Tree Preservation Plan

Site:

Museum of Anthropology
6393 NW Marine Drive
Vancouver BC V6T 1Z2

Prepared for:

University of British Columbia
1100-2329 West Mall
Vancouver, BC V6T 1Z4

Prepared by:

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Executive Summary

The Museum of Anthropology is soon to undergo seismic upgrades, envelope rehabilitation and roof membrane restoration. Given the close proximity of trees to the building, the potential for harm to be caused to the trees and the trees importance to the site, it was recognized than that a tree preservation plan was required. Bartlett Tree Experts were tasked with preparing an inventory of the trees on the site and with making recommendations for tree management throughout the life of the project.

Several areas of construction activity were highlighted as creating potential conflicts with trees including:

- Excavation to access column footings at the main entry.
- Skylight and façade cleaning at the main entry.
- Façade cleaning to the perimeter of the building.
- Management of trees at the western façade.
- Excavation to the south west of the great hall.
- Access routes to the site from the north and to the south side of the building.

These areas were discussed in the report and outline recommendations were made for tree protection.

Background

In March 2020, Beryl Allen, Landscape Architect with Atelier Anonymous, contacted Bartlett Tree Experts regarding tree preservation at the Museum of Anthropology in Vancouver, BC. The building is soon to undergo seismic upgrades along with ongoing envelope rehabilitation and roof membrane restoration. The project requires that the iconic and historically and culturally important landscape is retained and enhanced.

Consulting Arborist Craig Southwell visited the site on April 7 and toured the site with Beryl Allen. He visited again on April 30 to inventory existing trees and to inspect the site for the purpose of writing this report.

Purpose

The intended purpose of this report is to provide information on the condition of the trees, their suitability for retention and the measures required to protect any retained trees during the proposed construction activity. It also aims to address the particular concerns raised by the project Landscape Architect in regards to tree management.

Limits of the Assignment

The site plans provided to us show the existing layout of the site in relation to the surrounding land and trees; no detailed plans that might affect existing trees are yet known as of the writing of this report. However, an outline of the proposed work at the site was presented in the supporting documents and was discussed during the initial site visit.

The location of trees was obtained from the topographic surveys presented in the supporting documents provided by the Landscape Architect:

- 18AVED010-Arborist Scope dated July 18, 2019
- 2020.02.24 50 Construction Coordination Landscape sm. Dated February 21, 2020
- 2020.04.07 MOA Working Plan Arborist FINAL AA. Dated April 7, 2020
- L024.2018.11.23_FM INT-MoA site visit Nov 23 FINAL.

The inventory was performed from the ground for visual conditions.

This tree inventory was not a tree risk assessment. As such, no trees were assessed for risk in accordance with industry standards, nor are there any tree risk ratings or risk mitigation recommendations provided within this preservation plan.

There is no guarantee for the preservation of the trees contained in this report, however, the preservation plan is made with the best interest intended for the trees being preserved.

Description of Trees

The area around the Museum of Anthropology is a planted landscape mimicking native Pacific Northwest forests. The area is consistently used with a series of pedestrian paths intersecting the growing spaces. The tree species are primarily native with a few non-native ornamental and orchard species. Tree size was typical of woodlands with a few large trees (12 trees over 50 cm in trunk diameter) and many small trees. Overall, over 70% of the trees were in good condition.

Two areas were collected as groups of trees rather than individual trees (G1 and G2). These areas consisted of dense areas of western red cedar and western hemlocks. These areas were in good condition and only the edges of the groves may be impacted by construction. Individual trees within the groups may require pruning to maintain clearance from construction activity.

For the 118 individually assessed trees, western hemlock and vine maple were the most common species comprising two thirds of the population. These trees were primarily in good condition with only ten trees with low suitability for preservation. The western

hemlock ranged from 8 to 55 cm in trunk diameter with an average diameter of 27 cm. The vine maples were primarily multi-trunked as is typical of the species.

Mature trees can be difficult to preserve during construction projects. It is important to focus preservation on healthy, mature trees. A few of the largest, healthiest or most prominent trees to focus preservation on are:

- The western hemlocks around the main entry.
- The western hemlocks at the west façade.
- Doug firs #111, 117 (the largest trees assessed) and 64.
- Big leaf maples #65, 67, 84, 66 and 118 (the largest multi-trunk tree).
- Western red cedars #29, 53, and 70.

Effects of construction on trees

Tree root systems are generally confined to the uppermost sixty to ninety centimetres of the soil profile. Construction activities can cause profound changes to the area surrounding a tree's root system, by virtue of what has to be done for the majority of projects. Access traffic, storage of materials, grading, and trenching can result in soil compaction, crushing or severing of roots, injury to aboveground portions (trunk and branches), and drainage

Cutting of roots reduces a tree's ability to supply itself with water and nutrients necessary to produce the sugars and carbohydrates necessary for sustaining life. Compaction of the soil reduces air pockets in the soil and makes it more difficult for roots to grow through it. It also slows or even prevents drainage of irrigation or storm water, which can result in excessively wet conditions, leading to root rot. Breakage and injury to a tree's trunk and branches reduce its aesthetic value, but more importantly, can leave entry points for pests and diseases.

The issues above often do not appear immediately after the area surrounding a tree has been disturbed. It can be years after the project has been completed that stress signs become apparent. Reduced growth, changes in color or leaf size, branch dieback, or even tree death can follow large disturbances.

Pruning trees to create clearance for construction projects can also result in negative tree impacts. With protected trees in close proximity to and in some cases overhanging areas of work, there is a need to control who is carrying out pruning and what specifications they are following. Some of the past pruning carried out on the site was far from ideal and in many cases, not necessary.

Tree Impacts

The seismic upgrade of the columns at the main entry of the building requires an excavation to facilitate access to the footings. Tree #10 is growing within this area and would not survive this level of root disturbance. It would not be reasonable to relocate the tree and it would be unlikely to survive if this were attempted. Therefore, the tree should be removed before excavations commence. A small shrub (#17) on the south side of the excavation would also need to be removed because of its close proximity to the excavation.

The remaining trees on either side of the front entrance should be enclosed with protective fencing for the duration of the construction activity. Fencing should be placed at the edge of the existing concrete so as to maximize the potential root zone protected. It is possible that roots from some of these trees will be damaged during the excavation. However, the presence of existing concrete surfaces makes it difficult to predict how extensive this might be. Supervision by the project arborist during the excavation will help determine how much of an impact (if any) the work has had on the trees being retained.

In addition to the seismic upgrade at the front entrance, skylight replacement and façade cleaning is also proposed. This is likely to include the use of elevated work platforms which have the potential to cause compaction if used on unprotected soil surfaces. The project arborist should meet with the construction team responsible for this phase of the project and devise a detailed plan for the positioning of equipment and materials. Where the use of equipment within a tree root protection zone cannot be avoided, protective matting on top of wood chips can be temporarily installed. This will help spread the load and minimize damage. Any areas where soil compaction occurs should be aerated immediately following the removal of the ground protection. An Airspade used by a certified arborist should be employed to carry out such work as it can aerate the soil without causing further damage to the roots.

The trees around the perimeter of the building may be impacted by the envelope restoration work. Any clearance pruning should be carried out by Certified Arborists, under strict specifications provided by the project arborist before the restoration work commences. The extent of root zone protection will depend to a large degree on the construction methods and equipment being employed. Our main concern is the need to protect the soil from compaction which can occur with repeated foot or equipment traffic. Linear protective fencing should be installed between the trees and the building where possible. Where work or access routes come into conflict with tree root zones, the project arborist will brief the work crews and monitor the levels of traffic. Decompaction of the soil may be required once the construction activity in each area has been completed.

The western red cedar #96 to the south west of the great hall sits very close to the area being excavated for the pouring of a large concrete slab. The base of the tree sits very close to the line of excavation and the loss of roots would make the trees survival

impossible. Given the relative open access and lack of obstacles for the arborists removing the tree, it should be possible to preserve some of the larger diameter wood in useable lengths for local craft persons. Similarly, it should be possible for an excavator to extract the stump from the ground in one piece and deposit it elsewhere on site for use as a nurse stump. The tree has performed well on the site and has no doubt extended its roots into the moist soil conditions around the pond. This bodes well for the replacement of the tree with a similar native, moisture loving species such as western red cedar.

