

July 23, 2018

Seun Kan
CHSS International Investment & Management Ltd.
1827 Woodward Drive, Suite 310
Ottawa, Ontario
K2C 0P9

RE: TREE RETENTION ANALYSIS – 419/423 McLEOD STREET, OTTAWA

Dear Seun,

This report details a pre-construction tree retention analysis for a single mature red maple (*Acer rubrum*) located on the shared property line between the two above-noted addresses in Ottawa. The present condition and future prospects of this tree are the focus of this report, the need for which is related to the future re-development of 423 McLeod Street by CHSS International Investment & Management Ltd. The construction proposed for the subject property includes the demolition of the addition at the back of 423 McLeod St. and the full demolition of an existing residential dwelling at 447 Kent St. In their place a four storey apartment building, with a one-storey basement, is proposed to be constructed.

The foundation of the one-storey addition at the rear 423 McLeod St. sits 3.9m away from the centre of tree. Behind and extending further from the one-story addition is a two-storey addition which sits 5.6m from the tree. A paved laneway runs beside 423 McLeod St. and the tree, with asphalt right from the edge of the foundation to the base of the tree.

The original proposed setback of the new building from the eastern property line (on which the tree sits) was 1.2m. Obviously, the amount of setback is critical to the tree's future as it has implications both below and above ground. After several site meetings and discussions, both internally with the project team and City of Ottawa staff, the building setback was increased first to 2m and later to a full 3m radius from the centre of the tree. In fact, the majority of setback at the 4m mark is left intact except for two locations where corners of the proposed building encroach.

TREE AGE, SIZE AND HEALTH CONDITION

According to historic aerial photography, this tree has likely been in place since the early 1940s, giving it an approximate age of almost 80 years. In typical urban settings red maples of this age are considered very mature as their expected longevity is no more than 100 years.

Presently the tree appears in very good physiological condition for its age and growing environment. On average the annual growth on the observable branch ends is 2-3cm, an increment not unusual for a tree of this age, given its growing environment. Its crown is moderately dense with leaves of a good size, wound closure is generally good and there are no signs of dieback of the finer branch ends at the periphery of the crown. However, judging from the foliage it is suffering from a presumed nitrogen deficiency as interveinal chlorosis is evident. However, no signs of drought are apparent in the leaves. The same is largely true for any insect and disease issues – none appear to be impacting overall tree health.

The diameter at breast height of the tree is 83.9cm. Co-dominant stems arise at approximately 2.5m from grade orientated north-northwest/south-southeast. The living crown is held above three stories on the northeast side (*i.e.* over 419 McLeod St) and at two stories on the southwest over 423 McLeod St (please see Pictures 1 and 2 on page 3). The co-dominant stems share an acutely-angled union with upright stems holding approximately equal amount of the tree's crown. One thing found missing from the tree is a pronounced root collar. The root collar of a tree is the point at which the larger structural (or 'heart') roots meet the tree's lower stem, or bole. When present the root collar of a tree is typically characterized by a series of flares at its base. Flares generally reflect the number, size and general direction of the major supporting roots. In this instance the general lack of visible flares was very obvious (please see Pictures 3 and 4 on page 4). This is most likely due to the growth of major structural roots being suppressed over the years by the adjacent asphalt laneway. While not a definitive analysis by any means, this initial thought could bode well for the future of the tree as a lack of wide-reaching structural roots would avoid some conflict with the nearby excavation for the proposed new building. The loss of structural roots is always a concern as there are two separate but related impacts: 1) in severe cases potentially compromising the tree's stability and, 2) separating the tree from the distal absorbing root hairs through which it draws sustenance.

TREE ROOT INVESTIGATION

The latest proposed 3m setback of the building from the tree came as a result of a root investigation, the intent of which was to determine the exact morphological characteristics of the tree's roots under asphalt. After removing several layers of asphalt the subbase beneath was carefully removed with a combination of high pressure water and high volume vacuum. This service was provided via a Hydrovac truck.

The pattern root growth and development of any species of tree under such an unnatural surface treatment would be impossible to predict. Initially the presence of an impermeable surface layer was predicted to have suppressed all root growth beneath – both structural and absorbing. In fact, the opposite was found to be true – the density and range of root diameters was greater than usually found in close proximity of a mature tree. As the subbase was washed away a dense mat of many different sizes of intertwined roots became apparent. This is likely due to two factors: 1) the lack of a stone subbase beneath the asphalt (instead of the typical compacted bed of gravel it appears the asphalt was laid directly on top of native soil - which from a very basic ribbon test appeared to be a sandy clay loam); 2) root growth was uncommonly high in the soil profile – due to the impervious nature of asphalt all the roots would tend to grow close to the surface in order to capture what the little moisture makes it through. Picture 5 on page 5 shows the results of the root investigation.





