Clause 3 in Report No. 16 of Committee of the Whole was adopted, without amendment, by the Council of The Regional Municipality of York at its meeting held on October 15, 2015.

6

Street Tree Health and Performance Update

Committee of the Whole recommends adoption of the following recommendation contained in the report dated September 23, 2015 from the Commissioner of Environmental Services.

1. Recommendation

It is recommended that Council receive this report for information.

2. Purpose

This report updates Council on the status of the Street Tree program and provides new information on the recent tree health assessment. This report also highlights emerging financial pressures associated with roads and VivaNext maintenance that will be addressed through the budget submission.

3. Background

Street trees, as part of the urban forest, provide considerable environmental, social and economic benefits to our communities

Street trees are a component of the urban forest, which provides numerous benefits to residents, including shade, energy conservation, improved air quality, prevention of soil erosion, climate change mitigation, stormwater management and public health benefits. Recent urban forest studies estimated that the urban forest in the southern portion of York Region removes 923 tonnes of air pollutants annually, sequesters 39,979 metric tonnes of carbon annually and also saves residents $5.5 million in energy costs.

Regional streetscapes, including street trees, help define the character of our communities and contribute to a sense of place. The Region has made a

substantial investment in street trees since adoption of the Streetscape Policy in 2001 and implementation of Great Regional Streets and VivaNext projects.

Over 1,500 new street trees are planted annually along Regional roads

In 2001, Council adopted the Streetscaping Policy. This policy and subsequent guidelines set objectives and standards for street tree planting along Regional roads. Since 2001, the number of street trees has steadily increased as a result of annual planting efforts. Currently the Region plants 1,500 to 2,000 street trees each year. The majority of street tree planting occurs within existing urban areas. In recent years street tree planting projects have required more complex technologies (e.g. soil cells below sidewalks) to ensure street tree health and survival in urban settings including VivaNext corridors.

Street trees are capital assets that appreciate in value over time as they grow, increasing the benefits they provide to the environment, streetscapes and residents. To help manage this significant asset, a comprehensive street tree inventory and computerized maintenance management system has been developed. Currently there are 43,000 street trees in the inventory with an estimated replacement value of $24,080,000 ($560 per tree).

2003 street tree health assessment identified only 29 per cent of recently planted streets were in healthy condition

In the early 2000s, it was evident that newly-planted street trees were performing poorly due to the harsh roadway environment. To identify the factors contributing to this poor performance the Region undertook a comprehensive street tree health assessment in 2003. Results of the study identified that only 29 per cent of recently planted trees were in satisfactory or good health. The study further identified that there is a critical establishment period of up to five years following planting. During this period trees may die, experience minimal growth or decline in health as the trees try to focus resources on establishing a new root system.

Measures implemented to address poor performance have resulted in significant improvements in street tree health

The 2003 study identified a number of factors that impacted street tree performance including lack of water during the critical establishment period, poor boulevard soil conditions, quality of tree nursery stock, poor planting procedures and post planting maintenance practices.

To address the poor performance of street trees, the Region implemented significant program improvements in 2005 including:

- Additional water during the establishment period – increased frequency of watering and implemented Tree Gator watering bags to improve efficiency

- Improve tree species selection – developed a list of top performing species and diversity standards (e.g. Kentucky coffeetree, Honey locust, Ivory silk lilac)

- Improve planting practices – revised tree planting specifications and contractor audit procedures

- Optimize maintenance practices – revised mulching and pruning practices

- Investigate soil improvements – implemented trials including soil amendment and radial trenching

Evidence based decision making informed focussed actions which resulted in a dramatic improvement in street tree health. In 2010 the Region repeated the street tree health assessment and found that 76 per cent of trees were in good health, more than doubling the previous 29 per cent recorded in good health in 2003.

