Diamond Head Consulting Ltd.
Arborist Report

For:

5616 Westport Place
West Vancouver, BC

December 3, 2014

To be submitted with Tree Protection Plan
Dated: December 3, 2014

Submitted to:

Synthesis Design
258 East 1st Street
North Vancouver, BC
V7L 1B3

Submitted by:

DIAMOND HEAD
CONSULTING LTD.

342 West 8th Avenue
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V5Y 3X2

The following Diamond Head Consulting staff performed the site visit and prepared the report. All general and professional liability insurance and individual accreditations have been provided below for reference.

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This report summarizes the planned management of trees on the site. If there are any questions or concerns as to the contents of this report, please contact us at any time.

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Insurance Information

WCB:	# 657906 AQ (003)
General Liability:	Northbridge General Insurance Corporation - Policy #CBC1935506, $5,000,000 (Mar 2014 to Mar 2015)
Errors & Omissions:	Lloyds Underwriters – Policy #1010346D, $1,000,000 (June 2011 to June 2015)

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1.0 Introduction

Diamond Head Consulting Ltd. (DHC) was asked to complete an assessment of the trees on and adjacent to the following proposed development:

Civic address:	**5616 Westport Place, West Vancouver BC**
Project No.:	unknown
Client name:	Synthesis Design
Date of site visit:	November 27, 2014
Weather during visit:	Overcast and rain

The objective of this report is to ensure the proposed development is in compliance with the District of West Vancouver Development Procedures Bylaw No. 3984, 1996. The trees at the site were assessed, including: species, diameter at breast height (dbh) measured to the nearest 1 cm at 1.4 m above tree base, estimated height and general health and defects. Critical root zones were calculated for each of the trees with the potential for development impacts. Tree hazards were assessed according to International Society of Arboriculture and WCB standards. Suitability for tree retention was evaluated based on the health of the trees and their location in relation to the proposed building envelopes and infrastructure. This report outlines the existing condition of the trees on and adjacent to the property, summarizes the proposed tree removals and retention trees as well as suggested guidelines for protecting the remaining trees during the construction process.

1.1 Limits of Assignment

- Our investigation is based solely on our visual inspection of the trees on November 27, 2014. Our inspection was conducted from ground level. We did not conduct soil tests or root examination to assess the condition of the root system of the trees.
- Only the trees specified in the scope of work were assessed and assessments were performed within the limitations specified.
- This report does not provide any estimates to implement the proposed recommendations provided in this report.
- This report is valid for six months from the date of submission. Additional site visits and report revisions are required after this point to ensure accuracy of the report for the District's development permit application process.

1.2 Purpose and Use of Report

- Provide documentation pertaining to on and off site trees to supplement the proposed development permit application.

Figure 1. Location of site – 5616 Westport Place, West Vancouver

2.0 Observations

2.1 Site Overview

The site consists of one lot with a single residence located at the north east section of the property. There is a steep cliff located on the property. The proposed development area is located west of the cliff and access is from Westport road. This area is currently a forested stand that has been managed for views. Many of the trees have been previously topped. The total lot size is approximately 1800 m^2. The proposed minimum lot area is 985 m^2. The site is mostly composed of mature native conifer and deciduous species along with native and non native ground cover, there is one landscaped and maintained yard within the site. The by-law sized tree species within the lot consist primarily of Bigleaf Maple (*Acer macrophyllum*), Red Alder (*Alnus rubra*), Western Redcedar (*Thuja plicata*) and Douglas-fir (*Pseudotsuga menziesii*) which are located throughout the site. Tree attributes, critical root zones and recommendations for the trees are listed below in **Table 1**.

2.2 Tree Inventory

The following is an inventory of assessed trees, each of which was marked with a numbered tag as is required by the District Tree Bylaw. Tree species, characteristics, comments, recommendations and required root protection zones have been suggested (Table 1). Their locations are illustrated on the accompanying map.

