Natural Capital Asset Management Plan

Final Report
Rev. 5

June 5, 2024

Prepared by SLBC Inc.
and Green Analytics

EXECUTIVE SUMMARY

Introduction

This Natural Capital Asset Management Plan (NCAMP) communicates the requirements for the sustainable delivery of services through management of natural assets, compliance with regulatory requirements, and required funding to provide the appropriate Levels of Service (LOS) over the planning periods of 10 years and 25 years.

Inventory

The Town's natural assets have an estimated replacement value of **$237.5 million**. Table ES-1 provides a breakdown of the inventory and replacement value by asset type. Replacement values for natural area assets were estimated based on average restoration costs per hectare, and do not include the cost of land. The inventory includes natural assets are owned by the Town or managed by the Town under a formal agreement. Privately owned assets are excluded.

Table ES 1 Replacement Value of Natural Assets

Asset Category	Asset Class	Quantity	Replacement Value [a]	
			2024 ($M)	% of Total
Natural Area Assets	Forest and open space	350.6 hectares [b]	63.0 [b]	26.5%
	Waterbody	6.3 hectares	N/A [c]	N/A [b]
	Watercourse	36.9 km [d]	62.8 [d]	26.4%
	Wetland	78.3 hectares	19.4	8.2%
Natural Enhanced Assets	Community Gardens	2 locations with 52 plots each	0.45	0.2%
	Pet Cemetery	6.4 hectares	0.3	0.1%
	Urban Parks	125.4 hectares [e]	25.1 [e]	10.6%
	Urban Trees	26,435 street and park trees	66.4	28.0%
TOTAL			**237.5**	**100%**

[a] See Appendix B for a summary of unit cost assumptions. Replacement Values do not include land values.

[b] Includes Sheppard's Bush Conservation Area and Ducks Unlimited property, which the Town maintains in exchange for public access.

[c] For waterbodies, there is no standard restoration unit cost available. As an asset management improvement, Town to explore what types of restoration will most likely be needed for its waterbodies how much those would cost.

[d] Includes watercourse segments that traverse Town-owned property.

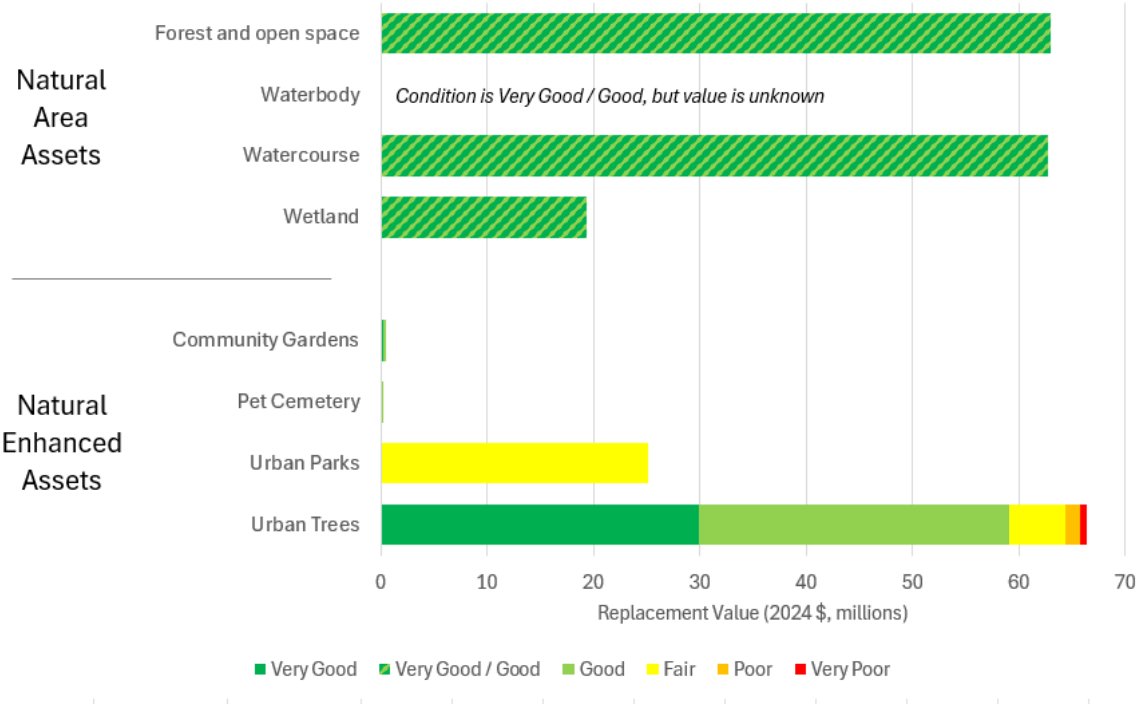
[e] Includes manicured grassy areas in Town-owned parks. Excludes naturalized areas (which are included in forest and open space) and building footprints.

State of Infrastructure

Overall, 86% of the Town's natural assets are in Good or Very Good condition and 13% are in Fair condition. One per cent (1%) are in Poor condition, meaning that they will soon require replacement, and 0.3% are in Very Poor condition, meaning that they are due or overdue for replacement.

Figure ES-1 shows the condition distribution of the Town's natural assets by asset class. The figure shows that the assets in Poor and Very Poor condition are urban trees.

Figure ES-1 Condition Distribution of Natural Assets



Levels of Service

The NCAMP presents Levels of Service (LOS) related to capacity, function and reliability of natural assets. Formal targets have not been established for most of the LOS. Instead, the metrics will be monitored to track year-to-year changes, and to observe their relationship with community satisfaction and operational costs.

In general, it is expected that due to land constraints and high land costs, the Town may not be able to expand its natural area assets, urban parks, community gardens and trails to keep up with population growth. As such, the capacity LOS for these assets will decrease, meaning that more people will share use of these assets.

For other LOS, the Town has more options, for example, as related to planting of new and replacement urban trees per year, and investment in control of invasive species.

Asset Management Strategy

The following three asset management strategies (scenarios) were compared:

- Scenario A: Status Quo
- Scenario B: Status Quo with Moderate Rehabilitation, Monitoring and Maintenance
- Scenario C: Status Quo with High Rehabilitation, Monitoring and Maintenance

Asset lifecycle activities included in each Scenario over the 25-year planning period are shown in Table ES-2.

Table ES-2 Comparison of Lifecycle Activities for Scenarios A, B and C

Lifecycle Activities Completed 2025-2049	Scenario A Status Quo	Scenario B Moderate	Scenario C High
Construct and Secure			
Net New Urban Trees Planted	1,500 trees 60 trees / year	**2,000 trees** **80 trees / year**	4000 trees 160 trees / year
Rehab and Restore			
Dead and Dying Urban Trees Replaced	6,000 trees (82% of need)*	**7,000 trees** **(95% of need)***	7,375 trees (100% of need)*
Invasive Species Control (hectares treated)	8.3 ha (2% of area)**	**53.6 ha** (13% of area)**	193.0 ha (45% of area)**
Targeted Seeding and Planting (hectares treated)	2.4 ha (1% of area)**	**10.3 ha** **(2.4% of area)****	20.4 ha (4.8% of area)**
Stream Rehabilitation projects completed	5 projects	**5 projects**	5 projects
Monitor and Maintain			
Condition Assessment (hectares assessed)	0	**1,243.7 ha**	1,286.6 ha
Tree Maintenance Increases with Net New Trees	Yes	**Yes**	Yes
Urban Park Maintenance	Same as current	**Same as current**	Same as current
Plan and Design			
Stream Management Master Plan Updated in 2029	Yes	**Yes**	Yes
Urban Forest Study Updated in 2034	Yes	**Yes**	Yes
Tree Inventory Updated in 2025	Yes	**Yes**	Yes

* Percent of need is determined based on the cumulative number of trees replaced by the scenario compared to the forecasted replacement need estimated in Section 4.2.4.

** Percent of area is determined based on the total area of Town-owned natural area assets.

Financial Strategy

Table ES-3 summarizes the costs of each scenario, and shows that 10-year costs range from $20.0 million for Scenario A (Status Quo) to $27.1 million for Scenario C (High), while the 25-year costs range from $37.9 million for Scenario A to $57.9 million for Scenario C. It is anticipated that 25-year costs of all Scenarios are under-estimated, because rehabilitation and restoration are not known and require condition assessments to be identified.

As the Status Quo scenario, Scenario A represents the anticipated annual funding available, and is used to calculate the funding gap, or additional funding needed, for Scenarios B and C. The table shows that an average of $0.3 million/year additional funding would be needed for Scenarios B and $0.7 million/year additional funding would be needed for Scenarios C.

Table ES-3 Comparison of 10-Year and 25-Year Costs for Scenarios A, B and C

	10-Year Cost Comparison			25-Year Cost Comparison		
	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	Scenario C
Total Cost (2024 $, millions)	$20.0	**$23.1**	$27.1	$37.9	**$45.7**	$57.9
Average Annual Cost (2024 $, millions/year)	$2.0	**$2.3**	$2.7	$1.5	**$1.8**	$2.3
Anticipated Annual Average Funding (2024 $, millions/year)	$2.0	**$2.0**	$2.0	$1.5	**$1.5**	$1.5
Average Annual Gap* (2024 $, millions/year)	--	**$0.3**	$0.7	--	**$0.3**	$0.8

* Differences due to rounding

It is recommended that the Town proceed with Scenario B, because it includes a moderate program of condition assessment, which will enable the Town to determine whether asset lifecycle activities should be reduced or expanded in the future. If Scenario B is adopted, the Proposed LOS are as listed in Table 5-9 (in main body of report).

To fund Scenario B, the Town may:

- Seek additional revenues through taxation or grants
- Re-allocate funds from other programs (this may result in reduced levels of service in other programs).

It is also recommended that the Town continue or expand its existing strategies to support Town's natural asset services, including the following:

- Continue to seek alternative ways to increase natural area asset capacity for its residents, for example, through maintenance agreements with external parties similar to the Town's existing agreements for use of the Duck's Unlimited property and Sheppard's Bush Conservation Area.

- Remain open to opportunities to re-purpose existing properties or to acquire natural areas that become available.
- Maintain existing partnerships with organizations that fund planting of trees in natural areas and seek additional partnership opportunities.
- Continue volunteer program for removal of invasive plant species on Town lands. Consider expanding.

The Town may also consider offering sponsorship opportunities wherein community organizations may pay for natural asset maintenance costs in exchange for acknowledgement signage.

Plan Monitoring and Improvement

Per O.Reg. 588/17, the Town will conduct an annual review of its progress in implementing this NCAMP and will update this NCAMP after at most 5 years.

The Town is committed to continually improving how assets are managed and how services are delivered. Development of asset management plans is an iterative process that includes improving data, processes, systems, staff skills, and organizational culture over time. Key recommendations include:

- Data
    - Develop and implement a condition assessment strategy for all natural asset classes. As part of strategy, establish condition scoring criteria.
    - Enhance the accuracy and precision of Geographic Information System (GIS) data to enable a comprehensive and nuanced understanding of natural capital assets.
    - Establish land classifications that will be applied consistently to assets in all Town documents, including the NCAMP, the Corporate AMP and the Parks and Recreation Master Plan.
- Technology
    - Continue the initiative to implement a computerized work order management system, which will be used to track maintenance and repair activities and costs at an asset level. This information can be used to improve future needs forecasting and budgeting.
- Processes
    - Establish processes to keep tree data current as trees are replaced or maintained.
    - Implement procedures to ensure that the Town land inventory is current, with appropriate notifications on new park openings or Town acquisitions of natural assets.
    - Monitor LOS performance relative customer input and cost to inform future target setting.
    - Use Town-wide tree targets to guide development of Town-owned tree targets
    - Consider building on the initial risk assessment for natural assets to further inform and prioritize risk mitigation actions for natural assets.

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List of Abbreviations

Abbreviation	Definition
AM	Asset Management
CAO	Chief Administrative Officer
CCAP	Climate Change Adaptation Plan
CRV	Current Replacement Value
dbh	Diameter at breast height
EAC	Environmental Advisory Committee
ELC	Ecological Land Classification
EVNCA	Economic Valuation of Natural Capital Assets Report
GDS	Green Development Standards
GIS	Geographic Information System
LOS	Levels of Service
MTSA	Major Transit Station Area
NCAMP	Natural Capital Asset Management Plan
OP	Official Plan
OPA	Official Plan Amendment
O.Reg.	Ontario Regulation
SLT	Senior Leadership Team
SOI	State of Infrastructure
TCA	Tangible Capital Asset
TRCA	Toronto Region Conservation Authority

1 INTRODUCTION

1.1 Background

The Town of Aurora is a municipality located within the boundaries of York Region. The Town has a population of over 60,000 residents and covers over 49 square kilometers of land, comprised of built and natural assets.

This Natural Capital Asset Management Plan (NCAMP) communicates the requirements for the sustainable delivery of services through management of natural assets, compliance with regulatory requirements, and funding to provide the appropriate Levels of Service (LOS) over the planning periods of 10 years and 25 years.

1.2 Alignment with Regulatory Requirements

Municipalities in Ontario have been using asset management processes to manage their built assets for decades. However, it has only been over the past five to ten years that municipalities have begun incorporating natural capital (e.g., wetlands, forests, meadows, watercourses, trees, parkland) into this framework. This shift has been triggered in part by:

(a) A growing need to repair aging municipal "grey" or built infrastructure with limited municipal tax dollars, which has pushed governments and others to start to explore alternative and complementary solutions.

(b) Climate change which, among other things, is putting municipal infrastructure at greater risk of failure.

(c) A growing recognition of the essential services provided by natural assets to communities at the local scale along with numerous co-benefits.

In Ontario, this shift is also being driven by Ontario Regulation (O.Reg.) 588/17 Asset Management Planning for Municipal Infrastructure under the *Infrastructure for Jobs and Prosperity Act* (2015), which came into effect January 1, 2018. O.Reg. 588/17 made Ontario the first province in Canada to regulate asset management planning at the municipal level and to require consideration of both human-made and natural assets as part of this process. Ontario remains the only Province with this type of legislation. O.Reg. 588/17 requires all municipalities in Ontario to have a comprehensive Asset Management Plan that identifies current LOS in place for all municipal infrastructure assets by July 1st of 2024, and a plan that includes proposed LOS by July 1st of 2025.

The definition of what constitutes a municipal infrastructure asset for the purpose of O.Reg 588/17 includes "green infrastructure", which is defined in the regulation as an:

> *infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs.*

For the NCAMP, natural assets have been divided into the following categories in alignment with Canadian Standards Association (CSA) Group's specifications for natural asset inventories CSA W218:23:

- Natural Area Assets: The stock of natural areas and ecosystem elements that are relied upon and managed by a municipality
- Natural Enhanced Assets: Designed elements that have been established to mimic natural functions and processes in the service of human interests

In accordance with the requirements of O.Reg. 588/17, this NCAMP is posted on the Town's website, along with related background documents.

1.3 Relationship with Other Documents

Asset management planning is a medium to long-term planning activity that relies on input from strategic planning activities and informs shorter-term decision making. The NCAMP provides a framework to validate the Town's budgeting processes and assist in prioritizing work activities, including capital projects, based on risk. It also discusses LOS that support goals in the Town's strategic plan, and lifecycle management strategies intended to reduce the overall cost of asset ownership.

The NCAMP is intended to be read with other Town policies and planning documents, including the following:

- Climate Change Adaption Plan (CCAP), 2022
- Green Development Standards (GDS), 2022
- Economic Valuation of Natural Capital Assets Report (EVNCA), 2013
- Town of Aurora Strategic Plan: 2011-2031
- Town of Aurora Official Plan 2023 Consolidation (OP)
- Town of Aurora Secondary Plans
- 2023 Parks & Recreation Master Plan
- 2023 Parks Maintenance Standard
- 2024 Urban Forest Study
- 2019 Stream Management Master Plan
- Comprehensive Stormwater Management Master Plan 2014

The 2022 CCAP recommends climate action items, including one to update the Town's 2013 EVNCA and one to incorporate natural capital assets into the Town's asset management plans. This NCAMP partially updates the EVNCA by presenting the value of Town-owned natural assets, and it incorporates natural capital assets into the Town's asset management plans.

1.4 Key Partners

Key partners in the preparation and implementation of this NCAMP are shown in Table 1-1.

Table 1-1 Key Partners in the NCAMP

Key Stakeholder	Role in Asset Management Plan
Town of Aurora Council	Council is dedicated to serving the residents and businesses of the Town of Aurora in a responsive and effective manner, through leadership and legislative action, for the present and future well-being of the community.
Environmental Advisory Committee (EAC)	The Environmental Advisory Committee (EAC) addresses ongoing climate change, adaptation and mitigation initiatives, energy conservation and environmental matters. EAC also contributes comments on the development of the Town's strategic plans that affect the environment, such as the Climate Change Adaptation Plan, the Community Energy Plan, the Corporate Energy Conservation and Demand Management Plan, the Corporate Environmental Action Plan, York Region's Climate Change Action Plan and the NCAMP.
Chief Administrative Officer (CAO) and Senior Leadership Team (SLT)	The CAO and SLT provides leadership that supports the policies and programs that drives the organization forward, focusing on ensuring the Town has efficient and effective systems in place to support the responsible growth of Aurora. The CAO and SLT provide corporate oversight to the Town's asset management program to ensure that the goal and directions of the asset management program are achieved and remain consistent with the overall strategic plan.
Finance	Finance provides historic Tangible Capital Asset (TCA) amounts, and historic and current capital and operating budgets.
Various Town Departments	Various Town Departments provide input data, forecasts and information for the NCAMP related to their service and program area or area of functional expertise.

1.5 Goals and Objectives of Natural Asset Management

The Town is seeking to create a detailed and comprehensive NCAMP that will serve as an extension to the Town's Corporate AMP.

The goal in managing natural and enhanced assets is to meet the defined LOS (as amended from time to time) in the most cost-effective manner for the present and future community.