2010 study identified a number of factors which continue to negatively impact the performance of street trees

Despite the success of program improvements, 24 per cent of street trees remained in poor health or died following planting. Following the 2010 health assessment a number of program improvements were implemented to address factors, which continued to impact street tree performance including:

- Improve tree watering – increased watering from 10 to 14 times per year for the first three growing seasons

- Soil improvements – implemented construction of boulevard soil trenches and revise planting soil specifications

- Improve nursery stock and planting quality – increased contractor oversight (auditing)

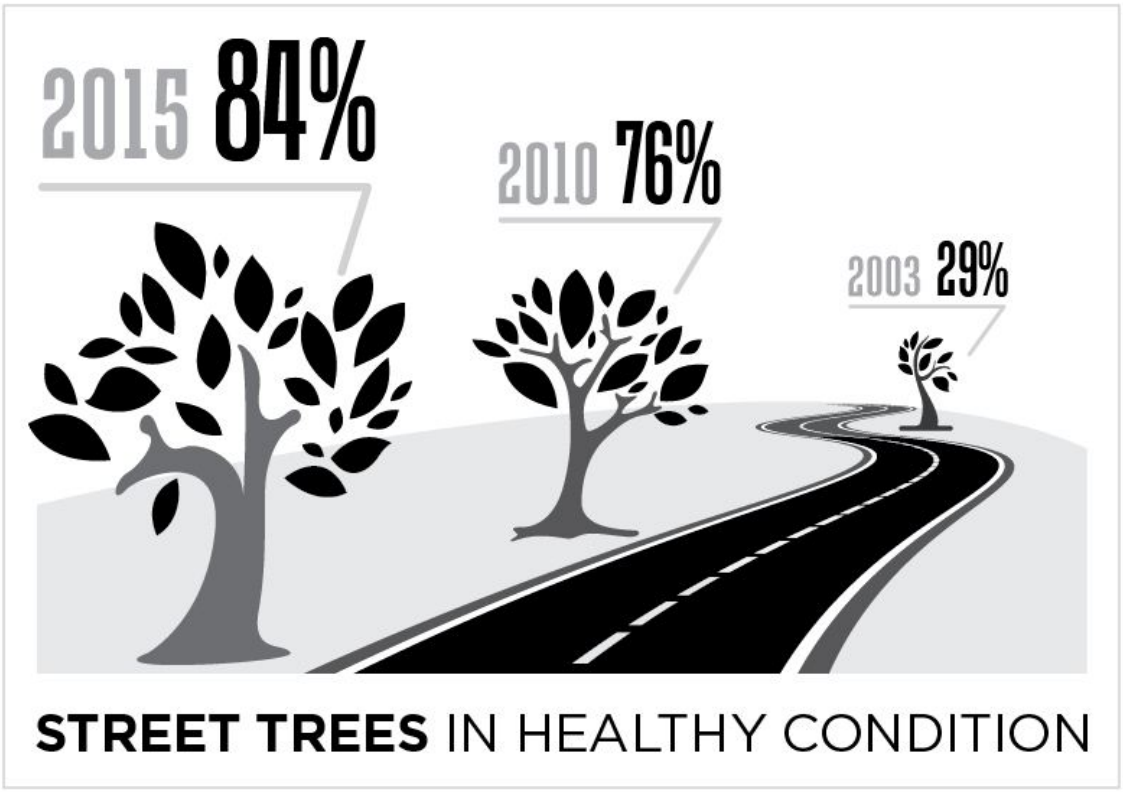
4. Analysis and Options

2015 assessment confirms investments in the Street Tree program have resulted in improved performance with 84 per cent of trees identified in a healthy condition

In 2015, a third street tree health assessment was completed to measure the effectiveness of program improvements. A detailed assessment of 3,100 street trees was undertaken to determine tree health and further assess factors affecting tree performance (see Executive Summary – Attachment 1).

Results of the assessment show that 84 per cent of recently planted trees were in satisfactory or good condition. This is a significant improvement over the 2003 (29 per cent) and 2010 (76 per cent) assessments and demonstrates that investments made in program improvements are having a positive effect on street tree performance.

Figure 1
Improvement in Street Tree Health 2003 to 2015



While investments made in the Street Tree program have resulted in significant improvements, street tree health is still below a performance target of 90 per cent of trees in good health. This target is based on industry experience and

expectations for the harsh roadway environment but may need to be reassessed. A 2011 City of Toronto report (Every Tree Counts, 2011) identified 49 per cent of street trees as being in good health. Municipalities continue to work towards quantifying assessments and targets for street tree condition. Municipal benchmarking, including street tree health and performance, is being reviewed as a Regional Public Works Commissioners of Ontario (RPWCO) Urban Forest Subcommittee initiative. At present no change in this target is recommended.