Overall Health and Structure Rating

Excellent = Tree of possible specimen quality, unique species or size with no discernible defects. Or a heritage tree.
Normal = These trees are in fair to good condition, considering its growing environment and species.
Poor = These trees have low vigour, with noted health and/or structural defects. This tree is starting to decline from its typical species growth habits.
Very poor = These trees are in serious decline from its typical growth habits, with multiple very definable health and/or structural defects.
Dead/Dying = These trees were found to be dead, and/or have severe defects and are in severe decline.
High Risk = These trees have been deemed hazardous by a Certified Tree Risk Assessor utilizing CTRA methods. They have a probability of failure of 3 or higher with a total overall risk rating of 8 (Moderate 3) or above.

Tree Retention Suitability Ratings

Unsuitable = Not suitable for retention in context of the proposed project design and land use changes. These trees have pre-existing health and structural defects. There is a significant chance that these trees will not survive or may become a hazard given the proposed future land use.
Moderate = These trees have moderate structural defects or health issues. The retention of this class of trees is not always successful or viable due to their pre-existing structural defects or health issues; however these trees may be viable for retention with the use of special measures.
Suitable = These trees have no obvious structural defects or health issues, and are worthy of consideration for retention in the proposed development.
Suitable as group = These trees have grown up in groups (groves) of other trees, and have not developed the type of trunk and root structure that will allow them to be safely retained on their own. These trees should only be retained in groups.

Tree Risk Assessment

Using the *Tree Risk Assessment in Urban Areas and the Urban/Rural Interface Release 1.4* manual, published by the International Society of Arboriculture, a Risk Rating out of 12 maximum points was given to the tree as shown in Table 2. The formula used was: **Probability of Failure + Size of Part + Target Area = Tree Risk Assessment (Rating).**

In the Tree Risk Assessment, the tree was rated as follows:

Probability of Failure = (1 low to 5 Extreme). This is the likelihood of branch or whole tree failure. One is the lowest possible score; five is the highest likelihood of tree part failure.

Size of Defective Part = (1 small to 3 large). This section identifies the largest part, which could fail. A part greater than 50 cm is given a rating of 3, a part between 10 and 50 cm is given a rating of 2 and all parts less than 10 cm are given a rating of 1.

Target Area = (1 low to 4 high). The target that the tree could strike is designated a value from 1 to 4 based on the potential to cause personal injury or damage structures and infrastructure.

A value for each of the three categories is assessed and added together in the Risk Rating calculation shown in Table 2. A score of 3-5 indicates a low risk, 6-8 is a moderate risk, 9-11 is a high risk and 12 indicates an extreme risk; this level warrants immediate tree removal. A risk category assigning ranges to the three levels of risk is also provided. Please refer to the table in Appendix 1 for detailed information on interpretation and implications of risk ratings and categories.

2.3 Photographs

Photo 1. The majority of trees located within the proposed development area have been previously topped for views..

Photo 2. View from within the development area.

Photo 3. The majority of trees located within the proposed development area have been previously topped for views.

Photo 4. The majority of trees located within the proposed development area have been previously topped for views.

Tree Inventory Table

Table 1. Tree Inventory.

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
1168	Douglas-fir	*Pseudotsuga menziesii*	23	8	Poor	Suitable as group	Previously topped for view. Growing on top of slope.	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	1.4
1169	Western Redcedar	*Thuja plicata*	32	8	Poor	Suitable as group	Previously topped for view. Growing on top of slope.	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	1.9
1172	Western Redcedar	*Thuja plicata*	66	28	Normal	Suitable as group	Intermediate stem in stand. Phototrophic lean. Growing at bottom of slope	Remove	Tree within building envelope of garage.	4
1173	Western Redcedar	*Thuja plicata*	39	26	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope	Remove	Tree within building envelope of garage.	2.3
1174	Western Redcedar	*Thuja plicata*	34	28	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope and stem against rock. Multiple tops at 25m	Remove	Not suitable for individual retention.	2
1175	Western Redcedar	*Thuja plicata*	51	28	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Scar and decay in base. Previously topped for view. Multiple tops at 25m	Remove	Tree within building envelope of proposed residence.	3.1
1176	Western Redcedar	*Thuja plicata*	57	28	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. 2 stems at 2m with included bark.	Remove	Tree within building envelope of garage.	3.4
1177	Western Redcedar	*Thuja plicata*	86	28	Normal	Suitable as group	Intermediate stem in stand. Minor decay pocket approximately 20m up the stem. Growing at bottom of slope.	Remove	Tree within building envelope of garage.	5.2
1192	Western Redcedar	*Thuja plicata*	44	28	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. Multiple tops at 25m.	Remove	Tree within building envelope of proposed residence.	2.6