The key elements of natural and enhanced asset management are:

- Providing a defined level of service and monitoring performance
- Managing the impact of growth through demand management and asset investment
- Taking a lifecycle approach to developing cost-effective management strategies for the long-term that meet the defined level of service
- Identifying, assessing, and appropriately controlling risks

- Linking to a long-term financial plan which identifies required, affordable expenditure and how it will be financed.

1.6 Corporate Asset Management System

Asset management plans aim to provide a line of sight between corporate strategic priorities, and tactical planning, including annual budgeting and business planning. Tactical plans are then used to guide work delivery, including capital delivery, operations and maintenance. The Town has an existing Corporate AMP that addresses other assets under O.Reg. 588/17 and this NCAMP follows the same steps and procedures. Although stormwater infrastructure is sometimes considered a natural asset, it has not been included here since it is already captured in the Corporate AMP. The line of sight is illustrated in Figure 1-1.

Figure 1-1 Strategic Plan line-of-sight to Work Plan

1.7 Organization of Document

The contents of this NCAMP follow the recommended elements of a detailed asset management plan:

- **Introduction**: Outlines scope, background information, relationship to other Municipal documents and plans, and applicable legislation.
- **State of Infrastructure**: Summarizes the inventory, valuation, condition and remaining life of the assets in the inventory by service and asset type.
- **Levels of Service**: Defines LOS performance indicators and targets, presents current performance and discusses the future performance outlook.
- **Asset Management Strategy**: Identifies risks to natural assets, recommends mitigation actions, and summarizes the asset management strategies, including restoration, renewal, maintenance and condition assessment, that will enable the assets to provide the required levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.
- **Financing Strategy**: Presents three scenarios for investing in the management of natural assets. Each option carries a different cost and delivers a different lifecycle benefit. A preferred scenario is recommended.
- **NCAMP Improvement and Monitoring**: Summarizes the next steps including improving future iterations of the NCAMP and monitoring the NCAMP implementation progress.

2 STATE OF INFRASTRUCTURE

The State of Infrastructure (SOI) section of the NCAMP describes the Town's inventory of natural assets, and provides a snapshot in time of the valuation, age and condition of these assets.

2.1 Asset Hierarchy and Inventory

This NCAMP focuses on Town-owned natural assets, because the Town can only directly maintain and manage natural assets on lands under its ownership, or through a shared management agreement (e.g., with another public agency such as a conservation authority). However, it is also understood that the system of natural assets that exists throughout the Town's jurisdiction is essential to the provision of services that benefit the community. These service provisions include things such as air pollution control, urban temperature regulation, water quantity and quality management, and physical and mental health benefits from time spent in and around natural areas. These benefits are discussed further in Section 2.2.

For the NCAMP, natural assets have been divided into the categories and classes shown in Table 2-1. The approach and assumptions used to establish the NCAMP inventory are summarized in Appendix A.

Locations of natural area and natural enhanced assets are shown in Figure 2-1. The map includes Sheppard's Bush Conservation Area and the Ducks Unlimited property, which the Town maintains in exchange for public access.

The NCAMP does not include stormwater ponds, which are considered built assets, and are included in the Corporate AMP.

In addition, although trails provide access to natural area assets, trails are considered built infrastructure and are covered in the Corporate AMP.

Table 2-1 Assets covered by this NCAMP

Asset Category	Asset Class	Description	Examples of Town Assets
Natural Area Assets	Forest and open space	Forested, naturalized or un-mowed open spaces as defined by the Ecological Land Classification (ELC)[1] geospatial data available for Aurora. The asset class captures coniferous forest, deciduous forest, mixed forest, cultural plantation, cultural woodland, cultural thickets, and cultural meadows ELC communities.	Holland River Valley North property is an example of a cultural meadow. Examples of forested areas include Vandorf Woodlot and Case Woodlot.
	Wetland	Area where water covers the soil or is present either at or near the surface of the soil all year or for varying periods of time during the year, such as swamps and marshes.	A large portion of Atkinson Park is wetland.
	Waterbody	Area submerged under a significant accumulation of water, such as natural lakes and ponds.	A waterbody exists west of Hollandview Trail, across from Ochalski Rd.
	Watercourse	A defined channel, having a bed and banks or sides, in which a flow of water regularly or continuously occurs. Inventory includes only segments that traverse Town-owned properties.	Segments of the East Holland River and Tannery Creek
Natural Enhanced Assets	Community Gardens	Sets of raised garden plots where residents and groups grow plants.	One located near Alliance Park. One located along Hartwell Way.
	Pet Cemetery	This property is a forested area that includes a manicured section with path stones and head stones. The manicured section is currently being restored. As the project evolves, the use and categorization of the different	Happy Woodland Pet Cemetery

[1] This is based on the ecological land classification (ELC) system mapping for southern Ontario (in accordance with the standards established by Lee et al., 1998) This classification system is an established and widely accepted standard in southern Ontario that is useful for informing inventory structure as well as condition assessment and management of natural assets.

Asset Category	Asset Class	Description	Examples of Town Assets
		areas of the property may be changed.	
	Urban Park	Manicured grassy areas within Town-owned parks	Thomas Coates Park
	Urban Trees	Town-owned street trees and park trees. Excludes trees in forests and open spaces.	Street trees Park trees

Figure 2-1 NCAMP Inventory

2.2 Asset Valuation

The current replacement value of an asset represents the expected cost to replace an asset to the same functional standard with a 'like for like' version based on current market conditions and construction standards. Establishing a current replacement cost for natural areas is somewhat more challenging than for built assets since natural areas (e.g. forest and wetlands) are not typically built or constructed. Therefore, estimating a replacement cost for most natural assets is achieved by estimating the anticipated cost to restore a natural asset. This was achieved by using average restoration costs per hectare of natural areas provided by Toronto Region Conservation Authority (TRCA). This approach follows best practices as outlined in the Natural Assets Initiative (2024)[2] guidance document to help municipalities across Canada incorporate natural assets into their assessment management planning process.

For individual tree assets or other enhanced assets (e.g. community gardens), more typical construction costs or costs of replacement are used. For natural and enhanced assets, the total replacement value is estimated to be **$237.5 million**. Table 2-2 and Figure 2-2 provide a breakdown of the inventory and replacement value by asset type.

Table 2-2 Replacement Value of Natural Capital Assets

Asset Category	Asset Class	Quantity	Replacement Value [a]	
			2024 ($M)	% of Total
Natural Area Assets	Forest and open space	350.6 hectares [b]	63.0 [b]	26.5%
	Waterbody	6.3 hectares	N/A [c]	N/A [b]
	Watercourse	36.9 km [d]	62.8 [d]	26.4
	Wetland	78.3 hectares	19.4	8.2%
Natural Enhanced Assets	Community Gardens	2 locations with 52 plots each	0.45	0.2%
	Pet Cemetery	6.4 hectares	0.3	0.1%
	Urban Parks	125.4 hectares [e]	25.1 [e]	10.6%
	Urban Trees	26,435 street and park trees	66.4	28.0%
TOTAL			**237.5**	**100%**

[a] See Appendix B for a summary of unit cost assumptions. Replacement Values do not include land values.

[b] Includes Sheppard's Bush Conservation Area and Ducks Unlimited property, which the Town maintains.

[c] For waterbodies, restoration costs were not readily available. As an asset management improvement, Town to explore what types of restoration will most likely be needed for its waterbodies and how much those would cost.

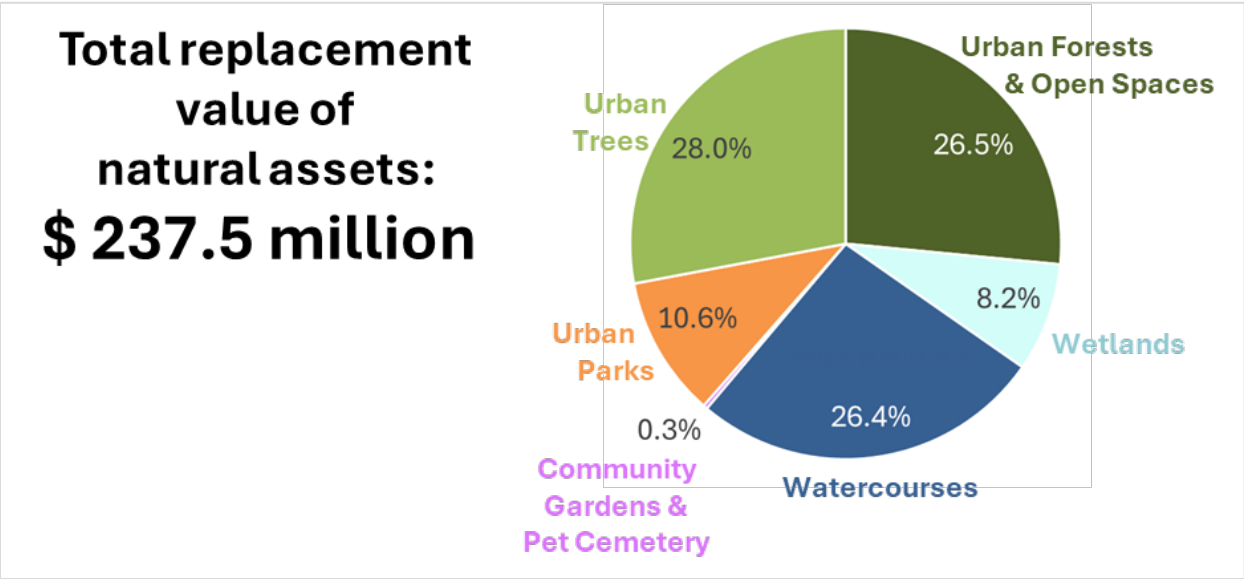
[d] Includes watercourse segments that traverse Town-owned property.

[e] Includes manicured grassy areas in Town-owned parks. Excludes naturalized areas (which are included in forest and open space) and building footprints. Area of manicured grass is slightly overestimated as it was not possible to remove playground footprints with the available data.

[2] NAI (2024). Nature is infrastructure: How to include natural assets in asset management plans. Natural Assets Initiative. naturalassetsinitiative.ca

For natural area assets it is important to recognize that while restoration costs can act as replacement cost for asset management purposes, it can take many years or decades for a natural system to grow, establish, and develop the ecosystem functionality to provide a 'like for like' replacement. While the restoration costs can approximate the expenditure need to replace some natural assets, it does not fully account for the lost or reduced Level of Service (LOS) provision that would exist if replacement were to occur.

Figure 2-2 Portion of Replacement Costs by Asset Type



For the purpose of an asset management plan, asset valuation is typically done using the replacement cost of the asset as is outlined in Table 2-2. The replacement value is an estimate of the capital costs associated with restoring natural assets. It is important to distinguish this from natural capital values which measure the value of ecosystem service provided by natural assets. Ecosystem services values are the benefits that humans derive from nature and are typically reported as an average annual service value. For instance, Aurora (2013)[3] and Green Analytics (2017)[4] explore a range ecosystem services value provided by Aurora's natural assets. These values recognize and demonstrate the importance of natural assets from the perspective of benefits provided to local communities. Ecosystem service benefits can be wide ranging including reduction of urban heat island effects, flood and erosion risk reduction, the provision of recreational opportunities, and physical and mental health benefits from time spent in nature. Aurora (2013) estimated the value of ecosystem service benefits at $7.4 million per year.

2.3 Asset Age and Remaining Life

For built assets, understanding the estimated life of an asset and the proportion of life that remains provides an insight into potential risk of asset failure and potential renewal needs. For natural

[3] Aurora (2013). The Economic Value of Natural Capital Assets Associated with Ecosystem Protection.

[4] Green Analytics (2017). Valuing Natural Capital in the Lake Simcoe Watershed. Report prepared for Lake Simcoe Region Conservation Authority.

assets, age and remaining life do not apply in the same way and will not provide the same insight. Natural assets typically exist in perpetuity, and if unimpacted by external pressures, will not degrade over time.

For street and park tree assets where management is based on individual units, age is sometimes measured and reported like built assets. However, currently there is no standard lifespan to use for street trees. Existing asset management plans from peer municipalities provide some precedent for tree lifespan, though ranges from 35 to 110 years have been used. The service life of a street or park tree will vary depending on tree species, where it is planted (e.g., in street, planter, boulevard etc.) and the conditions of the surrounding environment. For instance, trees in the boulevards tend to have a shorter lifespan that is anticipated to be in the 35-year range. For this NCAMP park trees were assumed to have an 80-year life and street trees a life of 50 years. The Town's existing urban tree inventory includes an age class that estimates tree age in 10-year periods. Using the mid-point of those age classes, the weighted average age of the Town's urban trees is 28 years.

Average service life and age of natural capital assets is shown in Table 2-3.

Table 2-3 Average Service Life and Age of Natural Capital

Asset Category	Asset Class	Average Service Life (Years)	Average Age (Years)
Natural Area Assets	Forest and Open Space	N/A [a]	N/A [a]
	Waterbody		
	Watercourse		
	Wetland		
Natural Enhanced Assets	Community Garden	Garden located near Alliance Park: 40 years Garden located along Hartwell Way: 25 years	Garden located near Alliance Park: Over 25 years Garden located along Hartwell Way: 0 years
	Pet Cemetery	N/A [a]	N/A [a]
	Urban Parks	N/A [a]	N/A [a]
	Urban Trees	Park trees: 80 years Street trees: 50 years	28

[a] Assets are expected to exist in perpetuity

2.4 Asset Condition

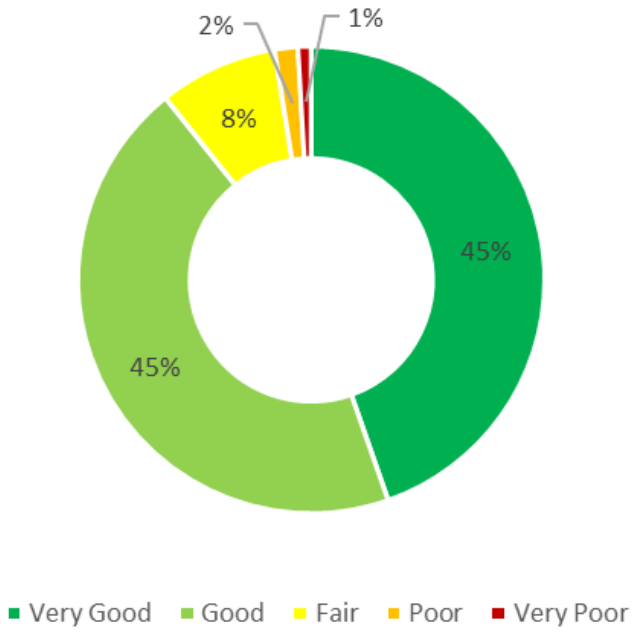
Maintaining urban trees in a healthy condition is a primary goal for the Town. Maintenance includes a wide range of activities including pruning to maintain structural integrity, promote healthy growth and eliminate dead or hazardous branches. The Town maintains an inventory of urban trees and documents their health rating on the following six-point scale: dead, death

imminent, declining, potential trouble, satisfactory, and good. For the purpose of this NCAMP the tree health scale has been adjusted to align with the corporate condition rating scale as summarized in Table 2-4. The condition distribution of urban tree assets is summarized in Figure 2-2. Approximately 90% of urban trees are estimated to be in Good or Very Good condition.

Table 2-4 Urban Tree Condition Rating

Condition Rating	Condition Score	Description of Urban Tree Condition	Tree Health Rating
Very Good	1	Fit for the future	Good
Good	2	Adequate for now	Satisfactory
Fair	3	Requires attention	Potential Trouble
Poor	4	Increasing potential of affecting service	Declining
Very Poor	5	Unfit for sustained service	Dead; death imminent

Figure 2-3 Condition of Urban Trees



For other natural assets in Aurora condition is currently not formally assessed. However, based on detailed discussions with the Town's Operations staff that maintain these assets, asset condition for the purposes of this plan can be assumed to be visually assessed and have been found to be in in good or very good condition and enhanced assets are assumed to be in fair or good condition as summarized in Table 2-5. The urban parks largely capture the manicured turf,

which were noted by Town staff as having a variety of conditions, but overall should be considered in fair condition due to presence of weeds and signs of heavy use.

Table 2-5 Asset Condition

Asset Category	Asset Class	Condition Rating	Condition Score
Natural Area Assets	Forest and Open Space	Good or very good	1 or 2
	Waterbody	Good or very good	1 or 2
	Watercourse	Good or very good	1 or 2
	Wetland	Good or very good	1 or 2
Natural Enhanced Assets	Community Gardens	Garden located near Alliance Park: Good Garden located along Hartwell Way: Very Good	2 1
	Pet Cemetery	Good	2
	Urban Parks	Fair	3
	Urban Trees	As per Figure 2-1	As per Figure 2-1

Not having detailed condition information for natural area assets is common across many municipalities, as asset management maturity is still relatively low for this asset category and there is currently no commonly accepted standard to establishing condition approach for natural area assets. However, as will be discussed in the Asset Management Strategy section of this NCAMP (Section 4), regular condition monitoring can help the Town better maintain its natural assets and respond to natural asset threats.

2.5 Confidence in Data

The information presented in this NCAMP is based on data available at the time of preparation. It is expected that with each update of this plan, the data confidence will improve from the development and implementation of the initiatives listed in the Recommendations and Continuous Improvement section (Section 6).

The confidence in data used to support the SOI can be summarized as follows:

- Data associated with the asset inventory and valuation is rated as high confidence.
    - Data is based on sound records, procedures, investigations, and analysis, with proper documentation. There are minor shortcomings, for example some data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation.
- Data associated with asset condition is rated as low confidence.
    - Data is based on unconfirmed verbal reports and/or cursory inspection and analysis. There are data gaps related to condition and the Town would benefit from continuing to fill baseline data moving forward in preparation of the next NCAMP update.

3 LEVELS OF SERVICE

In the State of Infrastructure (SOI) section, the value, age, and condition of the Town's natural capital assets were discussed. The Levels of Service (LOS) chapter builds on the SOI by defining the performance of the Town's assets and what they are intended to deliver over their service lives. For example, the Town's tree inventory may be expected to support a certain canopy target.