Improvements to current practices continue with increased focus on key factors including soil quality and planting locations

The 2015 assessment identified several key factors which continue to influence the performance of street trees in York Region including:

- Poor root development and function as a result of boulevard soil conditions (quantity and quality; physical, chemical and biological)
- Negative impact of planting trees in close proximity to edge of roadway
- Desiccation (drying/scalding) of trees subject to winter winds on open sites

Study results continue to identify the importance of soil quantity and quality on street tree performance. Boulevard soil trenches showed improved street tree performance compared to sites without trenches. The locations and specifications (e.g. soil depth) of boulevard soil trenches will be reviewed to optimize root development. In locations with limited space for tree root growth (e.g. under concrete sidewalks and other hardscapes), the use of soil cell technologies will be continued where possible to provide a minimum of 16 cubic metres of quality soil per tree with access to additional soils.

Species selection and location of street trees in the right-of-way is critical to their success. Planting locations will focus where possible outside a winter threat zone, beyond four metres of the roadway. Currently in urban areas approximately 30 per cent (12,900) of the trees are found within this zone. Where tree planting is contemplated within the winter threat zone due to specific objectives (e.g. VivaNext rapidways), measures such as raised planters will be considered to help protect trees, and only proven top performing species will be planted.

Street Tree program improvements will be implemented as part of ongoing Forestry adaptive management continuous improvement. Adjustments to existing programs, specifications and operating procedures will be made in each of these key areas in an effort to continue to improve street tree survival rates. Additional financial impacts are not anticipated for implementing these refinements.

Street tree management and tree maintenance programs continue to grow with maturing street tree population

The urban forest is thriving despite severe weather events (e.g. drought, ice storms) and invasive species impacts (e.g. Emerald Ash Borer). The Region's street tree population is continuing to grow in both number and tree size. With more trees surviving and performing well, the need to maintain these trees is increasing. Once established, pruning street trees on a regular basis is required to maintain tree health and minimize hazards for public safety. The Region recently completed a review of pruning practices and identified an optimum pruning cycle of three years for juvenile trees (0-10 years of age) and seven years for intermediate trees (10-50 years of age). This represents a refinement of our existing practices. It is anticipated that our pruning practices will be gradually adjusted over multiple years to align with this recommended maintenance cycle. Any budget implications will be assessed and brought forward as appropriate.

Climate change impacts, in particular the frequency and intensity of storms, are a threat to street trees. Proactive management including cyclical tree pruning reduces susceptibility to damage from severe weather, minimizing impacts of storm events like the December 2013 ice storm.

Urbanization of Regional corridors presents challenges requiring new technologies and practices

Street trees are recognized as a key component for successful urbanization of Regional corridors (e.g. VivaNext rapidways). Urban corridors present challenges for establishing and maintaining healthy street trees. To provide adequate soil and water, new technologies including engineered soil cell chambers and water efficient irrigation systems are required. Use of these systems is placing increased demands on operating budgets.

Current watering operations, including best practices that support water conservation and other environmental improvements, are being reviewed to optimize the delivery of water. Water efficient irrigation systems that are consistent with the Region's Long Term Water Conservation Strategy are being assessed as part of Transportation Services capital projects.

With urbanization, new streetscape features are being constructed including landscaped medians and boulevard planters. Maintenance requirements for this living asset in this more complex environment are different and more intensive than in previous streetscapes. To accommodate urbanization and achieve expected benefits, additional resources are required to maintain these assets.

Street trees and other green infrastructure elements are a significant capital asset

In 2013, the Region adopted a Corporate Asset Management Policy, which details principles for a consistent and coordinated approach for managing Regional assets to ensure long-term sustainability and to demonstrate fiscal stewardship. To meet the goals of the Corporate Asset Management Policy, Environmental Services is developing an Asset Management Strategy and specific Asset Management Plans.

