

Background Document

Developing a Sustainable Urban Forest Program



Operations Environmental Services, Infrastructure Services Department

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Table of contents

CHAPTER 1 - Introduction	
Section	Pg
Table of contents	3
List of figures and tables	4
Introduction	5
Summary of work completed to date	6
Quick fact #1 - Natural heritage & biodiversity	7

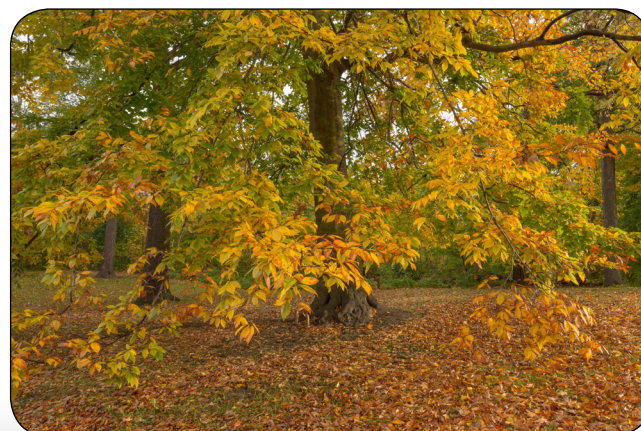
CHAPTER 2 - Project Background	
Section	Pg
2.1 What is the urban forest	9
2.2 Why is the city doing this work?	10
2.3 How will the city achieve this goal?	10
2.4 Are trees really that valueable of an asset?	11
2.5 Large, mature trees provide the most services	11
2.6 The services trees provide to the community	12
Quick fact #2 - Protecting big, old trees	13

CHAPTER 3 - Program Overview	
Section	Pg
3.1 Moving from a reactive to proactive program	15
3.2 Project outcomes	16
3.3 Summary of key project phases	17
3.4 Community engagement	18
3.5 Project framework - Principles & Program Elements	19
3.5.1 PLAN	20
3.5.2 ENGAGE	20
3.5.3 PROTECT	21
3.5.4 MAINTAIN	21
3.5.4.1 Structural pruning	22
3.5.5 PLANT	22
Quick Fact #3 - The costs\benefits of large big tree.	23

CHAPTER 4 - Kitchener's Urban Forest	
Section	Pg
4.1 Kitchener's tree canopy	25
Quick fact - Setting realistic canopy cover goals	26
4.2 Kitchener's street & park trees	27
4.3 Kitchener's natural areas	28
Quick fact # 5 - New technology tools ...	29

CHAPTER 5 - Challenges & Opportunities	
Section	Pg
5.1 Customer service levels	31
5.2 Soil quality & quantity	32
5.3 Competition for space	32
5.4 Natural area conservation	33
5.5 Invasive species	33
5.6 The private urban forest	34
5.7 Climate change	34
Quick fact # 6 - Thriving or alive?	35

CHAPTER 6 - Next Steps	
Section	Pg
Next steps	36
Contact information	36



List of Figures and Tables

LIST OF FIGURES		
#	Title	Pg
1	Components of the urban forest	9
2	Strategic direction for Kitchener's urban forest	10
3	Tree benefits increase as leaf area & tree size increase	11
4	Percent tree canopy by city ward	25
5	Four factors that change canopy cover	26
6	Number of street and park trees by life cycle stages.	27
7	Age of development by planning community	32
8	Natural area encroachments	33

LIST OF TABLES		
#	Title	Pg
1	Comparison of reactive and proactive urban forest program	15
2	Project outcomes and descriptions	16
3	Summary of key project phases	17
4	Principles of a sustainable urban forest	19
5	Program elements	19
6	Five key activities for planning and managing the urban forest	20
7	How Kitchener's tree canopy compares to other area cities?	25
8	Summary of natural area by size class in hectares (ha)	28
9	Roles the city could undertake on private lands	34

1. Introduction



This document provides background information on the urban forest to support the development of a sustainable urban forest program. The six sections address the following areas:

1. Background information on the project - why the City is undertaking the work; a description of the benefits the urban forest provides.
2. Project overview - provides specific information about this project such as outcomes, timelines, community engagement.
3. Project framework - identifies the guiding principles and the program elements that are required to work towards a sustainable urban forest.
4. Kitchener's Urban Forest - provides information about the urban forest today including tree canopy, the city's street and park trees, and natural areas. Reference is also provided to the City's website where you can explore the urban forest spatially across the City.
5. Key challenges and opportunities - provides information on service requests, soil quality and quantity, and climate change.
6. Next steps - provides information on next steps and how to stay informed and connected on the project.

1.1 Summary of work completed to date

In the spring of 2016 staff published a public document titled *Project Introduction* and attended a few of the citizen committees informing members and the public about the start of this corporate project - developing a sustainable urban forest program. At the time the proposed work received considerable media attention, and it was stated that staff would return in late summer (2016) with the background document. A number of factors delayed the second stage of this work.

During this time a large amount of work was undertaken; the list below identifies the key tasks completed and initiated. In addition to providing information to the background document, this work also supports the next stages of work to be undertaken.

- Background research & review of municipal urban forest program
- Initial internal stakeholder meetings & interviews
- Data collection including financial, work order and customer call data
- GIS analysis of tree inventory \ natural areas
- Tree canopy analysis
- Legal \ case law review & risk management
- GIS Story Maps
- Held two workshops \ lectures on urban soils
- Developed community engagement plan
- Developed background document

Kitchener's Natural Areas Program
Building bird boxes, Restoration and discovering nature, Citizen scientist butterfly count



Quick Fact # 1 - Kitchener's Natural Heritage & Biodiversity

Kitchener is fortunate to have over 1,000 hectares of natural areas conserved for current and future generations. These “natural patches” are a representation of this area’s natural heritage and biodiversity. The artistic illustration depicts the native biodiversity you can find in our natural areas showing twenty-eight different species! Can you see all of them?



2. PROJECT BACKGROUND



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This chapter of the document defines what the urban forest is, provides information on why the city is undertaking this work, along with how it will achieve the stated goal. Additional background information on the benefits trees provide to the community and the importance of large, mature trees is discussed.

CHAPTER 2 - Project background

Section	Pg
2.1 What is the urban forest?	9
2.2 Why is the city doing this work?	10
2.3 How will the city achieve this goal?	10
2.4 Are trees really a valueable asset?	11
2.5 Large, mature trees provide the most benefits.	11
2.6 The benefits trees provide to the community.	12
Quick Facts - Big trees	13

2.1 WHAT IS THE URBAN FOREST?

The urban forest is a collection of trees that grow within a city. It includes trees that have been planted in neighbourhoods, parks, cemeteries, golf courses, as well as on institutional, commercial, and industrial lands. It also includes trees that are natural - meaning they were not planted. This includes trees found in areas of the city that were not developed (ie. natural heritage features - woodlots) along with all of the trees that have sprouted up along fences, railway lines, abandoned lots, laneways, property lines, etc. Planted and naturally occurring trees can be found across the city. The urban forest is a shared resource that has multiple owners, and even individual trees can have more than one owner.