LOS are statements that describe the outputs and objectives the Town intends to deliver to its residents, businesses, and other stakeholders. Developing, monitoring, and reporting on LOS are all integral parts of an overall performance management program which is aimed at improving service delivery and demonstrating accountability to the Town's stakeholders.

As per O.Reg 588/17, the asset management plans are required to provide the current and proposed LOS for all assets, including natural assets, determined in accordance with qualitative descriptions and technical metrics established by the municipality.

In general, LOS are guided by corporate commitments to the community, legislative requirements, and internal guidelines, policies, and procedures. In many cases, LOS are also implied based on past service delivery, community expectations, and infrastructure system design. Effective asset management requires that LOS be formalized and supported through a framework of performance measures, targets, and timeframes to achieve targets, and that the costs to deliver the documented LOS be understood.

3.1 Levels of Service Framework

Figure 3-1 shows the LOS framework and line of sight from high-level corporate initiatives to detailed asset-specific LOS and asset lifecycle decisions. Corporate commitments, along with legislated LOS guide Community LOS, which are qualitative statements that describe how the Town's residents and businesses should experience its services. Community LOS can typically be categorized to one of the following service attributes:

- **Capacity:** Measures that reflect whether the service and supporting assets are of sufficient capacity to meet user demand.
- **Function:** Measures that reflect the suitability of the services, operations and assets for the user or other stakeholder.
- **Reliability & Quality:** Measures that reflect whether services and supporting assets are reliable, available when needed, and responsive to the community.
- **Affordability:** Measures that reflect whether services and supporting assets are adequately funded in both the short and long term.

Technical LOS are quantitative metrics that support the Community LOS. They relate to the allocation of resources to service activities to best achieve the desired community outcomes and demonstrate effective performance.

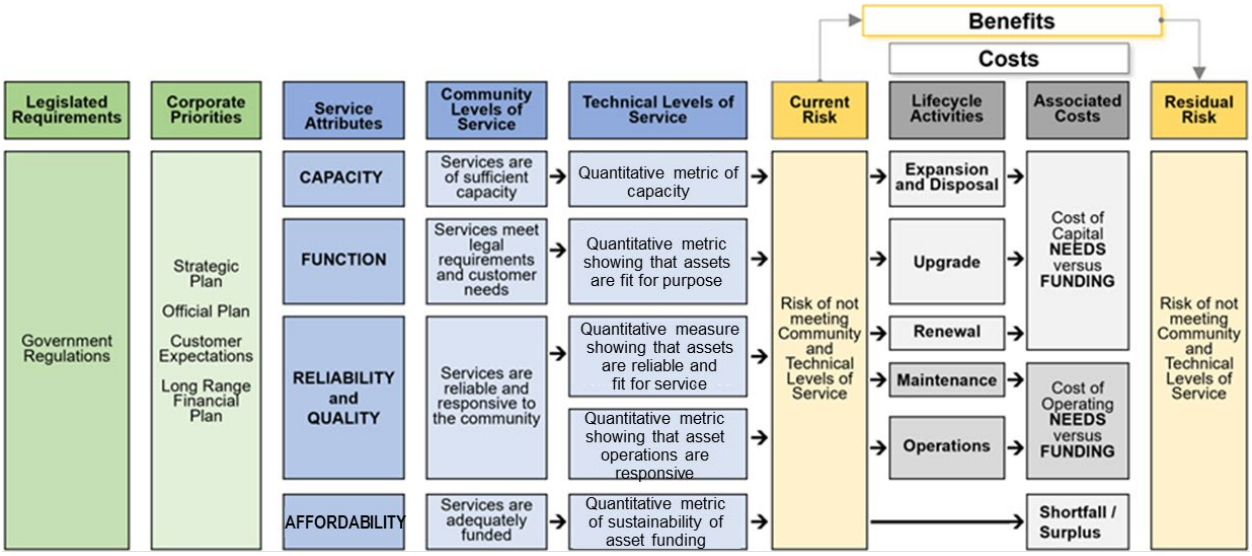
Community LOS are translated into Technical LOS, where:

- **Capacity LOS** are metrics that drive assessment of expansion needs
- **Function LOS** are metrics that drive assessment of upgrade needs

- **Reliability & Quality LOS** are metrics that drive assessment of renewal, maintenance and operations (and programming) needs
- **Affordability LOS** are metrics that drive assessment of financial sustainability needs.

Through the asset management process the risks of failing to achieve the defined Community and Technical LOS are assessed, and lifecycle activities are prioritized to address those risks. Lifecycle activities may include expansion, upgrade, renewal, maintenance or operational activities, depending on the category of LOS to be addressed. In some cases, lifecycle activities address several Community and Technical LOS. For example, a project on a runway may simultaneously increase capacity, make upgrades to meet regulatory requirements, and renew existing pavement. The nature of the lifecycle activity determines whether it should be funded as capital or operating, as well as eligible funding sources. As shown in the figure below, even after the lifecycle intervention, some residual risk may remain.

Figure 3-1 Levels of Service Framework



The following sections describe the legislative requirements, corporate priorities, and Community and Technical LOS that guide the Town's management of natural assets.

3.2 Legislative Requirements

Legislative requirements that impact the delivery of the Town's natural asset services are outlined in Table 3-1.

Table 3-1 Legislative Requirements

Legislation	Requirement
Municipal Act, 2001	The main statute governing the creation, administration and government of municipalities in Ontario, other than the City of Toronto.
Ontario Regulation 588/17 The Infrastructure for Jobs and Prosperity Act, 2015	Sets out the principles for the provincial government to regulate asset management planning for municipalities, including the requirement to include green infrastructure.
Public Sector Accounting Board Standard 3150	Standards on how to account for and report on tangible capital assets in government financial statements. Natural assets are not currently included in financial reporting however, there is active discussion on how to include the value of natural assets in financial statements.
Environmental Protection Act	The primary pollution control legislation in Ontario. Prohibits discharge of any contaminants to the environment that can cause or are likely to cause adverse effects. Amounts of approved contaminants must not exceed limits prescribed by the regulations. Requires that spills of pollutants are reported and cleaned up promptly. Has the authority to establish liability on the party at fault.
Ontario Water Resources Act	Focuses on both groundwater and surface water throughout the province. Regulates sewage disposal and "sewage works" and prohibits the discharge of polluting materials that may impair water quality.

3.3 Corporate Priorities

The Corporate Priorities establish the main vision or objective of service delivery for the Town. The Corporate Strategic Plan identifies three pillars of success that reflect the needs of the community and in turn guide the management of the Town's assets. As shown below, Natural Environment is one of three pillars of the Corporate Strategic Plan.

Table 3-2 Corporate Strategic Plan Pillars of Success

Pillar of Success	Service Level Objective
Community	Support an exceptional quality of life for all
Economy	Enable a diverse, creative and resilient economy
Natural Environment	Support environmental stewardship and sustainability

3.4 Community and Technical Levels of Service

Community LOS translate the Town's corporate priorities into statements that describe how the community should experience natural asset services. Technical LOS then translate those

statements into quantitative performance metrics, which allow the Town to compare its natural asset services with prior years or against service targets.

It is worth noting that a single natural asset can provide multiple services to a community, sometimes referred to as co-benefits (e.g., cooling, passive recreation venue, reduced stress, air quality improvements). In 2013, Aurora published an assessment of ecosystem services provided by the Town's natural assets, highlighting the range of services provided such as carbon storage and sequestration, pollution regulation, water regulation and treatment, pollination, recreation, and health benefits. The provision and value of these services demonstrate the importance of including natural assets in asset management planning.

While the "service-benefit stacking" noted above helps make natural assets a compelling solution for community service delivery, it adds to the complexity of incorporating natural assets into an asset management plan in a consistent and useful way. Furthermore, the science of ecosystem service measurement is still evolving and the more accessible options for quantifying such measures are driven largely by the area of the natural asset. For informing an asset management plan, areas managed for ecological or natural purposes, or percent of canopy cover, can be considered effective proxy measures for the provision of a suite of ecosystem services. For instance, percent canopy cover can be considered a proxy measure for local temperature reduction, carbon sequestration, and air quality regulation.

Table 3-3 summarizes Community and Technical LOS along with current and desired performance. The second last column of the table shows that formal targets have not been established for most of the technical LOS. Instead, the technical LOS will be monitored to track year-to-year changes, and to observe their relationship with community input and operational and capital costs.

Table 3-3 also illustrates that targets have been established for tree canopy and tree diversity; however those targets are not directly applicable to the Town's asset performance (fifth column of Table 3-3), because the targets apply to all trees within the municipal boundaries, whereas the Town's asset performance relates specifically to Town-owned trees.

For example, the Town's tree canopy target is 40%; however, the NCAMP defines LOS performance based only on Town-owned trees, since the Town only directly manages Town-owned assets. However, Town-owned trees provide an estimated 6.3% (or 314 ha) of canopy coverage, which makes the Town a major contributor to the community's ability to meet the 40% target. According to the Urban Forest Study the current area of canopy is 1,662 ha (34% of the Town's area) and the 40% target would amount to 1,970 ha meaning to meet this target an additional 308 ha of canopy cover is needed.

Similarly, the Town's tree diversity goal is that no species represents more than 5% of the tree population. This target applies to all trees within the municipal boundaries; however, for the NCAMP it has been applied to the inventory of Town-owned trees. (This assumes that the Town-owned inventory isn't deliberately being weighted to counter-balance lack of diversity of non-owned trees.) As shown in the table, several Town-owned tree species exceed the diversity target as a proportion of the Town-owned inventory. The Town is working to achieve the diversity target as part of its long-term tree planting and tree replacement program.

Table 3-3 Current Level of Service Performance

Service Attribute	Community LOS	Technical LOS	Relevant Asset Type	Current Performance Metric	Data Source	Target Performance	Target Performance Achieved?
Capacity & Use	Natural assets are suitable to all kinds of users and are easy to access.[a]	% residential homes within 500m of natural area assets or enhanced asset areas	Natural area and natural enhanced assets	99.35% of residential properties	GIS analysis	No established target. Town to monitor performance.	n/a
		Area of natural area assets and natural enhanced assets per 1000 people	Natural area and natural enhanced assets	Natural area assets per 1000 people: 6.56 ha [b,c] Natural enhanced asset per 1000 people: 1.99 ha [b,c]	Inventory analysis	No established target. Town to monitor performance.	n/a
		Area of canopy cover provided by the Town	Urban trees and forest and open space	Approximately 313 ha of canopy cover is Town-owned. This provides a canopy cover of 6.3%, which accounts for 18.5% of the current Town-wide canopy cover (34%).	Inventory analysis	Town does not have a target for Town-owned canopy cover but has established a Town-wide target of 40% canopy overall by 2034 (current performance is 34%).	n/a
		# of public maintained street and park trees per 1000 people	Urban trees	# of urban trees: 26,435 # of public maintained street trees/person: 398.3 [c]	Inventory analysis	No established target. Town to monitor performance.	n/a
		# of new trees planted per year	Urban trees Natural area trees	60 new urban trees planted (2023) 445 new trees planted in natural areas (2023)	Town operations estimate	No established target. Town to monitor performance.	n/a
		# of Community Garden locations per 1000 people	Community gardens	# of locations: 2 # of locations per 1000 people: 0.030 [c]	Inventory analysis	No established target. Town to monitor performance.	n/a
		# of km of trails through natural area assets and natural enhanced assets per 1000 people	Natural area and natural enhanced assets	40.87 km of trails through town-owned and town-maintained land Trails per 1000 people: 0.616 km [c]	GIS analysis	No established target. Town to monitor performance.	n/a
Function	Enrich Aurora's ecology by protecting and preserving biodiversity. [d]	Species diversity of maintained trees	Urban trees	Species composition for highest 5 species in Town's tree inventory: • Norway maple (14.96%) • Littleleaf linden (11.83%) • Ash (9.51%) • Honey locust (8.54%) • Silver maple (5.49%)	Analysis of tree inventory data	2024 Urban Forest Study Recommendation 8: Long-term goal that **no species represents more than 5%** of the tree population, no genus represents more than 10% of the tree population, and no family represents more than 20% of the intensively managed tree population both municipal-wide and at the neighbourhood level.	No (target is long-term)
		% Town-owned natural assets affected by invasive species	Natural area assets	55% of Open Space − Natural Cover plots show invasive plant species (from Urban Forest Study) [e]	2024 Urban Forest Study	No established target. Town to monitor performance.	n/a
Quality & Reliability	Natural and enhanced assets are in good condition, meeting the needs of users.[a]	Tree pruning activities completed per year	Urban trees	3150 (in-house) 183 (contracted)	Town operations estimate	No established target. Town to monitor performance.	n/a
		# of urban tree replacements per year	Urban trees	240 trees replaced (2023)	Town operations estimate	No established target. Town to monitor performance.	n/a

a) Adapted based on Level of Service Statement for Aurora's Parks & Recreation facilities.

b) The Parks and Recreation Master Plan, reports 2.7 hectares per 1000 residents of parkland, but defines parkland as lands within Town-owned park properties. Those properties do not consistently include or exclude naturalized areas.

c) Population in 2024 estimated at 66,370 based on 2022 York Region Official Plan.

d) From the Town of Aurora Corporate Environmental Action Plan 2018.

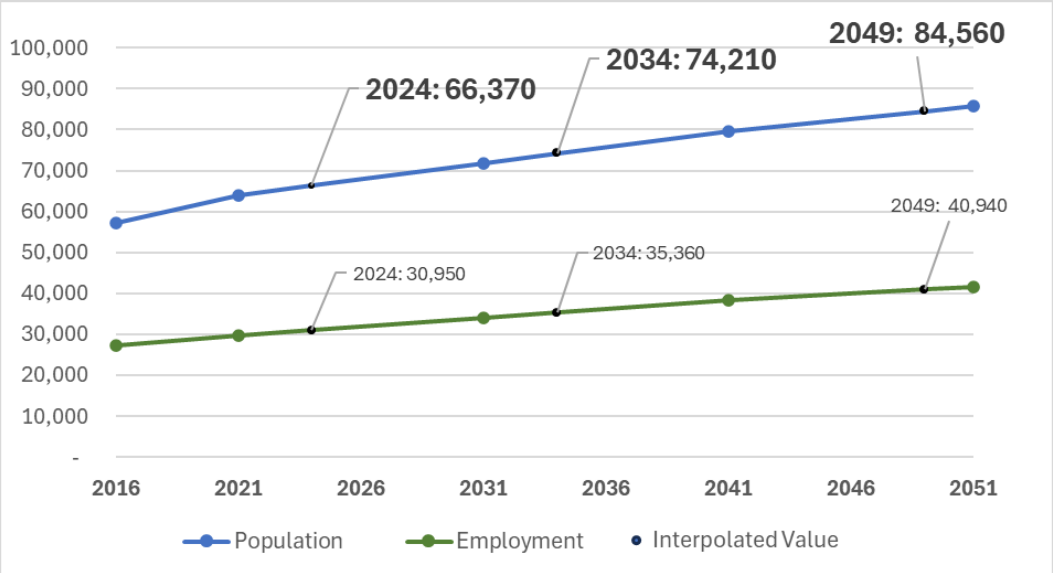
e) Existing data is not specific to town-owned natural assets. However, data compiled for the Urban Forest Study based on a series of representative sample plots across Aurora found that 55% of "Open Space – Natural Cover" plots had presence of invasive plant species.

3.5 Levels of Service Outlook

LOS performance may be affected by future trends, such as population growth or changes in the environment and climate. This section focuses on the impact of population growth on LOS, because many of the LOS are defined relative to population. Environmental, climate and other hazards are discussed in Section 4.1.2 on risk assessment.

Figure 3-2 shows that, based on the 2022 York Region Official Plan forecasts, the Town's population is expected to grow 27.4% from 66,370 in 2024 to 84,560 by 2049, and employment will grow from 30,950 to 40,940. O.Reg. 588/17 requires asset management plans to report forecasted population and employment growth; however, natural asset planning is primarily driven by growth in population (residents).

Figure 3-2 Forecast Population and Employment Growth



Source: 2022 York Region Official Plan

Table 3-4 describes the expected outlook for each technical LOS in consideration of the Town's anticipated population growth and its current plans for natural assets.

Table 3-4 Level of Service Outlook

Service Attribute	Community LOS	Technical LOS	Future Outlook
Capacity & Use	Natural assets are suitable to all kinds of users and are easy to access.	% residential homes within 500m of natural area assets or enhanced asset areas	According to the Official Plan, most new units will be added in the Aurora Promenade and Major Transit Station Areas. These corridors generally have natural asset parcels within 500m, so this metric is expected to **increase (improve)** with growth.

Service Attribute	Community LOS	Technical LOS	Future Outlook
		Area of natural area assets and natural enhanced assets per 1000 people	Due to land constraints and high land costs, the Town does not currently plan on acquiring additional natural area assets or urban parks. As such, natural area assets and natural enhanced assets per 1000 people is expected to **decrease**.
		Area of canopy cover provided by the Town	The Town-owned tree canopy is expected to **increase (improve)** as new trees are planted, and as trees mature in good in health. Tree planting and maintenance and planting levels will be discussed in the Asset Management Strategy (Section 4) and Financing Strategy (Section 5).
		# of public maintained street and park trees per 1000 people # of new urban trees planted per year	The ratio of Town-owned urban trees to people is expected to **decrease**, unless the Town plants additional trees in proportion to population growth.
		# of new trees planted per year in natural areas	The number of new trees planted in natural areas is expected to **remain steady**. These plantings are funded by external partners.
		# of Community Garden locations per 1000 people	As population grows, this ratio is expected to **decrease.** The Town does not currently plan to build additional community gardens.
		# of km of trails through natural area assets and natural enhanced assets per 1000 people	As population grows, this ratio is expected to **decrease.** The Town may build additional trails on private land under maintenance agreements; however, these are not expected to keep up with population growth.
Function	Enrich Aurora's ecology by protecting and preserving biodiversity.	Species diversity of maintained trees	The species diversity is expected to **slowly improve** through the Town's tree replacement and planting program.
		% Town-owned natural assets affected by invasive species	The % of natural assets affected by invasive species is expected to **increase (worsen)** if actions are not taken to manage them.
Quality & Reliability	Natural and enhanced assets are in good condition, meeting the needs of users.	Tree pruning activities completed per year	Given the same resources (budget), tree pruning activities are expected to remain **steady**. However, if the tree inventory grows, this would represent a reduction **(worsening)** in maintenance attention for each tree.
		# of urban trees replacements per year	Tree replacement activities are expected to remain steady; however, this is expected to be insufficient to keep up with the number of trees requiring replacement each year. This will result in a **growing backlog** of dead and dying trees.