Green infrastructure, including street trees and systems that support them have been identified as a capital asset. Work to develop an asset management plan has been initiated for this green infrastructure. In late 2016, the plan should lead to further improvements in the performance of street trees by ensuring the right investments are made at the right time to maximize the assets lifecycle and its benefits.

Link to key Council-approved plans

Delivery of the Street Tree program is consistent with the Regional Official Plan and 2015 to 2019 Strategic Plan fundamental principles of Sustainable Environment, and Preserving Green Spaces. A healthy and maturing street tree population will support increasing urban canopy cover and increase our green infrastructure. Further, public health benefits provided by street trees contribute to supporting community health and our residents overall well-being.

5. Financial Implications

Street tree health improvements will be achieved through program optimization

Recommendations from the 2015 street tree health assessment report will be reviewed and advanced on a priority basis. Major program changes (e.g. increased watering) and use of new technologies (e.g. soil trenches and soil cells) have already been implemented in previous years. Further street tree health improvements will be achieved through program optimization and implemented as part of ongoing adaptive management (e.g. pruning schedule refinement). Additional financial impacts are not anticipated for implementing these adjustments.

Growth and urbanization of Regional corridors is presenting additional pressure on tree maintenance operating budgets

Maintaining and improving the performance of street trees in urban environments will require new technologies, specialized expertise, and additional resources (e.g. horticulture, tree pruning, soils, automated irrigation). Maintenance activities associated with these streetscapes can be effectively delivered through contracted services, while expertise to manage these assets over the long term and audit contracted services is best delivered through Regional staff. Operating budgets are forecasted to increase by $587,000 between 2015 and 2018 to accommodate this growth and urbanization (Table 1). The required funding to support maintenance of new streetscapes will be presented through the multi-year budget and business planning process.

Table 1
VivaNext and Great Regional Streets Impact to Forestry Landscape Maintenance Budgets (Operating) 2015-2018

Program Area	2015 Budget	2016 Forecast	2017 Forecast	2018 Forecast
VivaNext Bus Rapid Transit	$625,000	$957,000	$1,066,000	$1,204,000
Transportation Services – Great Regional Streets	$62,000	$62,000	$62,000	$70,000
Total	$687,000	$1,019,000	$1,128,000	$1,274,000
Change over Previous Year	n/a	$332,000	$109,000	$146,000

It should be noted that the commissioning of additional planned VivaNext and Great Regional Street projects over the next decade will require further funding. An increase of $2,800,000 is forecast by 2025 to address the maintenance requirements of planned projects coming online including more cost intensive maintenance for 22 km of additional VivaNext transit rapidways.

Other global cities including Vancouver, San Francisco, London and Frankfurt, to name a few, have implemented similar innovative urbanization and transportation initiatives with a significant positive return on the investment. Balanced investment in projects with built and living green infrastructure provides a sense of place and community, and contributes toward achieving the vision of walkable and liveable cities.

6. Local Municipal Impact

The Region's street trees continue to play a significant role in defining the character of local communities. Healthy trees contribute to healthy communities. Improvements identified in this report will help to ensure street trees provide the expected benefits to the environment, communities and local residents. The street tree health assessments, continuous improvement measures and new technologies are also of interest to local municipal street tree programs. Staff will be working with local municipal staff through the Urban Forestry Forum to discuss this information to assist with program delivery and improvements in street tree health.

Regional Road right-of-way conditions (major arterial roads) are recognized as extremely harsh environments compared to local municipal street tree environments (residential roads). As such, although many of the technical findings and information on standards and practices are valuable, the survival rates and performance targets may vary.

7. Conclusion

Street trees are a significant Regional asset, providing many benefits to residents. They are a capital asset that appreciates in value over time. To achieve the expected benefits, trees require resources to ensure their growth and long term performance.

The 2015 street tree health assessment has confirmed that the Region's investment in the Street Tree program has made a positive impact on the performance of street trees. Evidence based decision making and maximizing the use of data are key to advancing performance improvements. The report clearly identifies opportunities for further improvement to help meet performance targets.

New streetscapes being constructed through the urbanization of Regional corridors are presenting new challenges and significant investments are required to maintain these assets. Investments for maintenance of these features will be proposed through the multi-year budget process.

