Arboricultural Inventory and Report

For:
Infrastructure Development-Project Services
The University of British Columbia

Site Location:
MacLeod Building
UBC Point Grey Campus
2356 Main Mall
Musqueam Traditional Territory

To be submitted with Tree Retention and Removal Plan dated April 23, 2020

Submitted to:
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Date: April 29, 2020

Submitted by:

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The following Diamond Head Consulting staff conducted the on-site tree inventory and prepared or reviewed the report.

All general and professional liability insurance and staff accreditations are provided below for reference.

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Please contact us if there are any questions or concerns about the contents of this report.

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Scope of Assignment:

Diamond Head Consulting Ltd. (DHC) was retained to complete an arboricultural assessment to supplement the proposed development for the MacLeod Building, UBC Point Grey Campus, 2356 Main Mall. This report contains an inventory of protected on and off-site trees and summarizes management recommendations with respect to future development plans and construction activities. Off-site trees are included because pursuant to municipal bylaws, site owners must include the management of off-site trees that are within the scope of the development. This report is produced with the following primary limitations, detailed limitations specified in Appendix 6:

1) Our investigation is based solely on visual inspection of the trees during our last site visit. This inspection is conducted from ground level. We do not conduct aerial inspections, soil tests or below grade root examinations to assess the condition of tree root systems unless specifically contracted to do so.

2) Unless otherwise stated, tree risk assessments in this report are limited to trees with a *high* or *extreme* risk rating in their current condition, and in context of their surrounding land use at the time of assessment.

3) The scope of work is primarily determined by site boundaries and local tree-related bylaws. Only trees specified in the scope of work were assessed.

4) Beyond six months from the date of this report, the client must contact DHC to confirm its validity because site base plans and tree conditions may change beyond the original report's scope. Additional site visits and report revisions may be required after this point to ensure report accuracy for the municipality's development permit application process. Site visits and reporting required after the first submission are not included within the original proposal fee and will be charged to the client at an additional cost.

The client is responsible for:

- Reviewing this report to understand and implement all tree **risk**, removal and protection requirements related to the project.
- Understanding that we did not assess trees off the subject property and therefore cannot be held liable for actions you or your contractors may undertake in developing this property which may affect the trees on neighboring properties.
- Obtaining a tree removal permit from the relevant municipal authority prior to any tree cutting.
- Obtaining relevant permission from adjacent property owners before removing off-site trees and vegetation.
- Obtaining a timber mark if logs are being transported offsite.
- Ensuring the project is compliant with the tree permit conditions.
- Constructing and maintaining tree protection fencing.
- Ensuring an arborist is present onsite to supervise any works in or near tree protection zones.

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1.0 Introduction

1.1 Site Overview

The MacLeod Building is located at 2356 Main Mall at UBC's Point Grey Campus, on Musqueam traditional territory. Several of the iconic red oak trees adjacent to the paved walkway area of the Main Mall are close to the building and a number of other significant trees are found close to the building. The paved area has been upgraded in recent years and during most times of the year hosts high pedestrian traffic.

1.2 Proposed Land Use Changes

The proposed development consists of a large renovation project for the MacLeod Building on the UBC Point Grey Campus.

1.3 Report Objective

This report has been prepared to ensure the proposed development is compliant with The University Endowment Lands' *Lands Use, Building and Community Administration Bylaw.* The bylaw requires that all trees 15cm DBH or larger are inventoried.

This report outlines the existing condition of protected trees on and adjacent to the property, summarizes the proposed tree retention and removal, and suggests guidelines for protecting retained trees during the construction process.