As indicated in the table, due to land constraints and high land costs, the Town may not be able to expand its natural area assets, urban parks, community gardens and trails to keep up with population growth. As such, the capacity LOS for these assets will decrease, meaning that more people will share use of these assets.

Despite the land constraints, the Town may seek alternative ways to increase natural area asset capacity for residents, for example, through maintenance agreements with external parties similar to the Town's existing agreements for use of the Duck's Unlimited property and Sheppard's Bush Conservation Area. There may also be opportunities for the Town to re-purpose some of its existing properties.

The Town-owned tree canopy is expected to increase (improve) as new trees are planted, and as trees mature in good in health; however, this depends on the resources allocated to both tree maintenance and tree planting. To maintain the current ratio of Town-owned trees to people, the Town will need to plant approximately 3,000 new trees by 2034. Through planting of new and replacement trees, the Town will slowly work toward its diversity target of no more than 5% of any one species. Tree maintenance and planting are discussed in Section 4.

The percent of natural assets affected by invasive species may increase (worsen) if actions are not taken to manage them. Mitigation and management of invasive species are discussed in Section 4.

3.6 Proposed Levels of Service

The expected outlook for LOS performance will change depending on the asset lifecycle strategies applied. Lifecycle needs will be discussed in Section 4. Different investment scenarios to meet those needs will be presented in Section 5 along with their expected impact on LOS. A scenario will be recommended, and if adopted, that scenario's associated LOS will become the Proposed LOS.

4 ASSET MANAGEMENT STRATEGY

The Asset Management Strategy section of the NCAMP identifies risks to natural assets, recommends mitigation actions, and summarizes the asset management strategies, including restoration, renewal, maintenance and condition assessment, that will enable the assets to provide the required Levels of Service (LOS) in a sustainable way, while managing risk.

4.1 Risk Assessment

This section addresses risks to the Town's natural assets. First, the risk context is discussed, then a risk assessment highlights anticipated hazards and threats to the Town's natural assets. Next, an asset failure risk assessment is presented for urban trees. Risk mitigation actions to address known risk are discussed.

4.1.1 Risk Context

The standard risk assessment approach used for built assets can also be applied to natural assets. However, the application of risk is slightly different given the unique features of natural assets and natural area assets in particular. Natural assets are resilient, meaning they can withstand a certain amount of stress and in many cases, they repair themselves when damaged. Therefore, degradation or damage to one component of a natural asset may not have a significant impact on the overall LOS (e.g., the loss of one tree may have a minor impact on overall forest or canopy cover and the associated services). This resiliency is one of the many reasons natural assets are seen as effective solutions to deal with certain infrastructure and climate change related challenges. However, cumulative effects and exposure to multiple stressors can lead to tipping points that can cause cascading or widespread failure of natural assets. Therefore, a risk assessment for natural assets needs to consider the range of hazards to which natural assets are exposed, and the potential impacts those hazards could trigger.

Ideally, the condition of natural assets is carefully assessed and monitored at regular intervals. In such a situation, a natural asset's condition can help inform the probability of asset failure, much in the same way it is used for built assets. Provided the condition assessments are robust, a lower condition rating would imply a lower level of natural resilience, and that a certain level of degradation has occurred such that additional stressors would be more likely to trigger failure.

Currently, condition assessments and regular monitoring of the condition of natural assets within Aurora is limited. However, the Town's objective is to develop and implement regular monitoring and condition assessment protocols. Once available, this information can be combined with the current understanding of threats and hazards to natural assets to inform the probability and consequences of asset failure.

4.1.2 Natural Asset Risk Assessment – Hazards and Threats

As a starting point, this NCAMP outlines the work completed to date toward understanding the range of threats and hazards to natural assets. The Town has already made progress on risk management related to natural assets through its 2022 Climate Change Adaptation Plan (CCAP). As part of the CCAP, specific climate hazards were identified. Each hazard was assigned a probability of occurrence rating and a severity of consequence rating, which were combined into four risk ratings summarized in Table 4-1.

Table 4-1 Risk Rating Overview

Risk Rating	Description*
Low Risk	No immediate vulnerability associated with natural infrastructure.
Low-medium Risk	Potential vulnerability exists, viability of the natural infrastructure is not an immediate concern, but action may be required in the foreseeable future.
High-medium Risk	Potential vulnerability exists, viability of the natural infrastructure is not an immediate concern, but action is needed soon to avoid anticipated consequences.
High Risk	A known vulnerability is present, mitigative actions are required to ensure viability of natural infrastructure.

* Descriptions of risk ratings were adapted from what was used in Aurora's Climate Change Action Plan and modified to also apply to non-climate related threats or hazards.

Climate change risks pose a significant challenge to managing Town assets and maintaining service levels. Climate change impacts increase the probability of natural asset failure and can also increase the consequence of failure in terms of financial impacts, service delivery, and damages to the natural environment. Therefore, in general, climate change is anticipated to increase the Town's risk exposure. Several specific climate related hazards are identified in the Town's CCAP. These hazards are further detailed into potential risks to natural assets as summarized in Table 4-2.

For natural assets, other non-climate or human activity-related threats and hazards exist that should also be considered. Building on the work done through the CCAP in addition to input gathered from Town staff and the results of the 2024 Urban Forest Study, other hazards identified include invasive species, pests and diseases, wildlife impacts, unauthorized edge encroachment or disturbances, contamination (e.g. road salting and other spills), and overuse and misuse of natural areas. The potential impacts and risk ratings associated with these hazards are detailed in Table 4-2 for natural area assets and natural enhanced assets.

Aurora's Urban Forest Study provides some additional insight into the invasive species and climate change vulnerability of forest and tree assets. For instance, the urban forest study reports that 55% of the Town's forest plots had at least one invasive species present. Presence and symptoms of spongy moth and emerald ash borer were observed in 15% and 8% of plots surveyed, respectively. Furthermore, 60% of the total tree population in Aurora (Town-owned and other) are tree species considered highly or extremely vulnerable to climate change.

Risk mitigation strategies are identified in Section 4.1.4.

Table 4-2 Risk Assessment of Threats and Hazards

Asset Category	Threat or Hazard	Potential Impacts	Risk Rating*
Natural Areas Assets	Extreme heat and drought	Vegetation dieback and increased watering or replacement of vegetation required.	Low-medium
	Extreme rainfall and erosion	Washout of vegetation, erosion of soil, exposure of roots, and damage to trees and vegetation.	Low-medium

Asset Category	Threat or Hazard	Potential Impacts	Risk Rating*
	Extreme storms (wind and lightning)	Replacement and maintenance of vegetation may be required after lightning or wind damage to trees and plants. Debris can also cause physical hazards.	Low-medium[5]
	Invasive species, pests and disease	Potential for tree mortality in forest areas from spongy moth and emerald ash borer. Phragmites impact ecological function of natural wetlands. European buckthorn, Manitoba maple, and garlic mustard were most common invasive species found in natural cover forest plots.	High-medium
	Wildlife Impacts	Beavers are a risk to tree canopy, and their dams cause flooding. There are limited remediation options.	High-medium
	Unauthorized edge encroachment or disturbances	Impacts resulting from inappropriate and unauthorized activities adjacent to and within natural assets that negatively impact the natural asset. For example these could include dumping of yard or other waste from adjacent land use; installation of forts, sheds, or other structures; Mowing or other gardening; creation of informal trails.	Low
	Contamination (e.g. road salting and other spills)	Introduction of pollutants and /or chemicals to the asset that can seriously impair the function of or kill the asset.	Low
	Overuse and misuse	Impacts resulting from heavy volume of activity or in appropriate uses of natural assets causing negative impacts. Impacts could include widening of formal trails; excessive off-trail activities, use of motorized vehicles such as ATVs, dogs off-leash, excessive litter, etc.	Low
Natural Enhanced Assets	Extreme heat and drought	Fields maybe become unusable and/or require additional maintenance.	Low-medium
	Extreme rainfall and erosion	Washout of vegetation, erosion of soil, exposure of roots, and damage to trees and vegetation.	Low-medium
	Extreme storms (wind and lightning)	Replacement and maintenance of vegetation may be required after lightning or wind damage to trees and plants. Debris can also cause physical hazards.	Low-medium
	Unauthorized edge encroachment or disturbances	Impacts resulting from inappropriate and unauthorized activities adjacent to and within natural assets that negatively impact the natural asset.	Low
	Overuse and misuse	Impacts resulting from excessive and overuse of open space and parkland causing negative impacts.	Low-medium

* Risk ratings were determined based on the CCAP, Urban Forest Study and staff input.

[5] Through the CCAP this risk was rated at low-medium. However, based on recent experience staff noted that this risk could be a medium-high risk.

4.1.3 Urban Tree Risk Assessment – Asset Failure

For urban trees, existing inventory data on individual trees allowed for a more detailed assessment of risk using consequence and probability of failure. Urban trees were assigned a consequence of failure rating based on their trunk diameter at breast height (Table 4-3). The rationale for this is that larger trees tend to provide a greater LOS and are more costly to replace. For instance, a large mature tree will provide a larger canopy cover offering greater shade, runoff control, and neighbourhood aesthetics. Loss of this tree results in greater loss of benefits. Probability of failure was assigned based on asset condition rating (Table 4-4).

Table 4-3 Consequence of Failure (CoF) Rating Scale

CoF Rating	Trunk diameter at breast height (dbh)
1	<5 cm
2	5 to <20cm
3	20 to <40cm
4	40 to <80 cm
5	>=80cm

Table 4-4 Probability of Failure (PoF) Rating Scale

PoF Rating	Probability of Failure	Corresponding Asset Condition
1	Rare	Very Good
2	Unlikely	Good
3	Possible	Fair
4	Probable	Poor
5	Almost Certain	Very Poor

Table 4-5 shown below, presents the Risk Evaluation Matrix Framework that depicts the risk exposure, based on the likelihood of occurrence and consequence rating for urban trees in Aurora.

Table 4-5 Risk Evaluation Matrix Framework

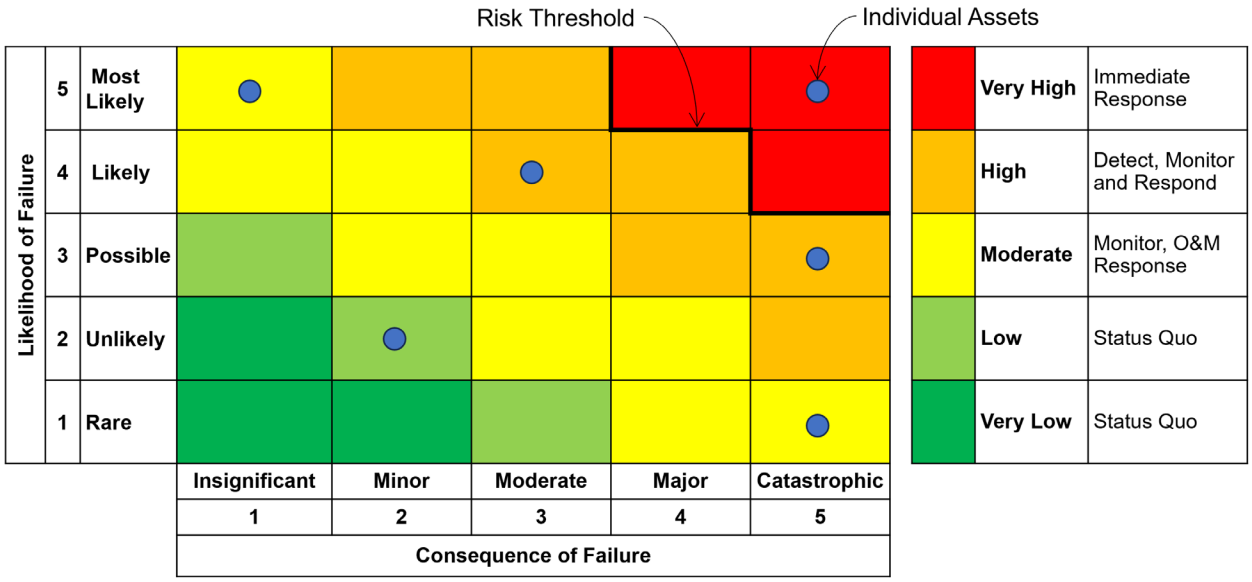


Table 4-6 shows the risk evaluation matrix for the Town's urban trees, based on the likelihood of occurrence and consequence ratings. Overall, only 0.1% of urban trees were considered Very High risk. This represents a total of approximately 60 trees and a replacement value of $63,000.

Table 4-6 Risk Evaluation Matrix (2024 $, millions) – Urban Trees

Likelihood of Failure	1	2	3	4	5
5	$0.03	$0.10	$0.12	$0.03	$0.00
4	$0.02	$0.19	$0.33	$0.18	$0.04
3	$0.11	$0.59	$2.04	$1.59	$0.14
2	$0.45	$4.05	$11.18	$5.74	$0.43
1	$0.59	$5.37	$8.42	$2.41	$0.07
	1	2	3	4	5
	Consequence of Failure				

Risk Exposure	CRV*($M)	CRV*(%)
Very High	$0.06	0.1%
High	$2.89	6.5%
Moderate	$22.26	50.4%
Low	$12.58	28.5%
Very Low	$6.41	14.5%
Total	**$44.20**	**100.0%**

* CRV = Current Replacement Value

4.1.4 Risk Mitigation Strategies

With an understanding of the risks facing natural assets, risk response or mitigation strategies can be established. Through the work of the CCAP and the Urban Forest Study, the Town has already identified several risk mitigation strategies many of which are already being implemented by the Town. Climate change risk mitigation actions identified for natural assets through the CCAP include the following:

1. Plan for low-maintenance landscaping with hardy species adapted to future climate conditions.
2. Adopt or enhance maintenance procedures to proactively identify hazardous trees and undertake preventative maintenance before damage occurs during extreme events.
3. Continue applying procedures in the Park Maintenance Plan to inspect parks following extreme weather events to identify damaged landscaping and amenities to prioritize repairs and minimize service disruptions.

The 2024 Urban Forest Study also identified recommendations related to the mitigation of climate change, invasive species and pest risk relevant to the Town's urban forest and urban trees. These include:

1. Assess the Town's current recommended planting list based on the climate vulnerability of each species. Shift recommendations to native and appropriate non-native, non-invasive species that have a higher tolerance and lower vulnerability to climate change impacts.
2. Consider targeted removal of high priority invasive plant species at high priority sites following best practices.
3. Develop a monitoring and action strategy for invasive species, including pests and diseases, and continue taking proactive approaches to address new and emerging invasive species, such as hemlock woolly adelgid and oak wilt.

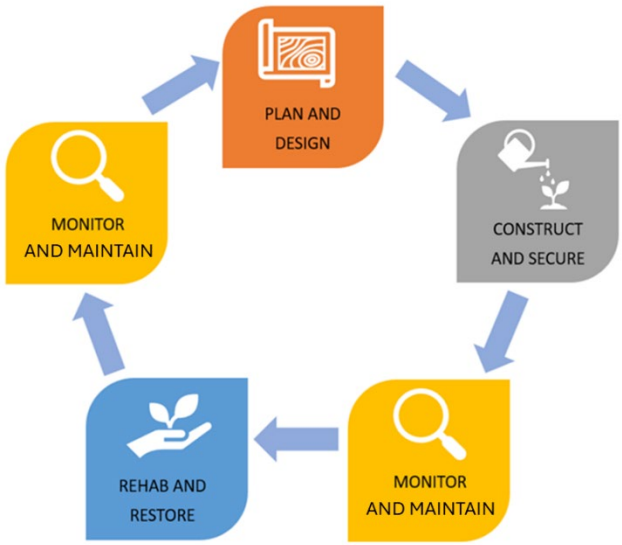
In addition to the risk mitigation already identified through the CCAP and the Urban Forest Study, this NCAMP recommends other mitigation actions for natural assets:

1. Conduct a study to assess the current condition of Town-owned natural area assets, documenting evidence of non-climate related risk (e.g. presence of invasive species, area degraded by overuse, etc.). Implement recommended upgrade, restoration, renewal and maintenance activities.
2. Remove and replace the trees identified as exposing the Town to very high risk (approximately 60 trees with a total value of $63,000 as shown in Table 4-6).
3. Explore options for managing beavers and formalize an approach to reducing their negative impacts on the tree canopy and drainage.
4. When the Town acquires new natural assets, conduct a condition assessment of the assets to inform financial considerations and risks to the Town.

4.2 Asset Management Strategies

The application of asset management lifecycle stages to natural assets is still evolving. For natural assets the stages are similar to built assets, however, some of the unique features of natural assets require a slightly different framing. The Natural Assets Initiative (2024)[6] recently released a guidance document to help municipalities across Canada incorporate natural assets into their assessment management planning process. The document articulates four key lifecycle stages for natural assets as shown in Figure 4-1 and as per the following descriptions:

Figure 4-1 Natural Asset Management Lifecycle



Source: Natural Assets Initiative (2024)

- **Plan and design** - activities to inform the subsequent stages that at a minimum involve data and information collection to understand the type, location and extent of natural assets under the management of the local government.
- **Construct and secure** – activities to provide a new asset that did not exist previously or to expand an existing asset (e.g., expanding an urban forest, planting new trees, constructing new community gardens). This includes securing land to expand the area of natural assets and where necessary, constructing new natural assets.
- **Rehabilitate and restore** – activities similar to upgrade and renewal of built assets. For natural assets, these activities tend to focus more on restoring degraded assets (e.g. replacing deteriorated sod, replanting deceased street trees, restoring streams affected by erosion), or improving asset resilience to known risks (e.g. replacing trees with different species to meet diversity targets or vaccinating trees).
- **Monitor and maintain** – activities needed to retain asset condition, including regularly scheduled inspection and assessment, regular fertilizing, overseeding, aeration and mowing of grassy areas; regular removal of litter and debris; or clean-up of tree limbs following extreme weather events.