The western hemlocks along the western façade were planted to provide shade to the exhibits on that side of the building. Some trees have been lost over time and gaps in the line have appeared. Some of the remaining trees show signs of decline potentially due to a combination of heavy pruning and poor soil conditions. An excavation at the southern end of the line of trees will mean the removal of tree #97. It may also cause non-survivable damage to the roots of tree #98 although this may not be confirmed until the excavation is carried out and the extent of any root damage is known. Given the loss of trees in this location and the general decline of those remaining, replacement planting should be planned. Native conifers such as western red cedar and Douglas fir should be considered with stock size being limited to specimens that can be reasonably installed by hand, without causing damage to the root zones of the other trees. A mix of species planted in a non-linear pattern may help to diversify the group and promote the longevity of the feature.

The final route of the temporary site access road on the west side of the site is yet to be decided. However, it may affect the health of the two oak trees (#119 and #120) growing on the bank at the west side of the existing road. Both trees should have protective fencing installed over as much of their critical root zones as possible. Branches overhanging the proposed route should be sympathetically pruned back so as to reduce the likelihood of accidental damage while also preserving their natural shape and branch architecture. If the route of the access road means that the trees cannot be retained, it may be possible to relocate them to another part of the site.

Access for personnel, equipment and materials will be required to the south side of the building for the construction of a new mechanical room. Access will be along existing gravel trails. To prevent any intrusion into the root zones of the trees, the trails will be lined with protective fencing. This should be secured to the ground using rebar or a similar material so that it cannot easily be moved. This will also prevent pedestrian access into these areas which can be just as damaging to soil structure over time.

Recommendations

1. Construction plans should be reviewed by the project arborist to evaluate impacts to trees from construction. The project calls for a dynamic approach to tree management and collaboration between the project arborist and the various trades working on the site.
2. Tree removals and pruning (once approved by relevant stakeholders) should be completed before construction activity commences on the site.
3. Trees to be preserved should have a tree protection zone (TPZ) established, based on the trunk diameter at breast height (DBH-taken to be 1.4 metres above ground level) and at least to the canopy drip line. Total trunk diameter for multi-stemmed trees can be calculated by taking the sum of the largest diameter stem and 60% of the diameter of the other stems. A tree protection distance table is provided in the appendices.
4. TPZs shall be delineated with construction fencing measuring a minimum of 1.2 metres high and set with steel posts spaced a maximum of 3 metres apart.
5. Groups of trees can be protected as groups, with the fencing mentioned above surrounding collective TPZs, rather than a series of closely spaced individual TPZs. This tends to be less time and material intensive, and often results in fewer disturbances for the trees being protected.
6. Signage approved by the project arborist shall be installed on the fencing surrounding TPZs. Such signage must state that the area inside the fence is a tree protection zone, and that entrance into the area is prohibited unless approved by the project arborist.
7. Incursions into TPZs are to be avoided, where practical. In cases where development must encroach into any TPZ, encroachment should be limited to 25% or less of the total area (square metres) of the TPZ. Before any such incursions occur, the project arborist will be consulted and will be present on site to supervise the work. Where possible, the most minimally damaging construction methods will be employed within the TPZ such as hand digging and the avoidance of heavy machinery.
8. Additionally, encroachment into any TPZ should approach no closer to the tree than 50% of the TPZ radius.
9. Stockpiling of materials, vehicle operation, and parking is prohibited within TPZs.
10. Maintain existing grade within TPZs. Raising or lowering grades is prohibited, except as permitted by and under the supervision of the consulting arborist. Contractor should contact the consulting arborist for recommendations where

trees to be saved conflict with grading.

11. Removal of branches or root pruning of trees to remain is to be performed by a qualified arborist under the supervision of the project arborist.

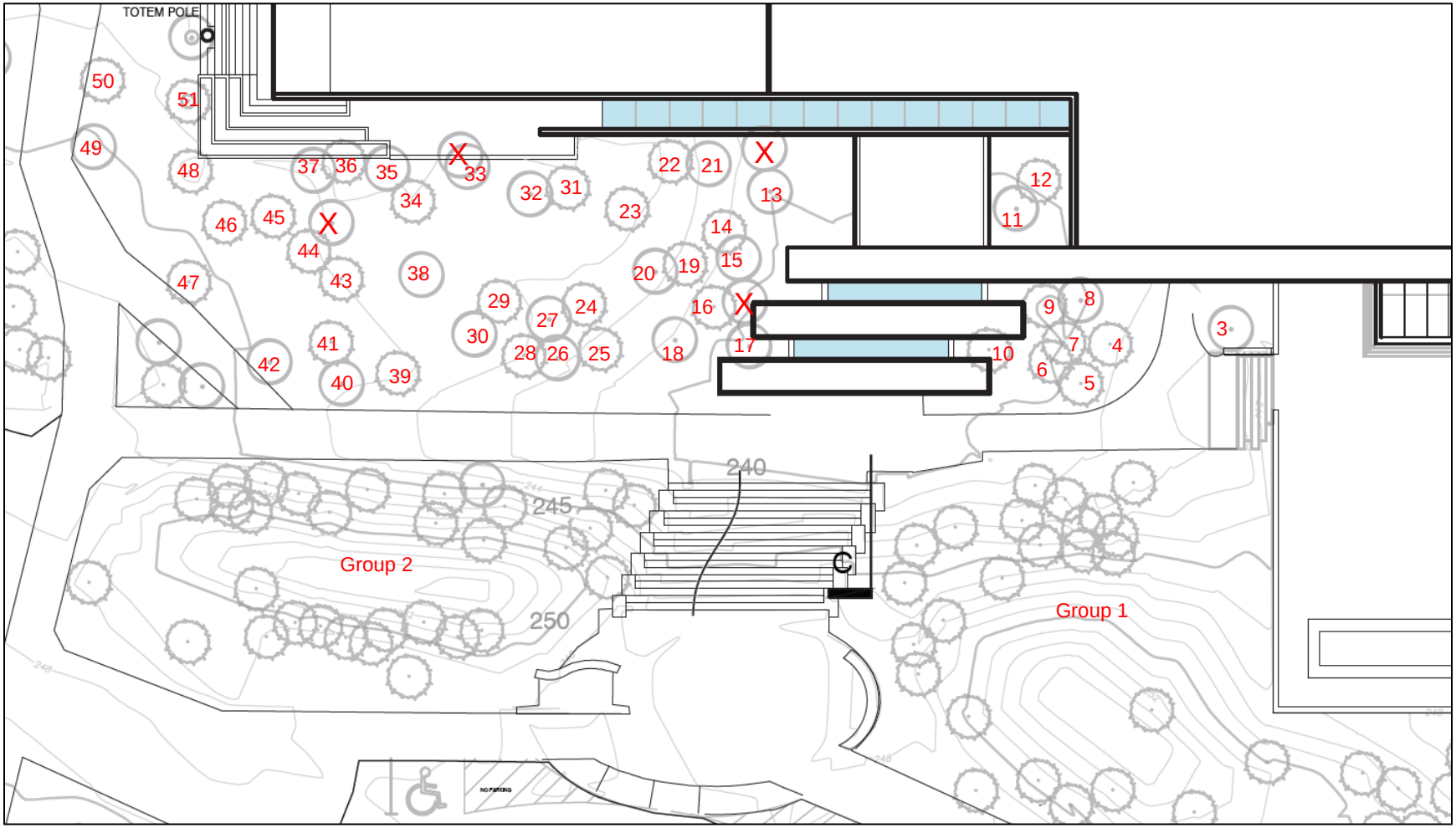
12. Excavation and trenching around tree roots within the TPZs is prohibited, except by permission and under the supervision of the project arborist.