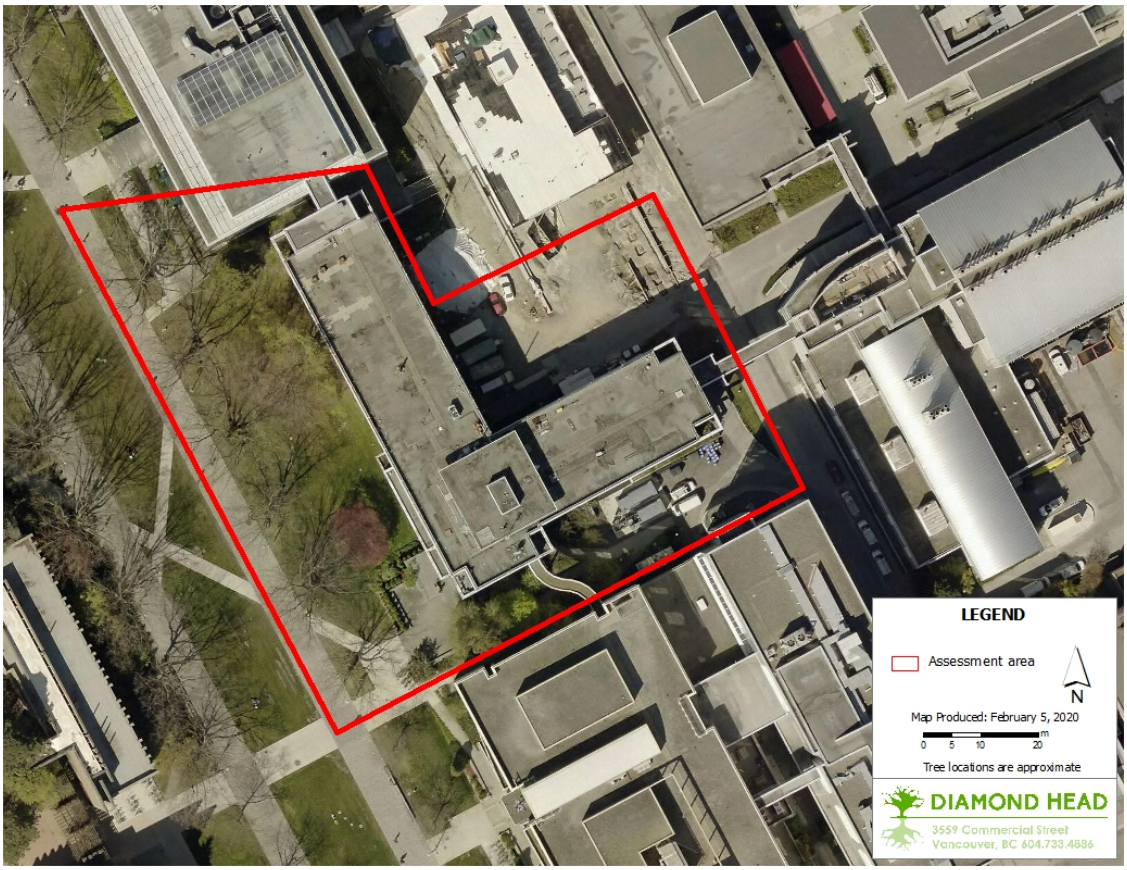

Figure 1. The MacLeod Building in the context of the surrounding landscape and infrastructure.

2.0 Process and Methods

Dan Brown of DHC visited the site on February 4, 2020. On this day there was significant snow which impeded the thorough inspection of the bases of some trees. The following methods and standards are used throughout this report.

2.1 Tree Inventory

Trees on site and trees shared with adjacent properties were marked with a numbered tag and assessed for attributes including: species; height measured to the nearest meter; and, diameter at breast height (DBH) measured to the nearest centimeter at 1.4 m above grade. Off-site trees were inventoried, but not tagged. The general health and structural integrity of each tree was assessed visually and assigned to one of five categories: *excellent; good; moderate; poor; or dying/dead*. Descriptions of the health and structure rating criteria are given in Appendix 2.

Tree retention value, categorized as *high, medium, low, or nil,* was assigned to each tree or group of trees based on their health and structure rating, and potential longevity in a developed environment. Descriptions of the retention value ratings are given in Appendix 3. Recommendations for tree retention or removal were determined by taking in to account a tree's retention value rating, its location in relation to proposed building envelopes and development infrastructure.

2.2 Tree Risk Assessment

Tree risk assessments were completed following methods of the ISA Tree Risk Assessment Manual[1] published in 2013 by the International Society of Arboriculture, which is the current industry standard for assessing tree risk. This methodology assigns risk based on the likelihood of failure, the likelihood of impact and the severity of consequence if a failure occurs. Only on-site hazard trees that had *high* or *extreme* risk ratings in their current condition and in context of their surrounding land use were identified and reported in section 3.2. Appendix 4 gives the likelihood and risk rating matrices used to categorize tree risk. DHC recommends that on-site trees be re-assessed for risk after the site conditions change (e.g. after damaging weather events, site disturbance from construction, creation of new targets during construction or in the final developed landscape).

2.3 Tree Protection and Replacement

Tree Protection Zones were calculated for each tree based on professional judgement of the project arborist to accommodate species specific tolerances and site specific growing conditions.

[1] Dunster, J.A., Smiley, E.T., Matheny, N. and Lilly, S. (2013). Tree Risk Assessment Manual. *International Society of Arboriculture*. Champaign, Illinois.

3.0 Findings: Tree Inventory and Risk Assessment

3.1 Tree Inventory

The complete tree inventory is found in Table 1.

Trees On-site

A total of 31 trees were inventoried, 4 of which are evergreen coniferous and the remaining 27 are deciduous broadleaves.

Of the on-site trees, 15 have good or excellent health and structure; they have high retention value and potential longevity in an urban landscape. A further 13 trees have moderate health and structure and have medium retention value but may require remedial work to promote their health and structural integrity if retained. 3 trees have poor health and structure and have low retention value.