This NCAMP focuses the asset management strategies on the lifecycle stages identified above. Note that disposal, a common consideration in asset management for built assets is largely not applicable to natural assets. An exception to this is some enhanced assets such as urban trees

[6] NAI (2024). Nature is infrastructure: How to include natural assets in asset management plans. Natural Assets Initiative. naturalassetsinitiative.ca

managed as individual units that have an end of life, and therefore disposal and asset replacement is needed.

Through asset management, the Town assesses the costs of potential lifecycle activities to determine the lowest lifecycle cost strategy to manage each asset type and deliver required services. Failing to take care of assets can impact the total cost of ownership for that asset and can also have other impacts such as causing damage to other infrastructure or interruption to service delivery.

This section of the NCAMP works through each of the lifecycle stages outlining what the Town is currently doing for each stage and potential future action that may be needed.

4.2.1 Plan and Design

The planning and design stage is intended to establish the long-term strategy for a service and its assets, and to inform the subsequent stages of planning for monitoring and maintenance, rehabilitation and restoration, and construction or securing of assets.

Table 4-7 lists the Town's current long-term strategic planning activities for natural assets. For natural area assets, the vision for scope and quantity of Town-owned services is shaped by the Strategic Plan 2011-2031, and land use plans defined in the Official Plan 2023 and Secondary Plans. In addition, the Town's Stream Management Master Plan 2019 defines the Town's vision for watercourse management. The Urban Forest Study 2024 defines the vision for tree canopy coverage, tree species diversity, and tree health. The Parks and Recreation Master Plan 2023 defines the Town's vision for urban parkland area and community gardens. The Pet Cemetery was acquired in 2011 and is in the process of being restored.

The table also shows potential future activities that may enhance the Town's long-term planning of natural assets. For example, it is recommended that the Town establish update frequencies for the Stream Management Master Plan and Parks and Recreation Master Plan and update these plans when they are due. Similarly, the Urban Forest Study should be updated on its established frequency of every 10 years. It is also recommended that the Pet Cemetery be incorporated into the into Official Plan and Parks and Recreation Master Plan when these are updated.

Table 4-7 Long-term Strategic Planning Activities

<table>
<tr><th>Asset Category</th><th>Asset Class</th><th>Current Activities</th><th>Potential Future Activities</th></tr>
<tr><td rowspan="3">Natural Area Assets</td><td>Forest and Open Spaces</td><td rowspan="3">Strategic Plan 2011-2031
Official Plan 2023
Secondary Plans (various)
Urban Forest Study 2024 (includes urban forests, updated every 10 years)</td><td rowspan="2">Update current plans when due.

Also consider incorporating carbon sequestration impact of natural assets in Town's GHG emissions plans, such as the Energy Conservation and Demand Management Plan and the Community Energy Plan.</td></tr>
<tr><td>Wetlands</td></tr>
<tr><td>Waterbodies</td></tr>
<tr><td></td><td>Watercourses</td><td>Strategic Plan 2011-2031
Official Plan 2023
Stream Management Master Plan 2019 (updated every 10 years)</td><td>Establish a frequency for updating the Stream Management Master Plan and update when due</td></tr>
<tr><td></td><td>Urban Trees</td><td>Urban Forest Study 2024 (includes urban trees, updated every 10 years)</td><td>Update the Urban Forest Study when due</td></tr>
</table>

Asset Category	Asset Class	Current Activities	Potential Future Activities
Natural Enhanced Assets		Tree inventory (used for Urban Forest Study)	Also consider incorporating carbon sequestration impact of urban trees in Town's GHG emissions plans, such as the Energy Conservation and Demand Management Plan and the Community Energy Plan.
	Urban Parks Community Gardens	Strategic Plan 2011-2031 Official Plan 2023 Parks and Recreation Master Plan 2023	Establish a frequency for updating the Parks and Frequency Master Plan and update when due
	Pet Cemetery	Site is planned for Heritage designation. Site acquired in 2011 and is in the process of being restored. Restoration is planned to continue over the next few years including clearing internal pathways, debris removal, stone cleaning, data/name collection and formal site/plot survey.	Incorporate Pet Cemetery into Parks and Recreation Master Plan

Planning for construction and securing, monitoring and maintenance, and rehabilitation and restoration of natural assets is currently done in this NCAMP, which references other planning documents where more detailed study has been completed. Construction and securing activities are discussed in Section 4.2.2, monitoring and maintenance activities are discussed in Section 4.2.3, and rehabilitation and restoration activities are discussed in Section 4.2.4.

4.2.2 Construct and Secure

As was explained in Section 3.5, the Town's population is expected to grow 11.8% from 66,370 in 2024 to 74,210 by 2034; however, due to land constraints and high land costs, the Town may not expand its natural area assets, urban parks, community gardens and trails to keep up with population growth.

The Town may consider planting additional trees to help achieve the Town-wide canopy target of 40%. Town-owned trees currently provides 6.3% canopy cover, which represents 18.5% of the current Town-wide canopy coverage of 34%. To meet the Town-wide target of 40% by 2034, the area of canopy cover needs to increase by 308 ha. It is challenging to translate canopy area need into a quantity of trees, because a tree's canopy coverage changes with age; however, assuming an average tree crown diameter of 6m, another 100,000 trees would be needed Town-wide, so any additional planting of Town-owned trees will help achieve this target.

Additional planting will also help the Town maintain its current LOS ratio of Town-owned urban trees to people. To maintain the current ratio of 398.3 trees per 1000 people, the Town will need to plant 3,123 urban trees by 2034 and another 2,779 urban trees by 2049, for a total of 5,902 urban trees planted over the next 25 years; however, maintaining the current LOS is not an

established target. For new plantings, the Town will select trees that will achieve its species diversity goal.

4.2.3 Monitor and Maintain

Monitoring and maintenance strategies for natural assets focus on improving assets' long-term resilience. Table 4-9 outlines the Town's current monitoring and maintenance activities by asset type. In addition, potential future activities have been identified that could help the Town improve and advance its overall management of natural assets. Frequency of inspections should be based on anticipated risks. However, targeting an inspection cycle of 5 to 10 years for all asset classes is recommended. The frequency of maintenance activities for natural area assets is more difficult to identify and should be based on identified needs that are uncovered as part of the inspection cycle. For natural enhanced assets, maintenance frequencies are defined in existing maintenance standards.

Table 4-8 Monitor and Maintain Management Strategies

Asset Category	Asset Class	Current Activities	Potential Future Activities
Natural Area Assets	Forest and Open Space	Current urban forest maintenance focuses on areas along the trail system, identifying and addressing trees that pose a hazard to public safety. Some identification of invasive species is completed; however, this is typically spearheaded by local ratepayers' groups.	Inspect for invasive species and assess management need. Urban Forest Study recommends developing a monitoring and action strategy for invasive species, including pests and diseases, and continuing to take proactive approaches to address new and emerging invasive species, such as hemlock woolly adelgid and oak wilt.
	Wetland	None	Inspect for invasive species and assess management needs. Adopt monitoring procedures to routinely inspect owned natural assets for preventative maintenance needs. Inspect assets regularly for signs of risk exposure, degradation, and possible rehabilitation needs. Potential future activities to be determined associated with Ducks Unlimited Canada property.
	Waterbody	None	Inspect for invasive species and assess management needs.
	Watercourses	Corrective maintenance of any issues when identified.	Execute operation and maintenance activities recommended by the Stream Management Master Plan. This plan also provides recommendations for a maintenance and monitoring plan as well as long-term monitoring based on a combination of 5 and 10-year inspection cycle field walks.

Asset Category	Asset Class	Current Activities	Potential Future Activities
Natural Enhanced Assets	Urban Trees	As per the Park Maintenance Standard, pruning of street trees varies by age class as follows: (1) Trees in the age class 15-25 years pruned once every 5 years; (2) Trees in the age class of 25-35 years pruned once every 7 years: (3) Trees in the age class of 35 years or more pruned once every 10 years. Corrective maintenance (clean up after storm).	Continue with tree maintenance program and implement recommendations from Urban Forest Study.
	Urban Parks	As per the Park Maintenance Standard, turf areas will be mowed to an average of 5cm, clippings will be removed from non-turf areas using a backpack blower, and litter and debris will be removed. Sports fields grass is aerated, top dressed, over seeded and fertilized.	Continue in accordance with existing maintenance standards.
	Community Gardens	Maintenance standards in development.	Formalize and implement maintenance standards.
	Pet Cemetery	Maintenance standards in development.	Formalize and implement maintenance standards.

4.2.4 Rehabilitate and Restore

The goal of rehabilitation and restoration activities is to improve asset condition, improve an assets' resilience to anticipated risks, or to respond to certain extreme hazard events that require reactive rehabilitation. Specific rehabilitation or restoration needs should be identified through routine monitoring and inspection. Currently the Town has a robust inspection cycle for urban trees. However, for other natural assets, restoration activities are more reactionary. A 5-to-10-year assessment cycle is recommended, recognizing that budget, condition, risk, and asset criticality should inform priority areas for assessment. Table 4-10 provides a summary of the Town's current and possible future rehabilitate and restore activities.

To estimate the tree replacement needs, a replacement age of 80 years for park trees and 49 years for street trees. These service life estimates yielded a replacement need of 646 trees, which approximated current replacement backlog of 666 trees identified in the inventory as dead or dying. Based on those service life estimates, it was projected that over the next 25 years, 7,361 urban trees will reach end of life and require replacement, or about 295 trees/year. With the unit replacement cost of $1,825, the total cost to address the backlog and replace all necessary trees over the next 25 years is projected to be $13.5 million, with an annual average cost of $538,375.

Table 4-9 Rehabilitate and Restore Management Strategies

Asset Class	Current Rehabilitation Activities	Potential Future Rehabilitation Activities
Wetlands Waterbody	No regular or planned rehabilitation efforts.	To be determined and prioritized through condition assessments and site inspections.
Forest and open space	The Town is nearing the end of its Emerald Ash Borer (EAB) management program, and there is no additional funding planned for forest restoration activities. Restoration programs are implemented as needed in response to specific threats and damage, such as invasive species, diseases or extreme weather. An Urban Forest Study is completed every 10 years to assess the health of trees and forests based on aerial photo. The most recent study was completed in 2024. The aerial photo does not enable assessment of the understory.	To be determined and prioritized through condition assessments and site inspections
Watercourses	A Stream Management Master Plan was completed in 2019, and the Town is continuing to implement the recommended erosion control improvements.	Complete the improvements identified in the 2019 Stream Management Master Plan.
Urban Trees	Street and park trees are individually replaced when they are damaged, dying or dead. Town staff complete a tree inspection and inventory on one quadrant of the Town each year. As such, trees are inspected every 4 years. During the inspection, trees are maintained or identified for replacement. Trees are also identified for replacement through the Urban Forest Study, which is completed every 10 years, and assesses the health of trees based on aerial photo. The most recent study was completed in 2024.	Continue replacing trees as needed, based on annual inspections, the Urban Forest Study and reports by residents and staff. An estimated average of 295 trees / year will require replacement. As trees are replaced, strive to achieve the species diversity target defined in the LOS (based on the Urban Forest Plan), and to shift to native and appropriate non-native, non-invasive species that have a higher tolerance and lower vulnerability to climate change impacts.
Urban Parks	As per the Park Maintenance Standard, manicured grassy areas are not restored or re-sodded unless, except for high wear areas of sports fields.	Continue in accordance with existing maintenance standards.
Community Gardens	These constructed assets are replaced and renewed as needed. The existing Community Garden is over 25 years old, and is in Good condition, so renewal is not currently planned.	Monitor the existing Community Garden for signs of deterioration and renew as needed. A second Community Garden is being constructed in 2024 and is not expected to require renewal in the NCAMP's 10-year planning period.

Asset Class	Current Rehabilitation Activities	Potential Future Rehabilitation Activities
Pet Cemetery	The Pet Cemetery was purchased in 2011 and has been undergoing restoration since 2017. The restoration is almost complete, and no additional renewal needs are anticipated.	Establish regular on-site monitoring and assessment of the Pet Cemetery, to proactively identify restoration and rehabilitation needs.

4.3 Summary of Lifecycle Management Needs

This section identified current lifecycle management activities and potential future activities to address risks to natural assets and achieve desired LOS.

4.3.1 Managing Risk

Based on the Town's CCAP and interviews with Town staff, invasive species, pests and diseases, and wildlife impacts (specifically beavers) present High-medium risks to the Town's natural assets. Low-medium risks include extreme weather, contamination, overuse, and misuse. Low risks include unauthorized edge encroachment or disturbances. No threats were ranked as High risk.

Risk treatments recommended by the CCAP and reinforced by recommendations from the Urban Forest Study include:

1. **Tree and Plant Selection**

   Regularly assess the Town's planting list to plant trees, shrubs and other plants that are native or non-invasive, low-maintenance, and resilient to invasive species, pests, diseases and projected climate conditions.

2. **Before Extreme Weather Events**

   Assess the costs and benefits of increasing the current tree inspection and maintenance process (one quadrant of the Town each year) to identify hazardous trees and undertake preventative maintenance before damage occurs during extreme weather events. Implement the optimal inspection and maintenance frequency.

3. **After Extreme Weather Events**

   Continue applying procedures in the Park Maintenance Plan to inspect parks following extreme weather events to identify damaged landscaping and amenities to prioritize repairs and minimize service disruptions.

4. **Managing Non-Climate Threats**

   Establish a program to monitor and assess degradation of natural assets due to invasive species, pests, diseases, contamination, overuse, misuse, unauthorized edge encroachment or other disturbances. Continue taking proactive approaches to address new and emerging invasive species, such as hemlock woolly adelgid and oak wilt. Consider targeted removal of high priority invasive plant species at high priority sites following best practices. Implement actions to restore degraded assets and to prevent future degradation.

5. **Managing Wildlife Threats**

   Explore options for managing beavers and formalize an approach to reducing their negative impacts on the tree canopy and drainage. However, it is recognized that options may be limited based on existing wildlife regulations.

In addition, asset failure risk was assessed for individual urban trees, and it was found that 0.1% of urban trees are exposing the Town to Very High risk, representing a total of approximately 60 trees and a replacement value of $63,000. It is recommended that the Town prioritize removal and replacement of these trees.

4.3.2 Managing the Asset Lifecycle

In addition to the Town's current practices for managing natural assets across the stages of the lifecycle, potential future activities for the Town to consider for each lifecycle stage include the following:

- Plan and Design
    - Continue updating the Stream Management Master Plan and Urban Forest Study every 10 years
    - Incorporate the Pet Cemetery into Official Plan and Parks and Recreation Master Plan when these are updated.
    - Consider incorporating carbon sequestration impact of urban trees in Town's GHG emissions plans, such as the Energy Conservation and Demand Management Plan and the Community Energy Plan.
- Construct and Secure
    - Due to land constraints and the high cost of land it may not be feasible for the Town to maintain the current LOS of natural area assets and natural enhanced assets per 1,000 people.
    - Given these constraints, construct and secure strategies should focus on working toward meeting the Town's 40% canopy cover target.
- Monitor and Maintain
    - Establish a program to assess and monitor degradation of natural assets, as described in Section 4.3.1, Recommendation 4 – Manage Non-Climate Threats. This should include assessing the condition of any newly acquired lands if any are secured.
    - Continue executing operations and maintenance activities recommended by the Stream Management Master Plan, including conducting regular field walks.
    - Continue maintaining trees in accordance with the Park Maintenance Standard and implement recommendations from the 2024 Urban Forest Study.
    - Continue maintaining urban parkland in accordance with the Park Maintenance Standard.
    - Continue formalizing maintenance standards for community gardens and pet cemetery, then implement.
- Rehabilitation and Restoration

- Implement restoration needs identified through the assessment of natural assets.
- Continue to implement the improvements identified in the 2019 Stream Management Master Plan.
- Continue replacing trees based on annual inspections, the Urban Forest Study and reports by residents and staff. Prioritize the trees identified as Very High risk in Table 4-6. As trees are replaced, consider the recommendations in the Tree and Plant Selection list updated in alignment with Section 4.3.1, Recommendation 1 – Tree and Plant Selection. Strive to achieve the species diversity target defined in the LOS (based on the Urban Forest Plan), and to shift to native and appropriate non-native, non-invasive species that have a higher tolerance and lower vulnerability to climate change impacts.

The next section discusses the estimated costs of the recommended risk mitigations and potential future lifecycle activities.

5 FINANCIAL STRATEGY

This section presents three options for investing in the management of natural assets. Each option carries a different cost and delivers a different lifecycle benefit. The scenarios are:

- **Scenario A: Status Quo**
  Manage assets according to current practices and planned restoration activities. Replacement of urban trees, invasive species management and targeted planting and seedling are based on capacity of existing budget. New urban tree planting continues based on current levels.
- **Scenario B: Status Quo with Moderate Rehabilitation, Monitoring and Maintenance**
  Continue status quo activities and initiate broader programs to manage invasive species, conduct targeted planting and seeding, and assess condition of natural area assets. Increased replacement of urban tree and planting of new urban trees.
- **Scenario C: Status Quo with High Rehabilitation, Monitoring and Maintenance**
  Continue status quo activities and initiate broader programs to more aggressively manage invasive species, conduct targeted planting and seeding, and assess condition of natural area assets. Address all urban tree replacement needs over the 25-year period and increase new urban tree plantings.

