

ROOT MAPPING REPORT

Date: **November 20, 2019** Rev 0: **ACL File: 19214**
 Attn: **Katie Hlynsky** Prepared by: **Norman Hol**
Hlynsky Architects Principal and Senior Consultant
 2439 Bellevue Avenue
 West Vancouver, BC V7V 1E1
 Project: **BP Application for a Single-Family Home**
4358 Ross Crescent
 Re: **Aerial inspection and Detailed Decay Testing**

Dear Ms. Hlynsky,

As a follow-up to our tree condition assessment carried out for a Grand fir tree located on this site (see our report from September 26, 2019), we have visited the site to undertake root mapping to determine soil and tree root conditions in the vicinity of where a proposed garage is to be constructed on the property.

The method of root mapping is via AIR-VAC, a non-destructive testing method where we are able to carefully remove soil from around important woody tree roots without causing damage to them using our air-spade, and then extracting the soil with our vacuum excavator. In this process, we prune small fibrous roots which in a localized area, but those roots are not integral to tree health or stability and can easily be replaced by the tree.

Photo 1. Subject tree is the central one in this photo.



Figure 1. Location of the subject tree and the current topographic conditions.

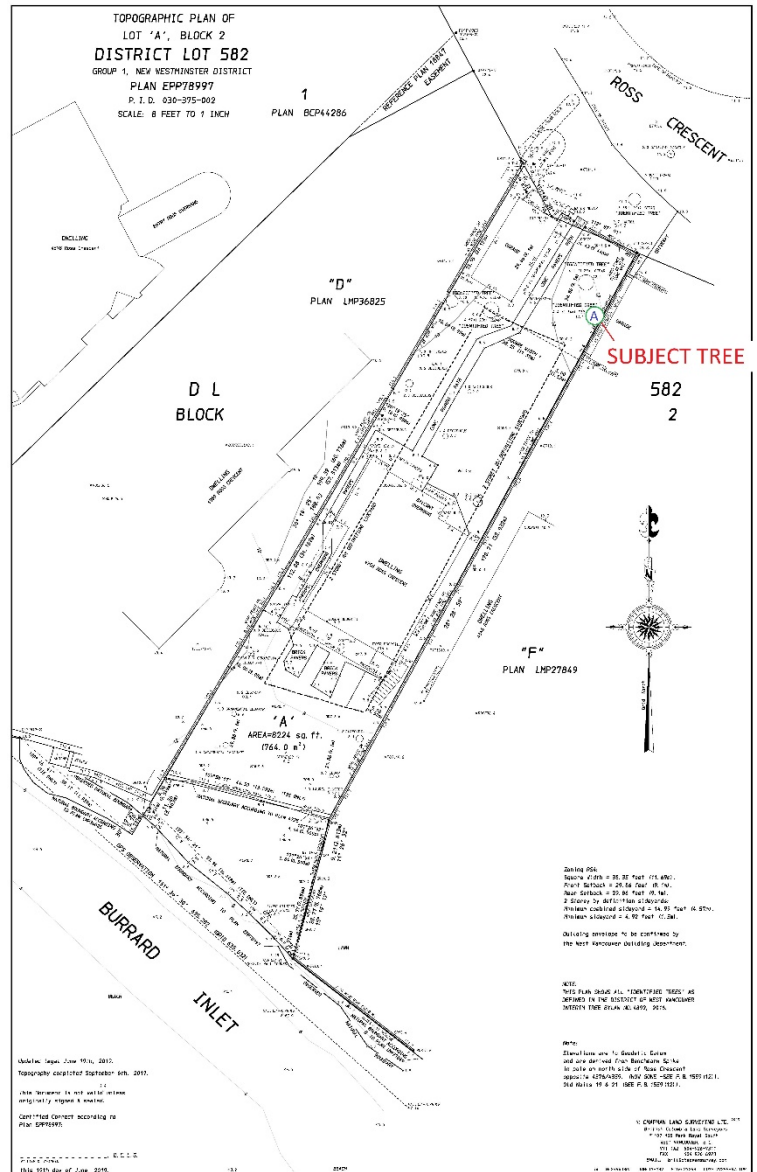
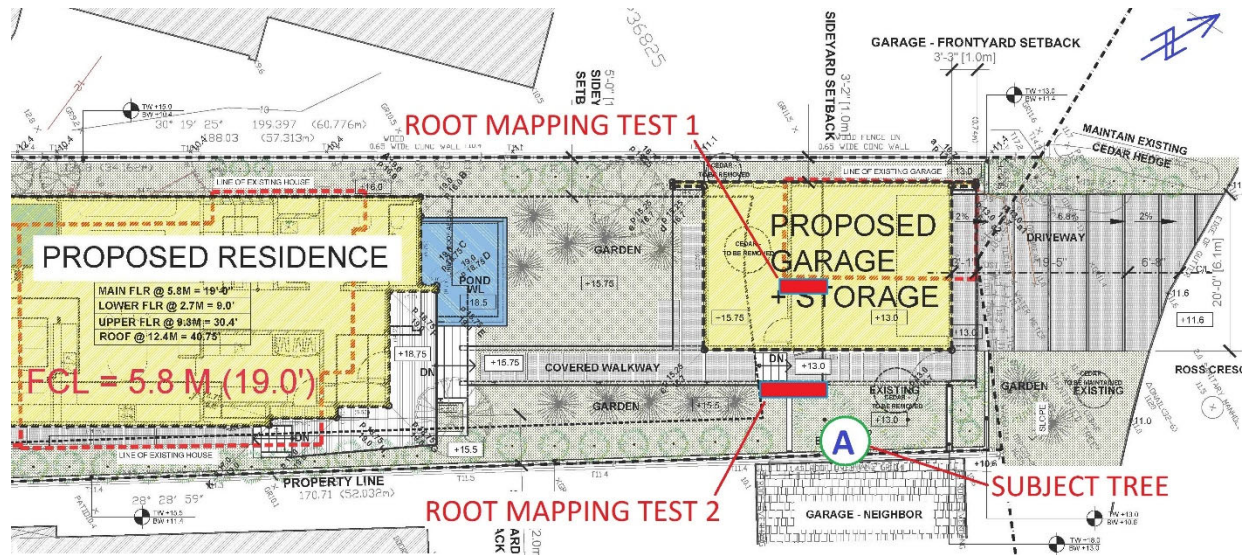




Figure 2. Root mapping locations relative to the tree and the proposed garage design.