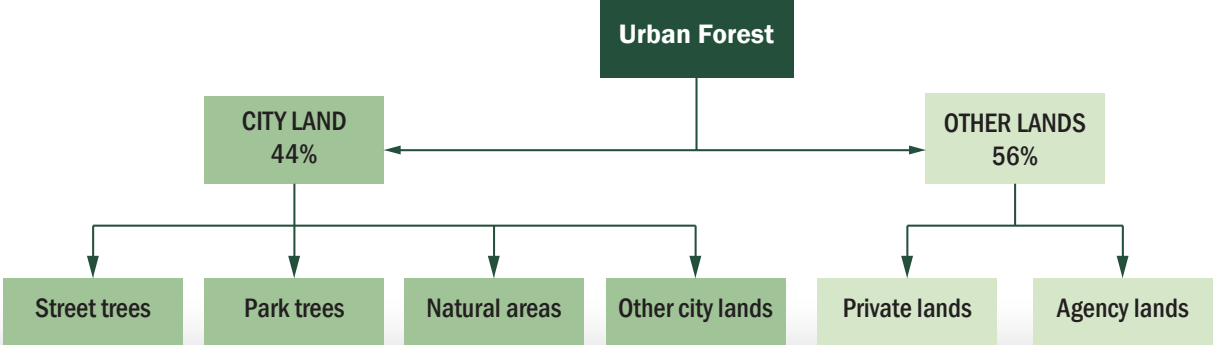
For the purposes of this project, the urban forest can be separated into two parts: lands that are the responsibility of the city, and lands that are the responsibility of private landowners and other agencies (e.g. trees along regional roads - See Figure 1). Trees growing on city lands (44% of urban forest) are further separated into; trees along city streets, parks, natural areas, and other city lands (e.g. cemeteries). This separation of roles and responsibilities will be useful as the discussion of creating an urban forest strategy with the community is initiated.

Urban Forestry is

“the art, science, and technology of managing trees and forest resources in and around urban community ecosystems for physiological, sociological, economic, and aesthetic benefits trees provide society.”

Helms 1998

Figure 1 - Components of the urban forest
Note: Percent value for city and other lands is the current canopy cover



2.2 WHY IS THE CITY DOING THIS WORK?

The direction to carry out this work comes from section 4.1 of the City's Strategic Plan (2015-2018), which identified the urban forest as one of the strategic initiatives in the sustainable environment and infrastructure section:

“Manage and enhance the urban forest so that it will continue to make a long-term contribution to the livability of Kitchener.”

In addition to the community identifying a high level of support for trees during the strategic plan process, other factors have also increased the focus on the urban forest, including the:

- loss of thousands of ash trees throughout the city due to emerald ash borer;
- impacts of recent storms, particularly the ice and windstorms of 2013;
- large number of service requests the city receives for street trees, and the length of time it takes for work to be completed (e.g. pruning, tree planting);
- urban forest on city lands is a corporate asset that is to be managed so that they are affordable, dependable and sustainable in the long term.

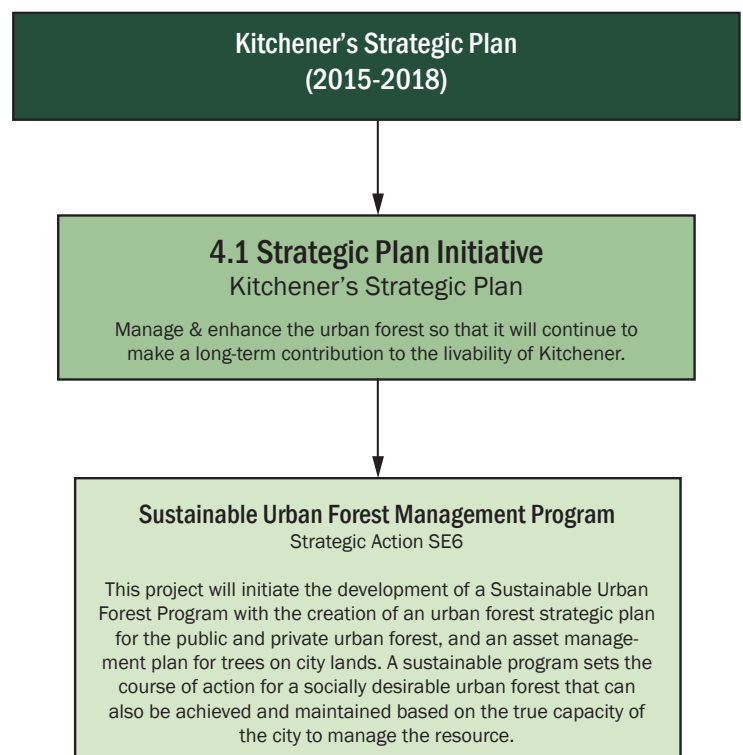
2.3 HOW WILL THE CITY ACHIEVE THIS GOAL?

Guided by the strategic plan initiative (4.1) the city created a corporate project with four key objectives:

1. Initiate the development of a sustainable urban forest program
2. Create an urban forest strategy for the public and private urban forest
3. Create an asset management plan for trees on city lands
4. Propose a program that can be achieved and maintained based on the true capacity of the city to manage the resource.

The figure (2) to the right identifies the linkages between the strategic plan and this corporate project.

Figure 2 - Strategic direction for Kitchener's urban forest



2.4 ARE TREES REALLY A VALUABLE ASSET?

Yes, trees provide important economic, environmental, and social benefits to the community. While the replacement cost of other assets (e.g. road infrastructure) is greater, the true value of the urban forest is in the benefits large, mature trees provide. These benefits result in significant and long-term cost savings, which improve the livability, health and prosperity of a city.

“Urban and community forestry has transcended its original niche function in public policy as an aesthetic amenity to soften the landscape. It is increasingly perceived as a solution to many more pressing urban environmental problems and even as a tool for community and social development ... Environmental benefits are also being quantified more accurately and more often in economic terms ... increasingly communities are realizing that green infrastructure is an economical long-term investment that reduces the need for much greater expenditures in gray infrastructure.”

JC Schwab (Ed.), 2009, Planning the Urban Forest

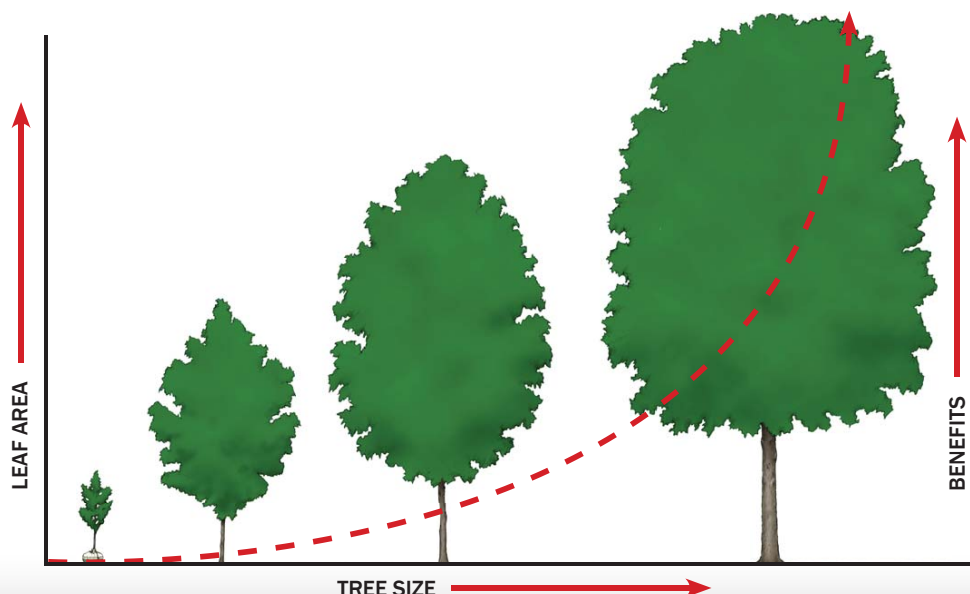
“The return on trees is significant: for each dollar spent on maintenance, between \$1.88 and \$12.70 in benefits are realized each year, depending on the city.”

TD Economics - Special Report, September 14, 2014, The value of the urban forests in cities across Canada.

