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Introduction

The process of evaluating tree health and condition involves gathering information in the field, determining the significance of that information and producing a report of the findings. Many reports are the product of periodic ongoing monitoring of a developing situation; as is the case at Chestnut Trails and over time, some repetition in explanatory information is inevitable.

In producing and explaining the findings, each report is intended to be readily understood and able to stand alone, with no further reference being required by either first time readers or the reader of multiple previous reports.

Each report contains the following sections;

- **Overview** Describes the events that precipitated the initial evaluation and identifies the subject, owner and location
- **Tree Inspection and Risk Assessment** Containing an explanation of the field work techniques and an outline of methods and instruments used in analysis and an explanation of the Risk Assessment system
- **Observations** Gives site and tree specific information and commentary
- **Conclusions** An interpretation of the field work observations, testing and analysis, with recommendations for treatment

Overview

The Chestnut Trails community was developed within several Native Growth Protection Areas. The areas containing pre-existing mature and semi-mature trees form buffers that surround the homes of the Chestnut Trails community. They are an integral part of the community landscape providing natural habitat with informal walking trails that provide recreational opportunities and add to the overall livability of the community as a whole.

In part because of the size, age, condition, location, and exposure of the trees; tree failure has occurred in the past. With an effort to assess and mitigate the risk associated with the trees and to facilitate risk management decisions the trees in the buffers have been periodically inspected. The inspections have taken place over a 20 Year span with the first evaluation being carried out in 1997.

The periodic assessments of the tres take place so that representatives of the community and their management team can act to best manage the assessed risk associated with the trees, minimize harm, and implement their duty of care. The most representative results rely on sampling during each season; each season showing a variety of signs of the growth or decline of trees. After a discussion with the Property Management Group; it was agreed upon to conduct the field study in the spring season. This is the report of the periodic inspection which took place during the latter part of the month of March 2019.

Tree Inspection and Risk Assessment

To develop an accurate picture of tree health and condition, information must first be gathered about the multiple, changeable, factors which influence

tree vitality and stability. Vital, healthy tree growth is the result of a complex association of internal and external influences and to consider each tree as an isolated entity is to fall short in understanding the whole picture. As a practical

matter, information must be gathered and structured in the best way to communicate the results of the observations and to impart any recommendations for treatment.

Individual tree inspection begins at ground level; tree genus and species is determined and soil quality, rooting conditions, soil level, irrigation and drainage characteristics are observed. Soil is a living micro-system that relies on an active working relationship between structural and living organic components. In an urban setting the structural condition of the soil is most commonly adversely affected. Alterations to physical soil structure will have an effect on the functions of the living soil components.

The quality of the soil may be assessed in its ability to contain and disperse available moisture and nutrient and the level of soil compaction may be tested to evaluate the aeration capacity of the soil. Some soil types are easily compacted and although they are high in nutrient quantity, little nutrient is available to the growing tree. Compact soils also cause problems by restricting the trees ability to discharge the gasses produced as part of the growth cycle.

The visible parts of the tree, the trunk, branches and leaves live in balance with the unseen roots. Damage to the soil leads to inhibited root growth and causes a lack of vitality and decline within the tree as a whole. Soil compaction may be the result of short term heavy or long-term frequent traffic in the root zone. The effects of soil compaction may not become apparent in the tree for decades following the initial compaction event.

If signs of stress are present, a soil test may be made to assess the fertility of the soil. Testing establishes the presence and degree of vital nutrients and micro-flora. Vital soil is essential to vital tree growth, the presence of nutrients and organisms within the soil mean that growth can continue. An imbalance of nutrients can cause poor vitality; often exhibited by leaf discoloration, distortion or lack of annual growth. Poor nutrition will slow growth can diminish the trees natural defense mechanisms and expose the tree to disease.

In nature, few tree species grow alone; the forest is their natural and protected setting. Whether native or introduced, regardless of a trees' origin, trees in a landscape setting demand special attention. Although bound by the genetic code of its predecessors each tree is also the product of its local environment in terms of health, vitality and structural form.

