PEEL REGION URBAN FOREST BEST PRACTICE GUIDE 3

Guide for Tree and Shrub Standards and Specifications for Regional Roads in Peel

OCTOBER 2021

BRAMPTON Flower City
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TOWN OF CALEDON

MISSISSAUGA

Region of Peel
working with you

Credit Valley Conservation
inspired by nature

Toronto and Region Conservation Authority

Peel Region Urban Forest Best Practice Guide 3

Guide for Tree and Shrub Standards and Specifications for Regional Roads in Peel

October 2021

Working together as part of the Peel Climate Change Partnership

Acknowledgments

This guide is the third in a series of five deliverables developed for Peel Region and its partners as part of the Peel Region Urban Forest Best Practices project. This guide, like all the deliverables for this project, has been developed collaboratively with input and guidance from members of the Project Team, Peel Urban Forest Working Group, Peel Climate Change Partnership and other urban forestry and arboriculture professionals. Specific thanks are extended to:

- REGION OF PEEL: Heather Hewitt, Mark Head, Samantha Paquette, Liz Brock, Chris Despins
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- TOWN OF CALEDON: Nick Pirzas
- CREDIT VALLEY CONSERVATION (CVC): Rod Krick, Yvette Roy
- TORONTO AND REGION CONSERVATION AUTHORITY (TRCA): Michelle Sawka, Noah Gaetz

This guide has been developed collaboratively by Landscape Architects, Arborists and Ecologists from Beacon Environmental Limited (Todd Smith, Margot Ursic, Stephan Crispin, Ash Baron, Dan Westerhof, Natasha Collins) with support from Jana Joyce and Mike Hukezalie at the MBTW Group.

Sincere thanks are also extended to Urban Forest Innovations for sharing details related to current practices in Brampton collected as part of their Urban Forest Management Plan.

While every attempt has been made to include current information in an accurate manner, the authors from Beacon take responsibility for any errors or omissions.

Disclaimer

The guidance provided in this document is primarily intended for street and park trees in the Region of Peel and its local municipalities (i.e., the Town of Caledon, City of Brampton and City of Mississauga) as their urban forest planning evolves both in anticipation of and in response to shifts associated with climate change. Aspects of this guidance may be applicable to trees in natural areas and to other urbanizing areas in southern Ontario and beyond.

The guidance in this document is intended to serve as a resource for application at the user's discretion; it does not reflect the position or direction of any of the partner agencies listed above.

Cover image credit: City of Brampton

Executive Summary

Unlike some other upper tier governments, the Region of Peel does not own or manage any forested areas. The urban forest assets under the Region's jurisdiction are limited to trees along regional rights-of-way and on landscaped areas associated with regional properties. Consequently, until recently, the Region has largely relied on its local municipalities (i.e., Caledon, Brampton and Mississauga) to lead most of the ongoing urban forest planning and management. However, over the past decade the Region has started to take a more active role in regional urban forest matters.

More recently, in response to the direction to increase green infrastructure as part of the Peel Climate Change Partnership's mandate (2018 – 2022), the Region has begun exploring ways of improving and expanding its urban forestry operations. Two key considerations in this regard include: (1) the potential for the Region to establish its own urban forestry program able to both review proposed landscaping along the Region's Rights-of-way and oversee the maintenance and management of trees established in regional Rights-of-way (as well as on other municipal properties), and (2) having both operational procedures and tree standards and specifications related to trees in regional Rights-of-way that build on local municipal practices and also align, to the extent feasible, with applicable best practices. This report is intended to provide specific and technical guidance that Regional staff can adopt as they develop and implement an urban forestry program focussed on maintaining and enhancing the Regions' treed assets.

Currently in Peel there are various operating procedures among the three local municipalities as well as a range of standards and specifications. The 2012 Peel Region Urban Forest Strategy has as one of its guiding principles: "*Improved communication and coordinated action will result in a more informed, streamlined, and effective approach to urban forest management*". This principle can be realized for regional and local municipal Rights-of-way by having and implementing Region-wide standards and specifications for use by all departments and contractors working in these contexts.

The land use context for this report is the current and future urbanization of the Region, primarily south of the Niagara Escarpment. Urbanization brings specific challenges to managing, planting and establishing trees and shrubs. These include the need to: manage drainage where impervious surfaces are being expanded, provide appropriate soil qualities and volumes, and mitigate the potential impacts of wind, salt, heat, and other stressors. The potential impacts of many of these stressors are compounded or exacerbated by climate change. This report includes standards that reflect a synthesis of best practices already being implemented by local municipalities in Peel and some suitable best practices from other nearby urban jurisdictions and/or locally appropriate sources. These standards are intended to help ensure that the urban forest is able to survive, and even thrive, under future climate conditions.

This report:

- reviews current tree establishment and maintenance standards and specifications from within the Region of Peel (Peel, Mississauga, Brampton, Caledon)

- ascertains consistent approaches and best practices from amongst standards and specifications from within Peel
- notes best practices from other urban jurisdictions and sources in southern Ontario (e.g., City of Toronto, York Region, Landscape Ontario and the Canadian Landscape Standard), and
- based on consideration of the above, recommends tree and shrub standards and specifications for all regional lands including rights-of-way geared towards building climate-resilience.

These recommendations are intended to build on and support the use and implementation of the Region's Streetscaping Toolbox (2017) with specific recommended standards and specifications related to tree establishment and maintenance for various types of roads and built contexts in Peel's urban areas.

Section 2 provides an overview of the administrative structures and municipal resources allocated to urban forestry across the municipalities of the Region to inform how the Region might enhance and expand its in-house urban forestry capacity, while also supporting the implementation of a consistent set of practices for optimizing the establishment and growth of trees on rights-of-way in a context of climate crisis and increasing urbanization.

Section 3 provides a list of woody plant standards and specifications being considered in the assessment of current and best practices. This comprehensive list of standards and specifications is organized to reflect the chronology and processes of successful tree planting and establishment.

Section 4 compares each of the listed standards and specifications across the municipalities in Peel to inform an amalgamated set of standards for the Region. A detailed comparison table is provided in Appendix A.

Finally, Section 5 presents a summary of recommended directions for Peel Region based on:

- the review of existing practices
- input from local municipal and agency staff involved in tree establishment and maintenance
- consideration of best practices from other comparable jurisdictions (see Appendix B), and
- consideration of the biophysical, land use and socio-cultural context in Peel's urban areas.

This the third in a series of five guidance documents developed as part of the Peel Region Urban Forest Best Practices project. The purpose of this project was to help sustain and expand tree cover in Peel's urban areas where it can provide benefits to the greatest number of people while also contributing to climate change mitigation and adaptation. The guides in this series are as follows:

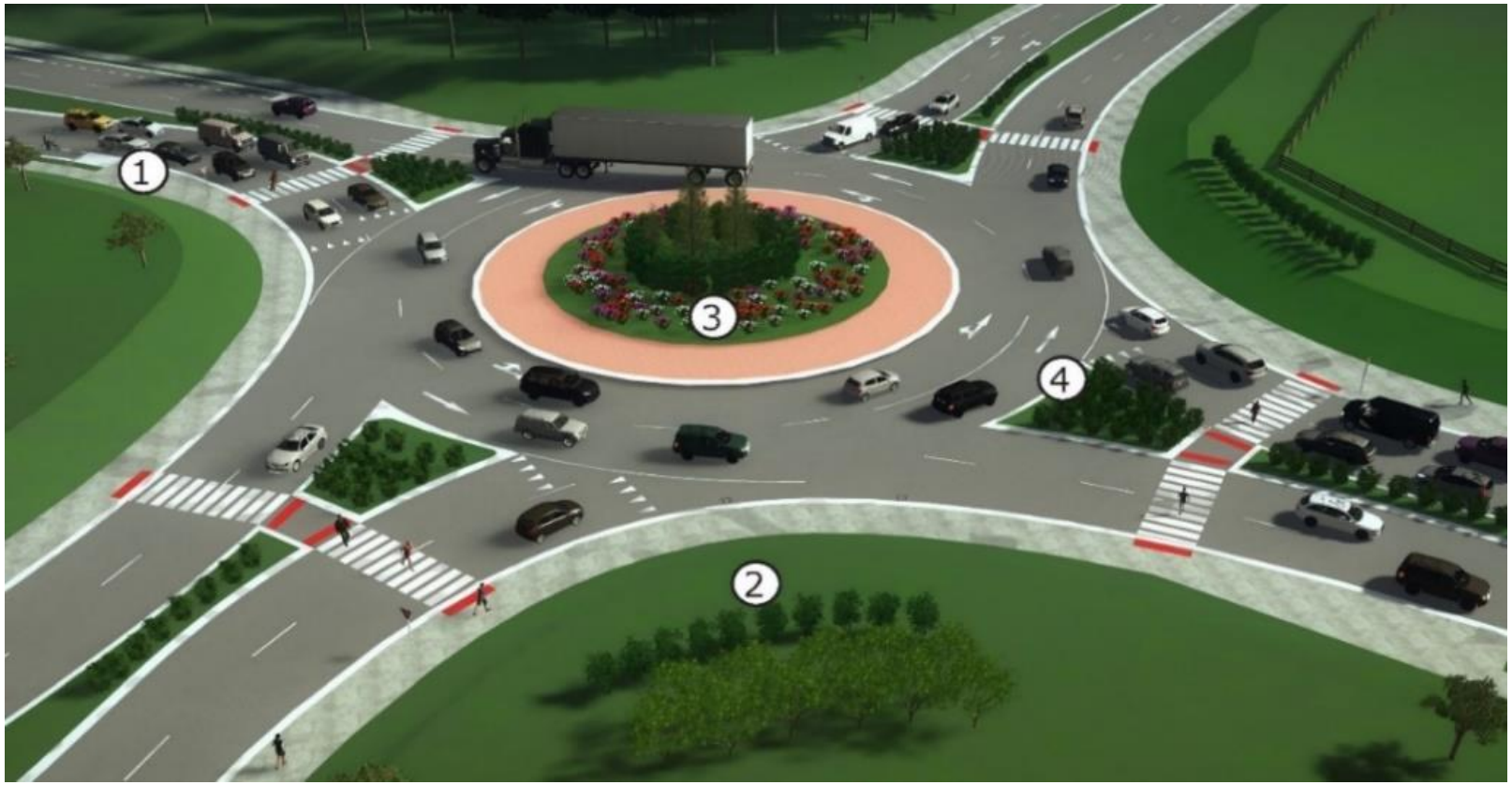
1. Guide 1: Best Practices Guide for Urban Forest Planning in Peel
2. Guide 2: Urban Forest Management Best Practices Guide for Peel
3. Guide 3: Guide for Tree and Shrub Standards and Specifications for Regional Roads in Peel
4. Guide 4: Potential Street and Park Tree Species for Peel in a Climate Change Context, and
5. Guide 5: Working with Trees: Best Practices for a Resilient Future.

Contents

Tables

Figures

Appendices



Credit: Streetscaping Toolbox Update (Region of Peel and CVC 2017)
Hypothetical roundabout design with landscaping

1. Introduction

Peel Region and its partners (i.e., the City of Mississauga, City of Brampton, Town of Caledon, Toronto and Region Conservation Authority [TRCA] and Credit Valley Conservation [CVC]) have been collaborating on various urban forest and climate change initiatives for well over a decade. These partners are currently collaborating through the Peel Climate change Partnership to implement the Community Climate Change Partnership Plan (2018 - 2022) which includes a specific strategy (#3) to: "*Increase the number of healthy trees in priority areas to reduce public health risk and enhance social and environmental outcomes*". Peel's Climate Change Master Plan 2020 - 2030 also includes a specific task (14.3) for implementing a "*tree planting and management program for new and existing trees*".

This guide is intended to provide specific information and guidance for Peel and its local municipalities to facilitate the streamlining and, where appropriate, improvement of tree establishment and maintenance practices along road rights-of way with the objective of increasing the number of healthy trees on these municipal lands in a context of urbanization and climate change.

Unlike some other upper tier governments, the Region of Peel does not own or manage any forested areas. The urban forest assets under the Region's jurisdiction are limited to trees along regional ROW and on landscaped areas associated with regional properties. Consequently, until recently, the Region has largely relied on its local municipalities (i.e., Caledon, Brampton and Mississauga) to lead most of the ongoing urban forest planning and management. However, over the past decade the Region has started to take a more active role in regional urban forest matters.

More recently, in response to the direction to increase green infrastructure as part of the Peel Climate Change Partnership's mandate, the Region has begun exploring ways of improving and expanding its urban forestry operations. Two key considerations in this regard include: (1) the potential for the Region to establish its own urban forestry program able to both review proposed landscaping along the Region's rights-of-way and oversee the maintenance and management of trees established in regional rights-of-way as well as on other municipal properties, and (2) having both operational procedures and tree standards and specifications related to trees in regional rights-of-way that build on local municipal practices and also align, to the extent feasible, with applicable best practices. This report is intended to provide context and recommendations for moving Regional urban forestry operational procedures and tree standards and specifications forward.

This the third in a series of five guides developed as part of the Peel Region Urban Forest Best Practices project. The purpose of this project was to provide guidance that will help sustain and expand tree cover in Peel's urban areas where it can provide benefits to the greatest number of people while also contributing to climate change mitigation and adaptation. The guides in this series are:

- Guide 1: Best Practices Guide for Urban Forest Planning in Peel

- Guide 2: Urban Forest Management Best Practices Guide for Peel
- Guide 3: Guide for Tree and Shrub Standards and Specifications for Regional Roads in Peel
- Guide 4: Potential Street and Park Tree Species for Peel in a Climate Change Context, and
- Guide 5: Working with Trees: Best Practices for a Resilient Future.

Unlike the other four guidelines, this document does not focus on best practices *per se*. Rather, it focusses on a comparison of existing practices among the municipal partners related to tree establishment and maintenance and considers selected relevant best practices from other jurisdictions and sources. Broader guidance on best practices drawn from the research and engagement undertaken is provided in the other guides.

Although this guide is primarily intended for the Region of Peel, the local municipalities in Peel are encouraged to continue to work with the Region as it expands its urban forestry capacity to align levels of service, standards and specifications across Peel's urban areas with identified targets and best practices.

The specific objectives for this report were as follows.

1. Provide an overview of current standard operating procedures (SOP) and levels of service (LOS) in the Region and its local municipalities as they pertain to urban forest management standards and specifications related to the built environment and public rights-of-way in particular (Section 2).
2. Identify the categories of woody plant standards and specifications to be considered in the assessment of current practices and best practices (Section 3).
3. Review and compare current woody plant standards and specifications in Peel focusing on the regional ROW context (Section 4).
4. Provide a summary of recommended SOPs, LOS, tree and shrub standards and specifications for trees in the urban areas (Section 5).

Recommended SOPs, LOS, tree and shrub standards and specifications have been identified with consideration for:

- current practices (see Appendix A) and relevant examples and best practices from other jurisdictions in the GTA (see Appendix B and the Urban Forest Management Best Practices Guide for Peel)
- input from the municipal and agency staff involved in overseeing and implementing these practices
- relevant information gleaned from external experts, and
- the consulting team's experience.

The focus of this guide is on urban forest natural assets in the built environment, with a specific interest in standards and specifications for tree establishment and maintenance along rights-of-way and other regional properties with individual trees. Practices and management related to wooded natural areas is not addressed in this guide.

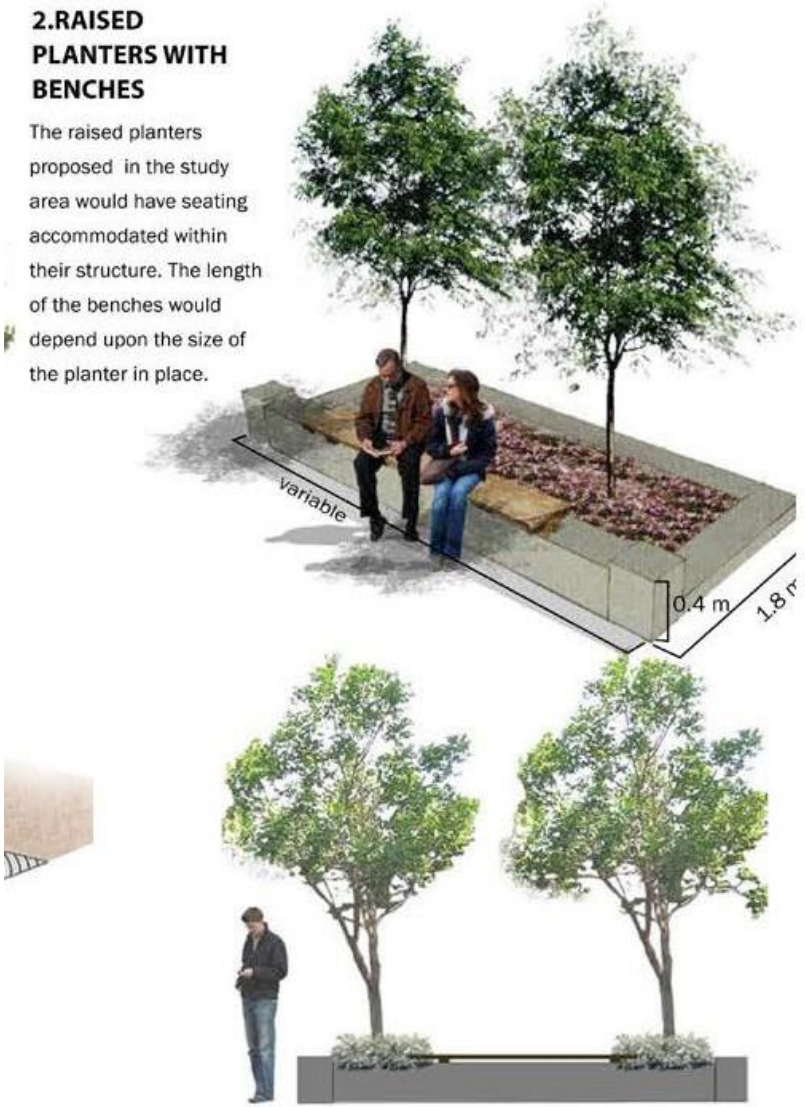
Trees in public rights-of-way are increasingly recognized as valued green infrastructure and municipal assets. However, any planning and resources directed towards getting trees and shrubs into the ground is wasted if an appropriate level of effort and attention is not invested in providing conditions and care that support their short-term establishment and long-term sustainability.

