Urban Forest Management Strategy

for the City of Waterloo

DRAFT

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Executive Summary

Highlights of the Urban Forest Management Strategy:

- The Urban Forest Management Strategy (UFMS) will advance the City of Waterloo towards fostering community resiliency following the 2019 City of Waterloo Corporate Climate Change Adaptation Plan recommendations.
- The primary objective of the UFMS is to protect and sustain Waterloo's Urban Tree Canopy (UTC) of 32.5% - equitably across Waterloo.
- The challenge of implementing the UFMS is to adapt to the pressures of land development intensification which created a scarcity of space for large trees and that accelerated Waterloo's UTC Gap.
- The UFMS will be implemented by the City's team, led by the Forestry Section. The collaboration among forestry, urban planning, and engineering in the City to create space for large urban trees to thrive is fundamental to the UFMS.
- To help achieve Tree Equity, Waterloo needs a Green Standard (or equivalent) for urban centres. A Green Standard would include mandatory compliance with minimum soil volume quantity and quality to grow large trees at the Tier 1 development application stage. This needs to be supported by a revised City Comprehensive Engineering & Landscaping Manual to design and build sufficient space for large shade trees in the development application process.
- Key City Documents must be harmonized with the UFMS, starting with new urban forest policies in Waterloo's new Official Plan, to realize Waterloo's Vision for its urban forest.
- A new, large-scale Community-based tree planting initiative will be crucial to meeting the City's UTC Targets.
- A new Heritage Tree By-law will improve the health of neighbourhoods and help maintain UTC.
- The City should invest in its green infrastructure by reinstating its 5-year cyclical Tree Elevation and Corrective Tree Pruning Program for its 31,893 street trees. The replacement value of these trees, based on i-Tree, is $54.1 million, and they have the following annual functional values: Carbon sequestration: $37,900; Avoided runoff: $32,800; and Pollution removal: $65,500.
- The total annual value of the ecological services from Waterloo's urban forest in 2021 is $38,533,000.
- A *Strategic Framework* outlines the UFMS's Vision, Guiding Principles, Goals & Objectives and Action Plan.

- The 5-Year Operating Plan for 2027-2031 prioritizes the costs of each *Action Item* in the Action Plan.
- Implementing the UFMS will firmly establish the City of Waterloo as a leader in sustainability and a future-ready community for all.

The UFMS was awarded to Williams & Associates Forestry & Environmental Consultants in the fall of 2022 under the City of Waterloo's RFP #22-11. Our team's mission is to promote a positive relationship between people and trees to maximize their benefits for everyone. We have successfully completed similar projects for other municipal clients. The W&A team is made up of a diverse group of consultants from Canada and the United States:

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Acknowledgements

The City's Project Team included members from across the organization who contributed to the development of this plan:

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CHAPTER 1

1. Introduction

1.1. About the Urban Forest Management Strategy

1.1.1. Purpose

The City of Waterloo's *Urban Forest Management Strategy 2027-2047* presents an opportunity to re-imagine a healthy relationship between people and urban trees, ensuring everyone benefits.

"Urban forestry is a critical element of urban planning. Around the world, many cities are actively implementing nature-based solutions... [leading to] a rise in the development of strategic and operational plans related to urban forests...[they] are necessary guides to successful urban forestry programs and often reveal the management conditions of urban forestry" (Barona et al., 2024).

Senior government levels of support for urban forestry has significant presence in the United States but not in Canada. Responsibility for urban forestry in Canada lies with municipalities. Historically, the lack of Canadian government support at the provincial and federal levels for urban forestry has hindered municipal efforts, with "only 20% of municipalities having a comprehensive management plan for their urban forests...The top pressures and obstacles facing urban forests are urban development, lack of funding and lack of planning" (Bardekjian, 2014). Municipalities worldwide grapple with a perplexing paradox. While the global urban population is increasing, Earth is experiencing record-setting daily temperatures (ABC News, 2024). Simultaneously, the urban tree canopy cover (UTC) that mitigates the urban heat island effect, continues to shrink (Nowak, 2018). Addressing this paradox is crucial for municipalities as it has led to a widening gap between the quality of life for urban residents and the urban forest's capacity to enhance it.

UTC is important because trees play a critical role for people and the planet. The scientific literature clearly shows that trees and urban nature improve people's mental and physical health, children's attention, children's school test scores and increase property values in a neighbourhood, among other benefits (Turner-Skoff, 2019). Trees also help to cool urban centers. The number one benefit of an urban tree is to reduce air temperature (Nowak, 2015). In the summer, the shade from large trees creates cooler communities. Cooler communities are healthier communities. There are close ties

between the UFMS and the City's *Climate Action Plan*. One way to reduce the urban heat island effect is to effectively manage the UTC in residential, commercial, transportation and recreational areas (Figure 1).



Figure 1. Benefits of urban trees. (Nowak, 2015)

The UFMS provides guidance for managing the City of Waterloo's urban forest for a 20-year period (2027-2047). This plan reflects input from the general public and neighbourhoods currently experiencing tree inequity, fostering a collaborative process. The focus of Chapter 2 is on the results of the UTC Study. Chapter 3 describes the results of the Public Engagement. Chapter 4 contains the Plan Vision, Guiding Principles, Goals and Objectives. It was developed with an environmental justice lens. It outlines five *strategic goals*, each with supporting *objectives.* Chapter 5 translates the Goals and Objectives in the *Strategic Framework* into SMART Goals. It contains a 5 Year Operating Plan which prioritizes and budgets all Action Items required to achieve the Goals and Objectives outlined in Chapter 4. A supporting document called the *UFMS Background Technical Report*, *2024* compiles all the consulting team's reports and findings. The *UFMS Background Technical Report, 202*4 and the *Urban Forest Management Strategy* are intended to be read as companion documents.

1.1.2. How the UFMS was Developed

The urban forest supports all five strategic priorities of the *City of Waterloo's Strategic Plan 2023-2026,* which states*: "Residents of Waterloo and community leadership have emphasized a focus on sustainability and climate leadership as a primary driver for the strategic plan...The[se] 5 strategic priorities are designed to be interconnected and work together."* For example, if sustainably managed as green infrastructure and accessible to equity-deserving groups, the urban forest can help attain Waterloo's climate leadership objective by fostering a more resilient community that is better prepared for climate change, ultimately leading to a higher quality of life for all residents.

The UFMS Project was designed with four main components (Figure 2).



Figure 2. The UFMS Project Components.

1.1.2.1. Background Research and Data Collection Component

The Background Research and Data Collection component of municipal urban forest management involves examining relevant planning, engineering, transportation, and forestry documents, as well as policies, by-laws, and other pertinent documents from the City and other levels of government due to its interdisciplinary nature. It also involves researching the best management practices in arboriculture and urban forestry.

This work is compiled into the *UFMS Background Technical Report*, *2024.* Discussions with staff considered the current and future needs of the community, resources, and staffing through a SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis (Chapter 2).

Land use shapes the habitat for urban trees; the more densely developed an area is, the less UTC it tends to have (Oakville, 2006) in the absence of making space for trees. To support UTC by creating space for trees to grow into large – stature shade trees in busy, high-density areas, the City of Waterloo will need some creative solutions in urban planning, design, and engineering. This is especially important because the City's Zoning By-law is likely to be updated due to new provincial requirements, which will encourage more development in certain areas. For example, this might mean increasing housing density near major transit hubs and allowing multiplex housing on lots that are currently limited to single-family homes.

TD Economics (2014a) shows that investing in the urban forest benefits both the economy and the environment: "For every dollar spent on annual maintenance, the City of Toronto's urban forest returns $1.35 – $3.20 worth of benefits and cost savings each year." In other words, "The cost savings produced by our urban forests make it clear that keeping the green on our streets, keeps the green in our wallets" (TD Economics, 2014b). "For people to receive their benefits, the urban forest needs to be healthy and diverse to create the most sustainable and livable communities possible" (Turner-Skoff, 2019). "The built environment as it currently exists is not conducive to most trees" (Watson & Himelick, 2013). "Many of the conditions that we seek to improve in our landscapes by planting trees are the same conditions that make tree establishment and growth so difficult" (Watson, 1994).

Trees have horizontal root structures. Urban (2008) suggests that a tree is structurally like a wine glass on a dinner plate, analogous to the proportion of glass height to plate size that closely resembles the natural model for forest trees. Good soils are quite fragile and can easily be degraded if not given priority in the design process and protected during construction and tree growth is directly related to the volume of soil available for root growth (Urban, 2008). Soil volume requirements for good tree growth must be factored into the many compromises that represent the urban design process, a process determines space and budgets for roads, sidewalks, utilities, grading, stormwater systems- and trees" (Urban, 2008). The technology is available to create space for urban trees, allowing large, healthy shade trees to grow in residential, commercial, recreational, and transportation areas. *This deliberate allocation of space for trees in urban areas requires meticulous planning, engineering, and urban design.*

1.1.2.2. Urban Tree Canopy Study Component

The UTC Study (Chapter 2) details the results of measuring and modelling Waterloo's past, present and future UTC. UTC Targets for public and private lands in 2050 and 2070 were established: a UTC Target was set to attain and sustain Waterloo's existing UTC over a 100-year horizon. The project also included developing a model that measures Tree Equity. Tree Equity is "the right number of trees so all people experience the health, economic, and other benefits that trees provide" (American Forests 2024). However, many Canadian municipalities have not yet evaluated their Tree Equity. The consulting team collaborated with the University of Waterloo's School of Planning (e.g., through a 2nd-year social planning course) to analyze Tree Equity in Waterloo as part of the background research and data collection. The consulting team developed a Priority Target Area for Tree Equity (PTATE) map. This map will serve as a guide for future public and community tree-planting initiatives designed to accelerate tree equity across the community.

1.1.3. Monitoring

The UFMS employs a science-based approach that relies on the three pillars of Criteria and Indicators for Strategic Urban Forest Planning and Management. Many other municipalities in Canada and the U.S. also use these pillars to track the progress of their plans. Waterloo was assessed using the "Criteria & Indicators for Strategic Urban Forest Planning and Management" model (Kenney et al., 2011). The findings are detailed in Chapter 2. The purpose of this assessment was to evaluate the municipality's status regarding urban forest sustainability and to identify areas for improvement. The model will be applied again to reassess the City's progress at the conclusion of each 5-year Operating Plan period. This process is crucial for effective monitoring, allowing for necessary adjustments to the UFMS and informing the development of the next Operating Plan. This reassessment will serve as a "Progress Report," measuring the City’s implementation of Waterloo’s UFMS.

CHAPTER 2

2. Current Environment

2.1. State of the Urban Forest

2.1.1. Windshield Survey Report: City Tree Maintenance Needs Mapping

To assess the condition of public trees in the urban forest, the Consulting Team conducted a Windshield Survey of Waterloo on October 17, 2022, focussing on municipal street trees (Figure 3).

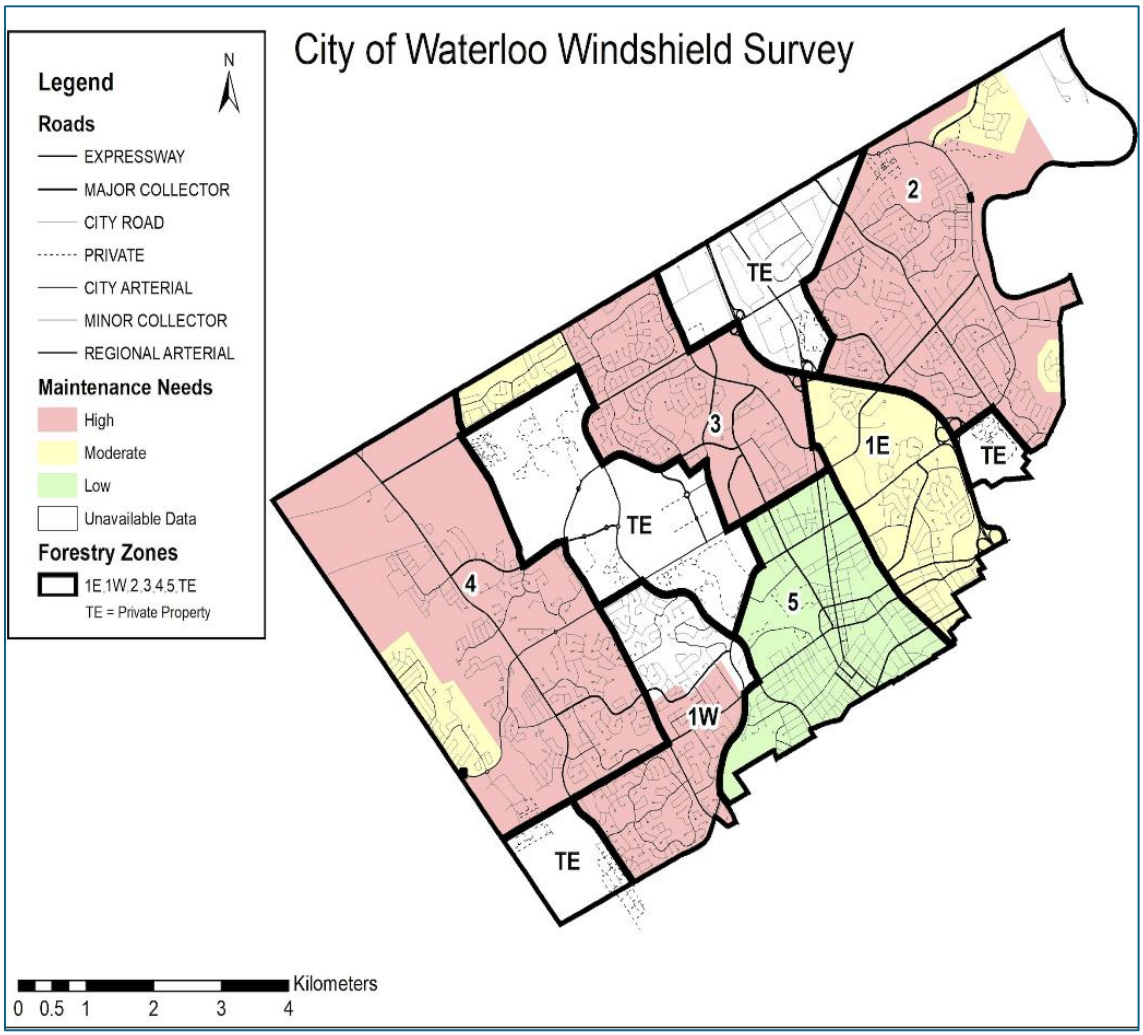


Figure 3. City of Waterloo Windshield Survey.
(UFMS Background Technical Report, 2024)

The pattern observed across the five Zones was a need for scheduled proactive tree maintenance for 'young' and 'semi-mature' trees (maturing trees). A consistent pattern throughout the city in Forestry Zones 1W, 1E, 2, 3, 4, and 5 is that Forestry Operations have effectively removed dead ash street trees, but there remains a need for proactive pruning of maturing street trees (UFMS Background Technical Report, 2024). The Windshield Survey noted that Zone 5 (Figure 3) includes the Heritage District. Forestry Operations must obtain a permit to remove City trees within this district. No outstanding maintenance was observed on the mature sugar maple trees, indicating that these trees are well-maintained by Forestry.

During the Windshield survey, a capital construction project currently underway at 214 Herbert St. in Zone 5 was assessed. To reduce construction damage to trees, it is important to implement appropriate tree protection measures. These include designing the project with attention to existing trees, holding a pre-construction meeting with the project arborist to ensure proactive pruning for clearance of construction equipment, and properly establishing the tree protection zone (TPZ). Additionally, the arborist should carry out site visits during construction to ensure the TPZ remains intact, and a post-construction site inspection should be conducted to identify any necessary remedial work for the trees or site. City capital projects, such as the road reconstruction at 214 Herbert St., must follow these tree protection measures to avoid damage to the tree canopy, roots, trunks, branches, and soil. Some municipalities regulate this process through a corporate Tree Protection Permit system, which requires third-party utility reconstruction projects to obtain a Tree Permit before receiving Municipal Consent (permit).

2.1.2. Background Research & Data Collection

2.1.2.1. City Policy Review

https://nph.onlinelibrary.wiley.com/doi/full/10.1002/ppp3.39 The RFP for this project required that "Review legislation, policy and studies that affect ...the urban forest" be examined. The documents reviewed are discussed and listed below.

- *Waterloo Park Environmental Inventory 2008-2009* (The City of Waterloo, 2008) *states:*

  *"*These management plans are based on *environmental philosophies and strategies* outlined below. All activities, initiatives and programs incorporated into the management plans should follow these philosophies and will have been *approved by the City Forester...* The management plans are not designed or intended to be analytical in nature but rather serve as a compilation of available

information for each Public Land. They are also a tool to guide Environmental Services to deliver updated programs based on the Environmental Lands Acquisition and Maintenance Policy (1999) and Environmental Lands Acquisition and Maintenance Strategy (1997).*"*

Currently, there is no "City Forester" position in Waterloo. A component of this project was to inventory 15% of its woodlands (i.e. woodlands on five properties). This inventory was subsequently used to support the development of Woodland Management Plans for internal use.

- *Urban Forest Policy, 1998, updated 2001* (The City of Waterloo, 2001)

This policy states:

> "When re-construction takes place near or around trees, the contractor/agency performing the work will protect the trees from damage at all times. The type of equipment used within the area -one and one half times the drip line of a tree will be such that operation of this equipment does not compact and/or damage the roots and limbs of the tree. All work performed will be inspected by City staff. A protective barrier such as fencing, plywood, or other method specific to protecting the tree and approved by the City be placed between the construction area and the tree at all times during construction. The method of installation of this barrier will be such that it does not negatively impact the tree."

This policy does not appear to be followed by all departments. Only one observation of a 'protective barrier' was observed during and documented in the Windshield Survey Report, which detailed a city capital road reconstruction project and an infill housing single lot redevelopment project, as well as from discussions with staff. This is addressed in Chapter 5, Action Item 2.1.1.

- *Official Plan*

Waterloo's Official Plan, Page 133, Section 8.2.9 outlines the City's policies regarding its urban forest (refer to Figure 4 for an excerpt of two policies under Section 8.2.9).

8.2.9 Urban Forest

(1) The City recognizes the *urban forest* as providing significant ecological, social, and economic benefits. The City will encourage the protection, restoration, wise management, and expansion of the *urban forest*.