For more information on this report, please contact Laura McDowell, Director, Environmental Promotion and Protection, at ext. 75077 or Ian D. Buchanan, Manager, Natural Heritage and Forestry, at ext. 75204.

The Senior Management Group has reviewed this report.

September 23, 2015

Attachment

#6335151

Accessible formats or communication supports are available upon request

ATTACHMENT1

Executive Summary

York Region

Street Tree Health Assessment

2015

YORK REGION FORESTRY
Healthy Trees. Healthy Communities.

SILV-ECON LTD.

Prepared for:

Natural Heritage & Forestry

Environmental Services Department

Regional Municipality of York

Prepared by:

Silv-Econ Ltd.

913 Southwind Court

Newmarket, ON

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August 11, 2015

Executive Summary

Over the past 12 years, York Region's street tree population has grown from 14,000 trees to over 43,000, a 17% annual increase. During this period, a number of challenges to tree establishment and growth have clearly been overcome as a result of the Region's adaptive management strategy which is guided by street tree health assessments which are now conducted on a 5-year cycle.

The present study conducted by Silv-Econ Ltd., represents the third street tree health assessment and investigates the health of 3,133 trees, sampling between 150-250 living trees planted within each of the last twelve years. The study involved close examination of trees to characterize their species and size and to identify their health and structural issues. At the same time, the factors most likely impacting tree health were investigated, such as planting site type (e.g., boulevard with turf, raised bed, soil trench, and natural soils), watering rates, rainfall levels, soil quality (e.g., fertility, road salt pollution, bulk density, texture & biological health), mulching levels, adjacent land use, wind exposure, and proximity to the roadway. Soil excavations were done on ten trees to examine root depth, growth rate and size to identify potential relationships with environmental site factors and tree vigor.

Improvements to tree health have been impressive and are steadily improving. For example, the proportion of ailing trees, which are ranked as declining or worse, has exponentially decreased from 33% in 2003, to 13% in 2010, and 5% in 2015. About 84% are now in good to satisfactory condition, compared with 76% in 2010 and 29% in 2003. Additionally, more newly planted trees are remaining healthy after planting, showing fewer symptoms of transplant shock (e.g., bark and twig dieback). For instance, only 2% of trees were ailing after their first winter compared to 12% in 2010 and 78% in 2003.

Despite the overall improvements in tree health, a large proportion of newly planted trees (30-50%) exhibited symptoms of transplant shock within first three years after planting (Figure A). These trees can be seen by the casual observer as having twig dieback, sparsely leaved crowns, and stunted growth. This phenomenon is primarily attributed to root loss when trees are dug from the nursery in combination with unsuitable environmental factors at the planting site as described below.

Primary observed causes of tree health issues

The major factors causing tree health problems when the Region implemented its first tree assessment in 2003 were identified to be substandard nursery stock and tree planting practices, and a lack of maintenance practices in the early years following planting. These issues have been clearly addressed by the Region with its current management strategies.