2.5 LARGE, MATURE TREES PROVIDE THE MOST BENEFITS

The benefits trees provide is directly related to the size of the tree, and how long it lives. Young trees provide less benefits than larger trees. From a cost/benefit perspective, trees do not start providing a return on the investment of tree planting, watering, and structural pruning until they reach maturity. Additionally, the longer a tree lives the greater the value of benefits it provides.

Figure 3 - Tree benefits increase as leaf area & tree size increase



2.6 THE BENEFITS TREES PROVIDE TO THE COMMUNITY

Trees pay us back in terms of the economic, environmental and community benefits they provide. A summary of these benefits are outlined below:

ECONOMIC BENEFITS OF TREES

The urban forest provides benefits that can be quantified in dollar terms, and trees provide direct real estate and business values, including:

- Boosting residential housing market
- Enhancing commercial activity
- Attracting economic players

“The presence of larger trees in yards and as street trees can add from 3% to 15% to home values throughout neighbourhoods.”

Green Cities: Good Health http://depts.washington.edu/hhwb/Thm_Economics.html
Wolf, K.L. 2007 (August). City Trees and Property Values. Arborist New

Source: http://www.naturewithin.info/New/2016.2.TNC-Outside_Our_Doors_Report.pdf



ENVIRONMENTAL BENEFITS OF TREES

The urban forest is a key part of a city's green infrastructure. Research by the United States Department of Agriculture has calculated the environmental benefits of urban trees. This includes improving:

- Local climate and reducing energy use
- Air quality, and climate change
- Water flow and quality
- Noise abatement
- Wildlife and biodiversity
- Soil quality

Calculating the value of individual trees and the urban forest using iTree Eco.

Source: http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf

COMMUNITY (SOCIAL) BENEFITS OF TREES

With more than 40 years of documented research, the social benefits of urban trees are well defined.

They include:

- Encouraging active lifestyles
- Nurturing mental and cognitive health
- Improving neighbourhood safety
- Increasing environmental equity

“Having 10 or more trees on your block has self-reported health benefits akin to a \$10,000 salary raise”

Toronto Star, July 14, 2015
(Neighborhood greenspace and health in a large urban centre)

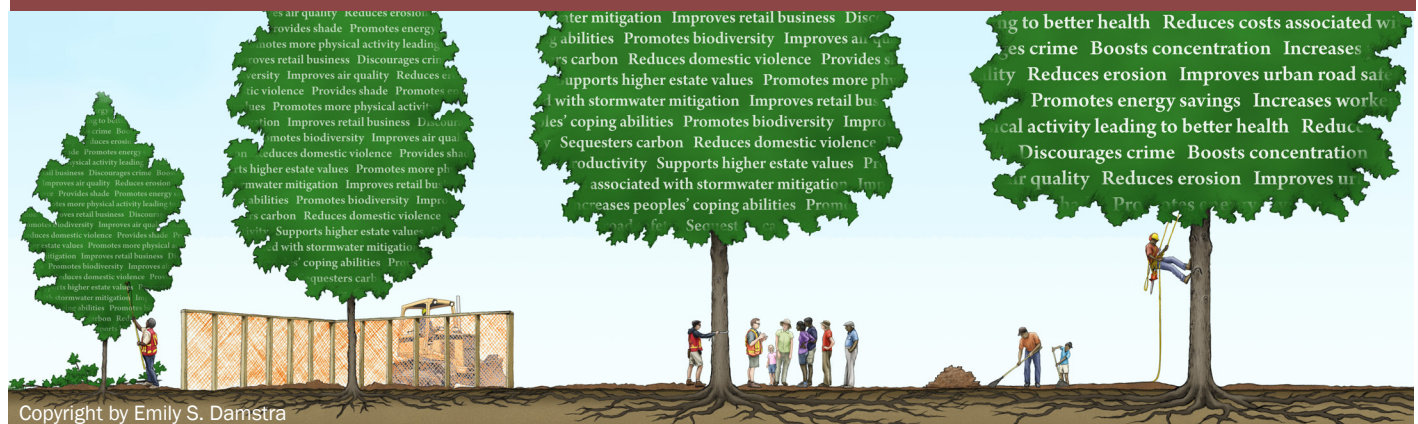
Source: http://www.naturewithin.info/New/2016.2.TNC-Outside_Our_Doors_Report.pdf

Quick Fact # 2 - Protecting big, old trees.

This red oak is a 127 cm in diameter! Trees of this size and age provide significant benefits to the community. Many years ago special measures were taken to protect this tree when Shanley Avenue was reconstructed, ensuring it would continue to provide benefits to the community. Proactive planning and action, like this, is required to ensure that the existing and future big trees continue to provide these valuable benefits to the community.



3. Project overview



A proactive program, illustrated above, includes; structural pruning, protection of the resource, collecting information about the resource, community engagement and stewardship.

With the goals of this project defined, this chapter of the document explains the benefits of moving from a reactive to proactive management program. The project outcomes, time lines and planned community engagement are also discussed. The last section describes the proposed framework that will be used to guide this project and the asset management plan for trees on city lands. The framework includes: 1) the guiding principles, and 2) the program elements. Five program elements (Plan, Engage, Protect, Maintain, Plant) are necessary for a sustainable urban forest.

CHAPTER 3 - Project overview	
Section	Pg
3.1 Moving from a reactive to proactive program	15
3.2 Project outcomes	16
3.3 Project time lines	17
3.4 Community engagement	18
3.5 Project framework (Principles, Program Elements)	19
3.5.1 PLAN	20
3.5.2 ENGAGE	20
3.5.3 PROTECT	21
3.5.4 MAINTAIN	21
3.5.4.1 Structural pruning	22
3.5.5 PLANT	22
Quick Facts - Life stages of a tree and cost\benefits	23

3.1 MOVING FROM A REACTIVE TO PROACTIVE PROGRAM

Historically, cities have viewed their urban forest for its aesthetic and historical value, along with the belief that these “natural” assets required limited care or attention. Based on this outdated belief there has often been support to increase the size of the urban forest, but limited understanding that the urban forest needs to also be actively managed.

Today, with the increased recognition of the importance of the urban forest, many cities including Burlington, Cambridge, Guelph, Kingston, London, Oakville, Ottawa, Peterborough, Mississauga, Thunder Bay, and Toronto have developed plans to better manage this asset. The table below contrasts some of the parts of a reactive program to a proactive (sustainable) program which many municipalities are working towards today.

Table 1 Comparison of reactive and proactive urban forest program	
Reactive Program	Proactive (Sustainable) Program
Trees viewed as providing aesthetic beauty only, limited support for program investments, except traditional activities (i.e. tree planting, street raising).	Trees are viewed as critical infrastructure. Sustainable investments are viewed as beneficial actions that improve the livability, and health of the community.
Customer complaints drive maintenance program.	Customer complaints are addressed based on set priorities within an approved plan.
Trees / natural areas within cities are thought to be ‘natural’, requiring limited or no management.	Recognizes that trees and natural areas require active management guided by a long-term plan.
Asset (trees, natural area) is allowed to increase in size with no consideration given costs or risks.	Asset size and growth is directed by an approved plan based on the true financial capacity of the city / community.
Tree planting is carried out with little consideration to site conditions and the long-term costs, risks and benefits.	Tree planting is focused on selecting trees that will provide the maximum services for the least cost/risk.
Program is guided by historical practices with a focus to address individual customer complaints.	Program is based on current knowledge, best practices, advances in technology and engagement.
Data collection is limited to the basic information required to complete work.	Data collection, analysis and monitoring is seen as a critical activity that ensures the goals are achieved.
Issues and decisions are made independently, issue by issue, with no consideration to the big picture.	There is an integrated and coordinated approach, at all levels directed by the approved plan.