Trees on Adjacent Properties

All trees are located on campus grounds and all that were considered within the potential zone of influence of the proposed development, were inventoried. All trees are considered to be on-site trees.

Table 1: Tree Inventory Table for the MacLeod Building, UBC Point Grey Campus

Tree Protection Zones are measured from the outer edge of a tree's stem. If using these measurements for mapping the tree protection zone, ½ the tree's diameter must be added to the distance to accommodate a survey point at the tree's center. Refer to Appendix 5 for construction guidelines. It is recommended that all trees being retained receive irrigation and root zone enhancements as per the construction guidelines in Appendix 5. Tree protection fencing should be installed prior to any work beginning, irrigation and monitoring of health should continue for at least three years following the completion of all work.

*TPZ is the tree protection zone size required by the relevant municipal bylaw or, if not defined, the project arborist.

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2756	Red Oak	Quercus rubra	37	9	40-59%	5	Good	Crown raised to 3 m, some pruning wounds not fully calloused, though appear recent.	High	Retain	Tree is outside of limit of work but should be protected as per the tree management plan and TPZ specification, to ensure no impacts occur during the work.	3.7
2757	Red Oak	Quercus rubra	81	11	40-59%	10	Moderate	Crown raised to 3m. Minor deadwood and some dieback. Single stem to 2m then union of 5 main scaffolds. Union between the 2 sides is acute with included bark and bleeding. Should be monitored with consideration given to load reduction and/or bracing.	High	Retain	Provide tree protection as per tree management plan and TPZ specification. New concrete/hardscape within the critical root zones of trees #2757 and #2758 must be installed above the existing grade, using low impact specification to be reviewed and approved by the project arborist. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	9.72

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2758	Red Oak	Quercus rubra	101	14	40-59%	12	Good	Crown raised to 3 m. Minor deadwood. Single stem to 1.8 m then union of 3 main stems that divide further into decurrent form. 1 un-calloused pruning wound at 3m in centre of crown, surround by necrotic bark may indicate reduced vigour. Ongoing and slight reductions in branch end weight could extend longevity.	High	Retain	Provide tree protection as per tree management plan and TPZ specification. New concrete/hardscape within the critical root zones of trees #2757 and #2758 must be installed above the existing grade, using low impact specification to be reviewed and approved by the project arborist. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	12.1
2759	Japanese Maple	Acer palmatum	55	6	60-79%	5	Moderate	20+20+15cm DBH and 5 smaller branches/stems. Lots of snow around base but unions appear poor though due to size of tree loading on unions is low.	Medium	Retain	Outside of limit of work. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	3.3
2760	Red Oak	Quercus rubra	80	14	40-59%	14	Good	Crown raised to 4 m. Minor deadwood. Some larger pruning wounds with limited callous.	High	Retain	Outside of limit of work but may have been impacted by prior upgrades to mall walkway/paving. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	9.6

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2761	Red Oak	Quercus rubra	85	14	40-59%	14	Good	Crown raised to 3 m. Minor deadwood. Some large pruning wounds with limited callous. Ongoing and slight reductions in branch end weight could extend longevity.	High	Retain	Outside of limit of work but may have been impacted by prior upgrades to mall walkway/paving. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	10.2
2762	European Beech	Fagus sylvatica	56	18	60-79%	11	Good	Group of 3 of same species, with shared crown. Retention value high together.	Medium	Retain	Outside of limit of work but may have been impacted by prior upgrades to mall walkway/paving. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	6.72
2763	European Beech	Fagus sylvatica	62	18	60-79%	11	Good	Group of 3 of same species, with shared crown. Retention value high together.	Medium	Retain	Outside of limit of work. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	7.44

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2764	European Beech	Fagus sylvatica	73	18	60-79%	11	Good	Group of 3 of same species, with shared crown. Retention value high together.	Medium	Retain	Provide tree protection as per tree management plan and TPZ specification. Arborist supervision is required for the trenching running parallel to the building and limit of work. Vertical shoring of the trench wall is required and low impact excavation (such as hydro-vac and airspade) should be implemented to limit impacts to tree roots. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	8.76
2765	Red Oak	Quercus rubra	73	14	40-59%	14	Good	Crown raised to 3 m. Minor deadwood. Some large pruning wounds, callousing well. Ongoing and slight reductions in branch end weight could extend longevity.	High	Retain	Outside of limit of work but may have been impacted by prior upgrades to mall walkway/paving. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail.	8.76