In recognition of the need to optimize streetscaping in Peel to support active transportation, place-making and community sustainability, the Streetscaping Toolbox Update (Region of Peel and CVC 2017) was developed to align with Peel's Road Characterization Study (Region of Peel 2013). This Toolbox provides streetscaping guidance for studies ranging from Master Plans and Environmental Assessments to site-specific land use plans and road construction projects. This guide is intended to build on and support the use and implementation of the Toolbox with specific recommended standards and specifications related to tree establishment and maintenance along various types of roads and other built contexts.

Although it may not be feasible for Mississauga, Brampton, Caledon and Peel to adopt all the recommendations in this guide, they are intended to serve as targets to work towards as opportunities and resources permit.

These standards and specifications recommended in this guide are also best implemented in conjunction with the best practices related to site assessment, stock selection and procurement, and tree / shrub establishment, as provided in the Urban Forest Management Best Practices Guide for Peel.

Until you dig a hole, you plant a tree, you water it and make it survive, you haven't done a thing. You are just talking.
Wangari Maathai



Credit: The MBTW Group 2019

Figure 1-1. Conceptual raised planters for urban streetscape

2. Forestry Procedures and Service Levels for Rights-of-way in Peel

Improved communication and coordinated action will result in a more informed, streamlined, and effective approach to urban forest management.

Peel Region Urban Forest Strategy (2011)

In Peel, the administrative structures and municipal resources allocated to urban forestry range widely between Peel, Caledon, Brampton and Mississauga. This difference is, at least in part, a reflection of the differences in municipally owned and managed treed assets among those jurisdictions. Both Mississauga and Brampton manage over 250,000 street trees and many hectares of municipal wooded natural areas, whereas Caledon has includes many forested areas but has many fewer trees to manage in its urban centres, and the Region currently does not own or manage any forests and is responsible for about 15,000 trees in its rights-of-way.

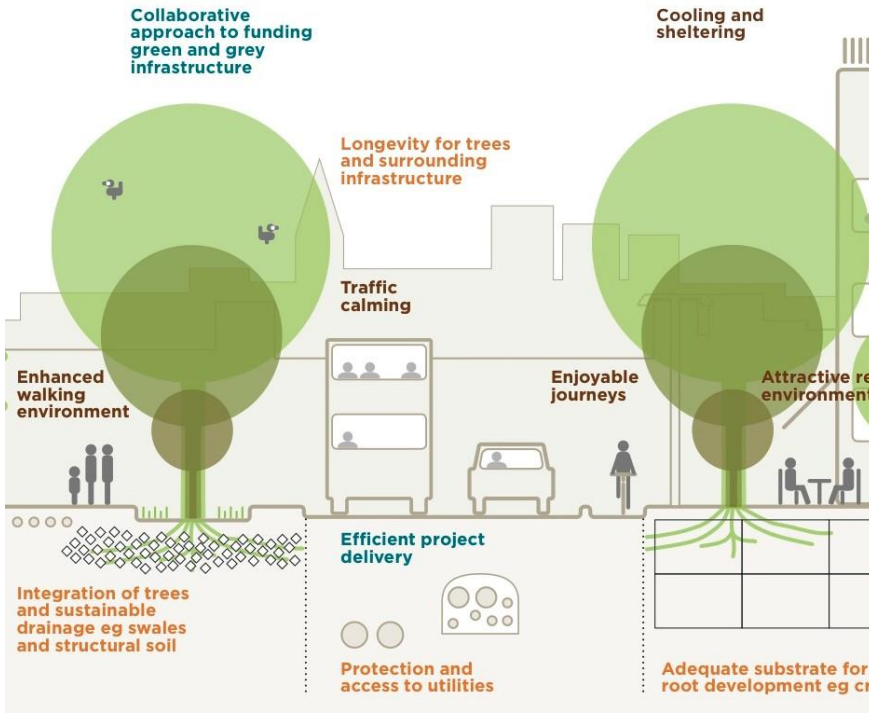
However, one thing all four municipalities have in common is that they are responsible for the planning, establishment and maintenance of trees on municipal lands, including rights-of-way. Although the Region has historically delegated the responsibility for trees in its rights-of-way to the local municipalities, over the past decade or so the Region has begun to reassume this responsibility as part of its leadership role with respect to climate change in Peel.

As part of this shift, the Region is seeking to enhance and expand its in-house urban forestry capacity, while also supporting the identification of a consistent set of practices for optimizing the establishment and growth of trees in municipal rights-of-way in Peel.

Effective urban forest management is by its nature necessarily multi-disciplinary and requires coordination between Planners, Engineers, Landscape Architects, Urban Designers / Architects and Arborists / Urban Foresters. In municipal rights-of-way, particularly in predominantly hardscape urban contexts, the importance of this coordination is paramount because, as illustrated in Figure 2-1, successfully establishing trees able to provide community services requires:

- a collaborative approach to planning for both green and grey infrastructure
- consideration for adequate above-ground space, drainage, rooting substrate and below-ground space for trees
- allocation of above-ground space for active and passive transportation / social activities, and
- accommodation of space and access for below-ground utilities.

Therefore, streamlining municipal urban forestry processes related to rights-of-way in Peel can provide a basis for streamlining levels of service, standards and specifications for other aspects of urban forestry in Peel. This section focusses on providing an overview of the framework and processes currently in place in each municipality in relation to their street trees (Sections 2.1 through 2.4) and makes some preliminary recommendations for streamlining this process (Sections 2.5).



Credit: Trees & Design Action Group (2019), http://www.tdag.org.uk/

Figure 2-1. Green infrastructure opportunities and challenges

2.1 Comparison of Municipal Forestry Processes for Rights-of-way in Peel

REGION OF PEEL

The planning and design process in Peel for road creation and upgrades generally includes the following (Region of Peel and CVC 2017, Region of Peel 2013).

- Consistency with the Region's Long-Range Transportation Plan (LRTP).
- Development and approval of the conceptual design through an Environmental Assessment (EA) process (typically including Indigenous engagement and a public process).
- Consultation with the appropriate local municipality and agencies to ensure compliance with applicable policies and regulations.
- Consultation with local utilities providers (i.e., through the Public Utility Co-ordinating Committee (PUCC)) to ensure as many trees as possible are incorporated while still meeting clearance requirements.
- Finalization of detailed designs, including landscaping where incorporated, with input from municipalities.
- Development and release of the contract and tender.
- Supervision of implementation of the design.

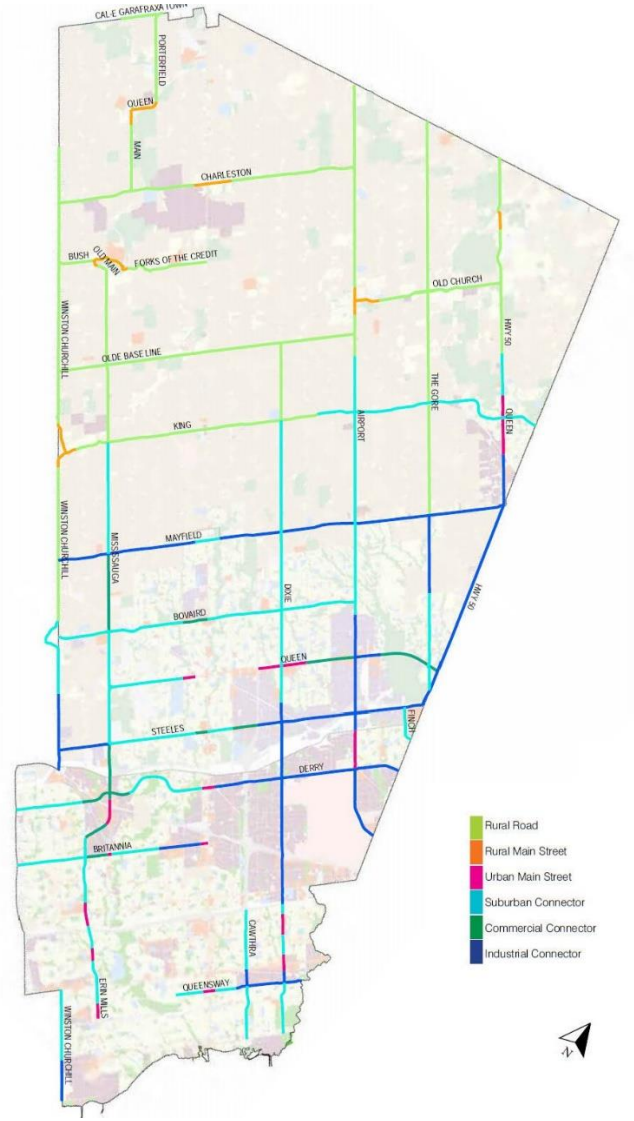
The 2017 Streetscaping Toolbox Update developed by the Region with assistance from CVC includes planning and design guidance as well as illustrative cross sections for each of the six regional road typologies in Peel, as summarized in Table 1 and illustrated in Figure 2-2. In the urban areas (which are the focus of this report), the road types are generally four to six lanes wide and intended to accommodate sidewalks of

at least 1.5 m plus furnishings, a planting zone, a splash strip and a utility zone.

Table 1. Overview of road typologies in Peel*

Road Typology	General Description	Desired Right-of-way Design Elements
rural road	agricultural / forest / scenic context with little or no built structures	2 to 4 lanes no sidewalks rural swale drainage
rural main street	a village centre with concentrated development	2 to 4 lanes 1.5-2.0 sidewalks curb and gutter drainage
urban main street	a mix of commercial, office, institutional and residential uses	4 to 6 lanes 1.5-2.0 m sidewalks curb and gutter drainage
suburban connector	a link between strip commercial retail and suburban housing	4 to 6 lanes 1.5-2.0 m sidewalks curb and gutter drainage
commercial connector	similar to suburban connector but with higher commercial activity	4 to 6 lanes 1.5-2.0 m sidewalks curb and gutter drainage
industrial connector	high amounts of warehousing and industrial development; high truck traffic	4 to 6 lanes 1.5-2.0 m sidewalks curb and gutter drainage or rural swale

* Adopted from the Road Characterization Study (Region of Peel 2013) and the Streetscape Toolbox Update (Region of Peel and CVC 2017).



Credit: Region of Peel (2017)

Figure 2-2. Hierarchy of roads in Peel Region

Practices identified in the Streetscaping Toolbox (2017) intended to support the integration of trees in this process include the following.

- Consideration of priority areas as identified in the Region's Tree Planting Prioritization Tool (2015) based on environmental, social and / or economic considerations.
- Use of the Streetscaping Toolbox (2017) to guide for both the conceptual and detailed designs.
- Review of the steps identified in the Low Impact Development (LID) Implementation Process for Regional Roads report, including site assessment.
- Designing with the end in mind, including consulting with maintenance staff during the design process.
- Use of three-dimensional modelling to determine best placement of utilities in relation to green infrastructure (including trees).
- installing utilities in the boulevard for ease of maintenance where possible.

Specific guidance related to tree establishment in the Streetscaping Toolbox (2017) includes:

- Provide the proper volume of high-quality topsoil
- Ensure species diversity
- Select species that tolerate salt
- Locate large statured trees outside the clear zone
- Co-plant shrubs and perennials
- Use native seed mixes
- Use soil-cell systems and / or tree trench planting
- Provide sufficient water for at least the first three years post-planting[1]
- Include trees in all boulevards of at least 8.0 m wide
- Set trees back at least 6.0 m from the pavement and 1.5 m from the property line, and
- Adapt tree placement and planting design methodology to the specific road typology functional context.

The Streetscaping Toolbox (2017) also identifies "green zones" and "median zones" in its cross-sections where trees could be accommodated and provides lists of tree and shrub species considered suitable for different contexts. However, the toolbox does not include specifications or standards for tree or shrub plantings.

Credit: City of Brampton (2013)

Figure 2-3. Boulevard and buffer plantings along roadside

[1] Note the levels of care related to newly planted tree watering are: (a) low – no watering; (b) medium – quarterly watering, and (c) high – monthly watering.

CITY OF MISSISSAUGA

Following the recommended direction in its 2014 Urban Forest Management Plan (UFMP), the City of Mississauga has been working (with the Region where appropriate) to ensure that trees are not adversely affected during municipal road construction or reconstruction projects, and that opportunities for proper tree establishment are identified early on in the process. This has been done through:

- review of conceptual plans, project requirements and potential conflicts being undertaken early in the process by a multi-disciplinary team (including municipal Planners, Landscape Architects, Engineers and Arborists)
- the use of City-wide standards for tree protection and establishment, including enhanced rooting environment specifications, and
- requiring site supervision and follow-up inspections by a Certified Arborist at key points prior to, during and following construction.

The UFMP further recommends that where it is not possible to increase soil volumes for tree plantings in established areas in conjunction with the replacement of street tree plantings, opportunities for integration of enhanced rooting environment techniques such as soil cells or continuous trenches should be considered.

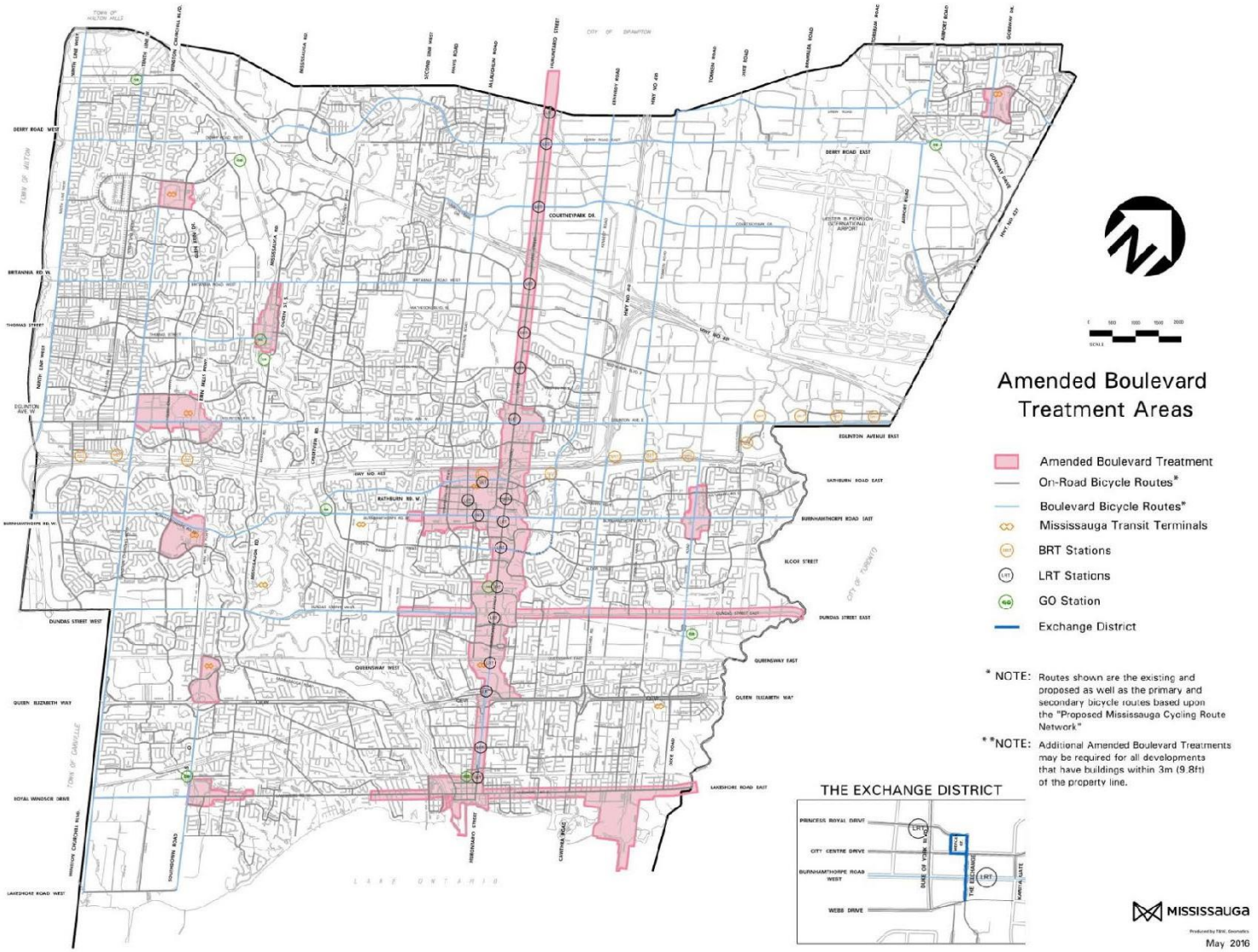
Even where good quality soil is available or introduced, salt spray remains a widespread problem along municipal streets and boulevards. Solutions suggested in Mississauga's UFMP include:

- planting more salt tolerant species in heavily affected areas
- reducing salt use by using alternatives or reducing the proportion of sodium in sprays
- limiting salt application in ecologically sensitive areas, protecting susceptible plants (e.g., with burlap or snow fencing), and
- increasing irrigation and / or flushing and mulching.

Mississauga has several documents that provide guidance related to protecting and establishing trees along municipal streets. The Transportation and Works Supplemental Specifications (2015) apply to all capital roads projects, while Community Service's Subdivision Requirements Manual (2003, pending update) apply to most other contexts where trees along roads are to be assumed by the City. Where streetscapes are involved, applications from private proponents are submitted to the Transportation and Works, Planning and Building, and Community Services Departments for comments. Once approved, final drawing must be submitted along with securities for all street tree plantings.

Streetscape plans must also be reviewed by the PUCC to ensure utilities have the regulated offsets. Utilities may be relocated with the cost borne by the proponent if needed within intensification areas to accommodate tree rooting areas.

The City has also identified roadways associated with identified intensification areas for streetscape improvements, as shown in Figure 2-4. Development applications in these areas must include a "Streetscape Feasibility Study" to verify that a 2 m wide by 2 m deep below-ground trench at least 0.75 m from the back of the municipal curb can be accommodated in the ROW along with adequate above-ground canopy areas to support street trees.



Credit: City of Mississauga (2017)

Figure 2-4. Boulevard areas identified for enhancements in Mississauga (in red)

CITY OF BRAMPTON

With direction from its updated 2020 Landscape Works on Capital Works Projects the City of Brampton strives to capture all stages – from initiation of Municipal Class Environmental Assessments through to construction completion – related to existing tree protection and preservation, design standards for planting, and construction and maintenance procedures and specifications. This Standard Operation Procedure:

- creates a standard procedure and streamlines the site co-ordination procedures to a uniform methodology that is adopted by all the responsible construction staff
- assists professional landscape architectural consultants to understand the requirements and the coordination within the City of Brampton in providing consulting services on capital projects in a uniform manner, and
- assists in the preparation of RFPs by City staff for retaining landscape consultants and helps consultants understand their responsibilities and liabilities during the construction phase.