3.2 PROJECT OUTCOMES

The proposed framework for this project and the development of a sustainable urban forest program for Kitchener is consistent with the approach being taken by municipalities across North America. The idea of a sustainable urban forest and the associated framework was first proposed by Clark *et al* (1997), and today it is the standard adopted by many cities. The project description identified four outcomes for this project. The table below provides a description of the four outcomes of this project.

A Sustainable Urban Forest is:

“The naturally occurring and planted trees in cities which are managed to provide inhabitants with a continuing level of economic, social, environmental and ecological benefits today and into the future.”

Clark et al, 1997 A Model of Urban Forest Sustainability

Table 2 - Project outcomes and description

Identified project outcomes	Description
1. Initiate development of program	This project will propose the adoption of a new proactive program for the urban forest. The initiation of this program is seen as a long-term effort that will include all of the parts identified below, and any other direction out of this work.
2. Urban forest strategy (Public & Private Lands)	The strategy creates the long-term vision and goals for the urban forest over the next 50-100 years. A time period that is consistent with the life stage of medium & large stature trees.
3. Implementation plan (Public & Private Lands)	Directed by the approved urban forest strategy and other city policies/plans, the implementation plan will identify the short, mid, and long-term priorities and their associated costs, based on the true capacity of the city and community.
4. Asset management plan (City Lands Only)	Directed by the approved urban forest strategy and implementation plan, staff will develop an asset management plan for all trees and the larger urban forest on city lands.

As urbanization continues to alter our environment, the understanding and management of trees and forests in and around urban areas is essential to provide optimal forest services and values to current and future generations to sustain environmental quality, human health and well being.

David J Nowak, United States Department of Agriculture, Forest Service

3.3 SUMMARY OF KEY PROJECT PHASES

Table 3 below identifies the key project phases in 2017 and 2018. Background analysis continues into the spring of 2017, along with the planned gap analysis and benchmarking. Increasing the awareness and understanding of the urban forest within the corporation and community will occur throughout this project.

Three phases of community engagement will occur; 1) phase one will inform and engage the community, 2) phase two will focus on collaborating with the community, during the fall and early winter, to create the vision, goals and priorities of the strategy on public and private lands, 3) phase three will provide the opportunity to review and have input on the draft strategy.

In late August (2017), at a Strategic Council Session, staff will provide an update and seek input from Council. In the spring of 2018 the draft strategy will be presented to council for their consideration. Once approved an implementation plan will be prepared for councils consideration. These documents will then be used to finalize the asset management plan for trees on city lands.

Table 3 - Summary of key project phases								
	2017				2018			
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Background Information (Document)	✓							
Gap Analysis & Benchmarking								
Increase urban forest awareness								
Community Engagement - Phase 1								
Community Engagement - Phase 2								
Community Engagement - Phase 3								
Urban Forest Strategy						Approval		
Implementation Plan							Approval	
Asset Management Plan								→



3.4 COMMUNITY ENGAGEMENT

Community engagement

The City of Kitchener's vision for engagement is to be a community in which the public is engaged and active in decision-making about local issues. The guiding principles for this project state the urban forest *is a shared community resource, with multiple owners and requires an informed and engaged community.*

Community engagement will be an important part of this project which will include:

- Informing the community by increasing awareness and understanding of the urban forest;
- Consulting by seeking public input on the strategy; including vision, goals and program elements, and;
- Collaborating with the community in the stewardship of the urban forest, on private and public lands.

Neighbourhood Strategy & The Urban Forest

The goal of Kitchener's Neighbourhood Strategy is to help people connect and work together to do great things in their neighbourhoods. Through the community engagement process the importance of the urban forest on public and private lands was identified as an important theme.

The potential connections and opportunities between the urban forest and neighbourhood strategy are significant. As the urban forest strategy develops, a key objective will be to identify and support these connections and opportunities.

Communications - increase awareness and understanding

Increasing the awareness and understanding of the urban forest is a key objective of this project. At the same time, it is recognized as one of the biggest challenges communities face that are considering implementing a sustainable urban forest program. The City of Seattle's Urban Forest Stewardship Plan, states "...we are faced with an adaptive challenge that requires individuals, communities and institutions to change their values, behaviors, and their attitudes about urban trees."

As part of this project, a significant effort will be put into informing all internal and external stakeholders about this project. Concurrently, we hope to increase the understanding of the opportunities, challenges and issues we face as the sustainable urban forest program is developed. To achieve this a range of communications tools (e.g. city website, GIS storymaps, posters, social media, advertisement) will be developed by the City.

"The main conclusions of the Green City - Why Nature Matters to Health found; 1) Green space improves physical health, mental health and wellbeing of urban residents, 2) Frequent access to nearby green space is important, especially for children, 3) Nearby green space may provide added benefit in low-income neighbourhoods, and 4) Green space that is perceived as unsafe and poorly maintained does not provide health benefits."

Toronto Public Health. (2015). Green City: Why nature matters to health – An Evidence Review. Toronto, Ontario.

3.5 PROJECT FRAMEWORK

A framework that consists of guiding principles and program elements is proposed for this project. This framework will guide the development of the strategy and asset management plan. Table 4 identifies the principles of a sustainable urban forest and are common themes in plans developed by other cities. The overall goal is to maximize the benefits the urban forest provides, while minimizing the associated costs and risks. This goal is consistent with the Kitchener's strategic priorities to provide efficient and effective services to the community.



Table 4 - Principles of a sustainable urban forest

A sustainable urban forest:

1. Is a shared community resource, with multiple owners.
2. Requires an informed and engaged community.
3. Provides valuable, long-term services, contributing to the health and resiliency of the city.
4. Is a key part of the city's green infrastructure, and plays a key role in climate mitigation \ adaptation.
5. Maximizes the economic, environmental, and social services, while minimizing the associated risks and costs.
6. Requires long-term planning, active management, protection and maintenance.
7. Recognizes that the first priority is to protect and maintain the existing resource, then increase it.
8. Utilizes and adapts to emerging science, technology and best practices.

The five elements of a sustainable urban forest program are identified in Table 5. They are discussed further on the following pages.

Table 5 - Program elements

1) PLAN for the future & existing urban forest
2) ENGAGE the community
3) PROTECT the existing and future urban forest
4) MAINTAIN and restore the existing urban forest
5) PLANT the future urban forest

3.5.1 PLAN \ Manage for the future and existing urban forest

Planning is the cornerstone of working towards a sustainable urban forest. Without long-term planning, the goal of maximizing benefits while minimizing costs and risk cannot be achieved. For effective and efficient planning to occur, the key information and activities identified in the Table 6 below must occur.

Table 6 - Five key activities for planning and managing the urban forest
PLAN - creates the long-term vision, goals and priorities (e.g. urban forest strategy)
INVENTORY - identifies and tracks information about the urban forest asset (e.g. canopy cover, trees)
MANAGE RISK - informs management based on an assessment of risk (e.g. financial, safety)
MANAGE ASSET- manage tree assets on a daily, yearly time frame guided by the goals & priorities
MEASURE, MONITOR & ADAPT - monitor progress, measure success, identify opportunities to improve

3.5.2 ENGAGE the community

It is clear that the community places a significant value on the urban forest. It is also recognized that 56% of the city's urban forest is on private lands. The greatest opportunities to increase tree canopy are on private lands and engaging the community is vital to maintain and/or increase Kitchener's tree canopy.

Community stewardship is a key component that must occur to increase tree health and longevity. Stewardship can be defined as the active care and monitoring of the urban forest by individuals, community groups and business.