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
1193	Western Redcedar	*Thuja plicata*	49	28	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. Multiple tops at 25m. Not on survey.	Remove	Tree within building envelope of proposed residence.	2.9
1194	Western Redcedar	*Thuja plicata*	46	26	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. Multiple tops at 22m.	Remove		2.8
1195	Western Redcedar	*Thuja plicata*	34	26	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. Multiple tops at 22m. Not on survey.	Remove		2
1196	Western Redcedar	*Thuja plicata*	42	24	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. Multiple tops at 20m. Not on survey.	Remove		2.5
1197	Western Redcedar	*Thuja plicata*	42	24	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope.Not on survey. Codominant stems at 12m. Previously topped for view. Multiple tops at 20m. Not on survey.	Remove		2.5
1198	Western Redcedar	*Thuja plicata*	65	16	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 16m.	Remove	Tree within building envelope of proposed residence.	3.9
1199	Western Redcedar	*Thuja plicata*	35	16	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 16m. Not on survey.	Remove	Tree within building envelope of proposed residence.	2.1
1200	Western Redcedar	*Thuja plicata*	34	16	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 16m. Not on survey.	Remove	Tree within building envelope of proposed residence.	2

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
1201	Western Redcedar	*Thuja plicata*	35	16	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 16m. Not on survey.	Remove	Tree within building envelope of proposed residence.	2.1
1202	Western Redcedar	*Thuja plicata*	38	24	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 22m.	Remove	Tree within building envelope of proposed residence.	2.3
1203	Western Redcedar	*Thuja plicata*	45	16	Dead/dying	Moderate	Wildlife stem. Decay in stem. Retain if there is no target. Not on survey.	Remove	Tree within building envelope of proposed residence.	2.7
1204	Western Redcedar	*Thuja plicata*	42	24	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 22m.	Remove	Tree within building envelope of proposed residence.	2.5
1205	Douglas-fir	*Pseudotsuga menziesii*	38	24	Poor	Moderate	Intermediate stem in stand. Maintain topping if retained. Growing on rocky slope. Previously topped for view. Multiple tops at 22m.	Remove	Tree within building envelope of proposed residence.	2.3
1206	Western Redcedar	*Thuja plicata*	117	24	Normal	Suitable as group	3 stems at base; 46cm, 30cm, 40cm. Growing on rocky slope. Good unions at base	Remove	Tree within building envelope of proposed residence.	7
1207	Western Redcedar	*Thuja plicata*	37	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Not on survey.	Remove		2.2
1208	Western Redcedar	*Thuja plicata*	39	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Not on survey.	Remove		2.3
1209	Western Redcedar	*Thuja plicata*	62	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. 2 stems at 1m; 42cm, 20cm. Not on survey.	Retain		3.7
1210	Bigleaf Maple	*Acer macrophyllum*	30	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope	Retain		1.8