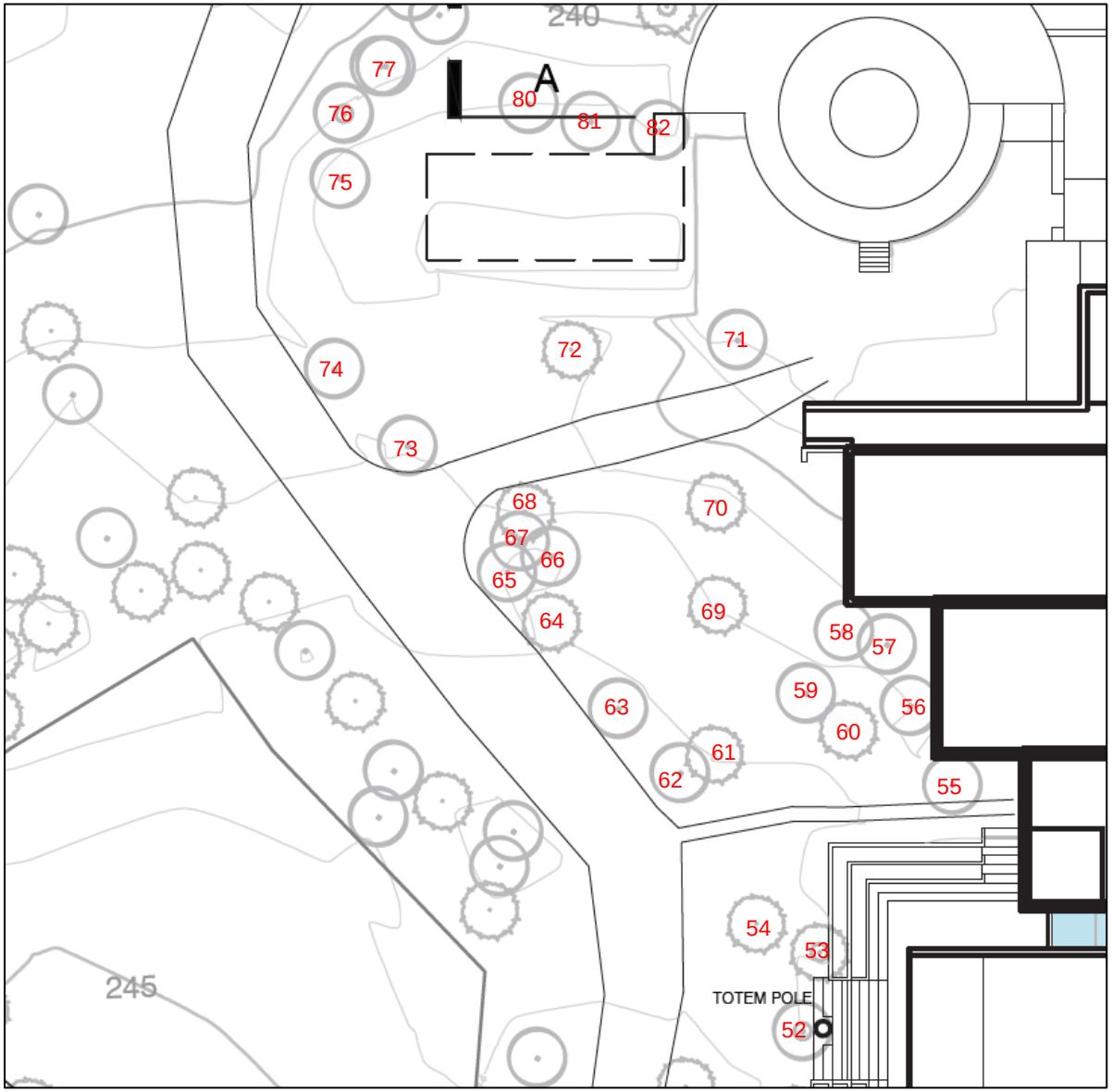
13. When excavating is required within the tree protection zones, locate roots by hand digging or by the use of an Air-Spade©. Do not cut roots larger than 5 centimetres in diameter. Cut smaller roots only if they interfere with new work and only with a sharp instrument.

14. TPZ fencing and signage are to be kept intact and in good repair until construction is complete and all inspections have been passed.