Looking at the overall picture, the health and condition of the soil, turf and other plants and trees can reveal the cause of disease or indicate potential problems. The presence of certain species of fungus can indicate decay. Decay fungi may destroy support tissues and leave conductive tissues unharmed. The tree may appear healthy and continue to grow

until the internal decay outpaces the new outer growth whole tree collapse can result.

A root crown examination may be necessary if root decay is suspected. By removing the soil at the base of the tree, the location, health and condition of the absorbing and support roots can be determined.

In the primary examination of the root crown and trunk a mallet is used to test for loose bark. Bark lifting can indicate dead or hollow areas and give signs of the presence of decay in the root crown zone and at the base of the trunk. The mallet may be used to "sound" for decay but has limited reliability. If decay is suspected the tree may be tested using the Resistograph. Where Resistograph tests were made a more detailed explanation and an interpretation with illustrations is given later in the text.

The type of decay and its effect on the stability of the wood depends on the species of fungus involved. Soil and root tissue samples may be taken to determine the cause of disease by laboratory testing.

The inspection continues with an evaluation of the tree crown, first by eye or with the use of binoculars then, if necessary, by climbing into the canopy of the tree. The color, size and condition of the leaves, trunk, branches and twigs are assessed. The shape and formation of all the trees components give information about health, vitality and structural strength. The crown density, the amount of live growth on each stem, and past and current growth extension, indicate current health and reveal previous problems. Changes in growth rate in past growth may indicate prior disease or injury.

An evaluation of the general growth habit will reveal any problems related to vigor, or the genetic component of tree growth. Previous treatments such as

pruning or cabling are observed, the quality of the work, and its effect on the tree is assessed. Any growth abnormalities are noted: weak limbs, discolored or missing bark, cracks or cavities in branches or trunks. Indications of disease are observed within the canopy of the tree, disease may be indicated by leaf blight, leaf loss, poor vitality, stem canker, fungal growth or insect and bird activity.

Trees produce adaptive growth to compensate for the stress related to growth and injury. The shape and formation of limbs and trunks can reveal the ability of the tree to compensate for weakness or may indicate internal problems that could lead to limb or trunk breakage. The interpretation of these changes in form is part of a growing body of knowledge pioneered in Europe and adopted across the globe. The knowledge is not new but the application of that knowledge in risk assessment is in the forefront of progress in understanding how trees compensate for stress. Research into stress-loading of trees and materials testing of wood structure has led to the development of systems of structural evaluation based on the principals of bio-engineering.

In many situations the results of the Tree Inspection are used as the basis of a Risk Assessment. The extent and depth to which the processes described above are followed depends on the scope of the assessment. For example; whether a single, high value tree next to a popular meeting place is the subject of the inspection or whether groups of trees in a relatively little used area of a community are of concern. Where large groups of trees are evaluated and are in similar condition and circumstances, group Risk Ratings may be applied.

Tree Risk Assessment

The assessment of risk in trees involves taking the information gathered during the ***Tree Inspection*** phase to determine the likelihood that all or part of a tree will break or fail. The assessment goes on to evaluate the consequences of such a failure by looking at the targets of the part deemed most probable to fail and the potential for harm or disruption of activities should failure take place. The method is outlined in the manual; ***Tree Risk Assessment in Urban Areas and the Urban Rural Interface.*** The manual forms the basis of the ***Tree Risk Assessment Course and Certification*** process. Further guidance is provided in the **ISA's Best Management Practices, Tree Risk Assessment. ANSI A300 Part 9 and the Tree Risk Assessment Manual Second Edition.**

Tree Risk Assessment is used to identify hazardous situations before damage or injury occurs. Risk Assessment is also used to facilitate risk management specifically to manage and mitigate the risk associated with the retention of trees, using cultural practices to maintain the risk at an acceptable level. Risk Assessments are undertaken periodically to provide tree owners/managers with pertinent information on trees under their care as a matter of due diligence to meet a standard of care.

Developing a Risk Rating

Past evaluations have relied on a modified quantitative approach to assessing risk based on the Likelihood of Failure and the consequences of failure in respect of harm. The method attached an ascending numeric value to specific aspects of trees and the probability that damage or injury may occur in the case of failure. The ratings were added together to produce a risk rating. This method has been revised in light of information about the mathematical accuracy of the approach. Subsequently this report uses a qualitative approach characterizing the field work entries to produce descriptors of tree condition and potential consequences of failure to produce a risk rating and mitigation recommendations. The objective in carrying out the recommended risk mitigation procedures is to reduce the high-risk trees to Low/Moderate.