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2766	Japanese Cedar	Cryptomeria japonica	60	19	80-100%	4	Good	Live crown almost to base. Retaining wall 2m to north.	High	Retain	Provide tree protection as per tree management plan and TPZ specification. Arborist supervision is required for the trenching running parallel to the building and limit of work. Vertical shoring of the trench wall is required and low impact excavation (such as hydro-vac and airspade) should be implemented to limit impacts to tree roots. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail. Construction access should not be permitted via path/walkway adjacent to this tree.	7.2
2767	Red Oak	Quercus rubra	100	14	40-59%	15	Good	Crown raised to 4 m. Massive scaffold limbs from 2m. 1 large limb removed (appears limb failed or tore our during pruning due to shape of wound) from north side, whic may allow heartwood decay into main stem. Ongoing and slight reductions in branch end weight could extend longevity.	High	Retain	Outside of limit of work but may have been impacted by prior upgrades to mall walkway/paving. Irrigation and organic mulch should be considered within TPZs, refer to Appendix 5 for detail. Construction access should not be permitted via path/walkway adjacent to this tree.	12

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2768	Juniper spp.	Juniperus spp.	30	5	60-79%	3	Moderate	Multistemmed, growing very close to stairs.	Medium	Remove	In conflict with existing infrastructure and proposed work.	
2769	Juniper spp.	Juniperus spp.	20	5	20-39%	3	Poor	Small, multistemmed, in contact with concrete platform at entrance to building.	Nil	Remove	In conflict with existing infrastructure and proposed work.	
2770	Juniper spp.	Juniperus spp.	20	5	20-39%	3	Poor	Small, multistemmed, in contact with concrete platform at entrance to building. 1 failed stem still attached.	Nil	Remove	In conflict with existing infrastructure and proposed work.	
2771	Silver Birch	Betula pendula	110	12	40-59%	7	Moderate	40+40+30cm DBH. One stem in contact with concrete platform at building entrance. Appears to have had some height reduction, possibly to remediate bronze birch borer dieback.	Low	Remove	In conflict with existing infrastructure and proposed work.	
2772	Japanese Maple	Acer palmatum	55	6	40-59%	5	Good	19+18+18 cm DBH. Growing in bed between buildings.	High	Retain	Provide tree protection as per tree management plan and TPZ specification.	3.3

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2773	Kousa Dogwood	Cornus kousa	10	5	40-59%	3	Moderate	Growing in bed between buildings, less than 2m from McLeod Building.	Medium	Remove	In conflict with proposed work.	
2774	Kousa Dogwood	Cornus kousa	14	5	40-59%	3	Moderate	7+7cm DBH. Growing in bed between buildings, less than 3m from McLeod Building.	Medium	Remove	In conflict with proposed work.	
2775	Japanese Maple	Acer palmatum	50	6	40-59%	3	Good	20+15+15cm DBH. Growing in bed between buildings. 1m from building. Will require ongoing pruning to maintain building clearance.	Medium	Retain	Outside of limit of work but provision of tree protection as per tree management plan and TPZ specification is recommended to avoid damage from construction access.	3
2776	Kousa Dogwood	Cornus kousa	30	6	40-59%	3	Moderate	10+10+5+5cm DBH. Growing in bed between buildings. 1m from building. Will require ongoing pruning to maintain building clearance.	Medium	Retain	Outside of limit of work but provision of tree protection as per tree management plan and TPZ specification is recommended to avoid damage from construction access.	2

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2777	Kousa Dogwood	Cornus kousa	25	6	40-59%	3	Moderate	10+10+5cm DBH. Growing in bed between buildings. 3m from building. Will require ongoing pruning to maintain building clearance.	Medium	Retain	Outside of limit of work but provision of tree protection as per tree management plan and TPZ specification is recommended to avoid damage from construction access.	2
2778	Vine Maple	Acer circinatum	40	5	40-59%	3	Good	4 x 10cm DBH. Growing in bed between buildings. 1m from concrete walkway and 2m from building. Will require ongoing pruning to maintain building clearance.	Medium	Remove	In conflict with proposed work.	
2779	Vine Maple	Acer circinatum	45	6	40-59%	3	Good	6 x 7-12cm DBH. Growing in bed between buildings. 3m from building, 1m from concrete sidewalks on north and south sides. Will require ongoing pruning to maintain building clearance.	Medium	Retain	Outside of limit of work but provision of tree protection as per tree management plan and TPZ specification is recommended to avoid damage from construction access.	2.7
2780	Kousa Dogwood	Cornus kousa	12	5	40-59%	2	Good	Growing in bed between buildings. 3m from building, 1m from concrete sidewalk to south.	Medium	Remove	In conflict with proposed work.	

