2020
Urban Forest Strategic Management Plan

OAKVILLE

1 Acknowledgements

The Oakville Urban Forest Strategic Management Plan (UFSMP) was prepared in collaboration with a Core Working Team made up of representatives from several Town Departments. Their participation provided valuable perspectives and insights to the development of this Plan.

Town of Oakville Core Working Group

Andres Olaya, Forestry Services
Chris Mark, Parks and Open Space
Curtis Marcoux, Forestry Services
Donna Hales, Economic Development and Strategy
Jalil Hashemi, Forestry Services
Jill MacInnes, Strategy Policy & Communications
Kirk Biggar, Planning Services
Philip Kelly, Development Services
Philip Wiersma, Planning Services

The 2020 UFSMP was developed by the following consulting technical team with input from the Town's Core Working Group.

Consulting Technical Team

KBM Resources Group
Rike Burkhardt, MFC, RPF
Dr. Ben Kuttner, MScF, PhD, RPF
Arnold Rudy, MScF
Heather Ledua, HBA

Dillon Consulting Inc.
David Restivo, HBS, EP, ISA Certified Arborist, TRAQ
Martina Braunstein, BES, MLA
Ann Joyner, BSc, MEC, FCIP, RPP

Lallemand Inc./BioForest
John Barker, MFC, ISA Certified Arborist, TRAQ

Natural Resource Solutions Inc.
Brett Woodman, MES, ISA Certified Arborist

We also gratefully acknowledge the input of participating members of the public and other Town staff, whose ideas and support for the urban forest help make 'Livable Oakville' a reality.

2 Contents

1 Acknowledgements ii

3 Executive Summary 1
- 1. Forest Protection 3
- 2. Forest Health and Resilience 3
- 3. Tree Planting and Establishment 4
- 4. Risk Management 4
- 5. Collaboration and Partnerships 4
- 6. Adaptive Management 4

4 Introduction 8

5 Urban Forest Management in Oakville 10
- 5.1 Policy and Planning Tools for the Urban Forest 13
- 5.2 Canopy Cover Targets 16
- 5.3 Engaging with Oakville's Residents 17

6 State of Oakville's Urban Forest 18
- 6.1 Summary of Trends: 2005-2018 18
- 6.2 Tree Condition and Forest Health 21
  - 6.2.1 Forest Pests 22
  - 6.2.2 Invasive Plants 23
- 6.3 Canopy Cover 24
  - 6.3.1 Canopy Cover Trend 24
  - 6.3.2 Canopy Distribution 26
  - 6.3.3 Supporting Policy 29
  - 6.3.4 Achieving 40 per cent Canopy Cover 30
- 6.4 Criteria and Indicators of Sustainable Forest Management: 2008-2018 32

7 Past Plans and 2020 UFSMP Priorities 35

8 Priorities and Actions 36
- 8.1 Forest Protection 36
- 8.2 Forest Health and Resilience 46
- 8.3 Tree Planting and Establishment 49
- 8.4 Risk Management 54
- 8.5 Collaboration and Partnership 55
- 8.6 Adaptive Management 58

9 Conclusions 62

3 Executive Summary

Oakville's urban forest is an important capital asset valued at 1.04 billion dollars.[1] It delivers many benefits to the town and its residents, including improved air and water quality, control of storm water, biodiversity, mitigating and adapting climate change impacts, energy savings, shade and beautification of neighbourhoods and commercial areas. Like other town assets, it is managed under a long-term plan that lays out strategic direction and management actions to preserve, maintain, and grow the urban forest. This 2020 Urban Forest Strategic Management Plan (UFSMP) consolidates two previously separate forestry plans for North and South Oakville. It incorporates data from previous studies as well as stakeholder input to develop an updated action plan to help the Town of Oakville continue to make progress on its forest management goals.

The value of the urban forest is reflected in a vision statement that was developed with community input for the town's 2008 forest management plan. This vision statement has had strong support from Council and the community over the years, which is a critical part of Oakville's success in preserving and expanding its urban forest. Support for urban forest preservation and management is also enshrined in policy and regulation through the town's Official Plan, the provincial Planning Act, the town's tree protection policies and by-laws and many other supporting guidelines and documents.

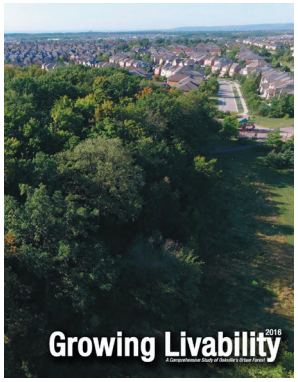
Fifteen years after the first forestry study was done in Oakville in 2005, forest monitoring is providing information about trends in key urban forest indicators. Improvements can be linked to management activities recommended in past plans and studies. Despite a 10-year battle with the emerald ash borer as well as extensive damage from a 2013 ice storm, overall canopy cover in Oakville has increased. This reflects the town's continued efforts and investments in urban forest management.

1 Growing Livability: A Comprehensive Study of Oakville's Urban Forest. Town of Oakville, 2016.

Oakville's Urban Forest Vision

"Oakville's urban forest, an equal part of the community's infrastructure, contributes positively to the health of all residents. Oakville is a proud leader in urban forest stewardship."

Environmental challenges like invasive species and climate change continue to put pressure on other aspects of Oakville's urban forest. This can be seen in changes to forest health since the first study was completed. Table 1 shows both positive trends in the state of the urban forest since 2005 as well as some of the ongoing management challenges.



Growing Livability 2016, A comprehensive study of Oakville's urban forests

Table 1. Changes in Oakville urban forest indicators (Source: 2016 Growing Livability study and Forestry data).

Indicator	Change	Status
Urban forest cover (UFC) %	Increased from 26.5% in 2005 to 31.2% in 2018*	Improved
Total number of trees	Increased from 1.9 million in 2005 to over 2 million in 2015	Improved
Replacement value ($)	Stable, despite 2013 ice storm damage and extensive emerald ash borer tree removals.	No significant change
Average tree condition (% crown dieback)	The number of trees in good or excellent condition increased from 76.8% in 2005 to 83% in 2015.	Improved
Woodland health	Variable between 2014-2017 but showing positive response to management activities like gypsy moth and fall cankerworm treatments in 2018.	Improved
Invasive species	The presence and abundance of invasive species has increased. For example, European buckthorn increased from 2% of the total tree population in 2005 to 10.6% in 2015.	Not improved
# Of trees planted per 100,000 people	The number of trees planted per 100,000 people has increased from 11,222 in 2016 to 25,112 in 2018.	Improved
Tree planting on private property[2]	An additional 2,072 trees were planted on private properties in 2017-2018 under the revised private tree by-law. An additional 101 trees and 89 shrubs were planted on private properties in 2017-2018 through Oakvillegreen's Backyard tree planting program.	Improved
# Trees removed and planted under private tree by-law	Comparing the number of trees removed and trees planted two years before and two years after the enactment of strengthened private tree by-law indicates, the number of trees removed was decreased by 50% and the number of planted trees increased form 47 to 3,311 trees.	Improved

**26.5% as first measured in South Oakville, 31.2% as measured for the entire town in 2018.*

2 Excludes trees planted as part of development application approvals and trees planted by the public outside of any town approvals.

Urban forest management has to be adaptable to a dynamic, changing environment. Urban development, as a reality in urban environment and other factors like climate change, pests and disease exert ongoing pressure on the urban forest. Forest managers use a variety of tools to respond to change in management priorities. These can include regular monitoring programs to forecast and respond to change in insect and disease cycles as well as systems to deal with immediate crises like extreme weather events. Having reliable data is an important aspect of adapting programs to changing environmental conditions.

The 2020 UFSMP has been developed with consideration for progress made since past plans, monitoring data from forestry studies and input from town staff and stakeholders. These inputs have identified the following six priorities for the 2020 UFSMP:

1. Forest Protection

Development is a reality in an urban environment. Almost all urban forest management studies in any municipalities discussed the impact of development on urban forest canopy. Protecting existing healthy trees is one of the best ways to maintain and grow Oakville's urban forest. Tree removal or damage to healthy trees should be minimized through continued application of town tree by-laws and tree protection policies. Ongoing collaboration between town departments on improvement to policy and guidelines, balancing the impact of development and other construction projects on urban forest canopy and sustainability, integration of trees into the process that shapes the urban environment and embracing healthy development will support the continued growth of Oakville's urban forest.

2. Forest Health and Resilience

The urban forest is under ongoing pressure from pests, disease, climate change, development and invasive species. Forest health monitoring and active management in urban areas and woodlands help the town maintain a healthy and resilient urban forest.

3. Tree Planting and Establishment

Oakville's tree planting programs and by-laws have helped maintain and increase forest cover across the town. Appropriate species, site selection and early tree maintenance make the urban forest more resilient and maximize investments in tree planting. Identifying opportunities to integrate more trees in impervious environments and targeting areas of low forest cover will help the town achieve its overall 40 per cent canopy cover goal.

4. Risk Management

Climate change, pests and disease as well as ongoing development will continue to put pressure on the urban forest. As the number of extreme weather events increases and new forest health threats emerge, early detection, robust emergency response systems as well as regular tree maintenance and forest health monitoring will help mitigate risk to people, property and the urban forest.

5. Collaboration and Partnerships

Expanding the urban forest canopy in Oakville will require ongoing collaboration between town departments, external partners and community based organizations. Studies have also identified opportunities to grow the urban forest on private land, where residents and businesses have an important role to play in meeting the town's goal of 40 per cent urban forest cover.

6. Adaptive Management

Past studies and plans have helped set the direction for Oakville's urban forestry program. Continued monitoring of forest condition and threats will help keep the town's forestry program on track. Having the proper information and data management tools supports accountability by generating reliable data for reporting to Council and the public.

Table 2 provides a summary of the UFSMP strategic priorities, as well as 24 actions, some of which are new and some carried forward from previous plans and studies to address the evolving urban forest management challenges in Oakville.

The Town of Oakville urban forestry program has been effective in preventing forest cover loss despite the recent threats of emerald ash borer and repeated extreme weather events, including the 2013 ice storm that caused significant damage to urban forests across Ontario.

Monitoring data shows that the town is on track toward meeting its canopy cover goal of 40 per cent by 2057. Further increases to tree cover under a scenario of intensifying urban density and ongoing climate change effects, however, will present new challenges for urban forest management in the coming years.

Table 2. Summary of 2020 UFSMP priorities and actions.

PRIORITY 1: FOREST PROTECTION

Priority Item No.	Solution	Priority	Timing	Estimated Cost
1	Continue to work collaboratively to identify opportunities for amending town policies and urban design guidelines to enhance urban forest contributions to climate resilience in Oakville.	High	2023	In-house
2	Update South Oakville canopy cover targets and implement recommended canopy cover targets for North and South Oakville in new and re-development/infill projects to support the town's overall 40% canopy cover goal.	High	2022	In-house
3	Assess root causes and quantify canopy change in Oakville, including the impacts of development and invasive species.	High	2023	In-house
4	Continue to apply the town's Tree Protection and Tree Canopy Preservation Policy and Tree Protection During Construction Procedure consistently to all development activities that affect trees in Oakville.	High	Ongoing	In-house
5	Identify opportunities within current permitting processes to improve communications with applicants about the "Design Guidelines for Stable Residential Neighbourhoods" and the value of retaining mature trees and vegetation on site.	Medium	When Official Plan is reviewed	In-house

PRIORITY 2: FOREST HEALTH AND RESILIENCE

Priority Item No.	Solution	Priority	Timing	Estimated Cost
6	Develop an Invasive Species Management Plan and implement interim management actions to address high priority and early response actions.	High	2022	$75,000
7	Consider allocating resources for rapid response to new invasive species infestations.	High	2023	In-house
8	Complete a woodland regeneration plan to include all woodlands heavily infested by European buckthorn and other invasive species.	High	2022	In-house
9	Implement the woodlands regeneration program to include all woodlands heavily infested by European buckthorn and other invasive species.	High	2026	$5,100,000
10	Examine options to expand high priority invasive species control on private land through the town's Property Standards By-law.	Medium	2024	In-house
11	Consider extending the forest health monitoring program in North Oakville as the town assumes lands, following development.	Medium	As lands assumed	$30,000/ year

PRIORITY 3: TREE PLANTING AND ESTABLISHMENT

Priority Item No.	Solution	Priority	Timing	Estimated Cost
12 *(carried forward from 2008 UFSMP)*	Increase the use of enhanced rooting environment techniques in land use areas with low canopy cover and limited pervious planting area.	Medium	Ongoing	Project specific
13	Use priority area tree planting maps to focus strategic tree planting efforts on both public and private lands.	Medium	2022	In-house
14	Develop and monitor implementation of new standardized tree planting specifications town-wide.	Medium	2022	In-house/ ongoing
15	Examine options for expanding the range of eligible tree planting or forest renewal and/ or stewardship activities under the town's Tree Replacement Fund.	Medium	2021	In-house
16 *(carried forward from 2008 UFSMP)*	Develop a long-term stock procurement strategy, including a study to determine the feasibility of producing its own nursery stock or collaborating on a municipal nursery structure.	Medium	2025	To be determined

PRIORITY 4: RISK MANAGEMENT

Priority Item No.	Solution	Priority	Timing	Estimated Cost
17 *(carried forward from 2015 Forestry Services Review)*	Analyse the impact of climate change and develop comprehensive emergency response plans and business recovery procedures to address future extreme weather events and impact of pest and disease.	High	2022	In-house
18 *(carried forward from 2015 Forestry Services Review)*	Continue to assess 10-year capital impact forecast outlining anticipated future Forestry Services budgetary, staffing and equipment projections, including impacts from the future assumption of lands in North Oakville.	High	Ongoing	In-house

PRIORITY 5: COLLABORATION AND PARTNERSHIPS

Priority Item No.	Solution	Priority	Timing	Estimated Cost
19	The town's Forestry Services Section should chair regular meetings of the Inter-Departmental Technical Advisory Committee to assist in implementing the UFSMP and prepare proposals for new policies for consideration by Council.	High	Ongoing	In-house
20	The town cannot reach its 40% canopy cover goal by 2057 without the contribution of private properties. It is recommended to create a dedicated position to develop strategic partnerships with the public, private sector, non-profits in support of the town's urban forestry, biodiversity and environmental stewardship goals.	High	2022	$91,000 *(Staff should consider options for section or department resource realignment for filling the position prior to external recruitment.)*

PRIORITY 6: ADAPTIVE MANAGEMENT

Priority Item No.	Solution	Priority	Timing	Estimated Cost
21	The town should update its urban forest inventories on a ten-year cycle or in response to significant environmental change. Future Woodland inventories should include a baseline assessment of the presence and abundance of invasive species.	Medium	2022	$600,000
22	Complete a comprehensive and updated land cover classification for the entire town, based on most recently available satellite imagery and Light Detection and Ranging (LiDAR).	Medium	2023	Included in Tree Inventory
23	Continue to record labour and equipment hours required to perform tree (asset) maintenance activities.	High	Ongoing	In-house
24	Extend Forest Stewardship Council certification to North Oakville woodlands as they are assumed by the town.	High	As lands assumed	Area-based, no significant costs anticipated

4 Introduction

Consistently ranked among the top ten 'best places to live' in Canada, part of Oakville's appeal is the result of the town's commitment to maintaining parks and green space, including the extensive urban forest canopy. Surveys show that Oakville's residents rank trees and parks as one of the most important elements contributing to quality of life in the town.[1] Over the years, strong Council and community support for urban forestry initiatives has helped make Oakville a leader in urban forest management.