(2) It is the City's intent to protect existing trees and plant new ones where feasible and appropriate. When considering *development* applications

Figure 4. Waterloo Official Plan Section 8.2.9

(The City of Waterloo, 2012)

During Phase 2 of the City's OP Review, the City should consider revising Policy 8.2.9.2 regarding 'replacement trees' to support the UFMS Strategic Framework, as detailed in the Action Items Section of this Plan.

Waterloo's OP recognizes the importance of preventing soil compaction in Section 8.2.9.8:

(8) The City will support and enhance the *urban forest* by implementing urban design standards that protect street trees, in particular in terms of preservation of existing root structures and preventing soil compaction.

Figure 5. Waterloo's Official Plan Section 8.2.9.8

(The City of Waterloo, 2012)

Some other municipalities such as the City of Toronto have made special provisions to solve this critical issue of soil compaction and hard surfaces (Figure 6).

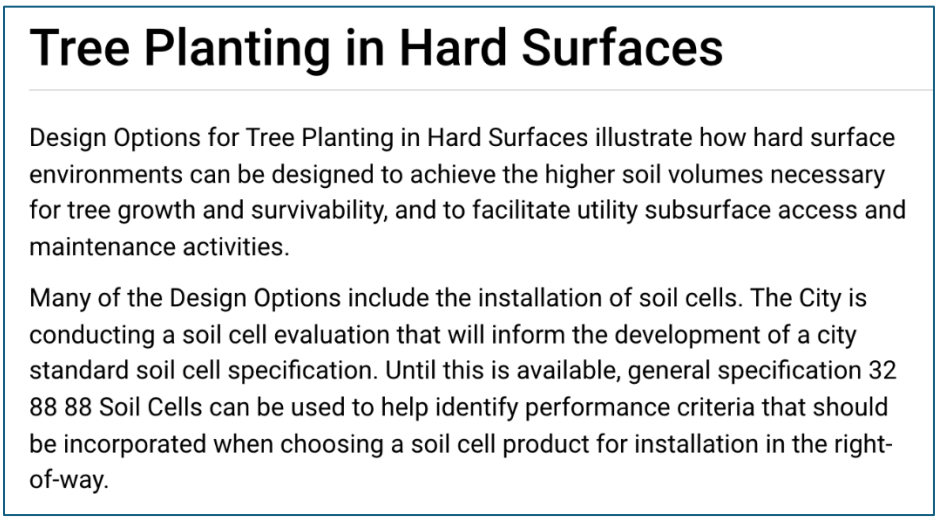


Figure 6. The need for special provisions to grow trees in hard surface environments (Toronto, City of, 2024a)

During Phase 2 of the City's OP Review, the City should consider revising Section 8.2.9.8 of its Official Plan regarding 'soil compaction' to support the UFMS Strategic Framework, as detailed in Chapter 5, Action Items.

The City of Waterloo's Official Plan Policy8.6.2.3 General (page 179), states:

> "The City will promote and undertake tree planting and landscaping initiatives to enhance and improve the *urban forest* as a means of improving air quality and minimizing contributions to climate change through shading, sheltering, screening, and increasing carbon sinks. The City will also promote the protection, restoration, wise management, and expansion of the *urban forest* as a means of pollution mitigation and carbon sequestration."
>
> Chapter 8, "Environment and Energy," page 128, states:
>
> "This chapter provides policy direction with respect to the protection, management, and stewardship of the environment." Subsection (2) Water Resources states, "Enhance existing stormwater management practices."

During Phase 2 of the City's OP Review, the City should consider developing new road cross-section designs as recommended in Chapter 5, Action Items, incorporating the improving air quality and stormwater benefits of street trees (refer to Figure 7).

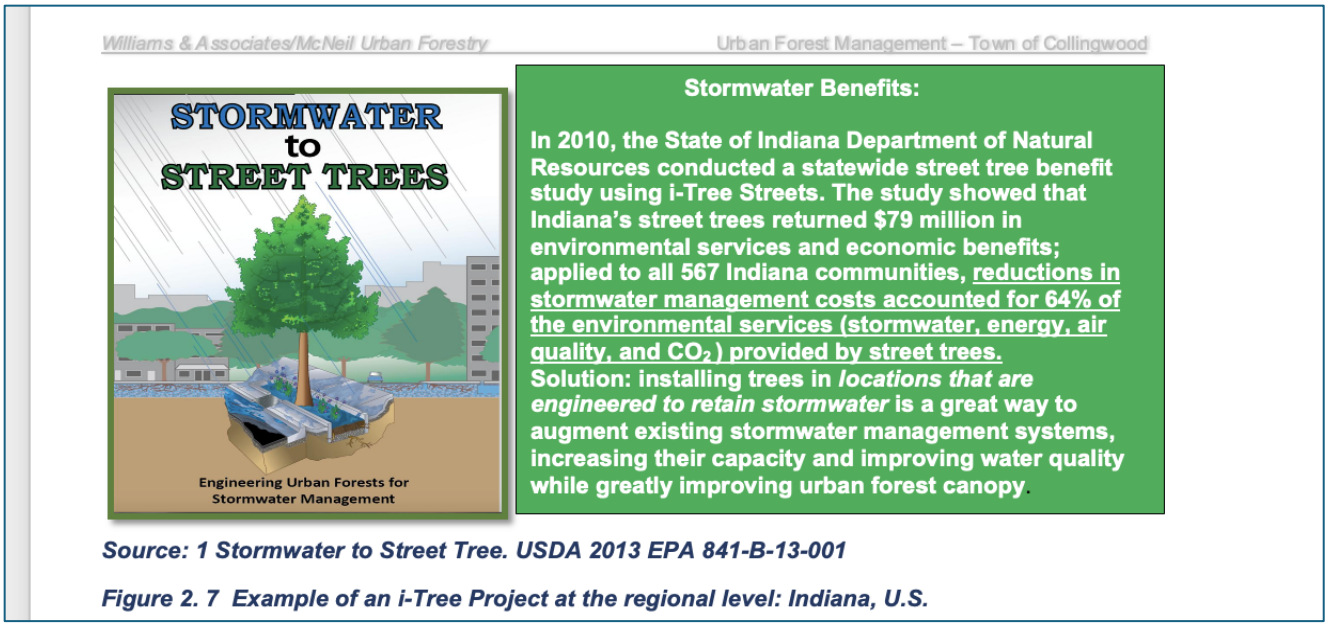


Figure 7. Stormwater Benefits of Street Trees (USDA (b), 2013).

Waterloo's *Environment and Climate Change* issue brief, OP Review, page 2, (The City of Waterloo, 2024c) in its description of city 'infrastructure' does not appear to recognize trees as *infrastructure* as it does for other corporate assets such as "roads, storm and wastewater systems." From a strategic direction and policy consideration perspective, the City's *Environment and Climate Change* issue brief does not seem to address the opportunities provided by the urban forest outside of Waterloo's natural heritage system while acknowledging the future impacts of climate change (Figure 8). During the City's Phase 2 OP Review, consideration should be given to adopting the urban forest policy directions for planning, engineering and urban design recommended in the Action Items Section of this Plan.



Figure 8. Waterloo's future climate conditions. (City of Waterloo, 2024c).

Waterloo's Official Plan (The City of Waterloo, 2012), page 329, states:

> "The "City's Urban Design Manual and the Supplemental "Northdale Urban Design Guidelines" ...provide specific built form, landscaping and sustainable site and building design and related site planning guidelines to assist Council in achieving the vision and principles established for the Northdale neighbourhood."

Section 11.1.45 Specific Provision Area 45 (Northdale Neighbourhood). Page 308-311 states:

> "Northdale will be an important opportunity for public and private investment and redevelopment as the neighbourhood evolves and urbanizes and supported through appropriate *infrastructure* and services."

Is there potential to recognize the supporting role of trees to help achieve this?

> "Northdale will be a safe neighbourhood which incorporates crime prevention through environmental design practices, and provides for street-related, ground floor animation areas, and building heights and setbacks which encourage 'eyes on the street', and through building designs and support services which enhance safety."

What is missing from this statement above? Recognition that trees reduce crime. A study in the City of Baltimore found "...that a 10% increase in tree canopy was associated with a roughly 12% decrease in crime" (USDA, 2012).

> "Public Realm: PR.5 Improved streetscaping should be provided in the form of tree lined boulevards, enhanced landscaping, paving and traffic calming, where feasible and appropriate, and through the provision of consistent and attractive street furniture to define the public realm and neighbourhood character" (page 313).

Are there additional design requirements for the street tree other than **"**consistent street tree establishment," such as to be 'sustainable'? Is there potential to achieve sustainable "tree lined boulevards" through creating a *Large Stature Trees in Hard Surfaces Policy*? Such a policy would support "Principle 5" to ensure 'sustainable supply of future 'mature trees' through review of the Northdale Urban Design Guidelines**.**' This is addressed in Chapter 5, Action Item 1.2.2.

- *Zoning Bylaw*

The Zoning Bylaw establishes a 30% landscape open space requirement for many zones, mandating a minimum percentage of landscaped open space—specifically, 30% for any new development. While the Official Plan (OP) sets an overall policy goal, the Zoning Bylaw is an enforceable law, and unless an amendment is requested, a minimum amount of vegetation is required. A common issue with Zoning Bylaws is that they often permit hard surfaces like interlock. Interlock is an impervious surface,

typically constructed over compacted granular material, which does not support UTC. Another key issue is that some Zoning Bylaws fail to address the core site plan design problem: compacted, unhealthy, and insufficient soil volume to grow large shade trees.

It is recommended that Waterloo adopt a new approach to ensure that any new development provides enough soil volume to support a tree canopy.
This approach may not require amending the existing Zoning Bylaw, even if it includes hard surfaces such as interlock, provided that the hard surface is supported by soil cells containing uncompacted soil.

To meet the City's UTC Targets outlined in this UFMS, any designated "landscape area" must be designed and built to support at least 32.5% UTC. If hardscape surfaces are present within this area, they must comply with the City's revised Comprehensive Engineering & Landscape Manual; this would involve meeting specific engineering standards for the minimum volume of uncompacted, healthy soil accessible to each tree- as detailed in the method outlined below. See Action Item 3.1.2.

The new method involves a formula to determine the amount of soil needed for any development to support the UTC Target(s). Regardless of the type of development, the required soil volume depends on the size of the privately owned site.

The formula is:

(35% of site area ÷ 66) x 30 = cubic metres of soil needed.

It is important to note that:

a) The soil can and should be deployed to the curb.
b) It can be deployed above grade, such as on roof decks or terraces, subject to planning (urban design).
c) Soil supporting existing protected trees can be counted towards the total soil volume needed.
d) The stormwater retention capacity provided by the soil volume should be counted towards any stormwater reduction requirements that the project may have.

- *Urban Design Manual*

“Waterloo’s Urban Design Manual is a consolidation set of City design guidelines and reference material approved by Council that implements the City’s Urban Design policies contained in the Official Plan” (City of Waterloo, 2024a). On page 6, “green” is

listed as one of the ‘intangibles’ supporting the Key Attribute of Comfort & Image. However, the ‘measurement’ does not include a metric for measuring tree benefits, such as sequestering carbon dioxide, air pollution filtration, stormwater mitigation and energy savings. These attributes can be quantified by i-Tree Design (USDA, i-Tree Canopy). During the City’s current “Urban Design Manual refresh” Project, consideration should be given to how to support the attainment of the City’s UTC Targets as detailed in the Action Items Section of this Plan.

Part 2. General City Design Guidelines states, “These guidelines are intended to guide many types of development in the City.” It contains the “Policy Objective: Promote a high standard of urban design in the City of Waterloo.” This includes “Pedestrian-Friendly Design’ to ‘improve human comfort (micro-climate conditions) along streets and amenity areas. Encourage use of ...landscaping” (City of Waterloo, 2024b), Figure 9.

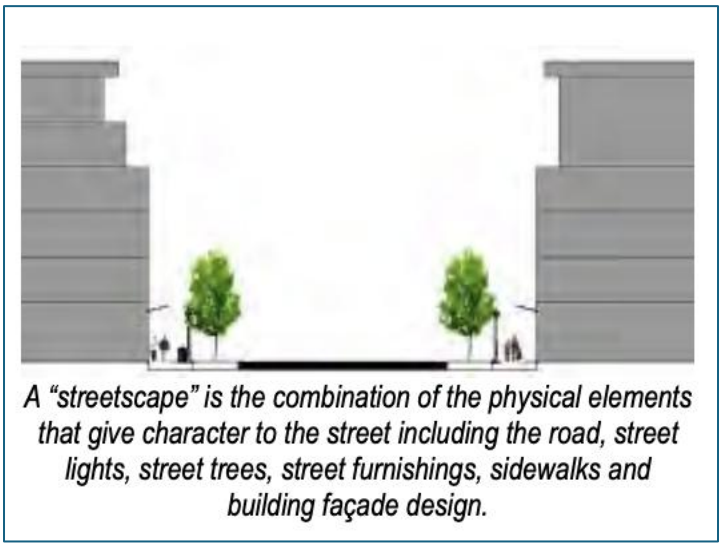


Figure 9. Street trees are part of the physical elements that give character to the street. (City of Waterloo, 2024b)

Staff interviews were conducted in 2023 during the background research phase of the Urban Forest Management Strategy to generate discussions on how this project can assist staff in their work and to understand how the activities of different city departments affect trees (UFMS Background Technical Report, 2024). The Staff Interviews Report, Theme 4, identified that there are insufficient well-defined corporate policies and processes in place to protect and make space for trees and that the current corporate policies and processes for development applications are inadequate. This inadequacy is hindering the implementation of existing corporate urban forest policies in a practical way. While it is important to establish policies that protect and make space for trees, there must be an understanding of the reasons behind them. Additionally, it's

crucial to develop specifications and standards for planting trees and designing sidewalks, especially in the most challenging constrained urban areas.

Waterloo's Urban Design Manual already acknowledges the importance of trees in the streetscape. However, the City's development approval process does not have sufficient mechanisms to realize this vision (UFMS Background Technical Report, 2024). This is addressed in Chapter 5, Action Item 2.2.4.

- *Comprehensive Engineering & Landscape Manual*

A detailed assessment of this Manual is out of scope of this Project. From discussions with staff a revision is required if Waterloo is to sustain its UTC in hard surface areas. Through developing the UFMS discussions with City staff identified “Theme 5: Interdepartmental collaboration is the key to realizing the important role that urban tree canopy can play in reducing the impacts of Climate Change.” The staff discussion confirmed that, in general, staff feel there is good coordination among departments.

City staff have historically focused on Waterloo’s hard infrastructure. However, staff are now trying to change this narrative and recognize that City infrastructure encompasses more than just the 'hard stuff.’ For example, Waterloo staff told us that Urban Forestry is important because people walking on multi-use trails are looking for (periodic) shade. However, during our Interviews*, we found that translating objectives like this for the urban forest into practice remains elusive for the City Waterloo*. This is addressed in Chapter 5, Action Item 3.1.1.

In conclusion, the City of Waterloo needs to re-evaluate how effectively it has included the large urban tree in its urban fabric, particularly in areas with a large proportion of impervious (hard) surfaces such as pavement. *There is a disparity between the current implementation of the space required to support large shade trees in Waterloo and the public tree envisioned in the City's Urban Design Manual, Northdale Urban Design Guidelines, and the Comprehensive Engineering & Landscape Manual.* It is essential to address this disparity to meet the UTC Targets and Tree Equity objective set by UFMS. The Strategic Framework in the Strategic Goals & Objectives Section outlines a strategy to address the UTC Targets.

2.1.2.2. Criteria & Indicators for Strategic Urban Forest Planning and Management

The City's Project Team, completed a self-assessment exercise on April 24, 2023, led by the Consulting Team. This procedure is based on the Criteria and Indicators for Sustainable Urban Forest Management (C&I) process, as outlined by Kenney et al. (2011). A summary of the results from the Criteria and Indicators analysis is presented in Table 1.

Criteria & Indicators						
	Performance Indicator					
Criteria	total	Low	Moderate	Good	Optimal	No Data
Vegetation Resource	7	0	5	2	0	0
Community Framework	7	3	2	2	0	0
Resource Management Approach	11	1	8	2	0	0
Total	25	4	15	6	0	0

Table 1. Summary of Results of the Criteria & Indicators (UFMS Background and Technical Report, 2024)

The C&I assessment found that Waterloo's ranking for 76% (19 out of 25) of the C&I for Sustainable Urban Forest Management were categorized as 'Low' or 'Moderate,' while 24% (6) of the C&I are rated as *'Good' or 'Optimal.'* This suggests room for improvement in urban forest management within the city. Most of the 'Low' C&I rankings were in the "Community Framework," enabling the City to improve its overall rating by focusing on following the 5-Year Forestry Operating Plan(s). One focus area could be to develop programs that encourage the participation of neighbourhood groups and the local green industry.

Over the next five years, the City should aim to improve at least one more C&I to a "Good" level in the "Resource Management Approach." This can be achieved by transitioning the maintenance of City trees from a reactive approach to ensuring that all publicly owned trees are systematically maintained on a cycle (e.g. 5 years) for a Grid (Block) Pruning Program, as detailed in the UFMS Background Technical Report from 2024.

2.1.2.3. SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis

After finishing the task, of the staff interviews, MUFI conducted a SWOT Analysis, summarized in Table 2.