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
2781	Kousa Dogwood	Cornus kousa	21	5	40-59%	3	Moderate	8+8+5cm DBH. Growing in bed between buildings. 1m from building, 1m from concrete lock-block retaining wall. Will require ongoing pruning to maintain building clearance.	Medium	Remove	In conflict with proposed work.	
2782	Arbutus	Arbutus menziesii	18	5	40-59%	4	Poor	Abutting building, very heavy lean to east. Not suitable for retention due to conflicts with building.	Nil	Remove	In conflict with existing infrastructure and proposed work.	
MV1	Vine Maple	Acer circinatum	10	4	40-59%	2	Moderate	Group of 4 vine maples, 3 of which are surveyed. Growing between buildings. Too small to tag. 1 above retaining wall, 3 below.	Medium	Remove	In conflict with the proposed work.	
MV2	Vine Maple	Acer circinatum	10	4	40-59%	2	Moderate	Group of 4 vine maples, 3 of which are surveyed. Growing between buildings. Too small to tag. 1 above retaining wall, 3 below.	Medium	Remove	In conflict with the proposed work.	
MV3	Vine Maple	Acer circinatum	10	4	40-59%	2	Moderate	Group of 4 vine maples, 3 of which are surveyed. Growing between buildings. Too small to tag. 1 above retaining wall, 3 below.	Medium	Remove	In conflict with the proposed work.	

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
MV4	Vine Maple	Acer circinatum	30	4	40-59%	2	Moderate	Group of 4 vine maples, 3 of which are surveyed. Growing between buildings. Too small to tag. 1 above retaining wall, 3 below.	Medium	Remove	In conflict with the proposed work.	
Courtyard-1	Cotoneaster	Cotoneaster sp.	10	4	40-59%	2	Moderate	Multstemmed. Rooting area restricted by retaining walls on south side.	Medium	Retain	Hardy shrub, tree protection not required.	2
Courtyard-2	Ash	Fraxinus sp.	5	3	40-59%	1	Moderate	Growing from cut-out in wooden deck, which covers rooting area.	Medium	Retain	Surrounded by hardscape and outside of limit of work, tree protection not required.	1
Courtyard-3	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	
Courtyard-4	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	
Courtyard-5	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	
Courtyard-6	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	
Courtyard-7	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	
Courtyard-8	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	

Tag #	Species Common Name	Botanical Name	DBH (cm)	Height (m)	LCR	Dripline Radius (m)	Health and Structure Rating	Comments	Retention Value Rating	Retain/ Remove	Retention/TPZ Comments	*TPZ (m)
Courtyard-9	Dogwood	Cornus kousa	10	2	40-59%	1	Moderate	Recently planted. Rooting area entirely covered in grass/maintained lawn.	Medium	Remove	In conflict with required construction access and staging area.	1

3.2 Tree Risk Assessment

There were no trees on this site that posed a *high* or *extreme* risk at the time of assessment.

4.0 Tree Replacement

The requirement for replacement trees will be determined by UBC Development Services.

5.0 Discussion and Summary

5.1 Trees On-site

Most of the trees inventoried were in good or moderate condition and have been well maintained. The red oaks growing adjacent to the paved Main Mall walkway are likely to have been impacted by the upgrades to the walkway, but all appear to be in moderate or good condition. Regular monitoring and inspections of the trees are recommended due to the high use of the area by pedestrians and high value of the trees to the surrounding landscape.

Due to the challenges faced by trees in urban environments, it is recommended that all tree protection measures and construction guidelines outlined in Appendix 5, be implemented prior to, during and following the proposed work, to ensure the protected trees are in optimal condition.

Appendix 1 Site Photographs

Photo 1. View of the red oak trees on Main Mall, looking north. Tree #2757 is far left.

Photo 2. View, from left, of trees #2769, #2770 (junipers) and #2771 (birch), with the entrance to the MacLeod Building visible far left.

Photo 3. View of tree #2780, typical of the dogwoods growing to the south of the MacLeod Building, between it and the building to the south.

Photo 4. View of tree #2778, typical of the maples growing to the south of the MacLeod Building, between it and the building to the south. The south entrance to the MacLeod Building is visible behind.

Appendix 2 Tree Health and Structure Rating Criteria

The tree health and structure ratings used by Diamond Head Consulting summarize each tree based on both positive and negative attributes using five stratified categories. These ratings indicate health and structural conditions that influence a tree's ability to withstand local site disturbance during the construction process (assuming appropriate tree protection) and benefit a future urban landscape.

Excellent: Tree of possible specimen quality, unique species or size with no discernible defects.

Good: Tree has no significant structural defects or health concerns, considering its growing environment and species.

Moderate: Tree has noted health and/or minor to moderate structural defects. This tree can be retained, but may need mitigation (e.g., pruning or bracing) and monitoring post-development. A moderate tree may be suitable for retention within a stand or group, but not suitable on its own.

Poor: Tree is in serious decline from previous growth habit or stature, has multiple defined health or structural weaknesses. It is unlikely to acclimate to future site use change. This tree is not suitable for retention within striking distance of most targets.

Dying/Dead: Tree is in severe decline, has severe defects or was found to be dead.