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
1211	Western Redcedar	*Thuja plicata*	40	24	Poor	Suitable as group	Intermediate stem in stand. Growing on rocky slope. previously topped for view	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	2.4
1212	Western Redcedar	*Thuja plicata*	35	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Not on survey.	Retain		2.1
1213	Western Redcedar	*Thuja plicata*	70	24	Poor	Suitable as group	Intermediate stem in stand. Growing on rocky slope, Dbh estimate. 2 stems at 2m with moderate inclusion	Remove		4.2
1214	Bigleaf Maple	*Acer macrophyllum*	57	20	Poor	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Phototrophic lean	Remove		3.4
1215	Western Redcedar	*Thuja plicata*	72	24	Poor	Suitable as group	Intermediate stem in stand. Growing on rocky slope. 2 stems at base. 32cm, 40cm. Phototrophic lean	Remove	Tree within building envelope of proposed residence.	4.3
1216	Western Redcedar	*Thuja plicata*	37	18	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. Previously topped for view. New tops at 10m. Not on survey.	Remove	Tree within building envelope of proposed deck.	2.2
1217	Western Redcedar	*Thuja plicata*	34	24	Poor	Moderate	Intermediate stem in stand. Growing on rocky slope. growing at base of slope. Not on survey.	Remove	Proposed driveway within root protection zone of tree.	2
1218	Western Redcedar	*Thuja plicata*	34	24	Poor	Moderate	Intermediate stem in stand. 2 stems at base; 24cm, 10cm. Poor rooting. Growing at base of slope. Not on survey.	Remove	Proposed driveway within root protection zone of tree.	2
Un-tagged 01	Western Redcedar	*Thuja plicata*	43				Tree was thought to be offsite, no data recorded. DBH from surveyor.	Remove	Proposed house within root protection zone.	2.6
dr30	Red Alder	*Alnus rubra*	30		Poor	Unsuitable	May be district owned. Not on survey.	Remove	Not suitable for long term retention. **District's approval required for removal.**	
dr45	Red Alder	*Alnus rubra*	45		Poor	Unsuitable	May be district owned. Not on survey. Leaning over road. Monitor.	Remove	Not suitable for long term retention. **District's approval required for removal.**	

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
OS dr70	Red Alder	*Alnus rubra*	70		Poor	Unsuitable	2 stems at base. **District owned tree.**	Remove	Root protection zone within proposed driveway. Not suitable for long term retention. **District's approval required for removal.**	
OS dr30	Red Alder	*Alnus rubra*	30		Poor	Unsuitable	May be district owned. **District owned tree.**	Remove	Root protection zone within proposed driveway. Not suitable for long term retention. **District's approval required for removal.**	
os01	Western Redcedar	*Thuja plicata*	50	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Not on survey.	Retain		3
os02	Douglas-fir	*Pseudotsuga menziesii*	50	24	Normal	Suitable as group	Intermediate stem in stand. Growing on rocky slope. Previously topped with new stems. Not on survey.	Retain		3
os03	Western Redcedar	*Thuja plicata*	45	12	Very poor	Suitable as group	Intermediate stem in stand. Pruned for power lines. 2 stems at base. 25cm, 20cm. Not on survey.	Retain		2.7
os04	Western Redcedar	*Thuja plicata*	37				No data recorded. DBH from surveyor.	Retain		2.2
os05	Western Redcedar	*Thuja plicata*	24				No data recorded. DBH from surveyor.	Retain		1.4
os06	Western Redcedar	*Thuja plicata*	24				No data recorded. DBH from surveyor.	Retain		1.4
os07	Douglas-fir	*Pseudotsuga menziesii*	49				No data recorded. DBH from surveyor.	Retain		2.9
os08	Douglas-fir	*Pseudotsuga menziesii*	61				No data recorded. DBH from surveyor.	Retain		3.7
os09	Douglas-fir		37				No data recorded. DBH from surveyor.	Retain		2.2
os10	Western Redcedar	*Thuja plicata*	43				No data recorded. DBH from surveyor.	Retain		2.6