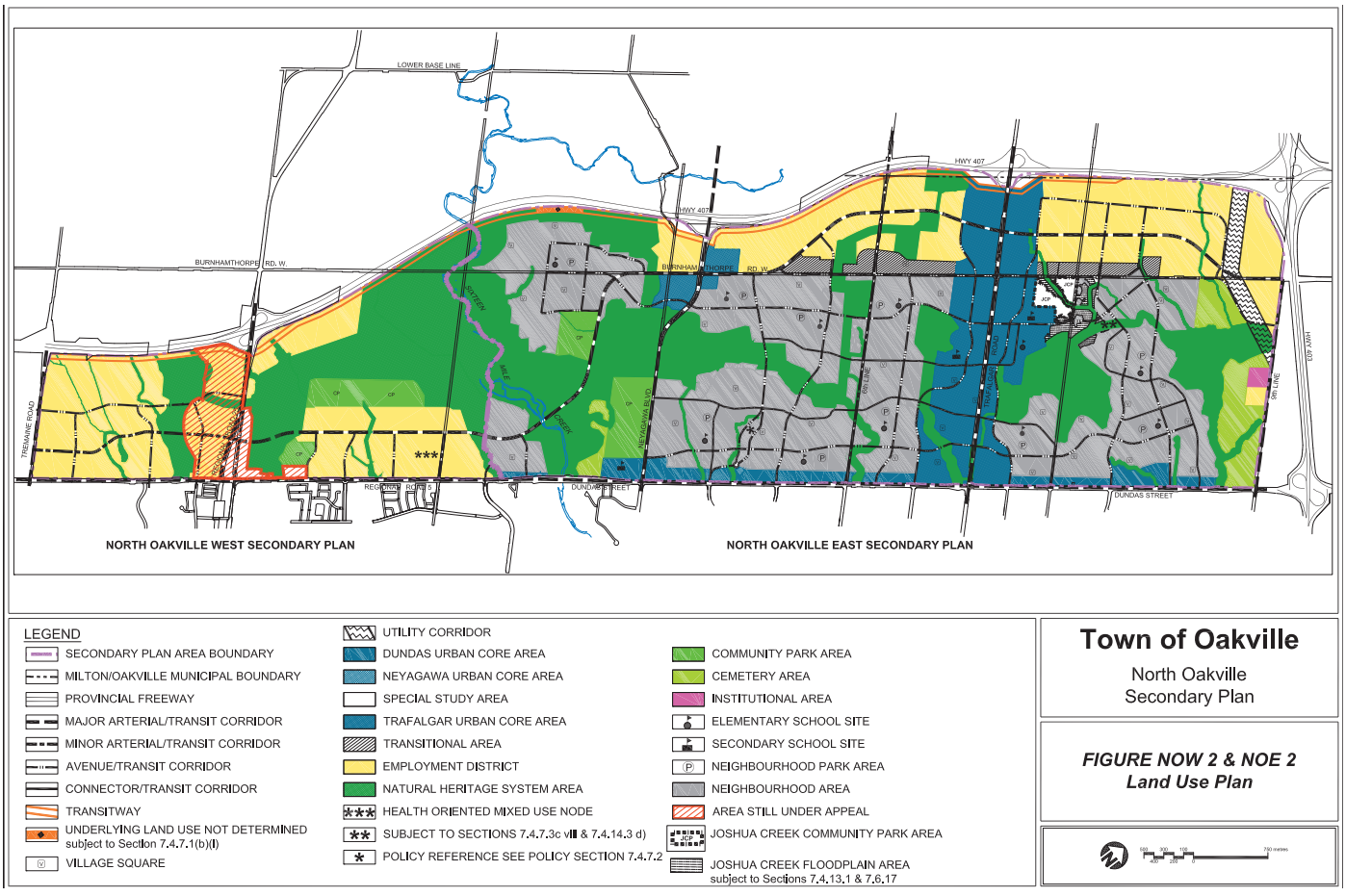
In recent years, a growing body of research has shown the importance of nature to human well-being. Urban forests provide many environmental, economic, and social benefits to communities, including air pollution removal, carbon storage, home energy savings and improvements in human mental and physical health. In fact, the urban forest represents part of the critical infrastructure that makes Oakville so livable.

Urban forests are dynamic, living systems in a state of constant flux. Managers need up-to-date information in order to respond to environmental change. The extensive impact of emerald ash borer (EAB) to ash tree species across Ontario is an example of a threat that has had significant implications for urban forests. Responding to EAB required extensive coordination, substantial investments and a swift response. Forest monitoring and budget forecasting were key aspects of responding effectively to this threat.

Examples of coming pressures on Oakville's trees and woodlands include urbanization and urban development, invasive species, and the increasing severity and frequency of storm events. Maintaining the funding levels needed to manage the urban forest as it expands is also an ongoing challenge for many municipalities. The unpredictable nature of change in the urban forest means that regular inventories and reliable data are an important part of developing successful management strategies.

1 Environmental Strategic Plan, Residential Character Study

This plan consolidates two previously separate forest management plans for South and North Oakville (2008 and 2012, respectively). The plan scope includes the entire Town of Oakville. Future urban forest studies and monitoring will also include the entire town. Although the management issues and land use history are different in these two distinct areas, the basic principles of sustainable urban forest management are applicable across the town. A solid plan backed by Council and resident support will increase the likelihood that the town's urban forest continues to grow and thrive.



5 Urban Forest Management in Oakville

Oakville's urban forest is an important part of the town's infrastructure. The urban forest includes all trees and shrubs found in parks, road right-of-ways (ROW), stormwater ponds, woodlands, schools, churches, hospitals, business areas, residential neighbourhoods, and all other privately owned properties.

The Town of Oakville Official Plans are legal documents that set direction for land use, development and growth in the community. Among many other things, Official Plans address the integration of natural heritage elements, including forest, in the urban landscape. They also implement provincial and regional land use planning requirements.

The Town of Oakville has two official plans in effect:

- The *Livable Oakville Plan*, which applies to the lands south of Dundas Street and to the lands north of Highway 407; and
- The *2006 Official Plan*, which applies to the lands north of Dundas Street up to Highway 407 (two secondary plans known as the North Oakville East Secondary Plan and the North Oakville West Secondary Plan remain as amendments to the 2006 Official Plan).

Until now, the town has also had two separate forest management plans in effect, including the 2008 South Oakville UFSMP and the 2012 North Oakville UFSMP. These plans have been guiding management of the urban forest. This in turn supports the implementation of many other town initiatives related to key environmental and sustainability performance indicators, such as stormwater, climate change and biodiversity. The town's forest management program was formalized in 2005 with the first tree canopy study in Ontario that used methodologies developed by the United States Department of Agriculture (USDA), Forest Service.

Since then, the town's forestry program has evolved, using information from studies, monitoring and program evaluation to direct management activities as well as new policy and guidelines. Figure 1 shows a timeline of important developments and improvements to Oakville's forestry program since 2005.

Oakville's Urban Forest

The urban forest consists of all trees and related ecosystems found on streets, in neighbourhoods, parks and remaining woodlands located on public and private property within the Town of Oakville.

Figure 1. Timeline of key developments in Oakville's urban forestry program.

2005	First UFORE and Canopy Study (Oakville's Solution to Our Pollution)
2007	Mayor sets official goal to achieve 40% canopy cover by 2057
2008	South Oakville Urban Forest Strategic Management Plan First Private Tree Protection By-law
2009	Tree inventory Revised Town Tree Protection By-law Revised Tree pProtection Policy and Procedure
2012	North Oakville Urban Forest Strategic Management Plan Canopy Cover Plan Required for Site Plan and Plan of Subdivision Applications
2014	"Livable by Design" manual Part A (urban design guidelines) references NOUFSMP
2015	Forestry Services Review Project
2016	Second Canopy Study, (Growing Livability - A Study of Oakville's Urban Forest)
2017	Revised Private Tree Protection By-law Improved Forestry Customer Service Level Standards
2018	2015 Forestry Services Review and Internal Audit Report Town wins Local Planning Appeal Tribunal appeal to increase landscape widths in the zoning by-law
2020	Consolidated Urban Forest Strategic Management Plan

Past forestry plans and studies identified key forest management issues and policy challenges in the Town of Oakville. Many of these issues have been addressed by adjustments to the forestry program as a direct result of recommendations made in management plans and studies. Other work is ongoing to implement the 104 recommendations that resulted from the 2008 UFSMP, the 2012 North Oakville Urban Forest Strategic Management Plan (NOUFSMP) and the 2016 Growing Livability – A Comprehensive Study of Oakville's Urban Forest report[1], Oakville Strategy for Biodiversity (2019).

1 Available online: https://www.oakville.ca/residents/urban-forest-strategic-management-plan.html and https://www.oakville.ca/assets/general%20-%20culture%20recreation/itree-growing-livability-report.pdf

Until now, North and South Oakville have been under separate forest management because these two areas have different histories of urbanization. As North Oakville continues to develop from former agricultural fields into high density residential and business areas, forestry operations will gradually expand management into new North Oakville neighbourhoods. In order to coordinate and prioritize Oakville's forest management activities, this plan reconciles the two previous urban forest plans for Oakville into one strategic management plan for the entire town.

Management of the town's urban forest is largely overseen by the Forestry Services Section, Parks and Open Space Department under the direction provided by Strategic Forest Management Plans and a body of enabling policy and legislation. An inter-departmental town working group is an important venue for working co-operatively to achieve the town's policy and strategic goals. These include objectives for increasing urban growth management while also increasing forest cover and protecting growing space for trees in the Town of Oakville.

Areas of Forestry responsibility include protection of town and private trees through tree protection by-laws, management of street trees, urban park trees and forested natural areas. However, other town departments also contribute to managing aspects of the urban tree canopy through development application review processes, providing funding for tree planting projects, and through various planting and inspection processes related to urbanization, urban development and implementation of Capital Projects in Oakville.

5.1 Policy and Planning Tools for the Urban Forest

In Oakville, the integration of trees in planning and development is rooted in policy and legislation. At the provincial, regional and municipal levels, specific legislation and policies provide the rationale for tree retention, protection and planting requirements as part of planning application review and approvals. Following is a summary of the tools that legally enable and support the practice of urban forestry in the Town of Oakville (Table 3).

Table 3. Summary of urban forestry regulatory and policy framework.

PROVINCE OF ONTARIO

Regulatory documents	Related regulatory content
Provincial policy statement (2014)	Section 1.6.2 enables planning authorities to promote green infrastructure to complement infrastructure. Section 1.8.1 directs planning authorities to support improved air quality and climate change adaptation through the use of land use and development patterns which: f) promote design and orientation which:…considers the mitigating effects of vegetation g) maximize vegetation within settlement areas where feasible.
Municipal act, 2001	Section 135. Tree By-laws: Section 135(1) (2) allows municipalities to prohibit or regulate the destruction or injury of trees. Section 270. Adoption of Policies Section 270(1) (7) of the Municipal Act requires that municipalities adopt and maintain policies with respect to the manner in which the municipality will protect and enhance the tree canopy and natural vegetation in the municipality.
Planning act	Section 41. Site plan control area Section 41(4) 2(e) allows municipalities to require development drawings to display the sustainable design elements on any adjoining highway, including without limitation trees… among other design elements. Section 41(7)(a)6 allows municipalities to impose as a condition of development approval the requirement for the owner of land to provide … trees … for the landscaping of the lands or the protection of adjoining lands.

REGION OF HALTON

Regulatory documents	Related regulatory content
Halton region tree by-law # 121-05	Prohibits the destruction and/or injuring of any tree located in Greenlands or in woodlands 0.5 hectares or larger.

TOWN OF OAKVILLE

Regulatory documents	Related regulatory content
Oakville's official plan (Livable Oakville Plan)	Livable Oakville includes provisions for the protection and enhancement of the urban forest with some examples as follows: Part C, Urban Design, Section 6.10.1 - Includes criteria for how development should preserve and enhance the urban forest. Part C, Sustainability and Urban Forests, Section 10.1 - Includes general objectives for sustainability that are: e) To maintain the existing urban forest, and f) To progressively increase the urban forest to achieve a canopy cover of 40 per cent town-wide beyond the life of this [Official] Plan. Part C, Sustainability and Urban Forests, Section 10.12 states: "The town considers its municipally owned urban forest as green infrastructure" Part C, Urban Forests, Sections 10.12.1 to 10.12.5 - Include criteria for replanting, inclusion of trees in new roads or improvements, standards for protection of trees in review of planning applications and municipal consents by utilities, standards for planting of new trees.
North Oakville secondary plans	The North Oakville Secondary Plans establish a planning framework for urban development in North Oakville. As a first priority for the town, a publicly owned natural heritage and open space system is established and will ultimately make up 30 per cent of the total land area. These areas are identified by the Natural Heritage System land use designation and contain natural features, buffers and linkages which include woodlands, wetlands, valleylands, wildlife habitat and other elements of the urban forest.
Comprehensive zoning by-laws *Zoning By-law 2014-014 applies to all properties in Oakville south of Dundas Street and north of Highway 407.* *North Oakville Zoning By-law 2009-189 applies to all remaining properties between Dundas Street and Highway 407.*	A zoning by-law establishes a range of "zones" that are intended to correspond to Official Plan designations. In the case of Oakville, zones that directly enable the urban forest include the Natural Heritage System zone and the Natural Area zone. Zoning by-laws also enable the urban forest indirectly by establishing regulations in these "zones" for space inside which the urban forest may be grown. Examples of these include the establishment of yards or the requirement for landscape buffers.
Livable by design manual (2014)	This manual incorporates canopy cover targets, which are currently being used to inform how much canopy cover should be applied to development applications through the Planning Services site plan process.
Oakville sustainable design guidelines (2010)	The guidelines are mandatory for all construction projects at town facilities including new construction, renovations, repairs or maintenance projects. They speak to preserving existing vegetation and soils as well as habitat conservation.

Regulatory documents	Related regulatory content
Oakville's site plan by-law 2005-062	The by-law describes the entire town as a site plan control area, and states that all development is subject to site plan control. Site plan approved by the Director of Planning includes all medium- and high-density residential development, all non-residential development, and residential development within 50 m of Lake Ontario or on severed parcels. Application of site plan control provides a tool for integrating urban forestry considerations through e.g., requirements for canopy cover plans.
Municipal tree protection by-law 2009-025	The Tree Protection By-law regulates the planting, care, maintenance and removal of trees on town property. The town's Tree Protection By-law also protects root and root zones by applying a tree protection zone around the tree.
Private tree protection by-law 2017-038	The Private Tree Protection By-law regulates and prohibits the injury or destruction of trees on private property within the Town of Oakville. The enhanced Private Tree Protection By-law enacted on May 2, 2017 protects healthy private trees over 15 cm in diameter. Property owners must apply for a permit and on-site consultation before removing any tree that has a trunk measuring 15 cm or larger in diameter.
Tree protection and tree canopy preservation policy EN-TRE-001	This policy enables the establishment of procedures to preserve tree canopy by minimizing tree removal, preventing damage or destruction of trees, establishing mandatory conditions for replacement of trees and optimizing planting provisions and tree health within the town.
Tree protection during construction procedure EN-TRE-001-001	This procedure provides an outline and required action to protect trees during construction.
Site alteration by-law 2003-021	The Site Alteration By-law requires site alterations within the town be subject to a mandatory review of existing trees.
Parks by-law, to prescribe rules and regulations for parks within the town of oakville 2013-013	This by-law prescribes rules and regulations to protect tree health and tree canopy in the town's parks.
By-law 2015-075 (to provide for the licensing and regulation of arborist consulting, arboriculture and landscaping/tree companies)	In conjunction with the Tree Protection By-Law, the annual licensing of certified arborists, arboricultural companies and landscaping/tree companies provides added protection to the town's urban forest and consumers.

5.2 Canopy Cover Targets

Many North American municipalities, including Oakville, have set canopy cover targets in recognition of the many benefits provided by the urban forest. In the early literature, 40 per cent was universally recommended as a target in a 1997 American Forests article "*After analyzing the tree canopy in dozens of cities over the [prior] five years and working closely with the research community.*" In Canada, some municipalities also refer to an Environment Canada report[2] that recommends 40 per cent forest cover as the minimum required to sustain basic watershed function.

Urban forest science has evolved over the past 20 years and there is a recognition that more nuanced approaches to target setting are necessary, based on consideration of factors including:

- Development densities (i.e., dense development patterns with more impervious surfaces have less opportunity for tree cover);
- Land use patterns (i.e., residential areas may have more opportunity for canopy than commercial areas);
- Regulations (i.e., parking lot shade regulations promote cover over some impervious areas); and
- Climate (i.e., canopy cover in desert cities is often less than temperate or tropical cities with a high historical forest composition).

That said, leading researchers from United States suggest that a 40-60 percent urban tree canopy is attainable under ideal conditions in forested states.[3] However, the amount of urban tree canopy cover is just one of many criteria to consider. Factors like age and species diversity, forest health and distribution of forest cover (landscape pattern) should also be considered.