Strengths	Weaknesses
○ Urban forest canopy cover is important to Waterloo. ○ There are strengths to build upon. What Forestry is doing well: 1. Worker safety. Staff have good equipment and training. 2. Good relations with the public. Staff's arboricultural knowledge is respected.	○ Staffing and resource levels are not sufficient to support Waterloo's public tree care management needs. ○ What Forestry is lacking: 1. Tree Maintenance Standards that reflect BMPs 2. A Pruning Cycle for Juvenile Trees; develop a balance between a *Request Pruning Program* generated by residents and a *Scheduled Pruning Program* generated by staff. 3. Staff training on structural pruning. 4. A Business Case may show that it would be more efficient if Enova contracted the City of Waterloo to perform Hydro-Line Clearing. 5. The After-hours Emergency on-call system is voluntary instead of mandatory. 6. Forestry Operations efficiency could be improved with a new Inspector position which would permit the Lead Hand positions to remain full-time with the maintenance crews. 7. A Forestry Planning position could be created to accelerate collaboration with other city departments and external agencies on urban forest planning and protection matters to support a new corporate Tree Protection Permit during Construction with a focus on in-fill development and utility reconstruction projects.
Opportunities	**Threats**
○ Planning staff incorporate direction from Urban Forest Management Strategy into their work on Phase 2 of OP Review. Leverage collaboration among city staff to ensure adequate space for trees in the development application process through the creation of a city Green Standard to guide urban design elements that support Waterloo's Urban Tree Canopy Targets. Planning staff incorporate direction from UFMS into their work on Phase 2 of OP Review. ○ Engineering staff incorporate direction from Urban Forest Management Strategy into their work on *Waterloo's Engineering and Landscape Manual* that recognizes and reflects that the public tree is an integral part of the public road allowance.	○ There are insufficient well-defined corporate processes in place to preserve and protect trees. For example, the city does not currently review utility construction plans for city tree protection. ○ Risk management issue due to the backlog of dead and dying ash trees in the city's woodland parks due to the Emerald Ash Borer infestation.
City of Waterloo SWOT Analysis, by MUFI, based on staff Interviews. October 2023. Updated July 2024.	

Table 2. SWOT Analysis (UFMS Background Technical Report, 2024)

All weaknesses, opportunities, and threats have been thoroughly addressed in Chapter 5, Action Items.

2.1.2.4. Woodland Inventory Data Collection

A component of this project was to inventory 15% of its woodlands (i.e. woodlands on five properties). This inventory was subsequently used to support the development of Woodland Management Plans for internal use.

2.1.3. Urban Tree Canopy Study

The urban forest is an essential component of cities. It is defined as “trees, forests, greenspace and relative abiotic, biotic and cultural components in and around cities and communities” (OPFA, 2024). The view from the air provides a better understanding of an urban forest. A pattern appears: the density of the urban forest varies with land use patterns in urban areas.

“Tree canopy (TC) is the layer of branches, stems, and leaves of trees that cover the ground when viewed from above” (The City of Kitchener, 2016). Existing UTC, or urban tree canopy, is the amount of tree cover when viewed from above using aerial or satellite imagery. For the purposes of the UTC Study, UTC is the sum of "Canopy—forests" plus "Canopy—trees” plus “Canopy—Shrubs.”

2.1.3.1. *Historical UTC: 3-Year Change Analysis*

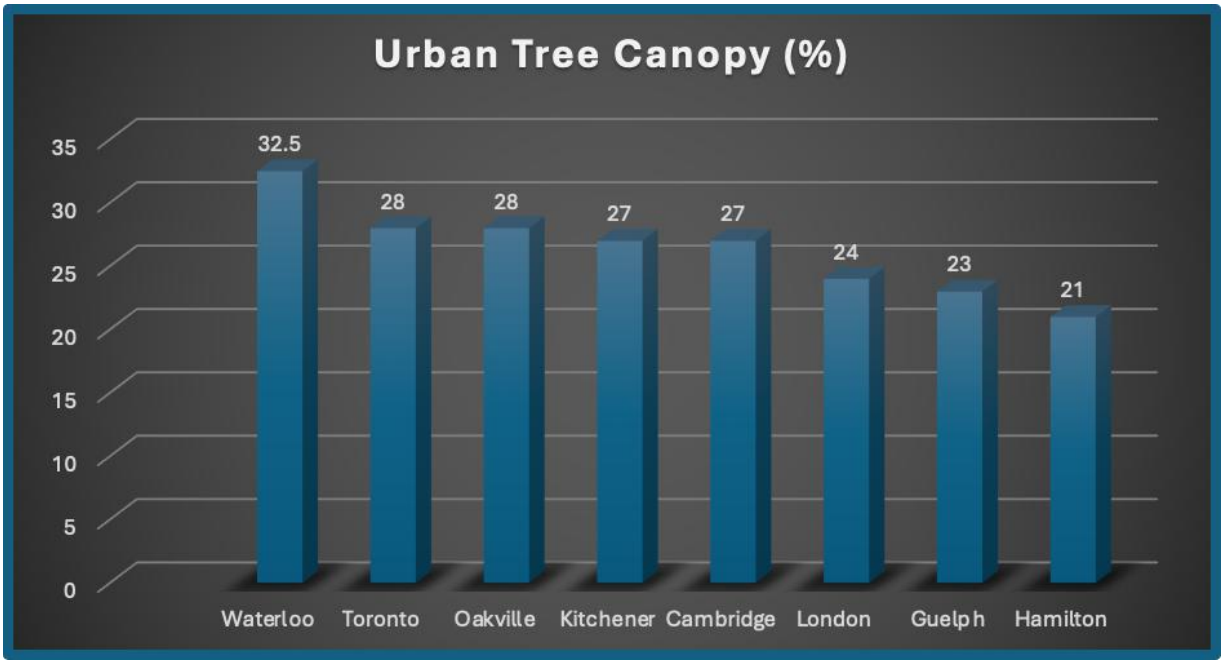
In 2018, the City of Waterloo's UTC was 32.8%, impervious surfaces covered 34.5% of the area, and Grass/Herbaceous—plantable area accounted for 19.7% of the land. However, based on the 2021 aerial imagery, the UTC decreased to 32.5%, the Grass/Herbaceous—plantable area decreased to 19.1%, and impervious surfaces increased to 35.1%. (Table 3).

	2018 - %	2021 - %
Canopy - Tree, Shrub, Forests	32.8	32.5

Table 3. 3-Year UTC Coverage Change in Waterloo (UFMS Background Technical Report, 2024)

2.1.3.2. Present UTC

Waterloo had 32.5% UTC coverage (public and private land) in 2021, as reported in the UFMS Background Technical Report, 2024. This percentage is higher than that of seven sampled municipalities (Graph 1).



Graph 1. UTC for Various Ontario Municipalities (UFMS Background Technical Report, 2024)

The breakdown of Waterloo's UTC (Tree Cover), Plantable Area, and Impervious Cover (non-plantable) is presented for City-owned land and other (non-City owned land) in Table 4.

	Tree Cover %	Plantable (Grass Cover %)	Impervious Cover %	**Permeable but non-plantable %**	**Water %**	**TOTAL %**
City-owned Land	60.1%	18.5%	6.4%	12.3	2.7	**100**
Others (private, other gov.)	27.3%	19.2%	40.1%	11.2	1.8	**100**
Overall	32.5%	19.1%	35.1%	11.4	1.9	**100**

Table 4. Public and Private Tree Cover and Plantable Areas (UFMS Background Technical Report, 2024)

Tree cover percentage is influenced by land use type. For instance, 'Low Density Residential' has 21% more tree cover compared to 'High Density Residential' and 48% more space for planting trees (Table 5).

Category	Official Plan - Land Use	Tree Cover % = forest + tree + shrub	Plantable (Glass/Herbaceous)	Impervious Surfaces	Permeable - non-plantable	Water
1	Right-of-way	17.7%	16.9%	61.0%	4.4%	0.0%
2	Commercial	10.4%	21.5%	53.1%	14.4%	0.6%
3	High Density Residential	23.1%	16.3%	53.7%	6.8%	0.0%
4	Low Density Residential	27.9%	24.1%	36.0%	12.0%	0.0%
5	Open Space	62.0%	14.8%	4.0%	11.4%	7.8%
6	Institutional	28.0%	16.0%	44.0%	12.0%	0.0%
7	Rural	69.2%	1.9%	0.0%	29.0%	0.0%
	Overall municipality	32.5%	19.1%	35.1%	11.4%	1.9%

Table 5. UTC Coverage by Land Use Type in Waterloo. (UFMS Background Technical Report, 2024)

Street tree data from the City of Waterloo were analyzed. However, because these data were dated, various assumptions were made. The City of Waterloo has 31,361 public trees along streets and in parks and cemeteries. The City's Asset Management Plan estimates that the replacement value of public trees is $116 million. The three most common tree species are Norway maple (18.0 percent), honeylocust (9.8 percent), and sugar maple (9.4 percent) (Figure 10).

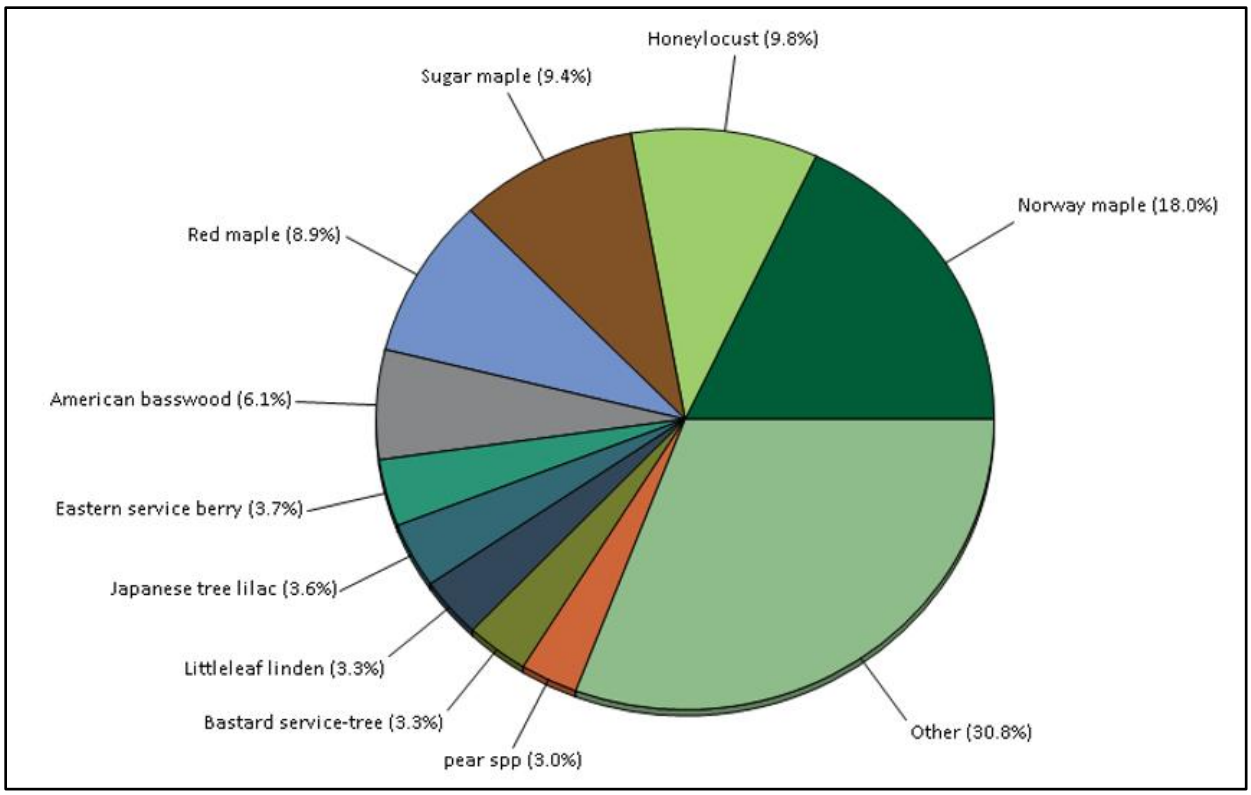


Figure 10. Street tree population composition. (UFMS Background Technical Report, 2024)

Most street trees (68%) are estimated to be less than 30 cm in diameter at breast height (DBH) (Figure 11). These younger trees require maintenance to enhance their structure and reduce future expenses by making the trees more resilient to weather events such as windstorms. This also reduces the number of complaints from residents and service calls regarding low-hanging branches obstruction of road signs and sidewalks.

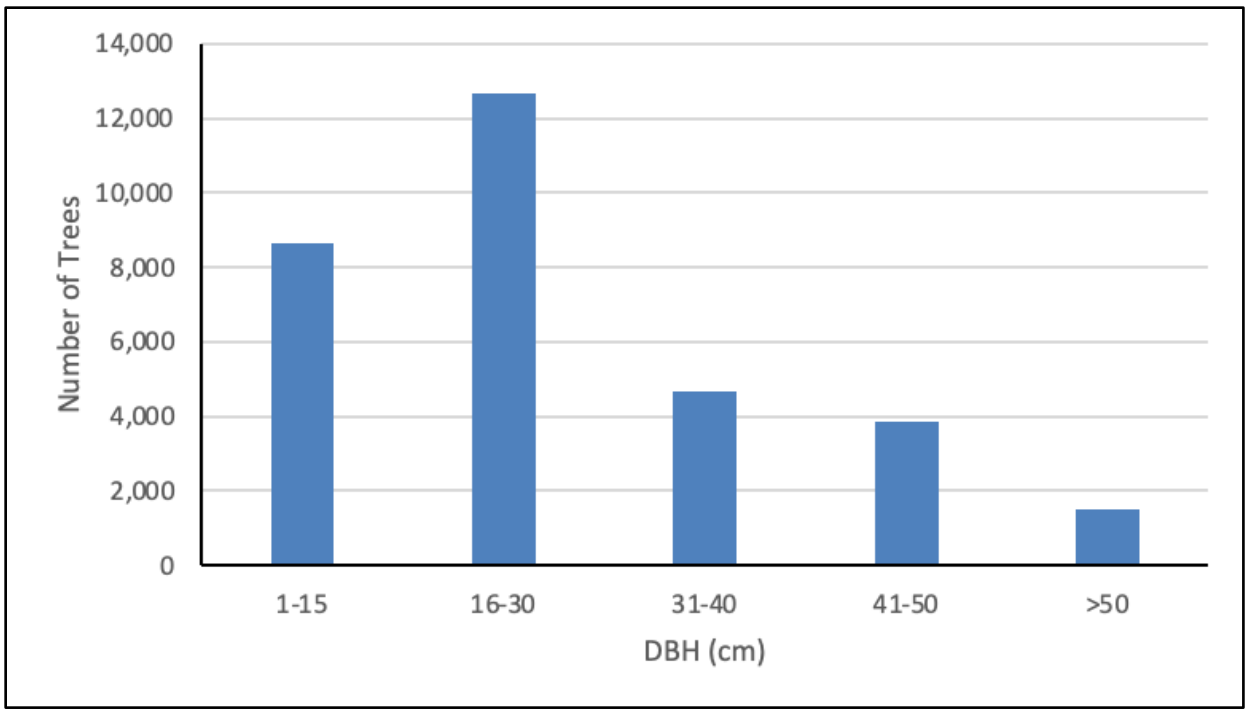


Figure 11. DBH distribution of street tree population. (UFMS Background Technical Report, 2024)

It is estimated that Waterloo has 98,430 woodland trees with the three most common species being sugar maple (38.9 percent), white spruce (12.3 percent), and American beech (8.5 percent) (Figure 12).

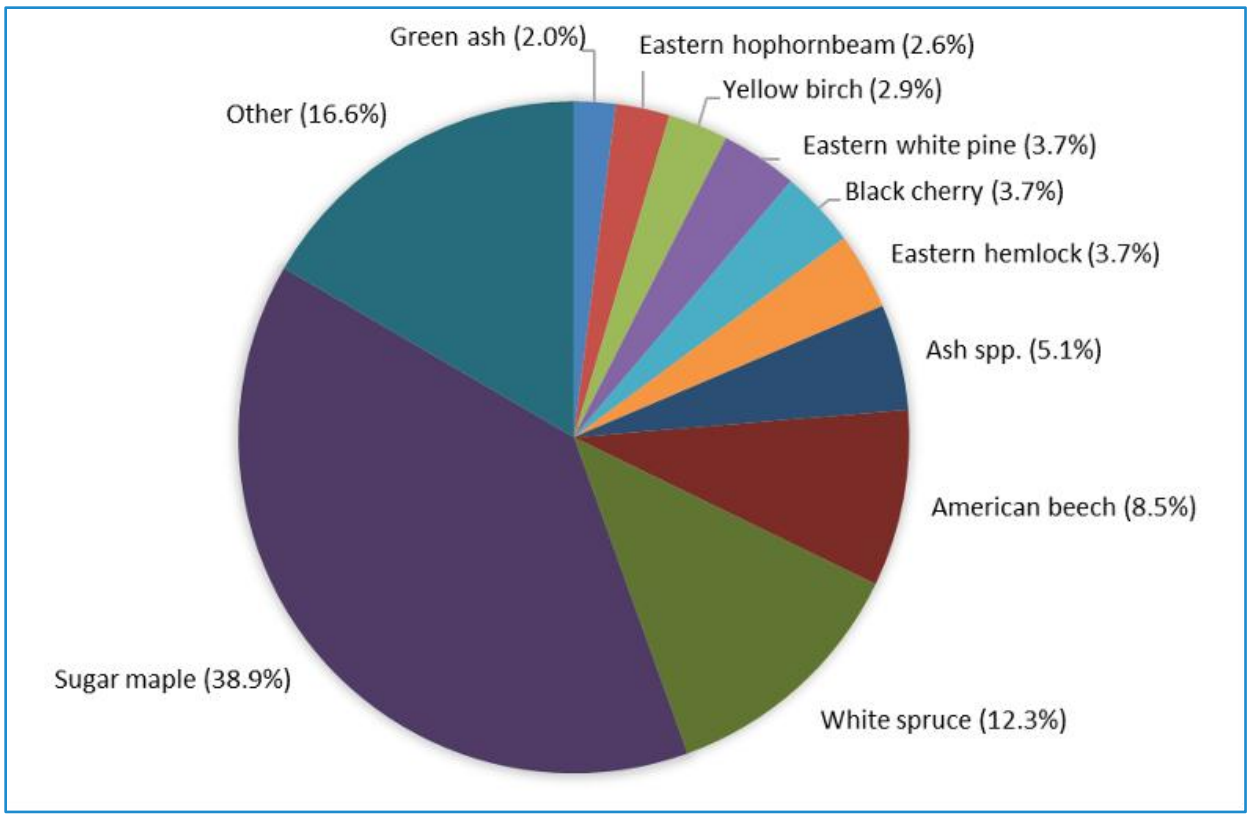


Figure 12. Woodland tree population composition. (UFMS Background Technical Report, 2024)

Ash species make up 7% of the city's trees. The City has been facing a corporate risk management issue due to the emerald ash borer, which is killing ash trees. This could lead to liability issues regarding public trails and private properties bordering woodlots. While the City has been dealing with trees in developed areas and some woodlands, there is a significant backlog in of ash removals in other woodland parks. Chapter 5, Action Items outlines a proactive approach to effectively manage this risk.