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
OS 1178	Douglas-fir	*Pseudotsuga menziesii*	53	33	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Exposed roots due to rocky ground.	Retain		3.2
OS 1179	Douglas-fir	*Pseudotsuga menziesii*	71	33	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Exposed roots due to rocky ground.	Retain		4.3
OS 1180	Western Redcedar	*Thuja plicata*	35	20	Normal	Suitable as group	Suppressed stem growing in grove on rocky area. High crown. Must retain with grove. Growing at top of slope	Retain		2.1
OS 1181	Douglas-fir	*Pseudotsuga menziesii*	53	30	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Growing at top of slope	Retain		3.2
OS 1182	Douglas-fir	*Pseudotsuga menziesii*	45	30	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Growing at top of slope	Retain		2.7
OS 1183	Douglas-fir	*Pseudotsuga menziesii*	43	30	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Growing at top of slope	Retain		2.6
OS 1184	Western Redcedar	*Thuja plicata*	50	30	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. Growing 0.1m from rock wall. Must retain with grove	Retain		3
OS 1185	Douglas-fir	*Pseudotsuga menziesii*	48	30	Normal	Suitable as group	Intermediate stem growing in row. 1.8m from house. Branches overhanging roof.	Retain		2.9
OS 1164	Douglas-fir	*Pseudotsuga menziesii*	36	25	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Growing on top of slope. Poor stem form	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	2.2

Tag #	Common Name	Botanical Name	DBH (cm)	Ht (m)	Overall Condition	Retention Suitability	Comments	Retain/ Remove	Tree Retention Comments	Root Protection Zone (m)
OS 1165	Douglas-fir	*Pseudotsuga menziesii*	35	10	Poor	Suitable as group	Previously topped for view. Growing on top of slope.	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	2.1
OS 1170	Douglas-fir	*Pseudotsuga menziesii*	58	30	Normal	Suitable as group	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. Growing on top of slope,	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	3.5
OS 1171	Douglas-fir	*Pseudotsuga menziesii*	53	30	Poor	Moderate	Intermediate stem growing in grove on rocky area. High crown. Must retain with grove. 3 stems at 25m. Still small, but may be an issue in future.	Retain	Future replacement leader management required to mitigate future hazards from previous topping.	3.2

Tree Risk Assessment Table

Only trees that had an overall risk rating of 9 (High 1) or above are included in the following table. The remainder of the trees on the subject site are a moderate risk rating or lower and are suitable for retention in their current land use and condition.

Table 2. Tree Risk Assessment.

Tag #	Common Name	Probability of Failure (1-5)	Size of Part (1-3)	Target Area (1-4)	Tree Risk Rating (3-12)	Tree Risk Category (Low 1-3/Mod 1-3/ High1-3/Extreme)	Action/ Comments
1203	Western Redcedar	4	2	1	6	Moderate 1	No current target, but will be a hazard to construction. Within building footprint

3.0 Summary

The site inventory identified thirty-six (36) trees on the subject site that are protected under the bylaw. Thirty (30) of the trees are to be removed for the development. One of the trees was found to be at high risk of failing and will require removal. There were twenty-six trees identified on adjacent properties that require protection (discussed below). Four of the trees may be owned by the District and will require District's approval for removal. The location of protected trees, their root protection zones as well as those trees to be removed have been illustrated on the accompanying map.

3.1 Tree Retention and Removal by Species

Table 3. Tree species on site summary.

Tree Species	Total Number of Trees	Total Retained	Total Removed
Bigleaf Maple	2	1	1
Douglas-fir	2	1	1
Western Redcedar	32	4	28
Total	**36**	**6**	**30**

4.0 Trees on Adjacent Properties

Twenty-two trees and four District owned trees found growing on the adjacent properties are included in the inventory and retention plan. These trees require root protection where the root protection zone (RPZ) extends onto the development site. The majority of off-site trees on the adjacent lots are pioneer species trees including Maple, Douglas-fir and Western Redcedar. A risk assessment was not done for trees outside the subject property. Root protection zones for the trees have provided within Table 1. Tree Inventory.

5.0 Construction Guidelines

The following are recommendations for risk mitigation and proper tree protection during the construction phase of the project.

Tree Retention Zones

Six times the diameter was used to determine the optimal root protection zone (RPZ). The RPZ is the area around the tree in which no grading or construction activity may occur without project arborist approval, and is required for the tree to retain good health and vigor.