Success will rely on applying a combination of approaches. It will also depend on the level of political and public support available for making high level urban forestry goals a reality. Strong Council support has led to the town's success in protecting and growing its tree canopy. The goal of the 2020 UFSMP is to recommend specific actions that will support continual improvement of the town's successful forestry program and progress toward achieving a 40 per cent canopy cover goal.

2 How Much Habitat is Enough? 3rd Edition. 2013. Environment Canada.

3 According to a national analysis by U.S. Forest Service researchers David Nowak (American Forest Science Advisory Board) and Eric Greenfield

5.3 Engaging with Oakville's Residents

Since the first forestry plan in 2008, the town has made efforts to engage with residents, volunteers and the private sector on various initiatives to encourage support for the urban forest and an improved understanding of how the forest is managed.

In support of the town-wide goal of 40 per cent canopy cover by 2057, significant contributions must be made within South Oakville, where there is a large amount of residential possible planting area. The town's current planting strategy does not include support or funding for planting on private land, except through support received for compensation planting under the Private Tree By-law. This is to mitigate the removal of canopy. Further efforts need to be made to increase planting on private land through partnerships and education, and any possible future financial incentives.

This includes ongoing public engagement and participation in events to increase appreciation for urban forests. Examples of town's initiatives to support sustainable forest management in Oakville by engaging with residents include:

- Consultations on management plan development
- To develop, facilitate and/or lead partnership initiatives with the private sector, nonprofits and community partners/stakeholders to achieve the town's forestry priorities, tree planting on private lands
- To promote the town's strategic agenda in support of its 40 per cent canopy cover goal, sustainable urban forestry management through the engagement of priority partners/ stakeholders and the transfer of technical resources management science, knowledge and expertise.
- To build and support local commitment, capacity and partnerships for long-term urban forest management in support of the town's business needs and priorities.
- Hosting forestry symposia and workshops for the public and other municipalities
- Open houses – Hydro Line Clearing Program
- Volunteer planting events in town parks and natural areas
- Supporting non-profit community organizations who plant trees on public and private property
- The Resident's Partnership Program in Street Tree Replacement Program
- The Forest Health Ambassadors Volunteer Program
- The PLANT (Please Let's Add New Trees) Program that encourages tree planting on private property

Moving forward, the town should engage more with residents and the private sector on forestry initiatives that support the town's short- and long-term strategic goals.

6 State of Oakville's Urban Forest

6.1 Summary of Trends: 2005-2018

Oakville's urban forest has been described extensively in past plans and study reports, including for reference the following key documents:

- Oakville's Urban Forest: Our Solution to Our Pollution (2005)
- Urban Forest Strategic Management Plan (UFSMP, 2008-2027) – South Oakville
- North Oakville Urban Forest Strategic Management Plan (2012)
- Growing Livability: A Comprehensive Study of Oakville's Urban Forest (2016)

These reports are available on the town's website or by request and help to provide context for the 2020 UFSMP. Drawing from past plans and studies, this section presents a summary of key indicators describing Oakville's urban forest and how it has changed over time. Based on study and monitoring data, the following positive trends have been observed in Oakville's urban forest between 2005 and 2018:

- An increase in urban forest cover in the South Oakville study area, as well as an increase in the number of trees;
- Improvements in average tree condition;
- An increase in the leaf area of large-stature native species;
- A slight decrease in maples, which were overrepresented in the street tree population and make the forest more vulnerable to pests like the Asian long-horned beetle (ALHB);
- Fewer trees removed and more trees planted on private property under the enhanced Private Tree Protection By-law; and,

- Management of insect pests (e.g., gypsy moth aerial spray), with positive results documented through the town's forest monitoring program.

One of the concerning trends in Oakville is an increase in the number and abundance of invasive species in natural areas. This has implications for the quality and health of these areas as well as native biodiversity, as discussed in more detail the Oakville Strategy for Biodiversity.

Overall, the data show that the amount of urban forest cover and average tree condition in urban areas have improved as a result of active management. On the other hand, the quality and health of the urban forest canopy in natural areas have been affected by invasive plants, pests and disease. Table 4 shows trends in urban forest indicators for which there is available data, as well as the source study or monitoring report for the assessment.

Table 4. Urban forest trends (2005-2018).

Indicator	Status	Notes	Source
Urban forest cover	Improved	Urban forest cover has increased from 26.5% in 2005 to 32.6% in 2018 in South Oakville. In 2018, urban forest cover for the entire town was assessed at 31.2%.	*2005, 2015 and 2018 canopy assessments*
Number of trees	Improved	Oakville had 1.9 million trees in 2005 and over 2 million trees in 2015.	*2005 and 2015 i-Tree studies*
Top three species by leaf area (m^2)	Improved	From 2005-2015 there was an increase in the overall leaf area of large-stature native species.	*2005 and 2015 i-Tree studies*
Average tree condition	Improved	Approximately 83% of trees in Oakville are in excellent or good condition, which represents an increase from 76.8% in 2005.	*2005 and 2015 i-Tree studies*
Replacement value ($)	No significant change	There was no significant change in the replacement value of the urban forest ($878 million in 2005 and $1.04 billion in 2015 roughly equivalent when accounting for inflation). The value of the forest is holding steady, despite a significant 2013 ice storm and severe EAB infestation that has killed a majority of the town's ash trees.	*2005 and 2015 i-Tree studies*

Indicator	Status	Notes	Source
Invasive species	Not Improved	The number and abundance of invasive species recorded in Oakville is increasing across the town. For example, the population of European buckthorn increased from 2% in 2005 to 10.6% in 2015. The town is currently managing buckthorn in woodlands through the forest regeneration program where ash is being removed.	*2005 and 2015 i-Tree studies*
Forest health (woodlands)	Improved	Forest health monitoring reports shows variable trend in woodland health ratings between 2014-2017. However, there was some improvement in 2018, likely a result of management activities to remove dead standing ash trees in woodlands and the aerial spray program to control damage from gypsy moth and cankerworm. Regular monitoring will help the town to respond proactively to known forest health issues and detect long-term trends.	*2014-2019 Forest Health Monitoring Reports*
Number of trees planted per 100,000 people	Improved	In 2016, there were 11,222 trees planted per 100,000 people. In 2018, this number had increased to 25,112.	*Forestry data, presented in World Council City Data (WCCD)*
Tree planting on private property (# of trees)	Improved	An additional 2,072 trees were planted on private property in 2017 and 2018 as a condition of the revised private tree by-law. An increased number of inspections has also resulted in an increase in m^2 of tree canopy preserved, from 11,303 m^2 preserved in 2016 to 24, 341 m^2 in 2018.	*2018 Forestry data and staff report to Community Services Committee*
Tree removals under revised private tree protection by-law	Improved	Comparing the number of trees removed and trees planted two years before and two years after the enactment of strengthened private tree by-law indicates, the number of trees removed was decreased by 50% and the number of planted trees increased form 47 to 3,311 trees.	*Forestry database and Corporation's permitting system*

6.2 Tree Condition and Forest Health

According to a sample-based inventory for South Oakville, 83 per cent of trees are in excellent or good condition (Table 5)[1] , which is up from 76.8 per cent in 2005. This number is higher for street trees, since they are managed more intensively than trees in woodlands. In addition, poor condition and dying trees play an important role in habitat for wildlife.

Table 5. Condition rating of all town-owned trees (Source: 2016 Growing Livability study for South Oakville).

Condition Rating	Overall	Street Trees
Excellent or Good	82.9%	95%
Poor or Fair	*9.2%	4%
Critical or Dying	1.4%	1%
Dead*	6.6%	generally removed

**Natural dieback of trees growing in woodland conditions is included in this number.*

Early detection of pests and disease is currently undertaken in South Oakville through a systematic forest health monitoring program in woodlands. This is completed on a rotating three-year cycle across the town's woodlands to detect short- and long-term trends in forest health.

A variety of factors influence forest health, including native and non-native insects and diseases, climate and weather, and the impacts of human activity. Forest health conditions may improve or worsen, depending on any individual factor or a combination of the effects of multiple factors acting simultaneously.

The Town of Oakville's forest health monitoring program began assessing the overall health of Oakville's woodlands in 2014. The surveys

employ long-term monitoring plots and visual pest detection surveys in woodlands, assessing both the forest canopy and understory conditions. The program also includes volunteer surveys of street trees to provide early detection of pests. Monitoring plots will help managers identify key forest health threats and their effects in the longer term.

1 This refers to general condition as observed through basic inventory procedures, e.g., extent of crown dieback. Condition ratings are not based on detailed assessments, but rather provided to give a general indication of forest condition.

6.2.1 Forest Pests

The first Woodland surveys started when ash mortality due to emerald ash borer infestation was approaching its peak. As a result, standing dead ash trees, sometimes present in large numbers, led to poor health ratings for affected woodlands. Over time, the Town of Oakville removed dead and dying trees, which reduced overall levels of dead standing trees in woodlands and thereby improved health ratings.

Meanwhile in 2016, forest health surveys detected the beginnings of a surge in the local and regional population of European gypsy moth and cankerworm, which are both defoliating pests of deciduous trees. This population surge continued into 2017, resulting in widespread defoliation and a relative decline in canopy health.

The Asian long-horned beetle (ALHB) infestation has been controlled in Ontario so far. However, it continues to represent a potential threat to the urban forest as it affects a long list of host species, including the maple trees that make up a large proportion of the town's forest population and leaf area. It is estimated that as much as 42 per cent of Oakville's total leaf area could be affected by an ALHB infestation.

Gypsy Moth Aerial Spray

An aerial spray program aimed at controlling gypsy moth and cankerworm in the spring of 2018 reduced their populations and prevented severe defoliation of the forest canopy. As a result, overall forest health ratings improved in 2018.

Oakville and other municipalities have coordinated efforts on the aerial spray to help reduce program costs.

The town's forest health monitoring program is an important tool for early detection of insect pests as well as invasive plants, which have been included in the monitoring program. Implementing a rapid response to early detection of invasive species is one of the primary and cost-effective ways to identify and mitigate threats to the urban forest.

6.2.2 Invasive Plants

Invasive plants threaten native biodiversity and they constitute a significant new management challenge in Oakville's woodlands. Many species of invasive understory plants have increased in presence (# of species found) and abundance (extent of invasion) in Oakville's woodlands over time. The most common invasive plants found in woodlands include European buckthorn, garlic mustard and invasive honeysuckles.

The emerald ash borer management program has led to the extensive removal of ash trees in many town woodlands. This tree removal has created ideal conditions for European buckthorn to aggressively colonize sites before successful regeneration with native tree stock can occur.

The quality and health of urban forest cover are a key part of urban forest sustainability, and the growing challenges of managing invasive species will be addressed as a high priority through this forest management plan. Oakville is currently implementing a forest regeneration program in selected woodlands severely impacted by emerald ash borer. This program includes buckthorn control and will have a positive effect in natural areas by restoring native species.

Other highly invasive species, such as Japanese knotweed and dog-strangling vine are still sparsely distributed and present an opportunity for the Town of Oakville to target management activities toward minimizing further incursions into its woodlands. Developing an invasive species management strategy is recommended to be a high priority for the Town of Oakville.

Woodland Regeneration

Oakville is supporting healthy woodland renewal through active management in select town woodlands, including those affect by EAB. While natural regeneration accounts for much of the regrowth in many woodlands, select sites have been identified for enhanced and/or intensive regeneration and replanting where invasive species pose a threat to forest health.

The removal of invasive plants, such as buckthorn, is an important part of regeneration activities as it provides growing space for newly planted trees and increases the success of native tree regeneration.

6.3 Canopy Cover

6.3.1 Canopy Cover Trend

In 2007, the Mayor of Oakville set a target to achieve 40 per cent canopy cover by 2057 as a sesquicentennial legacy project for Oakville. The most recent assessment shows a combined total urban forest cover for North and South Oakville of 31.2 per cent, which represents an overall increase of about five percentage points since 2005.

North Oakville currently has lower forest cover at 27.6 per cent because of the area's farming history. Much of the current forest cover is found in the designated natural heritage system, with recent tree planting in new subdivisions also contributing to canopy cover.

Forest cover in South Oakville is higher at 32.6 per cent, bringing the average for the entire town to 31.2 per cent. In South Oakville, mature residential neighbourhoods and woodlands contribute significantly to this total.

North Oakville Natural Heritage System

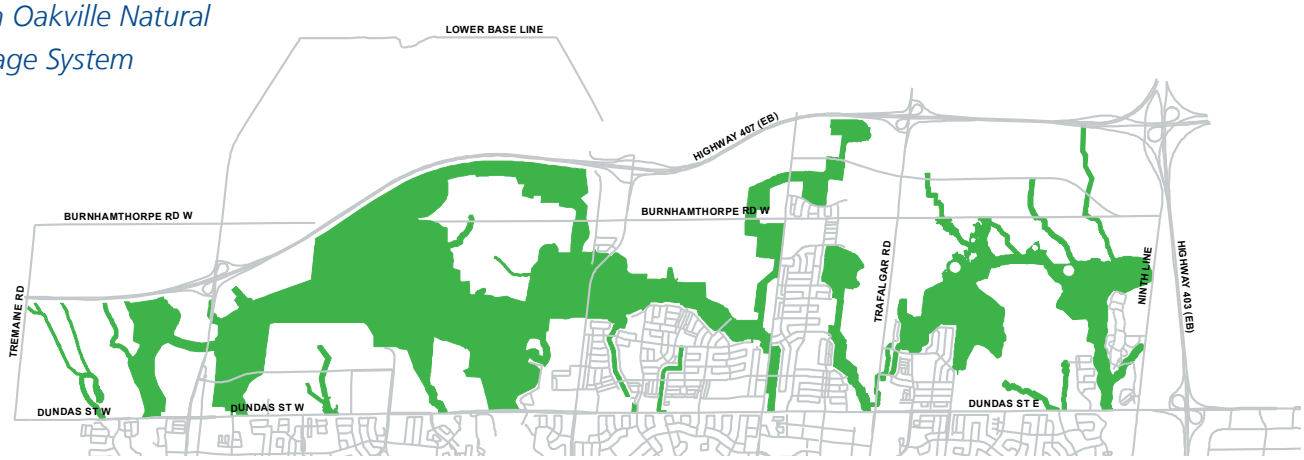
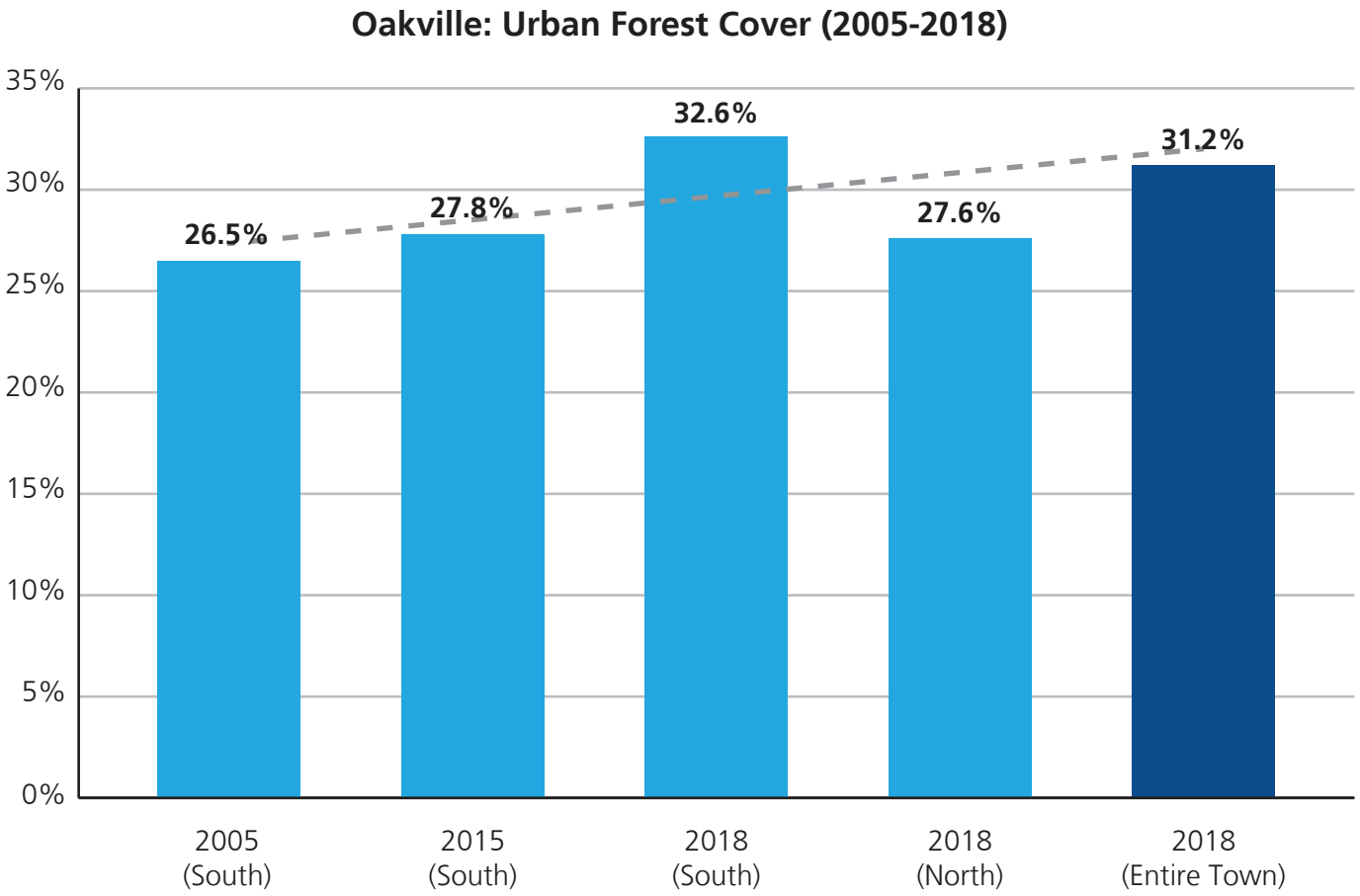


Figure 2. Oakville canopy cover (percent canopy cover from 2005-2018).