“Various insects and diseases can infest urban forests, potentially killing trees and reducing the health, replacement value and sustainability of the urban forest. As pests tend to have differing tree hosts, the potential damage or risk of each pest will differ among cities. The pests with the greatest potential for damaging street trees [in Waterloo] are the fall cankerworm, Asian longhorned beetle, and spongy moth. The pests with greatest potential for damaging woodland trees [in Waterloo] are the fall cankerworm, Asian longhorned beetle, spongy moth, and beech bark disease” (UFMS Background Technical Report, 2024).

2.1.3.3. Future UTC

Forecasting future tree populations is dependent upon knowing three parameters: 1) annual influx of new trees (e.g., planting or natural regeneration), 2) annual tree growth, and 3) annual mortality rates. Unfortunately, there is limited information on urban forest influx and mortality rates. Thus, future projections are limited at best and based on the assumptions used for these three parameters. The i-Tree Forecast model was used to project future tree population based on various assumption. The tree growth rates within i-Tree are reasonable, so the influx and mortality assumptions are critical" (UFMS Background Technical Report, 2024).

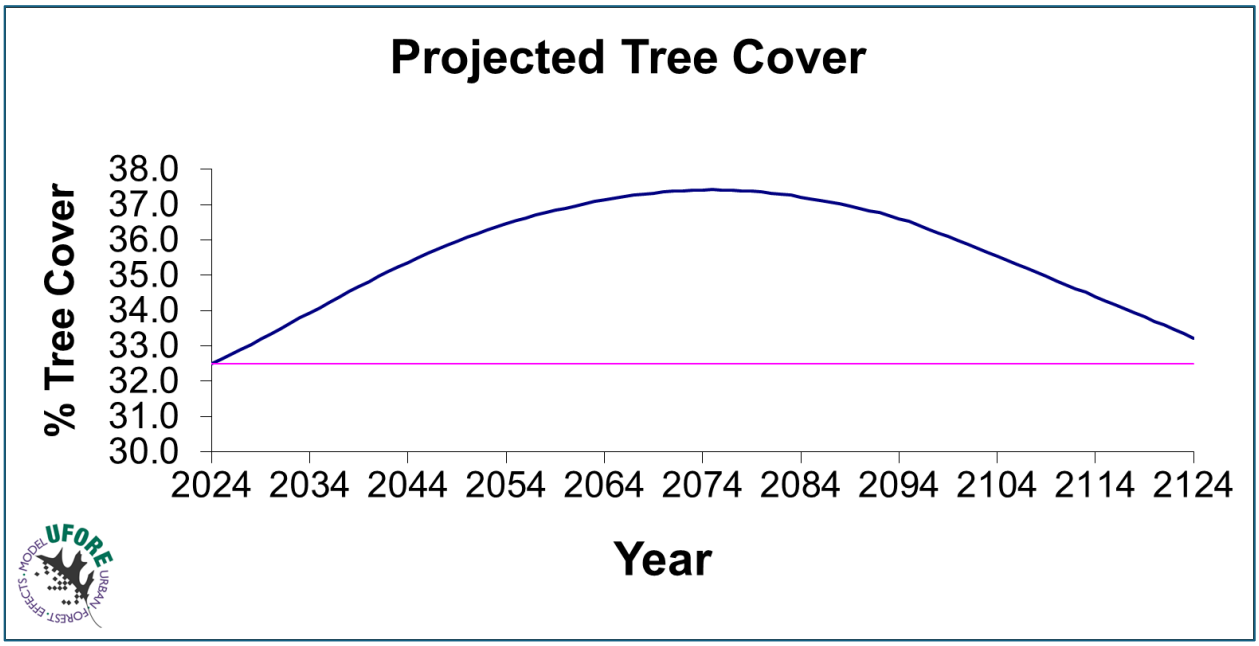
In order to maintain the street-tree population and canopy cover, it is important to know how many trees need to be planted annually.to offset the number and sizes of trees that die each year. Although tree mortality varies over time (e.g., episodic events like storms and insect outbreaks can kill many trees in short time) a consistent annual influx of new trees can help to help maintain a sustainable tree population. Variable annual tree planting will lead to variable population age structure that cause the population, its benefits and maintenance requirements to vary overtime. . The recommended annual tree planting rate to keep a consistent total public tree population total fairly constant over time was estimated using the i-Tree Forecast model. The number of trees to plant annually depends on the average tree mortality. As mortality rates increase, more tree plantings are needed. Maintenance efforts that reduce tree mortality will reduce the number of trees needing to be planted each year. While the street tree mortality rate in Waterloo is not known, different values were used to estimate the annual tree planting rates needed to keep the tree canopy.

To sustain the City of Waterloo's street tree population through the year 2070, the estimated annual planting rate from the i-Tree Forecast analysis is given [in Table 6] (UFMS Background Technical Report, 2024). It is crucial to mitigate the annual tree mortality rate by keeping healthy trees along the streets. This goal can be reached by carefully planning, designing, and engineering space for trees, ensuring a sufficient volume of healthy soil, and conducting regular maintenance.

Annual Mortality Rate	Annual Planting Rate (trees/year)
1%	380
2%	700
3%	1,000
4%	1,350
5%	1,700

Table 6. Annual street tree planting rate needed to sustain tree population based on annual mortality rate. (UFMS Background Technical Report, 2024)

Waterloo aims to keep its urban tree canopy (UTC) at 32.5% for the long term. To achieve this, a scenario called "Long-Term Sustainability" has been developed. To maintain the current UTC of 32.5% over the next 100 years, Waterloo plans to plant 1,250 trees annually on public lands and 3,750 trees annually on private lands. This initiative will result in a gradual and temporary increase in UTC to 36.4% in 2050 and 37.4% in 2070 (Graph 2) (UFMS Background Technical Report, 2024).



Graph 2. Projected Tree Cover (UTC) for Waterloo. Long-Term Sustainability. (UFMS Background Technical Report, 2024)

The Y-axis in Graph 2 represents the percentage of tree cover, and the corresponding values are included in Table 7.

Long-Term Sustainability (Citywide Tree Cover in 2121: 32.5%)			
		%Tree Cover	
Year	Public	Private	Citywide
2021	62.0	27.1	32.5
2050	66.9	30.7	36.4
2070	68.2	31.7	37.4

Table 7. % UTC Cover under the Modelling Scenario called Long-Term Sustainability (UFMS Background Technical Report, 2024)

2.1.4. Waterloo's Urban Tree Canopy Gap

Based on the historical data analyzed, Waterloo is projected to lose about 10% of its UTC over the next decade (Figure 13).

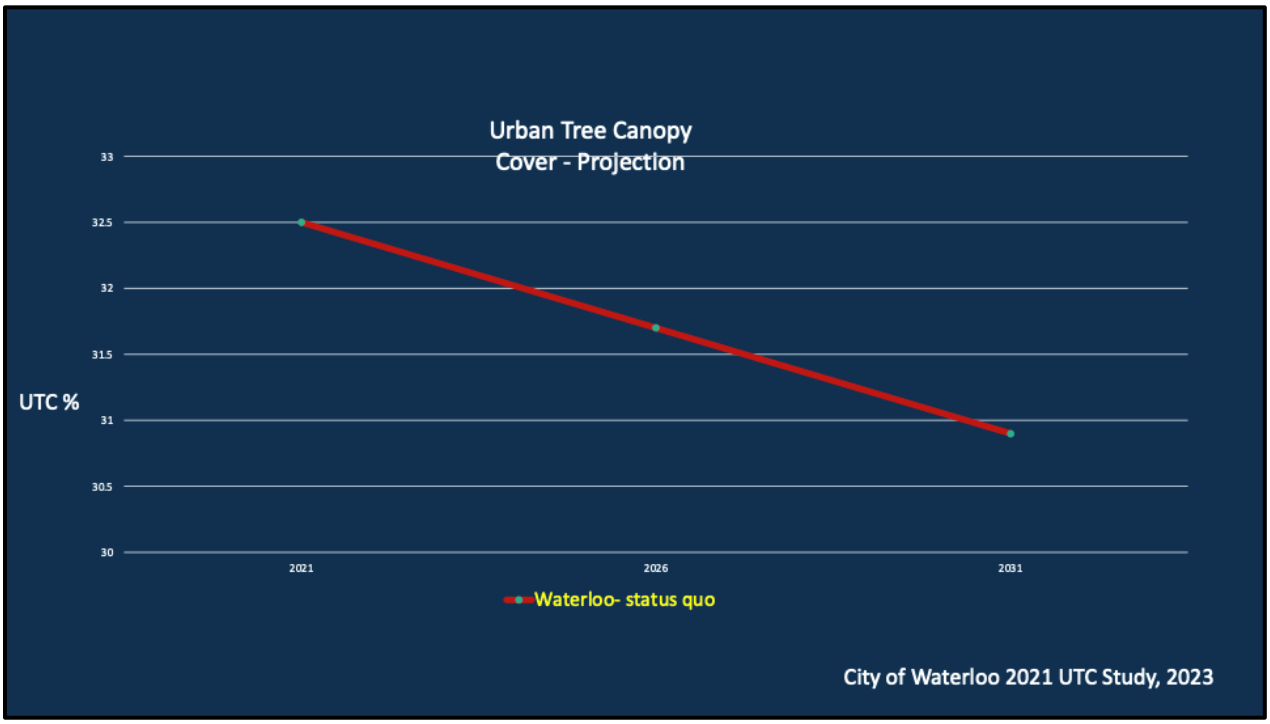


Figure 13. (UFMS Background Technical Report, 2024)

This downward trend is consistent with a 2018 report by the United States Forest Service, which stated:

”The percentage of tree cover in urban areas, throughout North America, has been on the decline...this decrease in UTC is directly related to the increase in impervious surfaces” (Nowak and Greenfield, 2018).

A key deliverable of the Urban Forest Management Strategy is to establish targets for tree canopy cover on public and private lands by 2050 and 2070.

Through discussions with the City’s Project Team the consulting team developed UTC Targets for Waterloo: 32.5% by 2050 and 35% by 2070.

The UTC targets were calculated using the i-Tree model (UFMS Background Technical Report, 2024). The strategies and action items to achieve these UTC Targets are detailed in Chapters 4 and 5.

There is a gap between the City’s UTC Targets (the top line in green in Figure 4) and the projected UTC for Waterloo (the bottom line in red in Figure 4). The difference is called *Waterloo’s UTC Gap*. (Figure 14).

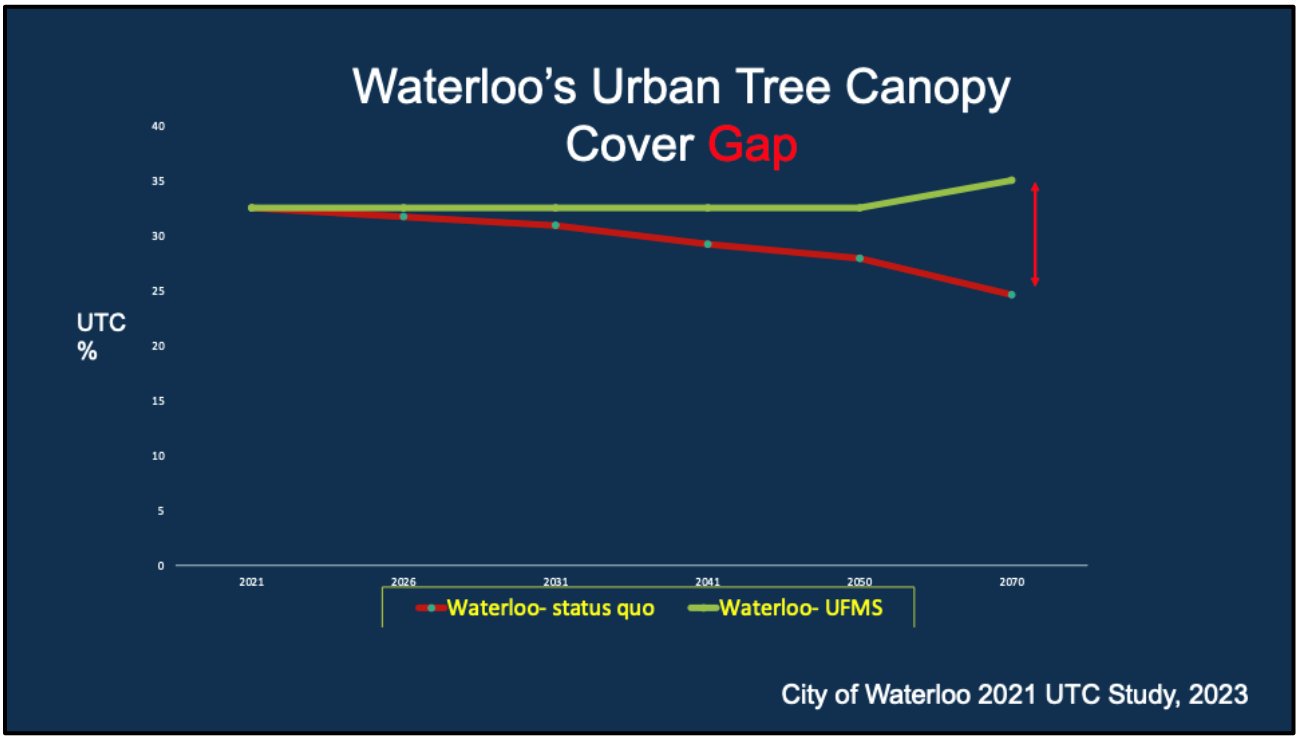


Figure 14 Waterloo’s UTC Gap (UFMS Background Technical Report, 2024)

Following the strategies and action items outlined in this UFMS will eliminate Waterloo's UTC Gap and achieve Waterloo's UTC Targets.

2.1.5. Tree Benefit Estimates

i-Tree Eco (formerly called UFORE Model) is designed to use standardized field data and local hourly air pollution and meteorological data to quantify urban forest structure and its numerous effects (Nowak, 2000), including:

- Urban forest structure (e.g., species composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Replacement value of the forest, as well as the value for air pollution removal and carbon storage and sequestration.
- Potential impact of infestations by pests, such as Asian longhorned beetle, emerald ash borer, spongy moth, and Dutch elm disease.

The i-Tree analysis reveals the immense value of the urban forest in the City of Waterloo. In 2021, trees stored 160.6 kilotons of carbon, with an estimated value of $38,367,000. What's more, they effectively removed significant amounts of harmful pollutants, including 2.1 tons of carbon monoxide, 11.5 tons of nitrogen dioxide, 114.7 tons of ozone, 5.6 tons of particulate matter less than 2.5 microns, and 38.4 tons of particulate matter greater than 2.5 microns and less than 10 microns, valued at $83,059.13. The total annual value of the ecological services from Waterloo's urban forest in 2021 was $38,533,000. The numbers speak for themselves, highlighting the critical importance of preserving and nurturing Waterloo's urban tree canopy for a healthier and more sustainable future.

"Urban forests have a replacement value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree); they also have functional values (either positive or negative) based on the functions the trees perform... Annual functional values also tend to increase with increased number and size of healthy trees. Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines" (UFMS Background Technical Report, 2024).

Street Trees

Street trees in Waterloo have the following replacement values:

- Replacement value: $54.1 million
- Carbon storage: $816,000

Street trees in Waterloo have the following annual functional values:

- Carbon sequestration: $37,900
- Avoided runoff: $32,800
- Pollution removal: $65,500

Woodland Trees

Woodland trees in Waterloo have the following replacement values:

- Replacement value: $37.6 million
- Carbon storage: $3.0 million

Woodland trees in Waterloo have the following annual functional values:

- Carbon sequestration: $54,500
- Avoided runoff: $94,400
- Pollution removal: $193,900

2.1.6. Tree Equity

A UFMS is an opportunity to offer municipalities, like the City of Waterloo, a platform to address the issue of Tree Equity. This concept focuses on ensuring a fair distribution of the urban forest across the city.

Tree Equity refers to ensuring that there is an adequate number of trees in every part of the city so that all people can enjoy the health, economic, and other benefits that trees provide (American Forests, 2024). City trees can prevent heat-related deaths and many heat-related illnesses. By working towards achieving Tree Equity, we can save lives and mitigate the impacts of climate change.

“In both cities and suburbs, affluent neighborhoods are more likely to enjoy the cool shade of trees than lower-income neighborhoods... The absence of trees is not just an aesthetic discrepancy — it can impact human health and well-being, a growing body of research shows. Neighbourhoods devoid of trees often grapple with the urban heat island effect, where concrete and asphalt absorb and magnify summer’s heat and elevate the risk of heat-related illnesses. Heat islands are often linked to factors such as income and race” (Miller, 2023).

Municipal planning, urban design, and engineering play key roles in shaping our cities and communities as they reflect the importance of impervious cover on the [inequitable] distribution of ecosystem services ... City policies could be directed to help offset the[se] disparities by enhancing tree cover and reducing impervious cover in [these] under-resourced areas (Nowak, 2022).

Our study in Waterloo assesses whether UTC is distributed equitably. We use an expanded environmental justice framework based on a recent review of American municipal UFMPs published between 2002 and 2020 (Grant et al, 2022). This review revealed that while some plans considered distributive justice, which involves fairly distributing benefits and burdens among impacted and affected parties, a more holistic approach should also include procedural and recognition justice.

To conduct a first assessment of Tree Equity in Waterloo, the consulting team partnered with the University of Waterloo for an applied term project involving approximately 100 students in a second-year planning course titled People and Plans during the Winter 2023 semester. Those findings show that Waterloo does indeed have tree equity issues. Student recommendations include the need for a more comprehensive analysis using equity indicators beyond population distribution. The key results were presented to the City’s UFMS Project Team on November 21, 2023. A rigorous analysis of tree equity in Waterloo produced a Priority Target Areas for Tree Equity map (Figure 15).