Kitchener's natural areas program (KNAP), which focuses on stewardship of the city's natural areas is well-developed and has strong community support. The stewardship of the city's street & park trees is in the early stages of development with the establishment of the volunteer tree watering program for new trees.

The opportunities for urban forest stewardship on private lands are significant and important. While the city has a role to play in encouraging and supporting urban forestry stewardship on private lands, experience of other municipalities shows that such programs are often best addressed through non-profit groups (e.g. LEAF - GTA, ReForest London, Sacramento Tree Foundation, Tree Pittsburgh) that have a focus on the urban forest.



Tree planting Lakeside park (top),
volunteer tree watering program (bottom)

3.5.3 PROTECT the existing urban forest

Recognizing that trees provide the most benefits to the community in their mid-to-late life stages - protecting these assets to ensure they reach maturity is a key objective. Since the urban forest is a dynamic and living system, protecting it from impacts (e.g. removal of tree before end of life cycle, damage to soil, encroachments, recreational impacts) is challenging, particularly when the environment around is also changing (e.g. climate change, re-development). Often when damage or loss does happen, it occurs due to a lack of understanding. Increasing community awareness and understanding is a key objective of any protection strategy. To ensure the asset is protected there also needs to be the appropriate bylaws, policies, and enforcement in place to discourage damage to the asset while also providing appropriate compensation when the asset is damaged or removed.

3.5.4 MAINTAIN the existing urban forest

Like any asset, regular planned maintenance is required throughout the tree's life stages to minimize costs and risks, so as to maximize the benefits trees provides. Maintenance activities for trees can be grouped into four main areas (inspect, prune, remove, stump). A fifth area, emergency response (i.e. ice storm) occurs when required.

Maintenance programs also need to respond to customer complaints (e.g. low limbs). More than 1,000 service requests about trees are received yearly. With this level of calls and current resources, Kitchener's urban forest program is a reactive program.

The benefits and cost savings of a pro-active maintenance can be significant. An example of this, structural pruning, described as the heart of a urban tree management program, is provided on the next page.



Trees and the soil they grow in must be protected for trees to reach maturity.



Protecting the urban forest from invasive species (i.e. emerald ash borer) is an increasing challenge.



Maintaining the existing urban forest includes removing trees that are at the end of their lifecycle or unsafe.

3.5.4.1 Structural pruning - Implementing best practices

Structural pruning controls the structural growth of the tree over time, by maintaining a central leader, and controlling the location and size of branches along the trunk. Over time all of the branches at the time of planting are removed, and at maturity there is a single tree trunk free of branches for at least the first 4m (14'), eliminating the ongoing need for street raising.

Implementing best practices is a cost-effective practice that reduces costs and risks over the long-term. Structural pruning, carried out in a pro-active manner during the early life stages of the tree, has the following benefits:

- increases structural integrity and resiliency of trees during storm events, thereby reducing costs;
- improves the long-term health of trees, thereby increasing the services trees provide;
- reduces long-term reactive maintenance costs and the practice of street raising;
- reduces the number of customer complaints;
- reduces the risk of tree failure and the potential for personal death \injury or property damage.

Structural pruning is the heart of a sustainable urban tree management program

(Edward Gilman, 2012, An Illustrated Guide to Pruning)

3.5.5 PLANT the future urban forest

Tree planting is an activity that is carried out to maintain or increase the existing number of trees. A significant number of the yearly requests the city receives for forestry is for the replanting of a tree that was removed as well as requests to plant a new tree.

Historically there has been the belief that tree planting is an easy activity that will produce the same results across the city. Today it is recognized that just planting trees will not produce the same results, and that a greater focus must be put on the quality and quantity of the soil that is required to grow healthy and vigorous trees.

Recognizing that soil quality and quantity plays an important role in the health of a tree, the City has increased its requirements for tree planting in new subdivisions.

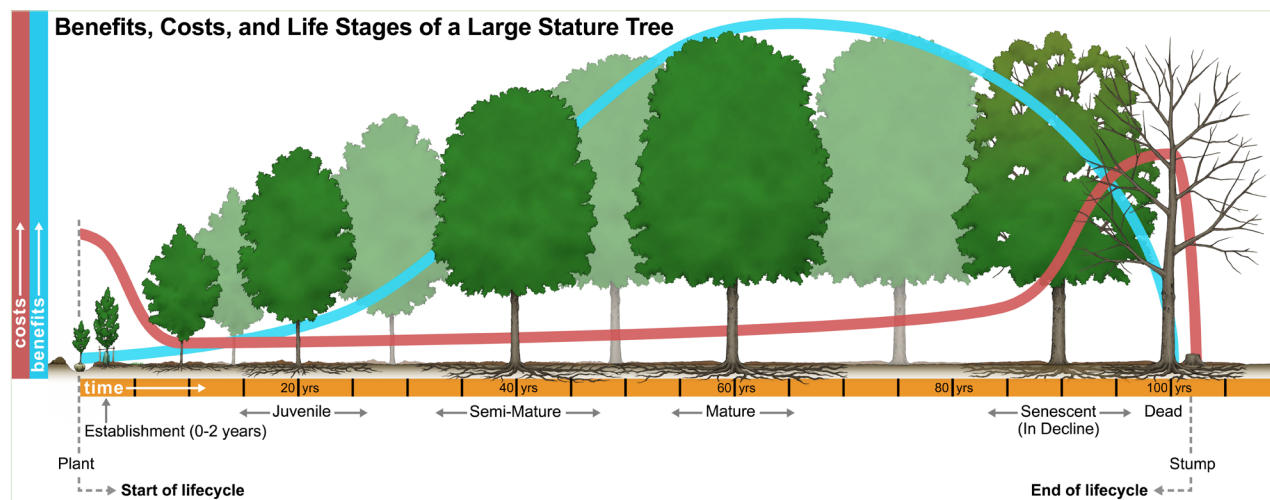
TREE PLANTING MAINTAINING OR INCREASING SERVICE LEVELS

From an asset management perspective tree planting can be separated into two groups;

1. The replanting of a tree to replace a tree that was removed. Existing service levels remain the same because there is no change in the number of trees to be maintained.
2. The planting of a new tree that did not exist before. An action that increases the size of the asset (# of trees). If existing service levels are to be maintained, an increase in resources is required.

Quick Fact # 3

The costs and benefits of a large stature tree (> 60 cm diameter).



Asset management requires an understanding of the asset's life stages. The illustration above shows the life stages (establishment, juvenile, semi-mature, mature, and senescent) of a large stature tree, along with the benefits and costs of the tree across its life time.

The blue graph represents the benefits the tree provides. Large stature trees start to provide benefits back to the community when they are semi-mature (>40 cm) with the majority of benefits coming when the tree is in its mature life stage.

The red graph shows the associated costs to maintain the tree in a pro-active program (i.e. tree watering during establishment, structural pruning during the juvenile and semi-mature life stages, tree protection). From a cost benefit perspective large stature trees start to provide a return on the initial investments when they reach the semi-mature life stage (40 years). To maximize the potential benefits large stature trees can provide they must reach and be maintained in the mature life stages for as long as possible.

4. Kitchener's urban forest



This chapter provides a high level introduction of the existing tree resource, and discuss the:

- tree canopy,
- street & park trees, and
- natural areas.

