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STREET TREE INVENTORY - UPDATE

The Transportation and Works Committee recommends the adoption of the recommendation contained in the following report, December 5, 2007, from the General Manager, Roads:

1. RECOMMENDATION

It is recommended that this report be received for information.

2. PURPOSE

At its meeting on January 26, 2006, Regional Council adopted Clause 2 of Report No. 1 of the Transportation and Works Committee titled Status Report – Street Tree Program, which directed staff to report back in 2007 on the details of a Regional street tree inventory. The purpose of this report is to update Council on the status of the Street Tree Inventory Program.

3. BACKGROUND

This report provides some background on the development, implementation, and results of an inventory completed for recently planted street trees within Regional road rights-of-way.

3.1 Urban Forest

Street trees are recognized as Regional assets providing considerable environmental, social, and economic benefits to the residents of York Region. Trees provide a variety of environmental services including cooling (shade), moderating the local climate, energy conservation, improving air quality, preventing soil erosion and contributing to storm water management. These trees also help define the character of our communities and provide a positive contribution to the overall urban forest. The Region has made a substantial investment in liveable streets where treed boulevards are an integral part of our communities.

3.2 Street Tree Management

Management of the Region's street trees involves planting and maintenance of trees to ensure a healthy street tree population. In order to effectively manage this asset, an understanding of the numbers, species, size, age, health, and location of street trees is required. A street tree inventory and its associated database can be used to identify, store, and analyze tree information and their attributes.

3.3 Development of a Street Tree Inventory

In 2004, staff initiated the development of a street tree inventory in consultation with Geomatics. This system is built on using Global Positioning System (GPS) and Geographic Information System (GIS) technology. The application developed incorporates a number of parameters including, species, size, location, and health. In 2007, the street tree inventory was completed. This initial inventory focused primarily on trees within urban areas. This inventory is currently being updated to capture street trees planted in the Fall of 2007.

Using this database, a preliminary analysis of the Region's street tree population was completed to determine:

- Number of street trees
- Species composition
- Age and size distribution
- Overall health
- Replacement cost
- An estimated current and projected (20 years out) asset value

In addition to providing information on the structure and health of the Region's street tree population, the inventory can also be used to investigate, monitor, model and assess impacts of specific tree health issues such as insect infestations. It can also be used in forecasting the financial implications relating to operational management associated with changing tree maintenance requirements of larger trees.

The Region is currently developing a Roads Asset Management Strategy. The street tree inventory has been designed to be compatible with this corporate initiative.

3.4 Other Street Tree Management Initiatives

In addition to the development of the street tree inventory, several other initiatives were undertaken in 2007 to continue to improve the health of our street trees. These included:

- June 2007 – hosting a “Street Trees – Our Green Infrastructure” staff training workshop.
- Summer 2007 – developed and implemented a comprehensive street tree watering program.
- Fall 2006 – Spring 2007 – street tree health re-assessment study.

The “Street Trees – Our Green Infrastructure” staff training was hosted by the Natural Heritage and Forestry Services Section, and emphasized the requirements for sustaining healthy trees on our Road rights-of-way. Region employees from Roads, Water and Wastewater, Planning, Health, and the local municipal partners attended the one day workshop. A series of speakers provided information on the critical requirements for

growing healthy trees, and how to incorporate these requirements into the capital delivery projects and roads operational management.

4. ANALYSIS AND OPTIONS

4.1 Current Status of Street Tree Population

Using the data collected in the street tree inventory, the current composition and structure of the street tree population in our urban areas was analyzed.

4.1.1 Quantity and Distribution of Street Trees

The results of the street tree inventory indicate that the current street tree population in urban areas on our rights-of-way is 26,549 trees. This number includes those trees planted by the Region in recent years (Table 1), trees planted in previous years, and trees planted by others on our behalf. Most of the Region's street trees are planted in co-ordination with road improvement construction projects. As such, the number of trees planted annually since 2000 has varied somewhat from year to year. Table 2 shows the distribution of Regional street trees by local municipality.

Table 1
Number of Trees Planted Along Regional Roads by the Region

Year	Number of Trees Planted in the Rights of Way
1996	293
1997	175
1998	1,579
1999	928
2000	1,713
2001	2,980
2002	3,577
2003	2,337
2004	2,129
2005	3,518
2006	2,692
2007	1,325
TOTAL	23,246 *

* Total excludes numbers of street trees planted within the rights-of-way by others.