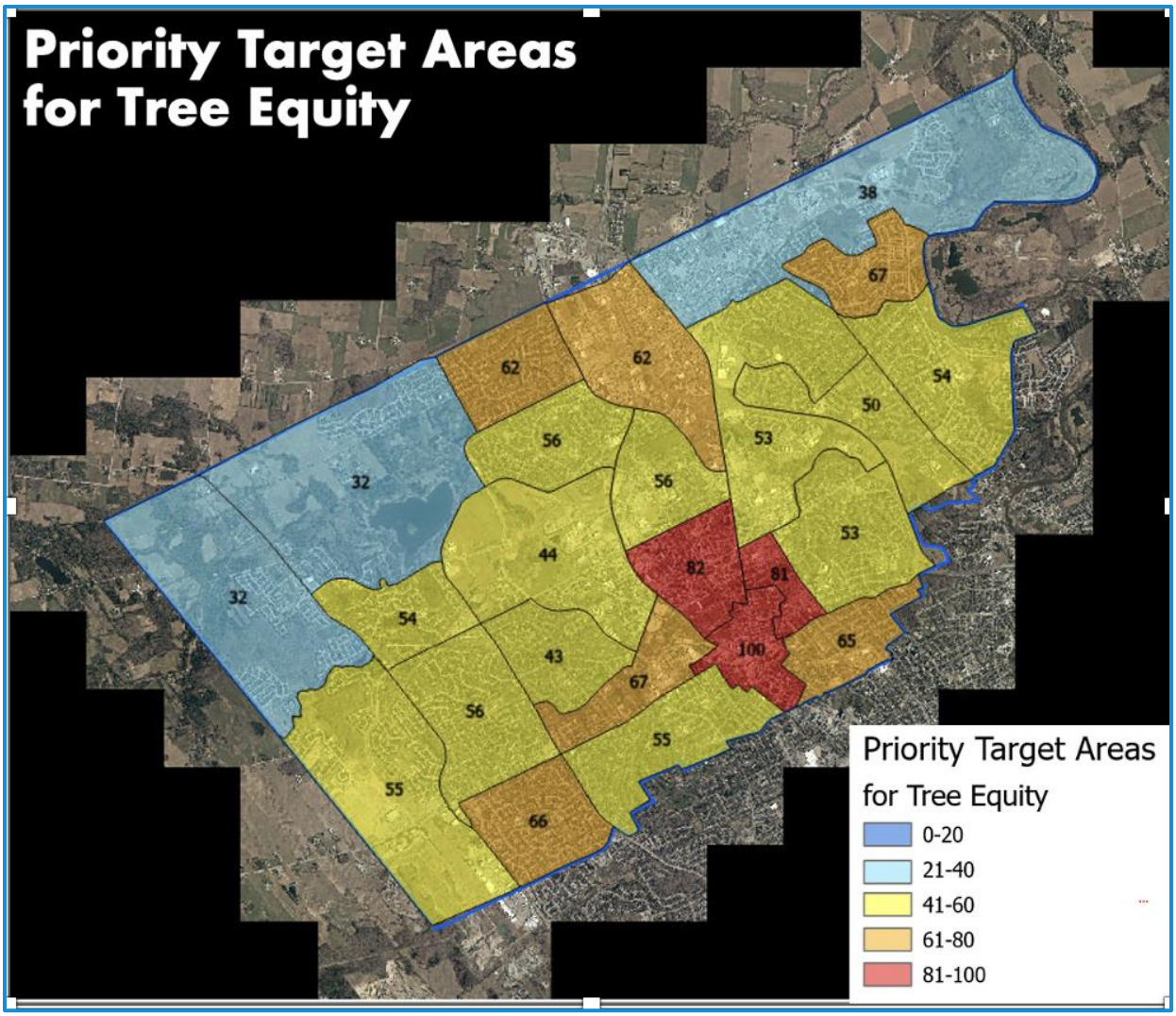


Figure 15. Priority Target Areas for Tree Equity. (UFMS Background Technical Report, 2024)

The areas with an “81-100” score, shown in red, are the top priority areas to address tree inequity in Waterloo. These high-priority areas include Uptown Waterloo, which has a low UTC (10.4%) associated with the Commercial Land Use Type (Table 5). Uptown Core has been designated for urban intensification, which will exert future downward pressure on UTC during redevelopment under the city’s current development application process and engineering standards applied to hard surfaces.

Conclusions and recommendations focused on Uptown Core as the City’s central hub for environmental justice initiatives. The Priority Target Areas for Tree Equity map (Figure 15) will help City staff prioritize strategies and guide the implementation of various action items outlined in Chapter 5.

CHAPTER 3

3. Summary of Public Engagement

3.1. Communications and Public & Interested & Affected Parties Engagement Component

Engagement through consultation is crucial in developing the City of Waterloo's Urban Forest Management Strategy. The findings from this engagement process helped guide the development of the UFMS.

The goals of this approach::

- articulate the current state of Waterloo's urban forest and its management.
- generate ideas about how to manage this forest going forward; and
- use those ideas to inform the strategy to improve the urban forest as Waterloo continues to grow.

A comprehensive approach was used to communicate with the general public, people in neighbourhoods experiencing tree inequity (as identified by the PTATE map), and Indigenous and First Nations peoples to assess their interests and preferred methods to provide input into the UFMS. Community input is crucial for helping develop goals and objectives for that support large-scale private tree-planting programs to achieve Waterloo's UTC Targets.

Through the participation of City staff, political leaders, interested and impacted communities, and citizens, the City of Waterloo has confidence that the Strategy accurately reflects the interests, values, and needs of its residents. Public participation in consultation is most successful when:

- the process is inclusive.
- a variety of inputs, ideas and perspectives are considered; and
- results are communicated including how the input was used.

The strategy aims to assess the current state of Waterloo's urban forest and develop ideas for its management. Feedback and suggestions from the consultation process were used to inform the strategy to help improve the urban forest as the city grows.

The following four broad *Themes* helped focus the messaging of the UFMS Project Engagement Approach on the City's Engage Waterloo Project web page:

1. Trees and communities need each other to thrive.
2. Make Space for Trees.
3. Trees for Everyone.
4. Trees are Good

Waterloo is a rapidly developing community striving to be a sustainable, future-ready place. One of its strategic priorities is environmental sustainability and climate action, and the City must maintain its natural assets, including trees, to achieve its environmental objectives. The communication efforts of UFMS focused on highlighting the importance of trees to Waterloo's future success. The goal to ensure that underserved communities participated in the development of UFMS and will be able to share in the benefits of the urban forest. The communication efforts also emphasized the significant health benefits, both physical and mental, that trees and forests provide to the population. These benefits will be achieved through the City's implementation of the strategies detailed in this Plan's Strategic Framework described in Chapter 4.

A summary of the Communications Plan/Engagement Approach to dialogue with the public and Interested & Affected Parties is provided below:

1. The Consulting team spoke with the City's Indigenous Initiatives Advocate (summer, 2023 and summer, 2024)
2. Staff Report COM2023-037, Urban Forest Management Strategy Introduction was approved by City Council on December 4, 2023
3. Corporate Communications launched the Engage Waterloo Project page (spring, 2024)
4. Corporate Communications conducted an online Public Survey (summer, 2024)
5. The Consulting team prepared an Enhanced Environmental Justice Report*:* Planning for Equitable Urban Tree Cover in Waterloo to guide engagement activities that address tree inequity (summer, 2024)
6. Participated in the City's Annual Service Centre Open House (June 8, 2024)
7. The City hosted a Tree Equity Event at the Albert McCormick Community Centre (August 24, 2024)
8. Draft Plan circulated to Indigenous and First Nations groups to elicit input to the UFMS.

3.2. What We Heard

3.2.1. Engagement Platform

In consultation with the Urban Forest Management Strategy's consulting team, the city's communications division created a project landing page on the city's online engagement platform, Engage Waterloo. The project landing page was entitled: Future of Trees in Waterloo. During the Period of May 1, 2024, to November 25, 2024, the project page had a total of 1600 visitors. Based on their level of engagement with the page, 271 of 1600 visitors (17%) were reported to be "engaged visitors", 586 of 1600 visitors (37%) were reported to be "informed visitors" and 1200 of 1600 visitors were reported to be "aware visitors".

3.2.2. Feedback Form

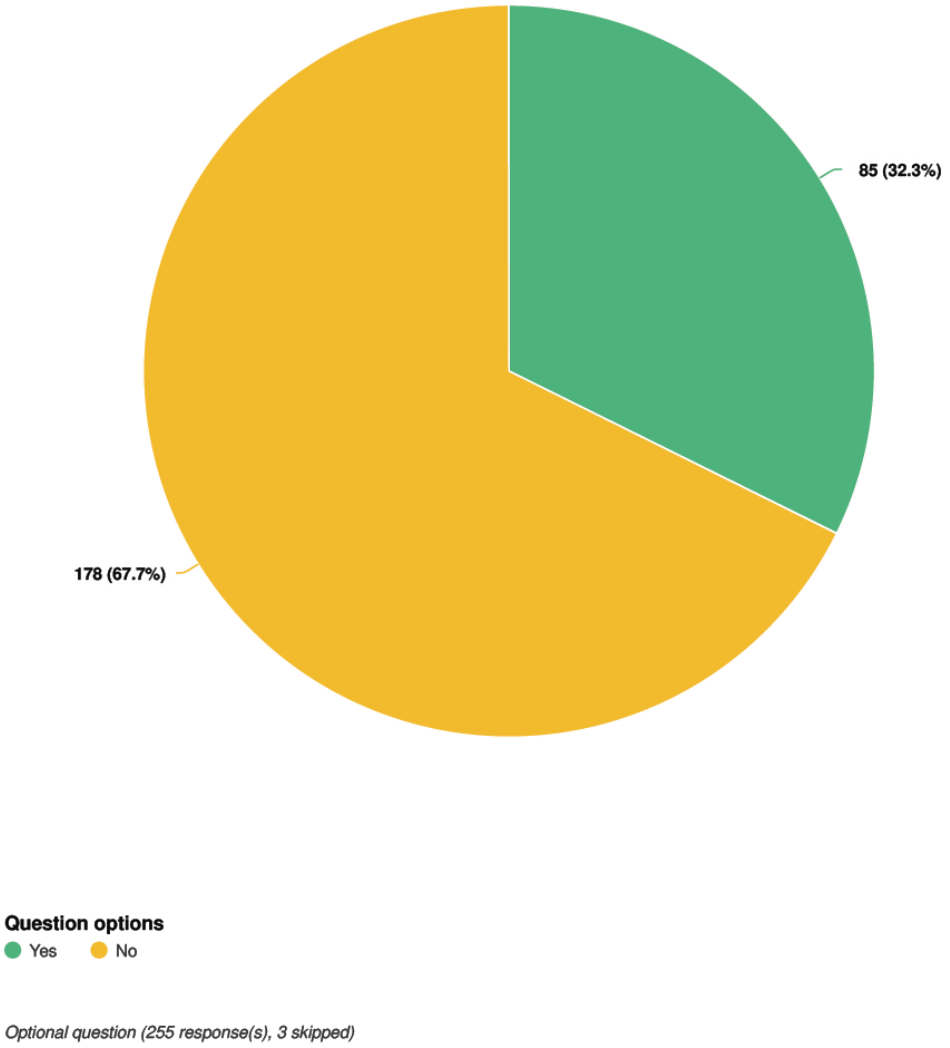
A feedback form was designed by the City of Waterloo's communications division due to the communications division's preference to create the form. The feedback form was comprised of three questions and was made available to the public through the city's *Engage Waterloo* online engagement platform. All promotion for the feedback form was done by the city's communications division. The feedback form was available online for the period of May 1, 2024 to November 25, 2024. During this period, there were 250 contributors and 258 contributions to the feedback form.

Below is a summary of the results of the city's feedback form:

Total responses: 258

Question 1: *Do you think there are enough trees in your neighbourhood?*

When asked "Do you think there are enough trees in your neighbourhood?" one hundred and seventy-eight of two hundred and fifty-five responses (68%) selected "No", while eighty-five of two hundred and fifty-five responses (32%) selected "Yes". Three responses skipped this question. See Graph 1 below.

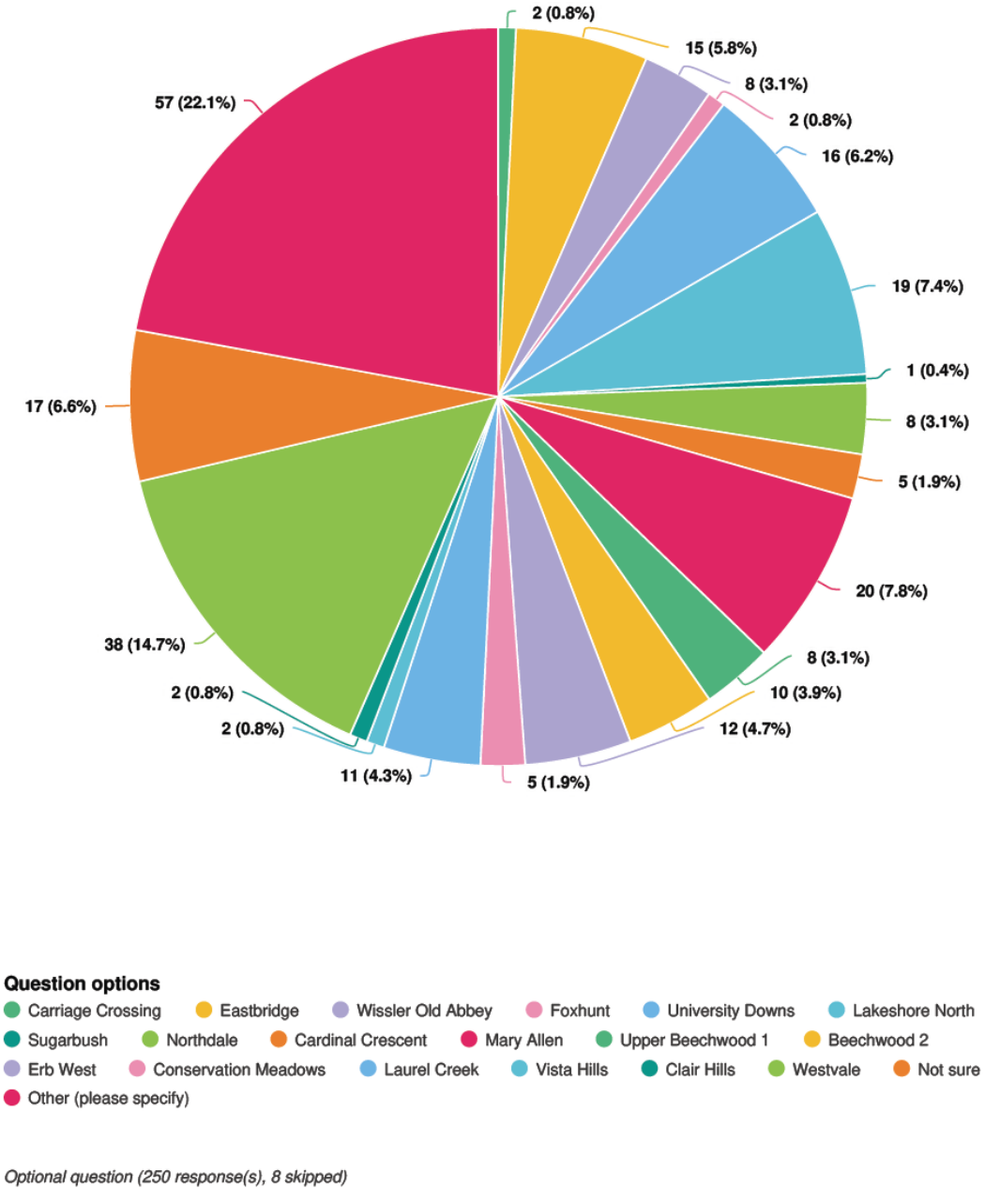


Graph 1. Responses to Question 1: Do you think there are enough trees in your neighbourhood? Source: Engage WR Survey – Future of Trees in Waterloo (May-November 2024)

Question 2: *What Waterloo neighbourhood do you live in?* (See map on main project page for reference.)

When asked “What Waterloo neighbourhood do you live in?”, eight of two hundred and fifty responses (3.1%) selected “Carriage Crossing”, ten of two hundred and fifty responses (3.9%) selected “Eastbridge”, twelve of two hundred and fifty responses (4.7%) selected “Wissler Old Abby”, five of two hundred and fifty responses (1.9%) selected "Foxhunt”, eleven of two hundred and fifty responses (4.3%) selected “University Downs”, two of two hundred and fifty (0.8%) selected “Lakeshore North”, two of two hundred and fifty responses (0.8%) selected “Sugarbush”, thirty-eight of two

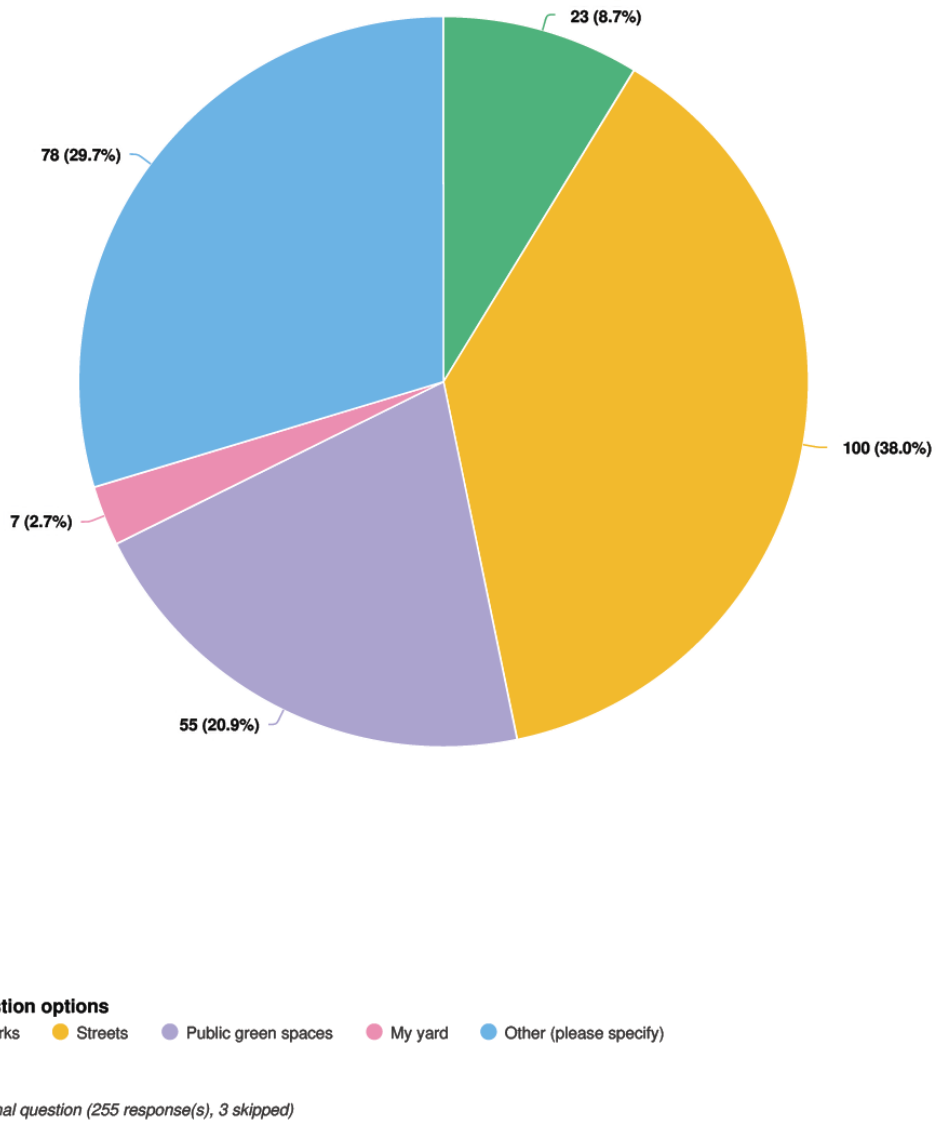
hundred and fifty responses (14.7%) selected "Northdale”, seventeen of two hundred and fifty responses (22.1%) selected "Cardinal Crescent”, fifty-seven of two hundred and fifty responses selected “Mary Allen”, two of two hundred and fifty responses (0.8%) selected "Upper Beechwood 1”, fifteen of two hundred and fifty responses (5.8%) selected “Beechwood 2”, eight of two hundred and fifty responses (3.1%) selected "Erb West”, two of two hundred and fifty responses (0.8%) selected "Conservation Meadows”, sixteen of two hundred and fifty responses (6.2%) selected "Laurel Creek”, nineteen of two hundred and fifty responses (7.4%) selected "Vista Hills”, one of two hundred and fifty responses (0.4%) selected "Clair Hills”, eight of two hundred and fifty responses (3.1%) selected "Westvale”, five of two hundred and fifty responses (1.9%) selected "Not sure”, twenty of two hundred and fifty responses (7.8%) selected “Other”. Eight responses skipped this question. See Graph 2 below.