The data[2] shows that the town's overall canopy cover has increased, despite impacts from the emerald ash borer infestation, a major ice storm in 2013, and significant concentrations of development applications south of the QEW. This increase could be the result of the town's aggressive tree planting and tree protection efforts in recent years.

The Growing Livability study reported that European buckthorn increased from 2 per cent of the population in 2005 to 10.6 per cent in 2015. The town increased buckthorn removal and control through woodland regeneration program as well as reactively completing invasive species control in response to resident's concerns. In total, European buckthorn has been removed, treated and replaced by planting native species in 132 hectares of woodlands in prime and enhancement sites. The impact of this project and the town's reactive response on the population of buckthorn should be assessed in the upcoming i-Tree 2022 study.

2 Point sampling of aerial photographs to classify land and forest cover in the Town of Oakville as part of 2020 UFSMP as compared to previous study estimates (Solution to Our Pollution, Growing Livability) using the same technique.

6.3.2 Canopy Distribution

In terms of specific land use areas, available population data shows that the number of trees has increased in every land use class, with the exception of the commercial land use (Table 6).

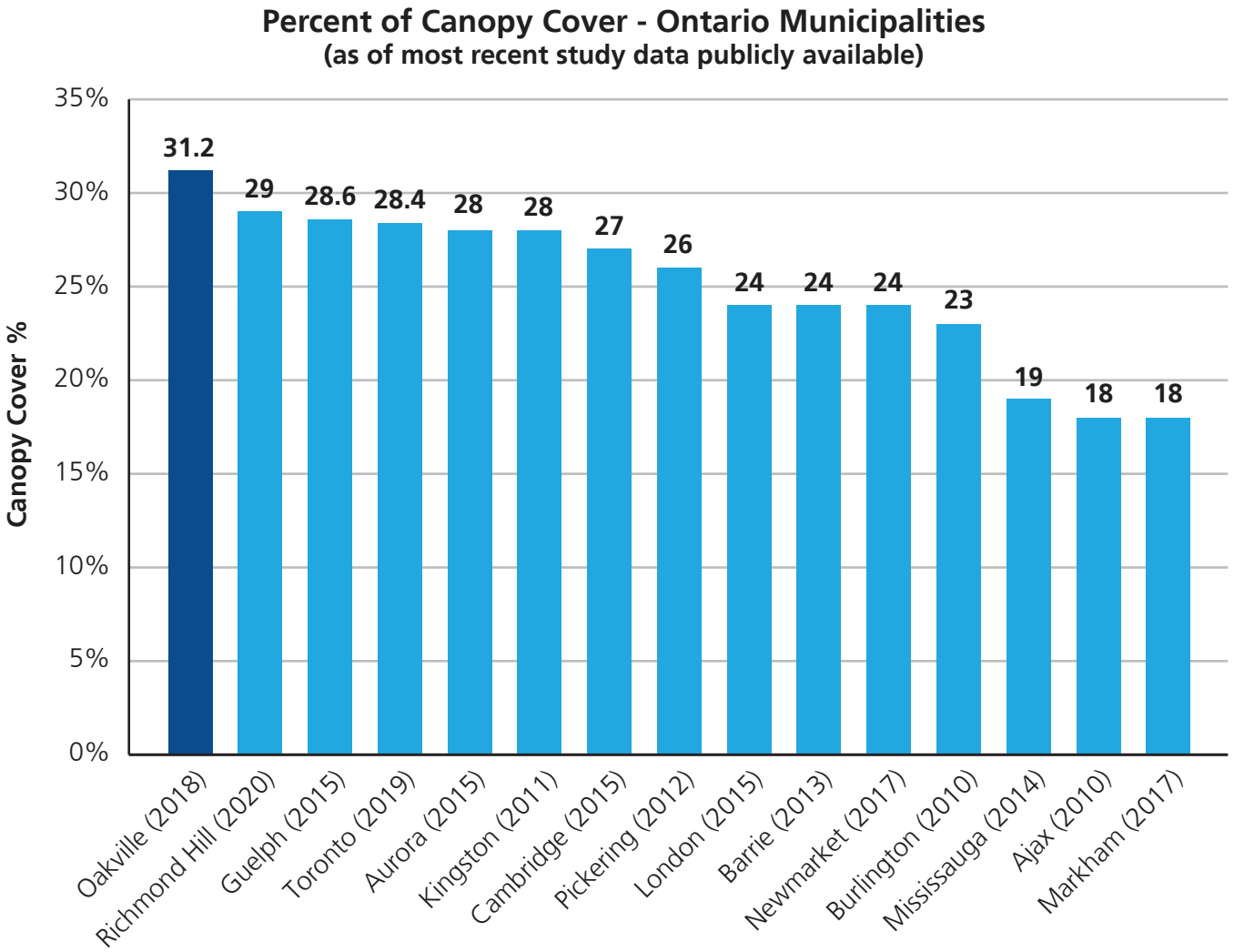
Table 6. Change in number of trees by land use (Source: Growing Livability study report, 2015).

Land use	2005	2015	Difference
Employment/ industrial	94,200	136,000	41,800
Woodlands	884,700	925,400	40,700
Open space/ parkway	274,800	314,300	39,500
Residential low	195,200	222,900	27,700
Residential medium	377,600	389,300	11,800*
Agricultural	1,200	10,200	9,000*
Public use	2,700	5,300	2,700
Commercial	19,000	13,000	-6,000
Town total	1,849,300	2,016,500	167,200

** Land uses with statistically significant increase in tree population, South Oakville*

Available studies from other municipalities suggest that Oakville is currently leading in terms of overall urban canopy cover among all municipalities in southern Ontario. Canopy cover in other southern Ontario municipalities ranges between a low of 18 per cent and a high of 29 per cent based on available study estimates. Given the upward trend in urban forest cover, the town seems to be on track to meeting its 40 per cent forest cover goal.

Figure 3. Percentage of canopy cover in 15 Municipalities assessed in municipal forestry studies since 2010.



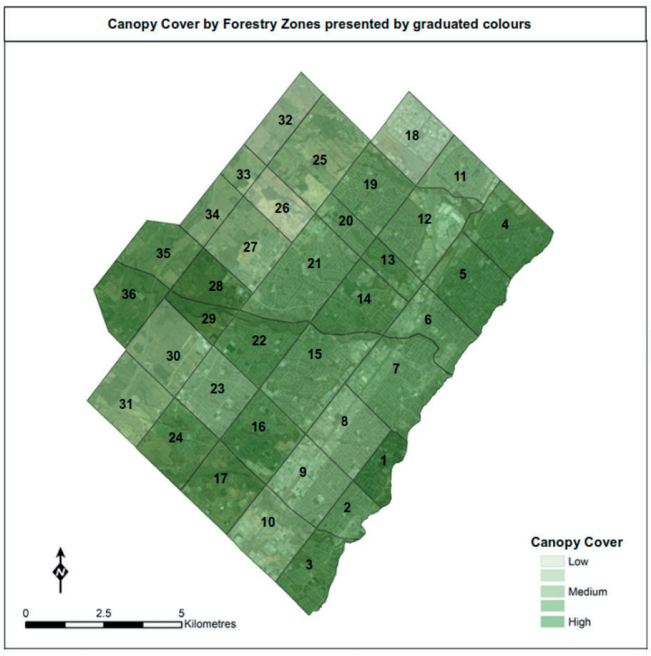
Future urban forest management should consider how to further manage the quality and health of Oakville's urban forest, as well the extent of canopy cover. This should be considered a high priority as the presence and abundance of invasive plant species continues to increase. With the spread of pathogens like beech bark disease and potential of oak wilt coming north from the United States, there are significant emerging threats to forest health. At the last assessment, 53.1 per cent of Oakville's canopy cover was located on public land with the remaining 46.9 per cent found on private land (Table 7).

Table 7. Distribution of canopy cover by land ownership (South Dundas).

Urban Tree Canopy (UTC) Ownership	Area (ha)	% of Total UTC Area
Public lands	1,346.8	53.1
Private lands	1,188.8	46.9
Total UTC area (ha)	2,535.6	100.0

In Oakville, higher levels of canopy cover are found in old South Oakville neighbourhoods and areas of the town where the natural heritage and parks system contribute to forest cover. Areas with lower average urban canopy cover generally coincide with employment and commercial/mixed use areas, as well as former agricultural lands in North Oakville (Figure 4).

Figure 4. Canopy cover by forestry zone (Source: 2018 UFSMP point sampling data).



Higher levels of canopy cover are typically found in lower intensity urban land uses like parks, woodlands and low-density residential areas. However, it is possible to improve the amount of forest cover in more urbanized land uses by encouraging tree planting on existing and available private lands, incorporating trees in planning and design for new development, preserving existing trees as well as increasing the amount of tree planting in hard surfaces like parking lots and sidewalks in commercial and other land use areas.

6.3.3 Supporting Policy

The town has procedures for integrating canopy cover into development across all land uses, which include a requirement for separate "canopy cover plans" and a "canopy calculation chart" as part of an application for rezoning, site plan or plan of subdivision. The town also implements canopy cover targets for each land use class, which are documented in the town's Livable by Design manual.

The implementation of targets by land use as well as the requirement to submit canopy cover plans (separate of landscaping plans) sets Oakville apart from other municipalities. Canopy cover targets by land use provide an important tool to ensure that trees are considered at early stages of planning and design. Oakville also has developed guidelines for "Greening Surface Parking",[3] which represents a significant amount (i.e., 5 per cent)[4] of the town's total land area. Periodic review of guideline implementation will help the town identify issues or opportunities for increasing sustainable canopy cover on these lands.

To date, the town has achieved its canopy cover targets by landuse in North Oakville as determined through a 2018 assessment of forest cover in new subdivisions. Continued monitoring of these targets as part of future studies will help the town stay on track toward its urban forestry goals.

Canopy Cover Plans

In Oakville, a canopy cover plan may be required as part of an application for:

- Zoning By-law Amendment
- Plan of Subdivision
- Site Plan Control

A canopy cover plan illustrates the retained existing and proposed tree canopy for a development site.

The requirement for a canopy cover plan is a best practice that sets Oakville apart from other municipalities.

3 Greening Surface Parking and Other Site Areas. Oakville Livable by Design Manual (Part C): Site Design and Development Standards [version 02.2017].

4 Estimate based on 2018 land cover point sampling.

6.3.4 Achieving 40 per cent Canopy Cover

Growing healthy trees and forests in an urban setting is, of necessity, a collaborative effort involving foresters, arborists, spatial analysts, urban planners, landscape architects and engineers, among other disciplines. Urban environments are complex and trees face a number of additional stresses that can include poor quality, compacted or contaminated soils, higher heat stress in paved environments, conflicts with infrastructure as well as damage from vandalism or other impacts related to growing in a densely populated setting. Achieving the town's Official Plan goal of 40 per cent urban forest cover by 2057 requires a broad range of actions aimed at continual and incremental improvements in this complex policy and growing environment.

The United States Department of Agriculture (USDA) Forest Service, a leader in sustainable urban forest research and policy, identifies six key elements that make up the framework for a sustainable urban forest management program. Implementing these principles successfully will involve not only Forestry Services, but also all the other town departments whose processes and activities affect the urban forest. The following summary provides an overview of existing town initiatives that address these six key sustainable forest management requirements:

1) Permanently protect forest tracts.

- Oakville has a designated natural heritage system that protects the town's natural heritage and biodiversity.
- Town woodlands are protected and independently certified by the Forest Stewardship Council.
- Woodlands in regeneration program are actively managed to control invasive species and promote long-term forest health.

2) Prevent forest loss during development by adopting or amending site development regulations and zoning.

- The town has made significant adjustments in the early stages of design to reduce tree loss and minimize impacts to remaining trees.
- Examples include weighting "canopy credits" more for the preservation of existing trees, incorporating alternate foundation construction methods such as helical piers to preserve root structure, and performing exploratory trenching to expose structural roots in order to make educated design and excavation decisions.

3) Maintain existing forest canopy by adopting regulations that restrict tree removal.

- Oakville has strong tree by-laws and tree protection policies in place to protect trees on both public and private land from damage during construction and from unnecessary removal.
- Revisions to the Private Tree By-law in 2017 have reduced the number of healthy private trees removed.

4) Increase tree planting during development by adopting or revising site development regulations such as landscaping and parking lot shading.

- Oakville is unique in having requirements for stand-alone canopy cover plans that are submitted with development applications under the site plan process. While these plans include landscaping plans, they are currently guided by the targets set for North Oakville. Since the town cannot achieve its 40 per cent canopy cover target by adapting North Oakville canopy targets for South, this study will provide evidenced based targets for lands south of Dundas. These plans include specific targets for each land use area that are integrated into landscaping plans.
- Oakville's Livable by Design Manual includes guidelines for "*Greening Surface Parking and Other Site Areas*".
- Enforcement of the enhanced Private Tree By-law enacted in 2017 have significantly increased the number of trees planted as the condition of private trees permits

5) Increase tree planting on public lands.

- The town makes regular investments in tree planting activities on town-owned lands and in ROW, both through Forestry Services programs, and through plantings by other town departments.
- The number of trees planted per 100,000 people has increased since the last UFSMP.

6) Encourage tree planting on private lands by developing education, stewardship and incentive programs.

- Oakville has engaged with community groups that work with landowners to increase the number of trees planted on private land.
- The *Private Tree Protection By-law* has requirements for tree replacement where trees are removed on private land.
- The number of trees planted on private land has increased since the last UFMSP.
- The town's PLANT (*Please Let's Add New Trees*) program is aimed at increasing the number of trees planted on private land, which residents can report through the town's website.

The area of private land stewardship has been addressed in the 2020 UFSMP as a high priority area for the town. Much of the future opportunity to grow the tree canopy is located on private land and landowners have an important role to play in this effort. Another key element of the 2020 UFSMP was to develop land use targets for South Oakville that will maintain and increase future canopy in the context of continuing infill and redevelopment projects. Collaboration through the town's Interdepartmental Technical Advisory Committee will be critical for continuing to maintain and grow Oakville's tree canopy.

6.4 Criteria and Indicators of Sustainable Forest Management: 2008-2018

Across Canada, forest managers often use what are referred to as "criteria and indicators" (C&I) to measure the effectiveness of forest management activities.[5] The 2008 UFMSP for South Oakville included a set 24 of criteria and associated performance indicators to rate Oakville's forestry program. Since then, changes in the program have resulted in improvements in many of the baseline performance scores. Changes to the status of 10 key C&I are shown in Table 8.