Table 2
Distribution of Regional Street Trees in Urban Areas

Municipality	Number of Street Trees	Percentage of Street Tree Population
Aurora	1,353	5.1
East Gwillimbury	1,191	4.5
Georgina	827	3.1
King	674	2.5
Markham	6,101	23.0
Newmarket	2,074	7.8
Richmond Hill	4,343	16.3
Vaughan	9,275	35.0
Whitchurch-Stouffville	711	2.7
Total	26,549	100

Table 3 provides a comparison of street tree numbers planted by York Region and other municipal jurisdictions in recent years. Our numbers are comparable with the major arterial street tree planting in the City of Toronto and Ottawa. The local municipalities plant trees, for the most part, in residential subdivisions. Peel and Durham were contacted to provide numbers, but data was not available. Jurisdictions with similar tree planting programs and conditions experience comparable street tree health issues. Information is shared on a technical basis amongst municipalities to improve best practices.

Table 3
Street Tree Planting

YEAR	York Region	City of Toronto*	City of Ottawa	Town of Markham
2007	1,325	9,500	N/A	530
2006	2,692	9,720	N/A	530
2005	3,518	10,000	1,865	530
2004	2,129	7,000	838	N/A
2003	2,337	N/A	2,172	N/A

* City of Toronto plants 75% bare root (small) stock in residential frontages, and 25% ball and burlap stock (comparable to York Region program) on major arterial roads.

4.1.2 Species Composition

To maintain a healthy urban forest, it is important to ensure that there is a diversity of species present. This biodiversity helps to promote vigour and resilience in the street tree population. Biodiversity buffers the potential devastation of present and future environmental threats or impacts. Understanding the current species composition allows managers to make informed decisions on species selection to promote a diverse urban forest. Using the data collected, the species composition of the Region's street tree population was determined (Table 4).

Table 4
Street Tree Species Composition

Species	Number of Street Trees	Percentage of Street Tree Population
Norway Maple	4,364	16.4
Green Ash	3,301	12.4
Ivory Silk Lilac	2,129	8.0
Honey Locust	1,394	5.3
Apple	1,273	4.8
Little Leaf Linden	1,088	4.1
Colorado Blue Spruce	871	3.3
Red Oak	745	2.8
Serviceberry	682	2.6
Kentucky Coffee Tree	644	2.4
Ohio Buckeye	639	2.4
Hackberry	569	2.1
Silver Maple	536	2.0
Other (66 species)*	8,165	31.4

* See *Attachment 1* for a complete listing of all species planted.

The inventory demonstrates that the Region has good biodiversity in its current street tree population. This reflects the practice of planting the right tree at the appropriate location, balanced with the use of the best performing trees, while also being sensitive to biodiversity both at the local and Regional scale. In 2007, the Region developed a list of top performing street trees to further guide the planting practices and improve health and survival.

4.1.3 Age and Size Class Distribution

Approximately 82% of the trees are less than 12 years old. This reflects the significant increase in tree planting efforts which began in the late 1990's and was refined with the adoption of the Streetscaping Policy in 2001. Understanding the current age structure of the urban forest allows managers to forecast future planting and maintenance requirements.

4.1.4 Street Tree Health

Street tree health remains an ongoing challenge for both capital delivery and roads maintenance. The street tree inventory provides an excellent management tool for monitoring, tracking and advancing improvements in street tree survival.

The street tree inspection cycle has evolved to include two main evaluations; (i) an initial inspection following planting, and (ii) an inspection at the conclusion of the warranty period after 2 years. In addition, trees are subject to inspections during tree maintenance

activities, and more detailed assessments may occur as part of focussed tree health investigations e.g. Asian Longhorned Beetle inspection. These initial two inspections offer an opportunity to confirm the quality of newly planted trees and record and track the health status following the two year warranty period.

The following information is provided to support that street tree health and survival continues to improve:

- 2003 Street Tree Health Assessment – 1,094 trees sampled - reported that 27% of the trees were in good to satisfactory condition.
- 2007 Warranty Assessment of the 2005 tree planting – 3,518 trees sampled – reported that 44% of the trees were in good to satisfactory condition.
- 2007 Street Tree Inventory – entire inventory including 26,549 trees sampled – reported that 80% of the trees were in good to satisfactory condition.

It is acknowledged that these data sets are not entirely comparable, however, it is clear that science, technology and lessons learned, are all driving improvements to our street tree health and survival. Further analysis of the tree health data confirms the period of transplanting shock and establishment, where many trees often initially decline after planting, as approximately 3 years, after which most trees that survive begin to improve.