The following are tree preservation guidelines and standards for the RPZs:

- No soil disturbance or stripping;
- The natural grade shall be maintained within the protection zone;
- No storage, dumping of materials, parking, underground utilities or fires;
- Any plan affecting trees should be reviewed by a consultant including demolition, erosion control, improvement, utility, drainage, grading, landscape, and irrigation;
- Special foundations, footings and paving designs are required if within the tree protection zone;
- Utilities should be routed around the RPZ;
- Excavation within the tree protection zone should be supervised by a consulting arborist;
- Surface drainage should not be altered so as to direct water into or out of the RPZ; and
- Site drainage improvements should be designed to maintain the natural water table levels within the RPZ.

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

Tree Protection Fences

Prior to any construction activity on site, tree protection fences must be constructed at the specified distance from the tree trunks. 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. This must be constructed prior to tree removal, excavation or construction and remain intact throughout the entire period of construction. Further standards for fencing construction can be found at:

http://westvancouver.ca/government/bylaws.aspx

Regulation of Soil Moisture and Drainage

The excavation and construction activities adjacent to the RPZs can influence the moisture availability to the subject trees. This is due to a reduction in the total rooting mass, changes in 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 protection zones should be monitored during hot and dry weather. When soil moisture conditions are dry, supplemental irrigation should be provided. Irrigation should wet the soil to the depth of the root system (approximately 30 cm deep).
- Any planned changes to the surface grades within the RPZ, including the placement of mulch, should be designed so that the water will flow away from the tree trunks.
- Excavation adjacent to trees can alter the soils hydrological processes by draining the water faster than it had naturally. It is recommended that when excavating within 6 m of any tree, the site be irrigated more frequently to account for this.

Tree Pruning

All heavy machinery (excavators, cranes, dump trucks, etc.) working within five meters of tree crowns 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 the tree crowns, a line with colored flags should be suspended at the height of the crowns along the length of the protected tree area. If there are concerns regarding the clearance required for machinery and workers within the tree protection zone, or just outside of it, the project arborist should be consulted so that a pruning prescription can be developed or a zone surrounding the crowns can be established. Any wounds incurred to the subject trees during construction should be reported to the project arborist immediately.

Fertilization

Fertilization and root zone enhancements may be recommended by the project arborist in any phase of the project if they deem it necessary to provide the best chance of tree survival.

Paving Within and Adjacent to Tree Protection Zones

If the development plans propose the construction of paved areas and/or retaining walls close to the proposed tree protection zones measures should be taken to minimize impacts. Construction of these features would raise concerns regarding proper aeration, drainage, irrigation and opportunities for adequate root growth. The following design and construction guidelines are recommended be followed to minimize the long-term impacts to trees if any paving or retaining walls are necessary:

- Any excavation activities near the TPZ (tree protection zone) should be monitored by a Certified Arborist. Excavation should remove and disturb as little of the rooting zone as possible and all roots greater than 2 cm in diameter should be hand pruned.

- The natural grade of the rooting zone should be maintained. Any retaining walls should be designed at heights that will maintain the existing grade to within 20 cm of its current level. If the grade is altered, it should be raised not reduced in height.
- The long-term health of the tree is directly dependent on the volume of available, below ground growing space. If the RPZ must be compromised, the planned distance of structures from the trunks of the subject trees should not be closer than 50% of the RPZ on more than two sides of the tree.
- Compaction of sub grade materials can cause the trees to develop shallow rooting systems. This can contribute to long-term damage to pavement surfaces as the roots grow. Minimizing the compaction of sub grade materials using structural soils and increasing the strength of the pavement reduces the reliance on 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 the TPZs

If there are plans to landscape the ground within the TPZ, measures should be taken to minimize impacts. It is not recommended that the existing grass layer be stripped, as this will damage the surface roots. The 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; however the depth of this new topsoil layer should not exceed 20 cm. Planting should take place within the newly placed topsoil mixture and should not disturb the original rooting zone of the trees. Two meters around the base of each tree should be left unplanted and covered in mulch.