Key elements of the approval process for planning and installing trees in streetscapes including rights-of-way in Brampton are as follows.

- Landscaping submissions based on the approved Draft Plan requirements are reviewed by the Environment and Development Engineering Division and are to be coordinated with the engineering plans submitted.
- Cost estimates are to be submitted on the City of Brampton Cost Estimation Forms.
- The applicant is responsible for: retaining a qualified Landscape Architect, obtaining any required permits, getting plans reviewed by PUCC, preparing the site for construction and providing securities for landscaping once the plans are approved.
- The retained Landscape Architect is responsible for: developing the tender package, confirming the bidder's list with the City, recommending a bidder to the City, developing a construction schedule, attending a pre-construction meeting and conducting weekly progress inspections.
- Prior to arranging a meeting for Preliminary Acceptance by the City, the consulting landscape architect is to review all the works on site and provide a Certification of Landscape Works for Subdivision Development.
- The two-year warranty period on landscape materials starts following Preliminary Acceptance and includes a one-year interim inspection prior to Final Acceptance.
- Final as-built drawings are required prior to assumption by the City.

The City of Brampton has several documents that support and provide guidance regarding the incorporation of trees into streetscapes, including arterial roads. In particular, the 2011 standard for Open Space Design & Construction / Parks Maintenance Operations lays out the review cycles and integration of various departments into landscape design and implementation along Brampton roads. Of note, the same staff that reviews and coordinates the landscape plans for all Capital Works projects are also PUCC members, eliminating errors and conflicts.

The Street Corridor Master Plan and Design Standards (2003) are intended for both public and privately funded road projects and identify a hierarchy of primary, secondary and tertiary corridors in the City as shown in Figure 2-6.

Brampton's Grow Green Environmental Master Plan (EMP) (2014) recommends the development of "*road standards and cross-sections for road rights-of-way that more efficiently use land, encourage transit and active transportation, incorporate Low Impact Development Measures, and support the establishment of street trees with appropriate soil volumes*."

The City's Landscape Development Guidelines (2019) provide the most current and specific guidance for plantings on arterial roads, collectors and parking lots. This document also outlines the process for subdivision development approvals, including landscaping of streets to be assumed by the City.

Credit: City of Brampton (2013)

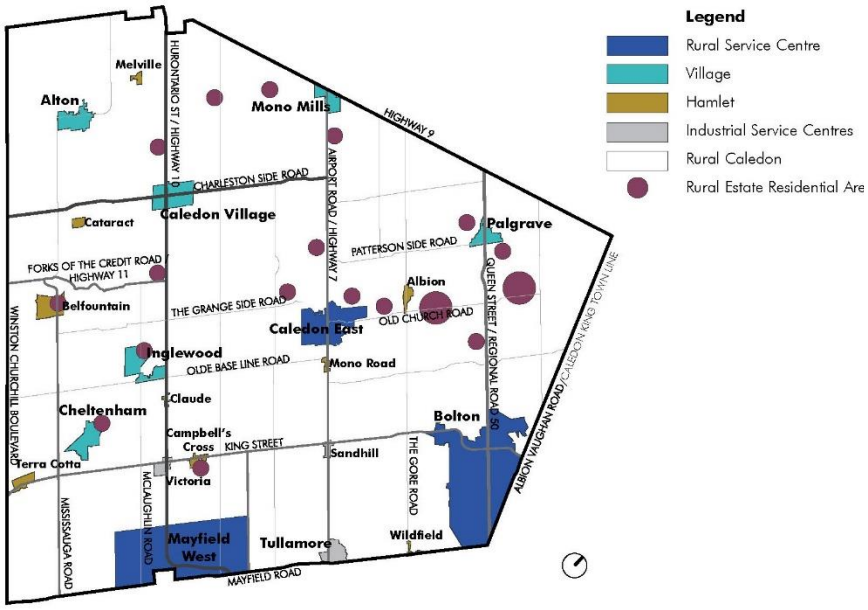
Figure 2-5. Roadside parking lot plantings in Brampton

Credit: City of Brampton (2003)

Figure 2-6. Arterial corridor types in Brampton

TOWN OF CALEDON

Unlike Brampton and Mississauga, Caledon is predominantly rural with three service centres (i.e., Bolton, Caledon East and Mayfield West) as well as several villages and hamlets, as illustrated in Figure 2-7.



Credit: Town of Caledon (2017)

Figure 2-7. Town of Caledon community structure

Two key documents support and provide guidance regarding the incorporation of trees into streetscapes in Caledon: the Comprehensive Town-wide Design Guidelines (2017) and the Development Standards Manual v. 5.0 (2019).

The Comprehensive Town-wide Design Guidelines (2017) includes sections on community streetscapes, main street designs and major road streetscapes. This document also identifies the following as part of the approval process as it relates to streetscapes.

- Provision of a design brief that includes streetscape design guidelines tailored to the local context.
- A potential shadow study to assess the impacts on adjacent uses.
- Accommodation of active transportation.
- Use of Peel's Streetscaping Toolbox (2017) and native species in buffer plantings.

The Town's Development Standards Manual (2019) provides specific requirements for protection of existing trees and landscaping requirements for new trees.

Road extensions and road widenings require replacement and new trees at 10 to 12 m on centre. Double rows of trees (i.e., one on the public boulevard and one on the adjacent private lands) are encouraged.

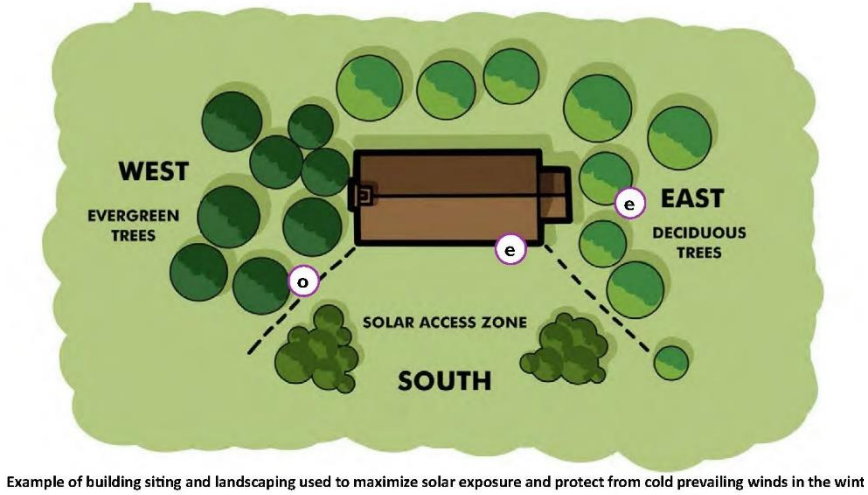
Prior to installing street trees, the Development Standards Manual (2019) notes that:

- locates should be coordinated (i.e., with the PUCC)
- the locations of the proposed tree plantings should be marked and reviewed on site with the Town's Open Space Design department
- trees should be inspected and certified by the proponent following planting
- residents should receive notice of the plantings (e.g., door knockers), and
- prior to installation, the Town-approved landscape plans should be updated based on as-recorded site conditions and provided to both the contractor and the Town.

Comparable to Brampton, the Town of Caledon follows a process of:

1. Preliminary Acceptance (after initial plantings are completed to the Town's satisfaction)
2. Interim Acceptance (after one-year post-planting), and
3. Assumption (following at least two years from the time of the initial planting).

Site inspections are required between May 15 and October 15. Identified deficiencies are to be corrected within 30 days. Replacement trees, if needed, are subject to one additional warranty year unless arranged otherwise with the Town.



Example of building siting and landscaping used to maximize solar exposure and protect from cold prevailing winds in the wint

Credit: Comprehensive Town-wide Guidelines (Town of Caledon 2017)

Figure 2-8. Energy efficient tree establishment

Credit: Comprehensive Town-wide Guidelines (Town of Caledon 2017)

Figure 2-9. Median and boulevard plantings in right-of-way

2.2 Comparison of Municipal Service Levels for Rights-of-way in Peel

Table 2 provides an overview and comparison of resources and service levels for key aspects of street tree establishment, maintenance and management in Mississauga, Brampton, Caledon and Peel at the beginning of 2020. This information has drawn on data collected through the City of Mississauga's UFMP (2014), the City of Brampton's UFMP (in progress) and preliminary interviews with selected municipal staff.

Table 2. Comparison of current resources and service levels related to street trees in Peel

Resource or Service for Street Trees	City of Mississauga (~777,000 pop.)	City of Brampton (~600,000 pop.)	Town of Caledon (~65,000 pop.)	Region of Peel (~1,390,000 pop.)	Best Practice
OVERALL MANAGEMENT: Responsible Department	Forestry Section in Community Services	Parks Maintenance & Forestry supported by Horticulture staff (for small tree block pruning in winter)	Parks Maintenance for Urban Street and Park trees; Roads Maintenance for rural roadside trees; No proactive management of woodlots or SWM areas	No dedicated Urban Forestry section	Have a standalone section whose primary responsivities include urban forest management
OVERALL MANAGEMENT: Inventory Software and Update Frequency	ArcGIS™ Inventory completed in 2020 and to be updated every 5 years using Infor and HAT-F in-house software	ArcGIS™ First inventory in progress and not yet linked to asset management or being updated	An inventory of urban street and rural roadside trees completed in 2004; In the process of updating urban street tree inventory	Hansen™ Not updated since 2013	GIS-based; integrated with corporate-wide asset management system; updated every 5 years
OVERALL MANAGEMENT: Work Orders Software and Integration	Infor and HAT-F in-house software	Hansen™ Not integrated with inventory	Citywide; Will be GIS-integrated with inventory data for urban street trees	Hansen™ Not integrated with inventory	No "best" software; Integrated with inventory
ESTABLISHMENT: No. trees / year (per capita)	6,250 caliper trees per year (0.008 per capita)	~2,000 (~0.003)	Replace 1 to 1 all removed urban street tree and Park trees	Unknown	N/A

Resource or Service for Street Trees	City of Mississauga (~777,000 pop.)	City of Brampton (~600,000 pop.)	Town of Caledon (~65,000 pop.)	Region of Peel (~1,390,000 pop.)	Best Practice
ESTABLISHMENT: Stock Size	40 – 60 mm cal.	50 – 60 mm cal.	50 – 60 mm cal.	50 – 60 mm cal.	40 – 60 mm cal.
ESTABLISHMENT: Basic Care	Watering: by contractor Mulch: by contractor Weeding: by contractor	Watering: by contractor Mulch: by contractor Weeding: by contractor	Watering: by contractor Mulch: by contractor Weeding: by contractor	Watering: by contractor Mulch: by contractor Weeding: by contractor	
ESTABLISHMENT: Young Tree Structural Pruning	By contractor	Rolled into pruning cycle (no separate program) or as needed	No formalized program	No formalized program	Up to 3 times in first 10 years of establishment
ESTABLISHMENT: Inspection Cycle	No formal cycle, as needed	No formal cycle, as needed	No formalized program	No formalized program	
MAINTENANCE: No. Street Trees Managed	~300,000 (~0.4); includes managed park trees	~250,000 (~0.4)	~ 10,000 urban street trees	~15,000 (N/A)	N/A
MAINTENANCE: Pruning Cycle	Every 7 years after tree has been established	5 to 7 years	No Program	No formalized program	5 to 7 years
MAINTENANCE: Target Response Times for Service Requests	Priority 1: 24hrs storm calls/emergency calls Priority 2: 3-6 months Priority 3: 6-8 months	Initial response: 35 – 90 days (non-peak vs. peak times) Action: within 12 months	Initial response within 2 weeks; Replacements occur one year after removal, dependant upon annual Council approved budgets	No formalized program	Unknown, but some comparable municipalities (e.g., London, Oakville) report initial response times within 5 to 30 days and action within 3 to 6 months.

Resource or Service for Street Trees	City of Mississauga (~777,000 pop.)	City of Brampton (~600,000 pop.)	Town of Caledon (~65,000 pop.)	Region of Peel (~1,390,000 pop.)	Best Practice
RISK MANAGEMENT: Assessment	Proactive and reactive inspections	Request-based and windshield surveys in designated areas	Request based; Certified arborists on staff	Request-based	Regular inspection of known "higher risk" areas and advanced (Level 3) testing when appropriate
RISK MANAGEMENT: Range of Approaches	Advanced tree diagnostics (Static Integrated Methodology (SIM) Tomography), tree support system, crown reduction, root pruning, removal	Removal	Remove and replace	Removal	Combination of cabling, bracing, crown reduction and removal if no other feasible alternative
IPM: Plan Status	Standalone Invasive Species Management Plan and Implementation Strategy, Integrated Pest Management Plan, EAB Management Program	Limited to a plan for EAB	EAB plan for urban street trees is remove and replace; No overall IPM plan; Pests are reviewed on specific case basis	None	Comprehensive IPM Plan developed and being implemented
IPM: Activities	Proactive management of EAB, Gypsy Moth (GM) and Asian Long-Horned Beetle (ALB)	Proactive management of EAB and GM	See above. New and replacement plantings consist of less susceptible species	Proactive management of EAB	Proactive management of EAB, GM, ALB, Dutch Elm Disease, Hemlock Woolly Adelgid, Oak Wilt, Black Knot
RESOURCES: Approach	Municipal staff and contractors	Municipal staff and contractors	Staff and Contractors	Mainly contractors	N/A
RESOURCES: In-house Training and Certifications	ISA Certified Arborist, Certified Municipal Arborist, Certified Tree Worker, Utility Arborist, TRAQ Tree Risk Assessor, Professional Foresters,	~50% of Forestry staff are ISA certified; Most municipal tree risk assessors hold the ISA TRAQ,	ISA certified forestry staff, Municipal By-Law Enforcement Officer	No current requirements	Forestry staff are ISA certified; Municipal tree risk assessors hold the ISA TRAQ; Have at

Resource or Service for Street Trees	City of Mississauga (~777,000 pop.)	City of Brampton (~600,000 pop.)	Town of Caledon (~65,000 pop.)	Region of Peel (~1,390,000 pop.)	Best Practice
	Butternut Health Assessor, Ecological Land Classification, Municipal By-Law Enforcement Officer	Municipal By-Law Enforcement Officer			least one staff trained in IPM
RESOURCES: Staffing	Five (5) Forestry Units comprised of 53 staff: Forestry Operations, Contract Operations, Forestry Inspections, Woodlands and Natural Areas, Tree Preservation & Protection	16 Arborists 3 Tree Inspectors 1 Administrator	No dedicated Arborists but 6 ISA Certified staff (including the Forestry Supervisor + 2 operations staff)	1 Arborist 0.25 Administrator Some other part-time support (limited)	N/A
RESOURCES: Funds allocated to street tree maintenance	$4,900,000 inclusive of labour and contractor costs for urban forest management (street and park tree maintenance)	About $840,000	About $400,000 to urban street tree maintenance including $100,000 annual budget for replacements and stump removal	Not tracked separately at this time	N/A

Notes: GIS = Geographic Information System; ISA = International Society of Arboriculture, TRAQ = Tree Risk Assessment Qualification, IPM = Integrated Pest Management

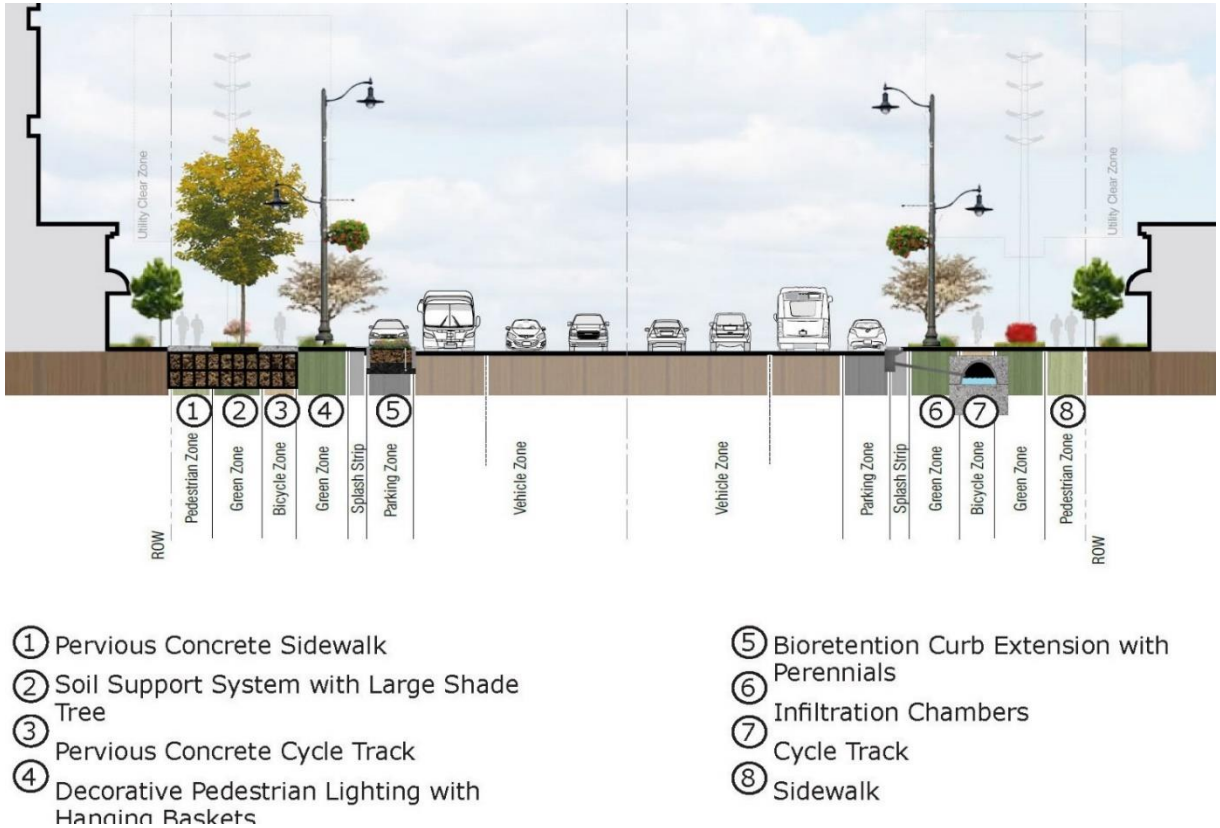
2.3 Suggested Directions for Peel

Table 3. Summary of recommended municipal forestry procedures and service levels for street trees in Peel