15. Trees that are to remain should be watered as needed to maintain their health during the course of construction.

Appendix I – Site Plans

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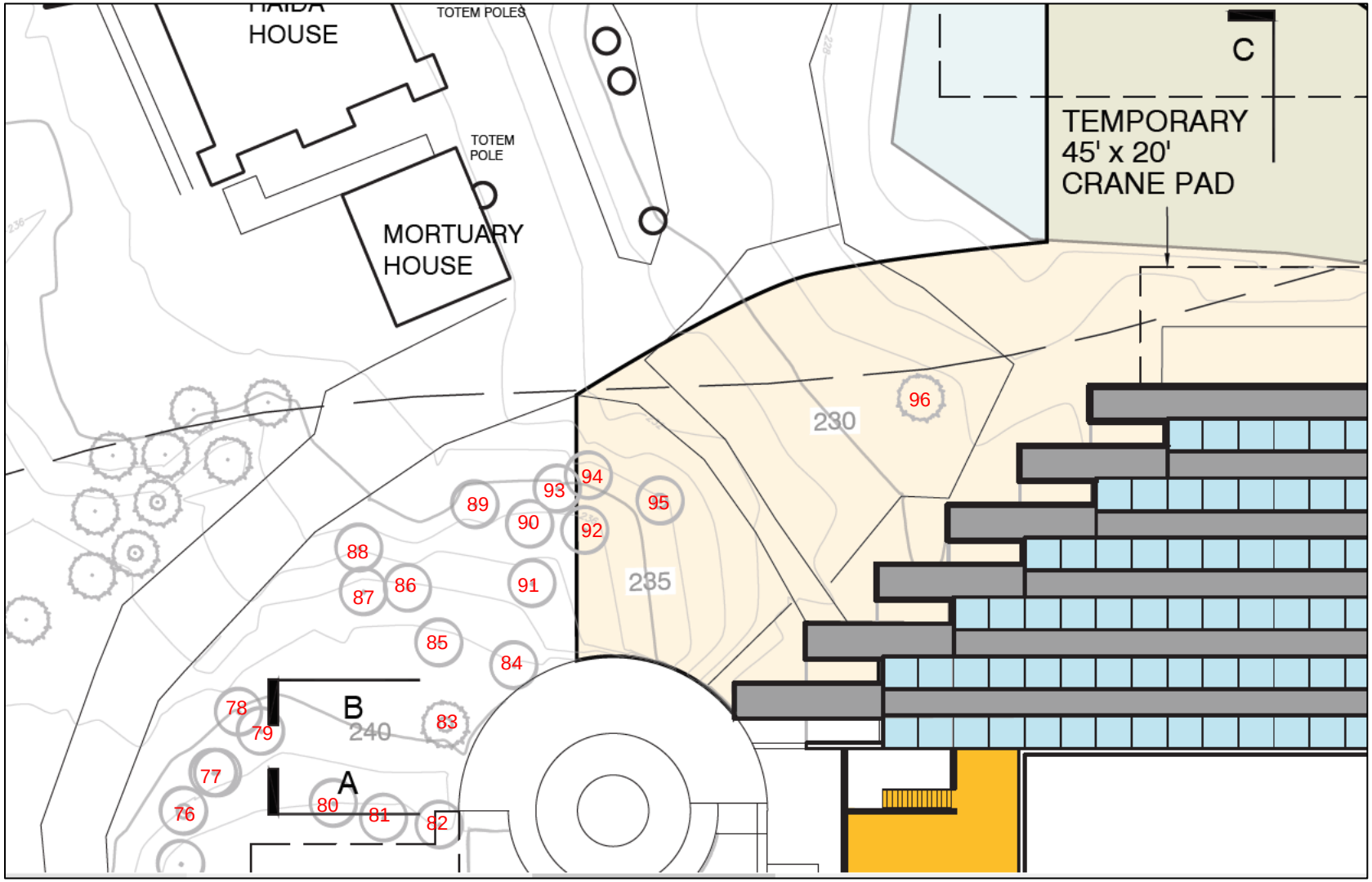
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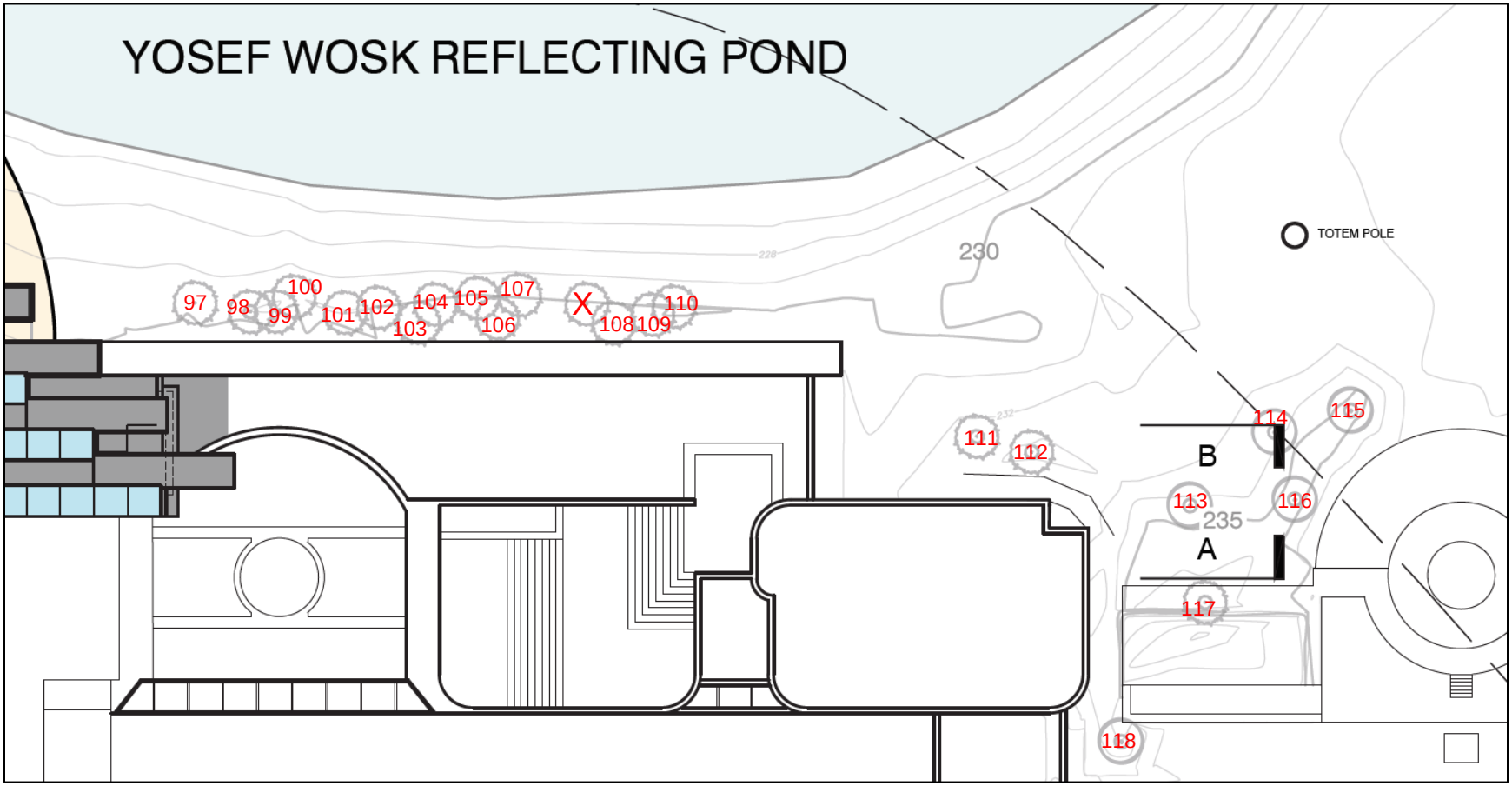
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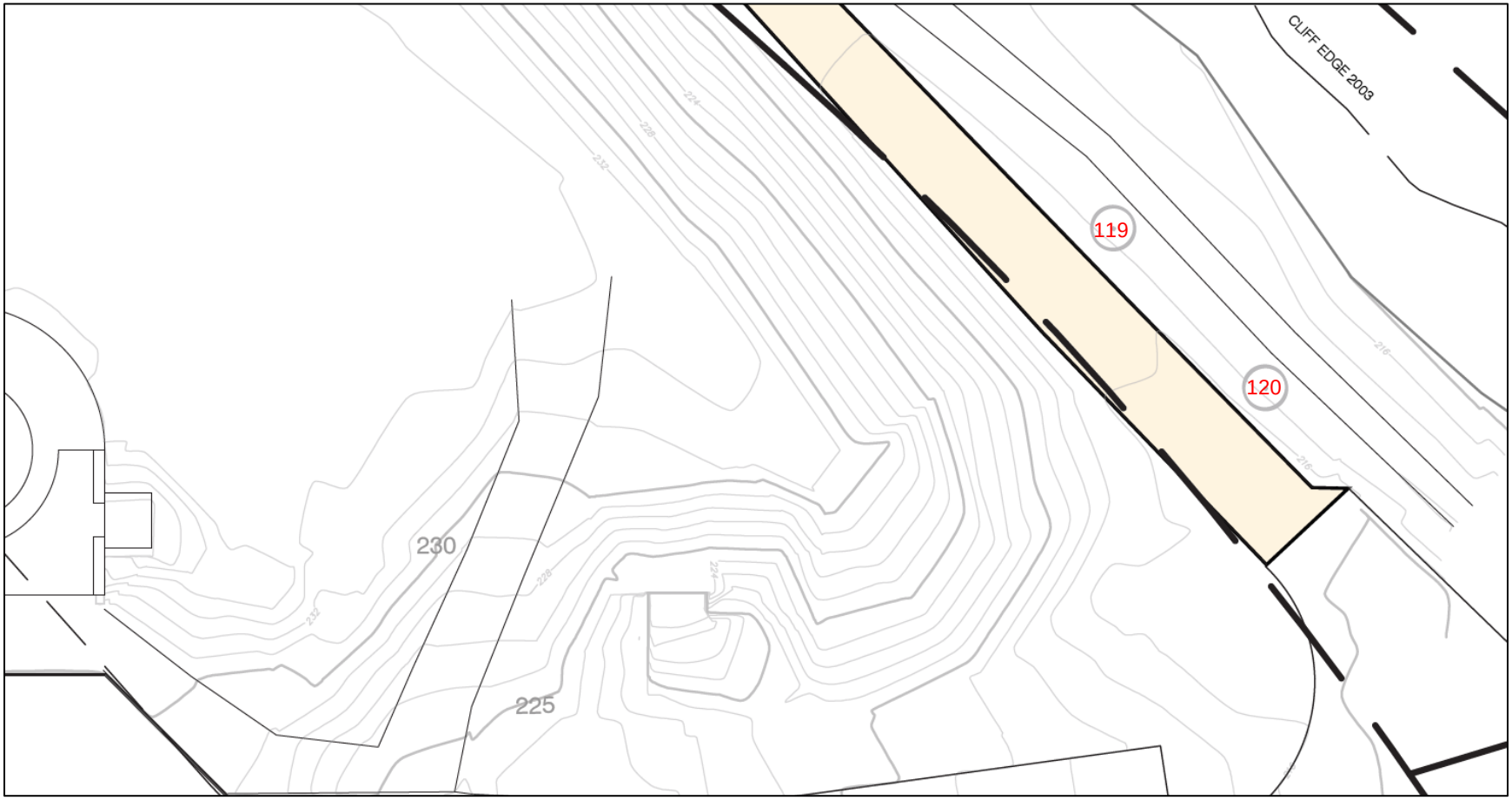
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Appendix II – Tree Details