As indicated by their names, the strategies differ primarily in their level of monitoring and maintenance of natural assets. Scenario A: Status Quo includes monitoring and maintenance of natural enhanced assets, but very little for natural area assets. Scenario B initiates rehabilitation, monitoring and maintenance for natural assets. Scenario C is similar to Scenario B, but includes funds for more aggressive rehabilitation, monitoring and maintenance.

Due to land constraints and the high cost of land, none of the Scenarios include the addition of natural area or enhanced assets.

The details of each Scenario are described below, followed by a summary comparison.

5.1 Scenario A: Status Quo

Table 5-1 summarizes the lifecycle activities included in the Status Quo scenario. All activities reflect existing fund levels in current capital plan and the 2024 operating budget. Assumptions regarding status quo activities and costs are as follows:

- Construct and Secure
  - 1,500 new urban trees planted over 25 years, or on average 60 trees/year at cost of $375/tree.
- Rehabilitation and Restoration
  - The total estimated cost for replacing community gardens is $450,000, with $150,000 needed in year approximately 2039 and the remaining amount in approximately 2049.
  - Invasive species controls are applied to 8.3 ha over the next 25 years. The annual invasive species control cost, which does not include value of volunteer work, is

estimated to be $20,000 per year. The total cost over 25 years is estimated to be $0.5 million.

  - Targeted seeding or planting activities are applied to 2.4 ha over the next 25 years. The annual cost, which excludes cost spent on trees planted through external partnerships, is estimated to be $20,000 per year and the total cost is $0.5 million.
  - The estimated cost for urban tree replacement is derived from an age-based forecast model, assuming the current replacement rate of 240 trees per year. With current replacement rate, a total of 6,000 trees is estimated to be replaced over 25 years, totaling around $11 million.
  - Recommendations of the 2029 Stream Management Master Plan will be implemented and are estimated based on current Town's budgeted expenses.

- Monitor and Maintain
  - Includes the continued maintenance efforts for urban parks, community gardens, and the pet cemetery. This cost is based on current budget expenses and an estimate of staff time related to these assets to generate an average maintenance cost of approximately $431,000.
  - Tree maintenance costs are estimated using a similar process including current expenses and staff time to generate an average maintenance cost of $203,000, with a total exceeding $5 million.
- Plan and Design
  - 10-year update of the Stream Management Master Plan (required in year 2029, 2039, and 2049), which is expected to cost about $150,000.
  - Updated tree inventory, on a 10-year frequency, is based on what is currently report in the 10-year Capital Budget amounting to $36,200. Currently planned for 2025, 2035 and 2045.
  - An update to the Urban Forest Study is also required on a 10-year frequency (required in 2034 and 2044) and estimated based on the Town's portion of the cost to complete the recent 2023 as reported in the 10-year capital budget.

Table 5-1 Scenario A: Status Quo Lifecycle Activities

Lifecycle Stage	**Activities for Natural Area Assets** (Forests and Open Spaces, Water Bodies, Wetlands, Watercourses)	**Activities for Natural Enhanced Assets** (Community Gardens, Urban Parks, Urban Trees and Pet Cemetery)
Construct and Secure	None	Assumes no additional parklands, community gardens or other enhanced areas. Per status quo, 60 new urban trees will be planted per year, resulting in 1,500 new trees by 2049. (Trees that are planted by developers would be additional). LOS drops from 398.3 urban trees / 1000 people in 2024 to **345 urban trees / 1000 people in 2049.**
Rehabilitation and Restore	Conduct invasive species control on 0.33ha of natural area assets per year, for a total of **8.3ha completed in 25 years (2% of natural areas)**. This quantity reflects status quo of ~$20k/year spending on this activity. Additional progress is made by volunteers, and it is recommended that the Town continue volunteer activities. Conduct targeted planting and seeding on 0.95ha of natural area assets per year for a total of **2.4ha completed in 25 years (1% of natural areas).** This quantity reflects status quo of ~$20k/year spending on this activity. In addition, 445 trees are planted in natural areas, funded through partnerships. It is assumed that trees will be planted at the same rate over the next 25 years. This will require the Town to maintain these partnerships.	Town to continue **replacing 240 urban trees / year**. It is estimated that 7360 urban trees will reach end-of-life by 2049, or approximately 295/year, so at the end of **2049 there will be a backlog of 1361 trees requiring replacement.**
Monitor and Maintain	Condition of natural area assets is not assessed. Does not include stream monitoring. 2019 Stream Management Plan recommend 5-year and 10-year monitoring cycles along different segments. 10-year assessments will be included with the Stream Management Plan Update (see Plan	Continue current maintenance levels for trees; however, does not allow for additional maintenance required as trees are added. Continue current maintenance practices for parklands (assuming no additional lands are acquired).

Lifecycle Stage	Activities for Natural Area Assets (Forests and Open Spaces, Water Bodies, Wetlands, Watercourses)	Activities for Natural Enhanced Assets (Community Gardens, Urban Parks, Urban Trees and Pet Cemetery)
	and Design section); however Scenario A does not include the recommended 5-year monitoring.	
Plan and Design	Update of Stream Management Master Plan in 2029 and 2039 (10-year cycle). The update includes stream monitoring (field walk) to collect data.	Includes Tree inventory update in 2025, 2035 and 2045 (10-year cycle) and Urban Forest Study Update in 2034 and 2044 (in accordance with 10-year cycle).

Table 5-2 and Figure 5-1 outline the financial needs forecast over both the 10- and 25-year planning periods for Scenario A – Status Quo. See Appendix D for detailed financial tables.

Overall, the total forecasted needs over the 10-year period are $19.99 million, with an average annual need of $2.0 million/year (indicated by the black dashed line in Figured 5-1).

The average annual needs over the 25-year forecast were estimated to be $1.5 million (indicated by the grey dashed line in Figure 5-1). This value is lower than the forecast 10-year needs, because the only rehabilitation and restoration needs known for natural area assets are stream rehabilitation identified in the 2019 Stream Management Master Plan, which will all be completed in 2031. Because natural area assets do not deteriorate with age, condition assessments are needed to identify of rehabilitation and restoration.

This scenario is derived from Status Quo activities and planned budget allocations, and thus represents the anticipated available funding.

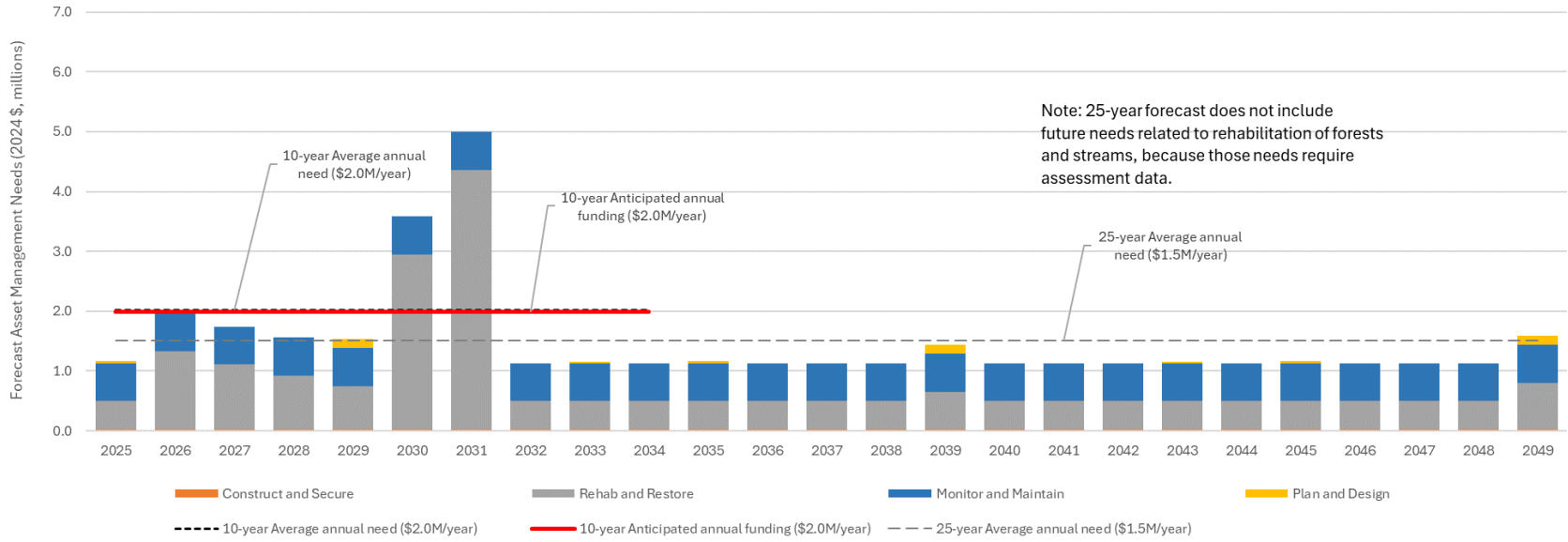
Table 5-2 Scenario A: Financial Needs Forecast Summary

No additional funding required for this Scenario.

	Forecast Needs (2024 $, millions)			
	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	0.23	0.02	0.56	0.02
Rehab and Restore	13.22	1.32	20.84	0.83
Monitor and Maintain	6.35	0.63	15.87	0.63
Plan and Design	0.20	0.02	0.59	0.02
OVERALL TOTAL*	**19.99**	**2.00**	**37.85**	**1.51**

* Differences due to rounding

Figure 5-1 Scenario A: Financial Needs Forecast 2025-2049



5.2 Scenario B: Moderate Rehab, Monitoring and Maintenance

Table 5-3 lists the lifecycle activities included in Scenario B. The lifecycle activities are the same as described in Scenario A, except for the following changes:

- Construct and Secure
    - 2,000 new trees planted over 25 years, or on average 80 trees/year at cost of $375/tree
- Rehabilitation and Restoration
    - Invasive species controls are applied to 53.6 ha over the next 25 years. The percentage of area to control each year is set at 0.5%. Based on costs reported by CVC (2020)[7], the unit cost for these procedures were estimated to be $6/m^2. When applied to the assumed area of treatment result in a cost of $3.2 million over the 25-year period.
    - Targeted seeding or planting activities are applied to 10.3 ha over the next 25 years. Based on costs reported by CVC (2020), the unit cost for these procedures were estimated to be $21/m^2. When applied to the assumed area of treatment results in a cost of $2.2 million over 25-years.
    - The tree replacing rate is set at 280 per year, and the total cost of $12.8 million to replace 7,000 trees over next 25 years.
- Monitor and Maintain
    - Tree maintenance cost is estimated based on existing cost per tree, increases with addition of trees planted each year, totalled at $5.3 million.
    - Over a 25-year period, the total projected assessment cost for natural area asset assessment amounts to approximately $1.2 million. This estimate is based on assessing 25% of the area (open spaces, forests, and wetlands) in 2025 and 2026, 15% in 2027 and 2028, and 10% annually thereafter, with a unit assessment cost of $1,000 per hectare.

[7] CVC (2020). Life Cycle Costing of Restoration and Environmental Management Actions: Costing Natural Assets in Peel Region.

Table 5-3 Scenario B: Moderate Lifecycle Activities

Lifecycle Stage	**Activities for Natural Area Assets** (Forests and Open Spaces, Water Bodies, Wetlands, Watercourses)	**Activities for Natural Enhanced Assets** (Community Gardens, Urban Parks, Urban Trees and Pet Cemetery)
Construct and Secure	Same as Scenario A - Status Quo	Assumes no additional parklands, community gardens or other enhanced areas (e.g. pet cemetery). 80 new urban trees will be planted per year, resulting in 2,000 new trees by 2049. (Trees that are planted by developers and through existing partnerships would be additional.) LOS in 2049: 356 urban trees / 1000 people (lower than in 2024)
Rehabilitation and Restore	Allows for 54ha of invasive species control per year in 25 years (13% of natural areas). This does not include efforts of volunteers. Additional progress will be made by volunteers (quantity unknown). Allows for 10.3ha of targeted planting and seeding in 25 years (2.4% of natural areas). This does not include the significant contributions of planting partnerships.	Town to **replace 280 urban trees / year**. It is estimated that 7360 urban trees will reach end-of-life by 2049, or approximately 295/year, so at the end of **2049 there will be a backlog of 361 trees requiring replacement**.
Monitor and Maintain	Completes condition assessment on all natural areas in first 6 years, then continues on a cycle of assessing each property every 10 years (1/10th of portfolio per year). Includes the 5-year monitoring that was excluded from Scenario A. As with Scenario A, 10-year monitoring will be covered by the Stream Management Plan Update (see Plan and Design section)."	Continue current maintenance levels for trees. Allow for additional maintenance proportional to growth in urban tree portfolio (trees planted by Town, does not include developer-planted trees because those are unknown). Same as Scenario A - Status Quo
Plan and Design	Same as Scenario A - Status Quo	Same as Scenario A - Status Quo

Table 5-4 and Figure 5-2 show the forecasted financial needs over both the 10 and 25-year planning periods for Scenario B. See Appendix D for detailed financial tables.

The overall forecasted need across all categories for the 10-year period totals $23.1 million or $2.3 million/year. The forecasted need surpasses the Status Quo Scenario by $0.32 million/year. This amount also represents the gap between anticipated available funding (indicated by the difference between the red line in Figure 5-2) and forecast need (indicated by the black dashed line).

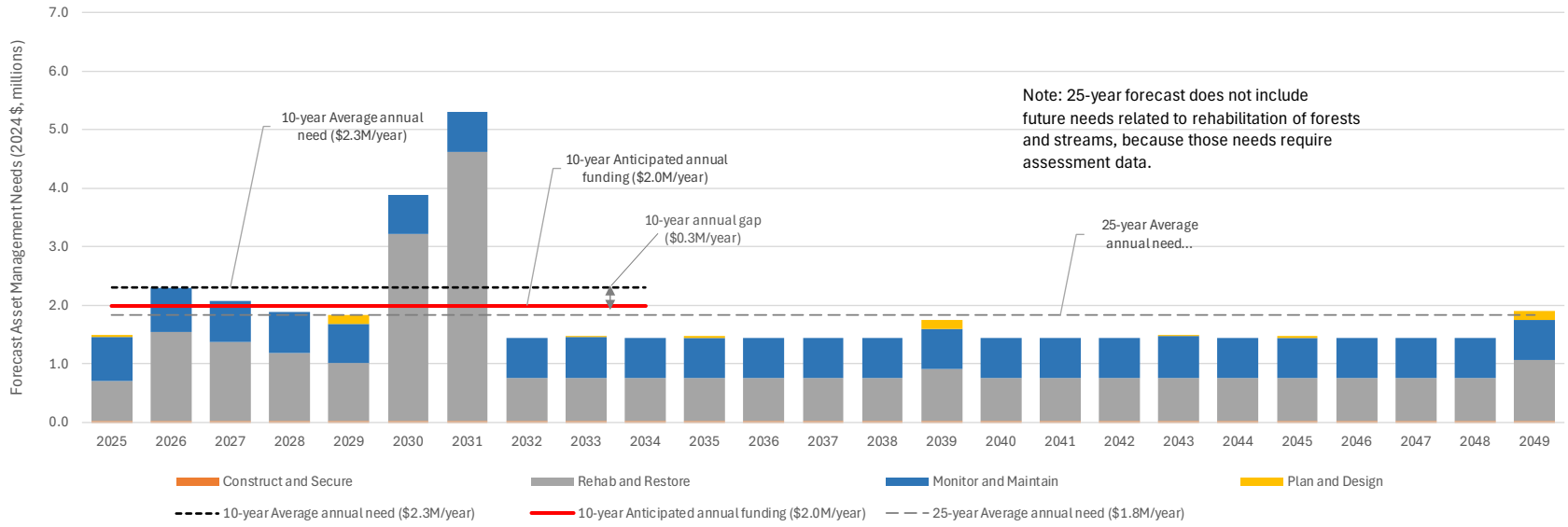
Over 25 years, forecast needs average $1.8 million/year; however, it is anticipated that this amount will increase after condition assessments are completed, and rehabilitation and restoration needs are identified.

Table 5-4 Scenario B: Financial Needs Forecast Summary

	Forecast Needs (2024 $, millions)			
	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	0.30	0.03	0.75	0.03
Rehab and Restore	15.64	1.56	27.04	1.08
Monitor and Maintain	7.00	0.70	17.34	0.69
Plan and Design	0.20	0.02	0.59	0.02
OVERALL TOTAL*	**23.14**	**2.31**	**45.72**	**1.83**
Difference from Status Quo*	3.15	0.32	7.87	0.31

* Differences due to rounding

Figure 5-2 Scenario B: Financial Needs Forecast 2025-2049



5.3 Scenario C: High Rehab, Monitoring and Maintenance

Table 5-5 lists the lifecycle activities included in the Scenario C. The lifecycle activities are the same as described in Scenario B, with exception of the following:

- Construct and Secure
    - 4,000 new trees planted over 25 years, or on average 160 trees/year at cost of $375/tree
- Rehabilitation and Restoration
    - Invasive species controls are applied to 193.0 ha over the next 25 years. The percentage of area to control each year is set at 2.0%. Based on the same cost assumptions outlined for Scenario B, the total cost for invasive species control is totalled around $11.6 million.
    - Targeted seeding or planting activities are applied to 20.4 ha over the next 25 years, using the same cost assumptions outlined for Scenario B.
    - The tree replacing rate is set at 295 per year, and the total cost of $13.5 million to replace 7,375 trees over next 25 years.
- Monitor and Maintain
    - Tree maintenance cost is estimated based on existing cost per tree, increases with addition of trees planted each year, totalled at $5.5 million.
    - Over a 25-year period, the total projected assessment cost for natural area asset assessment amounts exceeding $1.3 million. This estimate is based on assessing 25% of the area (open spaces, forests, and wetlands) in 2025 and 2026, 20% in 2027 and 2028, and 10% annually thereafter, with a unit assessment cost of $1,000 per hectare.