Moving forward, the Forestry Services Section will use an adapted version of the USDA Forest Service methodology as described in its guide "*The Sustainable Urban Forest: A Step-by-Step Approach*". This includes a set of 28 indicators of sustainable forest management. A baseline ranking using the 28 USDA C&I can be found in Appendix I of this plan.

5 2008 UFSMP.

Table 8. Change in performance indicators from 2008-2018. Adapted from Clark et al. (1997)

PRIORITY 6: ADAPTIVE MANAGEMENT

Legend: Status in 2008 Status in 2018

Criteria	Low	Moderate	Good	Optimal	Key objective
1. Tree inventory	No inventory.	Complete or sample-based inventory of publicly owned trees.	Complete inventory of publicly-owned trees AND sample-based inventory of privately-owned trees.	Complete inventory of publicly owned trees AND sample-based inventory of privately-owned trees included in city-wide GIS.	Complete inventory of the tree resources to direct its management. This includes age distribution, species mix, tree condition, risk assessment.
2. Canopy cover inventory	No inventory.	Visual assessment.	Sampling of cover using aerial photographs or satellite imagery.	Sampling of tree cover using aerial photographs or satellite imagery included in city-wide GIS.	High resolution assessments of the existing and potential canopy cover for the entire community.
3. City-wide management plan	No plan.	*Existing plan limited in scope and implementation.	Comprehensive plan for publicly owned trees accepted and implemented.	Comprehensive plan for ALL components of the urban forest (private and public assets) accepted and implemented.	Develop and implement forest management plans for private and public property.
4. Municipality-wide Funding	Funding for reactive management.	Funding to optimize existing urban forest.	Funding to provide for net increase in urban forest benefits.	Adequate private and public funding to sustain maximum urban forest benefits.	Develop and maintain adequate funding to implement a city-wide urban forest management plan.
5. City staffing	No staff.	No training of existing staff.	Certified arborists and professional foresters on staff with regular professional development.	Multi-disciplinary team within the urban forestry unit.	Employ and train adequate staff to implement city-wide urban forestry plan.
6. Tree establishment planning and implementation.	Tree establishment is ad hoc.	Tree establishment occurs on an annual basis.	Tree establishment is directed by the needs derived from a tree inventory.	Tree establishment is directed by needs derived from a tree inventory and is sufficient to meet canopy cover objectives.	Urban Forest renewal is ensured through a comprehensive tree establishment program driven by canopy cover, species diversity, and species distribution objectives.
7. Pruning of publicly owned, intensively managed trees.	No pruning of publicly owned trees.	Publicly owned trees are pruned on a request/reactive basis. No systemic (block) pruning.	All publicly owned trees are systematically pruned on a cycle longer than five years.	All mature publicly owned trees are pruned on a 5-year cycle. All immature trees are structurally pruned.	All publicly owned trees are pruned to maximize current and future benefits. Tree health and condition ensure maximum longevity.
8. Hazard tree management	No tree risk assessment/remediation program. Request-based/reactive system. The condition of the urban forest is unknown.	Sample-based tree inventory which includes general tree risk information. Request-based/reactive risk abatement program system.	Complete tree inventory which includes detailed tree failure risk ratings; risk abatement program is in effect eliminating hazards within a maximum of one month from confirmation of hazard potential.	Complete tree inventory which includes detailed tree failure risk ratings; risk abatement program is in effect eliminating hazards within one week from confirmation of hazard potential.	All publicly owned trees are safe.
9. Tree protection policy development and enforcement	No tree protection policy.	Policies in place to protect public trees.	Policies in place to protect public and private trees with enforcement.	Integrated municipal wide policies that ensure the protection of trees on public and private land are consistently enforced and supported by significant deterrents.	The benefits derived from large-stature trees are ensured by the enforcement of municipal-wide policies.
10. Publicly owned natural areas management planning and implementation.	No stewardship plans or implementation in effect.	Reactionary stewardship in effect to facilitate public use (e.g., hazard abatement, trail maintenance, etc.)	Stewardship plan in effect for each publicly owned natural area to facilitate public use (e.g., hazard abatement, trail maintenance, etc.)	Stewardship plan in effect for each publicly owned natural area focused on sustaining the ecological structure and function of the feature.	The ecological structure and function of all publicly owned natural areas are protected and, where appropriate, enhanced.

7 Past Plans and 2020 UFSMP Priorities

Urban forest management priorities change over time in response to changing environmental conditions. The 2008 UFSMP included a focus on management needs that were identified at the time, such as:

- Formalizing the town's forestry program through baseline inventories, planning and reporting;
- Integrating the town's forestry goals in town policy and planning documents;
- Emerald ash borer crisis management, which was an emerging forest health threat at the time.

A separate 2012 North Oakville plan provided a starting point for urban forest management north of Dundas Street, where new development was in its early stages. A focus of this plan was to establish and implement land use targets for tree cover in new developments, to meet the town's forestry objectives north of Dundas Street. The consolidated 2020 UFMSP will address some new challenges that have emerged since the last plans were developed.

Street trees planted on enhanced growing environment (Silva Cell), North Oakville

The current UFSMP is the town's first effort to consolidate planning for North and South Oakville. It focuses on emerging challenges as the EAB program is winding down and development in North Oakville and redevelopment in South Oakville progresses. Key management priorities addressed in the 2020 plan include:

- Developing a strategy to deal with the number and abundance of invasive species;
- Mitigating the effects of pests, disease and invasive species on woodland health;
- Establishing and maintaining partnerships to achieve tree canopy cover, forest health priorities and invasive species management;
- Continuing to adapt policy and urban design solutions to address the evolving challenges inherent in balancing urbanization and urban development with urban forestry to advance the town's objective of reaching 40 per cent canopy cover;
- Forecasting and budgeting for increases in Forestry Services resource requirements in light of future assumption of lands and management responsibilities in North Oakville; and,
- Generating reliable operational data to report accurately on key performance indicators and as input to adaptive management.

These issues, priorities and actions are explored in more detail in the following sections.

8 Priorities and Actions

8.1 Forest Protection

Forest protection in the UFSMP context includes both the existing urban forest and the potential future urban forest through protection of growing space. Opportunities to expand the tree canopy in Oakville are directly tied to the quality and amount of growing space in the urban landscape. Urban intensification and its associated infrastructure needs can have many positive environmental and economic outcomes for municipalities. However, this urbanization and urban development can also have the side effect of reducing existing tree cover to make space for new construction as well as reducing the available growing space for trees.

At the same time, many municipalities, including Oakville, have clear goals for increasing canopy cover to improve the quality of life in municipalities and maximize the benefits provided by trees. Managing these conflicting goals is possible but requires careful planning and early consideration for how canopy cover will be integrated in development both in the short and long terms.

Since the town's first urban forest study in 2005, Oakville has implemented many initiatives to protect, preserve and grow tree canopy on private and public land. Some of these represent best practices in urban forestry. These include improvements to the private tree by-law, property owner outreach and education to reduce unnecessary tree removals, separate canopy cover plan requirements as well as changes to the town's zoning by-law to protect growing space for trees in some land uses. The town works actively with landowners on these issues through the policy and standards that are in place and through pre-consultation meeting that occur before development applications are filed.

Town of Oakville Best Practices in Urban Forestry

- Requirements for separate "Canopy Cover Plans" (with targets) for development applications
- Investing in forest health monitoring, active management and forest renewal in woodlands
- Implementing an Arborist Licencing By-law to support good arboricultural practices and consumer protection in Oakville

Because pressures on the urban forest are constant, the effort to find new and innovative ways to integrate healthy canopy cover must also be an ongoing effort. The town has made good progress since 2008. However, there is room for further collaboration between town departments and the private sector to ensure Oakville will meet its canopy targets and maintain a healthy, sustainable urban forest. Some of the main challenges in Oakville are outlined in the following sections.

Challenge: Urban forests and climate resilience in Oakville.

Urban forests play an important role in climate change mitigation and adaptation. Municipal "climate action plans" often incorporate urban forestry into climate change mitigation and adaptation strategies, recognizing that healthy trees and forests can strengthen a community's ability to withstand and manage climate-related threats.[1] Average temperature increases caused by global warming are frequently amplified in urban areas, particularly where there are high levels of paved surfaces and built form. The heat island effect can have implications for many aspects of urban life, including energy use for cooling, heat related illness and mortality, limiting active transportation in uncomfortable pedestrian or cycling environments as well as causing increased stress on trees.

The urban forest is also a key moderating variable for mitigating climate impacts on people, particularly vulnerable populations including the young, the elderly, and the poor. Municipalities are also particularly susceptible to climate-related threats from storms and flooding. Urban trees can also help reduce the burden on stormwater infrastructure by intercepting rainfall and increasing the infiltration rate of deposited precipitation.[2]

As municipalities grow and land use intensity increases, this invariably affects the amount of growing space that is available for trees. This is particularly true for large trees, whose extensive root systems can occupy as much area as a mature tree crown. Ensuring future availability of lands for planting large stature trees in both North and South Oakville is a challenge, albeit for somewhat different reasons in these two different areas of the town.

1 Urban Forests and Climate Change. USDA Forest Service, Climate Change Resource Centre.
2 Ibid.

As currently designed, much of North Oakville's tree canopy in areas with residential land use will be located on town lands, specifically in road right-of-ways (ROW). The compact form of residential development in North Oakville has many benefits for the town and its residents, but it also has the side effect of limiting future growing space that could support mature trees, specifically on private lands in residential areas. In North Oakville, the approach to community design is such that substantial contributions to the overall canopy cover in North Oakville will come from the public realm, including the designated Natural Heritage System (NHS), ROW, parks and woodlands. Meanwhile, canopy cover targets are being applied in the development of other private lands where there is available growing space for trees (e.g., commercial, employment and other land use areas).

The situation in South Oakville is different with historically larger lots, more mature trees and more potential planting areas for trees while its woodlands being impacted by the effect of urbanization. South Oakville is lacking the extensive natural heritage system compared to North Oakville where it contributes extensively to canopy cover.

In June 2019, Oakville Town Council passed a motion declaring a climate emergency in Oakville. Oakville's *Climate Change Adaptation Initiative* actions include:

- Increasing the town's capacity to protect against and respond to projected climate change impacts;
- Educating through effective and efficient means of communication; and,
- Monitoring the implementation of adaptation actions and goals in order to make continuous operational improvements.

According to the International Institute for Sustainable Development (IISD),[3] it is important to continue expanding on the environmental aspects of planning, in anticipation of increasing climate-related stress in municipalities. Looking at urban design through the lens of climate resilience, it would be prudent to identify further opportunities to preserve and maximize growing space for trees (representing pervious areas, soils and potential future canopy) to contribute to building climate resilience in Oakville.

3 Eight Ways Cities Are Building Climate Resilience. IISD. https://www.iisd.org/faq/building-a-climate-resilient-city/

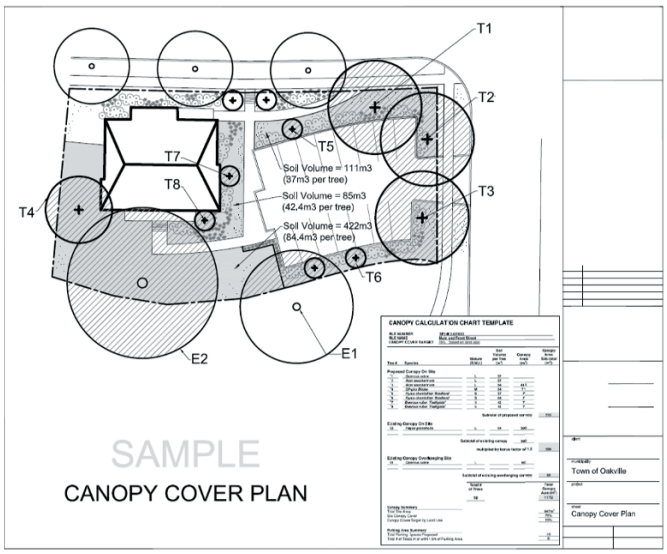
This recommendation is consistent with adaptation actions identified in the town's Climate Change Strategy, which references tracking and monitoring the implementation of those aspects of the Livable by Design manual that respond to local climate.[4] It is also consistent with the town's Sustainable Development Checklist (SDC), which includes stormwater measures that have the added benefit of supporting the retention and protection of growing space for trees, as follows:

- Maintain existing on-site trees that are 30 cm or more DBH (diameter at breast height);
- Optimize pervious cover (at least 35 per cent of site is pervious); and,
- Apply innovative building design or site plan layout.

The SDC also recommends incorporating shading by deciduous trees as a measure to improve energy efficiency.

Oakville has incorporated many best practices in urban design into existing guidelines and policies for the town. However, the following action is suggested in the spirit of continual improvement as the science on best practices for building climate resilience evolves.

Action: Work collaboratively to identify opportunities for amending town policies and urban design guidelines to enhance urban forest contributions to climate resilience in Oakville.



Challenge: Developing canopy cover targets for North and South Oakville that support an overall 40 per cent canopy cover goal. In Oakville, development proposals have to comply with applicable regulations, standards and guidelines contained in the Zoning By-laws, Livable by Design Manual and other guiding policy documents. Oakville's past forestry plans identified targets for canopy cover by land use that were integrated in other town policies and guidelines.

Canopy cover targets for each land use provide a critical tool for the town to translate high level policy goals into on-the-ground results as development occurs. Secondly, they help to focus tree planting efforts across all land uses and ownerships, to improve the distribution and benefits of tree cover in all areas of the town.

Since 2012, the town has required the development of Canopy Cover Plans and Canopy Calculation Charts to project, and in the future, verify how a given development is contributing to the town's urban forest cover goals. These are currently required under zoning amendment, Site Plan and Plan of Subdivision applications.

4 Track and monitor the implementation of the manual related to urban design that responds to the local climate.

The North Oakville canopy targets were first developed in 2012. While targets were generally being met, there were some adjustments to reflect implementation challenges in certain land uses as well as opportunities in others. Specifically, the parks target was reduced from 50 per cent to 40 per cent to address the high interest in maintaining space for recreational use in parks. At the same time, the target for stormwater management ponds was increased to take advantage of the opportunities for more tree planting in those areas. The rebalancing of canopy target between our park lands and our stormwater management ensures we remain on track for meeting the canopy target for the North Oakville area and the community as a whole.

Table 9 shows the revised land use targets for North Oakville that have been implemented in new developments both north and (in the interim) south of Dundas Street. Part of the scope of the 2020 UFMSP was to develop specific canopy targets that reflect the development context for South Oakville.

Table 9. North Oakville canopy cover targets (%) by land use (Source: North Oakville Urban Forest Strategic Management Plan (Draft) Review- 2016)..

Zone and Land Use	Overall Target Canopy Cover (%)	Total Land Area (ha)	Area of Canopy Cover (ha)
The NHS & natural lands north of 407 (NHS)	90%	1,208	1,082
Agricultural lands north of 407	0%	600	0
Employment (LE, GE, SA, AS)	20%	630	126
Residential (all types) (HDR, NC, GU, S)	20%	665	133
Park (P)	40%	160	64
Arterial, connector & avenue roads	34%	190	65
Commercial, service and related uses, and mixed use (TUC, NUC, DUC, PUC, NC)	15%	290	43
Cemetery (CE)	34%	65	22
Stormwater management facility (SMF)	35%	80	28
Transit way	34%	35	12
Community uses	20%	35	7
Transitional	15%	40	6
Institutional uses (I)	25%	40	10

The process for developing canopy cover targets for South Oakville was as follows:

1. Determine existing canopy cover by land use in South Oakville - what does each land use currently support?

2. Determine what level of canopy cover is required to achieve the town's overall 40 per cent canopy cover target;

3. Set preliminary land use targets;

4. Use land cover data to determine how much "possible planting area"[5] is available in each land use relative to the target area of canopy; and,

5. Incorporate feedback based on local knowledge from other town departments overseeing development applications and infrastructure in Oakville to adjust land use targets.

A detailed methodology is provided in Appendices E and F.

The analysis resulted in the following land use targets for South Oakville (Table 10). In this case, the target for private land is presented separately from the overall land use target. This was done to reflect the contributions of town tree canopy to meeting the overall goal in a particular land use.