Resource or Service	Recommendation for Peel	Rationale for Recommendation
OVERALL MANAGEMENT: Responsible Department	Have a standalone department or section whose primary responsibilities include urban forest management	This structure encourages a focus and prioritization on tree-related activities within that section, and provides a resource for other municipal staff, residents and proponents
OVERALL MANAGEMENT: Inventory Software	GIS-based inventory integrated with corporate-wide asset management system; updated every 5 years	Consistent with best practices and will allow for integration with local municipalities was they shift towards GIS-based systems; will also facilitate integration into asset management planning
OVERALL MANAGEMENT: Work Orders Software and Integration	GIS-based	Consistent with best practices; will allow for integration with inventory and with local municipalities once they have shifted to GIS
ESTABLISHMENT: No. trees / year (per capita)	3:1 replacement target	Consistent with best practices and with urban forest and climate change objectives
ESTABLISHMENT: Stock Size	40 – 60 mm cal.; Prioritize stock health over size	Consistent with best practices and local municipal practices
ESTABLISHMENT: Basic Care	See Urban Forest Management Best Practices Guide for Peel for more guidance	Consistent with best practices
ESTABLISHMENT: Young Tree Structural Pruning	Up to 3 times in first 10 years of establishment, but not within first two years	Consistent with best practices
ESTABLISHMENT: Inspection Cycle	Years 1, 3, 5, 7 and 10 post-planting	Consistent with best practices and with Mississauga's cycle for newly established naturalization areas
MAINTENANCE: Pruning Cycle	5 to 7 years	Consistent with best practices and with current practices in Brampton
MAINTENANCE: Target Response Times for Service Requests	Initial response times within 5 to 30 days and action within 3 to 6 months	Generally consistent with best practices and with current practices in Brampton
RISK MANAGEMENT: Assessment	Regular inspection of known "higher risk" areas and advanced (Level 3) testing when appropriate	Generally consistent with best practices
RISK MANAGEMENT: Range of Approaches	Combination of cabling, bracing, crown reduction and removal if no other feasible alternative	Generally consistent with best practices (although rarely practiced for street trees due to liability concerns)

Resource or Service	Recommendation for Peel	Rationale for Recommendation
IPM: Plan Status	Comprehensive IPM Plan developed and implemented	Consistent with best practices and with current practices in Mississauga and Brampton
IPM: Activities	Proactive management of EAB, GM, ALB, Dutch Elm Disease, Hemlock Woolly Adelgid, Oak Wilt, Black Knot	Consistent with best practices (local municipalities largely focussed on EAB and ALB, to a lesser extent GM)
RESOURCES: In-house Training and Certifications	Forestry staff are ISA certified; Municipal tree risk assessors hold the ISA TRAQ; Have at least one staff trained in IPM	Consistent with best practices

Notes: ISA = International Society of Arboriculture, TRAQ = Tree Risk Assessment Qualification, IPM = Integrated Pest Management



Credit: Streetscaping Toolbox Update (Region of Peel and CVC 2017)

Figure 2-10. Hypothetical urban main street cross section with streetscaping

3. Tree / Shrub Standards and Specification Considered

Table 4 summarizes the categories of woody plant standards and specifications considered in the assessment of current practices and best practices for Peel. The detailed results of this assessment are provided in Appendix A.

Table 4. Summary of tree / shrub standards and specifications considered

CATEGORY	TREE / SHRUB STANDARDS AND SPECIFICATIONS	COMMENTS
1.0 Tree and Shrub Planning	1.1 Street tree planting targets (density, diversity) 1.2 Master Planning Direction	• Asset management practices and suggested directions are to be summarized in Section 2 of this guide
2.0 Site Preparation	2.1 Soil testing 2.2 Width and depth of planting pit 2.3 Planting soil volume 2.4 Soil quality and amendments, and other soil preparation	• Proper site preparation is critical tree establishment • Physical/biophysical and built environment considerations are addressed in the *Urban Forest Management Best Practices Guide for Peel* (2020)
3.0 Tree and Shrub Placement	3.1 Offset from Utilities 3.2 Offset from multi-use trails and sidewalks 3.3 Hard surfaces 3.4 Offset from retaining walls 3.5 Offset from noise walls 3.6 Clear Zone requirements 3.7 Tree spacing, density 3.8 Utility locates / coordination 3.9 Sightlines / daylight triangles 3.10 Streets 3.11 Light standards 3.12 Private approaches / driveways 3.13 Property lines	• Public Utilities Coordinating Committee (PUCC) process to be addressed in Section 2 • Design review process addressed in Section 2
4.0 Tree and Shrub Selection	4.1 Tree and shrub species selection: (a) for regional roads, (b) for under overhead wires, (c) near	• Tree and shrub type included to reflect areas where coniferous may be favoured; where non-

CATEGORY	TREE / SHRUB STANDARDS AND SPECIFICATIONS	COMMENTS
	underground infrastructure (d) near Natural Heritage areas, (e) near LID and stormwater management practices, (f) for diversity, (g) for disease and pest resistance, (h) for salt tolerance, and (g) for narrow and wide boulevards 4.2 Tree and shrub type selection: (a) deciduous vs. coniferous and (b) native vs. non-native	native may be permitted • Design Review process addressed in Section 2 • Planting size, stock type, and selection factors addressed in *Urban Forest Management Best Practices Guide for Peel* (2020)
5.0 Tree and Shrub Planting	5.1 Planting details 52. Mulch 5.3 Tree staking 5.4 Fertilizer and/or planting amendments 5.5 Planting soil 5.6 Tree guards / watering bags / wraps 5.7 Root barriers	• Submittals, as-built drawings and GIS requirements discussed in Section 2
6.0 Tree and Shrub Inspection	6.1 Inspection of nursery stock 6.2 Inspection of installation 6.3 Inspection during and end of warranty period 6.4 Inspection during establishment 6.5 Acceptance criteria	• Levels of service covered in Section 2
7.0 Tree and Shrub Maintenance	7.1 Maintenance during warranty period 7.2 Maintenance during establishment period: (a) pruning, (b) fertilizing, (c) watering, (d), mulching, (e) disease and pest control, and (f) dead tree removal	• Levels of service, emergency response covered in Section 2
8.0 Tree and Shrub Protection	8.1 Protection zone 8.2 Protection barriers 8.3 Heavy equipment and storage around trees 8.4 Branch and root pruning 8.5 Trenching and tunneling	

4. Comparison of Municipal Tree and Shrub Standards and Specifications in Peel Region

This section provides a review and comparison of current woody plant standards and specifications in all municipalities in Peel Region (i.e., Peel, Mississauga, Brampton, Caledon) focusing on the regional right-of-way and municipal building landscaping / hardscape contexts. The detailed findings of this review are summarized in Appendix A, while key similarities, differences and gaps are provided below.

In general, the research found many of the items in Table 4 are foubd in each municipality's standards and specifications. For example, all municipalities have:

- a planning document that guides road and street tree planting on and off municipal lands
- basic standards and specifications for tree selection, placement, and planting
- a standard for diversity and disease resistance, and
- a preference for use of native species.

However, though most municipalities made some mention, the research found key gaps in the following areas:

- species and stock selection for climate change adaptation and genetic diversity
- tree placement near driveways
- clear zone requirements
- offsets from retaining walls, and
- specific street tree target numbers.

A gaps matrix summary is provided in Table 5.

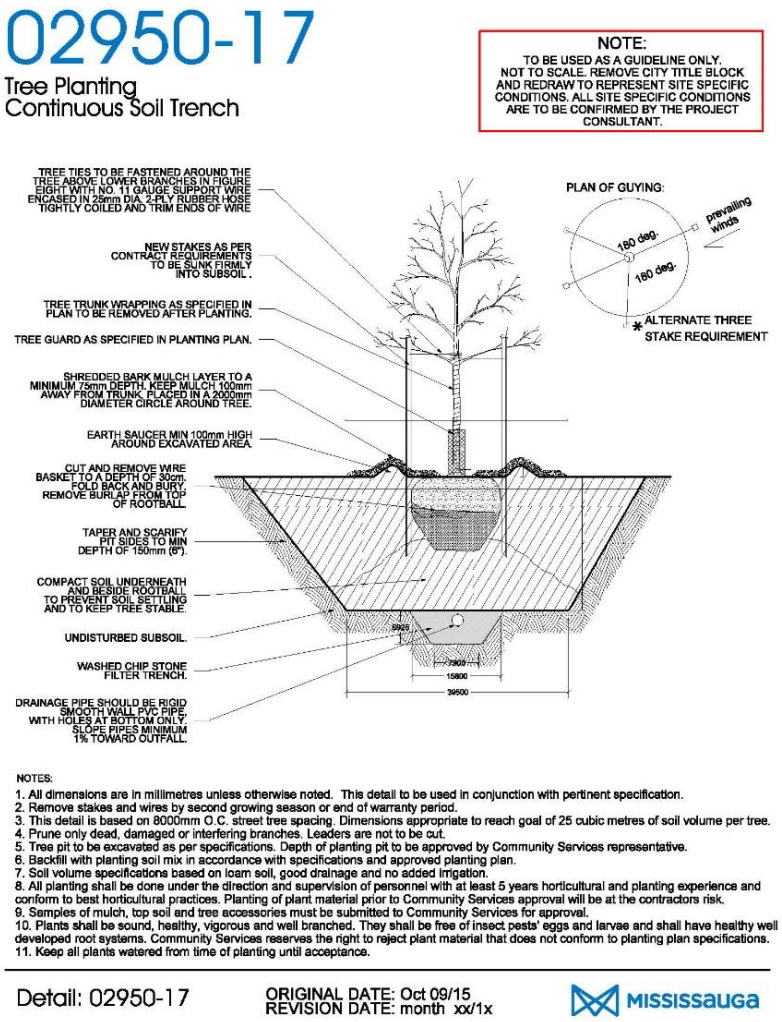
4.1 City of Mississauga

The City of Mississauga covers many of the standards and specifications with their Community Services Subdivision Requirements (2003) and the tree planting requirements enacted during Site Plan Control application process. Additional urban forest focused specifications are found in their Streetscape Feasibility Terms (2017) for select Boulevard Treatment Areas. These wide boulevards (e.g., arterial cross section) often have similar ROW widths as a regional road and serve as a suitable comparator.

For infill or new development fronting City streets, the following standards and specifications are generally aligned with best practices.

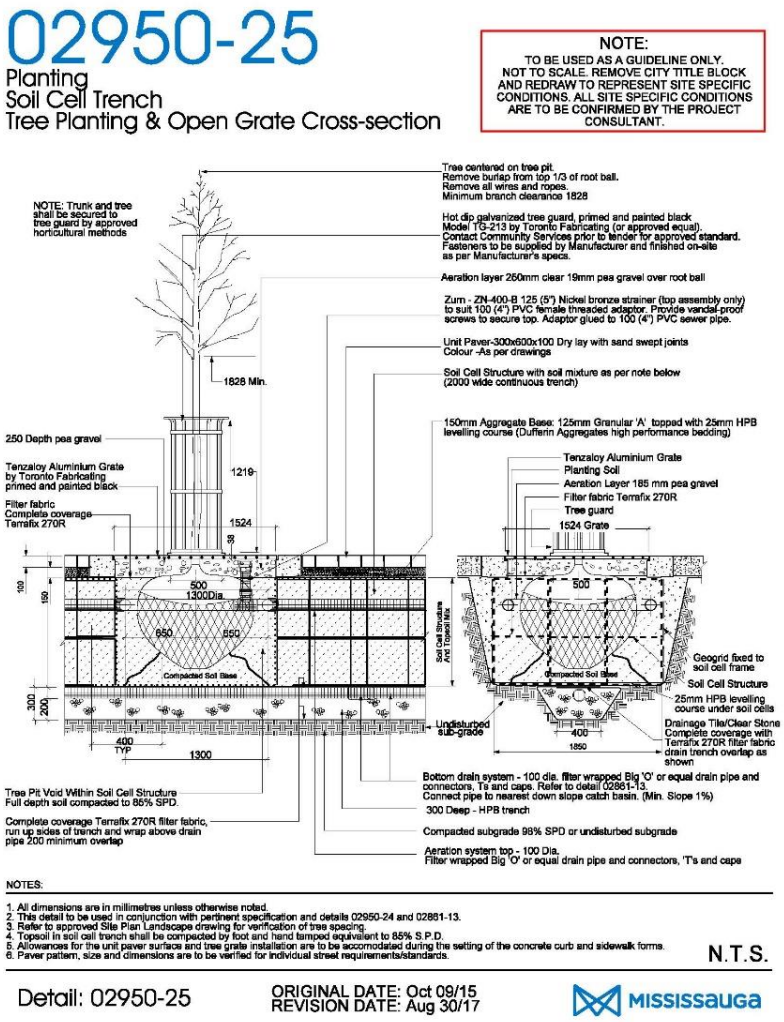
- Continuous trench and/or soil cell tree planting details are required for all major boulevards and for most new street and road trees.
- Tree planting trenches must be accommodated on major boulevards.
- Utilities' alignments are often secondary to the priority of tree placement along major roads.

Two examples of these details from the City of Mississauga's specifications are provided in Figure 4-1 and Figure 4-2 below.



Credit: City of Mississauga (2017)

Figure 4-1. Continuous soil trench tree planting detail



Credit: City of Mississauga (2017)

Figure 4-2. Soil cell trench tree planting and open grate detail

Continuous trench and/or soil cell tree planting details are the "new normal" and an established best practice for ensuring adequate soil volumes encouraging taller and fuller trees in hardscapes.

GAPS

The City of Mississauga has standards and/or specifications for most of the items listed in Table 4, however the following were not found:

- Clear zone requirements
- Species selection for low impact development / green infrastructure and / or climate change adaptation
- Specific standards towards climate change adaptation, and
- No clear street tree planting targets.

4.2 City of Brampton

The City of Brampton includes many of the listed standards and specifications with their Standard Landscape Specifications and Subdivision Design Manual. They have recently released updated Landscape Development Guidelines (2019) to assist landowners/developers and consultants, including specific guidance for streetscapes and open space. These comprehensive guidelines illustrate the various street typologies and the related tree planting layouts. These standards and guidelines are equally applicable to regional roads and landscape buffers between regional roads and residential developments. Like Mississauga, they have standard cross-sections for arterial roads which could be used as a comparator for Peel regional roads, and they show relative offsets for tree planting for utilities, walls, curb, etc.

Brampton also provides comprehensive plant tables - called Technical Planting Bulletins - outlining recommendations for species selection dependant upon area and phase of development. Examples of best practices within Brampton's *Landscape Development Guidelines* (2019) include:

- recommendations for landscape treatments in suitable areas along berms and adjacent to noise walls (Figure 4-3)
- design standards for arterial roads (Figure 4-4), and
- a Technical Planting Bulletin (Figure 4-5).

a) **Noise Wall/Fence**: The backyard is separated from the street by a noise wall/fence (typically 2.2 m in height) on top of a berm that has a maximum slope of 3:1, subject to the applicable noise attenuation requirements.

b) **Noise Wall and Berm Location:** The noise wall and berm may be centered 0.3 m inside private property or public property depending on the abutting right-of-way; half of the berm is on the street side (varying from 3.0 m to 4.5 m wide depending on the width of the buffer block). (Refer to City of Brampton Subdivision Site Plan Fencing and Wall Standards).

c) **Berm Size:** The backyard portion of the berm may not exceed 1/3 of the backyard depth and the level backyard between the house and the berm must be at least 7.0 m.

d) **Buffer Size:** Buffers on reverse frontages of parkways and on lots flanking onto an arterial road are usually 4.5 m wide with a typical berm height of 1.5 m, again subject to the applicable noise attenuation requirements.

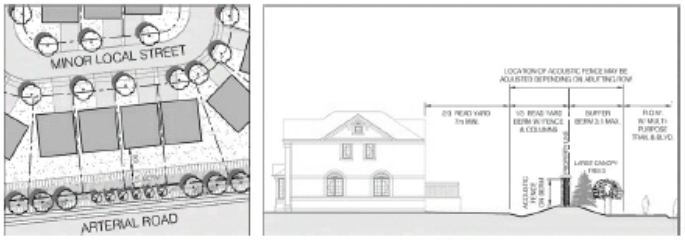
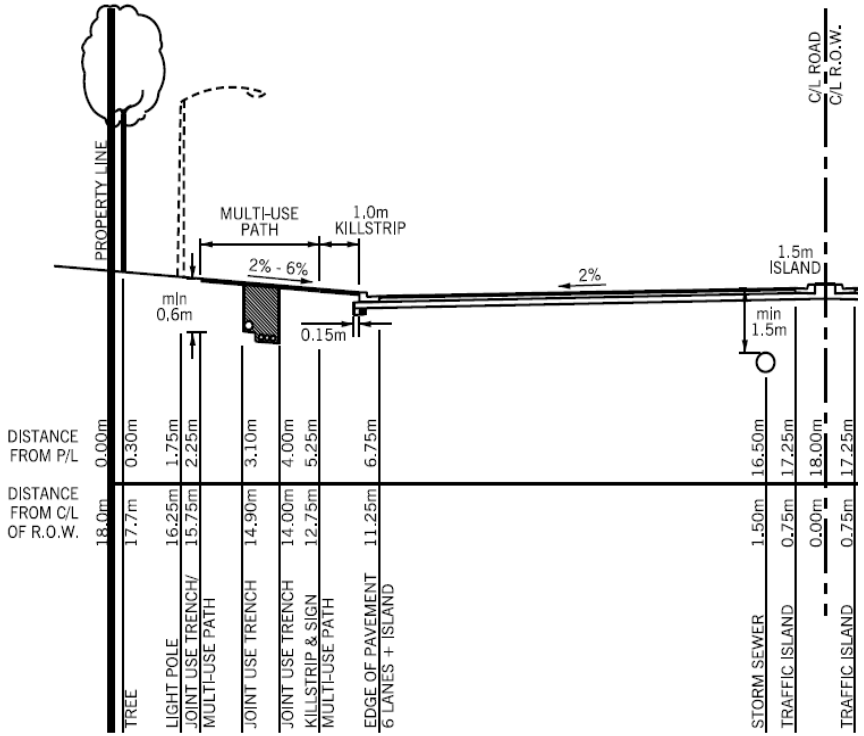


