

***Tree Inspection Report for RF Binnie & Associates Ltd.***



**November 2, 2018**

**Prepared by Owen Croy**

## SCOPE OF ASSIGNMENT

The scope of this assignment is to:

- Carry out a site investigation to evaluate the condition (health & structure) of a *Paulownia tomentosa* (Empress Tree of China; aka Royal Paulownia; aka Princess Tree) growing in Memorial Park;
- Determine the risk associated with the tree;
- Recommend condition and mitigation measures, if any;
- Meet with City officials and Project Manager to provide a brief verbal overview of findings; and
- Prepare a summary report of findings.

**Location:** Memorial Park, 15000 Blk Marine Drive, White Rock, BC

**Date and Time:** February 2, 2018; 12:45 PM

**Weather:** Sunny, 16 degrees C

**Tree:**

- City of White Rock Tree No. 400, *Paulownia tomentosa* (Empress Tree of China; aka Royal Paulownia; aka Princess Tree)

## BACKGROUND

*P. tomentosa* is an extremely fast growing deciduous tree native to central China. Its rapid growth takes place during the first 12-15 years, with growth generally slowing when the tree attains heights of approximately 5-7 metres. *P. tomentosa* typically matures at heights ranging from 10 – 15 metres (33 - 50 feet) although some specimens have been known to grow to 31 metres (102 feet).

The USDA Forest Service reports that this species is relatively short-lived, as it is a pioneer species, with trees rarely living beyond 70 years under ideal circumstances.

In the climate of White Rock, this species will produce purple flowers in May, thereafter producing oblong pointed fruit that release many small seeds when mature. These small seeds can germinate in cracks in asphalt and concrete, producing unwanted effects on infrastructure.

This tree is widely cultivated in Japan and in Europe, where it can be found in gardens and on road sides. When grown in plantations in eastern North America, it produces wood with properties making it suitable for a number of uses, including wood for construction. In eastern North America, it is routinely considered an invasive species, known to seed prolifically and colonize unmanaged lands regardless of soil type. However, its adaptability also makes it suitable for planting on mine reclamation sites. In the Lower Mainland, it is not widely distributed by local nurseries, and is not generally used as a street tree. It can be found occasionally in park gardens.

The subject tree is growing at the east end of the City of White Rock's Memorial Park, and is the smaller of two of this species that were located here historically. The Park is presently being re-developed under a new park design, with active construction in close proximity to the tree.

**Site Specifics:**

- South aspect;
- 15% slope;
- Sandy-loam soil. Horticultural efforts in garden beds located beneath the tree canopy have resulted in significant organic matter being incorporated in the soil. Soils are loose and friable, with low bulk density suitable for normal root growth;
- The site has a marine influence; the tree has significant wind exposure to the south and south-west;
- A retaining wall is located 2.3 m south of the tree, running east-west and north-east to south-west at its eastern end. A second retaining wall is located 2.3 m from the tree on its north-east side, running north-east to south-west. According to construction workers familiar with the site, historically another retaining wall was located to the west of the tree, distance from the tree not known, length and orientation unknown.
- A temporary stair system and path has been installed to the west of the tree, with disturbed soils within 2.1 m of the tree.
- Originally, a tree protection barrier was in place at a distance of 4 metres from the tree, based on the City of White Rock's *Tree Protection Guidelines* (see Figure 1., Appendix I). In

anticipation of the tree being removed, the contractor was apparently directed to remove the barrier, which was not in place at the time of inspection. Construction works were taking place at the time of inspection within the drip line of the canopy, which has resulted in damage to the tree's root system. (see Roots Section, below).

### **Subject Tree Specifics**

The subject tree is 11 metres tall, with a hemispherical crown indicative of a mature tree of this species having grown in the open. The diameter of the tree at breast height (DBH) is 65 cm. However, the trunk of the tree is swollen at this point (evaluated further, below); the diameter below the swelling is 55 cm.

### **Root System:**

- Retaining walls to the south, north and east have constrained the tree's root system in those directions.
- The tree has a surface root on its east side (figure 1., Appendix II) which has also constrained the growth of the root system towards the east, with notable lack of trunk flare on the east side.
- The tree had a well-developed root system on its west side.
- Construction workers at the site advise that one very large root extended to the south-west of the tree approximately 7.6 m; this root has been severed at a distance of 3.8 m from the base of the tree. (Figure 2., Appendix II) The approximate diameter of the root where severed by machine (not cleanly cut) is approximately 15 cm.
- Another large root of 12 cm diameter has been cut at a distance of 3.4 m from the tree on its north-west side. (Figure 3., Appendix II)
- Several roots of 5 cm diameter have been severed approximately 3.5 m from the tree on its north-west side.
- An excavation of roots on the west side of the tree disclosed several sections of cut roots of ranging in size from 7 – 12 cm.