You can see much more detail and the characteristics of the urban forest in your neighbourhood by visiting our urban forest story map at www.kitchener.ca/trees

CHAPTER 4 - Kitchener's urban forest

Section	Pg
4.1 Kitchener's tree canopy	25
Quick Facts - Realistic & achievable canopy goals	26
4.2 Kitchener's street & park trees	27
4.3 Kitchener's natural areas	28
Quick Facts - LiDAR advances in technology	29

The City of London's urban forest has a structural value of \$1.5 billion, it removes 370 tonnes of pollutants each year, representing an annual savings of \$4.5 million of reduced health care costs, it stores 360,000 tonnes of carbon, removes 12,5000 tonnes of carbon each year, and contributes 1.7 million in energy savings each year.

City of London Urban Forest Strategy - Enhancing the Forest City, June 2014

4.1 KITCHENER'S TREE CANOPY

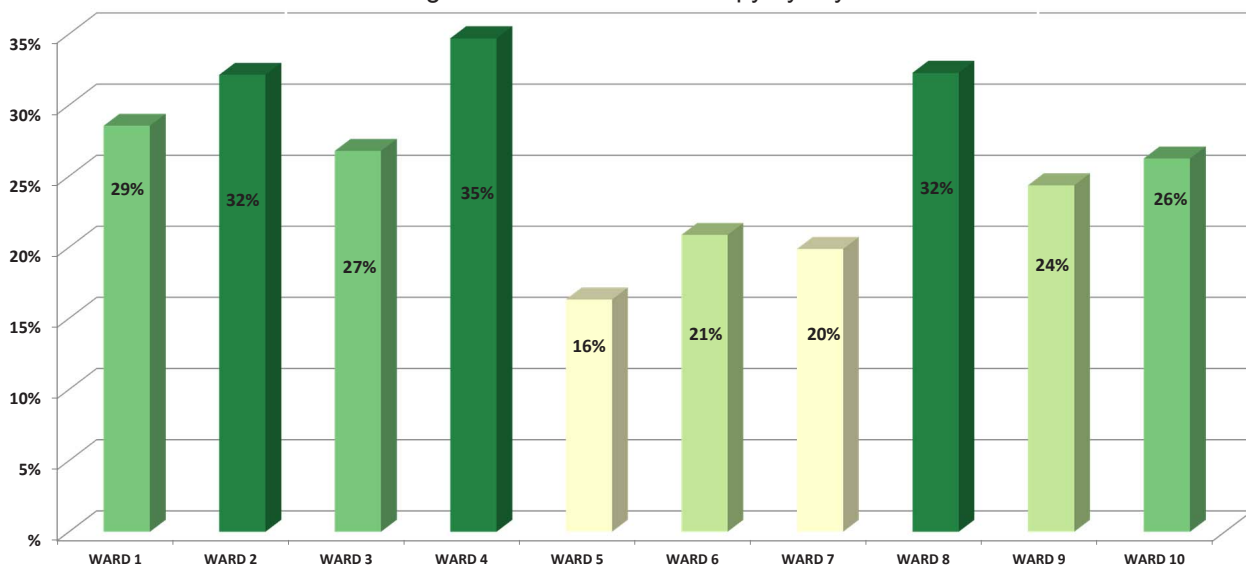
Canopy cover is the total area of a city that, when viewed from above, is covered by trees. It is a coarse measurement that can be used to identify changes in a city's urban forest over time (e.g. extreme weather, invasive tree pests, land development) and help to monitor goals that are set to maintain or increase the existing canopy.

Kitchener's existing tree canopy cover is 26% based on the analysis of 2014 data. Recognizing the emerald ash borer (EAB) is still very active and contributing to the loss of ash trees across the city, it is expected that future measurements of the canopy will identify additional losses of canopy cover due to EAB. As shown in Table 7 below Kitchener has a comparable canopy cover to Cambridge and Oakville.

Table 7 How Kitchener's tree canopy compares to other area cities?				
Kitchener	Cambridge	London	Oakville	Mississauga
26%	27%	23%	28%	19%

Using aerial imagery and LiDAR (light detection and ranging) the canopy cover was calculated for each land parcel. Using this information the tree canopy can be analyzed at multiple levels (e.g. wards, neighbourhood associations, sub watersheds, land parcel) providing a powerful planning tool. A key finding of this work is that while Kitchener's canopy is 26%, there is variation across the city. This variation, shown by city ward below, is due to the age of development and the historical amount of natural heritage features (e.g. woodlots, creeks) present in the area.

Figure 4 - Percent tree canopy by city ward.



To see what the tree canopy looks in your neighbourhood and across the city explore our urban forest story maps at www.kitchener.ca/trees

Quick Fact # 4

Setting realistic and achievable canopy cover goals

As the urban forest strategy is developed, part of the discussion will be about Kitchener's existing (26%) and future canopy cover. Recognizing the significant services that the urban forest provides there is often a strong desire to set an ambitious canopy cover goal, with the focus on tree planting.

While tree planting is an important activity to maintain and increase a community's canopy cover, it is only one of four factors that controls changes in canopy cover. The other three factors affecting canopy cover are; 1) tree mortality, 2) tree growth and 3) natural regeneration. Collectively these four factors determine whether the canopy cover stays the same, increases, or decreases.

Figure 5 Four factors that change canopy cover.



To set realistic and achievable canopy cover goals all four of these factors must be addressed. With the recent canopy study work completed by the University of Vermont Spatial Analysis Lab, the city has taken the first step to quantify the existing canopy cover and establish baseline data. Monitoring and setting canopy cover goals is complex and requires a long term effort.

The best means to collect and analyze the required information is through the use of the iTree suite of tools developed by the United States Forest Service. Today these tools are used by cities worldwide to estimate the ecosystem's services and structural characteristics of the urban forest through the establishing of permanent sampling plots. This second step in setting realistic and achievable canopy cover goals will be identified and discussed further in the next phase of this project.

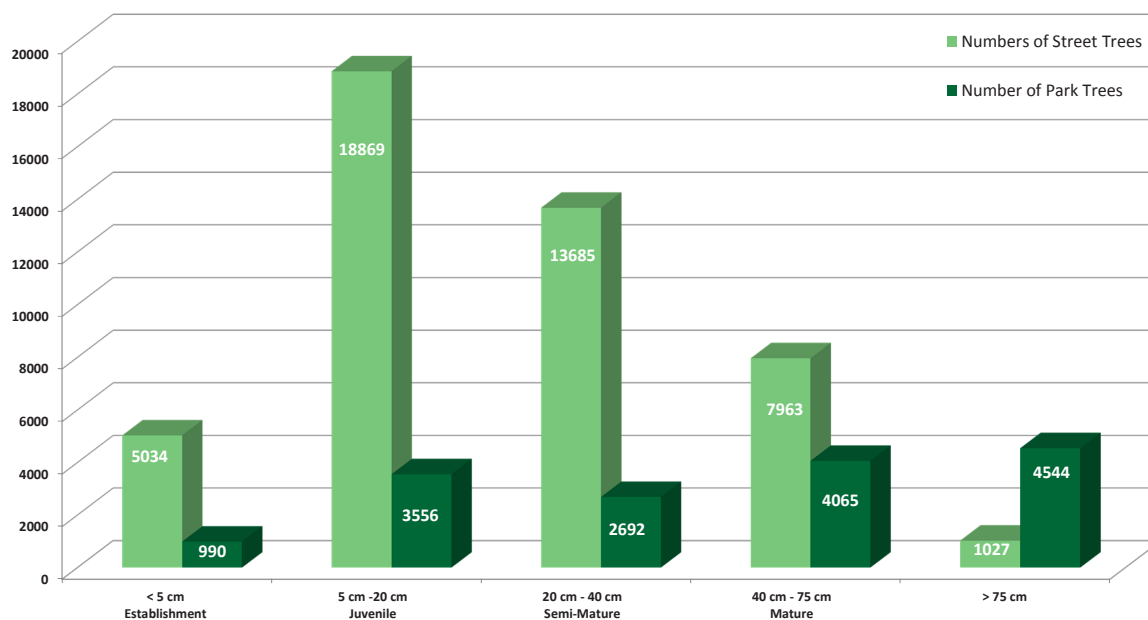
4.2 KITCHENER'S STREET & PARK TREES

In Kitchener, the planting of trees have been a tradition since the early 1800s. Today there are 46,578 street trees, which has increased by 10,478 trees in the last 17 years. The maple genus (e.g. red maple, sugar maple, etc.) accounts for 43% of the trees along city streets. This high reliance on one genus is not a good management practice, because of the vulnerability of losing a large number of street trees from a invasive species (e.g. Dutch elm disease, emerald ash borer, Asian long-horned beetle). In the past, managing species diversity was very challenging. However, today with advances in technology (e.g. GIS based tree inventory) this kind of issue, even with tens of thousands of trees distributed over the city, is very achievable.