Figure 2 Typical landscape treatment along residential reverse frontage lots

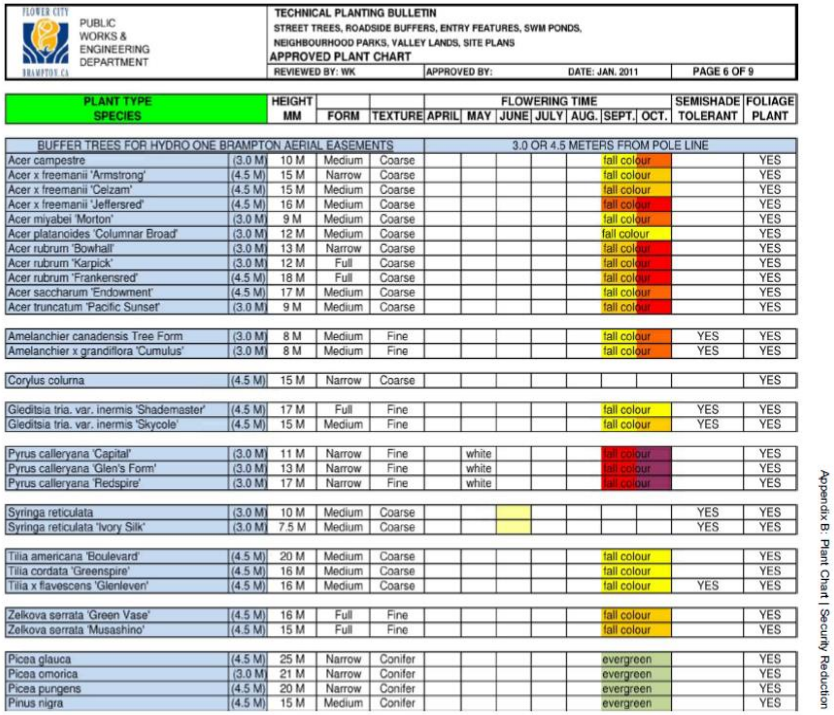
Credit: City of Brampton (2019)

Figure 4-3. Landscape treatments for berms and noise walls



Credit: City of Brampton (2019)

Figure 4-4. Arterial road cross-section



PUBLIC WORKS & ENGINEERING DEPARTMENT

TECHNICAL PLANTING BULLETIN
STREET TREES, ROADSIDE BUFFERS, ENTRY FEATURES, SWM PONDS, NEIGHBOURHOOD PARKS, VALLEY LANDS, SITE PLANS
APPROVED PLANT CHART
REVIEWED BY: WK | APPROVED BY: | DATE: JAN. 2011 | PAGE 6 OF 9

PLANT TYPE SPECIES		HEIGHT MM	FORM	TEXTURE	FLOWERING TIME APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	SEMISHADE TOLERANT	FOLIAGE PLANT
BUFFER TREES FOR HYDRO ONE BRAMPTON AERIAL EASEMENTS					3.0 OR 4.5 METERS FROM POLE LINE								
Acer campestre	(3.0 M)	10 M	Medium	Coarse						fall colour			YES
Acer x freemanii 'Armstrong'	(4.5 M)	15 M	Narrow	Coarse						fall colour			YES
Acer x freemanii 'Celzam'	(4.5 M)	15 M	Medium	Coarse						fall colour			YES
Acer x freemanii 'Jeffersred'	(4.5 M)	16 M	Medium	Coarse						fall colour			YES
Acer miyabei 'Morton'	(3.0 M)	9 M	Medium	Coarse						fall colour			YES
Acer platanoides 'Columnar Broad'	(3.0 M)	12 M	Medium	Coarse						fall colour			YES
Acer rubrum 'Bowhall'	(3.0 M)	13 M	Narrow	Coarse						fall colour			YES
Acer rubrum 'Karpick'	(3.0 M)	12 M	Full	Coarse						fall colour			YES
Acer rubrum 'Frankensred'	(4.5 M)	18 M	Full	Coarse						fall colour			YES
Acer saccharum 'Endowment'	(4.5 M)	17 M	Medium	Coarse						fall colour			YES
Acer truncatum 'Pacific Sunset'	(3.0 M)	9 M	Medium	Coarse						fall colour			YES
Amelanchier canadensis Tree Form	(3.0 M)	8 M	Medium	Fine						fall colour		YES	YES
Amelanchier x grandiflora 'Cumulus'	(3.0 M)	8 M	Medium	Fine						fall colour		YES	YES
Corylus colurna	(4.5 M)	15 M	Narrow	Coarse									YES
Gleditsia tria. var. inermis 'Shademaster'	(4.5 M)	17 M	Full	Fine						fall colour		YES	YES
Gleditsia tria. var. inermis 'Skycole'	(4.5 M)	15 M	Medium	Fine						fall colour		YES	YES
Pyrus calleryana 'Capital'	(3.0 M)	11 M	Narrow	Fine		white				fall colour			YES
Pyrus calleryana 'Glen's Form'	(3.0 M)	13 M	Narrow	Fine		white				fall colour			YES
Pyrus calleryana 'Redspire'	(3.0 M)	17 M	Narrow	Fine		white				fall colour			YES
Syringa reticulata	(3.0 M)	10 M	Medium	Coarse								YES	YES
Syringa reticulata 'Ivory Silk'	(3.0 M)	7.5 M	Medium	Coarse								YES	YES
Tilia americana 'Boulevard'	(4.5 M)	20 M	Medium	Coarse						fall colour			YES
Tilia cordata 'Greenspire'	(4.5 M)	16 M	Medium	Coarse						fall colour			YES
Tilia x flavescens 'Glenleven'	(4.5 M)	16 M	Medium	Coarse						fall colour		YES	YES
Zelkova serrata 'Green Vase'	(4.5 M)	16 M	Full	Fine						fall colour			YES
Zelkova serrata 'Musashino'	(4.5 M)	15 M	Full	Fine						fall colour			YES
Picea glauca	(4.5 M)	25 M	Narrow	Conifer						evergreen			YES
Picea omorica	(3.0 M)	21 M	Narrow	Conifer						evergreen			YES
Picea pungens	(4.5 M)	20 M	Narrow	Conifer						evergreen			YES
Pinus nigra	(4.5 M)	15 M	Medium	Conifer						evergreen			YES

Appendix B: Plant Chart | Security Reduction

Credit: City of Brampton (2019)

Figure 4-5. Excerpt from Technical Planting Bulletin for major roads

Continuous trench and/or soil cell tree plantings are increasingly being planted in Mississauga and Brampton. This approach is the "new normal" and is an established best practice for ensuring adequate soil volumes in hardscapes.

GAPS

The City of Brampton has standards and/or specifications for many of the items listed in Table 4, however the following were not found:

- specifications for planting in hard surfaces
- species selection for genetic diversity, and
- species selection for climate changa adaptation.

4.3 Town of Caledon

The Town of Caledon covers many of the listed standards and specifications with their newly released Development Standards Manual (2019) and their Planting and Tree Preservation Standard Details and Open Space Design Standards Specifications.

The 2019 Development Standards Manual assists landowners / developers and consultants in the development of streetscapes and open space. It is a comprehensive guide illustrating all the various street typologies and the inherent tree planting layouts, etc.

Two examples of best practice elements included in Caledon's 2019 Development Standards Manual include:

- Street tree layouts to maximize new trees along roads and between driveways during new development (Figure 4-6), and
- Inclusion of minimum clearances for road and street trees as an easy reference in their Open Space Standards for Tree and Shrub Placement and Selection (700 series notes) (Figure 4-7).

2.3.1.1. General Street Tree Planting

The following are recommended street tree spacing for public boulevards along residential frontages. This is excluding Palgrave Estate Residential Areas.

A. < 9 meters between driveways:

Where there is less than 9 meters between driveways, one 60mm caliper, large high branching deciduous tree shall be planted centrally between the driveways. Adjustments may be required due to utility and signage conflicts;

B. 9 – 12 meters between driveways:

Where there is more than 9 meters and less than 12 meters between driveways, two 50 mm caliper small high branching deciduous trees shall be planted at even intervals. Adjustments may be required due to utility and signage conflicts; and

C. ≥ 12 meters between driveways:

Where there is more than 12 meters between driveways, two 60mm caliper large high branching deciduous trees shall be planted at even intervals between the driveways. Adjustments may be required due to utility and signage conflicts.

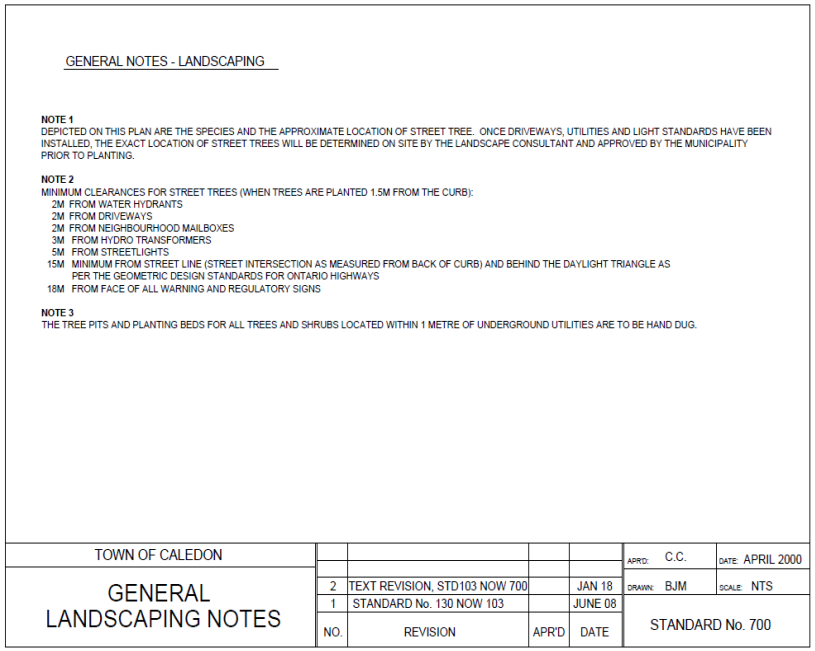
Credit: Town of Caledon (2019)

Figure 4-6. Excerpt from major road tree spacing adjacent driveways

GAPS

The Town of Caledon has standards and/or specifications for many of the items listed in Table 4, however the following were not found:

- Planting in hard surfaces
- Offset from retaining wall, noise wall
- Clear zone requirements, and
- Species selection for climate change adaptation.



GENERAL NOTES - LANDSCAPING

NOTE 1
DEPICTED ON THIS PLAN ARE THE SPECIES AND THE APPROXIMATE LOCATION OF STREET TREE. ONCE DRIVEWAYS, UTILITIES AND LIGHT STANDARDS HAVE BEEN INSTALLED, THE EXACT LOCATION OF STREET TREES WILL BE DETERMINED ON SITE BY THE LANDSCAPE CONSULTANT AND APPROVED BY THE MUNICIPALITY PRIOR TO PLANTING.

NOTE 2
MINIMUM CLEARANCES FOR STREET TREES (WHEN TREES ARE PLANTED 1.5M FROM THE CURB):
2M FROM WATER HYDRANTS
2M FROM DRIVEWAYS
2M FROM NEIGHBOURHOOD MAILBOXES
3M FROM HYDRO TRANSFORMERS
5M FROM STREETLIGHTS
15M MINIMUM FROM STREET LINE (STREET INTERSECTION AS MEASURED FROM BACK OF CURB) AND BEHIND THE DAYLIGHT TRIANGLE AS PER THE GEOMETRIC DESIGN STANDARDS FOR ONTARIO HIGHWAYS
18M FROM FACE OF ALL WARNING AND REGULATORY SIGNS

NOTE 3
THE TREE PITS AND PLANTING BEDS FOR ALL TREES AND SHRUBS LOCATED WITHIN 1 METRE OF UNDERGROUND UTILITIES ARE TO BE HAND DUG.

TOWN OF CALEDON

GENERAL LANDSCAPING NOTES

NO.	REVISION	APR'D	DATE
2	TEXT REVISION, STD103 NOW 700		JAN 18
1	STANDARD No. 130 NOW 103		JUNE 08

APR'D: C.C. DATE: APRIL 2000
DRAWN: BJM SCALE: NTS
STANDARD No. 700

Credit: Town of Caledon (2019)

Figure 4-7. Excerpt from Standard No. 700 for streetscape / road tree planting

Table 5. Standards and specifications gaps matrix summary

Municipality	Summary of Gaps in Municipal Standards and Specifications
Town of Caledon	• Planting in hard surfaces • Offset from retaining wall, noise wall • Clear zone requirements • Species and standards for climate change adaptation
City of Brampton	• Planting in hard surfaces • Species selection for genetic diversity • Species and standards for climate change adaptation
City of Mississauga	• Clear zone requirements • Species selection for Low Impact Development / Green Infrastructure • No clear street tree planting targets • Species and standards for climate change adaptation

4.5 Best Standards and Specifications Practices for Tree / Shrub Establishment in Peel

The selected best standards for tree / shrub establishment in a context of urbanization and climate change from within Peel are summarized in Table 6. These were drawn from a review of the standards and specifications within Peel Region, the Town of Caledon, the City of Mississauga and the City of Brampton in place in 2020 (see Appendix A),

Table 6. Summary of best standards and specifications within Peel

TREE / SHRUB SPECIFICATION OR STANDARD	MUNICIPAL BEST PRACTICE WITHIN PEEL
Soil testing / Soil quality	*Mississauga, Community Services, Subdivision Requirements, Section 02212* This is an industry-wide standard for testing soils imported to site, or to be used for planting. The best soil for trees encourages trees to grow to maturity, providing shade, water management, habitat, etc.
Width and depth of planting pit	*Mississauga, Community Services, Subdivision Requirements, Section 02950* Section 3.4 gives clear direction on width and depth, to be approved by Community Services or Consultant. Lateral room for structural and feeder root growth encourages trees to grow to maturity, providing shade, water management, habitat, etc.
Planting soil volume	*Mississauga, Community Services, Subdivision Requirements, Detail 02950-17* This is an industry-wide standard for planting soil volumes for trees to grow to near/maturity. 1 tree = 30m3; shared trees = 15m^3 each. Applicable to regional ROW with continuous trenches, either hardscape or softscape.
Offset from Utilities	*Town of Caledon, Open Space Standards, Standard No. 700* Applicable to regional ROW, these notes convey many utility clearances in a note included in drawing submissions.
Hard surfaces	*Mississauga, Community Services, Subdivision Requirements, Detail 02950-24, 02950-25* This is becoming an industry-wide standard for planting soil volumes for urbanized trees to grow to near/maturity. 1 tree = 30m^3; shared trees = 15m^3 each. Applicable to regional ROW with continuous trenches, hardscape.
Utility locates/coordination	*Mississauga, Community Services, Streetscape Feasibility Terms of Reference (2017)* On urbanized regional roads, 2x2m tree trench requires utilities to be relocated in favour of tree placement.
Sight triangles	*City of Brampton Bylaw 5-2014; Subdivision Design Manual (2008)*

TREE / SHRUB SPECIFICATION OR STANDARD	MUNICIPAL BEST PRACTICE WITHIN PEEL
	Trees prohibited within sight triangles.
Street/road trees	*City of Brampton Landscape Development Guidelines (2019)* Major road tree plantings shown for all road typologies; applicable to regional roads ROW
Native vs. non-Native	*City of Brampton Landscape Development Guidelines (2019)* Appendix B shows plant chart favours native when possible but acknowledges non-natives sometimes better suited.
Planting details	*Mississauga, Community Services, Subdivision Requirements, Detail 02950 (1-8, 17, 24-26)* Most current and comprehensive planting details covering many site conditions (hardscape and softscape).
Incorporation of trees and shrubs in Low Impact Development (LID) measures	• *City of Brampton Landscape Development Guidelines (2019)* • City of Mississauga soil cell trench tree planting and open grate detail 02950-25 (see Figure 4-2) • See Appendix B for plant chart for LID / Green Infrastructure measures
Maintenance during Warranty Period	*City of Brampton standard specification SPG 26 Landscaping* Clear instruction on contractor responsibilities.
Maintenance Pruning	*City of Brampton standard specification Section 02232; 5-7 year pruning cycle* Acknowledged as industry best practice.
Protection barriers	*Caledon Standard Details 606, 710, 711* Tree protection hoarding must be approved by certified arborist prior, during, post-construction.

5. Summary of Recommendations for Peel

Urbanization brings specific challenges for managing, planting and establishing trees and shrubs. These challenges tend to be compounded or exacerbated by climate change-related stressors. Key challenges include the need to: manage drainage where impervious surfaces are being introduced and expanded, provide appropriate soil qualities and volumes, and mitigate the potential impacts of seasonal and extreme wind events, salt spray, extreme and / or extended heat, and other stressors such as pests.

As noted above, the Region is seeking to develop procedures, levels of service, standards and specifications for tree establishment and maintenance that are aligned with the best practices already being implemented with the local area municipalities in Peel, or from other appropriate sources where needed. Table 7 provides a summary of standards that are considered best practices appropriate for street and park trees in Peel's urban areas in a changing climate. These best practices may be considered aspirational in the short term but are all considered implementable with adequate effort and investment. They are also what is considered necessary for building resilience in Peel's urban forest under current and future climate conditions by helping to maximize the health and resilience of the stock being established. These recommended best practices have been selected from within Peel, from selected comparator jurisdictions outside Peel Region (i.e., York Region and City of Toronto) and from established standards at the provincial and federal levels as per Appendix B.