Table 5-5 Scenario C: High Lifecycle Activities

Lifecycle Stage	Activities for Natural Area Assets (Forests and Open Spaces, Water Bodies, Wetlands, Watercourses)	Activities for Natural Enhanced Assets (Community Gardens, Urban Parks, Urban Trees and Pet Cemetery)
Construct and Secure	Same as Scenario A - Status Quo	Assumes no additional parklands, community gardens or other enhanced areas (e.g. pet cemetery). 160 new urban trees will be planted per year, resulting in 4,000 new trees by 2049. (Trees that are planted by developers would be additional.) LOS in 2049: **398 urban trees / 1000 people** (same as in 2024)

Lifecycle Stage	Activities for Natural Area Assets (Forests and Open Spaces, Water Bodies, Wetlands, Watercourses)	Activities for Natural Enhanced Assets (Community Gardens, Urban Parks, Urban Trees and Pet Cemetery)
Rehabilitation and Restore	Allows for 193**ha of invasive species control per year in 25 years (45% of natural areas).** This does not include efforts of volunteers. Additional progress will be made by volunteers (quantity unknown). Allows for **20.4ha of targeted planting and seeding in 25 years (4.8% of natural areas)**. This does not include the significant contributions of planting partnerships.	Town to **replace 295 urban trees / year, which is** expected to be sufficient to replace all trees that reach end-of-life by 2049 (**no backlog**).
Monitor and Maintain	Completes condition assessment on all natural areas in **first 5 years**, then continues on a cycle of assessing each property every 10 years (1/10th of portfolio per year). Same as Scenario B - Medium.	Same as Scenario B - Medium; however, funding requirement is higher because more new trees are planted in Scenario C. Same as Scenario A - Status Quo
Plan and Design	Same as Scenario A - Status Quo	Same as Scenario A - Status Quo

Table 5-6 and Figure 5-3 display both the 10-year and 25-year financial needs forecast for Scenario C. See Appendix D for detailed financial tables.

The total projected financial need for all categories is estimated to be $27.1 million over the 10-year period, with an annual average need of $2.71 million/year. Compared to Scenario A – Status Quo, Scenario C requires an additional $7.1 million over the 10-year period. This represents an average annual funding gap of $0.71 million/year, indicated by the difference between the black dash line (forecast need) and the red line (anticipated annual funding) in Figure 5-3.

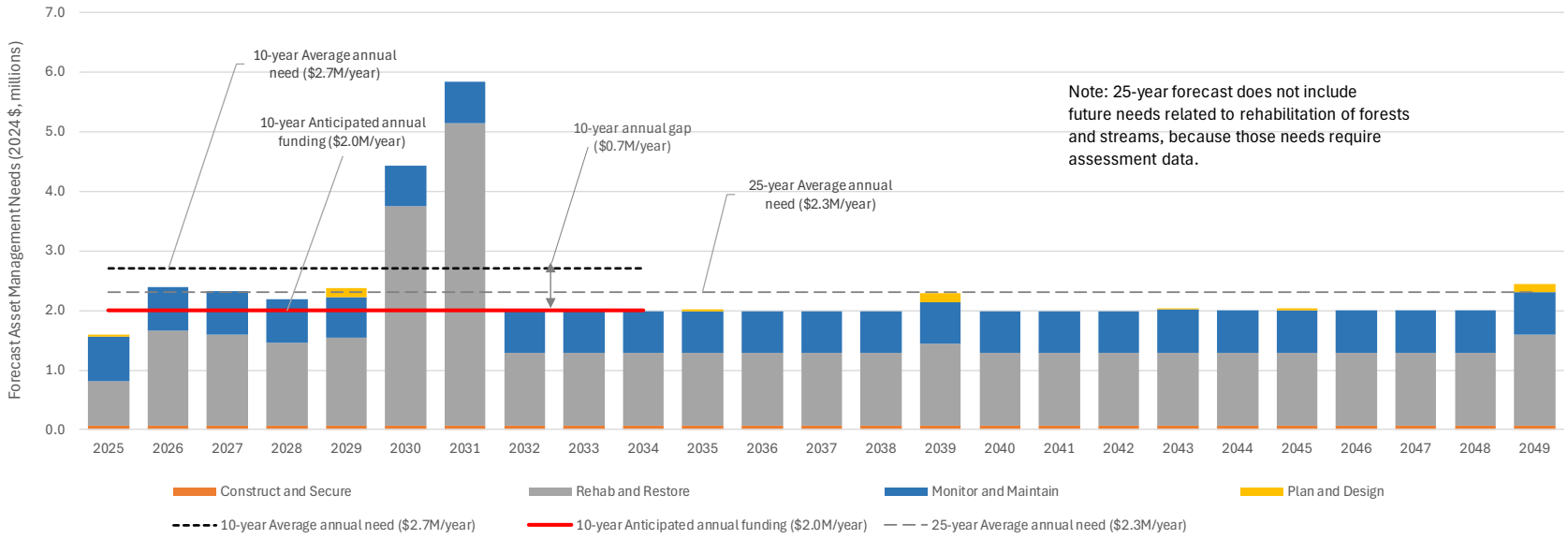
The 25-year forecast shows an average annual need of $2.3 million/year; however, it is anticipated that this amount will increase after condition assessments are completed, and rehabilitation and restoration needs are identified.

Table 5-6 Scenario C: Cost Forecast 2025-2034

	Forecast Needs (2024 $)			
	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	0.60	0.06	1.50	0.06
Rehab and Restore	19.25	1.93	38.20	1.53
Monitor and Maintain	7.07	0.71	17.57	0.70
Plan and Design	0.20	0.02	0.59	0.02
OVERALL TOTAL*	**27.12**	**2.71**	**57.86**	**2.31**
Difference from Status Quo*	7.14	0.71	20.01	0.80

* Differences due to rounding

Figure 5-3 Scenario C: Cost Forecast 2025-2034



5.4 Comparison of Scenarios

The three scenarios for natural asset management are compared in Table 5-7 through Table 5-9. Table 5-7 summarizes the costs of each scenario, and shows that 10-year costs range from $20.0 million for Scenario A (Status Quo) to $27.1 million for Scenario C (High), while the 25-year costs range from $37.9 million for Scenario A to $57.9 million for Scenario C.

As the Status Quo scenario, Scenario A represents the anticipated annual funding available, and is used to calculate the funding gap, or additional funding needed, for Scenarios B and C. The table shows that an average of $0.3 million/year additional funding would be needed for Scenarios B and $0.7 million/year additional funding would be needed for Scenarios C.

Table 5-7 Comparison of 10-Year and 25-Year Costs for Scenarios A, B and C

	10-Year Cost Comparison			25-Year Cost Comparison		
	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	Scenario C
Total Cost (2024 $, millions)	$20.0	$23.1	$27.1	$37.9	$45.7	$57.9
Average Annual Cost (2024 $, millions/year)	$2.0	$2.3	$2.7	$1.5	$1.8	$2.3
Anticipated Annual Average Funding (2024 $, millions/year)	$2.0	$2.0	$2.0	$1.5	$1.5	$1.5
Average Annual Gap* (2024 $, millions/year)	--	$0.3	$0.7	--	$0.3	$0.8

* Differences due to rounding

Table 5-8 compares the lifecycle activities completed of each scenario over the 25-year planning period. As shown in the table, Scenario A replaces 82% of the estimated tree replacement need (as calculated in Section 4.2.4), and new tree plantings continue based on current levels to contribute to achieving the 40% canopy cover target. Natural area condition assessments are not conducted, but existing levels of invasive species control and targeted seeding and planting continue. This Scenario will leave the Town and its natural assets unprepared for hazards such as extreme weather, invasive species, encroachment and misuse.

Scenario B replaces 95% of the estimated tree replacement need (as calculated in Section 4.2.4), and plants 2000 (80/year) new trees to contribute to achieving the canopy target. Moreover, natural area condition assessments will be completed on all properties in the first 6 years before transitioning to a 10-year cycle. Moderate programs of invasive species control and targeted seeding and planting will also be conducted.

Scenario C is similar to Scenario B but aims to replace 100% of the estimated tree replacement need (as calculated in Section 4.2.4) and to plant 4000 new trees to contribute to the tree canopy target (and would be sufficient to maintain the current LOS ratio of trees to population). Natural

area condition assessments will be completed on all properties in the first 5 years (1 year faster than Scenario B) before transitioning to a 10-year cycle, and invasive species control and targeted seeding and planting will also be conducted at a higher rate. This will better position the Town for the identified risks to its natural assets.

Table 5-8 Comparison of Lifecycle Activities under Scenarios A, B and C

Lifecycle Activities Completed 2025-2049	Scenario A Status Quo	Scenario B Moderate	Scenario C High
Construct and Secure			
Net New Urban Trees Planted	1,500 trees 60 trees / year	2,000 trees 80 trees / year	4000 trees 160 trees / year
Rehab and Restore			
Dead and Dying Urban Trees Replaced	6,000 trees (82% of need)*	7,000 trees (95% of need)*	7,375 trees (100% of need)*
Invasive Species Control (hectares treated)	8.3 ha (2% of area)**	53.6 ha (13% of area)**	193.0 ha (45% of area)**
Targeted Seeding and Planting (hectares treated)	2.4 ha (1% of area)**	10.3 ha (2.4% of area)**	20.4 ha (4.8% of area)**
Stream Rehabilitation projects completed	5 projects	5 projects	5 projects
Monitor and Maintain			
Condition Assessment (hectares assessed)	0	1,243.7 ha	1,286.6 ha
Tree Maintenance Increases with Net New Trees	Yes	Yes	Yes
Urban Park Maintenance	Same as current	Same as current	Same as current
Plan and Design			
Stream Management Master Plan Updated in 2029, 2039, 2049	Yes	Yes	Yes
Urban Forest Study Updated in 2034, 2044	Yes	Yes	Yes
Tree Inventory Updated in 2025, 2035, 2045	Yes	Yes	Yes

* Percent of need is determined based on the cumulative number of trees replaced by the scenario compared to the forecasted replacement need estimated in Section 4.2.4.

** Percent of area is determined based on the total area of Town-owned natural area assets.

Table 5-9 compares the forecast LOS of each scenario at the end of the 25-year planning period. As shown in the table, the forecast LOS is the same across all scenarios for several of the metrics, including the following:

- % residential homes within 500m of natural area assets or enhanced asset areas
- Area of natural area assets and natural enhanced assets per 1000 people
- # of Community Garden locations per 1000 people
- # of km of trails through natural area assets and natural enhanced assets per 1000 people

These are the same across all scenarios, because the scenarios do not include addition of lands, community gardens or trails.

LOS is also the same across all scenarios for the tree pruning LOS, because all the scenarios assume that pruning will be done at the current rate, with activity increasing proportionally with addition of trees.

Differences between scenarios relate to the following LOS:

- Area of canopy cover provided by the Town
- # of public maintained street and park trees per 1000 people
- # of new urban trees planted per year
- Species diversity of maintained trees
- % Town-owned natural assets affected by invasive species
- # of urban tree replacements per year

For each of these metrics, Scenario A – Status Quo provides a benchmark performance level, Scenario B provides a slightly improved performance, which will make the Town's natural assets healthier and more resilient to climate and non-climate threats. This scenario will require $0.32 million/year of additional funding.

Scenario C provides even greater health and resilience but requires $0.73 million/year of additional funding.

Table 5-9 Level of Service Performance Forecasts for Scenarios A, B and C

Service Attribute	Community LOS	Technical LOS	Relevant Asset Type	Current Performance	Performance Forecast for 2049		
					Scenario A Status Quo	Scenario B Moderate	Scenario C High
Capacity & Use	Natural assets are suitable to all kinds of users and are easy to access.[a]	% residential homes within 500m of natural area assets or enhanced asset areas	Natural area and natural enhanced assets	**99.35%** of residential properties	Percentage expected to increase (improve) with growth of Aurora Promenade and Major Transit Station Area		
		Area of natural area assets and natural enhanced assets per 1000 people	Natural area and natural enhanced assets	Natural area assets per 1000 people: **6.56 ha** [b,c] Natural enhanced asset per 1000 people: **1.99 ha** [b,c]	Natural area assets per 1000 people: **5.15 ha** [c] Natural enhanced asset per 1000 people: **1.56 ha** [c]		
		Area of canopy cover provided by the Town	Urban trees and forest and open space	Approximately 313 ha of canopy cover is Town-owned. This provides a canopy cover of 6.3%, which accounts for 18.5% of the current Town-wide canopy cover (34%).	1,500 new urban trees [f]	2,000 new urban trees [f]	4,000 new urban trees [f]
		# of public maintained street and park trees per 1000 people	Urban trees	# of urban trees: 26,435 # of public maintained street trees/1000 people: **398.3** [c]	29,195 trees **345.3** trees/1000 people [c]	30,095 trees **355.9** trees/1000 people [c]	33,695 trees **398.5** trees/1000 people [c]
		# of new urban trees planted per year	Urban trees	60 new urban trees planted (2023)	60 trees / year	80 trees / year	160 trees / year
		# of Community Garden locations per 1000 people	Community gardens	# of locations: 2 # of locations per 1000 people: **0.030** [c]	2 locations **0.024** locations / 1000 people [c]		
		# of km of trails through natural area assets and natural enhanced assets per 1000 people	Natural area and natural enhanced assets	40.87 km of trails through town-owned and town-maintained land Trails per 1000 people: **0.616 km** [c]	40.87 km **0.483 km** / 1000 people [c]		
Function	Enrich Aurora's ecology by protecting and preserving biodiversity. [d]	Species diversity of maintained trees	Urban trees	Species composition for highest 5 species in Town's tree inventory: • Norway maple (14.96%) • Littleleaf linden (11.83%) • Ash (9.51%) • Honey locust (8.54%) • Silver maple (5.49%)	Low improvement	Low-Medium improvement	Medium improvement
		% Town-owned natural assets affected by invasive species	Natural area assets	55% of Open Space − Natural Cover plots show invasive plant species (from Urban Forest Study) [e]	Invasive species control completed on 8.3ha over 25 years	Invasive species control completed on 55ha over 25 years	Invasive species control completed on 197ha over 25 years
Quality & Reliability	Natural and enhanced assets are in good condition, meeting the needs of users.[a]	Tree pruning activities completed per year	Urban trees	3150 (in-house) 183 (contracted)	Same rate as current, activity increases proportionally with addition of trees		
		# of urban tree replacements per year	Urban trees	**240** urban trees replaced (2023)	**240** trees / year (81.5% of need) [g]	**280** trees / year (95.1% of need) [g]	**295** trees / year (100% of need) [g]

a) Adapted based on Level of Service Statement for Aurora's Parks & Recreation facilities.

b) The Parks and Recreation Master Plan, reports 2.7 hectares per 1000 residents of parkland, but defines parkland as lands within Town-owned park properties. Those properties do not consistently include or exclude naturalized areas.

c) Population estimated at 66,370 in 2024 and 84,560 in 2049 based on 2022 York Region Official Plan.

d) From the Town of Aurora Corporate Environmental Action Plan 2018.

e) Existing data is not specific to town-owned natural assets. However, data compiled for the Urban Forest Study based on a series of representative sample plots across Aurora found that 55% of "Open Space – Natural Cover" plots had presence of invasive plant species.

f) Canopy cover provided by new trees will vary over time.

g) Forecast tree replacement need is approximately 295 trees / year.

5.5 Recommended Scenario and Proposed LOS

It is recommended that the Town proceed with Scenario B, because it includes a moderate program of assessment, maintenance and restoration activities. The data collected through the assessments will enable the Town to determine whether these programs should be reduced or expanded in the future. If Scenario B is adopted, the LOS performance forecasted in Table 5-9 for that scenario will be the Town's Proposed LOS.

To fund Scenario B, the Town may:

- Seek additional revenues through taxation or grants
- Re-allocate funds from other programs (this may result in reduced levels of service in other programs).

It is also recommended that the Town continue or expand its existing strategies that support the Town's natural asset services, including the following:

- Continue to seek alternative ways to increase natural area asset capacity for its residents, for example, through maintenance agreements with external parties similar to the Town's existing agreements for use of the Duck's Unlimited property and Sheppard's Bush Conservation Area.
- Remain open to opportunities to re-purpose existing properties or to acquire natural areas that become available.
- Maintain existing partnerships with organizations that fund planting of trees in natural areas and seek additional partnership opportunities.
- Continue volunteer program for removal of invasive plant species on Town lands. Consider expanding.

The Town may also consider offering sponsorship opportunities wherein community organizations may pay for natural asset maintenance costs in exchange for acknowledgement signage.

6 NCAMP IMPROVEMENT AND MONITORING

6.1 NCAMP Improvement Recommendations

The Town is committed to continually improving how assets are managed and how services are delivered. Development of asset management plans is an iterative process that includes improving data, processes, systems, staff skills, and organizational culture over time. Table 6-1 identifies recommendations for the Town that will help the NCAMP evolve and improve through each iteration.

Table 6-1 Asset Management Improvement Recommendations

Gap	Improvement Recommendation
State of Infrastructure	
Establish a condition assessment program for natural assets	For this NCAMP, condition scores for many asset classes were established based on staff knowledge and expertise. Future efforts should work toward establishing a condition assessment program, as recommended in Section 4 under Maintenance and Monitoring activities. The protocol should also include an assessment of condition for any acquired lands the Town may secure. Prior to beginning a condition assessment program it is recommended that the Town establish condition scoring criteria for different natural asset types, so that the appropriate data can be collected. For instance, the Town may refer to and adapt Credit Valley Conservation's "Rapid Condition Assessment Protocol."
Inventory improvements	An initial natural asset inventory has been developed based on the best available data which incorporates local Ecological Land Classification (ELC) mapping, the Town's parks and open space GIS layer, as well as available spatial data associated with community gardens, the pet cemetery, and watercourses. The inventory also includes lands maintained but not owned by the Town. Future refinements to consider include addressing: • Enhance the accuracy and precision of Geographic Information System (GIS) data to enable a comprehensive and nuanced understanding of natural capital assets. • While the inventory provides the best available depiction of the Town-owned natural assets, there are limitations with ELC data; for example, the ELC's defined land cover is not always an accurate reflection of what is on the land. • Land types should be defined consistently across the NCAMP and the Parks and Recreation Master Plan. For example, the Parks and Recreation Master Plan defines parklands to include all lands within the boundaries of a Town-owned park; however, for the purposes of the NCAMP, some of the areas are considered forests or open spaces (meadows). • Based on the GIS date, urban park assets (manicured grassy areas) in the NCAMP include park facilities that are not part of this NCAMP, such as playgrounds, play courts, skate parks and splash pads. Future refinements should designate them appropriately.