5 Possible planting area or PPA consists of all pervious land cover (bare soil and non-canopy vegetation) in the Town of Oakville, minus sports fields.

Table 10. South Oakville canopy cover targets (%) by land use.

Land Use	South Oakville Overall Target UTC (%)	Private Land Canopy Targets (%)	Current Private Land UTC (%)	UTC% Change to Meet Private Land Targets	Total Private Land Area (ha)	Current Private PPA (ha)	UTC Area Change Needed to Meet Targets (ha)	Total Private Land Target UTC Area (ha)
Commercial and mixed use	20	19	5.5	13.5	388.4	67.7	52.5	73.8
Employment	20	20	8.9	11.1	1352.5	358.5	149.9	270.5
Open space and parkway	50	21	28.6	-7.6	254.5	116.9	-19.3	53.4
Public use	20	18	12.4	5.6	193.9	65.8	10.8	34.9
Residential class A	45	35	43.3	-8.3	753.0	226.2	-62.7	263.6
Residential class B	30	25	21.0	4.0	2557.5	826.5	102.3	639.4
Transportation corridor	15	11	7.9	3.1	70.7	28.6	2.2	7.8
Woodlots & natural heritage system	90	32	39.8	-7.8	203.7	73.1	-15.9	65.2
AREA TOTALS					**5774.2**	**1763.3**		**1408.5**

Once adopted, the revised land use targets will be updated in other town policy and guidance documents to be integrated into the development and plan review processes.

It is important to note that given the variability to be expected between individual project sites, the proposed targets represent the minimum recommended level of canopy cover. As a part of site plan review, staff should explore ways to encourage or require planting in excess of the minimum where possible. As was the case with North Oakville, a review of these targets for South Oakville will be part of the implementation process and provide an opportunity to refine the approach as necessary.

Action: Update and implement recommended North and South Oakville canopy cover targets in new and re-development/infill projects to support the town's overall 40 per cent canopy cover goal.

Challenge: Understanding the root cause of canopy change.

Having a sound understanding on the root causes of canopy change is important for forest managers because it supports effective policy and program response. This relies in large part on having reliable data to describe these trends.

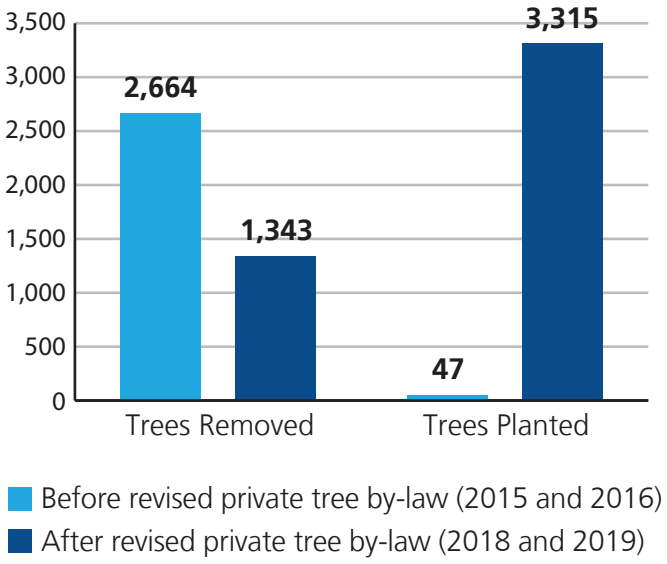
Periodic studies help track overall canopy cover change in Oakville. However, they do not provide information to describe the causes of change. Collecting the information on trees removed and planted help managers understand and report on the main factors contributing to canopy change. This information is collected under the following regulations:

- Trees removed and planted regulated under Private Tree Protection By-law (including development applications that are not regulated under Planning Act or Building Code);
- Trees removed and regulated under Planning Act and/or building code;
- Forestry operations (records town tree removals); and,
- Tree planting records (these are largely kept by Forestry, with some data from other town departments that plant trees).

The town's Private Tree Protection By-law was strengthened in May 2017. The enforcement of the revised by-law resulted in a decrease in the number of private tree removals and an increase in the number of trees planted as a condition of private tree removal permits. Comparing private tree removal and planted two years before and two years after the enactment of the new private tree by-law shows a 50 per cent decrease in the number of tree removal and a significant increase from 47 planted trees to 3,315 trees in two years. Figure 5. shows trees removed and

trees planted on private properties, before and after revised private tree by-law in May 2017.

Figure 5. Tree removal and tree planting on private properties before and after revised private tree by-law in May 2017.



Without data, the town cannot accurately analyze, evaluate, report or forecast the key elements affecting canopy change in Oakville. It is also challenging to target program improvements if the root causes of canopy loss are not well understood.

The number of trees removed and/or planted are not readily available in some of the development applications. The impact of development on tree canopy can be assessed once all data capturing trees removed and planted in all development applications are available. This information would assist in understanding how development under this process is affecting canopy change and assist forest managers to make evidence based decisions regarding canopy cover impact in Oakville.

Forest monitoring for the UFSMP shows there has been a fairly significant increase in canopy cover in Oakville since the last urban forest study in 2016. While this is a positive trend in terms of the amount of tree cover, this percentage increase in canopy cover as a measure does not describe to the quality of the additional forest canopy.

The 2016 study data and the forest monitoring program have shown a significant increase in the proportion of European buckthorn and other invasive species in Oakville's urban forest. Forestry's aggressive buckthorn removal and treatment through the woodland regeneration program controlled this invasive species in prime sites and enhancement sites. There has not been a study to show the impact of buckthorn control efforts in decreasing its population density since 2015. Hence, there is still a possibility that invasive species, like European buckthorn, might play a role in canopy expansion. Invasive species provide some urban forest benefits like stormwater attenuation, air pollution mitigation, carbon sequestration and carbon storage. However, they are undesirable from the perspective of maintaining the ecosystem health and integrity of natural areas, which is important for supporting native biodiversity. For that reason, the town should investigate the possible role of invasive species in canopy expansion and identify priorities for management in the development of an invasive species strategy.

Action: Assess root causes of canopy change in non-development and development related applications and permits regulated under private tree Protection By-law, Planning Act and building code in South Oakville and assess the role of invasive species in canopy cover.

Challenge: Improving mature tree retention rates.

In 2017, responsibility to enforce the enhanced Private Tree Protection By-law shifted to the Forestry Services Section (Forest Protection, Parks and Open Space). As regulated under the new by-law, trees outside the building footprint within an application for removal would be subject to the private tree by-law permitting process.

Working with builders and designers during review of their applications, Forest Protection uses the by-law to reduce the number of trees removed on private property and increase tree replacement when removal is unavoidable. As the tree protection requirements become more familiar, builders, designers and their arborists have begun to utilize methods to mitigate impacts to trees.

The town's planners (through the site plan review process) also use applicable policies and guidelines to achieve the same objectives. Notable changes have included:

- Significant adjustments in the early stages of design to reduce tree loss and minimize impacts to remaining trees;
- Incorporating alternate foundation construction methods such as helical piers to preserve root structure; and,
- Performing exploratory trenching to expose structural roots in order to make educated design and excavation decisions.

In terms of options to improve the retention rates of mature trees in Oakville, the town currently has many good policies and procedures in place. Improvements could look at how to improve or expand on the current practices by improved application and enforcement of existing tree protection policies and procedures consistently across the town. This following recommendation reflects Oakville's commitment to best practices which make the town a leader in urban forest management.

Action: Continue to apply the town's Tree Protection and Tree Canopy Preservation Policy and Tree Protection During Construction Procedure to preserve town and private trees covered under any municipal permit process or agreement relating to construction.

Challenge: Protecting and preserving trees in residential building and construction not subject to Planning Act applications.

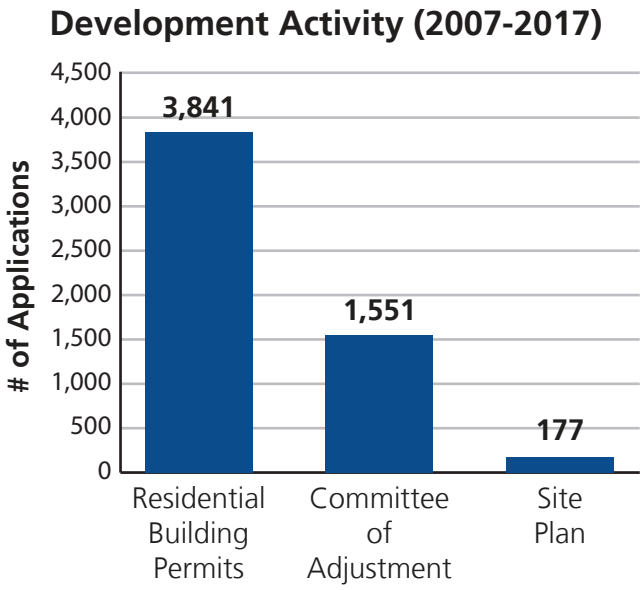
A 2018 Residential Character Study for Oakville[6] highlighted the importance of trees to preserving residential character in areas of redevelopment. According to the study, residential character is created by the *"qualitative interplay of built form, vegetation and infrastructure elements, in both the public and private realms. It is the combination of these elements working together within a streetscape which creates the character we interpret."*

Residential character in Oakville is preserved in part through the application of the town's Design Guidelines for Stable Residential Neighbourhoods, which among other things recognizes that *"topography, mature trees, hard and soft ground cover, green space and established landscaping are important elements of site context that contribute to neighbourhood character."*

The guidelines state that *"…to the greatest extent possible, healthy mature trees located on the property are encouraged to be preserved and integrated into the overall site development."*

6 Areas subject to the Livable Oakville Official Plan.

Figure 6. Development activity (2007-2017) - Residential Character Study 2018, Town of Oakville.



These design guidelines are applicable to new residential dwellings and significant additions, which are subject to site plan control and/or Committee of Adjustment approvals for minor variances and/or consents to sever, under the provincial Planning Act.

Application of these guidelines is "strongly encouraged" but not mandatory for other types of residential building and construction (e.g., work done under building permit).[7] Because guidelines are not the applicable law for the issuance of a building permit.

In a town survey that was part of the 2018 character study, mature trees and landscaped yards were identified by the community as a very important element contributing to neighbourhood character.[8] Furthermore, many residents felt that currently permitted zoning allows for development that is 'out of character' for a particular streetscape or neighbourhood.[9] This is relevant, because building and construction that falls under as of-right zoning is not subject to planning/urban design review and represents a majority of the total applications received in Oakville.

Within 2007-2017, there were more than twice as many residential building permits issued than Committee of Adjustment and site plan applications combined. These applications are not reviewed by planning and urban design staff for adherence to the design guidelines nor do they require submission of a canopy cover plan. Although the application of the Design Guidelines for Stable Residential Neighbourhoods is encouraged in non-development applications, there are some gaps in the permit application process that may not be optimizing opportunities to inform applicants about the guidelines or the relevance of preserving trees and vegetation on site.

Action: Identify opportunities within current permitting processes to improve communications with applicants about the "Design Guidelines for Stable Residential Neighbourhoods" and the value of retaining mature trees and vegetation on-site.

7 Oakville Design Guidelines for Stable Residential Neighbourhoods, Section 1.3
8 Open House, Residential Character Study. https://www.oakville.ca/assets/2011%20planning/Web_%20Open%20House%20Panels.pdf
9 2018 Residential Character Study.

8.2 Forest Health and Resilience

Challenge: Managing increasing presence and abundance of invasive species.
A priority issue the town needs to address to support forest health and biodiversity is the management of invasive species. Invasive tree or shrub species make up an increasing amount of the town's urban forest cover and understory.

The most recent i-Tree study (2016)[10] showed European buckthorn in the top three tree species by population, increasing from 2 per cent of the population in 2005 to 10.6 per cent in 2015. This represents an increase of about 192,000 buckthorn stems in 10 years. Forest health monitoring[11] also shows an increase in the presence of the number and abundance of invasive species in woodlands.

Understory non-native invasive plants like European buckthorn and garlic mustard in natural areas create particular challenges for native forest regeneration. Two consecutive survey years in Oakville woodlands showed an increase in the number of compartments with the top invasive understory plants, from 75 per cent to 82 per cent, from 77 per cent to 86 per cent and from 94 per cent to 100 per cent respectively (Table 11).

Table 11. Percentage of forest compartments infested by the top three invasive plants in Oakville's woodlands.

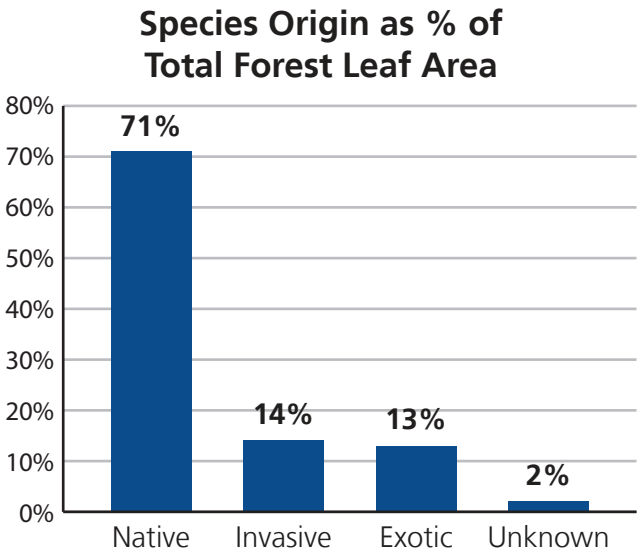
FOREST COMPARTMENTS WITH TOP INVASIVE UNDERSTORY PLANTS

Survey years	European buckthorn	Garlic mustard	Invasive honeysuckles
2014	75%	73%	Not included in survey
2017	82%	81%	60%
2015	77%	77%	52%
2018	86%	83%	64%
2016	94%	98%	73%
2019	100%	96%	88%

10 Growing Livability: A Comprehensive Study of Oakville's Urban Forest. 2016.
11 2014-2018 Woodland Health Reports, Town of Oakville.

Invasive species now make up approximately 14 per cent of the total urban forest leaf area. 71 per cent of the town's leaf area is comprised of native species and the remainder are non-invasive, exotic species (Figure 7).

Figure 7. Species origin as percent of total leaf area, based on data collected in Growing Livability 2016

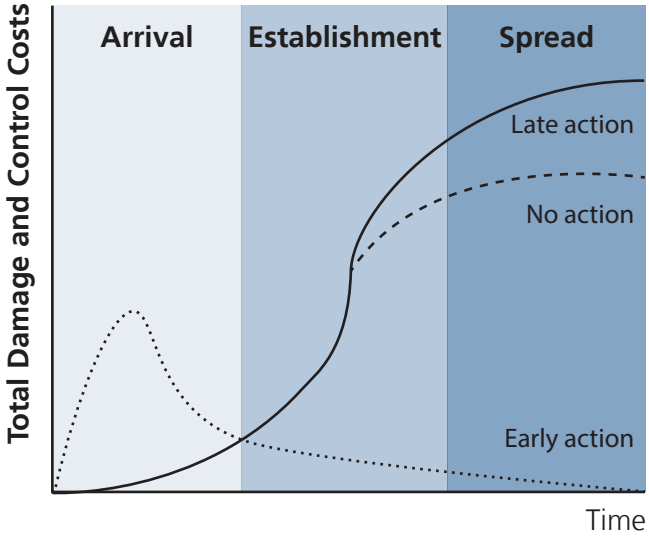


EAB is an example of an invasive insect that has decimated ash populations in Ontario. In the 10 year span since it was first detected in Oakville in 2008, the town has removed thousands of mature ash, representing significant loss of tree canopy in areas of the town hardest hit by the beetle.

The increasing presence of invasive species threatens regional biodiversity and has potentially large-scale impacts to long-term forest health and resilience. Invasive species are also a potential nuisance for landowners whose property values or agricultural productivity may be affected by uncontrolled invasions. Some invasive species (e.g., giant hogweed) can also pose a risk to public health and safety.