Graph 2. Responses to Question 2: What Waterloo neighbourhood do you live in?
Source: Engage WR Survey – Future of Trees in Waterloo (May-November 2024)

Question 3: *Where would you like to see more trees?*

When asked “Where would you like to see more trees?”, one hundred of two hundred and fifty-five responses (38%) selected “Streets”, fifty-five of two hundred and fifty-five responses (21%) selected “Public Green Spaces”, twenty-three of two hundred and fifty-five (9%) respondents selected “Parks”, seven of two hundred and fifty-five responses (3%) selected “My yard”, and seventy-eight of two hundred and fifty-five responses (30%) selected “Other”. Three responses skipped this question. See Graph 3 below.



Graph 3. Responses to Question 3: Where would you like to see more trees?
Source: Engage WR Survey – Future of Trees in Waterloo (May-November 2024)

3.2.3. Idea Gallery

The City of Waterloo's communications division created an "Idea Gallery" on the city's Engage Waterloo online platform. The Idea Gallery invited public participants to share their ideas for the Urban Forest Management Strategy on a virtual gallery board where visitors to the page could see the ideas posted by others. There was an option for others to vote in favor of ideas posted in the gallery. The Idea Gallery was open from May 2024 to November 2024. During this period, there were a total of one hundred and thirty-four fourteen visitors to the Idea Gallery, and fourteen unique ideas were posted on the Idea Gallery.

Below is a list of ideas posted on the Idea Gallery, including the number of votes each idea received*:

- "Shrink parking lots, by replacing portions with green space."
    - Total votes: 5
- "Partner with schools to educate children and increase public awareness. Program could include planting trees in school yards."
    - Total votes: 5
- "Address the injustice that has been done by hydro infrastructure to the street tree canopy of older central neighbourhoods."
    - Total votes: 5
- "Prioritizing bike centric/public transit focused infrastructure that uses trees for traffic calming. Fewer cars on the road = more trees."
    - Total votes: 5
- "When a tree along a boulevard interferes with the power lines above it, move the power lines instead of cutting the tree."
    - Total votes: 3
- "Line the cities streets with large canopy trees in multiple varies. Helps with city appeal, wild life, shade, climate change and happiness."
    - Total votes: 3
- "Protect homes and trees: Install root barriers"
    - Total votes: 0
- "Stricter TPP, TPF, and Compensation Requirements"
    - Total votes: 3
- "Trees lining Laurel Creek on the Walmart Parking lot side (Bridgeport and Weber)."
    - Total votes: 2
- "Create more naturalized areas on the underutilized grasslands in our parks."
    - Total votes: 1

- “Encourage and educate on better tree care and management.”
    - Total votes: 2
- “Plant more edible plants”
    - Total votes: 1
- “Avoid invasive species.”
    - Total Votes: 0
- “Replace backyard wooden fencing with shrubs such as cedars or small fruiting shrubs. Templates for easy care backyard designs may aid also”
    - Total votes: 0

*For additional details posted for some of these ideas, please see the appendices for full Engage Waterloo Project Report.

3.2.4. Recommendations

The Urban Forest Management Strategy report considers this public feedback through the inclusion of recommendations required to “make space for trees”, including on streets and in public green spaces and parks, as well as in Uptown Waterloo. The Strategy also includes recommendations to enhance educational and outreach programming. Additionally, the Urban Forest Management Strategy report recommends interdepartmental collaboration to ensure trees are recognized and maintained as vital community infrastructure.

3.2.5 Indigenous and First Nations Consultation

The Six Nations of the Grand River and Mississaugas of the Credit River were contacted personally to discuss the project and the consultation process. A copy of the Draft UFMS with a supporting letter was then sent to each First Nations. Both First Nations were interested in the project and willing to provide feedback on the current draft of the UFMS. Williams & Associates met with the Mississaugas of the Credit River First Nation on April 1, 2025. A meeting with the Six Nations of the Grand is expected to occur in April 2026. Discussion results from both groups will be considered and incorporated into the final UFMS.

Other Indigenous and First Nations groups, in addition to Anishnabeg Outreach, will receive notice that this Draft UFMS is available online for comment. This input will be considered in development of the final UFMS submitted for City of Waterloo Council for approval/adoption.

CHAPTER 4

4. Strategic Framework: Vision, Guiding Principles, Goals & Objectives

The *Strategic Framework* (Figure 16) for Waterloo's UFMS consists of a Vision Statement for Waterloo's urban forest, 5 Guiding Principles, 5 Strategic Goals, 9 Objectives. These are translated into 34 Action Items in the *Action Plan* in Chapter 5.

4.1. Vision

The Vision Statement represents the desired state by the year 2047:

> Waterloo's urban forest, part of our community's green and social infrastructure, is an essential element of what makes us a sustainable community. A healthy and resilient urban forest will support a future-ready and equitable community for all. Through sound stewardship, our urban forest will be protected and enhanced for the benefit of all generations.

By the end of this planning period, all 25 Criteria & Indicators for Strategic Urban Forest Planning and Management (Chapter 2) should be at the 'good' or 'optimum' indicator level.

4.2. Guiding Principles

The Guiding Principles are based on Waterloo's values for its urban forest. They reflect that Waterloo believes in the importance of its urban forest. These principles are high-level, inspirational, and aspirational directions that guide the UFMS's actions and decisions. They are derived from the Sustainable Forest Initiative (SFI, 2024), as modified to reflect the unique conditions in Waterloo:

- Urban forests are vital for community well-being, health, resiliency, and sustainability.
- The benefits of urban forests should be accessible and available to everyone.
- Urban forests depend upon understanding, awareness, appreciation, stewardship, and engagement by communities and people in order to thrive.

- Urban forests require proper planning, care, and management to optimize benefits and minimize risks.
- Urban forests are nature-based solutions to pressing issues and essential green infrastructure.

4.3. Goals & Objectives

Goal 1. Maintaining: Manage the public tree as green and social infrastructure

In Ontario, the courts have set a standard of care for trees. ”Under English common law, there is a presumption that the owner of or the person responsible for a tree has what is termed a duty of care for that tree……. In general terms, the actions necessary to establish negligence require proof that a duty of care existed, that this duty of care has been breached in some manner, and that damage has resulted from this breach” (Dunster, 1997).

Objective 1.1 Maximize the public benefits derived from public trees and minimize the public expense.

“The pruning cycle is the number of years it takes to prune all the street trees in the community using programmed maintenance.....a pruning cycle of 5 years will produce optimum tree values” (Miller, 1998). It would also reduce the City’s tree risk management exposure. Waterloo used to have a proactive Tree Elevation and Corrective Pruning Program, but the budget was cut about half a dozen years ago. This situation has resulted in a sizable part of the City now requiring elevated levels of tree maintenance (Figure 3).

Objective 1.2 The design of the City’s urban fabric reflects elements that demonstrate people and trees need each other

Whether in a public park or a streetside cafe, people naturally gather under the shade of trees as social infrastructure. In recognition of this, a land use planning guideline has emerged called the “3-30-300 rule” (Konijnendijk van den Bosch, Cecil). It is the intention that applying the ‘3-30-300 rule’ will improve and expand the urban forest. From discussions with staff, it is appropriate to apply this rule as a guideline for community planning over City-controlled lands.

Objective 1.3 Fully account for the value of the urban forest in the Asset Management Plan

The current method of valuing city assets is based on their replacement value. Trees, as an asset class, appreciate over time and provide additional value through the ecological services they offer (i-Tree). After discussing with Asset Management staff, it was determined that the status quo is preferred.

Goal 2. Protecting: Ensure that trees and grey infrastructure coexist.

The urban forest in municipalities requires ongoing care and maintenance despite lack of provincial regulatory requirements. This is important not only to meet the expected 'standard of care' established by the Ontario court system but also to recognize that trees are a valuable municipal asset that appreciate in value over time. “Forest-grown trees are self-maintaining unless a specific forest management objective requires otherwise. Street trees, on the other hand, are forest trees and cultivars of forest trees transplanted to an alien environment, thus demanding intensive management (arboriculture) ...through cultural practices [which]...include pruning, fertilization, protection, cabling and bracing...[removals and emergency storm response]” (Miller, 1998).

Objective 2.1 Recognize trees as part of green and social infrastructure

To effectively manage trees as green infrastructure, it is crucial to recognize in corporate policy that public trees are infrastructure. Therefore, public trees should be planned and managed in conjunction with all other City of Waterloo infrastructure.

Objective 2.2 Eliminate Waterloo’s “UTC Gap”

Chapter 2 describes the unfavourable variance for UTC between where it should be and where it is projected to be in Waterloo. This can be solved by implementing the Strategic Framework detailed in Figure 16 to reduce Tree Equity differences.

Goal 3: Planting - Sow the seeds of success.

This UFMS involves planting new trees in locations where they can grow to their full size and thrive, rather than dying prematurely.

Objective 3.1 Design and construct space for growing large shade trees in the public realm through the creation of a formal mechanism to translate this vision into a built reality for Waterloo's urban fabric

The current approach to building cities doesn't accommodate trees well. It's more common to lack sufficient space for large shade trees rather than to have it. By incorporating requirements for adequate tree space into the municipal development application approval process, we can ensure that it becomes standard practice.

Objective 3.2 Ensure that trees and their benefits are available for everyone

People benefit from trees when they are close to each other (Nowak, 2015). This means that in order for all members of the community to enjoy a healthy tree environment, the distribution of an adequate urban tree canopy must be spread across all neighborhoods.

Goal 4. Collaboration: Planning in collaboration with all relevant City departments and agencies to sustain and enhance the urban forest.

The Corporation of the City of Waterloo is one of 444 municipalities in Ontario. Municipal governments are established by provincial statutes and are limited to powers granted by the province. "The Municipal Act is a consolidated statute governing the extent of powers and duties, internal organization and structure of municipalities in Ontario…Municipal governments are responsible for providing many of the services within their local boundaries that [people] rely on daily…" (AMO). These services include tree maintenance of municipal trees. Unlike some other municipal assets, the Regulations in this Act do not specify minimum maintenance standards for the municipal tree. This creates a challenge for Forestry budget requests as they must compete for funding against regulated services, which have statutory compliance requirements that prioritize their funding.

Objective 4.1 Cultivate a culture of collaboration towards the stewardship of Waterloo's urban forest

A single municipal department alone cannot sustainably manage an urban forest. Lessons learned identify the role that collaboration amongst key civic departments, as well as collaboration between the public and private sectors engaged in tree stewardship, is the path to realizing the Vision of this UFMS.

Objective 4.2 Measure and monitor the sustainability of the urban forest

This UFMS is based on Adaptive Management. This requires scheduled monitoring using Key Performance Indicators (KPI) to measure progress and adjust strategies and action items as needed. This approach has been built into the Operating Plan 2027-2031.

Goal 5. Environmental Justice: Our lens to view urban forest management to address current inequities.

Historically, urban forest management plans did not address who benefits from trees (Grant, 2022). This UFMS changes that narrative.

Objective 5.1 Aspire to attain Tree Equity throughout Waterloo

Sharing the ecological benefits of trees is a powerful way to promote environmental justice and serve the public good.

Objective 5.2 Form tree-related solid partnerships with the community

The collaboration between the City of Waterloo and its neighborhood-based tree organizations will play a vital role in achieving the tree planting targets on private properties as outlined in the UFMS. This partnership is crucial for the community's efforts to address Waterloo's Tree Canopy Gap.

4.4. Strategic Framework

The consulting team, with input from the City's project team, developed a *Strategic Framework* (Figure 16). It summarizes the Vision, Guiding Principles, Goals & Objectives and Action Items (Chapter 5) in one place.

Urban Forest Strategic Framework

VISION FOR THE URBAN FOREST

Waterloo's urban forest, part of our community's green and social infrastructure, is an essential element of what makes us a sustainable community. A healthy and resilient urban forest will support a future-ready and equitable community for all. Through sound stewardship, our urban forest will be protected and enhanced for the benefit of all generations.

GOALS

Maintaining: the public tree as green and social infrastructure	**Protecting:** trees and grey infrastructure coexist	**Planting:** Plant for success	**Planning:** Sustain and enhance the urban forest in collaboration with all relevant city departments	**Environmental Justice:** our lens to view the management of the urban forest to address current inequities

GUIDING PRINCIPLES*

Urban forests are vital for community well-being, health, resiliency, and sustainability.	Urban forests depend upon understanding, awareness, appreciation, stewardship, and engagement by communities and people to thrive.	Urban forests are nature-based solutions to pressing issues and essential green infrastructure.	Urban forests require proper planning, care, and management to optimize benefits and minimize risks.	The benefits of urban forests should be accessible to everyone. * Modified from The Forest Sustainability Initiative https://forests.org/wp-content/uploads/SFI_UCFSS_101_June7.pdf

Targets/Objectives

Pruning Cycle	*People need Trees*	*No Net Loss*	*Optimize the value of the ecological services provided by urban forest*	*Make Space for Trees*	*Trees for Everyone*	*Cultivate a culture of collaboration towards the stewardship of Waterloo's urban forest*	*City-wide Urban Tree Canopy (UTC)Target*	*Tree Equity*	*Trees thrive through community*
Phase-in a 5-Year pruning cycle for Waterloo's 31,893 street trees	Adopt the "*3-30-300 Rule*" * as a guideline for community planning over city-controlled lands * https://iucnurbanalliance.org/promoting-health-and-wellbeing-through-urban-forests-introducing-the-3-30-300-rule/	Formalize a Tree replacement policy* * the tree replacement ratio is subject to calculation by Development Engineering to provide a minimum of 350 trees/year to Forestry for to implement Waterloo's new *Conservation Tree* Bank ** Program ** http://phytosphere.com/treeord/treebank.htm	Increase the intrinsic value of the urban forest through increasing the number of bigger and healthier trees	Provide access to a minimum of *30 cubic meters of uncompacted soil per tree within the Public Realm*	Facilitate Community-based Urban Forest Workshops Develop incentives and programs for private tree planting and stewardship	Create a City Urban Forester position to lead the implementation of the Urban Forest Management Strategy	Sustain & Enhance 32.5 % UTC through 2050 and increase to 35 % UTC by 2070	The Priority Target Areas for Tree Equity (PTATE) map guides tree planting	The Priority Target Areas for Tree Equity Map guides tree planting

HOW: Action Items									
0-5 Years	5-10 Years	0-5 Years	5-10 Years	0-5 Years	5-10 Years	0-5 Years	5-10 Years	0-5 Years	5-10 Years
Reintroduce the proactive 5-year cycle maintenance program for city trees with the required resources. Establish a Forest Health Monitoring Program.	According to the "3-30-300 Rule," * every citizen should be able to: See at least 3 well-established trees in view from their home; Live in neighbourhoods with at least 30% UTC: Live no more than 300 metres from the nearest public green space. * https://naturecanada.ca/news/blog/the-urgency-and-opportunity-to-increase-the-access-of-all-canadians-to-urban-forests/	Apply the Tree Replacement Policy to Lands subject to certain Planning Act applications (e.g. Draft Plan of Subdivision, Site Plan) as well as to Public lands impacted by third-party construction projects, such as Utilities. Create a new corporate Tree Protection Permit linked to Municipal Consents.	Conduct a UTC Change Analysis every 5 years using i-Tree Canopy. * Conduct a UTC Study every ten years using i-Tree Eco. * * https://www.itreetools.org/	Plant 1,250 trees per year on Public lands through, in part, the new Conservation Tree Bank Program that converts 5% of the city's parkland from turf to trees. *Develop a mechanism to ensure trees are considered early in the planning and design process to guarantee minimum soil volume and adequate space for trees during the development application process.* *The mechanism supports Waterloo's UTC Targets.* *Embed and front-load mandatory regulatory code for minimum standards & specifications for soil as detailed in Waterloo's revised Urban Design Manual & revised Comprehensive Engineering and Landscape Manual and revised Zoning By-law*	Plant trees per year on Private lands through the new *Waterloo Strong Roots Outreach Program.* The Priority Target Areas for Tree Equity Map guides short-term tree planting.	Create the supporting high-level Policy Framework for Waterloo's urban forest in Phase 2 of the Official Plan Review: The public tree is an essential component of the public road allowance. Forestry added as a member of the Waterloo Utilities Coordinating Committee.	UTC Targets reflected in Phase 2 of Official Plan Review. Review and update the Criteria & Indicators for Sustainable Forest Managemen t Planning every 5 years.	Increase the score in the PTATE map by addressing inequity in the neighbourhoods with the lowest scores first. *Review & Update the PTATE map, as required, to contribute towards attainment of Waterloo's UTC Targets*	Launch the new *Waterloo Strong Roots Outreach* Program. Inspire citizen members of the new *Waterloo Strong Roots Outreach Program*

Figure 16. The Strategic Framework for Waterloo's UFMS.