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
G1	Western Red Cedar (*Thuja plicata*) Western Hemlock (*Tsuga heterophylla*)	To 73	To 25	-	-	-	-	3-5	H	Area of closed canopy woodland. Mostly good quality trees with several smaller dead stems to remove before construction commences. The trees should be protected as a group and crown raised around the edges to avoid conflict with construction activity.
G2	Western Red Cedar (*Thuja plicata*) Western Hemlock (*Tsuga heterophylla*)	To 78	To 25	-	-	-	-	3-5	H	Area of closed canopy woodland. Mostly good quality trees with several smaller dead stems to remove before construction commences. The trees should be protected as a group and crown raised around the edges to avoid conflict with construction activity.
3	Vine Maple (*Acer circinatum*)	To 7	4	3	2	3	2	4	H	Multi-stemmed tree growing within contained area adjacent to the steps. Protect root zone to the edge of the concrete and crown raise to avoid conflict with construction activity.
4	Western Hemlock (*Tsuga heterophylla*)	12	11	2	2	1.5	2	5	H	Minor deadwood. Protect as part of the group to the north of the main entrance.
5	Western Hemlock (*Tsuga heterophylla*)	23	20	1.5	1.5	2	2.5	1	L	Dead tree to be removed before construction commences.
6	Western Hemlock (*Tsuga heterophylla*)	20	17	1	1	2.5	3	4	H	Minor deadwood. Suppressed by surrounding trees. Branches touching structure. Light pruning for clearance before construction commences. Protect as part of the group to the north of the main entrance.
7	Western Hemlock (*Tsuga heterophylla*)	20	17	2	2	2	1	3	M	Minor deadwood. Suppressed by surrounding trees. Trunk exudations likely due to boring insects. Protect as part of the group to the north of the main entrance.
8	Vine Maple (*Acer circinatum*)	9,8,8	10	5	3	1.5	1.5	4	H	Multi-stemmed tree growing close to the building. Protect root zone as part of the larger group. Lightly prune for clearance before construction commences.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
9	Western Hemlock (*Tsuga heterophylla*)	24	20	1	1	1	1.5	3	M	Sparse crown. Trunk exudations likely due to boring insects. Close to existing concrete slab. Protect as part of the group to the north of the main entrance.
10	Western Hemlock (*Tsuga heterophylla*)	28	20	2	3	3	3	4	L	Planted in narrow space between concrete slabs. Grows through gap in building. Within area of proposed construction and cannot be retained in a viable condition. Remove before construction commences.
11	Vine Maple (*Acer circinatum*)	12,11	8	1	2.5	3	2	4	H	Multi-stemmed tree growing close to the building. Protect root zone as part of the larger group to the edge of the concrete. Lightly prune for clearance before construction commences.
12	Western Hemlock (*Tsuga heterophylla*)	55	24	6	6	6	6	5	H	Growing in small area at the corner of the building. Canopy is above and overhanging the roof. Protect root zone as part of the larger group to the edge of the concrete. Light pruning to maintain clearance and remove deadwood and stubs.
13	Mountain Ash (*Sorbus aucuparia*)	To 10	7	3	1.5	1	2	S	M	Suppressed by surrounding trees. Low vigor. Prune to remove deadwood and create clearance from the building. Protect as part of the woodland group.
14	Western Hemlock (*Tsuga heterophylla*)	26	14	3	3	2	3	4	H	Lower canopy deadwood. Protect as part of the woodland group.
15	Vine Maple (*Acer circinatum*)	To 11	7	3	2	2	1.5	4	H	Multi-stemmed tree growing close to the building and over the roof. Protect root zone as part of the woodland group. Lightly prune for clearance before construction commences.
16	Western Hemlock (*Tsuga heterophylla*)	32	24	5	3	4	5	3	H	Partially occluded spiral torsion fractures in main stem. Lower canopy deadwood. Protect as part of the woodland group.
17	Flowering Currant (*Ribes sanguineum*)	11	2	2	1	1	1	2	L	Heaving root ball. Very close to concrete pad. Remove before construction commences.
18	Flowering Currant (*Ribes sanguineum*)	To 7	3	2	2	1	1.5	3	L	Previously reduced. Protect as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
19	Western Hemlock (*Tsuga heterophylla*)	30	24	2	2	2	1.5	3	M	Partially occluded spiral torsion fractures in main stem. Lower canopy deadwood. Protect as part of the woodland group.
20	Vine Maple (*Acer circinatum*)	To 5	6	2	2.5	2	1	4	H	Suppressed by surrounding trees. Protect root zone as part of the woodland group.
21	Vine Maple (*Acer circinatum*)	13	9	3	1	3	3	3	M	Leans away from the building. Protect root zone as part of the woodland group.
22	Western Hemlock (*Tsuga heterophylla*)	26	18	4	2	2	2.5	5	H	Close to building and ventilation shaft. Stubs on main stem and deadwood. Protect as part of the woodland group.
23	Western Hemlock (*Tsuga heterophylla*)	22	18	3	2.5	3	2.5	5	H	Close to ventilation shaft. Deadwood in the lower canopy. Protect as part of the woodland group.
24	Western Hemlock (*Tsuga heterophylla*)	36	18	3	3	2.5	2	3	M	Trunk exudations likely due to boring insects. Deadwood in the lower canopy. Sparse canopy. Protect as part of the woodland group.
25	Western Hemlock (*Tsuga heterophylla*)	25	18	4	2	2	2	3	M	Partially occluded spiral torsion fractures in main stem. Deadwood in the lower canopy. Sparse canopy. Protect as part of the woodland group.
26	Vine Maple (*Acer circinatum*)	To 8	10	4	1	1	5	3	M	Suppressed by surrounding trees. Phototrophic growth to the east. Protect root zone as part of the woodland group.
27	Vine Maple (*Acer circinatum*)	To 5	8	4	3	1	1	2	L	Suppressed by surrounding trees. Phototrophic growth to the north. Protect root zone as part of the woodland group.
28	Western Hemlock (*Tsuga heterophylla*)	26	18	3	2	2	3	4	L	Deadwood in the lower canopy. Protect as part of the woodland group.
29	Western Red Cedar (*Thuja plicata*)	68	20	5	6	6	5	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
30	Vine Maple (*Acer circinatum*)	To 3	5	1	1	1.5	3	3	M	Suppressed by surrounding trees. Phototrophic growth to the east. Protect root zone as part of the woodland group.
31	Western Hemlock (*Tsuga heterophylla*)	21	16	2	2.5	1.5	2	4	H	Partially occluded spiral torsion fractures in main stem. Deadwood in the lower canopy. Protect as part of the woodland group.
32	Vine Maple (*Acer circinatum*)	11	7	1.5	3	2	1	4	M	Suppressed by surrounding trees. Phototrophic growth towards the building. Protect root zone as part of the woodland group.
33	Willow (*Salix* sp.)	16	10	2	2	2	1.5	5	M	Very close to retaining wall. Protect root zone as part of the woodland group.
34	Western Hemlock (*Tsuga heterophylla*)	11	12	1.5	1.5	1	1	4	H	Deadwood in the lower canopy. Protect as part of the woodland group.
35	Vine Maple (*Acer circinatum*)	To 10	6	2	2	1.5	1.5	4	M	Very close to retaining wall. Protect root zone as part of the woodland group.
36	Western Hemlock (*Tsuga heterophylla*)	30	20	5	6	4	4	5	H	Very close to wooden retaining wall. Deadwood in the lower canopy. Protect as part of the woodland group.
37	Vine Maple (*Acer circinatum*)	11	6	2	2.5	2.5	1	3	M	Soil heaving. Suppressed by surrounding trees. Protect root zone as part of the woodland group.
38	Vine Maple (*Acer circinatum*)	To 6	8	1	3	2	1	3	M	Suppressed by surrounding trees. Protect root zone as part of the woodland group.
39	Western Hemlock (*Tsuga heterophylla*)	40	20	6	5	4	5	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
40	Vine Maple (*Acer circinatum*)	To 6	8	1	1.5	3	4	4	M	Suppressed by surrounding trees. Protect root zone as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
41	Western Hemlock (*Tsuga heterophylla*)	31	20	3	3.5	3	3	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
42	Western Hemlock (*Tsuga heterophylla*)	26	20	2	2	2	2	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
43	Western Hemlock (*Tsuga heterophylla*)	15	16	2	1	1	2	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
44	Western Hemlock (*Tsuga heterophylla*)	27	20	5	4	4	4	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
45	Western Hemlock (*Tsuga heterophylla*)	25	18	2	4	2	3	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
46	Western Hemlock (*Tsuga heterophylla*)	20	16	3	2	3	3	1	L	Dead and potentially unstable. Remove before construction commences.
47	Western Hemlock (*Tsuga heterophylla*)	20	12	4	5	5	4	4	H	Close to gravel path. Deadwood in the lower canopy. Protect as part of the woodland group.
48	Western Hemlock (*Tsuga heterophylla*)	18,10	9	2	3	3	3	1	L	Severe canopy die back and potentially unstable. Remove before construction commences.
49	Big Leaf Maple (*Acer macrophyllum*)	90	28	5	8	6	5	1	L	Kretzschmaria deusta fungal decay pathogen present. Uneven canopy from loss of stems. Remove the majority of the tree leaving a 10 metre tall wildlife stem, before construction commences.
50	Western Hemlock (*Tsuga heterophylla*)	25	16	3	4	4	3	5	H	Close to gravel path. Protect as part of the woodland group.
51	Western Hemlock (*Tsuga heterophylla*)	26	18	5	3	4	4	5	H	Close to wooden retaining wall. Deadwood in the lower canopy. Protect as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
52	Vine Maple (*Acer circinatum*)	To 6	6	4	2	2	2	4	M	Close to totem pole. Protect root zone as part of the woodland group.
53	Western Red Cedar (*Thuja plicata*)	66	24	5	7	5	5	5	H	Close to wooden steps. Protect as part of the woodland group. Renewal of wooden steps will require a strategy for critical root zone protection.
54	Western Hemlock (*Tsuga heterophylla*)	27	22	2	4	4	4	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
55	Vine Maple (*Acer circinatum*)	11,10	8	1.5	1	1	2	3	M	Close to building but leans away due to past stem removals. Protect root zone as part of the woodland group and to the edge of the path.
56	Vine Maple (*Acer circinatum*)	To 10	1.5	1	1	1	1	2	M	Recently cut back to coppice stumps. Close to building. Protect root zone as part of the woodland group and encourage regeneration.
57	Vine Maple (*Acer circinatum*)	To 10	1.5	1	1	1	1	2	M	Recently cut back to coppice stumps. Close to building. Protect root zone as part of the woodland group and encourage regeneration.
58	Vine Maple (*Acer circinatum*)	8	7	1.5	1.5	1.5	1.5	4	M	Close to building. Lightly prune to clear the building before construction work commences. Protect root zone as part of the woodland group.
59	Western Hemlock (*Tsuga heterophylla*)	28	16	4	4	3	4	5	H	Deadwood in the lower canopy. Protect as part of the woodland group.
60	Red Alder (*Alnus rubra*)	11	12	3	3	2	1.5	G	L	Likely self-seeded. Protect as part of the woodland group.
61	Western Hemlock (*Tsuga heterophylla*)	33	20	5	4	3	4	1	L	Dead tree with basal decay. Increased risk of failure. Remove before construction commences.
62	Vine Maple (*Acer circinatum*)	15,7	7	4	2.5	4	4	5	M	Close to paths. Protect root zone as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
63	Vine Maple (*Acer circinatum*)	17	12	4	2	1.5	2	4	M	Close to paths. Protect root zone as part of the woodland group.
64	Douglas Fir (*Pseudotsuga menziesii*)	40	20	5	3	4	5	G	H	Close to paths. Deadwood in the lower canopy. Protect root zone as part of the woodland group.
65	Big Leaf Maple (*Acer macrophyllum*)	45	30	4	6	5	6	5	H	Close to path. Deadwood in the lower canopy. Protect root zone as part of the woodland group.
66	Big Leaf Maple (*Acer macrophyllum*)	55,35, 27	30	7	8	4	6	4	M	Multi-stem tree with included bark unions. Deadwood in canopy. Protect root zone as part of the woodland group.
67	Big Leaf Maple (*Acer macrophyllum*)	61	30	2	10	6	2	4	M	Multiple leaders with included bark unions. Deadwood in canopy. Basal decay. Protect root zone as part of the woodland group.
68	Western Red Cedar (*Thuja plicata*)	28	14	4	4	4	3	4	M	Close to path. Growing up through the canopies of adjacent trees. Protect root zone as part of the woodland group.
69	Western Hemlock (*Tsuga heterophylla*)	9	7	1	1	1	1	1	L	Dead tree with increased risk of failure. Remove before construction commences.
70	Western Red Cedar (*Thuja plicata*)	59	20	5	5	4	5	5	H	Close to path and building. Lightly prune for clearance before construction commences. Protect root zone as part of the woodland group.
71	Vine Maple (*Acer circinatum*)	To 11	7	3	3	2	1	4	M	Close to paths. Protect root zone as part of the woodland group.
72	Western Hemlock (*Tsuga heterophylla*)	27	18	2	2	2	3	5	H	Close to path. Deadwood in the lower canopy. Protect root zone as part of the woodland group.
73	Vine Maple (*Acer circinatum*)	To 9	7	3	3	2	2	4	M	Close to paths. Deadwood. Protect root zone as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
74	Mountain Ash (*Sorbus aucuparia*)	15	8	3	2	3	2	3	M	Close to paths. Deadwood. Protect root zone as part of the woodland group.
75	Big Leaf Maple (*Acer macrophyllum*)	30,26	16	8	5	4	6	3	M	Multiple stems growing from an old stump. Protect root zone as part of the woodland group.
76	Vine Maple (*Acer circinatum*)	To 6	6	1	2	4	2	4	M	Deadwood. Protect root zone as part of the woodland group.
77	Vine Maple (*Acer circinatum*)	11,11	9	2	3	4	1	4	M	Co-dominant stems. Protect root zone as part of the woodland group.
78	Vine Maple (*Acer circinatum*)	To 15	9	2	5	3	1	4	M	Growing over archway. Lightly prune for clearance. Protect root zone as part of the woodland group.
79	Vine Maple (*Acer circinatum*)	To 11	9	3	3	2	2	4	M	Protect root zone as part of the woodland group.
80	Red Alder (*Alnus rubra*)	20	16	4	5	4	3	5	L	Self-seeded tree growing close to historic structure. Protect root zone as part of the woodland group.
81	Red Alder (*Alnus rubra*)	20	16	4	5	3	4	5	L	Self-seeded tree growing close to historic structure. Protect root zone as part of the woodland group.
82	Vine Maple (*Acer circinatum*)	To 11	6	4	3	1	3	4	M	Included bark unions. Protect root zone as part of the woodland group.
83	Western Red Cedar (*Thuja plicata*)	18,16	8	2	2	2	2	5	H	Growing close to historic structure. Protect root zone as part of the woodland group.
84	Big Leaf Maple (*Acer macrophyllum*)	18,17	12	3	3	3	3	4	M	Co-dominant stems with included bark unions. Protect root zone as part of the woodland group.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
85	Vine Maple (*Acer circinatum*)	To 10	6	3	2	2	2	4	H	Included bark unions. Protect root zone as part of the woodland group.
86	Serviceberry (*Amelanchier* sp.)	7,6	5	2	3	1	1	4	M	Suppressed by surrounding vegetation. Protect root zone as part of the woodland group.
87	Mountain Ash (*Sorbus aucuparia*)	13	9	1.5	1.5	1.5	1.5	3	M	Co-dominant stems. Protect root zone as part of the woodland group.
88	Vine Maple (*Acer circinatum*)	14	6	1	2	2	1	5	H	Protect root zone as part of the woodland group.
89	Sycamore Maple (*Acer pseudoplatanus*)	14,12	10	2	3	4	4	4	M	Co-dominant stems. Crown raise over the path. Protect root zone as part of the woodland group.
90	Vine Maple (*Acer circinatum*)	13	4	1	2	2	1	5	H	Protect root zone as part of the woodland group.
91	Red Alder (*Alnus rubra*)	14	11	2	2	2	2	5	M	Protect root zone as part of the woodland group.
92	Apple (*Malus* sp.)	11	5	1.5	2	2	1.5	4	M	Small fruit tree. Within construction area. Protect root zone as part of the woodland group if possible.
93	Red Alder (*Alnus rubra*)	14	12	3	3	4	3	5	M	Protect root zone as part of the woodland group.
94	Apple (*Malus* sp.)	8,7	4	1	1	2	1	4	M	Small fruit tree. Within construction area. Protect root zone as part of the woodland group if possible.
95	Apple (*Malus* sp.)	13	4	1	1	1	1	4	M	Small fruit tree. Within construction area. Protect root zone as part of the woodland group if possible.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
96	Western Red Cedar (*Thuja plicata*)	58	15	6	6	6	6	5	L	Within area to be excavated. Remove before construction commences.
97	Western Hemlock (*Tsuga heterophylla*)	44	18	2	2	2	3	5	L	Within area to be excavated. Remove before construction commences.
98	Western Hemlock (*Tsuga heterophylla*)	29	18	1.5	5	2	2	5	L	Very close to area to be excavated. Unlikely to survive root disturbance. Remove before construction commences.
99	Western Hemlock (*Tsuga heterophylla*)	26	18	2	5	2	1.5	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
100	Western Hemlock (*Tsuga heterophylla*)	21	16	2	5	2	1.5	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
101	Western Hemlock (*Tsuga heterophylla*)	26	18	1.5	5	2	1.5	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
102	Western Hemlock (*Tsuga heterophylla*)	26	18	2	5	2	1.5	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
103	Western Hemlock (*Tsuga heterophylla*)	25	18	1.5	5	1.5	1	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
104	Western Hemlock (*Tsuga heterophylla*)	28	18	2	5	1.5	1	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
105	Western Hemlock (*Tsuga heterophylla*)	19	14	1	4	1	1	3	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
106	Western Hemlock (*Tsuga heterophylla*)	27	18	2	4	2	1.5	4	1	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.