Monitoring During Construction

Ongoing monitoring should be provided for the duration of the 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:

- The integrity of the Tree Protection Zone and fencing;
- Changes to TPZ limits including: overall maintenance, parking on roots, and storing or dumping of materials within TPZ. If failure to maintain and respect TPZ is observed, suggestions will be made to ensure tree protection measures are upheld;
- Review and confirmation of recommended tree maintenance including root pruning, irrigation, mulching and branch pruning;
- Health and condition of each tree;

- Damage to trees that may have resulted from construction activities will be noted, as will the health of branches, trunks and roots of protected trees. Recommendations for remediation will follow;
- Changes to soil moisture levels and drainage patterns; and
- Factors that may be detrimentally impact the trees.

All findings and recommendations will be documented in a summary report. All concerns will be highlighted along with recommended mitigation measures.

6.0 Limitations

1. Except as expressly set out in this report and in these Assumptions and Limiting Conditions, Diamond Head Consulting Ltd. ("**Diamond Head**") makes no guarantee, representation or warranty (express or implied) with regard to: this report; the findings, conclusions and recommendations contained herein; or the work referred to herein.

2. This report has been prepared, and the work undertaken in connection herewith has 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 in light of 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 as at the date of this report. Except as expressly stated in this report, the findings, conclusions and recommendations set out in this report 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**", including without limitation structural defects, scars, decay, fungal fruiting bodies, evidence of insect attack, discoloured 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; and 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 the trees recommended for retention are both healthy and safe, no guarantees, representations or warranties are made (express or implied) that those trees will remain standing or will not fail. The Client acknowledges that it is both professionally and practically impossible to predict with absolute certainty the behaviour 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 by-laws, 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.

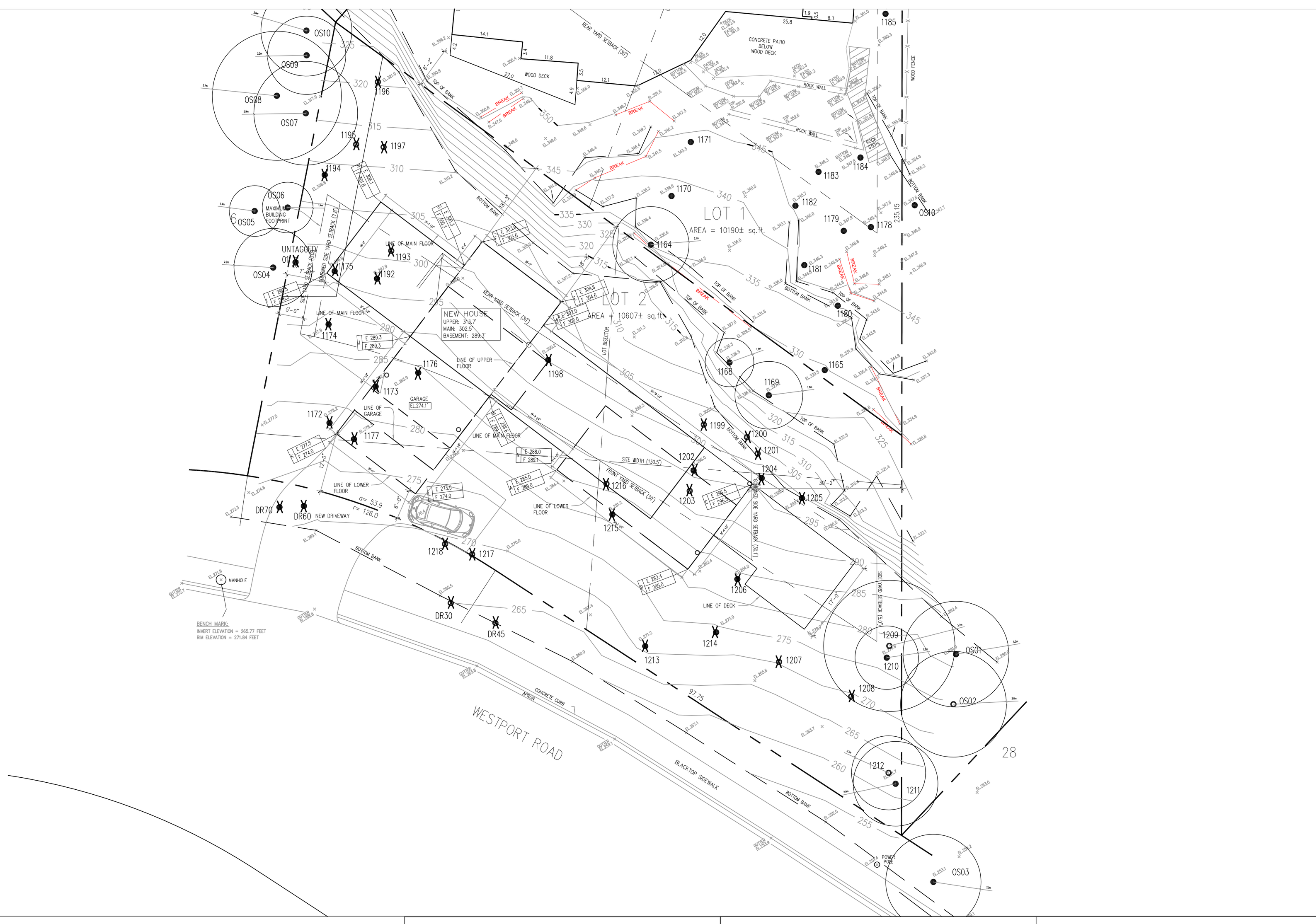
9. Loss or alteration of any part of this report invalidates the entire report.