In the city's parks there are 15,847 trees. The figure below shows the distribution of the street and park trees by their life cycle stages. Information like this can be used to identify existing and future workloads (e.g. number of trees in the establishment life stage requiring weekly watering, number of trees in the juvenile & semi-mature life stage requiring structural pruning).

Investing in and maintaining a up-to-date tree inventory is a key requirement of a sustainable urban forest. Limited resources and other priorities (emerald ash borer) have not allowed for the city tree inventory to be maintained, therefore it does not present an accurate picture of today's conditions.

Figure 6 - Number of street and park trees by life cycle stages.



Using the urban forest story maps, you can find street trees near where you live, and learn more about Kitchener's street & park trees at www.kitchener.ca/trees.

4.3 KITCHENER'S NATURAL AREAS

Kitchener has a long history of conserving natural areas, as evident by the early efforts of local communities leaders that took action to ensure Briethaupt and Homer Watson (Cressman Woods) were protected for future generations.

The city's natural areas are important areas for the conservation of Kitchener's biodiversity (e.g. snapping turtle, great horned owl), areas to explore and learn about our natural heritage, and provide numerous opportunities for the community to participate in urban forest stewardship.

Today the city has 169 natural areas that account for 61% (1,036 hectares) of the city's total parkland. In the last 20 years, the total area of natural areas has more than doubled, increasing by 616 hectares. A breakdown of the natural areas by size is provided in the table below.

Table 8 Summary of natural area by size class in hectares (ha)			
< 1 ha	1 to 10 ha	10 to 20 ha	> 20 ha
69	72	16	12

Trails in natural areas provide opportunities to explore and experience nature close to home. There are close to 100 km of organized and unorganized trails in the city's natural areas. Many of these trails have developed over time with little thought given to the impact, risks or costs of such a large trail network. One goal of proactive management is to support appropriate public use, while at the same time ensuring they are also conserved for future generations, in a sustainable, cost effective manner.

To learn more about Kitchener's urban forest explore our urban forest story maps at www.kitchener.ca/trees.



Discovering and learning about nature.



Snapping turtle



Urban forest stewardship



Great horned owl

Quick Fact #4

New technology tools for urban forest management.

The map below shows the height of the tree canopy. These heights were measured using new LiDAR imagery and complex GIS analysis. Only available in the last few years, this technology can also separate trees into different sized patches, from individual street trees, to large natural areas. This kind of information allows communities to monitor future changes in their urban forest at a very detailed level across the city.

You can learn about Kitchener's urban forest by exploring the story maps at www.kitchener.ca/trees.



5. Challenges & opportunities



In working towards a sustainable urban forest program and strategy it is important to understand the existing challenges and opportunities to achieving such a goal. This chapter identifies seven key issues:

- customer service levels,
- soil quality & quantity,
- competition for space,
- natural area conservation,
- invasive species,
- the private urban forest, and
- climate change.

CHAPTER 5 - Challenges & opportunities

Section	Pg
5.1 Customer service levels	31
5.2 Soil quality & quantity	32
5.3 Competition for space	32
5.4 Natural area conservation	33
5.5 Invasive species	33
5.6 The private urban forest	34
5.7 Climate change	34
Quick Facts - Thriving or Alive ?	35

The United States Forest Service notes that “urban forests play an important role in climate change mitigation and adaptation. Active stewardship of a community’s forestry assets can strengthen local resilience to climate change while creating more sustainable and desirable places to live”.

5.1 CUSTOMER SERVICE LEVELS

While the urban forest provides significant economic, environmental and social benefits to the community, Kitchener's - Operations Environmental Services, is responsible for providing efficient and effective services to its residents when there is a concern about a city-owned tree along a residential street, in a city park or in a natural area.

In 2015, the city received 1,352 calls regarding concerns about the urban forest on city lands; this represents the highest number of calls within Operations Environmental Services. The vast majority of these calls were about a city tree in front of a residential property. This is not surprising, since 37,264 residential properties have a city tree within five meters of their property line. In 2013 during both the ice and summer storm events the number of calls doubled to 2,894. With the current level of calls received it can take at least four to six weeks before a call is investigated during peak periods.

A large number of the calls received are for tree planting, and concerns about low branches blocking a sidewalk, roadway, etc.. Requests to remove healthy city trees for a variety of reasons (e.g. tree is messy, driveway widening) are also received. When a tree is identified to be removed, it can take up to two years before a new tree is planted. Residents often call wanting to know the status of their work request. The largest number of complaints received by the city concern trees pruned by the city (e.g. structural pruning, street raising) and KW Hydro for line clearance.

The city is currently carrying out a gap analysis to determine existing service levels and identify opportunities to improve service levels. This work will be part of the public discussion as the vision, goals and priorities are identified in the next phase of this project.



Large tree removal requires skilled tree workers and specialized equipment.

Environmental Services is responsible for:

- 46,578 street trees
- 15,847 park trees
- 1,036 hectares of natural area

And in 2015 they:

- removed 1,767 trees
- stumped 1,556 trees
- planted 1,039 trees

(Note includes removal of ash trees due to Emerald ash borer)



In recent years there has been a focus on reducing the large backlog of stumping.

5.2 SOIL QUALITY & QUANTITY

A key limiting factor of tree health and growth is the quality and quantity of soils trees have access to. The biggest challenges, evident by poor tree growth and high mortality, is in recently developed areas of the city (Figure 6 - orange and red areas) where the soils are more disturbed. To start to address this, the city recently implemented new soil and tree planting standards for residential developments.

This past summer two leading experts (Bryant Scharenbroch, James Urban) on urban soils visited Kitchener to further increase awareness of the importance of soils, and to provide effective solutions to existing challenges such as restoring poor quality soils and increasing their biological activity, rapid soil assessment, as well as strategies to increase the health and growth of trees planted in hardscape areas (e.g. downtown core).

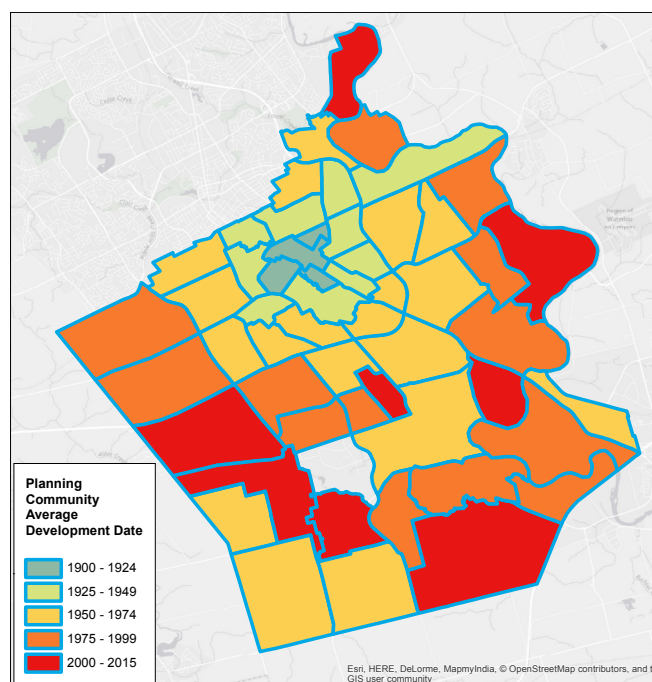


Figure 7 - Age of development by planning community
(Note the white area identifies industrial land)



In some new subdivisions due to intensification there is no room for trees in city boulevards.