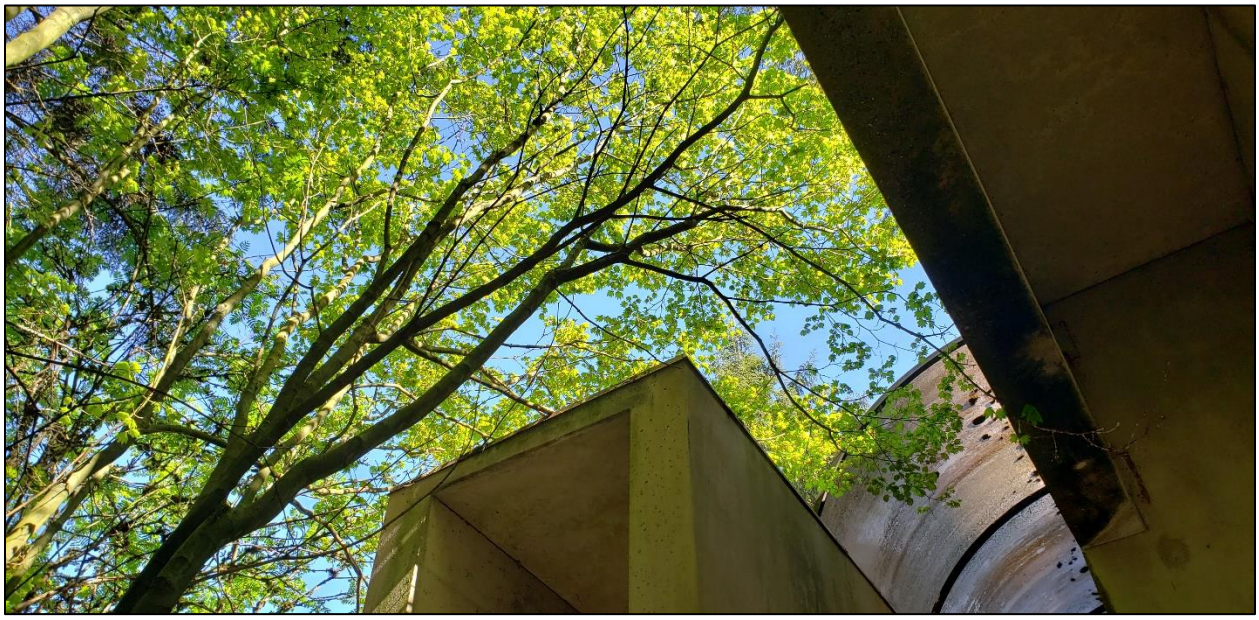
No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
107	Western Hemlock (*Tsuga heterophylla*)	27	18	2	4	2	2	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
108	Western Hemlock (*Tsuga heterophylla*)	30	18	1.5	1.5	2	1	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
109	Western Hemlock (*Tsuga heterophylla*)	31	18	1.5	4	2	1.5	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
110	Western Hemlock (*Tsuga heterophylla*)	43	18	6	6	3	3	4	H	Uneven canopy. Close to building but forms part of important screen. Protect root zone as part of linear group. Aerate soil to alleviate compaction.
111	Douglas Fir (*Pseudotsuga menziesii*)	91	30	8	8	10	8	5	H	Branches touching building and overhanging the roof. Lightly prune to provide clearance and to remove large dead branches. Protect root zone in single area with tree #112.
112	Sitka Spruce (*Picea sitchensis*)	45,37	18	7	7	3	5	4	H	Branches touching building and overhanging the roof. Lightly prune to provide clearance and to remove large dead branches. Protect root zone in single area with tree #111.
113	English Oak (*Quercus robur*)	25	16	2	5	3	3	5	H	Uneven canopy due to phototrophic growth. Deadwood in lower canopy. Protect root zone as a single tree.
114	Big Leaf Maple (*Acer macrophyllum*)	22	18	2	4	5	2	5	M	Protect root zone as part of group with #115 and #116.
115	Norway Maple (*Acer platanoides*)	42	14	6	7	8	6	3	M	Canopy dieback. Protect root zone as part of group with #114 and #116.
116	Norway Maple (*Acer platanoides*)	31	17	7	5	7	6	5	M	Minor deadwood. Protect root zone as part of group with #114 and #115.
117	Douglas Fir (*Pseudotsuga menziesii*)	105	30	7	7	8	7	5	H	Deadwood and hanging branches. Butt swell. Prune to mitigate hazards. Carry out level 3 assessment of lower stem. Protect root zone as a single tree.