ROOT MAPPING FINDINGS

Test 1	Adjacent to SE Corner of Existing Garage
<p>Photo 2. Location of test before excavating to 70 cm depth.</p> 	<p>Photo 3. Observed minimal fine cedar roots only.</p> 
<p>Test 1 Findings:</p> <ul style="list-style-type: none"> • This area of the site is populated only by sparse cedar roots. • No grand fir roots were observed in this test location. • Soil conditions were highly compacted at the 70 cm depth and unlikely to be sufficiently fertile and aerable to allow tree roots to have developed within that soil strata. 	

Test 1 1.8m West of and Adjacent to Trunk of Subject Grand Fir Tree

Photo 4. Location of test before excavating to 35 cm depth.



Photo 5. Observed dense fine cedar roots and sparse fir roots.



Photo 6. Test pit with cedar tree in background.



Photo 7. Test pit with grand fir tree in background.



Test 2 Findings:

- This area of the site is populated only by fine cedar roots and sparse small diameter woody roots from the grand fir.
- No significant woody roots and no buttress roots from the grand fir were observed in this test location, despite the close proximity to the tree. Also, indicators at the root crown (see photos 5 and 7) lead us to expect buttress roots to be present in the test pit, but no grand fir buttress roots were found.
- Soil conditions in the upper 30 cm depth of this test pit consisted of organic overburden. Below that depth we encountered boulders and rocks with a distinct absence of organic soil. We expect that this condition extends below this depth but we are not able to excavate any lower with the method and machinery used for this root mapping investigation. We can only conclude that the root system of this grand fir tree has developed in a deeper soil strata at an unknown depth.

CONCLUSIONS:

We observed that the area in the vicinity of the existing garage was absent of grand fir roots.

From our root mapping investigation we have determined that the overburden soil to the west of the subject tree appears to be void of woody roots from this Grand fir tree, and that minimal small roots from this tree are present at measurable depths. We suspect that the tree roots for both the primary structural needs of the tree and for the nutrient and water uptake needs are located in the soil zone below the rocky soil strata we encountered.

This type of anomaly and root growth response is not unprecedented. We have seen deep and narrowly vertical root systems in rocky and coarse sand based soils with this species and with Douglas-firs on past projects in other areas of the Lower Mainland. While rare, from our extensive experience we suspect that this particular tree has formed vertical oriented buttress roots extending unusually deep into the subsoil and has not developed the normal root mat in the surface overburden soil.

RECOMMENDATIONS

We support a design and construction concept for the new garage and the associated sidewalk as follows:

1. The western half of the garage can be excavated to bearing ground and the foundation constructed to conventional standards with a continuous strip footing etc.
2. As the excavation proceeds, we would assist with on-site supervision and monitoring to assess, identify and root prune any Grand fir roots that require it. At the same time, we would support extending the excavation eastward toward the tree until such a time that roots are encountered to a size or density that protection measures are required.
3. The remaining section of the garage between the excavation limits and the east alignment of the structure would be kept intact at existing grade and a suspended slab solution would be implemented. The finished grade of the garage relative to existing grade leaves sufficient space for this to be implemented without requiring excavation.
4. The foundation for this section of the suspended slab would be design with pier footings and grade beams. The pier footing would likely be located at the southeast and northeast corner of the east garage wall, and at some interval between them. From the root mapping findings we expect that the pier footing excavations could be dug without implication for the grand fir tree, but that will depend on geo-technical and footing size criteria that is unknown at this time and would affect the size and depth of the excavation. Follow-up coordination with this office to review those items will be required.
5. The grade beam would need to be designed such that the invert (bottom) of the grade beam is suspended above existing grade. To enable constructability of this design, we would recommend and support the area below the grade beam and the suspended slab to be covered with a layer of clear crushed gravel so that the bottom of the grade beams could be poured directly on grade.
6. The sidewalk is envisioned to be cantilevered and suspended structurally to the east side garage foundation (pier footings and grade beams) and overhanging the existing grade so that the existing grade between the garage and the grand fir tree may be left intact and "as-is".
7. The roof leaders are recommended to be directed to splash pads at the uphill northeast corner of the garage so that the storm water intercepted by the garage roof is redirected to the ground and it would then flow overland below the suspended garage slab such that the soil will be re-hydrated naturally and the percolation and aeration of the soil can continue uninterrupted in the zone where root protection is required. The roots below the garage would remain functional and viable and will not become desiccated via these measures.
8. The finished landscape within the zone between the sidewalk and the tree could be carefully landscaped with strategic growing medium placement and pocket planting of shrubs and/or ground cover.
9. In order to ensure the best chance for success of the grand fir tree preservation, all of the above work would be subject to low impact methods directed and supervised by the project arborist.



Certified by;

Norman Hol, Principal and Senior Consultant

ISA Certified Arborist #PN-0730A
ISA Qualified Tree Risk Assessor (TRAQ)
PNWISA Certified Tree Risk Assessor #0076
BC Certified Wildlife and Danger Tree Assessor #P2529
Land Surveying Technologist

Enclosures;
none