5.3 COMPETITION FOR SPACE

While trees have always had to compete for the limited space within the road right of way the competition for this space has increased significantly in recent years as lot sizes decrease and intensification increases. The competition for the limited space within the road right of way, decreases the space for new trees (Figure 7, right) and challenges for protecting existing city trees (e.g. driveway widening). For trees, the key factor is to ensure that there is adequate soil for the tree to reach maturity. This requires the protection of existing soil resources, along with innovative and co-operative design that works for all assets including trees.

5.4 NATURAL AREA CONSERVATION

The city's natural areas are vital areas where citizens can explore and relax. They are also important areas for conserving our local natural heritage and biodiversity. Natural areas along watercourses and those containing wetlands are also part of the city's stormwater system, and play a key role for flood control, pollution prevention and climate mitigation.

Historically natural areas have not been managed and left to take care of themselves. Challenges facing Kitchener's natural areas include the loss of biodiversity, invasive species, encroachments, recreational impacts, and climate change. Active management, community stewardship and education are key themes to conserving these valuable areas.

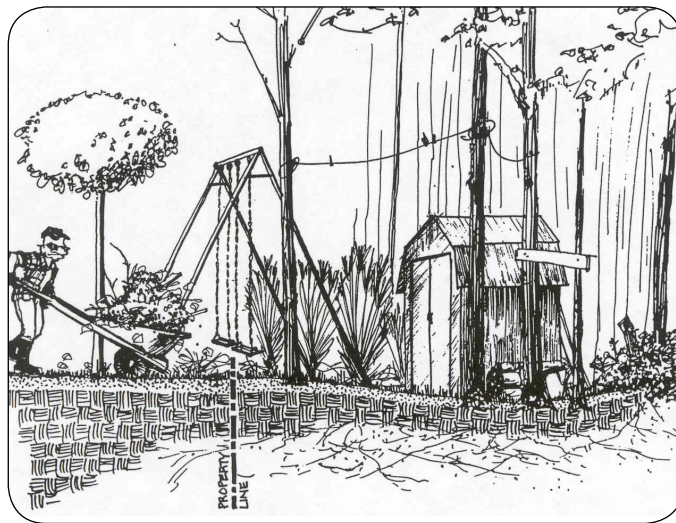


Figure 8: This illustrative figure shows some of the common encroachments in city natural areas by adjacent residents. Combined, these individual acts post a significant impact and cost to the city.



Dog-strangling vine



Asian Long-horned beetle

5.5 INVASIVE SPECIES

With the recent and ongoing impacts of the emerald ash borer (EAB), the community has become more aware of the impact of invasive species. For EAB, the cost will be in the millions of dollars, along with the loss of the ash tree canopy and the economic, environmental and social benefits these trees had provided.

Other invasive species, including dog-strangling vine and common buckthorn are already impacting our natural areas, and there is also the ongoing threat of the Asian long-horned beetle, which is already present in the GTA.

A key strategy to mitigating these threats is to build resiliency through long-term planning, monitoring and active management.

5.6 THE PRIVATE URBAN FOREST

Recognizing that 56% of the urban forest is on private lands (e.g. residential, commercial) and these lands have the greatest opportunities to increase canopy cover, the importance of the private urban forest cannot be understated. Institutional (i.e. schools, hospitals) and other government agency lands (e.g. GRCA) while not private, are also important components of the private urban forest.

The fact that there are tens of thousands of owners of the urban forest creates challenges, but also significant opportunities for stewardship and conservation. This will be a key part of the discussion as the urban forest strategy is developed in the next phase. The potential roles the city could undertake to support the development of a sustainable urban forest on private lands are identified in Table 7.



Trees that are not maintained (e.g. picture above), often develop structural defects that make them more vulnerable to failure during extreme weather.

Establishing a pro-active, structural pruning program can significantly reduce the number of tree failures that occur during extreme weather events.

Table 9
Roles the city could undertake on private lands

- | |
|---|
| • Lead by example, practice best practices |
| • Increase awareness of the urban forest, and its benefits to the community |
| • Increase awareness of the importance of the private urban forest |
| • Monitor and share key information (i.e. tree canopy, iTree Eco) on public and private lands |
| • Encourage and support urban forest stewardship on private and public lands |
| • Utilize tools (i.e. bylaws) to maintain, protect and enhance the urban forest |

5.7 CLIMATE CHANGE

In 2013, Kitchener experienced two extreme weather events (ice storm & summer wind storm). The cost of clean-up for these two short-term events was close to one million dollars. The cleanup took a year to complete, and added significantly to forestry's existing backlog. The recent report Localized Climate Projection for Waterloo Region predicts that the frequency of ice and wind storms, heavy rainfall events and more extreme heat days will increase in future years. These changes will have a negative impact on the urban forest. At the same time the urban forest plays a key role in mitigating climate change and increasing community resiliency through carbon capture, energy savings, reducing the heat island affect, slowing runoff and increasing infiltration, and buffering winds.

Quick Fact # 5 - Thriving or Alive?



A thriving tree showing excellent health condition.



A tree that is just alive - showing very poor health condition.

While both of the trees, shown above, were planted around the same time their health condition is very different. The tree on the left, with the dense canopy, is in excellent condition. In contrast the health condition of the tree on the right is very poor, and this tree will die in the next few years.

The primary goal of a sustainable urban forest is to maximize the services the urban forest provides, while minimizing the associated costs and risks. The cost to plant and maintain trees is significant and trees that die prematurely are a net loss.

Building on recent work initiated by the city (e.g. new tree planting and soil standards for new development, tree watering program, etc.), the urban forest strategy will identify actions that can be taken to increase the services the urban forest provides while at the same time minimizing the associated costs and risks.

6. Next Steps

With the publication of this document, the posting of the story maps on the city's website and the completion of the community engagement plan this phase of work is completed.

During the spring and summer staff will be increasing awareness about this project and connecting with the community by participating in special events and by holding pop up events in city parks and along trails. The first event that staff will attend is the Huron Natural Area Earth Day event on Saturday April 29th. Through the spring and summer additional activities will be posted on the website and through social media.

Work also continues on the collection of information for the gap analysis that will identify the existing urban forestry services the city provides. This information and the results of the first phase of engagement will be presented to council at the August 28th strategic council session.

How can I stay informed?

- The city's website (www.kitchener.ca/trees) and social media sites are the best places to find information about this project.
- You can also send an email to trees@kitchener.ca and ask to be notified of updates.

Questions?

- If you have questions about this project please contact us by email or phone (see contact links below).
- If you have concerns about a city tree (e.g. requires pruning, tree is dead) please contact our Corporate Contact Centre 519-741-2345 or at info@kitchener.ca.

Contact links

Website: www.kitchener.ca/trees

Email: trees@kitchener.ca

Twitter: @CityKitchener

Facebook: City of Kitchener

Phone: 519-741-2600 x4891 (David Schmitt MES, Environmental & Urban Forest Project Manager)