No.	Species	DBH	Ht	N	W	S	E	Condition	Suitability	Comments
118	Big Leaf Maple (*Acer macrophyllum*)	60,55 48,46 42,32	28	8	7	8	7	4	M	Large multi-stemmed tree growing very close to the building. Protect root zone as a single tree.
119	Red Oak (*Quercus rubra*)	13	8	2	2	2	2	4	H	Trees may be impacted by the installation of the site access route. Protect root zone as a single tree.
120	Red Oak (*Quercus rubra*)	15	9	3	3	3	3	5	H	Trees may be impacted by the installation of the site access route. Protect root zone as a single tree.

Appendix III – Photographs

The bases of western hemlocks growing at the north side of the main entry. Tree #10 should be removed before the construction work commences due to unresolvable conflict with the excavation.

The base of trees #11 and #12 positioned at the north side of the main entry. Given the already limited soil volume around these trees, it is imperative that their root zones are well protected.



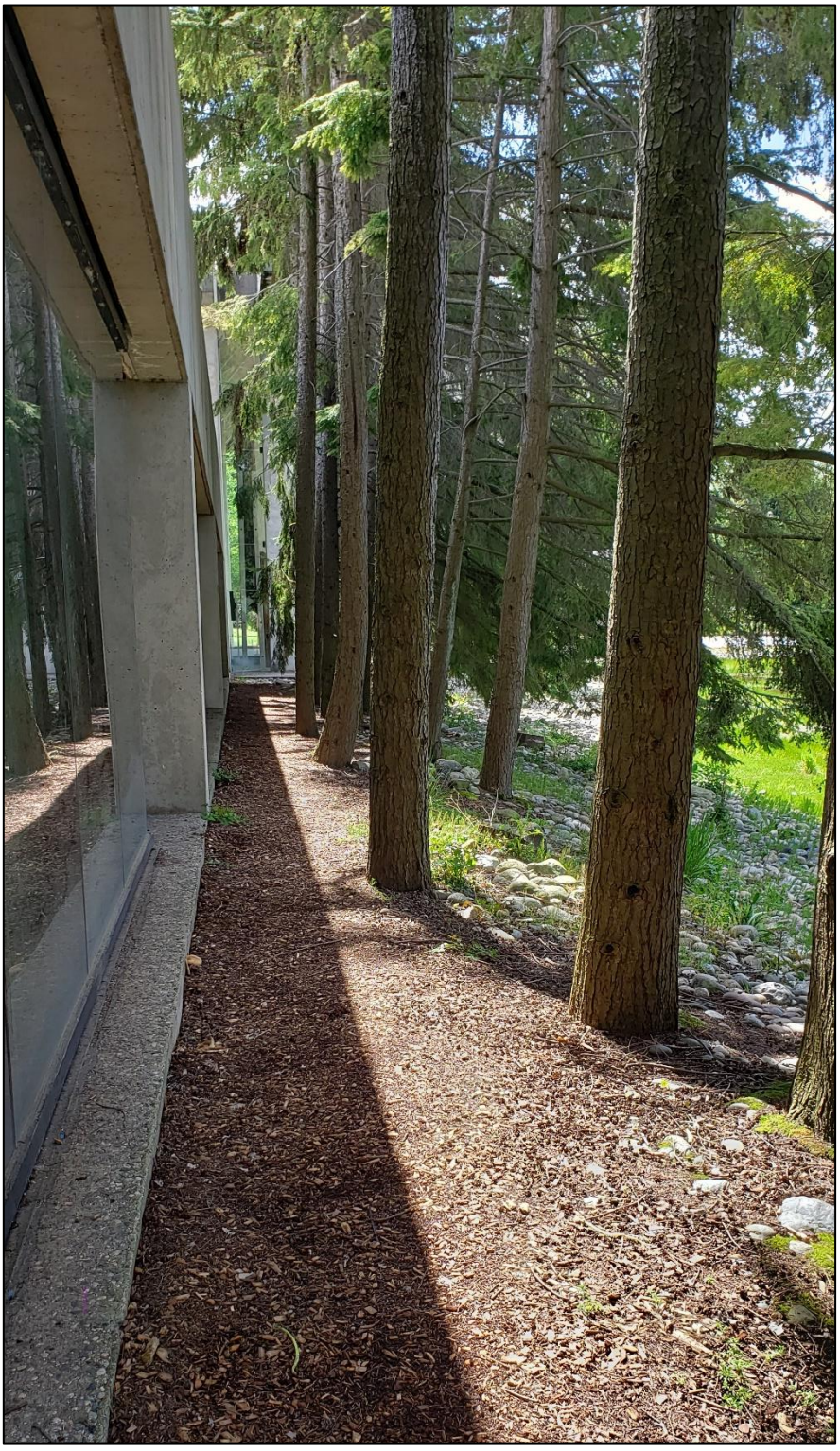
Trees overhanging the building should be sympathetically pruned back prior to work on the façade commencing. This should be carried out by a certified arborist under the direction of the project arborist.