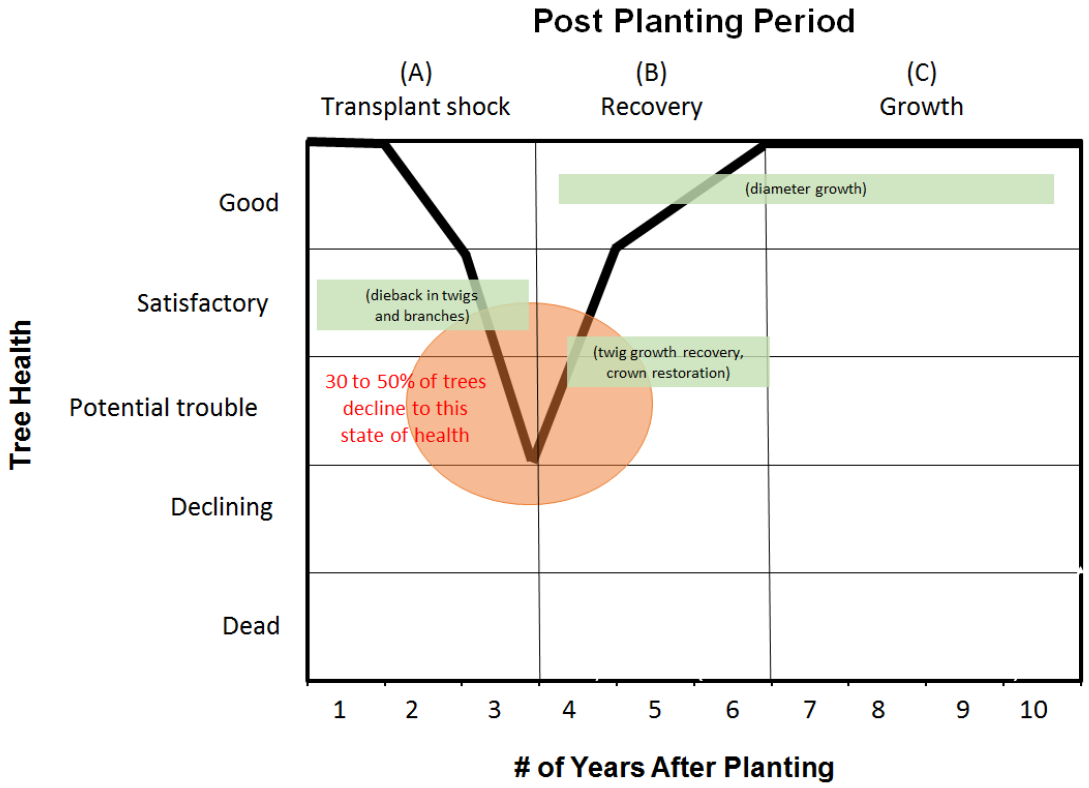

Figure A. Observed relationship between tree health, growth and the number of years following planting.

Today, the underlying environmental factors affecting tree health are becoming noticeably apparent as observed through field investigations conducted as part of this work. The top four reasons for poor tree health have been attributed to the proximity of the tree to the roadway, wind exposure, soil chemistry and soil texture.

Close proximity of planting site to the road

The primary factor affecting health of the Region's street trees is their close proximity to the roadway. This study found that the area within 4 meters of the roadway is a "winter threat zone" where trees are at greatest risk. About 30% of the Region's trees are located in this area (Figure B). Trees within this zone exhibit the following issues:

- Trees are physically damaged by impacts of snow and ice thrown by snow ploughs, and chemically desiccated by splashing salty ice water onto trunks, twigs and buds. Damage often appears as patches of dead bark tissue which was found on up to 8% of the trees in this zone compared to less than 4% for those further from the road.
- Tree growth following planting is noticeably lethargic, over a six year period and is a result of high concentrations of sodium. Sodium increases the soil's alkalinity (i.e., raises the soil pH). Soil alkalinity was found to be 100x greater within the

"winter threat zone" than measures taken from planting sites located outside of the zone where trees were healthier.

- Foliage is deficient in many nutrients which is a sign of unhealthy soil conditions. Specimens exhibited yellowing or chlorosis between the veins of younger leaves, while veins remained green and leaf margins browned. These are symptoms of iron deficiency; a result of highly alkaline soils (pH > 8.3).

Figure B. Schubert cherry planted inside the "winter threat zone". Only a small assortment of species planted by the Region, not including cherry, can tolerate the physical and chemical impacts related to winter roadway maintenance and vehicle traffic.

Soil texture

Trees growing in sandy soils (60 to 70% sand) were healthier and also showed better twig growth (>50% longer) compared to soils with less than 40% sand: an observation similarly made in the last tree health assessment (2010).

Wind exposure

Planting sites which showed the most impressive tree health conditions were located in sheltered residential areas. Here 86% of the trees were healthy. Comparatively fewer healthy trees were found on more open commercial sites (e.g. plazas 78%), in rural areas (e.g., agricultural 62%), and in construction areas (55%). Residential areas tended to contain a greater abundance of structures that offer trees protection from winter wind, thereby reducing plant tissue dehydration. For example, 91% of the trees planted on low wind sites were rated as good to satisfactory in health, compared to only 66% on very windy sites. On low wind sites trees did not exhibit tissue necrosis which is a key indicator of dehydration. In comparison, on windy sites dehydration symptoms such as twig dieback, and crown dieback were prevalent (79% and 300% more).