Picture 1. Crown of red maple over three-storey roof of 419 McLeod Street.



Picture 2. Crown of red maple over two-storey roof of 423 McLeod Street.



Picture 3. Paved laneway between red maple and 423 McLeod Street.



Picture 4. Layers of asphalt removed prior to root investigation of red maple shared between 419 and 423 McLeod Street. Note lack of pronounced flaring at base of tree on right. Also note soil and fine roots directly beneath asphalt layer.



Picture 5. Exposed roots of red maple shared between 419 and 423 McLeod Street. Note density of roots and lack of large structural roots.

In the context of construction damage, the influence of roots on tree decline is directly related to the vascular system of each species. That of the maple family is described as being ‘diffuse porous’. This means the vessels which transport moisture, nutrients, carbohydrates, hormones, *etc.* between the roots and branches of the tree are small and spaced uniformly throughout each annual growth ring. The roots of diffuse porous trees normally support multiple branches within the tree’s crown, typically branches found on the same side of the tree as the supporting roots. This has direct implications in terms of construction damage - if a major root were to be severed on such a tree it is anticipated no single branch above would show signs of dieback. Instead, the impact would be spread out amongst a number of branches. In this instance the impact of root loss is likely to be spread throughout the southwestern and western half of the crown and not concentrated in one or two branches. Since this side of the crown will be raised in height and reduced in breadth to accommodate the new taller building, the anticipated crown dieback due to root loss will be pro-actively addressed through this necessary pruning.

FUTURE PROSPECTS OF TREE

In order for established trees to overcome the longer-term stresses of construction the exposure of their crowns to sunlight, the amount of available soil volume for rooting and the physical properties of the soil within their rooting area must emerge relatively unchanged. In this instance, two of these factors will be altered significantly: 1) the amount of available soil volume will obviously be diminished, and 2) the crown’s exposure to sunlight will be decreased due to the presence of a new taller building. Although it is anticipated the tree will decline due to these changes, two mitigating circumstances exist which hopefully will allow it to plateau physiologically and not spiral into full decline; 1) the exposure to sunlight will only be reduced towards the west and southwest, all other aspects will remain unchanged; 2) as soil volume and roots are lost through excavation, an equal, if not greater amount of above-ground biomass will be lost through pruning. It is hoped these offsetting losses will allow the tree to reach a physiological equilibrium. If so, with the proposed improvements to the surrounding surface treatments (*i.e.* replacement of impervious asphalt surfaces with ‘soft’ landscaping) it is hoped the tree can recover from the loss of soil volume by being able to access greater soil depths than before due to deeper penetration of moisture and gaseous exchange.

It should be noted that there is one potential downside to removing the asphalt layer. As the tree has adapted over many years to the holding capacity of such a heavy surface layer, it could be prone to uplifting (*i.e.* full tree failure) once the asphalt is removed. The tree’s shallow mat of roots in a friable sandy soil add to the potential for failure. A combination of large boulders placed near the tree’s base to weigh down its root plate and guy wires to provide external support may be required to stabilize the tree in the short- to medium terms.

TREE PRESERVATION AND PROTECTION MEASURES

Measures intended to mitigate long-term damage to trees generally entail preserving current soil characteristics such as bulk density, grade and drainage. Preserving such characteristics within the remaining rooting zone is critical to the tree’s recovery.

The following measures are recommended to promote the survival of the maple following construction:



- 1) When excavation takes place close to the tree it should be done either by hand or with hydraulic or pneumatic air excavation technology. If roots are encountered while excavating they should be cleanly cut with either pruning shears or saw wiped with alcohol before each cut. This will ensure clean cuts of the roots, thus facilitating healing. Any roots larger than 1cm in diameter should be sealed with beeswax soon after being cut in order to help keep them viable by preventing the loss of moisture.
- 2) If any tree roots are exposed during construction they should be immediately reburied with soil or temporarily covered with burlap, filter cloth or woodchips and kept moist (*i.e.* watering with a soft-spray nozzle at least three times a week). A covering of plastic should be used in order to retain moisture during an extended period when watering may not be possible (*i.e.* over weekends).

Working in close proximity to the tree will require great care, regular professional oversight and some well thought out preservation measures as well as innovative construction practices to avoid encroaching any further than 3m from the tree. For instance, shoring will be required to maintain the integrity and cohesion of the soil profile within the tree's remaining rooting area.