The base of tree #49 showing fungal decay pathogen *Kretzschmaria deusta*. Trees with identified hazards should be considered for removal prior to construction staff occupying the site.

Trees along the east side of the building will require root zone protection during the façade cleaning.

Western red cedar tree #96 is too close to the excavation and installation of the concrete slab to survive. It should be removed before construction work commences and where possible, the resulting wood used by local craft persons.

The western hemlocks along the west façade should be protected following the removal of trees impacted by the required excavation towards the southern end of the row. Replacement planting using native conifers will help to ensure the longevity of this important group.



The ground between the western hemlocks and the western façade is used by security personnel and may be prone to compaction. Aerating this soil and providing and alternative walking route will help to improve the long term health of these trees.

Appendix IV – Tree Protection

Tree Protection Distance Table

*Minimum Protection Required Around Tree

Tree Trunk Diameter			Distance from Trunk		Total Diameter	
cm	inches	feet	**m**	feet	**m**	feet
20	8	0.6	**1.2**	3.9	**2.60**	8.5
25	10	0.8	**1.5**	4.9	**3.25**	10.7
30	12	1.0	**1.8**	5.9	**3.90**	12.8
35	14	1.2	**2.1**	6.9	**4.55**	14.9
40	16	1.3	**2.4**	7.9	**5.20**	17.1
45	18	1.5	**2.7**	8.9	**5.85**	19.2
50	20	1.7	**3.0**	9.8	**6.50**	21.3
55	22	1.8	**3.3**	10.8	**7.15**	23.5
60	24	2.0	**3.6**	11.8	**7.80**	29.6
75	30	2.5	**4.5**	14.8	**9.75**	32.0
90	36	3.0	**5.0**	16.4	**10.90**	35.8
100	40	3.3	**6.0**	19.7	**13.00**	42.7

Tree Protection Zone Signage

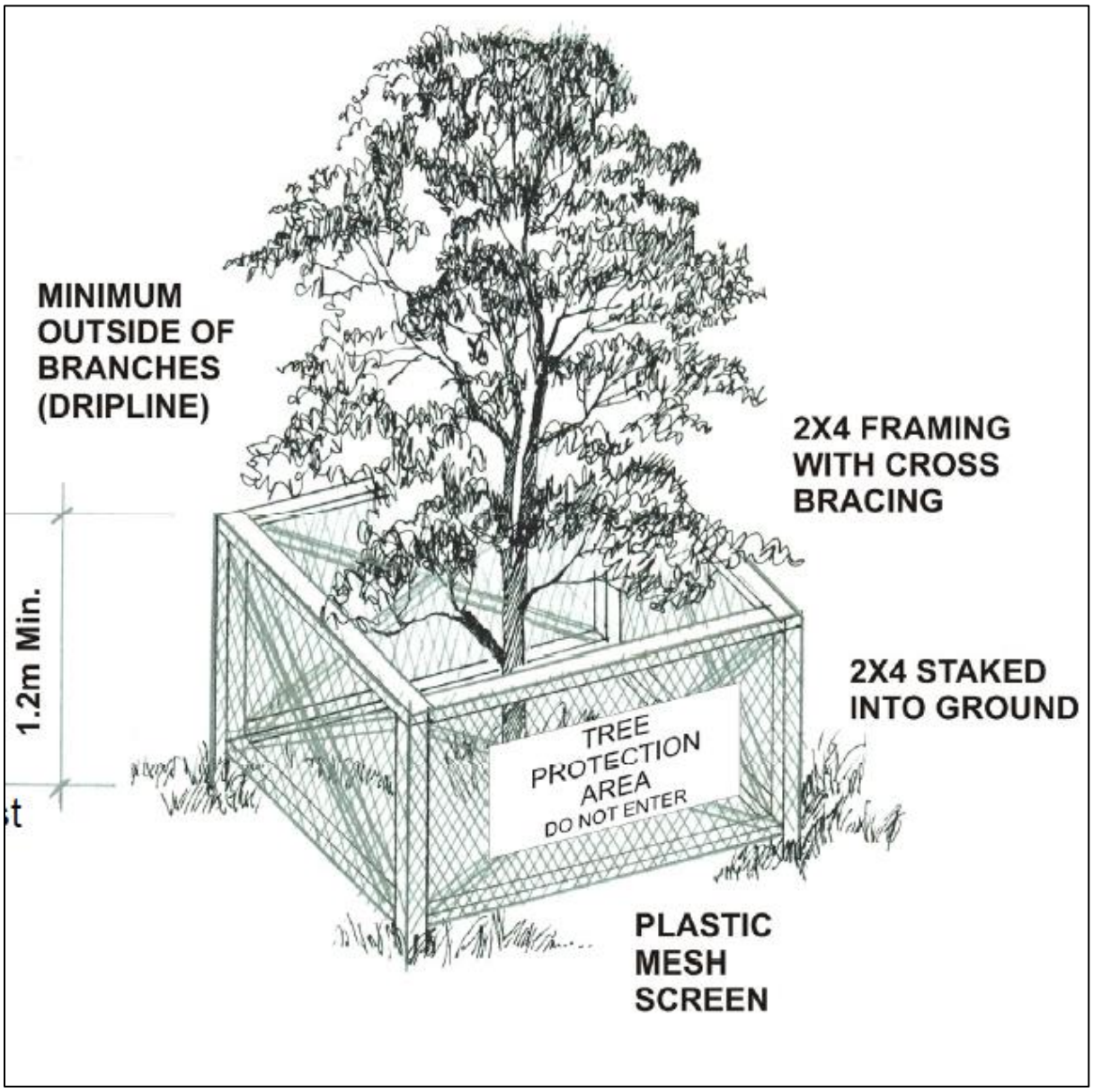
All TPZ are required to have signage as shown in Fig. 2. The signage must be a minimum of 11"x14" in size on *at least* 2 sides. A sign is now available for download from the City of Richmond's Tree Bylaw webpage at www.richmond.ca/sustainability/environment/treeremoval.htm

For Tree Protection Barrier inspection requests and enquiries call 604-247-4684.

NOTE: Failure to maintain tree protection barriers may result in fines of up to $10,000.00 per offence.

Fig. 2 – Tree Protection Zone Sign

Example Tree Protection Signage (City of Richmond)


MINIMUM
OUTSIDE OF
BRANCHES
(DRIPLINE)
2X4 FRAMING
WITH CROSS
BRACING
1.2m Min.
2X4 STAKED
INTO GROUND
TREE
PROTECTION
AREA
DO NOT ENTER
PLASTIC
MESH
SCREEN

Appendix V - Assumptions and Limiting Conditions

Any legal description provided to the consultant is assumed to be correct. Any titles and ownership to any property are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is evaluated as though free and clear, under responsible ownership and competent management.

Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.

The consultant shall not be required to give testimony or attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

Loss or alteration of any part of this report invalidates the entire report.

Possession of this report or a copy thereof does not imply right of publication of use for any purpose by any other than the persons to whom it is addressed, without the prior expressed written or verbal consent of the consultant.

This report, or any copy thereof, shall not be conveyed, in whole or in part, by anyone, including the client, to the public via any media type or outlet, without the prior expressed consent of the consultant specifically as to value conclusions, identity of the consultant, or any reference to any professional society or institute or to any initialed designation conferred upon the consultant as stated in his qualification.

This report and values expressed herein represent the opinion of the consultant, and the consultant's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.

Illustrations, 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.

Information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection. There is no warranty or guarantee, expressed or implied, that problems of deficiencies of the plans or property in question may not arise in the future.

Appendix VI - Certificate of Performance

I, Craig Southwell, certify that:

I have no current or prospective interest in the trees on the property, and have no personal interest or bias with respect to the parties involved;

The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts;

My analysis, opinions, and conclusions were developed and this report has been prepared according to commonly accepted arboricultural practices;

No one provided significant professional assistance to me, except as indicated within this report;

My compensation is not contingent upon the reporting of a predetermined conclusion that factors the cause of the client or any other party, nor upon the results of the assessment, the attainment of stipulated results, or the occurrence of any subsequent events.

I further certify that I am an ASCA Registered Consulting Arborist #692, an International Society of Arboriculture Certified Arborist # UI-0484A, and am tree risk assessment qualified. I am a member in good standing of the International Society of Arboriculture. I have been involved in the field of Arboriculture in a fulltime capacity for a period of twenty five years.

Signed: _____ Date: May 27, 2020