Observations

The Native Growth Protection Areas (Buffers) at Chestnut Trails consist of stands or groups of indigenous conifers; semi-mature Douglas fir (*Pseudotsuga menziesii*) with Western Hemlock (*Tsuga heterophylla*), Western redcedar (*Thuja plicata*), and native broadleaves Red Alder (*Alnus rub*ra) and Bigleaf Maple (*Acer macrophyllum*). The species involved are primarily pioneer species that re-generate following site clearing or other circumstances where areas are “opened up” and successive tree species are allowed to establish in new open areas.

During the earlier phases of tree inspection and risk assessment at Chestnut Trails several areas within the Native Growth set-asides were established. Groups of trees and individual trees located within the buffers were identified as growing within disease sites. After resonance testing “sounding” indicated that internal decay was present in a tree or a close group of trees; some of which was severe, they were marked for action to reduce risk. Risk Mitigation was achieved largely by the removal of high-risk trees and those perceived to become

high risk within the one-year time frame of the inspection. It should be noted, that some areas our worse than others. Planting of trees that are immune to the disease should commence after recommended tree removal takes place. A list of recommended native trees is in the following section.

In the past, the primary mode of tree failure at Chestnut Trails has been wind-throw of whole trees. Failure was largely a result of high winds on exposed trees with decayed roots. Past inspections have identified and confirmed root disease sites, primarily attributed to Laminated Root Rot, diagnosed in 1997. Subsequently, this has called for the removal of exposed and infected trees in proximity to those sites. High target zones have also been identified. The high target zones contain trees adjacent to residential property that are exposed.

Conclusions and Recommendations

The annual Tree Inspection and Risk Assessment of the trees at Chestnut Trails took place during the latter part of March 2019. The tree work that was recommended following the 2018 inspection has been completed and trees have either been cut to the ground or reduced to high stumps to form wildlife snags. Trees that are recommended for removal or wildlife snagging have been marked with fluorescent pink flagging in the NGPA's with the closest street or adjacent property address. The sketch plan has been updated to reflect this year's recommended work which includes the following:

- Seven Douglas fir flagged for removal or snagging to a safe height. Resonance testing gave indication of internal decay and structural defects