Soil chemistry

Soil fertility in Regional road allowances has been identified to be unsatisfactory for trees as determined through laboratory testing. This corresponded to low foliar nutrition. The two most commonly deficient foliar nutrients were iron (84% of the samples), and nitrogen (80%). The laboratory attributed the deficiencies to high soil alkalinity, inadequate supplies of nitrogen, phosphorus, potassium and iron. Significant deficiencies in soil fertility were measured in phosphorus (100% of the samples), and

potassium (96% of samples), and excessive amounts of sodium (90% of samples). Soils were found to lack beneficial soil fungi and other micro-organisms as determine through laboratory tests for soil health.

Top ten recommendations to improve street tree management practices and promote healthy trees

Management practices that have had a significant positive impact to tree health are described below with prioritized recommendations to further improve tree health and growth into the future. Additional recommendations to be considered are provided in the body of the report.

Enhanced planting designs (soil trenches & planters)

Use of soil trenches and raised planters in boulevards has clearly led to healthier trees growing along Regional roads. This was attributed to improvements in soil quality (favorable bulk densities (< 1.5 g/cm^3) and greater amounts of sand: > 60% compared to <50% among constructed boulevards and natural soils). Trees growing in sandy soils (60 to 70% sand) were healthier and also showed better twig growth (>50% longer) compared to soils with less than 40% sand. Use of soil trenches has partly led to an observed reduction in soil compaction. For example, today only 34% of the sites sampled had high bulk densities (≥ 1.7g/cm^3), compared to measures taken in 2010 which found 72% to be compacted.

Recommendation

1. The Region must work to achieve better soil quality and quantity in its boulevards to minimize transplant shock and ensure long term tree growth. This can be accomplished by expanding development of soil trenches or raised planters in boulevards throughout the Region. This will be particularly important to implement within the “winter threat zone” and where soils are not conducive to tree growth. Conducting soil quality tests to determine if enhancements are warranted is encouraged. Soils installed in trenches and planting beds should be constructed following York Region’s planting soil specification as this provides soil texture recipes ideally suited to Regional trees. Furthermore, all trees should be provided with 16 m^3 / tree of soil with direct access to an additional 14 m^3 / tree of adjacent soil and trenches should be increased to a depth of 50 cm.
2. For sites without soil trenches, explore options to amend soil immediately adjacent to the planting hole.

Tree watering

The Region’s current watering program involves placement of watering bags (Tree Gator Watering Bags) around each newly planted tree, and filling them with 57 litres of water, 14 times annually between June to September for three years. Watering newly planted trees is critical to reducing transplant shock and promoting good health and growth immediately following planting during the establishment period. Natural rainfall cannot

be relied on as it is inconsistent, and may not hydrate the root ball when the mulch bed is dry.

Recommendation

3. A soil moisture monitoring program applied in concert with the watering program is recommended to verify that trees are obtaining adequate amounts of water, or are not being over watered. An automated system that uses soil moisture probes and data loggers on selected trees will ensure monitoring is done efficiently and provides useful data to refine future watering programs so they are cost effective and beneficial to trees. Such a system will also be useful to monitor the efficacy of automated irrigation systems in planting beds.

Plant species with solid, proven performance

The Region has developed a list of "Top Performing" small form (hydro form) and full form tree species, based on past results of street tree health assessments, extensive literature review, and anecdotal records of species performance in Regional road allowances. These lists represent species which have desirable characteristics and are tolerant of the harsh growing environment present along Regional roads. While being sensitive to species diversity, these lists have been developed to ensure that trees planted meet performance expectations and achieve the expected benefits for Region residents. Today, the top four performing species are found on the "Top Performing" list and include Kentucky coffee tree, honey locust, ivory silk lilac, and Ohio Buckeye. Their health ratings average 'good' among at least 50% of their cohorts. Presently about half the tree population is dominated by six species which makes it potentially vulnerable to impacts of disease or insect infestation that are related to an individual species.

