of the grade line.          Likelihood of Failure: Probable          Likelihood of Impact: High          Consequences of Failure: Severe          Recommendation: Full Tree Removal</p>
C46	Red Alder	76	18	<p>Cavity at the base of a tree.          Soils periodically inundated.          Poor height/diameter ratio.          Live Crown ratio 40%.          Tree leans to the south 4-6 degrees. Heavy lean is from tree damage.          Location is 10' north of the grade line.          Likelihood of Failure: Probable          Likelihood of Impact: High          Consequences of Failure: Severe          Recommendation: Full Tree Removal</p>
C47	Red Cedar	54	20	<p>Dead standing tree.          Likelihood of Failure: Imminent          Likelihood of Impact: High          Consequences of Failure: Severe          Recommendation: Full Tree Removal or reduce height to 15' to mitigate for severe impacts, leave main stem for wildlife activity.</p>
C48	Douglas Fir	81	19	<p>Crook in the main stem at 40'.          Root collar has a lack of supporting roots in two quadrants.          Root collar is on the grade line and will have impacts to the critical root zone.          Live Crown ratio 50%.          Tree leans to the south 4-6 degrees.          Likelihood of Failure: Possible          Likelihood of Impact: High          Consequences of Failure: Severe          Recommendation: Full Tree Removal</p>

C49	Red Cedar	81	24	Live Crown ratio 90%. Tree leans to the south 0-2 degrees. Location is 10' north of the grade line. Critical root zone impacts expected Likelihood of Failure: Possible Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C50	Big Leaf Maple	35	7,12	Dead standing tree with co dominant stems. Location is 30' east of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C51	Red Alder	76	17	Linear vertical cracks observed. Large vertical crack in the main stem of the north quadrant. Poor height/diameter ratio. Live Crown ratio 40%. Tree leans to the south 4-6 degrees. Location is 45' north of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C52	Red Alder	77	18	Potential rot inside root collar, stream undermining root collar, saturating soils and periodically flooding root system. Vertical linear cracks observed on the west quadrant of the main stem. Poor height/diameter ratio. Live Crown ratio 30%. Tree leans to the south 4-6 degrees. Location is 10' north of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C53	Red Alder	76	22	Potential rot inside root collar, stream undermining root collar, saturating soils and periodically flooding root system. Live Crown ratio 45%. Tree leans to the south 0-2 degrees. Heavy lean is from tree damage. Location is 30' north of the grade line. Likelihood of Failure: Probable Likelihood of Impact: High Consequences of Failure: Severe Recommendation: Full Tree Removal
C54	Red Alder	76	22	Large cavity on the south quadrant of the tree. Response growth on cavity with potential rot inside root collar. Poor height/diameter ratio. Live Crown ratio 45%. Tree leans to the south 4-6 degrees.

				<p>Location is 10' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
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Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C55	Red Alder	74	16	<p>Linear frost cracks are located throughout the main stem.  Poor height/diameter ratio.  Live Crown ratio 45%.  Tree leans to the south 0-2 degrees.  Location is 10' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C56	Red Alder	71	27	<p>Linear frost cracks are located on the main stem with response growth.  Co-dominant stems.  Ivy has entered the tree.  Tree crown is leaning towards the grade line.  Live Crown ratio 40%.  Tree leans to the south 2-4 degrees.  Location is 18' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C57	Red Alder	71	15	<p>Linear frost cracks are located on the main stem.  Root collar disturbance.  Poor height/diameter ratio.  Live Crown ratio 30%.  Tree leans to the southwest 0-2 degrees.  Location is 20' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C58	Red Alder	72	14	<p>Root collar undermined by stream with potential rot, soils erosion and saturated soils.  Poor height/diameter ratio.  Live Crown ratio 30%.  Tree leans to the south 6-8 degrees.</p>

				<p>Location is 18' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C59	Red Alder	80	16	<p>Root collar undermined by stream with potential rot, soil erosion and saturated soils.  Poor height/diameter ratio.  Live Crown ratio 35%.  Tree leans to the south 4-6 degrees.  Location is on and north of the grade line. Critical root zone impacts.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C60	Cherry	69	18	<p>Co-dominant main stems with included union.  Epicormic branching on the main stem.  Poor height/diameter ratio.  Live Crown ratio 70%.  Tree leans to the south 10-12 degrees.  Location is 1' north of the grade line. Critical root zone impacts expected.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C61	Red Alder	76	19	<p>Main stem has a broken top with frost cracks and associated response growth.  Poor height/diameter ratio.  Live Crown ratio 80%.  Tree leans to the south 4-6 degrees.  Location is 1' north of the grade line. Critical root zone impacts expected.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C62	Red Alder	79	18	<p>Mushroom conks and associated rot observed 30' up the main stem.  Linear crack on main stem with crown dieback.  Root collar has a lack of root support in the west quadrant.  Poor height/diameter ratio.  Live Crown ratio 20%.  Tree leans to the southwest 6-8 degrees.  Location is 30' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>

C63	Big Leaf Maple	67	14	<p>Crown dieback.  Response growth on main stem, linear cracks in the north quadrant.  Crown is over weighted to the south.  Live Crown ratio 40%.  Tree leans to the south 0-2 degrees.  Location is 2' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
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Tree ID	Species	Height (feet)	Diameter (inches)	Tree Characteristics
C64	Cherry	61	15	<p>Root collar undermined  Cavity on main stem  Poor height/diameter ratio.  Live Crown ratio 30%.  Tree leans to the south 4-6 degrees.  Location is 8' north of the grade line.  Likelihood of Failure: Probable  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>
C65	Big Leaf Maple	35	13	<p>Crown dieback with branch failures.  Live Crown ratio 10%.  Tree leans to the south 10 degrees.  Location is 10' north of the grade line.  Likelihood of Failure: Possible  Likelihood of Impact: High  Consequences of Failure: Severe  Recommendation: Full Tree Removal</p>

## References

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