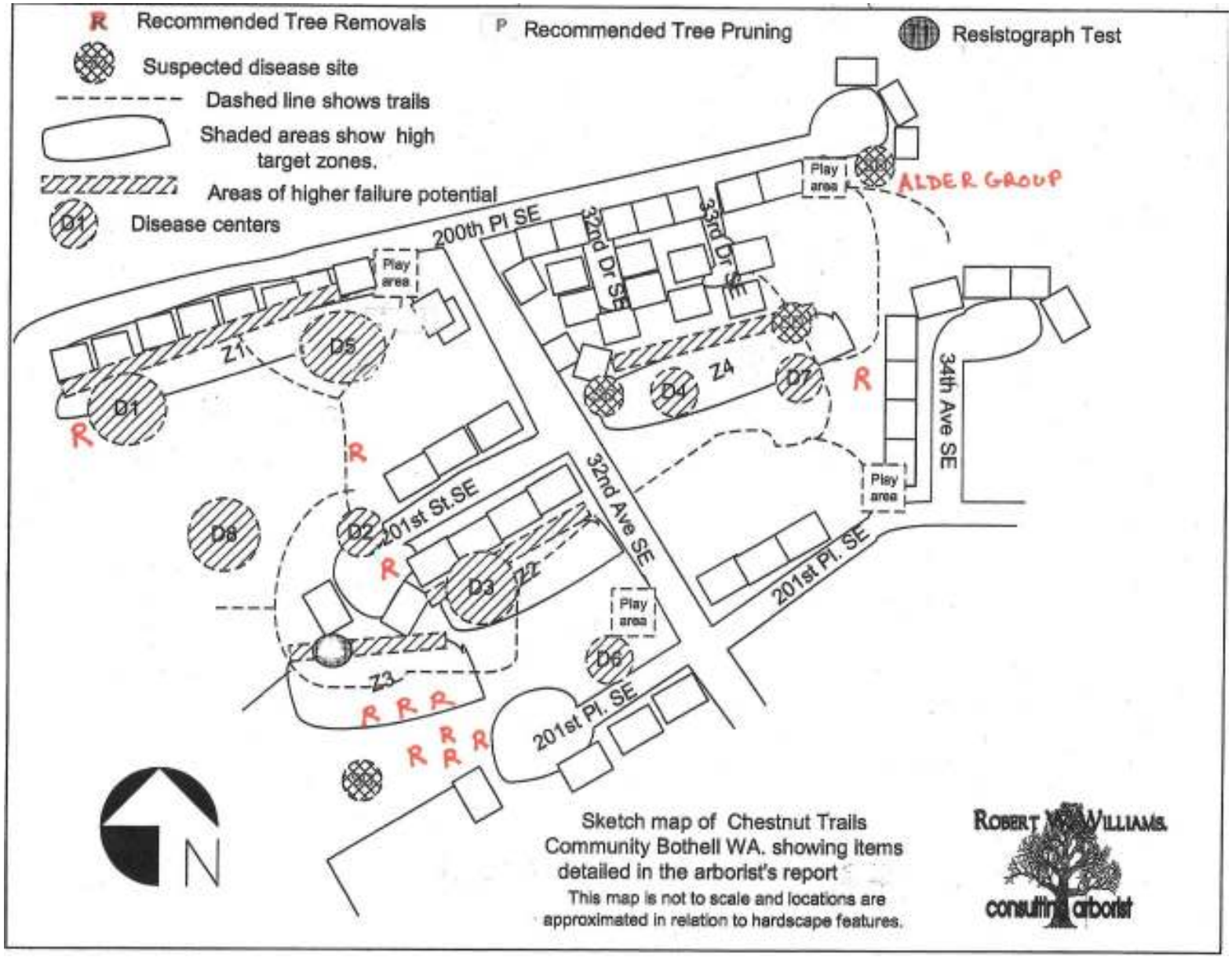
that make them unsafe for retention. The trees are located at the base and uphill of the NGPA buffer adjacent to the residence at 3113 201st Place SE

- One Alder growing behind the residence at 3104 201st Street SE is leaning against the fence and causing damage. The tree is showing signs of decline and should be cut to the ground
- One Douglas fir was flagged for removal or snagging. The tree is dying and is severely decayed. The tree is located on top of the NGPA close to the fence; behind 3004/3010 200th Place SE
- One Alder with severe dieback should be cut to the ground. This tree is located behind 3104 201st Street SE
- One Douglas fir located adjacent to the pathway off 200th Place SE should be snagged. Resonance testing indicated that the tree is decayed. There is also a bulge in the trunk and a high crown (shown on pg. 3)
- One Douglas fir should be snagged which is located in the NGPA behind 20018 34th Avenue SE. The tree is decayed and has a high crown with little to no trunk flare
- An Alder group that is located behind the play area near the cul de sac on the east end of 200th Place SE should be selectively removed within two years. The trees are leaning toward the play area; with cracks in the trunks

The trees within the NGPA's at Chestnut Trails should continue to be monitored on a one or two-year inspection cycle; based on an assessment of condition and community concerns.

The following is a list of trees that are Resistant and Immune to this variety of Laminated Root Rot.

Western redcedar	(*Thuja plicata)*
Bigleaf Maple	(*Acer Macrophyllum)*
Red Alder	(*Alnus rubra)*
Vine Maple	(*Acer circinatum)*


R Recommended Tree Removals
P Recommended Tree Pruning
Resistograph Test
Suspected disease site
Dashed line shows trails
Shaded areas show high target zones.
Areas of higher failure potential
D1 Disease centers
200th Pl SE
32nd Dr SE
33rd Dr
Play area
ALDER GROUP
Z1
D5
D1
R
D4
Z4
D7
34th Ave SE
201st St.SE
D8
D2
32nd Ave SE
D3
Z2
Z3
D6
201st Pl. SE
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Sketch map of Chestnut Trails Community Bothell WA. showing items detailed in the arborist's report
This map is not to scale and locations are approximated in relation to hardscape features.
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