- Intact roots were excavated on the south side of the tree, starting at 1 m from the retaining wall. At 1.0 m, the roots were approximately 8 cm in diameter. (Figure 4, Appendix II)  
Roots of 4-5 cm diameter were present at the south retaining wall, where the roots turn and run horizontally along the wall at a depth of 20 cm.
- Test holes were dug in front (south side) of the south retaining wall. The footing for the wall is present between 62 cm and 50 cm. No roots were observed growing beneath the footing for the south retaining wall. However, historical trenching for utility construction may have severed roots growing on the south side of the south retaining wall.

#### **Main Stem:**

- The main stem has an old wound, 20 cm tall x 6 cm wide, likely arising from the removal of a large scaffold branch, at approximately 1.6 m. Wet, decayed wood is present within the wound. (Figure 5, Appendix II) A metal probe inserted into the decayed wood shows that the wet decayed wood extends approximately 43 cm below the lower lip of the wound in the centre of the main stem. Sound wood appears to be present above the wound.
- The main stem is swollen by approximately 10 cm diameter below the wound, which is likely a growth response of the tree related to the decay occurring within the main stem below the wound.
- Sounding of the main stem with a mallet supports the conclusions drawn from inserting the metal probe; that is, little decay occurs above the wound, but significant decay is present at and below the wound.
- Advanced diagnostic testing by way of resistance drilling or sonic tomography was not carried out to determine the extent of decay in the main stem of the tree.
- A small cavity is present on the main stem of the tree within the top of a crotch located approximately 5 m in height. It is anticipated that this small cavity would not indicate any significant pathology or structural weakness in the tree at this location.

#### **Canopy:**

- Visual inspection (tree was climbed) and sampling by way of a pole pruner shows that several large branches growing on the west and north side of the tree are completely dead all the way back to the main stem. (Figure 6, Appendix II)
- Numerous large live branches have subordinate smaller branches that are dead.
- It is estimated that 25-30% of the crown is dead.
- Examination of live branches within the tree indicate minimal twig growth and shoot elongation in the 2018 growing season.
- The live branches have a heavy seed crop, which is often associated with stress in trees. (As this is mast year for this species, the heavy seed crop cannot necessarily be associated with stress in the tree.)

## **ANALYSIS**

### **Tree Condition:**

The removal of a large portion of the tree's roots on the north-west, west and south-west sides of the tree has occurred. This has resulted in a reduced capacity of the tree to take up both water and nutrients. This has in turn caused considerable die-back within the crown of the tree. Anecdotal evidence reported by construction staff indicate that the leaves were drooping during hot days in July and August; this was likely the result of root damage and removal. Unfortunately, several of the large roots were not cut cleanly, but rather were raggedly severed, likely through the use of a large mechanical device such as a back-hoe. These raggedly broken roots will not heal as quickly as cleanly cut roots, which will make them more susceptible to colonization by fungal pathogens that can cause root decay.

The large wound in the tree has not calloused over with response wood. This opening in the stem, together with the presence of decay in the tree, has likely also impaired (to a minor extent) the tree's ability to transport and store carbohydrates while also creating an area of weakness in the main stem.

The branch die-back, short shoot growth, drooping leaves and heavy seed crop indicate that **this tree is in relatively poor condition and is under considerable stress**. This stress will likely continue into the 2019 growing season.

- **Should a decision be made to retain the tree, efforts that may assist in mitigating damage associated with the construction would be the installation of an irrigation system to provide optimum soil moisture, based on monitoring using a piezometer. In addition, soil fertility would need to be determined, and an optimal fertilization program put into place as required. All exposed would need to be cleanly cut.**
- **It is anticipated that more of the subordinate branches will die back in 2019, and the tree will also be more susceptible to attack by insect pests and damaging pathogens. *It is entirely possible that despite best efforts, the tree may continue to decline and die over the period of a few years.***

It has been suggested that the southern retaining wall might be removed in order to accommodate a new retaining wall that matches the other new park infrastructure. Should this take place, it has been estimated that the soil on the north side of the retaining wall would be removed back by approximately one metre to the north of the retaining wall. This action would remove a considerable portion of the tree's remaining living root system. This in turn would exacerbate the issue of impairment of uptake of water and nutrients, causing significant additional stress to the tree. **It is anticipated that the tree would not survive in the medium term if this work takes place.**

**Risk:**

Several subordinate branches in the 3-6 cm diameter range have already fallen from the tree. Given the tree's exposure to ongoing on-shore winds and the number of dead branches in the canopy, failure of additional dead subordinate branches is imminent under normal wind patterns. Failure of dead large branches is probable during periods of elevated wind speeds.