In the past 4 years, benchmarks to improving the survival of our street trees have included:

- 2003 - undertook a baseline comprehensive street tree health assessment.
- 2003 - implemented changes to our tree planting contract specifications to ensure proper planting practices to maximize survival.
- 2004 - published the Street Tree Planting Guidelines to define criteria to direct the right tree being planted at the right location.
- 2003-2007 - ongoing improvements in mulching, fertilizing, pruning and watering programs and practices.
- 2006 - initiated a street tree inventory to proactively manage this Regional asset.
- 2007 - hosted 'Street Trees – Our Green Infrastructure' – staff training symposium for continuing education and awareness on what street trees require to grow and provide the expected services.

As an example of improved practices, the way in which the street tree watering program has evolved is an important case history. Since 2003 the watering program has evolved from watering trees being at the discretion of the tree planting contractor, to a comprehensive program involving a variety of water delivery mechanisms. In 2007, one of the driest years on record, water was delivered to trees through the following:

- Contractor is responsible to water the trees on planting.
- Contractor was assigned to water individual trees delivered 6,547 water units.

- Roads maintenance ‘brine’ trucks retrofitted to deliver 3,416 water units during the summer months.
- Stake tank truck delivered 2,219 water units.

Note: a watering unit is 40 litres.

Over 12,000 trees were watered as part of the 2007 watering program. We have also explored the use of other technologies for water delivery such as water storage slow release devices (e.g. Gator bags and Ooze Tubes). In 2008 a comprehensive street tree watering program will be in place which will include the use of Gator Bags placed on newly planted trees to enhance establishment. We anticipate a significant improvement in street tree health with the delivery of this program.

The street tree inventory provides an excellent tool to track the health of both individual trees and the overall population. The data base will increasingly become a valuable tool for tracking and deploying maintenance for this Regional asset.

4.1.5 Current and Future Value of Street Trees

Street trees, like other municipal infrastructure, are considered a Regional asset. However, unlike many other assets, trees appreciate in value over time. The value based on current replacement costs (50 mm trunk diameter tree at \$450) would be approximately \$12M. Recognizing that over time these trees grow on the boulevard, a value based on replacing the inventory with “comparably sized” larger trees (80 mm diameter tree at \$800) would be estimated at \$21M. Using Regional tree growth rates, it is estimated that if the current street tree population was grown for a 20 year period, it would be worth in excess of \$50M. This demonstrates the importance of recognizing street trees as a tangible asset, and recognizes the considerable commitment to a long term investment in green infrastructure.

4.1.6 Contribution to Urban Forest Canopy Cover

In urban areas one way of measuring the contribution of trees to the environment is through an assessment of tree canopy cover (tree leaf area). Contributions to measuring the overall canopy cover typically come from all trees including those situated in parks, natural areas (e.g. ravines and woodlots), trees on private property, and also street trees.

Currently the Region’s street tree population in urban areas contributes an estimated 1.82 hectares of tree canopy to the urban forest. Modelling estimated growth rates and assuming reasonable tree performance, the projected tree canopy of the current street tree population if grown for forty years would be 115 hectares (Table 5). The initial investment in street trees will result in considerable benefits and services provided by these mature trees.

Table 5
Projected Contribution of Street Trees to Urban Forest Canopy Cover

Tree form	By year - projected contribution to urban forest canopy cover (hectares)				
	2007	2017	2027	2037	2047
Full Form	1.46	12	34	68	92
Small Form (under hydro)	0.36	3	8	17	23
Total	1.82	15	42	85	115

4.2 Application of Street Tree Inventory

In addition to baseline statistics and characterization, the street tree inventory can also be used to model potential impacts of various stresses. Examples would range from assessing the impacts associated with the introduction of tree pests, to anticipating the influence of climate change due to global warming. From an operations standpoint, the street tree inventory can also be used to proactively model scenarios to determine future maintenance requirements. This tool will allow managers to make informed decisions when identifying the future resources required to manage this asset.

The following sections offer two examples which are provided to demonstrate the application of the current inventory database.

4.2.1 Example #1 Emerald Ash Borer – Risk Assessment

During the summer of 2002, the presence of an exotic tree pest, known as the Emerald Ash Borer (EAB) *Agrilus planipennis*, was discovered in Essex County in south western Ontario. Since its discovery, significant resources have been allocated to study and manage the impact of this pest. The EAB has moved easterly through south western Ontario causing the death of ash trees. On December 4th, 2007 the Canadian Food Inspection Agency confirmed the finding of the EAB in the City of Toronto, just south of the Town of Markham. Previous to this date, the eastern extent of the EAB infestation was in the London area. No method of control currently exists for the containment of this pest, and it is expected to continue moving east across southern Ontario.