Table 7. Summary of recommended best practices for trees and shrubs in rights-of-way in Peel

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION
TARGET PROCEDURES AND LEVELS OF SERVICE	
Organizational Structure	Have a standalone department or section in the Regional staffing structure whose primary responsibilities include urban forest management.
Street Tree Inventory	• Develop and maintain a GIS-based tree inventory integrated with a corporate-wide asset management system that updated continually or at least every five (5) years • Set-up a work order system for municipal trees that is also GIS-based and integrated with the tree inventory
Young Tree Inspections	Inspect newly established trees in years 1, 3, 5, 7 and 10 post-planting and coordinate with pruning
Pruning Cycle	See City of Brampton standard specification Section 02232 and York Region (see Table 11 Urban Forest Management Best Practices Guide for Peel (2020)) which recommend the following pruning:

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION
	• juvenile trees (1 – 12 cm dbh) up to 3 times in first 10 years of establishment if needed, but not within first two years; • intermediate trees (13 – 50 cm dbh) once every 5 to 7 years; and • mature trees: (>50 cm); 4-year inspection cycles and prune as needed.
Target Response Times for Service Requests	Initial response times within 30 days and action within 3 to 6 months
Risk Management	• Regular inspection of known "higher risk" areas and advanced (Level 3) testing when appropriate • Combination of cabling, bracing, crown reduction and removal if no other feasible alternative
Integrated Pest Management (IPM)	• Develop and implement a comprehensive IPM Plan • Undertake proactive management of EAB, GM, ALB, Dutch Elm Disease, Hemlock Woolly Adelgid, Oak Wilt, Black Knot and/or high priority pests as identified in the IPM Plan
Resources, In-house Training and Certifications	Have on staff at least: • One Certified Arborist per 10,000 street trees being managed per climbing arborist • One Certified Arborist that can climb • Minimum 20 hours training per staff member per year including at least one ISA Certified Arborist and one with risk management training, and • Adequate budget for tree establishment, maintenance (including IPM and risk management), removal and administration.
TARGET STANDARDS AND SPECIFICATIONS	
Establishment Planning in Rights-of-way (see Appendix A Items 1.1 - 1.2)	See City of Brampton Landscape Development Guidelines (2019) (they include tree plantings shown for all road typologies; applicable to regional ROW), Mississauga UFMP (2014) and Caledon (2019): • Space trees 8 to 10 m on center • Avoid monocultures of the same street tree species over large areas (Caledon and MBTW 2017) • Target no more than 20% of any one tree species on a given street (Caledon 2019) and work towards including different genera and families across the jurisdiction as well • Integrate shared rooting volumes for trees and associated herbaceous and small shrub plantings wherever possible. • Plan for tree planting early on in design processes

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION

Site Preparation (see Appendix A Items 2.1 - 2.4)	• The planting hole width should be a minimum of three times the diameter of the root ball and no less than 1.5 times the diameter of the root ball
	• The planting depth should ensure the final soil level, once backfilled and settled, is just below the root flare (by 8 – 10 cm)
	• From City of Kitchener Development Manual, Section M (2015):
	  o For small stature trees (20 – 39 cm dbh) min. of 17 m3 / tree, 11 m3/two trees
	  o For large stature trees (40 – 59 cm dbh) min. of 28 m3 / tree, 18.5 m3 /two trees
	  o For very large stature trees (≥ 60 cm dbh) min. of 45 m3 / tree, 30 m3 / two trees
	  o Minimum soil depths of 90 cm and maximum soil depths of 1 m
	• For trees in hardscape areas: 2 x 2 m tree trenches (1 m deep) and silva cell technology should be integrated

Hard surfaces	See Mississauga, Community Services, Subdivision Requirements, Detail 02950-24, 02950-25. Also see City of Kitchener minimum soil volume requirements from their Development Manual Section M (2015). • Require structural soil cells for hard surface areas • Reflective of what is becoming the industry-wide standard for planting soil volumes for urbanized trees to grow to near/maturity (generally 1 tree = 30 m^3; shared trees = 15 m^3 each) • Applicable to regional rights-of-way with continuous trenches, in hardscapes • From Toronto Tree Planting in Hard Surfaces Manual: T-PCP series for trenches and soil cells
Incorporation of trees and shrubs in Low Impact Development (LID) measures**	• Provision of adequate soil volumes, good quality soil and the required rooting space also expands capacity for site-specific stormwater management detention and release (e.g., through evapotranspiration), which can have tremendous value in built-up urban areas dominated by impervious surfaces • *City of Brampton Landscape Development Guidelines (2019),* City of Mississauga soil cell trench tree planting and open grate detail 02950-25 (see **Figure 4-2**) and see Appendix B for plant chart • Also see Low Impact Development (LID) planning and design guidance and toolkit developed and maintained by Credit Valley Conservation Toronto and Region Conservation /authority and Lake Simcoe Region Conservation Authority (https://wiki.sustainabletechnologies.ca/wiki/Main_Page)
Replacement and Planting Ratios	• Follow the Tableland Tree Replacement Guidelines City of Brampton 2018) which require a replacement ratio ranging from 1:1 to 5:1, depending on the dbh of the tree being removed • Continually seek opportunities to establish trees where none currently exist (and provide the appropriate below and above-ground conditions) on all projects and initiatives on municipal lands
Establishment: Stock Size and Care	See Urban Forest Management Best Practices Guide for Peel (2020) for recommended best practices related to tree and shrub selection and care: • For trees in rights-of-way, generally select 40 – 60 mm cal.; and • Inspect stock from the nursery (if possible at the nursery) and select for stock health and conditions over size

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION
Offsets from Utilities	From Electrical Safety Authority: • Overhead wires – Low/Medium/Tall zones • Underground hydro – 1.0 m • Transformers – 3.0 m • Fire hydrant – 3.0 m • Hydro poles – 3.5 m • Traffic signage/signal – 3.5 m
Utility locates/coordination	From Electrical Safety Authority: • Underground utilities – 1.0 m See Mississauga, Community Services, Streetscape Feasibility Terms of Reference (2017) • On urbanized regional roads, 2x2 m tree trench requires utilities to be relocated in favour of tree placement
Sight triangles	See City of Brampton Bylaw 5-2014; Subdivision Design Manual (2008): • Trees prohibited within sight triangles
Species selection	See City of Brampton Landscape Development Guidelines (2019), Appendix B: • Plant chart favours native when possible but acknowledges non-natives sometimes better suited • Provides plant species selection chart for some types of Low Impact Development / Green Infrastructure along rights-of-way
Protection barriers	See Caledon Standard Details 606, 710, 711: • Tree protection hoarding must be approved by Certified Arborist prior, during, post-construction.
Planting details	See Mississauga, Community Services, Subdivision Requirements, Detail 02950 (1-8, 17, 24-26): • Most current and comprehensive planting details covering many site conditions (hardscape and softscape)
Tree and Shrub Selection (see Appendix A Items 4.1-4.2)	York Region Road Design Guidelines: • 2020, Sections 8.11: Appendix K 'Acceptable Tree Species for Regional Road Allowances' From City of Brampton: • Landscape Development Guidelines, 2019: Appendix B Plant Chart, Buffer/Road Trees From City of Toronto: • Landscape Design Guidelines for Stormwater Management Ponds, 2015: Appendix A • Green Streets Technical Guidelines, 2017: 'Large canopy native species are preferred', Vegetation Selection Tool • Climate change considerations must be built into all levels of service, standards and specifications

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION
	• Although Peel Region's guidance is in line with best practices for the overall urban forest, this target is often unattainable when looking at street trees alone and therefore Mississauga and Caledon's targets are considered more appropriate • From various studies, highest salt tolerance is found among the following species suitable for Peel: o Native: - *Acer campestre* - *Celtis occidentalis* - *Gymnocladus dioica* - *Quercus alba* - *Quercus macrocarpa* o Non-native: - *Gingko biloba* - *Quercus robur 'Fastigiata'* - *Gleditsia triacanthos*
Tree and Shrub Selection (see Appendix A Items 5.1-5.7)	From Landscape Ontario Guide: • Organic or inorganic mulches can be used; all should be free of invasive/noxious weeds, salts, chemicals • Depth 50-100 mm, 150 mm away from the trunk • Stabilize with tree stakes only if necessary (small root ball, windy site, risk of damage) • Mycorrhizal fungi (Root Rescue) and compost tea as bio-stimulant From City of Toronto for hard surfaces: • TS 5.30; Section 32 94 56 Planting Soil for Silva Cells; Section 32 91 21 Growing Medium
Tree and Shrub Inspection (see Appendix A Items 6.1-6.5)	Inspection of nursery stock From Landscape Ontario Guide: • Become educated about nursery production practices; look for central leader; crown branches well-distributed; branch angles are wide; trunk straight; scars are closed; graft unions closed • Inspect stock at the nursery if possible and then again upon delivery to the site • From Canadian Landscape Standard: Section 2.1.21, Section 9.1.4, Appendix G Inspection of Installation • From Landscape Ontario Guide: Correct planting and placement • From Canadian Landscape Standard: Section 2.1.21, Section 9.1.6 Inspection during and end of warranty period • From Landscape Ontario Guide: Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering • From Canadian Landscape Standard: Section 2.1.21 Inspection during establishment

PROCEDURES, LEVELS OF SERVICE AND STANDARDS	DRAFT RECOMMENDED SELECTED BEST PRACTICES FOR PEEL REGION
	• From Landscape Ontario Guide: Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering • From Canadian Landscape Standard: Section 2.1.21 and Acceptance Criteria
Tree and Shrub Maintenance (see Appendix A Items 7.1-7.2)	Maintenance during warranty period • Water bag for 2 to 3 years • From Canadian Landscape Standard: Chapter 9; Section 9.1.5 (1-5) Maintenance during establishment period • From Canadian Landscape Standard: Chapter 9; Section 9.1.5 (6-8) Pruning • Typically a 7 year pruning cycle • From Canadian Landscape Standard: Section 6.3.8; Section 9.3.12 Fertilizing • From Landscape Ontario Guide: Pp. 45-47 • From Canadian Landscape Standard: Section 9.3.3 Watering • Water bag for 2 to 3 years • From Landscape Ontario Guide: Pp. 53-54 • From Canadian Landscape Standard: Section 9.3.2 Mulching • From Landscape Ontario Guide: Pp. 51-53 • From Canadian Landscape Standard: Section 9.3.6 Disease and pest control • From Canadian Landscape Standard: Section 9.3.9 • Dead tree removal - To be included in Warranty notes
Tree and Shrub Protection (see Appendix A Items 8.1-8.5)	From City of Toronto: Tree Protection Policy and Specifications for Construction Near Trees, 2016 • Protection zone and barriers including heavy equipment and storage around trees • Branch and root pruning including trenching and tunneling

** Incorporation of trees and shrubs into Low Impact Development (LID) measures such as bioretention swales, green roofs, stormwater planters, and stormwater treatment trains is increasingly recognized as a "win-win" approach to obtaining tree-related services (such as cooling, shade) and stormwater management (e.g., updatke of water through evapotranspoitation, soil erosion control from tree root systems) in urban spaces. Also see Guide 5 of this series.

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Appendix A. Peel Tree / Shrub Standards and Specifications Comparison Table and Draft Recommendations

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
1.0 Tree and Shrub Planning	1.1	Street tree planting targets (density, diversity)	TPPT (Tree Planting Priority Tool) used to identify and prioritize areas for tree planting within Peel's urban areas (Peel and CVC 2017). Note: Specific target numbers for tree planting jurisdiction-wide not identified.	Urban Forest Management Plan, 2014: No tree species represents more than 20% on a given street by 2033; Green Dev Standards, 2012: shade trees 6-8 m O.C. Note: Specific target numbers for tree planting jurisdiction-wide not identified.	Brampton Grow Green (2014) - 1000 City trees / 800 parkland trees per year short term 2010 data; Landscape Development Guidelines, 2019, Part 1, Section 1.1 Boulevards: 50% Dominant spp. / 50% Sub-dominant spp. 8-10 m O.C.; Typologies (boulevard, buffer, arterial, flankage, window, median); 1700-2000 new street trees planted per year projected. Note: Specific target numbers for tree planting jurisdiction-wide not identified.	Preservation and enhancements to the urban tree canopy to promote ecological function. Maintain and preserve mature canopy in private and public (Caledon and MBTW, 2017); No more than 4-8 of same species on one street; No more than 20% of any one species to be used on street; Spacing 10-12 m O.C. Note: Specific target numbers for tree planting jurisdiction-wide not identified.	Spacing: 8-10 m O.C. Diversity: See item 4(f) below for more on diversity targets. Integrate shared rooting volumes for trees and associated herbaceous and small shrub plantings wherever possible. *Target numbers for tree planting in ROWs jurisdiction-wide not identified through this project.*
	1.2	Master Planning Direction	SS Toolbox, page 40; LID (CVC 2014), Streetscape Master Planning (Peel and CVC 2017); Road Characterization (Peel 2013)	Green Development Standard 2012; Streetscape Feasibility ToR, 2017: requires 2x2 m tree trench for Hurontario/Queensway/Lakeshore; One Million Trees planting program; SPA process guidelines	Landscape Development Guidelines 2019; Subdivision Design Manual 2008; Development Design Guidelines 2003; Draft Plan of Subdivision tree planting requirements	Development Standards Manual (Caledon 2019); Caledon Design Guidelines 2017)	Plan for tree planting early on in design processes. Integrate shared rooting volumes for trees and associated herbaceous and small shrub plantings wherever possible For soil volumes see items 2.2 and 2.3 below.
2.0 Site Preparation	2.1	Soil testing	**	Community Services, Subdivision Requirements, Section 02212	BSS 802 (Nov 2019) Construction Specification for Topsoil	Section 2.3.5.7 in Development Standards Manual (2019) for park blocks and Table 2 soil testing as part of ESA if required as part of a new development.	Use the locally applicable soil testing standards: - Mississauga Community Services, Subdivision Requirements, Section 02212 - Brampton Standard Landscape Specifications, Section 02911 - Caledon Section 2.3.5.7 in Development Standards Manual (2019)
	2.2	Width and depth of planting pit	Design Standards, Vol.2, Section R.4.8.2	Community Services, Subdivision Requirements, Section 02950	Standard Landscape Specifications, Section 02911; SPG 26 Landscaping Specifications	Root ball width plus and additional 30 cm out from ball (Caledon 2018).	The planting hole width should be a minimum of three times the diameter of the root ball and no less than 1.5 times the diameter of the root ball. The planting depth should ensure that the final soil level, once backfilled and settled, is just below the root flare (by 8 – 10 cm).
	2.3	Planting soil volume	Peel's rough guideline: each cubic meter of soil volume will support apx. 2.2 square meters of tree canopy area (Peel and CVC 2017).	Community Services, Subdivision Requirements, Detail 02950-17; Groups of 2 or more trees - minimum 15 cubic meters of high	Standard Landscape Specifications, Section 02911	**	From City of Kitchener Development Manual, Section M (2015):

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
				quality topsoil per tree. A single tree should have minimum 30 cubic meters soil volume (Mississauga 2012)			- For small stature trees (20 – 39 cm dbh) min. of 17 m3 / tree, 11 m3/two trees - For large stature trees (40 – 59 cm dbh) min. of 28 m3 / tree, 18.5 m3 /two trees - For very large stature trees (≥ 60 cm dbh) min. of 45 m3 / tree, 30 m3 / two trees - Minimum soil depths of 90 cm and maximum soil depths of 1 m For trees in hardscape areas: 2 x 2 m tree trenches (1 m deep) and silva cell technology should be integrated.
	2.4	Soil quality and amendments, and other soil preparation	Design Standards, Vol.2, Section R.4.5.1: - Max. 52% sand, max. 50% silt, max. 27% clay; - min. 5% organic matter; - salt conductivity of less than 2 mlms/cm - Topsoil free of coarse vegetation at least 75 mm diameter and 100 mm long and debris and stones in excess of 25 mm; - pH 6.0 to 7.5	Community Services, Subdivision Requirements, Section 02212: - 20 – 70% sand, 5-20% organics for clay loams and 2-20% organics for sandy loams; - Topsoil free of subsoil, roots, grass, weeds, toxic materials, stones in excess of 25 mm and foreign objects; - pH 6.0 to 7.5 - Nutrients shall be available as follows in the topsoil: Nitrogen (N) 20-40 mg/g; Phosphorus (P) 10-20 mg/g; Potassium (K) 80-120 mg/g ; Calcium (Ca), Magnesium (Mg) and micro-nutrients including Iron (Fe), Zinc (Zn), Boron (B), Sulphur (S), Copper (Cu) and Molybdenum (Mb) in balanced ratios.	BSS 802 (Nov 2019) Construction Specification for Topsoil Standard Landscape Specifications, Section 02911: - 40 – 50% sand, 30 – 40% silt, 15 – 25% clay; min. 4% organics for clay loams and 2% organics for sandy loams;; - Topsoil free of coarse vegetation at least 10 mm diameter and 100 mm long and debris and stones in excess of 50 mm; - pH 6.2 to 7.2 - Test for (presumably exceedances of) Boron (B), Iron (Fe), Manganese (Mn), Zinc (Zn), Sulphur (S), Copper (Cu), soluble salts and Atrazine.	Town Standard detail 702, Section C; Standard Detail No. 805, 700 series	- 40 – 50% sand, 30 – 40% silt, 15 – 25% clay; - min. 4% organics for clay loams and 2% organics for sandy loams; - Topsoil free of coarse vegetation at least 10 mm diameter and 100 mm long and debris and stones in excess of 50 mm; - pH 6.0 to 7.5 - Nutrients shall be available as follows in the topsoil: Nitrogen (N) 20-40 mg/g; Phosphorus (P) 10-20 mg/g; Potassium (K) 80-120 mg/g ; Calcium (Ca), Magnesium (Mg) and micro-nutrients including Iron (Fe), Zinc (Zn), Boron (B), Sulphur (S), Copper (Cu) and Molybdenum (Mb) in balanced ratios. - Test for exceedances of: Iron (Fe), Manganese (Mn), soluble salts and Atrazine.
3.0 Tree and Shrub Placement	3.1	Offset from Utilities (e.g., overhead wires, underground pipes, fire hydrants, valves, hydro poles, manholes, traffic signage, traffic signals, etc.)	Placement of trees and LID methods should be done as to have minimal effect on existing utilities; for larger projects, site assessment using 3D utility modeling is useful. Also: Public Works Design Criteria Manual, Section 2.7, page 10	6-lane Arterial Cross Section Standard 2211.130: 1.5 m from JUT, 3m from hydrant, 3.5 m from street light	Minimum 3.0m from hydro pole / OH wire (drawing L919); Subdivision Design Manual, 2008	A max. height restriction of 7.5m is imposed on trees planted directly under hydro wires. Taller species with ultimate spread of no more than 12m may be planted along street line i.e.. 5m back from line of hydro poles (Caledon and MBTW, 2017).	From Electrical Safety Authority: - Overhead wires – Low/Medium/Tall zones - Underground hydro – 1.0 m - Transformers – 3.0 m Fire hydrant – 3.0 m Hydro poles – 3.5 m Traffic signage/signal – 3.5 m
	3.2	Offset from multi-use trails and sidewalks	Min. 1.5m setback from existing infrastructure and proposed tree trunk (deciduous). Min. 1m setback from existing infrastructure and	6lane Arterial Cross Section Standard 2211.130: 0.5m from sidewalk, 3.0m from curb	Arterial Cross Section Standard 208: 0.7m from sidewalk, 3.0m from curb	1.0 m from edge of trunk to sidewalks and trails as a general rule as part of the design review process.	From Toronto Multi-use Trail Guidelines: - 2.0 m away from edge of trail - 1.5 m from edge of sidewalk