Appendix 3 Tree Retention Value Rating Criteria

The tree retention value ratings used by Diamond Head Consulting provide guidance for tree retention planning. Each tree in an inventory is assigned to one of four stratified categories that reflect its value as a future amenity and environmental asset in a developed landscape. Tree retention value ratings take in to account the health and structure rating, species profile*, growing conditions and potential longevity assuming a tree's growing environment is not compromised from its current state.

High: Tree suitable for retention. Has a good or excellent health and structure rating. Tree is open grown, an anchor tree on the edge of a stand or dominant within a stand or group. Species of *Populus, Alnus* and *Betula* are excluded from this category.

Medium: Tree suitable for retention with some caveats or suitable within a group**. Tree has moderate health and structure rating, but is likely to require remedial work to mitigate minor health or structural defects. Includes trees that are recently exposed, but wind firm, and trees grown on sites with poor rooting environments that may be ameliorated.

Low: Tree has marginal suitability for retention. Health and structure rating is moderate or poor; remedial work is unlikely to be viable. Trees within striking distance of a future site developments should be removed.

Nil: Tree is unsuitable for retention. It has a dying/dead or poor health and structure rating. It is likely that the tree will not survive, or it poses and unacceptable hazard in the context of future site developments.

* The species profile is based upon mature age and height/spread of the species, adaptability to land use changes and tree species susceptibility to diseases, pathogen and insect infestation.

** Trees that are 'suitable as a group' have grown in groups or stands that have a single, closed canopy. They have not developed the necessary trunk taper, branch and root structure that would allow then to be retained individually. These trees should only be retained in groups.

Appendix 4 Risk Rating Matrices

Trees with a *probable* or *imminent* likelihood of failure, a *medium* or *high* likelihood of impacting a specified target, and a *significant* or *severe* consequence of failure have been assessed for risk and included in this report (Section 3.2). These two risk rating matrices showing the categories used to assign risk are taken without modification to their content from the International Society of Arboriculture Tree Risk Assessment Qualification Manual.

Matrix 1: Likelihood

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	**Low**	**Medium**	**High**
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2: Risk Rating

Likelihood of Failure and Impact	Consequences of Failure			
	Negligible	**Minor**	**Significant**	**Severe**
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Appendix 5 Construction Guidelines

Tree management recommendations in this report are made under the expectation that the following guidelines for risk mitigation and proper tree protection will be adhered to during construction.

Respecting these guidelines will prevent changes to the soil and rooting conditions, contamination due to spills and waste, or physical wounding of the trees. Any plans for construction work and activities that deviate from or contradict these guidelines should be discussed with the project arborist so that mitigation measures can be implemented.

Tree Protection Zones

A Tree protection zone (TPZ) is determined using either dripline or a DBH multiplier to define a radius measured in all directions from the outside of a tree's trunk. It is typically determined according to local municipal bylaw specifications and may be modified based on professional judgement of the project arborist to accommodate species specific tolerances and site specific growing conditions. For retained trees, the TPZ and fencing indicated in this report are proposed as suitable in relation to the level of disturbance proposed on the site plan provided to the project arborist. Arborist consultation is required if any additional work beyond the scope of the plans provided is proposed near the tree. Work done in addition to the proposed impacts discussed in this report may cause the tree to decline and die.

Tree Protection Fencing: Tree protection zones (TPZs) will be protected by Tree Protection Fencing except where site features constrict roots (e.g., retaining walls or roads), where continual access is required (e.g., sidewalks), or when an acceptable encroachment into the TPZ is proposed, in which case the fencing will be modified. Tree Protection Fencing is shown on the Tree Protection Plan and, where it varies from the TPZ, the rationale is described in the inventory table in Section 3.1.

Within a TPZ, no construction activity, including materials storage, grading or landscaping, may occur without project arborist approval. Within the TPZ, the following are tree preservation guidelines based on industry standards for best practice and local municipal requirements:

- No soil disturbance or stripping.
- Maintain the natural grade.
- No storage, dumping of materials, parking, underground utilities or fires within TPZs or tree driplines.
- Any planned construction and landscaping activities affecting trees should be reviewed and approved by a consulting arborist.
- Install specially designed foundations and paving when these structures are required within TPZs.
- Route utilities around TPZs.
- Excavation within the TPZs should be supervised by a consultant arborist.
- Surface drainage should not be altered in such a way that water is directed in or out of the TPZ.

- Site drainage improvements should be designed to maintain the natural water table levels within the TPZ.

Prior to any construction activity, Tree Protection Fencing must be constructed as shown on the Tree Protection Plan. The protection barrier or temporary fencing must be at least 1.2 m in height and constructed of 2" by 4" lumber with orange plastic mesh screening. Tree Protection Fencing must be constructed prior to tree removal, excavation or construction and remain intact for the entire duration of construction.