Early detection and rapid response intervention to new invasions are the most effective way to manage invasive species (Figure 8). The more established a species becomes, the more complex the treatments are to manage or control it. Early treatments of invasive species are more cost-effective, as there is a lower density and smaller average size of plants to manage on-site.[12]

Figure 8. Phases of biological invasion and control costs of invasive species (Adapted from: Rapid Response Lowers Eradication Costs of Invasive Species: Evidence from Florida, A Publication of the Agricultural and Applied Economic Association- 4th Quarter 2018. 33 (4) Alvarez and Solís,)



The introduction and spread of invasive plants are often facilitated by human activity, like dumping yard waste in woodlands, transporting firewood and moving seeds via footwear or clothing inadvertently into natural areas during recreational activities. Invasive species can spread across property boundaries, and new invasions on private lands may affect other landowners. For this reason, the town

12 *Ontario Invasive Plant Council, URL: https://www.ontarioinvasiveplants.ca and Mississauga 2017 Invasive Species Management Plan, URL: https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/06/OIPC-ISMP_May2017.pdf and Credit Valley CA 2009 Draft Invasive Species Strategy, URL: https://cvc.ca/*

should investigate mechanisms to manage invasive species on private lands. The town already has a framework to pursue this through the Property Standards By-Law.

Developing an Invasive Species Strategy for the Town of Oakville would help managers identify targeted investments to mitigate the highest priority effects of invasive species on native biodiversity and on the quality of natural, recreational and agricultural areas. There are existing resources that can guide the next level of invasive species management planning and help focus the town's efforts, including the recently developed Biodiversity Strategy for Oakville. The following action is also consistent with adaptation actions identified in the town's 2015 Climate Change Strategy.[13]

Action: Develop an Invasive Species Management Strategy for the Town of Oakville, with consideration for the following priorities:

- *Allocate funds for reactive (rapid) response for new invasive species infestations regulated under provincial legislation and/or that pose a threat to urban forests.*
- *Expand the woodlands regeneration program to include woodlands heavily infested by European buckthorn and other invasive species.*
- *Establish stewardship position to help coordinate efforts to engage the community in partnerships to address invasive species removal.*
- *Examine options to expand invasive species control on private land through the town's Property Standards By-law.*

Challenge: Forecasting and mitigating significant forest health threats.

Forest health monitoring is important in evaluating the status of the resource over time and determining whether there is improvement or decline in the urban forest. The state of the urban forest is always evolving as a variety of biotic and abiotic factors continue to shape forest health and structure. Monitoring provides relevant baseline data that allows managers to track changes, trends and patterns over time.

An Urban Forest Health Monitoring program for South Oakville has been in place since 2014. The program looks at a third of the town's woodlands each year for signs of pests, disease and other disturbances. The program has also begun to document the presence and abundance of invasive species, which will help with early detection and response to new infestations. A report card of the woodlands surveyed in each year is produced to evaluate the health of forest. The town also engages residents who help monitor neighbourhood street trees for invasive insects, disease and other issues related to forest health.

The forest health monitoring program currently operates in South Oakville only. This is because the town is just beginning to assume management responsibility for many of the future public lands in North Oakville, including the designated Natural Heritage System (NHS) lands that are currently privately owned.

However, the abundance of invasive species in the NHS is likely to increase with time, creating a potential cost liability for the town. Having a better understanding of the issues through monitoring will help the town plan proactively for

13 Climate Change Strategy – Technical Report, Version 1.1. 2015. Town of Oakville.

management of these land assets, once assumed. It will also help identify any invasive species hotspots, where early intervention may be useful to mitigate future costs of management.

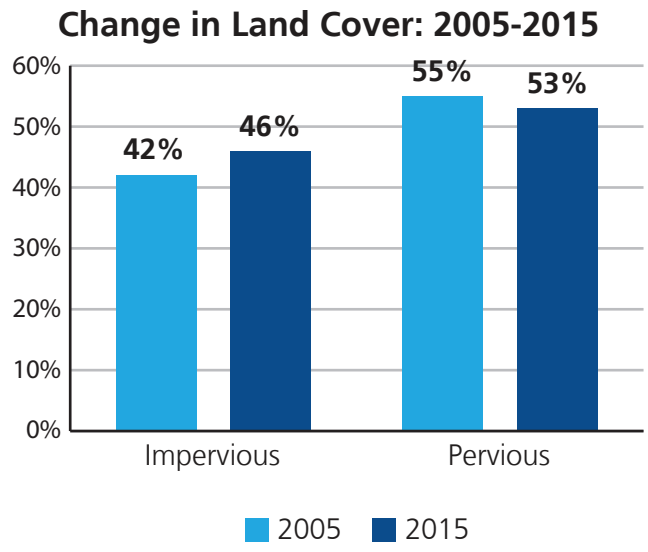
Action: Extend the forest health monitoring program in North Oakville as lands are assumed by the town through development.

8.3 Tree Planting and Establishment

Challenge: Achieving a more equitable distribution of canopy cover and its associated benefits.

Land cover change measured between the 2005-2015 studies shows about a 4 per cent increase in hard surfaces and a decrease in pervious area town-wide over the ten-year study period (Figure 9).

Figure 9. Change in land cover 2005-2015, Town of Oakville (Source: 2005 and 2015 i-Tree studies).



This change shows the effects of urban development, which reduces pressure on surrounding land areas, but also reduces growing space for trees and other vegetation. This creates a challenging situation where on the one hand, Oakville is trying to increase tree cover, while on the other hand, the amount and quality of the growing environment is decreasing.

In some highly urbanized areas, site conditions may not allow tree canopy targets to be met through soft landscaping. However, there are technical solutions for incorporating tree canopy into hard surfaces that could mitigate growing space constraints in areas where quality (pervious) growing space is limited. Commercial areas in the town are one example of a land use where these conditions are found.

As noted in the 2008 UFSMP, *"the term enhanced rooting environment techniques refers to specific design and engineering applications intended to ensure that tree roots can benefit from sufficient moisture availability (including rain fed infiltration or irrigation), drainage, aeration, nutrients and a bulk density conducive to good root extension while meeting the engineering specifications required by the site. Examples of root environment enhancements include but are not limited to applications such as engineered soils, for example, products such as DeepRoot's "Silva Cell".* There may be other similar enhancements to the below ground environment worth considering along with the related surface treatments, such as porous paving, turf stone, mulch, etc.

The 2016 forestry study data for South Oakville showed an increase in tree populations in most land use areas in Oakville. However, although not statistically significant, there was a possible decrease in the number of trees (and subsequently canopy cover) in commercial areas. These areas would be a good example of where pervious growing space is limited,

but increased canopy cover could have positive benefits for improving the distribution of canopy cover and its associated benefits. In 2005, a limited trial of "CU-Structural Soils" was installed in the uptown core of Oakville. Action Item 18 of Our Solution to Our Pollution (Oakville 2006) recommended an expansion of this initial trial. Since then, the town has planted more trees on enhanced growing space using two different techniques, including Silva Cells and CU-Structural Soils.[14]

The town maintains a database and online map showing the location of all trees planted in structural soil and/or on enhanced growing space using soil cells. Specific opportunities to expand the use of and funding for enhanced rooting environment techniques on both private and public lands should be reviewed by the town. This recommendation has been carried forward in the current UFSMP as a tool for improving the equitable distribution of canopy cover across land uses in the town.

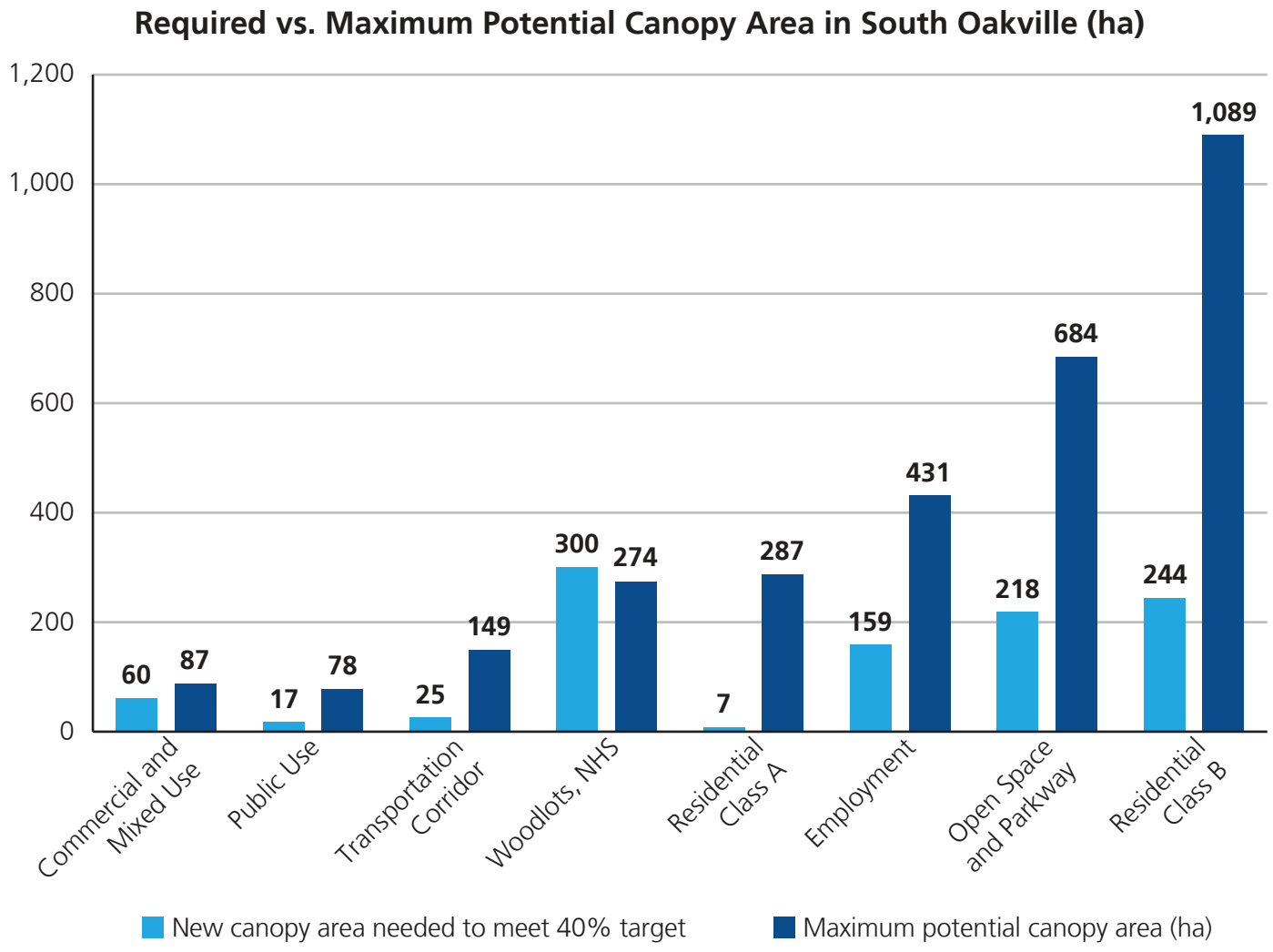
Action: Increase the use of enhanced rooting environment techniques in land use areas with low canopy cover and limited pervious planting area.

Challenge: Achieving maximum canopy cover on public and private lands.

There is a finite amount of space available for increasing tree cover on town lands. Many areas have been afforested through past planting programs. In addition, competing space for other uses in Parks and Open Spaces can limit the area available for planting trees. Parks and open spaces are needed to meet other social needs, including recreation, sports fields, gathering places and open, sunny areas for residents to enjoy. However, there are still some opportunities to increase and maximize canopy cover on public lands, particularly in the Open Space and Parkway land use.

14 See the Town of Oakville mapping website for more information.

Figure 10. Required increase in canopy area to meet target compared to available possible planting area by generalized land use (Source: Town of Oakville data).



The 2020 UFSMP includes a series of maps that identify priority planting areas (based on existing level of tree cover and possible planting area). These can be used for operational planning to help staff identify and prioritize areas on town lands where additional trees can be planted and to reach out to other public landowners. A dedicated stewardship coordinator could help accelerate this moving forward.

Past forestry plans and studies have identified that another major area of opportunity for increasing canopy cover is on private lands, particularly in residential areas in South Oakville as well as other land use areas in North Oakville. Working with private landowners across the entire town will be an important part of the UFSMP approach. Priority planting maps will also help focus future outreach efforts to private landowners, to identify opportunities to increase urban forest cover on private lands, particularly in areas of low canopy cover (e.g., commercial and industrial land use areas).

In terms of available impervious growing space, parking lots represent an area of opportunity for the town. Land cover estimates show that parking lots make up about 5 per cent (or the equivalent of about 700 ha) of the town's land area[15] These represent areas that could benefit from the use of techniques to enhance rooting environments and increase quality growing space for trees. This will take time as existing private parking lots are greened through either new development or retrofits. Greening parking lots with trees has the added benefit of increasing tree canopy in areas that are generally deficient in forest cover.

Other areas of opportunity identified by past studies include:

- Private lands (representing the most available planting area);
- Commercial areas; and,
- Employment and industrial lands (areas with low urban tree canopy).

Developing incentives for tree planting may speed this process. In some Ontario municipalities, stormwater fees for businesses, including industrial, commercial, institutional and multi-residential properties, are linked to the percent impervious area coverage on a property.[16] It is possible that this model could be extended to include canopy cover as part of the stormwater fee calculation.

Action: Use priority planting maps to focus strategic tree planting efforts to address UFMSP land use and tree cover goals on public and private lands.

Challenge: Standardizing planting specifications across town departments. Several town departments include tree planting in their business activities. Tree planting standard developed in 2012 North Oakville Strategic Management Plan have been successfully utilized in the development process North of Dundas. Due to the differences between South and North Oakville, the challenges of adapting the same standard for South necessitates a revised and standardized set of specifications. In order to achieve a consistent standard and ensure optimal growth outcomes, a revised and standardized set of specifications was developed for this UFSMP. The revised Tree planting standard have been distributed to Engineering Standard Management Committee. The next step is to review those specifications and discussed in this committee to achieve a harmonized standard that is implemented consistently across all departments in future tree planting projects.

Action: Roll out and monitor implementation of new standardized tree planting specifications town-wide.

15 2018 land cover point sampling data using the iTree canopy tool.
16 City of Guelph - Stormwater fees and credits for businesses.

Challenge: Broadening eligible forest management activities under the town's "Tree Replacement Fund".

Oakville's Private Tree Protection By-law has compensation guidelines that identify how many trees will be planted on-site to compensate for private tree removals. This is calculated as the equivalent of one tree for every 10 cm of diameter (measured at breast height) removed. In cases where tree planting cannot be achieved on-site, the town collects monies or a letter of credit to cover the costs of the replacement tree(s), and the maintenance of the tree(s) for a period of up to two (2) years, through the town's Tree Replacement Fund.[17]

Currently, monies collected into the fund have been used primarily for tree planting activities. There are other areas that funds could be applied to support sustainable forest management that contributes to growing and expanding a healthy urban tree canopy such as improving planting site quality and long-term tree growth through soil amendments, improving forest renewal investments in woodlands through competition removal (e.g., buckthorn) and young tree pruning to optimize investments in newly planted trees.

Action: Examine options for expanding the range of eligible tree planting or forest renewal and/ or stewardship activities under the town's Tree Replacement Fund.

Challenge: Reliable access to quality growing stock.

In many jurisdictions, species selection for plantings is limited by availability of stock at the local nurseries. If the long-term planting stock requirements are not forecast in advance and contracts are not in place with nurseries,

municipalities must take stock that the commercial growers have available. This may not be consistent with the town's policy and operational objectives.

Better forecasting would make it possible for growers to accommodate planting needs for native species grown from local seed sources and recommended species ratios. Specification for planting stock quality and planting procedures also needs to be clearly defined.

For this reason, it is recommended the Town of Oakville to develop a long-term strategy for nursery stock procurement. Part of this strategy should include a study to examine the feasibility of having municipally owned and operated nurseries, which has happened in some jurisdictions (e.g., Montreal, Quebec). This would allow the town to exert more control over its plant stock selection rather than relying on the available plant material of third-party growers.

Action: Develop a long-term plant stock procurement strategy, including a study to determine the feasibility of the town producing its own nursery stock or collaborating on a municipal nursery structure.