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
			estimated dripline at 15 years for (coniferous) (Peel and CVC, 2017)				
	3.3	Hard surfaces	SS Toolbox, page 41: Consider the use of a soil-cell system	Standard Detail 02950-24, 02950-25	**	**	From Toronto Tree Planting in Hard Surfaces: - T-PCP series for trenches and soil cells
	3.4	Offset from retaining walls	**	1.2 m from wall – deciduous trees only at walls	2.0 m typical	**	Centre of tree planted min. 1.5 m from toe or top of wall
	3.5	Offset from noise walls	Min. 1.5m setback between noise wall and trunk of tree (Peel and CVC, 2017)	1.2 m from wall – deciduous trees only at walls	Minimum 2.75m from noise wall (drawing L915)	**	Centre of tree planted min. 1.5 m from wall
	3.6	Clear Zone requirements	Place street trees outside of the clear zone. Use shrubs where clear zone is an issue (Peel and CVC, 2017)	**	Comply with TAC guidelines	**	Where clear zone required, place street trees outside of the clear zone.
	3.7	Tree spacing, density	Caliper trees of >40mm planted in groups should be spaced approximately 5-8m on center. Species and site may influence the distance (Peel and CVC, 2017)	6-8 meters apart along all street frontages, open space frontages and public walkways (Miss., 2012)	Landscape Development Guidelines, 2019: tree spacing shown for all street typologies	Only general information regarding spacing within developments is provided (Caledon, 2019)	Spacing of 8-10 m O.C.
	3.8	Utility locates / coordination	Consult with each utility on clearances (Peel and CVC, 2017)	Streetscape Feasibility ToR, 2017: required 2x2m tree trench for Hurontario/Queensway/Lakeshore; utilities are relocated;; Community Services, Subdivision Requirements, Section 02950	Shown on 200 Series Road Cross Sections	Coordinate the location of street lighting fixtures and utility boxes to ensure healthy and sustained tree growth and avoid obstructions to street lighting and other hydro infrastructure (Caledon and MBTW, 2017). Tree pits within 1m of UG utilities are to be hand dug (Caledon, 2018a); Town Standard detail 701, Section A.	From Electrical Safety Authority: - Underground utilities – 1.0 m From City of Mississauga Streetscape Feasibility TOR: - Prioritize tree planting and re-direct utilities around SUE investigations for large projects Ontario One Call
	3.9	Sightlines / daylight triangles	**	Boulevard Encroachment Permit: Sight triangles must remain vacant for safety reasons	Bylaw 5-2014: No trees within Intersection Sightline Triangle; Subdivision Design Manual, 2008	Development Standards Manual, 2019: trees prohibited within sight triangles.	York Region Sight Triangle Manual, 2011.
	3.10	Streets	Incorporate plantings that include street trees in ROWs with boulevards wider than 8m (Peel and CVC, 2017)	Streetscape Feasibility ToR, 2017: required 2x2m tree trench for Hurontario/Queensway/Lakeshore;	Landscape Development Guidelines, 2019: trees shown for all street typologies	Provide row of street trees between the sidewalk and roadside curb or as appropriate. Provide double, staggered row of trees on higher order or special streets with heavy pedestrian traffic (Caledon and MBTW, 2017)	Section 8.11 of York Region Road Design Guidelines, 2020. Section 8.11
	3.11	Light standards	6m setback from light and proposed tree planting (Peel and CVC, 2017)	6lane Arterial Cross Section Standard 2211.130: 3.7m from light standard	Arterial Cross Section Standard 208: 0.7m from sidewalk, 2.7m from light standard	5 m from street lights (Caledon, 2018a. #700). Also see 3.1 c	Light pole/road lighting – 6.0 m
	3.12	Private approaches / driveways	**	1.2m from driveways – 2.4m on centre	1.2m from driveways; Driveway widening's are coordinated through permit approvals which include clearance for trees.	Offset 2m from driveways; On-lot tree planting in the private realm is encouraged (Caledon and MBTW, 2017; Town Standard Detail 700)	Driveways – 3.0 m
	3.13	Property lines	Set back trees a minimum of 1.5m from property line (Peel and CVC, 2017)	6lane Arterial Cross Section Standard 2211.130: 0.3m from property line	Arterial Cross Section Standard 208: 0.7m from sidewalk, 0.3m from property line	0.5m from edge of trunk to sidewalks and trails as a general rule as part of the design review process.	Property line – 1.5 m

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
4.0 Tree and Shrub Selection	4.1	Tree and shrub species selection					
	a.	For regional roads	**	Not without Region of Peel approval	Landscape Development Guidelines, 2019: Appendix B Plant Chart	*Preferred Street Tree List forthcoming*	York Region Road Design Guidelines, 2020, Sections 8.11: Appendix K 'Acceptable Tree Species for Regional Road Allowances'
	b.	For under overhead wires	Appendix F in SS Toolbox has list of trees approved by Ontario Hydro. Designers should work with utility providers to ensure trees can be planted adjacent to sidewalks and multi-use trails while maintaining the use, functionality, and accessibility of overhead utilities (Peel and CVC 2017).	Ornamental or low overhead growing species – when applicable – try to avoid planting under overhead hydro when possible	Landscape Development Guidelines, 2019: Appendix B Plant Chart	Plant smaller deciduous tree species when there are space limitations (Caledon and MBTW 2017).	From City of Brampton: - Landscape Development Guidelines, 2019: Appendix B Plant Chart, Buffer/Road Trees
	c.	Near underground Infrastructure	Work with utility companies for best location of trees (Peel and CVC 2017).	Work with utility companies for best location of trees or follow guidelines and standards and not plant at all to avoid future legacy (stump) and expectation that tree will be replanted if mortality strikes.	Landscape Development Guidelines, 2019: Appendix B Plant Chart	Coordinate the location of street lighting fixtures and utility boxes to ensure healthy and sustained tree growth and avoid obstructions to street lighting and other hydro infrastructure (Caledon and MBTW, 2017). Tree pits within 1m of UG utilities are to be hand dug (Caledon 2018a).	From City of Toronto: - Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 10 lists species intolerant to adjacent construction
	d.	Near Natural Heritage areas	Native and non-invasive species should always be selected when planted near naturalized / natural heritage areas (Peel and CVC 2017).	Native and non-invasive species should always be selected when planted near naturalized /natural heritage areas	Landscape Development Guidelines, 2019: Appendix B Plant Chart	Plant native species adjacent to the natural heritage system (Caledon and MBTW 2017).	From Peel Region: - Native and non-invasive species should always be selected when planted near naturalized / natural heritage areas (Peel and CVC 2017).
	e.	Near LID and stormwater management practices	Methods of LID such as incorporation of trees to bioswales, rain gardens etc. should be considered where possible (Peel and CVC 2017).	**	Landscape Development Guidelines, 2019: Appendix B Plant Chart	Encouraged to incorporate water infiltration measures at the tree base, i.e.. LIDs and decorative metal grates (Caledon and MBTW, 2017)	From City of Toronto: - Landscape Design Guidelines for Stormwater Management Ponds, 2015: Appendix A - Green Streets Technical Guidelines, 2017: 'Large canopy native species are preferred', Vegetation Selection Tool
	f.	Diversity requirements	Need for genetic diversity mentioned in Streetscape Toolbox (Peel and CVC 2017). No single species should represent more than 5%, no genus should represent more than 10% and no family should represent more than 20% of the tree population (Peel and CVC 2017).	Need for genetic diversity mentioned in UFMP (2014) and in relation to climate change mentioned in in Climate Change Plan (2019). Urban Forest Management Plan (2014): No tree species represents more than 20% on a given street by 2033.	Need for genetic diversity in relation to climate change mentioned Brampton Grow Green 2014. Landscape Development Guidelines, 2019, Part 1, Section 1.1 Boulevards: 50% Dominant spp. / 50% Sub-dominant spp., 8-10m O.C.; Typologies (boulevard, buffer, arterial, flankage, window, median)	Need for genetic diversity mentioned in Development Standards Manual (2019) Section 2.3 and in relation to climate change mentioned in Caledon Community Climate Change Action Plan. Avoid monocultures containing the same street tree species over large areas (Caledon and MBTW, 2017). No more than 20% of any one tree species on a given street (Caledon, 2019).	- Climate change considerations must be built into all levels of service, standards and specifications. - Although Peel Region's guidance is in line with best practices for the overall urban forest, this target is often unattainable when looking at street trees alone and therefore Mississauga and Caledon's targets are considered more appropriate.

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
	g.	Disease and pest resistance	Select tree species that can tolerate adverse weather and pests (Peel and CVC 2017).	Forestry section monitors City trees for signs of insects and pest plant species (website, 2020).	City has two plant health care specialists, monitoring trees daily (website, 2020).	Avoid species that are affected by invasive insects (Caledon and MBTW 2017).	See *Urban Forest Management Best Practices Guide for Peel* (2020)
	h.	Salt tolerance	High level of salt tolerance required for urban areas in the ROW. See plant list in SS Toolbox (Peel and CVC 2017).	Plant trees that are hardy, salt tolerant and high branching of deciduous varieties that can tolerate street environments	Landscape Development Guidelines, 2019, page 14: Avoid *using A. rubrum, A. saccharum, Tilia* on arterial roads.	Plant trees that are hardy, salt tolerant and high branching of deciduous varieties that can tolerate street environments (Caledon and MBTW 2017)	From various studies, highest salt tolerance: Native: - *Acer campestre* - *Celtis occidentalis* - *Gymnocladus dioica* - *Quercus alba* - *Quercus macrocarpa* Non-native: - *Gingko biloba* - *Quercus robur 'Fastigiata'* - *Gleditsia triacanthos*
	i.	For narrow and wide boulevards	Use of shrubs in narrow boulevards where there is no room for trees (Peel and CVC 2017).	Right tree for the right location	Landscape Dev Guidelines, 2019, page 14: Narrow/Medium form species.	Development Standards Manual (2019), Section 2.3.1.1: Note section outlines requirements for boulevards >2.0m wide.	From City of Brampton: - Landscape Development Guidelines, 2019, page 14 Boulevard Trees 'narrow-medium form'
	4.2	Tree and shrub type					
	a.	Deciduous vs. Coniferous	Deciduous shade trees that will grow greater than or equal to 15m tall at maturity (Peel and CVC 2017).	Deciduous for street tree plantings (Mississauga 2003).	Landscape Development Guidelines, 2019: Appendix B Plant Chart	Deciduous varieties for street tree planting, coniferous trees can be incorporated in site frontages and buffer areas (Caledon and MBTW 2017).	Deciduous for urbanized regional roads Coniferous for rural regional roads and buffers
	b.	Native vs. non-Native	Use of native, cultivars and other approved non-native species may be acceptable (Peel and CVC 2017).	Ensure 50% of proposed plantings are native species where feasible (Mississauga 2012).	Landscape Development Guidelines, 2019: Appendix B Plant Chart; UFI (2020) 'We favour native species wherever possible, but recognize that non-natives may be better suited to some sites and plant accordingly.'	Native species are preferred, where possible (Caledon and MBTW 2017).	Minimum 50% native species for any regional road planting
5.0 Tree and Shrub Planting	5.1	Planting details	Tree Planting Details for Softscape Boulevards - Dwgs NHF-01 to 03 and NHF-17 to 19 (Peel, 2016a). Boulevard Tree Planting Soil Trench for Softscape Boulevards - Dwg 5-4-5 (Peel 2016b).	Community Services Details: Tree Planting Details 02950 (1-8, 17, 24-26)	SPG 26 Landscaping Specifications Deciduous Tree Planting - Dwg L910 (Brampton, 2018), Tree Planting on Slope - Dwg L913, Buffer Planting - Dwgs L915, L916, L916a, L917 and L917a, Traffic Island Concept - Dwg L919 (Brampton, 2014.)	Deciduous Tree Planting - Dwg 800 (Caledon 2018).	Utilize local planting details
	5.2	Mulch	10 cm depth woodchip mulch with 30 cm depth mulch ring. Mulch should be kept 5 cm away from trunk of tree (Peel and CVC 2017).	3" of evenly spread shredded bark mulch (Mississauga 2002).	Shredded wood bark at 100mm min. (Brampton, as of 2019. Section 02906)	75mm depth approved shredded pine mulch (Caledon 2018).	From Landscape Ontario Guide: - Organic or inorganic mulches can be used; all should be free of invasive/noxious weeds, salts, chemicals. Depth 50-100mm, 150mm away from the trunk
	5.3	Tree staking	Wooden stakes aligned with prevailing wind where required. Tree tie used to anchor tree to stake (Peel, 2016a). Tree ties should be biodegradable (Peel and CVC 2017)	T-Rail steel stakes 37 x 37 x 1200mm long. Wires #11 gauge min. galvanized iron wire with 2-ply reinforced black rubber hose (Mississauga 2002).	T-Bar steel stakes 40 x 40 x 5 x 2440mm with #10 wire and pine or fir wood 38 x 38 x 2400mm treated with 'Pentox' preservative. Use rubber hose for tie around tree	Min. two 2.4m long, 50mm square pressure-treated wood stakes with 12ga. galvanized wire enclosed in 12mm dia. Black rubber hose (Caledon, 2018)	From Landscape Ontario Guide: - Stabilize only if necessary (small root ball, windy site, risk of damage)

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
					(Brampton, as of 2019. Section 02906)		
	5.4	Fertilizer and/or planting amendments	Myke Pro Landscape G mycorrhizal inoculant (Peel 2016a) ROOT RESCUE	Community Services, Subdivision Requirements, Section 02212	10-6-4 @ 36g/1mm of caliper for trees (Brampton, as of 2019. Section 02906)	**	From Landscape Ontario Guide: - Mycorrhizal fungi ('Root Rescue') and compost tea as biostimulant
	5.5	Planting soil	Backfill with native soil (Peel, 2016a). Planting soil as specified with 40mm of organic matter tilled into top layer of installed planting soil to a depth of 60-90mm (Peel 2016b)	Community Services, Subdivision Requirements, Section 02212	Standard Landscape Specifications, Section 02911	2 parts triple mix, mixed with 1 part local topsoil (Caledon, 2018a. #702)	From City of Toronto for hard surfaces: - TS 5.30; Section 32 94 56 Planting Soil for Silva Cells; Section 32 91 21 Growing Medium
	5.6	Tree guards / watering bags / wraps	'Arborgard + AG9-4' tree guard or approved equal. Tree Gator watering bag for 3 years after planting. White-wash, burlap 'Kraft Wrap' or 'Foylon' applied to trunk for sunscald prevention (Peel and CVC 2017)	Community Services, Subdivision Requirements, Section 02950	1.4mm wire with 25 x 50mm mesh for tree guards. Tree wrapping material: new, clean, plain burlap strips min, 2.5kg/m2 mass 150mm wide (Brampton, as of 2019. Section 02906). Trunk rodent prevention (Brampton, 2018)	Approved spiral plastic rodent guard (Caledon, 2018)	- 'Arborgard' or approved equal - Watering bags ('Gator bags') gaining in success rates and use - Wrapping not recommended
	5.7	Root barriers	NA	Not required unless requested or deemed essential	**	NA	- Root deflectors sometimes required adjacent to utilities that cannot be relocated
6.0 Tree and Shrub Inspection	6.1	Inspection of nursery stock	**	The Vendor shall comply with the following: - Make plant materials available for inspection at source of supply when requested by the Contract Manager. - Approval of plant materials at source of supply shall not impair the right of the Contract Manager to inspect plants upon arrival on the site or during the course of planting and to reject plants which have been damaged or which, in any way do not conform to the specifications.	**	Town Standard detail 701, Section B iv)	From Landscape Ontario Guide: - Become educated about nursery production practices; look for central leader; crown branches well-distributed; branch angles are wide; trunk straight; scars are closed; graft unions closed; ALL above again upon delivery to site From Canadian Landscape Standard: - Section 2.1.21; Section 9.1.4; Appendix G
	6.2	Inspection of Installation	**	- All plant materials shall meet the Horticultural Standards of the Canadian Nursery Landscape Association with respect to size, grading and quality.	**	Town Standard detail 702, Section D iii)	From Landscape Ontario Guide: - Ensure correct depth, width, and placement From Canadian Landscape Standard: - Section 2.1.21; Section 9.1.6
	6.3	Inspection during and end of warranty period	**	The Vendor warrants and covenants to the City that all trees supplied or planted by Vendor shall: - be free from defects and disease; - be fit for purpose; - be of merchantable quality; - be inclusive of all labour and materials; and	**	Town Standard detail 702, Sections E & F. and Development Standards Manual (2019), Section 2.4.	From Landscape Ontario Guide: - Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering From Canadian Landscape Standard: - Section 2.1.21

Category	Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
			- correspond with the description of the trees where such description is provided by the City for a period of 2 years from the date of planting. Each warranty and covenant made by the Vendor is deemed to constitute condition of this Contract and shall survive the termination or expiration of the Contract.			
	6.4 Inspection during establishment	**	Maintenance is required throughout the term of the Contract. GPS reports must be provided to the City when invoicing for maintenance. General maintenance is required over the entire length of the contract. This maintenance includes all measures necessary to establish and maintain all plants in an acceptable, vigorous and healthy growing condition. - Watering when required, ensuring saturation of the root system. Records indicating Watering dates and times must be provided to the City when requested. - Pruning is to include the removal of dead, broken, interfering, and low branches. - Maintaining all accessories in good condition such as tree stakes and ties. Straightening of leaning trees shall be the responsibility of the Vendor up to the final warranty date of August 1st of the second year from installation of the plants. - Fertilizing of all plant material on initial planting, using controlled release fertilizer 18-6-12 90% SCU Application rate to be 354.88ml (12oz) applied to the root ball surface prior to the application of topsoil and mulch. - Maintaining all tree wells and shrubs beds free of weeds.	**	Town Standard details 702 & 703 and Development Standards Manual (2019), Section 2.4.	From Landscape Ontario Guide: - Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering From Canadian Landscape Standard: - Section 2.1.21

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
				Cultivated area must be completed with a garden fork once a year with the last cultivation completed prior to final warranty. - Re-mulching of all trees with shredded pine bark or shredded cedar bark must be done prior to Final Acceptance.			
	6.5	Acceptance criteria	**	Any trees that the Contract Manager deems in its sole and absolute discretion to be diseased, dead, or contain defects or is otherwise in unacceptable condition shall be promptly replaced by the Vendor. The Warranty will extend to August 1 (annual inspection end date), two years following each new Contract year: Vendors must provide the name of the warranty inspector for the duration of the Contract, who will be responsible for co-ordinating warranty inspections with the Contract Manager.	**	Town Standard details 702 & 703 and Development Standards Manual (2019), Section 2.4.	From Landscape Ontario Guide: - Appendix A, Table 10 From Canadian Landscape Standard: - Section 2.1.22; Section 9.1.11; Section 9.2
7.0 Tree and Shrub Maintenance	7.1	Maintenance during warranty period	**	Community Services, Subdivision Requirements, Section 02950	SPG 26 Landscaping Specifications	Proper irrigation, cultivation and weeding of tree pits and planting beds, insect and disease control, pruning and fertilizing, replacement of dead plant material (Caledon, 2018a. #703); Town Standard detail 703, Section G	Gatorbag watering for 2 years From Canadian Landscape Standard: - Chapter 9; Section 9.1.5 (1-5)
	7.2	Maintenance during establishment period			SPG 26 Landscaping Specifications		From Canadian Landscape Standard: - Chapter 9; Section 9.1.5 (6-8)
	a.	Pruning	**	Community Services, Subdivision Requirements, Section 02950	Specification section 02232; UFI (2020) 5-7 year pruning cycle; for young trees -- No formal young tree structural pruning program, but young trees are pruned as part of cycle and by City staff on as-needed/as-assigned basis.	Town Standard details 703, Section G 4), 800 Notes and 801 Notes.	Typically a 7 year pruning cycle From Canadian Landscape Standard: - Section 6.3.8; Section 9.3.12
	b.	Fertilizing	**	Fertilizing of all plant material on initial planting, using controlled release fertilizer 18-6-12 90% SCU Application rate to be 354.88ml (12oz) applied to the root ball	UFI (2020) year 3 fertilization	Town Standard detail 703, Section G 4)	From Landscape Ontario Guide: - Pp. 45-47 From Canadian Landscape Standard: - Section 9.3.3