- **Based on the foregoing there is currently elevated risk to construction staff who are working in the vicinity of the tree when adverse weather is expected; hard-hats should be worn at all time when working within the vicinity of the tree, and work should be suspended within 6 m of the tree if gale-force winds are experienced at the site.**

Once the park is opened to the public and park patrons are able to be within the strike zone of the falling branches, and if dead limbs are not removed, this same risk would extend to park users.

- **If the tree is to be retained, it's crown should be cleaned of dead branches and the tree should be regularly monitored for die-back of additional branches, with pruning and removal of dead branches as required.**

While there is a open wound and wet decayed wood in the main stem, there is also considerable sound wood to provide support to the tree under normal weather conditions. The likelihood of complete mid-stem failure is possible; failure could occur, but it is unlikely during normal weather conditions. In and of itself, this would not be a sole reason for immediate removal of the tree. However, as there are railway tracks, a pathway and passive park areas within the strike zone of the tree, the risk is elevated, especially during times of adverse weather conditions where exposure to prevailing storm winds is high. (e.g. winds equal to or exceeding 80 km/hour from the south and south-west)

- **If the tree is to be retained, two guy cables should be installed 2/3 of the height of the tree, anchored back to the north-west and north-east sides of the tree, into secure devices installed in the ground. Also, careful evaluation of extent of the decay should be made through advanced testing to establish a base-line of extent of the decay, with follow-up testing carried out one year later to determine if the decayed area is expanding within the stem of the tree.**

If a new retaining wall is developed on the south side, and additional roots are removed during the process, there will be increased risk of whole-tree failure from the roots. Given the proximity of the railway, paths and passive park area, whole tree failure would be possible



during adverse weather conditions. Based on the impact to tree condition and risk, **If the retaining wall work is to be undertaken, the tree should be removed.**

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Appendix 1. – Excerpt from the chart contained within City of White Rock *Tree Protection Guidelines*

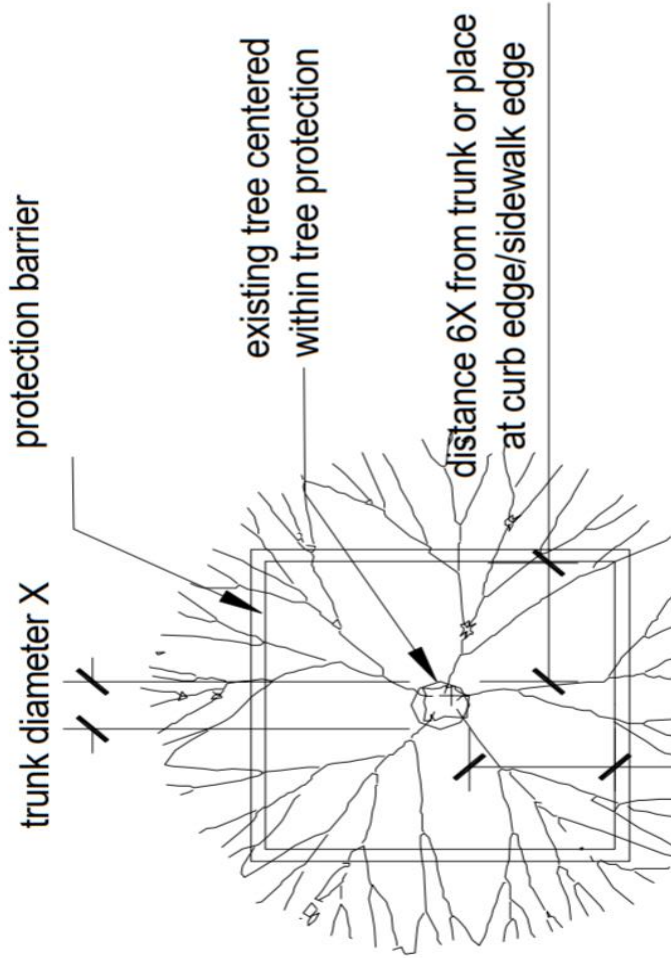


TABLE: PROTECTION BARRIER DISTANCE

TRUNK DIAMETER (CM)	MINIMUM PROTECTION DISTANCE (M FROM TRUNK)
X	6X
20	1.2
25	1.5
30	1.8
35	2.1
40	2.4
45	2.7
50	3.0
55	3.3
60	3.6
75	4.5
90	5.0
100	6.0

**Appendix II – Photographs taken during the November 2, 2018 site visit.**



Figure 1. Lateral surface root inhibiting root development on East side.



Figure 2. Large root severed by machine 3.4 to south-west of stem.



Figure 3. Large root north-west of tree severed.



Figure 4. Intact roots on the south side of the tree, measured 1.0 m north of the retaining wall.



Figure 5. Wound located on main stem, showing steel probe inserted 41 cm into wet decayed wood within.



Figure 6. 12 cm diameter branch dead all the way to the main stem.

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