CHAPTER 5

5. Action Plan

Translating the Goals and Objectives in the *Strategic Framework* into SMART Goals (specific, measurable, attainable, realistic and timely) is achieved using the following numbering system:

- Goal (first number),
- Objective (second number) and
- Action Item (third number).

Example: Action Item 1.1.1:

- Goal 1(Maintaining);
- Objective 1.1 (Maximize the public benefits derived from public trees and minimize the public expense in achieving these benefits
- Action Item 1.1.1 (Reintroduce the City's 5-Year Cyclical Tree Elevation & Corrective Tree Pruning Program)

5.1. Action Items

The cost associated with each Action Item is budgeted and prioritized in the *Operating Plan 2027-2031* (Table 8).

Action Item 1.1.1 Reintroduce the City's 5-Year Cyclical Tree Elevation & Corrective Tree Pruning Program.

During the background research phase of the Urban Forest Management Strategy, staff interviews were conducted in 2023. The purpose of these interviews was to generate discussions on how this project can assist staff in their work and to understand how the activities of different city departments affect trees (UFMS Background Technical Report, 2024). Our subsequent Report from the staff discussions identified "**Theme 1.** Staffing and resource levels are not sufficient to support Waterloo's public tree care management needs."

Divide the Forestry Zones into five (5) working areas with approximately equal volumes of annual pruning work. This annual pruning workload is approximately 6,379 trees based on the current number of City street-trees. The work consists of elevating low limbs and structural pruning to ensure the maturing tree grows structurally sound and is less susceptible to damage by storm events and eliminates conflicts with traffic (both sight lines and vehicular flow). It is proposed to contract out this work.

Action Item 1.1.2 Update and maintain the Municipal Tree Inventory.

It is recommended that the City inventory its public trees in developed acres (e.g., along roads and in facilities with a consistent set of attributes. The inventory should be updated at the time that any work is done on a tree; including pruning, planting and removal, such as when each municipal tree is pruned at the time of tree pruning. as part of the Tree Elevation and Corrective Pruning Program (Action Item 1.1.1). The inventory should be updated as work is done in the field using data collectors to upload the data to the City's GIS-based tree inventory. This process supports tree maintenance work and the green infrastructure components of City's Asset Management Plan.

Action Item 1.1.3 Complete Forest Inventory and Management Plans for the remaining City Woodlot properties.

The City of Waterloo owns approximately 405 hectares of woodlot park properties. As part of this UFMS project, W&A completed the forest inventory and developed forest management plans for 5 properties. The remaining balance, consisting of approximately 344 hectares, is outstanding.

Action Item 1.1.4 Convert capital funding for EAB to operational funding to support the removal and management on city woodlots

The Emerald Ash borer has killed most of the ash trees in the woodlot parks of the city. As these trees decay, they pose a risk of personal injury and property damage, depending on their location. It is important to remove them promptly. In some cases, a high concentration of dead and/or dying ash trees may require the temporary closure of a park.

Action Item 1.1.5 Update and revise The City of Waterloo's management philosophy for its environmental lands

The current Environmental Lands Acquisition and Maintenance Policy dates back to 1999 and follows a 'hands-off' (no intervention) approach. After significant forest health

problems (e.g., Emerald Ash Borer, Beech Bark Disease and Ice storms) and discussions with staff, it's clear that the policy should be updated to align with a pro-active, science-based approach.

Action Item 1.1.6 Planning for Storm Readiness

Storm events are becoming more frequent and severe. The impacts on urban forests are significant. This requires municipal Forestry Operations to prepare accordingly. Having an Emergency Storm Readiness Plan that is well-developed, rehearsed, and funded is now considered best practice. The process can begin internally using i-Tree Storm (www.itreetools.org/tools/i-tree-storm-legacy): “i-Tree Storm establishes a standard method to assess widespread damage immediately after a severe storm in a simple, credible, and efficient manner. This assessment method is adaptable to various community types and sizes, and it provides information on the time and funds needed to mitigate storm damage.”

Action Item 1.1.7 Reduce Insurance Claims and Risk

One of the impacts of the Emerald Ash Borer infestation in Waterloo is the buildup of unfunded liabilities in City-owned woodlots caused by thousands of dead and dying ash trees along public trails and near the backyards of residential properties. This issue requires urgent action to prevent future insurance claims related to the damage these trees might cause. Hiring additional qualified Arborists to maintain the City-owned woodlots is essential. Four seasonal Arborist staff are requested.

Action Item 1.1.8 Continue to work with the Agro-forestry industry

Periodically, the City collaborates with members of the local Mennonite community to assist in the management of City-owned woodlots. This mutually advantageous partnership should be sustained as circumstances permit.

Action Item 1.1.9 Reduce Forestry staff reliance for winter control operations.

Adding extra winter hires to the winter operations program allows forestry staff to stay focused on forestry tasks, improving efficiency and better handling service requests.

Action Item 1.2.1 Adopt the ‘3-30-300 rule’ as a guideline for community planning over city-controlled lands

This approach, used by municipalities in several Scandinavian countries, aims to expand the urban forest through land use planning at the neighbourhood level (Konijnendijk van den Bosch, 2021). This emphasizes the importance of comprehensive local planning for the urban forest. Waterloo should consider applying this approach to street trees and landscaping in Site Plan applications and Subdivisions.

Action Item 1.2.2 Create a comprehensive Complete Streets Policy 2.0 as recommended in The City of Waterloo Transportation Master Plan Update 2021.

During the background research phase of the Urban Forest Management Strategy, staff interviews were conducted in 2023. The purpose of these interviews was to generate discussions on how this project can assist staff in their work and to understand how the activities of different city departments affect trees. Our subsequent Report from the staff discussions identified the following ‘themes: **Theme 2.** There are strengths to build upon; **Theme 3.** Urban tree canopy cover is important to Waterloo and “**Theme 5**. Interdepartmental collaboration is the key to realizing the important role that urban tree canopy can play in reducing the impacts of Climate Change” (UFMS Background Technical Report, 2024).

Planning and Engineering staff play a fundamental role in the urban tree canopy. Why? Because these staff members create the site conditions for trees, especially public trees, they ultimately determine the quality and quantity of the urban tree canopy. This interdependence is reflected in Figure 17:



Figure 17. Urban Tree Canopy depends on City interdepartmental collaboration

To effectively manage the urban forest in Waterloo, coordination and collaboration among the following Departmental action items are required: Action Item 2.2.1, Action Item 2.2.4, Action Item 3.1.1, Action Item 3.1.2, Action Item 3.2.3, Action Item 4.1.2, and Action Item 4.1.4.

The focus of each department's actions aimed at achieving the corporate UTC targets outlined in this UFMS to realize positive tree canopy change is illustrated in Figure 18 (City of Kitchener).

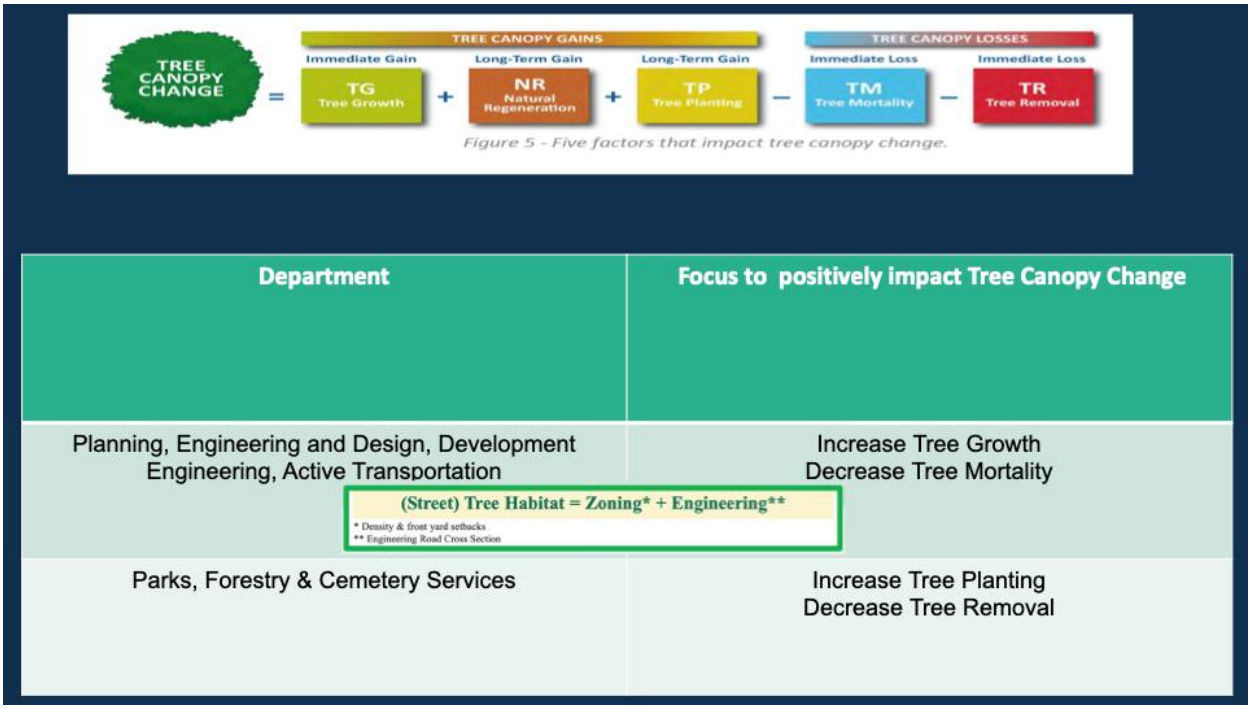


Figure 18. Departmental focus for positive Urban Tree Canopy change

Action Item 1.3.1 Change Forestry's 'Estimated Service Life' criteria in the Asset Management Plan based on site/location instead of based on tree species.

From discussions with Asset Management staff, the current method of using tree species to determine the 'estimated service life' needs to be changed to reflect that service life is influenced more by the site and/or the location of the tree rather than by the species of tree.

Updating the valuation method for trees in the Asset Management Plan to consider tree's ecological service value rather than just the replacement cost, perhaps using processes in the Guide for Plant Appraisal (CTLA, 2000) combined with the i-Tree model would more closely reflect its full value.

Action Item 1.3.2 Engineered soils and their associated volumes should be included in the Asset Management Plan and 'owned' by Forestry.

From discussions with Asset Management staff, it was emphasized that assigning the 'ownership' of both the engineered soils and the planted tree(s) to the same department is beneficial. Currently the ownership is divided among Forestry and other Departments.

Action Item 2.1.1 Update the 2004 Forestry Operations Manual to reflect current BMPs such as ANSI A300 Tree Care Standards.

After consulting with the Forestry Operations staff, it has been determined that an update to the City's technical arboricultural standards practiced by municipal tree maintenance crews is necessary.

Action Item 2.1.2 Update the Urban Forest Policy Manual 2011 and create a new policy and procedure for Tree Protection in the Construction Process.

This will primarily apply to third-party construction projects, such as Utility Capital Projects and infill land development. It will also apply to City-led capital projects (Public Works and Active Transportation) by creating and implementing a new corporate Tree Protection Permit associated with the Municipal Consent for third-party construction projects.

At present, the public tree is not protected during third-party construction projects. This leads to avoidable damage to city assets by construction crews working for utilities. This results in a negative impact on UTC across the city. The costs for remedial repair become a tax levy burden through Forestry Operations. The proposed solution is to expand the current city regulations on third-party construction (Municipal Consents) to also include the protection of the public tree. Implementing this new regulatory system would likely require a new staff member in Forestry, who is a Tree Protection Officer.

Action Item 2.1.3 Create a Heritage Tree By-law.

Tree by-laws are developed because municipalities realize that they need to have some control over the removal and planting of trees, in order to preserve urban tree canopy at the community level. With increasing awareness of the importance of urban trees, some municipalities have implemented tree by-laws to protect trees on private property that exceed a certain size. Different municipalities have different measurements to determine which trees are protected. For instance, in the City of Toronto, any tree with a diameter greater than 30 cm measured at 1.4 m above grade is protected under the Toronto Private Tree By-law (City of Toronto). Other examples can be found for the municipalities of Mississauga, Oakville, Brampton, Markham, Richmond Hill, and Burlington.

As the values trees provide increase exponentially as they grow, maintaining large trees in the landscape is an important part of achieving the greatest benefits from Urban Tree Canopy. A Heritage Tree By-Law would provide important protection for these trees,

while limiting the impact on the public and minimizing the administrative costs to the City. Implementing this new regulatory system would likely require a new staff member in By-law Enforcement.

A municipal policy scan by the University of Waterloo (Figure 19) examines the range of policies addressing urban trees across 17 municipalities. It recommends designating trees as Heritage Features (Webber et al, 2020).

Municipality	Official Plan	Private Tree By-law	Urban Design Guidelines	Urban Forest Management Plan
Ajax	✔	✔	✔	✔
Barrie	✔	✔	✔	
Cambridge	✔		✔	✔
Guelph	✔	✔	✔	✔
Kingston	✔	✔	✔	✔
Kitchener	✔	✔	✔	✔
Mississauga	✔	✔	✔	✔
Niagara Falls	✔		✔	✔
Oakville	✔	✔	✔	✔
Oshawa	✔		✔	
Peterborough	✔	✔		
St. Catharines	✔		✔	✔
Thunder Bay	✔		✔	✔
Toronto	✔	✔	✔	✔
Vaughan	✔	✔	✔	✔
Waterloo	✔		✔	
Windsor	✔			

Figure 19. Municipal Policy Scan, Source: Webber, Kaitlin, et. al, 2020.

Action Item 2.2.1 Development Engineering to establish the appropriate corporate 'tree replacement ratio' for new development applications to provide a minimum of 350 trees per year to Forestry.

The City of Waterloo aims to plant an average of 350 trees per year on public lands, in addition to the current 900 trees planted annually by Forestry. This initiative is part of the City's efforts to meet the targets set in the Waterloo Urban Forest Management Strategy (UFMS). To achieve this, a new program called the Waterloo Conservation Tree Bank Program will be created. These 350 new trees will be sourced from the development application process. The Development Engineering Department will oversee this process by formalizing the tree replacement ratio it currently applies to development applications. This initiative is associated with Action Item 3.2.3.

Action Item 2.2.2 Conduct an Urban Tree Cover Change Analysis every 5 years using i-Tree Canopy.

An Urban Tree cover change analysis, as the name implies, is simply a comparison of the tree canopy cover to note changes in UTC. UTC is one of the 25 metrics that Waterloo used to baseline is urban forest management performance- see *Criteria and Indicators for Sustainable Urban Forest Management* in Chapter 2. Monitoring UTC every 5 years will assist the City in tracking its progress toward attaining the UTC targets established in this UFMS. The best current tool to use is an online tool developed by the United States Forest Service (i-Tree).

Action Item 2.2.3 Conduct an Urban Tree Cover Study every 10 years using i-Tree Eco.

An urban tree cover study involves a detailed analysis of the form, function and value of the urban forest within a community. This study provides specific information about the types of trees present in the community, which is crucial for making decisions about managing the urban forest. The best current tool to use is an online tool developed by the United States Forest Service (i-Tree).

Action Item 2.2.4 Revise the Comprehensive Engineering and Landscape Manual to re-design that part of the City’s engineering road cross-section(s) to reflect adequate space for the public tree.

Enhance the site conditions for public trees by establishing standards for the minimum spacing and minimum volume of uncompacted healthy soil accessible by the public tree. This is particularly important in areas where streets are mainly covered by hard,

impervious surfaces. These changes aim to ensure the urban fabric is designed and built with at least 30 cubic meters of uncompacted soil for each public tree in a hard streetscape.

Action Item 3.1.1 Harmonize the Comprehensive Engineering and Landscape Manual and the Urban Design Manual to reflect trees as part of the City's Green Infrastructure.

Recognize that utilities and vehicular traffic must coexist in an environment that supports trees. To meet the City's UTC Targets outlined in this UFMS, any designated "landscape area" must be designed and built to support at least 32.5% UTC. If hardscape surfaces are present within this area, they must comply with the City's revised Comprehensive Engineering & Landscape Manual (CELM); this would involve meeting specific engineering standards for the minimum volume of uncompacted, healthy soil accessible to each tree- as detailed in the method outlined below. The City's revised CELM should contain standards and specifications that will:

1. Enhance the site conditions for public trees by establishing standards for the minimum spacing and minimum volume of uncompacted healthy soil accessible by the public tree. This is particularly important in areas where streets are mainly covered by hard, impervious surfaces. It is proposed that a tree should have access to a minimum of 30 cubic meters of uncompacted, healthy soil.
2. Recognize that utilities and vehicular traffic must coexist in an environment that supports trees;
3. Reflect collaboration with the Waterloo Utilities Coordinating Committee to ensure member compliance with the new Corporate Policy and Procedure, *Tree Protection in the Construction Process* (Action Item 2.1.2).

These changes aim to ensure the urban fabric is designed and built with at least 30 cubic meters of uncompacted soil for each tree in a hard streetscape.

Action Item 3.1.2 Amend the Zoning By-law to change the definition of a "landscape area" and provide standards for the minimum volume of uncompacted soil.

The definition of 'landscape area' needs to be revised because it currently allows for the applicant to build impervious hardscape such as interlock as a 'landscape feature.' To meet the City's UTC Targets outlined in this UFMS, any designated "landscape area" must be designed and built to support at least 32.5% tree canopy cover. If there are

hardscape surfaces within this area, they must comply with the City's updated engineering technical standards. This involves meeting specific criteria for the minimum soil volume of uncompacted soil that is accessible to trees, while also allowing for impervious surfaces. Chapter 2 contains more details.