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
				surface prior to the application of topsoil and mulch.			
	c.	Watering	Provide sufficient water for at least 3 years after planting (Peel and CVC, 2017)	Water when required and sufficient so saturate root system - foliage should not be allowed to wilt (Miss., 2002)	Watering tips online, directed to public (website, 2020)	Water at time of planting and whenever deemed necessary to maintain the plant material in a healthy condition (Caledon, 2018a. #708)	Gator bags for 2 to 3 years From Landscape Ontario Guide: - Pp. 53-54 From Canadian Landscape Standard: - Section 9.3.2
	d.	Mulching	**	Mulching shall consist of shredded pine bark or shredded cedar bark. The mulch shall be spread in a layer at least 10cm (3.93in) thick over the whole soil surface of the saucers and planting bed(s), keeping clear of the stem/trunk of each tree.	PDF Mulching Techniques directed to public	As requested by Town staff during the inspection process.	From Landscape Ontario Guide: - Pp. 51-53 From Canadian Landscape Standard: - Section 9.3.6
	e.	Disease and pest control	**	Forestry section monitors City trees for signs of insects and pest plant species. (website, 2020)	City has two plant health care specialists, monitoring trees daily (website, 2020)	**	From Canadian Landscape Standard: - Section 9.3.9
	f.	Dead tree removal	**	See 6.5 - Acceptance	**	Town Standard details 703, Section G 5)	To be included in Warranty notes
8.0 Tree and Shrub Protection	8.1	Protection zone	**	City of Mississauga Tree Preservation & Protection Standards (2017)	Protection beyond the dripline (Brampton, as of 2019. Section 02901)	Dripline at a minimum (Caledon, 2008)	All from City of Toronto: Tree Protection Policy and Specifications for Construction Near Trees, 2016
	8.2	Protection barriers	1.2m ht. 9ga wire fixed to metal T-bar posts on 3m centers. 15cm dia. Wood posts on 21m centers. Should be prescribed by a qualified professional and completed by a certified Arborist (Peel and CVC, 2017)	Protection fencing (solid or framed hoarding, page wire, modular) to be installed in accordance with the City of Mississauga Tree Preservation & Protection Standards (2017) or as directed by the City Arborist; Hoarding details 02830-1 to 02830-6	Minimum 1.2m high temporary fencing as per City of Brampton detail L110 (Brampton, as of 2019. Section 02901) 2x radius of drip line for trees with DBH >30cm, fence on drip line for trees with DBH <30cm (Brampton, 2014)	Standard 1.2m height snow fence secured to T-bar stakes at a minimum 2.4m on center. Siltation control fencing may be used as TP fence if required (Caledon, 2008)	Detail TP-1, February 2016
	8.3	Heavy equipment and storage around trees	**	No traffic, vehicles or equipment to compact soil within the dripline of trees to be retained. No stockpiling of material within the drip line; No storage of any excavated material, construction material, fill, refuse or equipment, or vehicles within the Tree Protection Zone (TPZ) (Miss., 2015)	No equipment, soil, vehicles, debris or materials over root systems of trees within protective fencing (Brampton, as of 2019. Section 02901)	Areas within preservation area to remain undisturbed and shall not be used to materials or equipment storage (Caledon, 2008)	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 6
	8.4	Branch and root pruning	Should be prescribed by a qualified professional and completed by a certified Arborist (Peel and CVC, 2017)	Prune limbs that may be impacted by construction. Root pruning only when directed by City's Arborist. Pruning to be carried as specified in OPSS 503 or by ISA Certified Arborist (Miss., 2015) City of Mississauga Tree Preservation & Protection Standards (2017)	**	Prune branches to removed damaged limbs only. No more than 20% of the tree shall be pruned unless directed by the town (Caledon, 2008)	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 6

Category		Standards and Specifications	Peel Region	Mississauga	Brampton	Caledon	DRAFT RECOMMENDATIONS*
	8.5	Trenching and tunneling	Trenching for utilities should remain outside of the dripline. Trenchless techniques should be used when it is not possible to work around dripline (Peel and CVC, 2017)	Tunnel under or around roots by hand digging to prevent damage to roots (Miss., 2015); All efforts should be made to route all underground utilities around the TPZ; if this cannot be achieved, utilities should be bored or tunnelled with a minimum depth of 1.2m under the TPZ. Boring/tunnels should not go directly beneath the trunk; instead the boring/tunnels should be offset based on the tree diameter (City of Mississauga Tree Preservation & Protection Standards 2017)	**	**	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 2 (prohibited)

* These reflect the recommended directions, where applicable, from the *Urban Forest Management Best Practices Guide for Peel* (2021) and have been drawn from within Peel and from comparator jurisdictions.
** No information was available in this jurisdiction for this particular specification or standard at the time of this review.
Miss. = City of Mississauga, CVC = Credit Valley Conservation

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Appendix B. Tree and Shrub Standards and Specifications Comparison from Other Selected Jurisdictions and Sources

Category		Standards and Specifications	City of Toronto	York Region	Landscape Ontario Tree Planting Guide	Canadian Landscape Standard
1.0 - Tree and Shrub Planning	1.1	Street Tree Planting Targets	Forest Management Plan Appendix 2: overall canopy target of 40%; Section 7 - No more than 5% of one species, 10% of one genus, and 20% of one family on any one street section; Increase % of mid-large sized trees (DBH>30cm). Toronto maintains a database with individual street trees as point data. Note: Specific street tree target % unclear.	Max 20% from same genus; Max 10% from same species; %. >2000 road trees planted annually	NA	NA
	1.2	Master Planning Direction	Forest Management Plan, 2012; Tree Canopy Study, 2018; Urban Forestry service pillars: Maintain, Protect, Plant, and Plan	York Region Road Design Guidelines, Feb. 2020, Sections 8.10, 8.11, Appendices J, K; Streetscape Design Review Manual, 2014; York Region Forest Management Plan, 2017; Designing Great Streets, 2019: Toolbox: Boulevard and Roadway Elements	NA	NA
2.0 Site Preparation	2.1	Soil Testing	TS 5.10	GAP	Determine soil texture based on lab analysis or hand-texturing method; perform compaction testing and perform necessary de-compacting (subsoiling, backhoe-turning, surface decompaction, radial trenching	Section 2.1.17; Section 6.1.6
	2.2	Width and Depth of Planting Soil	TS 5.30	GAP	Depth – most soils – root flare at or slightly above grade; poorly-drained soils – plant about 10 cm above grade Width – three times the diameter of the root ball	Section 9; Table T-6.3.5.5 600 mm (24") deep for as large an area as possible around each tree (min. 10 m2)
	2.3	Planting soil volume and quality	TS 5.30; Toronto Green Standard Tier 1 EC 1.1 min. 30 m3 per separate tree area	GAP	Estimate useable soil volume for each tree planting location	
	2.4	Soil quality and amendments, and other soil preparation	TS 5.30	GAP	- Identify drainage characteristics of the site (poor/moderate/excessive) from a drainage test - Maintain organic matter of min. 5% - Biochar - Consider hardiness zones, light levels, reflected heat; vertical mulching for tree roots	- Section 6.2.6, Section 6.3.4 - Section 6.2.5 - Table T-6.3.5.1 to 4; Section 3
3.0 - Tree and Shrub Placement	3.1	Offset from Utilities (e.g., overhead wires, underground pipes, fire hydrants, valves, hydro poles, manholes, traffic signage, traffic signals, etc.)	Tree Planting Solutions in Hard Surfaces, 2014: T-PCP series	York Region Road Design Guidelines, 2020, Sections 8.11: Appendix K; Generally, min 1m away from UG utilities	Consider crown space requirements; choose deep-rooting species; avoid aggressive rooting species	
	3.2	Offset From Multi-Use trails and Sidewalks	Toronto Multi-Use Trail Design Guidelines, 2015: page 92; generally 2.0 m away from edge of trail 1.5m away from sidewalks	Min 1m from sidewalk. 1.5m preferred	Install sidewalk cut-outs	

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	3.3	Hard Surfaces	Tree Planting Solutions in Hard Surfaces, 2014: T-PCP series; Continuous soil trenches with soil cells or reinforced concrete panels Green Streets Technical Guidelines, Section 3.2.6; Section 32 88 88 Soil Cells	York Region Road Design Guidelines, 2020, Section 8.11: 'Innovative techniques may be required to provide this space in constrained environments (e.g. soil cells, structural soils'	Install modular suspended pavement systems and use manufactured soil blends	
	3.4	Offset From Retaining Walls	GAP	GAP		
	3.5	Offset From Noise Walls	GAP	GAP		
	3.6	Clear Zone Requirements	GAP	Min 2.5m from clear zone	Determine distance between the planting site and where de-icers will be applied	
	3.7	Tree Spacing	Tree Planting Solutions in Hard Surfaces, 2014: T-PCP series; Generally 10m; trees to be spaced at no less than 5m and no more than 10m; Toronto Green Standard min 8m spacing	Full form species, 10m on centre; small form 8m on centre		
	3.8	Utility Locates	GAP	Refer to DS-001 in RDGL Appendix G for standard utility offsets	Ensure locates are completed and setbacks are followed prior to siting trees	
	3.9	Sightlines / Daylight Triangles	GAP	York Region Road Design Guidelines, 2020, Sections 8.10, Appendix J Sight Triangle Manual		
	3.1	Streets	Tree Species Suitability List (Manual)	York Region Road Design Guidelines, 2020, Sections 8.11		
	3.11	Light Standards	GAP	Min 3 m away from light standard		
	3.12	Private Approaches / Driveways	GAP	Min 3 m away from entrance/driveway		
	3.13	Property Lines	GAP	Min 1 m offset from property lines		
4.0 - Tree and Shrub Selection	4.1	Tree and Shrub Species				
	a.	For Regional Roads	Street Tree Brochure: Every Tree Counts	York Region Road Design Guidelines, 2020, Sections 8.11: Appendix K 'Acceptable Tree Species for Regional Road Allowances'		
	b.	For Under Overhead Wires	GAP	York Region Road Design Guidelines, 2020, Sections 8.11: Appendix K; max height within >2.5m from wire		
	c.	Near Underground Infrastructure	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 10 lists species intolerant to adjacent construction	GAP	Select species and cultivars with narrow/small mature crowns	
	d.	Near Natural Heritage Areas	Street Tree Brochure: Every Tree Counts; City Native Plant List for Habitat Types	GAP	Especially important to consider the invasiveness of non-native selections if planted close to natural areas	
	e.	Near LID and Stormwater Management Practices	Landscape Design Guidelines for Stormwater Management Ponds, 2015: Appendix A Green Streets Technical Guidelines, 2017: 'Large canopy native species are preferred', Vegetation Selection Tool	GAP		
	f.	For genetic diversity	Urban Forestry database GIS mapping of areas of interest with species diversity analysis	GAP		
	g.	Climate change adaptation	Updating species lists for street trees; database of robust trees for seed collection; increased soil volumes to encourage mature trees for heat island effect; Shade Guidelines; City Drought Tolerant Landscaping Manual	GAP	Cold hardiness and heat tolerance are important for long-lived trees that will experience a changing climate; many tree species in Ontario are predicted to expand their northern-most ranges due to increases in precipitation and temperatures	

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	h.	Diversity Requirements	GAP	Max 20% from same genus; Max 10% from same species	Diversity at the genus or family level can be more important in reducing vulnerabilities to pest/disease; Rule of 10/20/30	
	i.	Disease and Pest Resistance	GAP	GAP	Cultivars can be developed with enhanced pest/disease resistance (e.g., Elm hybrids)	Section 2.1.20
	j.	Salt Tolerance	Tree Species Suitability List (Manual)	York Region Road Design Guidelines, 2020, Sections 8.11		
	4.2	For Narrow and Wide Boulevards included	Tree Species Suitability List (Manual)	York Region Road Design Guidelines, 2020, Sections 8.11		
	4.3	Deciduous vs. Coniferous	Street Tree Brochure: Only deciduous trees for street trees; Tree Species Suitability List (Manual)	York Region Road Design Guidelines, 2020, Sections 8.11		
	4.4	Native vs. Non-Native	Street Tree Brochure: Every Tree Counts; Toronto Green Standard: min. 50% native plants	York Region Road Design Guidelines, 2020, Sections 8.11: Appendix K 'Acceptable Tree Species for Regional Road Allowances' 'where reasonable incorporate species native to the area'	Tree environmental tolerances will determine the success of the planting, regardless of the native origin of the tree; urban environments are drastically different than origin environments	
5.0 - Tree and Shrub Planting	5.1	Planting Details	Tree Planting Details for Softscape Boulevards - Dwgs NHF-01 to 03 and NHF-17 to 19 (Peel, 2016a). Boulevard Tree Planting Soil Trench for Softscape Boulevards - Dwg 5-4-5 (Peel, 2016b)	York Region Road Design Guidelines, 2020, Sections 8.11, Appendix K; York Region's Street Trees – Enhanced Planting Strategies; NHF detail series 101-405; Planting Calendar for nursery stock	LO Guide, Appendix B	
	5.2	Mulch	TS 5.30; Section 32 93 00 Tree Planting in Hard Surfaces	NHF detail series 101-405	Organic or inorganic mulches can be used; all should be free of invasive/noxious weeds, salts, chemicals. Depth 50-100mm, 150mm away from the trunk	Section 9.3.9, Section 10
	5.3	Tree Staking	TS 5.30; Section 32 93 00 Tree Planting in Hard Surfaces	NHF detail series 101-405	Stabilize only if necessary (small root ball, windy site, risk of damage)	Section 9.3.10
	5.4	Fertilizer and/or Amendments	TS 5.30; Section 32 93 00 Tree Planting in Hard Surfaces	GAP	Mycorrhizal fungi and compost tea as biostimulant	
	5.5	Planting Soil	TS 5.30; Section 32 94 56 Planting Soil for Silva Cells; Section 32 91 21 Growing Medium	GAP		Section 9.3.4
	5.6	Soil Volume and Quality	TS 5.30; Toronto Green Standard Soil volume template	GAP		
	5.7	Tree Guards / Watering Bags / Wraps	TS 5.30	NHF detail series 101-405		Section 9.3.7
	5.8	Root Barrier	TS 5.30	GAP	Use for trees adjacent to sidewalks	
6.0 - Tree and Shrub Inspection	6.1	Inspection of Nursery Stock	TS 5.30	GAP	Become educated about nursery production practices; look for central leader; crown branches well-distributed; branch angles are wide; trunk straight; scars are closed; graft unions closed; ALL above again upon delivery to site	Section 2.1.21; Section 9.1.4; Appendix G
	6.2	Inspection of Installation	TS 5.30	GAP	Ensure correct depth, width, and placement	Section 2.1.21; Section 9.1.6
	6.3	Inspection During and End of Warranty Period	TS 5.30	GAP	Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering	Section 2.1.21
	6.4	Inspection During Establishment	GAP	GAP	Plant condition, crown quality, trunk stability, mulching, soil berm, pests, watering	Section 2.1.21
	6.5	Acceptance Criteria	GAP	GAP	LO Guide, Appendix A, Table 10	Section 2.1.22; Section 9.1.11, Section 9.2

Category		Standards and Specifications	City of Toronto	York Region	Landscape Ontario Tree Planting Guide	Canadian Landscape Standard
7.0 - Tree and Shrub Maintenance	7.1	Maintenance During the Warranty Period	TS 5.30	GAP	Replace unacceptable trees	Chapter 9; Section 12.1.4
	7.2	Maintenance During Establishment Period	Toronto Forest Management Plan Goal 6: Improve Monitoring; detailed mortality survey of new trees; Section 7	GAP	Water management, weed management, mulch management, pruning, tree support, trunk protection, harmful diseases, soil nutrient levels	Chapter 9; Section 12.3.2, Section 13 (Post-establishment maintenance); Appendix D (Winter Damage)
	a.	Pruning	Shifting to proactive tree risk assessment and tree pruning and maintenance to mitigate risk and improve long-term health of trees; 7 year cycle	GAP		Section 6.3.8; Section 9.3.12
	b.	Fertilizing	TS 5.30	GAP		Section 9.3.3
	c.	Watering	Section 32 84 10 Rainwater Distribution System	GAP		Section 9.3.2
	d.	Mulching	TS 5.30	GAP		Section 9.3.6
	e.	Pest and Disease Control	Toronto's Forest Health Threats, 2017	York Region Emerald Ash Borer Management Plan, 2011		Section 9.3.9
	f.	Dead Tree Removal	GAP	GAP		To be included in Warranty notes
8.0 - Tree and Shrub Protection	8.1	Protection Zone	Tree Protection Policy and Specifications for Construction Near Trees, 2016	Street Tree and Forest Preservation Guidelines, 2016		Section 3.1.5; Table T-3.1
	8.2	Protection Barriers	Detail TP-1, February 2016	Street Tree and Forest Preservation Guidelines, 2016		Section 3.2.4
	8.3	Heavy Equipment and Storage Around Trees	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 6	Street Tree and Forest Preservation Guidelines, 2016		Section 3.2.7
	8.4	Branch and Root Pruning	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 6	Street Tree and Forest Preservation Guidelines, 2016		Table T-3.2
	8.5	Trenching and Tunneling	Tree Protection Policy and Specifications for Construction Near Trees, 2016, Section 2 (prohibited)	Street Tree and Forest Preservation Guidelines, 2016		Section 3.2.7

* These reflect the recommended directions, where applicable, from the *Urban Forest Management Best Practices Guide for Peel* (2020).

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