Recommendation

4. York Region should partner with academic institutions and industry to trial new species, including those currently not planted by the Region. Annual health conditions should be monitored closely for 5 years. An annual report with recommendations should be developed based on findings. A final list of new species for planting in roadside environments should be developed after the 5 year period.

Nursery stock selection, tree inspections, tagging and tree guards

York Region's Natural Heritage & Forestry began a program in 2008 to carefully inspect and select trees at the nursery for all new plantings. Regional staff also critically inspect trees at the time of planting and reject any which appear unhealthy or damaged and to ensure they have been correctly planted. Two years following planting, the young trees are inspected again as part of the warranty program, and every two years thereafter as part of juvenile tree maintenance program until the tree has been installed for 10 years.

Recommendation

5. Work with industry to improve the quality of nursery stock by encouraging nurseries to develop trees that do not have co-dominant limbs or girdling roots.

6. Expand tree protection guards (arborguard) by connecting several together when trees are maintained so they don't become too small for trees as they grow. Fifty four percent (54%) of the tree population have tree guards. About 30% of the trees had outgrown their guards with constricted stem growth observed on a few specimens. Tree guards become too small for trees when tree diameter at breast height (DBH) is 6cm or about 3 to 4 years after planting and should be enlarged as necessary.

Tree pruning

The Region presently prunes its trees to remove branches protruding into sidewalks and roadways, or to remove dead or broken limbs.

Recommendation

7. The Region should continue to expand its pruning program to implement structural pruning to manage crown structure: 64% of all full form trees were found to have co-dominant limbs. Co-dominant limbs occur when the crown forks into two main branches that originate at the same point. As the tree matures, the branch connection at the "fork" becomes weak as a result of bark included between the limbs. This makes a large tree very likely to split and result in limb breakage at the fork, particularly during storm events. Associated problems include pre-mature limb or trunk failure, development of unattractive wounds and even tree death. A structural pruning program should focus on improving structure early in the tree's life.

Selecting planting sites

Selecting suitable planting locations is critical in directing future tree health. The following points should be considered when selecting sites.

Recommendation

8. Keep trees away from the road, ensuring boulevard planting sites are located outside of the "winter threat zone" which is within 4 meters of the roadway whenever possible. When planting inside this zone, ensure soil conditions are ideal and consider using raised planters as a way to protect the trees from salt spray.

Protecting trees on construction sites

Trees located in construction areas were often poor in health (44% are potential trouble or worse) and have a high incidence of being damaged by soil disturbance or vehicle/equipment impacts. Poor tree health is often preventable simply by installing and maintaining a tree preservation fence around the tree.

Recommendation

9. The Region should review and revise its tree preservation requirements to incorporate industry leading best practices.

10. The Natural Heritage and Forestry Division should work with other Regional departments to increase efforts to implement and enforce tree preservation around trees on construction sites.

Proven street tree management practices to be continued

The following is a list of the Region's management practices which are confirmed by this study to be most important at supporting healthy tree populations and are recommended for continued implementation.

1. Commit to continued monitoring, auditing and adaptive management including routine monitoring of tree health and environmental conditions on a 5 year cycle to identify future challenges, and to understand influences on future performance.
2. The Region must continue with watering newly planted trees, 42x over a 3 year period. This practice helps to maintain hydration of the rootball, and moisten and lubricate surrounding soils to promote root penetration.
3. Continue to select the majority of trees planted from the Region's top performing street tree species lists until other species of proven performance are identified.
4. Regional staff must continue to select trees in the nursery and conduct strict monitoring of contractor planting activities. This will ensure that only trees in superior health condition and form are accepted as part of Regional infrastructure.
5. The Region must continue to implement a pruning program for black knot fungus to maintain the health of Schubert choke cherry trees. This assessment found 8% of the cherry trees had this disease which can cause branch breakage and crown dieback if not managed.
6. The Region must continue to maintain mulch beds on a three year cycle to keep them relatively weed free. A mulch bed that is 2 meters wide and 20 cm deep should remain effective and not diminish significantly in size within the current maintenance cycle. A longer cycle will likely result in more than 25% of the trees having excessive weed growth (> 25% coverage) in the mulch bed.