17 As set out in the rates and fees schedule approved by Council as part of the annual budget approval process

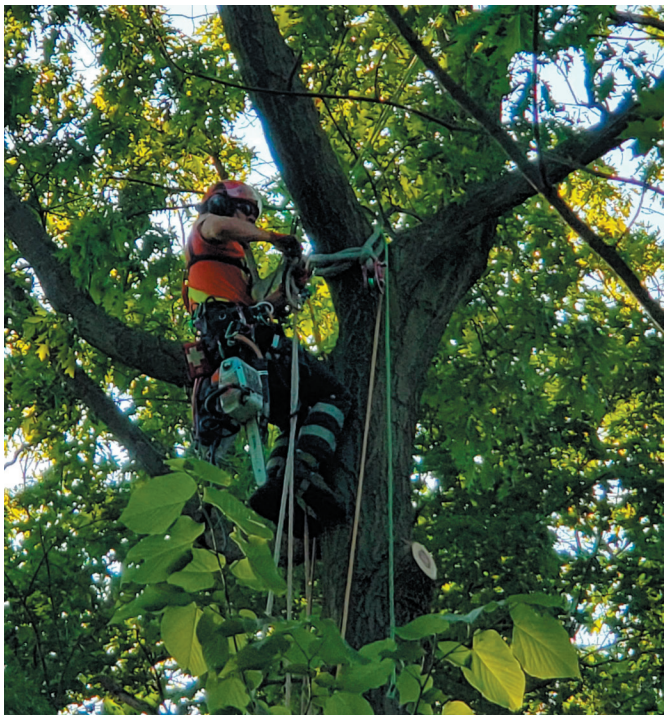
8.4 Risk Management

Challenge: Managing seasonal work volume and emergency response.
The town's Climate Change Strategy identifies an increase in the severity and frequency of extreme weather events as one expected impact of climate change. It is difficult to prepare for extreme weather events. Although they can usually be predicted in a general sense, they tend to happen quickly, leaving little time for preparedness in the 'eye of the storm', which makes emergency preparedness planning a key tool in any extreme weather situation.[18]

From an operational standpoint, extreme weather events test the town's resiliency. Urban forests, transportation corridors, utility services, staff and residents can all become vulnerable. Day to day operations are typically put on hold to respond to storm aftermath and priority situations. Operationally, this puts added stress on workload, budgets and work/life balance for those staff called upon to respond.

Storm-related spikes in workload are a challenge that the Forestry Services Section manages on a regular basis. These spikes in work volume in response to wind, intense rain and ice storms make it difficult to manage day-to-day activities, when all hands are required on deck to respond to emergencies.

This was addressed in part through a 2015 Forestry Services Review, which resulted in organizational restructuring within Forestry, a review of emergency response procedures, improvements to service standards and ongoing efforts to collaborate with other departments to manage peak workloads. Recognizing the need to continue this work,



the need for continual improvements to emergency response and business recovery procedures are identified in this plan.

Action: Develop comprehensive emergency response plans and business recovery procedures to manage the impacts of future extreme weather events

Challenge: Forecasting future resource needs.
Oakville is in a period of rapid growth and redevelopment and the town is gradually assuming management responsibility for public lands north of Dundas Street. At this time, forecasting future impacts to the town's Forestry Services Section and related strategies is important to facilitate appropriate resource allocation. Urban growth projections could be used to forecast expected growth in urban tree canopy based on urban design principles and

18 Climate Change Strategy – Technical Report, Version 1.1. 2015. Town of Oakville.

targets by land use. Furthermore, the town's tree inventory provides source data (e.g., tree species, age, condition) that can be used to assist in the forecasting of the 10-year expected tree maintenance levels, and maintaining proper staffing levels and equipment resources.

The process of land assumption by the town in those areas of North Oakville under development agreements has been a challenging area for forestry budgeting. Due to the uneven nature of the land assumption, forestry resource levels may not match management requirements in the upcoming years.

For these reasons, the following action is suggested (consistent with the 2015 Forestry Service Review and 2018 Status Report), recognizing that the town needs to anticipate future costs associated with the expansion of forest management responsibilities.

Action: Continue to assess 10-year capital impact and climate impact forecast outlining anticipated future Forestry Services budgetary, staffing and equipment projections, including impacts from the future assumption of lands in North Oakville.

8.5 Collaboration and Partnership

Oakville's urban forest program has benefited over the years from strong public and Council support. Qualified and dedicated town staff in several departments have worked to implement many of the previous UFSMP recommendations. The outcome of these efforts is a strong forestry program that is supporting the town's goal of expanding and sustaining a healthy urban forest.

Past forest management plans have addressed many of the foundational requirements for good urban forest management through implementation of many new programs, policies and initiatives. Moving forward, future plans will have to start addressing some of the nuances, incremental improvements and more complex forest management and urban planning challenges to see continued improvement in urban forest indicators. These indicators will be monitored to assess progress toward achieving Oakville's forest management goals.

This will require increased collaboration between departments to address complexities at the interface of urban planning, land development, infrastructure development, municipal operations and environmental policy. Future plan implementation will also require

dedicated resources to increase the town's outreach efforts with the public and potential partners, including private landowners and local businesses in the next phases of urban forest management.

Challenge: Increasing collaboration to solve complex policy challenges.

The 2015 Forestry Services review included recommendation that highlighted the importance of positive collaboration between town departments to resolve urban forest management challenges. The report noted, "By establishing a dialogue, preparing for compromise and continuing exchange of project information, there may be some areas of improvement available that would contribute further to the protection of the Urban Forest." An example where continued communication can contribute to future improvements is in the area of implementing canopy targets in plan review. Ongoing dialogue between Forestry and other departments can help to identify and resolve implementation challenges related to this and other UFSMP actions.

The existing Inter-Departmental Technical Advisory Committee (ITAC) provides a good forum for putting forward solutions to multi-faceted problems that may constrain the future growth of Oakville's urban forest canopy. The process of discussing this UFSMP proved the critical importance of this technical advisory committee. To increase collaboration and achieve consistency, it is recommended the ITAC to schedule regular meetings to discuss how to balance urbanization and urban development with urban forest. Meetings should include, at minimum, staff from Parks and Open Space, Planning, Engineering and Construction, Development Engineering and Legal departments (as required).

Action: As noted within the Forestry Review 2015, the town's Forestry Services Section should chair regular meetings of the Inter-departmental Technical Advisory Committee to assist in implementing the Urban Forest Strategic Management Plan and prepare proposals for new policies and funding opportunities for consideration by Council.

Challenge: Dedicating resources to outreach and partnership development, including other public and private landowners.

Planting prioritization mapping undertaken under this UFSMP study has identified areas of public and private land that may benefit from targeted outreach efforts to engage landowners in support of the urban forest. Private lands could be a priority of future planting and/or stewardship efforts that are aimed at improving the amount and quality of urban forest cover in Oakville. These efforts are also consistent with the town and public interest in finding ways to mitigate climate change effects, like extreme summer temperatures, drought and intense storms, all of which could present public health and safety concerns and reduce the quality of life in urban areas.

There is a growing interest in public/private partnerships to help offset the cost of municipal programs and assets that benefit all citizens. Partnerships have been used for many kinds of projects, including transportation, water and wastewater systems, delivery of social services and others. Examples of mechanisms for creating public/private partnerships in forestry include the New York Tree Trust, whose mandate is to:

- *"Foster public-private partnerships in urban forestry;*
- *Raise public awareness of the importance of urban forestry conservation and stewardship;*

- *Promote new technologies to enhance tree survival and advance innovative management tools; and,*
- *Revitalize historically and arboreally significant municipal trees."*

To date, Oakville has never had a staff position dedicated specifically to community engagement, partnership development and education related to the town's environmental goals and objectives, including urban forestry. Given the critical importance of private and other landowner participation in supporting Oakville's canopy cover, biodiversity and climate resilience goals, the time has come to dedicate resources to a focused effort on increasing education, tree planting and other stewardship efforts on these lands. It is recommended to hire a dedicated staff to develop strategic partnerships with the public, private sector, non-profits in support of the town's urban forestry, climate change strategy and environmental stewardship goals. Some of the responsibilities of this position include:

- Develop, nurture and manage relationships with stakeholders, including non-government organizations (NGOs), general public, and businesses to promote community support for town's strategic agenda for a 40 per cent canopy cover goal. Stakeholder organizations include a broad range from small localized single-purpose groups to large, complex companies and non-profits with each requiring different and unique levels of support and guidance from the Partnership and Community Specialist;
- Develop, plan, facilitate and/or lead forestry management partnership initiatives/actions aligned to town's priorities;
- Identify, prioritize and match partners to urban forest initiatives/actions by researching, evaluating and understanding partner organizations and their mandates, facilitating the collaboration of multiple diverse organizations to achieve common goals, coordinating/ negotiating the resolution of inter-agency differences/ conflicts, identifying high level solutions that will meet the needs of diverse organizations, and aligning the town's business needs and priorities with community issues and capacity;
- Develop, negotiate and manage mutually beneficial and effective strategic business arrangements/agreements with partners, in keeping with the town's directives;
- Monitor, assess and evaluate partner

engagement strategies and business relationships to ensure accountability and measure effectiveness of outcomes toward achieving town's targets;

- Design, develop and implement education, information and communications initiatives to transfer and share knowledge/information/science and best practices that will enable sustainable urban forest management actions and decisions of stakeholders, non-government agencies, general public, and businesses;
- Lead and/or coordinate strategic resource management outreach, education and awareness initiatives in partnership with others. Ensure that program content is customized to the needs/interests of the audience and that information is presented in a format suitable to the audience (e.g. translating technical information for non-technical audiences); and,
- Promote and provide technical advice to partners/stakeholders.

Action: The town should consider creating a dedicated position to develop strategic partnerships with the public, private sector, non-profits in support of the town's urban forestry and environmental stewardship goals.

8.6 Adaptive Management

Periodic re-assessments of the urban forest provide insight into the changes that are taking place and the success of management strategies. These re-assessments allow Oakville's urban forest managers to look at what is working or not working and to make informed decisions about changes in program direction.

Challenge: Maintaining up to date forest inventories.
Forest inventories provide the foundational data to inform forest management planning and priorities. They are a 'state of the asset' report that allows managers to plan and forecast operations, and proactively anticipate threats to forest health. Up-to-date street tree and Woodland inventories can also be used to identify potential hazards and support risk management.

Oakville's last street tree inventory was completed in 2009-2010, and the last full woodland inventory was completed in 2010. As workflows allow, the public tree inventories are sometimes updated with management activities, but data is not consistently added or removed, and the overall accuracy of the inventory is unknown.

The last land cover classification was completed in 2015, making the data overall still indicative of general conditions in Oakville. However, the classification only included South Oakville and conditions have changed since that time. This data is important for tracking land cover change, evaluating planting opportunities and communication on the state of the urban forest. As part of the effort to consolidate forestry data and planning for the entire town, an updated and comprehensive land cover classification should be completed. This data can also support a review of canopy cover targets for both North and South Oakville as part of adaptive management.

Since then, Oakville's urban forest has also seen extensive change in part as a result of the emerald ash borer as well as the ice storm in 2013. These changes in the asset condition are also not reflected in the current tree inventories. Finally, the town has also begun to assume management responsibility for lands in North Oakville that have not been included in past tree inventories.

The town should update its urban forest inventories on a ten-year cycle or in response to significant environmental change. Future woodland inventories should include a baseline assessment of the presence and abundance of invasive species.

Action: Complete a comprehensive and updated land cover classification for the entire town, based on most recently available satellite imagery and LiDAR.

Challenge: Data and information management.

Most municipalities use asset management software to track the number and type of city-owned assets and to help develop inspection and maintenance cycles. These systems are also used to input costs and to generate summaries for annual budget reporting. Town assets that are tracked in asset management systems may include: water and sewer infrastructure, recreational facilities, parks and related infrastructures (ice rinks, swimming pools, playgrounds, drinking fountains, washrooms), etc.

Generally, engineered assets are the easiest to integrate into municipal asset management planning, but natural capital (green) assets also need to be tracked. Forestry departments commonly encounter challenges with municipal asset management systems (AMS), which are not designed for dynamic, living assets like the urban forest.

Having reliable data to track and report on performance is a critical part of good management programs and urban forest specific software has evolved to address the limitations of some municipal asset management software.

Oakville's Forestry Services Section currently uses a variety of software systems to track forest management activities in the town, as follows:

- *Cityworks* – Tracks town street and park tree removals, maintenance activities and some tree planting activities (e.g., street and park tree planting by town, street tree planting by developers in new subdivisions and projects implemented by Parks Planning and Development);

- *Amanda* – Tracks private tree removals under the Private Tree Protection By-law permit process; and,
- *ArcGIS* – Used to track planting in woodlands, though this data is being integrated into Cityworks.

Forestry Services Section plant the highest number of trees along roads, in parks and woodlands in the town. However, the following departments, agencies and groups may be implementing tree planting projects in Oakville:

- Construction and Engineering
- Conservation Halton
- Development and Environmental Engineering
- Region of Halton
- Community groups
- Private landowners

In 2016, the town responded by developing internal processes for other departments to report the removal and planting of town trees to Forestry. As a result, inter-departmental communications have improved in this area. There has also been a significant improvement to make forestry data available for other departments and public through ArcGIS on line, forestry web portal, story maps for different forestry's activities and programs and explore Oakville for staff. However there are some data gaps that should be addressed to better enforce private tree by-law and measure the impact of development on canopy cover changes, including the following:

- Tree planting on private land through site plan applications. The trees planted as a condition of site plans and DESPs are protected under our private tree by-law. Proper reporting is strongly recommended for these trees.

Data management systems should be designed to help the town track and report on a set of key performance indicators:

- All town trees planted (all departments);[19]
- All private trees planted as a condition of site plan and/or DESP;[20]
- Town trees removed, for all departments (with tree IDs);
- Number and attributes of trees maintained through the rotational pruning program;
- Number of hectares of invasive species treated annually by type and program (e.g., ground and aerial spray, manual, etc.);
- Productivity data related to core forestry management activities.

Having systems in place that enable the consolidation of information collected by other departments will provide reliable data when asked to report to other departments or Council. Some of this work is in progress, but has been included here to highlight the importance of completing outstanding tasks.

Action: Improve program forecasting by using available systems (Cityworks) in conjunction with labour and equipment hours to assess resource requirements for tree maintenance activities.

Challenge: Effective communication about Oakville's sustainable forestry practices.
South Oakville's urban forest is certified under an independent, third-party certification system (Forest Stewardship Council Canada). Certification is a way to assure the public that the forest is well managed, in accordance with basic principles of sustainable forest management. FSC certification provides assurance of third-party oversight and dispute resolution tools in cases of controversy. Examples of where this has been useful is in addressing public concerns about harvesting in woodlands, which has been done primarily in conjunction with efforts to address the effects of EAB.

Third-party certification has been a useful communications and public relations tool for Forestry at a very low cost to the town. Independent verification of good forestry practices in the town's woodlands demonstrates the town's commitment to sustainable management of its natural areas. For this reason, it is recommended that FSC certification be extended to include all woodlands North and South of Dundas Street.

Action: Extend Forest Stewardship Council certification to North Oakville woodlands as they are assumed by the town.

19 Including attributes consistent with the town's tree inventory protocol (i.e. number, species and size of trees).
20 Once planted, all of these trees are protected under the town's Private Tree Protection By-law.

9 Conclusions

Oakville's urban forest is a growing asset that continues to provide vital benefits to the community. The Town of Oakville has steadily progressed toward meeting its urban forestry objectives, in part through implementation of recommendations and actions from past studies and plans. This shows the value of adaptive management, where data is used to inform program direction and adjust activities as needed.

Oakville faces similar challenges to other Ontario municipalities in terms of external threats to the town's urban forest. Urban intensification and urban development policies, invasive pest and disease species, extreme weather events and climate change are among the numerous factors affecting the growth and health of the forest.

Given the challenges related to the limited planting space remaining on town lands, future expansion of Oakville's urban forest will rely on continued cooperation between town departments, the public and private enterprise. The success of the forestry program in Oakville has been and will continue to be the result of strong political and public support for trees, as well as the co-operation of other town departments in implementing solutions and strategies that support the continued growth of Oakville's urban forest. Through the implementation of this UFSMP, the town will be taking the necessary steps to meeting its future urban forestry goals and objectives.