Tree Crown Protection and Pruning

All heavy machinery (excavators, cranes, dump trucks, etc.) working within five meters of a tree's crown should be made aware of their proximity to the tree. If there is to be a sustained period of machinery working within five meters of a tree's crown, a of line of colored flags should be suspended at eye-level of the machinery operator for the length of the protected tree area. Any concerns regarding the clearance required for machinery and workers within or immediately outside tree protection zones should be referred to the project arborist so that a zone surrounding the crowns can be established or pruning measures undertaken. Any wounds incurred to protected trees during construction should be reported to the project arborist immediately.

Unsurveyed Trees

Unsurveyed trees identified by DHC in the Tree Retention Plan have been hand plotted for approximate location only using GPS coordinates and field observations. The location and ownership of unsurveyed trees cannot be confirmed without a legal surveyed. The property owner or project developer must ensure that all relevant on- and off-site trees are surveyed by a legally registered surveyor, whether they are identified by DHC or not.

Removal of logs from sites

Private timber marks are required to transport logs from privately-owned land in BC. It is property owner's responsibility to apply for a timber mark prior to removing any merchantable timber from the site. Additional information can be found at: http://www.for.gov.bc.ca/hth/private-timber-marks.htm

Regulation of Soil Moisture and Drainage

Excavation and construction activities adjacent to TPZs can influence the availability of moisture to protected trees. This is due to a reduction in the total root mass, changes in local drainage conditions, and changes in exposure including reflected heat from adjacent hard surfaces. To mitigate these concerns the following guidelines should be followed:

- Soil moisture conditions within the tree root protection zones should be monitored during hot and dry weather. When soil moisture is inadequate, supplemental irrigation should be provided that penetrates soil to the depth of the root system or a minimum of 30 cm.
- Any planned changes to surface grades within the TPZs, including the placement of mulch, should be designed so that any water will flow away from tree trunks.

- Excavations adjacent to trees can alter local soil hydrology by draining water more rapidly from TPZs more rapidly than it would prior to site changes. It is recommended that when excavating within 6 m of any tree, the site be irrigated more frequently to account for this.

Root Zone Enhancements and Fertilization

Root zone enhancements such as mulch, and fertilizer treatments may be recommended by the project arborist during any phase of the project if they deem it necessary to maintain tree health and future survival.

Paving Within and Adjacent to TPZs

If development plans propose the construction of paved areas and/or retaining walls close to TPZs, measures should be taken to minimize impacts. Construction of these features would raise concerns for proper soil aeration, drainage, irrigation and the available soil volume for adequate root growth. The following design and construction guidelines for paving and retaining walls are recommended to minimize the long-term impacts of construction on protected trees:

- Any excavation activities near or within the TPZ should be monitored by a certified arborist. Structures should be designed, and excavation activities undertaken to remove and disturb as little of the rooting zone as possible. All roots greater than 2 cm in diameter should be hand pruned by a Certified Arborist.
- The natural grade of a TPZ should be maintained. Any retaining walls should be designed at heights that maintain the existing grade within 20 cm of its current level. If the grade is altered, it should be raised not reduced in height.
- Compaction of sub grade materials can cause trees to develop shallow rooting systems. This can contribute to long-term pavement damage as roots grow. Minimizing the compaction of subgrade materials by using structural soils or other engineered solutions and increasing the strength of the pavement reduces reliance on the sub-grade for strength.
- If it is not possible to minimize the compaction of sub-grade materials, subsurface barriers should be considered to help direct roots downward into the soil and prevent them from growing directly under the paved surfaces.

Plantings within TPZs

Any plans to landscape the ground within the TPZ should implement measures to minimize negative impacts on the above or below ground parts of a tree. Existing grass layer in TPZs should not be stripped because this will damage surface tree roots. Grass layer should be covered with mulch at the start of the project, which will gradually kill the grass while moderating soil moisture and temperatures. Topsoil should be mixed with the mulch prior to planting of shrubs, but new topsoil layer should not be greater than 20 cm deep on top of the original grade. Planting should take place within the newly placed topsoil mixture and should not disturb the original rooting zone of the trees. A two-meter radius around the base of each tree should be left unplanted and covered in mulch; a tree's root collar should remain free from any amendments that raise the surface grade.

Monitoring during construction

Ongoing monitoring by a consultant arborist should occur for the duration of a development project. Site visits should be more frequent during activities that are higher risk, including the first stages of construction when excavation occurs adjacent to the trees. Site visits will ensure contractors are respecting the recommended tree protection measures and will allow the arborist to identify any new concerns that may arise.