TREE MAINTENANCE MEASURES

Following the completion of construction the following measures should be performed in order to maintain the tree's health over the next several growing seasons:

- 1) Additional watering within each tree's root zone should be implemented, especially during extended periods of drought. Watering should be done with a soft-spray nozzle at least once a week. All broken branches and those displaying dieback (*i.e.* chlorotic/necrotic foliage, twig mortality, *etc.*) should be pruned from the trees' crowns.
- 2) Pruning of living branches should only be performed in cases where they are broken or abraded to the point that they will not survive.
- 3) Bark tracing of wounds should be performed to remove loose or pealed bark back to the point of contact with the cambium. This will facilitate healing through the production of callus. Wounds larger than 4cm² should be sealed with beeswax to help prevent the loss of moisture.
- 4) Fertilizing the tree with a liquid, deep-root, slow-release fertilizer is recommended only after the completion of all construction. Since the tree could show signs of root-related stress, a fertilizer with a high-phosphorus formulation should be used.

I trust that this report satisfies all of your requirements. This report is subject to the attached Limitations of Tree Assessments to which the reader's attention is directed.

Please do not hesitate to contact me if you have any questions concerning this report.

Yours,

Andrew Boyd

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LIMITATIONS OF TREE ASSESSMENTS

It is the policy of *IFS Associates Inc.* to attach the following clause regarding limitations. We do this to ensure that our clients are clearly aware of what is technically and professionally realistic in assessing trees for retention.

The information contained in this report covers only the tree(s) in question and no others. It reflects the condition of the assessed tree(s) at the time of inspection and was limited to a visual examination of the accessible portions only. *IFS Associates Inc.* has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the forestry and arboricultural professions, subject to the time limits and physical constraints applicable to this report. The assessment of the tree(s) presented in this report has been made using accepted arboricultural techniques. These include a visual examination of the above-ground portions of each tree for structural defects, scars, cracks, cavities, external indications of decay such as fungal fruiting bodies, evidence of insect infestations, discoloured foliage, the condition of any visible root structures, the degree and direction of lean (if any), the general condition of the tree(s) and the surrounding site, and the proximity of property and people. Except where specifically noted in the report, the tree(s) examined were not dissected, cored, probed or climbed to gain further evidence of their structural condition. Also, unless otherwise noted, no detailed root collar examinations involving excavation were undertaken.

While reasonable efforts have been made to ensure that the tree(s) recommended for retention are healthy, no warranty or guarantee, expressed or implied, are offered that these trees, or any parts of them, will remain standing. This includes other trees on the property not examined as part of this assignment. It is both professionally and practically impossible to predict with absolute certainty the behaviour of any single tree or groups of trees or their component parts in all circumstances. Inevitably, a standing tree will always pose some risk. Most trees have the potential for failure in the event of adverse weather conditions, and this risk can only be eliminated through tree removal.

Notwithstanding the recommendations and conclusions made in this report, it must be realized that trees are living organisms, and their health and vigour constantly change over time. They are not immune to changes in site conditions, or seasonal variations in the weather. It is a condition of this report that *IFS Associates Inc.* be notified of any changes in tree condition and be provided an opportunity to review or revise the recommendations within this report. Recognition of changes to a tree's condition requires experience and so it is recommended that *IFS Associates Inc.* be employed to re-inspect the tree(s) with sufficient frequency to detect if conditions have changed significantly.

No responsibility is assumed for matters legal in character. Statements made to *IFS Associates Inc.* in regards to the condition or history of the tree(s) are assumed to be correct. Any and all property is assessed or evaluated as though free and clear, under responsible ownership and competent management. It is assumed that any property is not in violation of any applicable codes, ordinances, statues or other government regulations.



Neither the author of this report nor anyone else in association with *IFS Associates Inc.* shall be required to give testimony or attend court by reason of this report unless contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement, or as previously accepted.

The information, recommendations and opinions expressed in this report are for the sole benefit of the client(s) named above. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior expressly written consent of the author. Unless otherwise required by law, neither all or any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressly written consent of the author, and especially as to value conclusions, identity of the author, or any reference to any professional society or institute or to any initialed designation conferred upon the author as stated in his qualifications.

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

Details obtained from photographs, sketches, *etc.*, are intended as visual aids and are not to scale. They should not be construed as engineering reports or surveys.

Although every effort has been made to ensure that this assessment is reasonably accurate, the tree(s) should be reassessed at least annually. The assessment presented in this report is valid at the time of the inspection only.

Lastly, loss or alteration of any part of this report invalidates the entire report.