7.0 Appendix 1 – Overall risk rating and action thresholds

The Overall Risk Rating and Action Thresholds

Risk Rating	*Risk Category*	*Interpretation and Implications*
3	Low 1	Insignificant - no concern at all.
4	Low 2	Insignificant - very minor issues.
5	Low 3	Insignificant - minor issues not of concern for many years yet.
6	Moderate 1	Some issues but nothing that is likely to cause any problems for another 10 years or more.
7	Moderate 2	Well defined issues - retain and monitor. Not expected to be a problem for at least another 5 - 10 years.
8	Moderate 3	Well defined issues - retain and monitor. Not expected to be a problem for at least another 1 - 5 years.
9	High 1	The assessed issues have now become very clear. The tree can still reasonably be retained as it is not likely to fall apart right away, but it must now be monitored annually. At this stage it may be reasonable for the risk manager/owner to hold public education sessions to inform people of the issues and prepare them for the reality that part or the entire tree has to be removed.
10	High 2	The assessed issues have now become very clear. The probability of failure is now getting serious, or the target rating and/or site context have changed such that mitigation measures should now be on a schedule with a clearly defined timeline for action. There may still be time to inform the public of the work being planned, but there is not enough time to protracted discussion about whether or not there are alternative options available.
11	High 3	The tree, or a part of it has reached a stage where it could fail at any time. **Action to mitigate the risk is required within weeks rather than months.** By this stage there is not time to hold public meetings to discuss the issue. Risk reduction is a clearly defined issue and although the owner may wish to inform the public of the planned work, he/she should get on with it to avoid clearly foreseeable liabilities.
12	Extreme	This tree, or a part of it, is in the process of failing. **Immediate action is required.** All other, less significant tree work should be suspended, and roads or work areas should be closed off, until the risk issues have been mitigated. This might be as simple as removing the critical part, drastically reducing overall tree height, or taking the tree down and cordoning off the area until final clean up, or complete removal can be accomplished. The immediate action required is to ensure that the clearly identified risk of harm is eliminated. For areas hit by severe storms, where many extreme risk trees can occur, drastic pruning and/or partial tree removals, followed bv barriers to contain traffic, would be an acceptable first stage of risk reduction. There is no time to inform people or worry about public concerns. Clearly defined safety issues preclude further discussion.

The Table shown above outlines the interpretation and implications of the risk ratings and associated risk categories. This table is provided to inform the reader about these risk categories so that they can better understand any risk abatement recommendations made in the risk assessment report.



LEGEND

- TREE TO BE RETAINED
- TREE TO BE REMOVED
- UNSURVEYED TREE
- ROOT PROTECTION ZONE
- ROOT PROTECTION FENCING

DATE

December 03, 2014

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TREE PROTECTION AND REMOVAL PLAN
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