During each site visit the following measures will be assessed and reported on by a consulting arborist:

- Health and condition of protected trees, including damage to branches, trunks and roots that may have resulted from construction activities, as will the health of. Recommendations for remediation will follow.
- Integrity of the TPZ and fencing.
- Changes to TPZ conditions including overall maintenance, parking on roots, and storing or dumping of materials within TPZ. If failures to maintain and respect the TPZ are observed, suggestions will be made to ensure tree protection measures are remediated and upheld.
- Review and confirmation of recommended tree maintenance including root pruning, irrigation, mulching and branch pruning.
- Changes to soil moisture levels and drainage patterns; and
- Factors that may be detrimentally impact the trees.

Appendix 6 Report Assumptions and Limiting Conditions

1) Unless expressly set out in this report or these Assumptions and Limiting Conditions, Diamond Head Consulting Ltd. ("Diamond Head") makes no guarantee, representation or warranty (express or implied) regarding this report, its findings, conclusions or recommendations contained herein, or the work referred to herein.

2) The work undertaken in connection with this report and preparation of this report have been conducted by Diamond Head for the "Client" as stated in the report above. It is intended for the sole and exclusive use by the Client for the purpose(s) set out in this report. Any use of, reliance on or decisions made based on this report by any person other than the Client, or by the Client for any purpose other than the purpose(s) set out in this report, is the sole responsibility of, and at the sole risk of, such other person or the Client, as the case may be. Diamond Head accepts no liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm (including without limitation financial or consequential effects on transactions or property values, and economic loss) that may be suffered or incurred by any person as a result of the use of or reliance on this report or the work referred to herein. The copying, distribution or publication of this report (except for the internal use of the Client) without the express written permission of Diamond Head (which consent may be withheld in Diamond Head's sole discretion) is prohibited. Diamond Head retains ownership of this report and all documents related thereto both generally and as instruments of professional service.

3) The findings, conclusions and recommendations made in this report reflect Diamond Head's best professional judgment given the information available at the time of preparation. This report has been prepared in a manner consistent with the level of care and skill normally exercised by arborists currently practicing under similar conditions in a similar geographic area and for specific application to the trees subject to this report on the date of this report. Except as expressly stated in this report, the findings, conclusions and recommendations it sets out are valid for the day on which the assessment leading to such findings, conclusions and recommendations was conducted. If generally accepted assessment techniques or prevailing professional standards and best practices change at a future date, modifications to the findings, conclusions, and recommendations in this report may be necessary. Diamond Head expressly excludes any duty to provide any such modification if generally accepted assessment techniques and prevailing professional standards and best practices change.

4) Conditions affecting the trees subject to this report (the "Conditions", include without limitation, structural defects, scars, decay, fungal fruiting bodies, evidence of insect attack, discolored foliage, condition of root structures, the degree and direction of lean, the general condition of the tree(s) and the surrounding site, and the proximity of property and people) other than those expressly addressed in this report may exist. Unless otherwise stated information contained in this report covers only those Conditions and trees at the time of inspection. The inspection is limited to visual examination of such Conditions and trees without dissection, excavation, probing or coring. While

every effort has been made to ensure that any trees recommended for retention are both healthy and safe, no guarantees, representations or warranties are made (express or implied) that those trees will not be subject to structural failure or decline. The Client acknowledges that it is both professionally and practically impossible to predict with absolute certainty the behavior of any single tree, or groups of trees, in all given circumstances. Inevitably, a standing tree will always pose some risk. Most trees have the potential for failure and this risk can only be eliminated if the risk is removed. If Conditions change or if additional information becomes available at a future date, modifications to the findings, conclusions, and recommendations in this report may be necessary. Diamond Head expressly excludes any duty to provide any such modification of Conditions change or additional information becomes available.

5) Nothing in this report is intended to constitute or provide a legal opinion and Diamond Head expressly disclaims any responsibility for matters legal in nature (including, without limitation, matters relating to title and ownership of real or personal property and matters relating to cultural and heritage values). Diamond Head makes no guarantee, representation or warranty (express or implied) as to the requirements of or compliance with applicable laws, rules, regulations, or policies established by federal, provincial, local government or First Nations bodies (collectively, "Government Bodies") or as to the availability of licenses, permits or authorizations of any Government Body. Revisions to any regulatory standards (including bylaws, policies, guidelines an any similar directions of a Government Bodies in effect from time to time) referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary. Diamond Head expressly excludes any duty to provide any such modification if any such regulatory standard is revised.

6) Diamond Head shall not be required to give testimony or to 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.

7) In preparing this report, Diamond Head has relied in good faith on information provided by certain persons, Government Bodies, government registries and agents and representatives of each of the foregoing, and Diamond Head assumes that such information is true, correct and accurate in all material respects. Diamond Head accepts no responsibility for any deficiency, misinterpretations or fraudulent acts of or information provided by such persons, bodies, registries, agents and representatives.

8) 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.

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