Action Item 3.2.1 Develop incentives and programs for private tree planting and stewardship.

Many communities have partnerships between municipalities and local community tree planting organizations. Resources to help operate these programs are available (Tree Canada).

Action Item 3.2.2 Support planting of trees annually on private lands.

The City should use the Priority Target Areas for Tree Equity map as a guide to direct the efforts of a new neighborhood-based outreach program called "Strong Roots." This volunteer-based outreach program supported by the City will focus on planting trees on private lands (lands not owned by the City of Waterloo) and should try to aim to plant an average of 3,750 trees per year to help achieve the UTC targets outlined in this UFMS.

Action Item 3.2.3 Support planting an average of 1,250 trees annually on the City of Waterloo lands.

The City of Waterloo plans to plant an average of 350 more trees per year on public lands in addition to the current 900 trees planted annually by Forestry. This brings the combined annual total to 1,250 trees. Part of the tree planting initiative will involve naturalizing approximately 5% of the City’s parkland by converting turf areas into tree-covered spaces under the new Waterloo Conservation Tree Bank Program. This initiative is associated with Action Item 2.2.1.

Action 3.2.4 As part of the City's resilience strategy, scale-up green infrastructure projects by replacing impervious surfaces with trees and green spaces to mitigate costly flooding.

Trees mitigate storm events by capturing water runoff that contains harmful pollutants that are costly to clean. Stormwater management systems designed to emphasize green infrastructure solutions are effective (Figure 20).

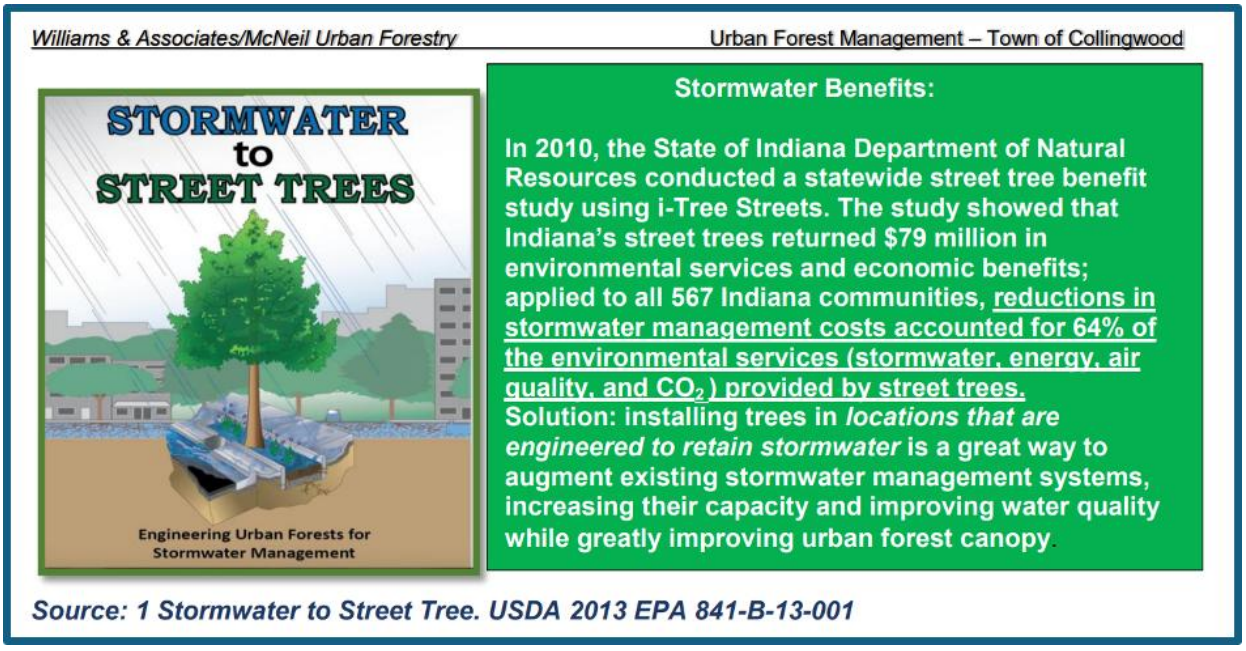


Figure 20. Stormwater benefits of street trees (USDA Forest Service(b), 2013)

Action Item 4.1.1 Create a City Forester position to lead the implementation of the Urban Forest Management Strategy.

The UFMS requires a leader for its implementation. Currently, the City does not have a registered professional forester with urban forestry expertise on staff. This new position would enhance efficiencies in Forestry by enabling the Forestry Supervisor to concentrate on arboriculture operations and would enhance collaboration efforts with key departments to achieve Waterloo's UTC Targets as outlined in this UFMS.

Action Item 4.1.2 Include Forestry as a member of the Waterloo Utilities Coordinating Committee and the Environmental Sustainability Team.

This would signify a commitment to integrating urban forestry management into utility planning and aligning and streamlining corporate initiatives.

This initiative is linked to Action Item 2.1.1, which has shown the importance of protecting public trees in third-party construction projects, including Utility Capital Projects and infill land development. By formalizing Forestry as a member of this Committee, Waterloo can strengthen relationships and knowledge to help achieve the UTC Targets outlined in this UFMS.

Action Item 4.1.3 The City to prepare a Business Case and enter discussions with Enova to explore the opportunity to transfer Hydro-Line Clearing Operations from Enova to the City of Waterloo.

Merging the yearly Hydro line clearing program with the City's annual tree pruning could be both economically advantageous and improve customer service, increasing efficiency in service delivery and tree care. For example, the Town of Oakville performs the annual hydro line clearing service for Oakville Hydro. To determine if this strategy suits Waterloo, the City should develop a Business Case and consult with Enova.

Action Item 4.1.4 The City should organize a series of interdepartmental sessions to collaborate and identify a list of City technical manuals that regulate various city business processes impacting the public tree.

The objective is to amend the appropriate city documents and processes to align with a new corporate policy and procedure for tree protection in the construction process.

This initiative is linked with Action Item 1.2.2, which has shown the importance of the interdependence amongst key departments for Waterloo to manage the urban forest effectively as reflected in these Action Items: Action Item 2.2.1, Action Item 2.2.4, Action Item 3.1.1, Action Item 3.1.2, Action Item 3.2.3, Action Item 4.1.2 and Action Item 4.1.4. Bringing all these key departments together to focus on the urban forest is an important step in achieving the UTC Targets outlined in this UFMS.

Action Item 4.2.1 During Phase 2 of Waterloo's Official Plan Review, Section 8.2.9 Urban Forests should be updated.

This update would include new policies which reflect:

1. The public tree as a crucial element of the public realm. The City will establish and enforce regulations to ensure that the public tree effectively occupies the public realm, including full stocking on the public road allowance in all projects approved by the City;

2. City-wide Tree Canopy Cover Target(s), UTC, as established in the Urban Forest Management Strategy (UFMS): 32.5% by 2050 and 35% by 2070 for public & private lands;

3. Trees are recognized as green and social infrastructure;

4. Creation of a Waterloo Green Standard to cover the development application process by making the tools to support the UTC Targets;

5. Tree Equity in support of Complete Community policies.

Action Item 4.2.2: Develop a mechanism to ensure trees are considered early in the planning and design process to guarantee minimum soil volume and adequate space for trees during the development application process.

The City should develop a mechanism to ensure that trees are considered early in the planning and design process, recognizing trees as a vital part of the public road allowance and other public and private spaces. One way to achieve this is by establishing a City Green Standard including a mandatory Tier 1 performance standard for all development applications. Another approach is to incorporate a revised Comprehensive Engineering and Landscape Manual (CE&LM) standard to reinforce the Urban Forest within the development application process. These strategies should be implemented by integrating and prioritizing the mandatory regulatory codes for minimum standards and specifications for uncompacted soil, as outlined in Waterloo's revised Urban Design Manual and revised CE&LM. This standard should adopt a formula-based approach (Zoning By-law, Chapter 2) to help reach the City-wide Tree Canopy Cover Target of 32.5% by 2050 and 35% by 2070. Additionally, include a checklist of requirements that developers must meet to qualify for reduced development fees as an incentive for compliance. An example is the City of Toronto's Toronto Green Standard – Tier 1 mandatory compliance of minimum soil volume for trees.

Action Item 4.2.3 Review and update the Criteria & Indicators for Sustainable Forest Management Planning every 5 years.
The 25 metrics that Waterloo used to establish the performance of its urban forest management need to be reviewed and updated periodically. It is recommended to do this on a five-year cycle. For more details, refer to the Criteria and Indicators for Sustainable Urban Forest Management in Chapter 2.

Action Item 5.1.1 Ensure that Tree Equity is a vital component of the UFMS.

This initiative is connected to Action Item 4.2.1, Official Plan update, and the proposed Green Standard in this UFMS. It serves as a means for the City of Waterloo to achieve Tree Equity.

Action Item 5.1.2 The Priority Target Areas for Tree Equity (PTATE) map guides tree planting priorities.

This initiative is connected to Action Item 3.2.2, planting trees per year on private lands, and Action Item 3.2.3, planting 1,250 trees per year on public lands, for the City of Waterloo to attain the UTC Targets outlined in this UFMS.

Action Item 5.2.1 Increase the score in the PTATE map by addressing inequity in the neighbourhoods with the lowest scores first.

The PTATE map developed by the Consulting Team will become a useful tool to support the City attain Tree Equity.

Action Item 5.2.2 Create a new Waterloo Strong Roots Outreach Program. This initiative is associated with Action Item 3.2.1 and highlights the significant role that private trees play in helping achieve the UTC Targets outlined in this UFMS.

5.2. Operating Plan 2027-2031

The 5-Year Operating Plan for 2027-2031, as detailed in Table 8, prioritizes and budgets all 38 Action Items required to achieve the Goals and Objectives outlined in Chapter 4. The preparation of the next 5-Year Operating Plan for 2032-2036 is also included in the schedule.

5-Year Operating Plan 2027-2031

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
Strategic Goal 1: Maintaining									
Objective 1.1 Maximize the public benefits derived from public trees and minimize the public expense									
1.1.1 Reintroduce the City's 5-Year cyclical Tree Elevation & Corrective Tree Pruning Program [32,000 trees/5-year cycle @ $75/tree]	*Parks, Forestry & Cemetery Services*			$480,000	$480,000	$480,000	$480,000	$1,920,000	-
1.1.2 Update and maintain the Municipal Tree Inventory	*Park, Forestry & Cemetery Services*			In-house				$0	
1.1.3 Complete the Inventory & Management Plans for the remaining City Woodlot properties	*Parks, Forestry & Cemetery Services*			$25,000	$20,000			$45,000	
1.1.4 Convert capital funding for EAB to operational funding to support the removal and management on city woodlots	*Financial Reporting*		$200,000	$200,000				$400,000	
1.1.5 Update and revise its management philosophy for its environmental lands	*Parks, Forestry & Cemetery Services*			In-house				$0	

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
1.1.6 Planning for Storm Readiness	*Forestry*			In-house				$0	
1.1.7 Reduce Insurance Claims and Risk	*Forestry*		$85,000	85,000	85,000	85,000	85,000	425,000	2,7
1.1.8 Continue to work with the Agro-forestry industry	*Forestry*							$0	
1.1.9 Reduce reliance on Forestry staff for winter control operations.	*Parks, Forestry & Cemetery Services*		$140,000	$140,000	$140,000	$140,000	$140,000	$700,000	1.3
Objective 1.2 The design of the urban fabric reflects the elements that people and trees need each other									
1.2.1 Adopt the 3-30-300 'Rule' as a guideline for community planning over city-controlled lands (e.g. street trees and the landscaping undertaken through Site Plan applications and Subdivisions)	*Planning*	Interdepartmental	In-house					$0	
1.2.2 Create a comprehensive Complete Streets Policy 2.0 as recommended in *The City of Waterloo Transportation Master Plan Update 2021* with 'appropriate attention ... to street trees/urban forestry' through Action Items 2.2.4, 3.1.1 and 4.1.4.	*Active Transportation*	Interdepartmental	In-house					$0	

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
Objective 1.3 Ensure to fully account for the value of the urban forest in the Asset Management Plan									
1.3.1 Change Forestry's 'Estimated Service Life' criteria in the *Asset Management Plan* based on site/location instead of based on tree species	*Asset Management*	Interdepartmental	In-house					$0	
1.3.2 Engineered soils and their associated volumes should be included in the *Asset Management Plan* and 'owned' by Forestry	*Asset Management*	Interdepartmental	In-house					$0	
Strategic Goal 2: Protecting									
Objective 2.1 Recognize trees as part of green and social infrastructure									
2.1.1 Update the 2004 Forestry Operations Manual to reflect current BMPs such as ANSI A300 Tree Care Standards	*Parks, Forestry & Cemetery Services*		In-house					$0	
2.1.2 Update the *Urban Forest Policy Manual 2011* and create a new policy and procedure - *Tree Protection in the Construction Process.*	*Parks, Forestry & Cemetery Services*	Interdepartmental		$85,000	$85,000	$85,000	$85,000	$340,000	1.0

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
2.1.3 Create a Heritage Tree By-law	*Parks, Forestry & Cemetery Services*		$85,000	$85,000	$85,000	$85,000	$85,000	$425,000	1.0
Objective 2.2 No net loss of UTC									
2.2.1 Development Engineering establish the appropriate corporate 'tree replacement ratio' for new development applications to provide a minimum of 350 trees per year to Forestry.	Development Engineering	Inter-departmental	In-house					$0	
2.2.2 Conduct an Urban Tree Cover Change Analysis every 5 years using i-Tree Canopy	*Parks, Forestry & Cemetery Services*						$10,000	$10,000	
2.2.3 Conduct an Urban Tree Cover Study every 10 years using i-Tree Eco	*Parks, Forestry & Cemetery Services*						$25,000	$25,000	
2.2.4 Revise the Comprehensive Engineering and Landscape Manual to re-design that part of the City's engineering road cross-section(s) to reflect adequate space for the public tree.	*Active Transportation*	Interdepartmental	In-house					$0	
Strategic Goal 3: Planting									

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
Objective 3.1 Design and construct space for growing large shade trees in the public realm through the creation of a formal mechanism to translate this vision into a built reality for Waterloo's urban fabric									
3.1.1 Harmonize the Comprehensive Engineering and Landscape Manual and the Urban Design Manual to reflect trees as part of the City's Green Infrastructure.	Development Engineering	Interdepartmental	In-house					$0	
3.1.2 Amend the Zoning By-law to change the definition of a "landscape area" and provide standards for the minimum volume of uncompacted soil.	*Planning*	Interdepartmental	In-house					$0	
Objective 3.2 Ensure that trees and their benefits are available for everyone									
3.2.1 Develop incentives and programs for private tree planting and stewardship	*Parks, Forestry & Cemetery Services*		In-house					$0	

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
3.2.2 Support planting trees annually on private lands	*Parks, Forestry & Cemetery Services*		In-house					$0	
3.2.3 Support planting an average of 1,250 trees annually on the City of Waterloo lands	*Parks, Forestry & Cemetery Services*		In-house					$0	
3.2.4 Scale up green infrastructure projects by replacing impervious surfaces with trees and green spaces to mitigate costly flooding as part of the city's resilience strategy	Development Engineering	Interdepartmental	In-house					$0	
Strategic Goal 4: Planning									
Objective 4.1 Cultivate a culture of collaboration towards the stewardship of Waterloo's urban forest									
4.1.1 Create a City Forester position to lead the Urban Forest Management Strategy implementation	*Strategic Initiatives*	Interdepartmental	$105,000	$105,000	$105,000	$105,000	$105,000	$525,000	1.0

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
4.1.2 Forestry's inclusion as a member of the Waterloo Utilities Coordinating Committee and the Environmental Sustainability Team	Development Engineering	Interdepartmental	In-house					$0	
4.1.3 The City prepares a Business Case and enters discussions with Enova	*Forestry*	Interdepartmental				In-house		$0	
4.1.4 The City organizes a series of interdepartmental sessions to collaborate and identify a list of City technical manuals that regulate various city business processes.	*Forestry*	Interdepartmental	In-house					$0	
Objective 4.2 Measure and monitor the sustainability of the urban forest									

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
4.1.2 Forestry's inclusion as a member of the Waterloo Utilities Coordinating Committee and the Environmental Sustainability Team	Development Engineering	Interdepartmental	In-house					$0	
4.1.3 The City prepares a Business Case and enters discussions with Enova	*Forestry*	Interdepartmental				In-house		$0	
4.1.4 The City organizes a series of interdepartmental sessions to collaborate and identify a list of City technical manuals that regulate various city business processes.	*Forestry*	Interdepartmental	In-house					$0	
Objective 4.2 Measure and monitor the sustainability of the urban forest									

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
4.2.1 In Phase 2 of *Official Plan* Review, Section 8.2.9 Urban Forests should be updated	*Planning*	Interdepartmental	In-house	In-house				$0	
4.2.2 Create a Waterloo Green Standard for all development applications to ensure adequate space for trees in the planning and design process.	*Planning*	Interdepartmental	In-house	In-house				$0	
4.2.3 Review and update the Criteria & Indicators for Sustainable Forest Management Planning every 5 years	*Parks, Forestry & Cemetery Services*						In-house	$0	
Strategic Goal 5. Environmental Justice									
Objective 5.1 Aspire to attain Tree Equity throughout Waterloo									
5.1.1 Ensure that Tree Equity is a vital component of Action Item 4.2.2	*Planning*						In-house	$0	
5.1.2 The Priority Target Areas for Tree Equity (PTATE) map guides tree planting priorities	*Parks, Forestry & Cemetery Services*		In-house					$0	

Action Item	Lead	Partners	2027	2028	2029	2030	2031	2027-2031 Total	# of FTE
Objective 5.2 Form tree-related solid partnerships with the community									
5.2.1 Increase the score in the PTATE map by addressing inequity in the neighbourhoods with the lowest scores first	*Parks, Forestry & Cemetery Services*						In-house	$0	
5.2.2 Create a new *Waterloo Strong Roots Outreach Program.*	*Parks, Forestry & Cemetery Services*			In-house				$0	
Total			**$570,000**	**$800,000**	**$755,000**	**$755,000**	**$790,000**	**$4,795,000**	**7.0**

Table 8. 5-Year Operating Plan for the period 2027-2031

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