As identified in the inventory, ash trees are the second most common street tree (3,630 trees or 12%). As a proactive approach, in preparation of the arrival of this pest to York Region, staff has undertaken a preliminary threat assessment. Based on the inventory, staff estimated that 3,630 street trees in urban areas will be impacted by the EAB, with a similar number of street trees being affected in rural areas. Understanding how many trees will be affected, and in what areas, provides an excellent tool to monitor and manage for the impending threat. From a local municipal Regional Road perspective, 37% of the ash street trees in urban areas are located in the City of Vaughan. While the Towns of Richmond Hill and Markham each have 19% of the ash street trees.

The infestation of the EAB will result in the death of all ash trees. The removal of street trees which will likely be assessed as a hazard as they deteriorate, based on current

contract costs is estimated to be \$3M. Replacement of these trees with new trees will cost an additional \$3M. It is important to note that the referenced costs are based on impacts to Regional street trees, but the impact and associated financial implications of the arrival of the EAB across the landscape will be significantly greater. Staff will be reporting on implications of the new find in a subsequent staff report.

4.2.2 Example #2 Block Pruning - Street Tree Maintenance

Since 1996, the Region has planted 23,382 street trees. A significant investment has been made in the maintenance of these newly planted trees, including a watering and immature tree maintenance program (mulching, fertilizing, pruning, etc.). However as these trees grow, current programs will not be adequate to provide the required maintenance. Programs will need to be implemented to prune larger trees to improve their structure and reduce future hazards. These programs are referred to as block pruning programs, and are required when trees reach a height of 5 metres. The current mature tree maintenance program which focuses on the reduction of hazards will need to expand to provide this proactive maintenance.

Using the street tree inventory, staff has been able to identify timelines for the requirement of these future programs to be implemented, including locations where the works will need to be deployed. By 2011, approximately 10% of the population of street trees will be tall enough that a block pruning program will need to be implemented. Initial locations for these programs included Regional roads in Markham, south of 16th Avenue and roads in Vaughan, south of Highway 7. Over the next several years, Natural Heritage and Forestry Services staff will be working on developing a program and business case, for block pruning, to keep pace with our growing asset.

4.3 Relationship to Vision 2026

Inventory of the Region's street trees, as part of the Urban Forestry program, will continue to support Vision 2026 and such key goal statements as:

"In 2026, York Region will have grown at a pace that supports healthy communities, economic vitality, sustainable natural environment and effective human services."

The study strengthens the Region's commitment to focus on Vision 2026 actions areas including:

- Securing a Green York Region.
- Ensuring clean water, air and promoting conservation.
- Attracting and supporting business.
- Creating well designed and liveable communities.
- Developing an integrated transportation network.

5. FINANCIAL IMPLICATIONS

The continued update of the Region's street tree inventory will be completed through current staff and funding resources. Future adjustments in the street tree inventory application and technology will be completed through the asset management initiative and associated resources.

Funds required for emergency action in terms of dealing with insect infestations will be requested as required. Resources for new street tree planting and maintenance programs will be brought forward as part of the regular business plan and budget cycle.

6. LOCAL MUNICIPAL IMPACT

It is recognized that street trees often help to define the character of local communities. Improved management using the street tree inventory will help to ensure that the street trees provide a positive contribution to the local streetscape, and are recognized as valuable green infrastructure.

Local municipalities face similar urban forest management challenges. Region staff will continue to work with our municipal partners to share our knowledge and experience, and provide science and technology transfer.

7. CONCLUSION

The development and implementation of the street tree inventory has provided valuable information regarding the current structure and health of the Region's street tree population. Through continued inventory and monitoring of street trees, improvements will be tracked. Street tree management practices will continue to improve and the benefits will be recognized. The planting and maintenance of healthy street trees is recognized by the public as a visible contribution to our green infrastructure.

Recognition of street trees as a significant Regional asset, which increases in value over time, is critical. The Region must continue to move towards a balanced appreciation of the requirements of trees through planning, design, construction and maintenance as an integral part of the Regional Road network. Healthy street trees are a viable component of the urban forest, and need to be managed and recognized for their contributions both economically and aesthetically to the communities. The existing street tree population provides 1.82 hectares of canopy cover today, this canopy cover will increase to 42 hectares in 20 years, and provide an estimated 115 hectares of urban canopy cover by 2047. The initial investment in street trees results in a number of benefits and services to our communities, which will grow exponentially as the urban forest matures. The inventory is an important tool which allows us to proactively manage the street trees as an integral green infrastructure component of our growing communities.

Report No. 1 of the Transportation and Works Committee
Regional Council Meeting of January 24, 2008

For more information on this report, contact Brian Harrison, Director, Operations, Roads Branch at extension 5205 in the Transportation Services Department.

The Senior Management Group has reviewed this report.

(The attachment referred to in this clause is attached to this report.)