Gap	Improvement Recommendation
	• New properties have been recently purchased that have not been included and should be added for the next NCAMP. • Implement procedures to ensure that the Town land inventory is current, with appropriate notifications on new park openings or Town acquisitions of natural assets.
Regular urban tree inventory updates	Continue to update and improve the accuracy of the street tree inventory. Design and implement processes to keep the tree inventory current by updating the asset data as trees are replaced or maintained. These updates should be incorporated into work order management processes, and tree inventory data should be required from developers and tree planting contractors.
Replacement Value of Waterbodies	To estimated value of waterbodies, Town to explore what types of restoration will most likely be needed for its waterbodies and how much those would cost.
Levels of Service	
Refinement of Levels of Service	LOS have been established for this NCAMP that demonstrate some of the important services delivered by natural assets. As the Town's asset management maturity evolves for this asset portfolio, LOS should be updated and refined to improve the connections between LOS measures, management actions, and financial impacts.
Monitoring and Target Setting	LOS performance should be monitored relative customer satisfaction and cost to inform future target setting.
Use Town-wide tree targets to guide development of Town-owned tree targets	Although targets have been set for tree canopy and tree diversity, those targets are not directly applicable to the Town's asset performance, because the targets apply to all trees within the municipal boundaries, whereas the Town's asset performance relates specifically to Town-owned trees. The Town-wide tree targets should be used to guide development of Town-owned tree targets, which in turn will guide the Town's asset investment needs. For example, given that the Town-wide canopy target is 40%, consideration should be given on how much of that should comprise Town-owned trees. Also, consideration should be given to whether the diversity target should be applied to the Town-owned inventory or whether should the Town aim for a different species mix to offset an imbalance in non-owned tree species.
Asset Management and Financial Analysis	
Risk Management	Consider building on the initial risk assessment for natural assets to further inform and prioritize risk mitigation actions for natural assets. However, it is recognized that the industry is still in the early stages of understanding how to best apply risk management assessment to natural assets and the Town's approach will evolve

Gap	Improvement Recommendation
	over time as the industry matures. The Natural Assets Initiative (2024)[8] recently released a guidance document that provides some potential options
Determine or refine growth needs assessment	Currently, LOS as defined by area of assets per capita provide a good metric for understanding the general LOS being provided. This LOS can also inform growth needs. However, there is a limit to how much land can be acquired and dedicated to natural assets as the population continues to grow. This NCAMP assumes no growth due to land and financial constraints, but some land acquisition may be possible that could reduce the decline of the population-based LOS.
Incorporate Natural Assets in GHG emissions plans	Consider incorporating carbon sequestration impact of natural assets in Town's GHG emissions plans, such as the Energy Conservation and Demand Management Plan and the Community Energy Plan.
Conduct a rehabilitation and restoration needs assessment	To better understand the financial needs for natural assets, consider a site-specific assessment of rehabilitation and restoration needs, which would establish and prioritize necessary management inventions.
Monitor tree replacement needs to enable better forecasting	Monitor trends in urban tree replacement needs (for example age, location, species and other factors) to enable better forecasting and planning of replacement needs.
Maintenance Costs	Current maintenance funding has been well defined for urban parks and urban trees. Working toward a better understanding of maintenance needs for natural area assets could shift some of the funding needs for managing natural assets from capital budgets to operation budgets as maturity with natural areas assets increases over time. Continue the initiative to implement a work order management system, which will be used to track maintenance and repair activities and costs at an asset level. This information can be used to improve future needs forecasting and budgeting.

6.2 NCAMP Monitoring and Review

The NCAMP will be updated every five years to ensure it reports an updated snapshot of the Town's asset portfolio and its associated value, age, and condition. It will ensure that the Town has an updated 10-year outlook including service levels, costs of the associated lifecycle strategies and an assessment of any funding shortfalls.

Per O.Reg. 588/17, the Town will conduct an annual review of its progress in implementing this NCAMP and will discuss strategies to address any factors impeding its implementation.

[8] NAI (2024). Nature is infrastructure: How to include natural assets in asset management plans. Natural Assets Initiative. naturalassetsinitiative.ca

6.3 Performance Measures

The effectiveness of this NCAMP can be measured in the following ways:

- The degree to which the forecast costs identified in this NCAMP are incorporated into the long-term financial plan,
- The degree to which the 1- to 5-year detailed works programs, budgets, business plans align with the recommendations of the NCAMP, and
- The degree to which the existing and projected service levels and service consequences, risks and residual risks are incorporated into the Strategic Planning documents and associated plans.

APPENDIX A: ESTABLISHING NCAMP INVENTORY

To establish the NCAMP inventory, the spatial boundaries of Town-owned land and 2 properties (Ducks unlimited Canada lands and the Ontario Heritage Trust's Sheppard's Bush property) of town-maintained land were combined. A natural asset hierarchy was then established to organize the inventory into asset types within the parent categories of "Natural Area Assets" and "Natural Enhanced Assets". The data utilized to compose the inventory is outlined in Table A-1.

Table A-1 Data Utilized

Data Name	Source
Municipal Boundary	Data_NCAMP.gdb / Municipal Boundary
Building Footprints	Data_NCAMP.gdb / Building Footprints
LSRCA Ecological Land Classification	Data_NCAMP.gdb / LSRCA
Parks and Open Space Lots (New)	Aurora
Community Gardens	Aurora - Additionally provided shapefile for Community Gardens
Pet Cemetery	Aurora - Additionally provided shapefile for Pet Cemetery
Additional Town-owned Land	Aurora - Additionally provided shapefile for polygons missing from original Town-owned Land data
Town-maintained Land	Aurora - Additionally provided shapefile for further delineation of Town-maintained Land
Streams & Reaches v2	Aurora

To develop the Natural Area Assets portion of the inventory hierarchy, ELC classes were used to delineate natural polygon areas on the town-owned and -maintained lands. An outline of the conversion of ELC classes to Asset Type groups is outlined in Table A-2.

Table A-22 Conversion of ELC Category to Asset Class groupings

Asset Class	Ecological Land Classification Category
Forest and Open Space	Coniferous Forest
	Cultural Plantation
	Cultural Thicket
	Cultural Woodland
	Deciduous Forest
	Mixed Forest
	Cultural Meadow
Waterbody	Open Water
	Submerged Shallow Aquatic
	Mixed Shallow Aquatic
Wetland	Deciduous Swamp
	Meadow Marsh
	Mixed Swamp
	Shallow Marsh

For watercourse assets, data (Streams & Reaches v2) was provided for the project and was used to identify the stream segments and attributes associated with Town-owned and managed properties.

The identification of Natural Enhanced Assets was performed using multiple datasets. For Urban Trees, data was provided that identified individual street and park trees. This data was unmodified and adopted to meet the hierarchy structure of the inventory. Urban Parks were identified using the “Parks and Open Spaces Lots” dataset. Parks and Open Space boundaries in the city provided data did not have complete ELC coverage within the area. For example, an ELC forest polygon may have only covered a portion of a park area, leaving the rest of the park as a gap in the inventory. In areas classified as Urban Park in the “Parks and Open Space Lot” dataset, gaps were classified as “Urban Park”. In areas classified as Urban Forest and Open Space in the “Parks and Open Space Lot” dataset, gaps were classified as “Forest and Open Space”.

Community Gardens and a Pet Cemetery were added into the inventory by merging the layers into the inventory and prioritizing their boundaries as a uniquely classified enhanced asset over any existing classification

Once the inventory was organized, the data was clipped to be restricted to the boundaries of the merged Town-owned Land and Town-maintained Land. Any assets that fell within Town-maintained land were assigned an attribute within the data to allow easier filtering of Town-maintained assets.

Finally, the data was inspected and compared to available satellite imagery to identify any glaring errors associated with the allocation of the ELC classes, with emphasis on ensuring manicured turf areas were not allocated a natural land cover. A total of 3 properties were adjusted based on this review.

APPENDIX B: UNIT COST ASSUMPTIONS

Table B-11 Unit Cost Assumptions

Asset Category	Asset Class	Asset Subtype	Unit Cost
Natural Area Assets[a]	Forest and unmanicured open space	Cultural Meadow	$198,144 per ha
		Coniferous Forest	$173,847 per ha
		Deciduous Forest	
		Mixed Forest	
		Cultural plantation	
		Cultural woodland	
		Cultural Thicket	$188,546 per ha
	Wetland	Deciduous Swamp	$268,404 per ha
		Mixed Swamp	
		Thicket Swamp	$245,945 per ha
		Meadow Marsh	$224,816 per ha
		Shallow Marsh	
	Waterbody		NA[b]
	Watercourse		$1,700,200 per km[c]
Natural Enhanced Assets	Community Garden		$150,000 for the existing garden $300,000 for the newly built garden[d]
	Pet Cemetery		$300,000[e]
	Manicured open space		$200,000 per ha[f]
	Urban Trees		$375 per tree + $16.50 per cm dbh (removal)[g]

a) Natural asset unit costs per ha are based on 2023 typical restoration costs provided by TRCA. In general, the NCAMP replacement values do not include land costs.

b) For waterbodies restoration costs were not readily available. As an asset management improvement, Town to explore what types of restoration will most likely be needed for its waterbodies and how much those would cost.

c) While there has been some stream restoration works done within Aurora, those have focused more on shoreline and stream bank stabilization and may not sufficiently capture the 'replacement cost' value of the whole stream feature. Future work could explore the potential cost of broader stream restoration focused on recreating natural stream features. CVC (2019) provides an approximate estimate of stream corridor rehabilitation. It should be noted that costs for stream rehabilitation projects can vary widely depending on local context, site access, extent of flow management required, etc. The CVC (2019) rehabilitation costs are based on stream corridor segments assumed to be 500m long and 20m wide. For comparison, Aurora's Stream Management Master Plan estimates a reach-scale restoration project for Tannery Creek could cost $7M for 1,250m (or about $5.6 M per km).

d) Community garden costs are based on an estimated construction cost for the newest community garden. There are two community gardens both with 52 garden plots. Therefore, $300,000 per garden was applied.

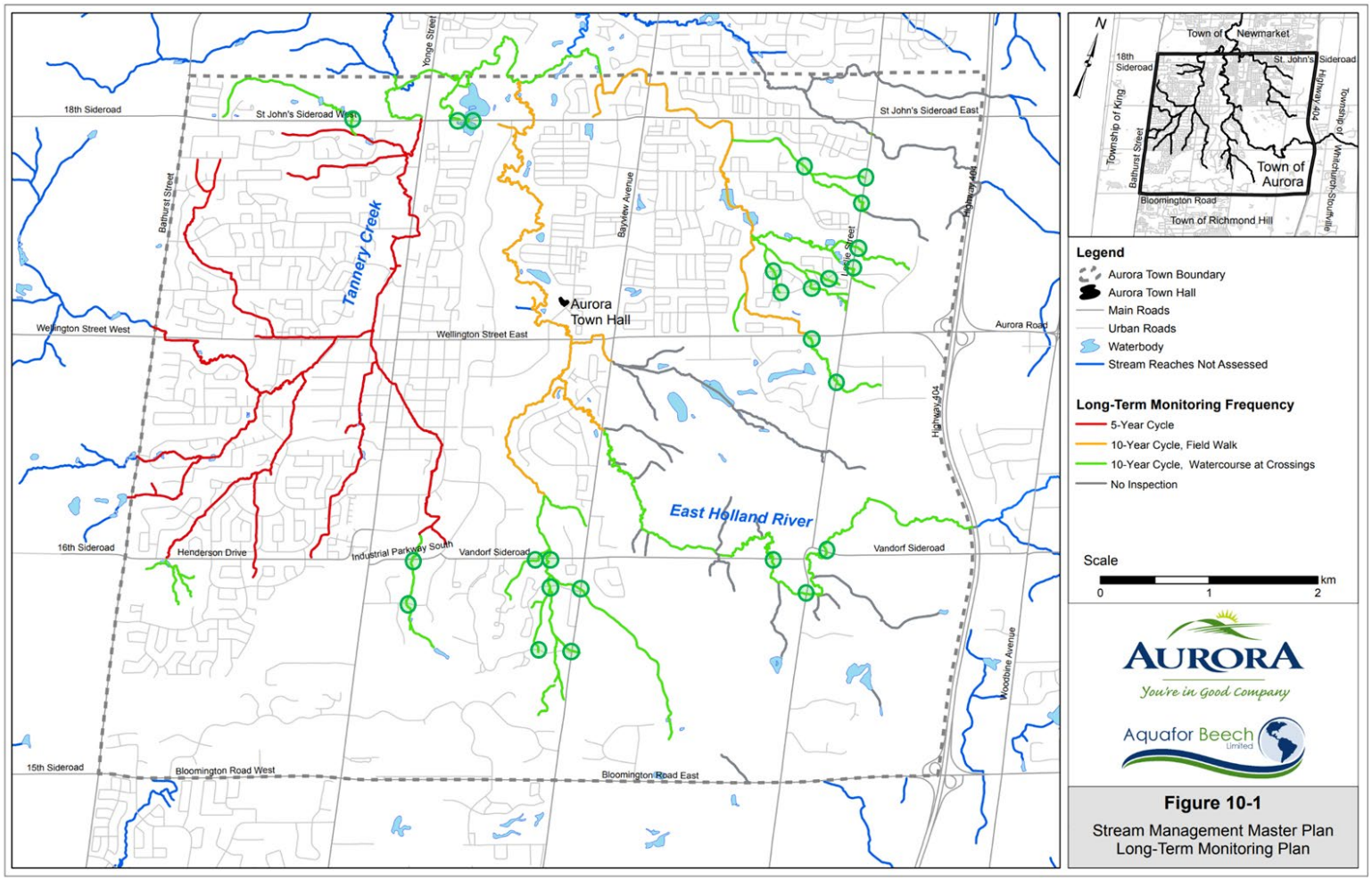
e) The pet cemetery is considered a cultural heritage area and considered irreplaceable. However, for the purpose of the NCAMP, recent upgrade costs estimated to be roughly $300,000 is applied. In general, the NCAMP replacement values do not include land costs.

f) Urban park areas largely capture manicured grassy areas. Therefore, the average cost of $200,000/ha, used as a replacement cost is based on $20/sqm cost of installed sod.

g) Replacement costs for individually managed urban trees was established using the diameter replacement method. A cost of $375 per tree is applied to the estimated number of trees needed to replace existing trees, which is determined by dividing the diameter at breast height (dbh) of each tree by the assumed dbh of the replacement tree (5cm). This approach is used to help establish a “like for like” replacement. For instance, a replacement tree with a 5cm dbh will not be able to provide the same service level as a tree with 100cm dbh. It should be recognized that the Town does not actually replace trees based on this ratio. The ratio is used for the purpose of this NCAMP to establish the “like for like” replacement cost. In addition to the tree replacement, a removal cost is also applied based on an assumed average cost for tree removal and stumping ($1,650 per tree). However, in an effort to avoid applying a removal and stumping cost for mature trees to the young trees currently in the inventory, the $1,650 was assumed to apply to 100cm dbh tree to generate a removal and stumpage cost that could be scaled by each tree’s diameter at breast height (dbh). The resulting assumption is a removal and stumpage cost of $16.50 per 1cm dbh.

APPENDIX C: MAP OF RECOMMENDED MONITORING FREQUENCY

Figure C-1 Map of Recommended Monitoring Frequency



Source: Stream Management Master Plan, 2019

APPENDIX D: DETAILED FINANCIAL FORECAST TABLES

This Appendix provides detailed cost projections for:

- Scenario A: Status Quo
- Scenario B: Status Quo with Moderate Rehabilitation, Monitoring and Maintenance
- Scenario C: Status Quo with High Rehabilitation, Monitoring and Maintenance

Table D-11 Detailed Cost Forecast for Scenario A: Status Quo

	Forecast Needs (2024 $)																									Forecast Needs (2024 $)		Forecast Needs (2024 $)	
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	225,000	22,500	562,500	22,500
Rehab and Restore	478,000	1,316,000	1,086,000	904,000	729,000	2,932,000	4,336,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	628,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	778,000	13,215,000	1,321,500	20,835,000	833,400
Monitor and Maintain	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	6,346,821	634,682	15,867,051	634,682
Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	201,200	20,120	588,600	23,544
OVERALL TOTAL	1,171,382	1,973,182	1,743,182	1,561,182	1,536,182	3,589,182	4,993,182	1,135,182	1,150,182	1,135,182	1,171,382	1,135,182	1,135,182	1,135,182	1,435,182	1,135,182	1,135,182	1,135,182	1,150,182	1,135,182	1,171,382	1,135,182	1,135,182	1,135,182	1,585,182	**19,988,021**	**1,998,802**	**37,853,151**	**1,514,126**

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construction and Securing (Growth)																													
Additional trees planted each year	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***60.0***	***600***	***60***	***1,500***	***60***
Urban tree planting - new trees (does not include trees planted by developers)	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	225,000	22,500	562,500	22,500
Rehabilitation and Restoration																													
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% area to control each year	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***0.08%***	***3.3***	***0.3***	***8.3***	***0.3***
Invasive Species Control (does not include value of volunteer work)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	200,000	20,000	500,000	20,000
% area to seed / plant each year	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***0.02%***	***1.0***	***0.1***	***2.4***	***0.1***
Targeted Seeding or Planting (does not include trees planted through external partnerships)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	200,000	20,000	500,000	20,000
Stream Rehabilitation - Tyler St.	-	718,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	718,000	239,333	718,000	39,889
Stream Rehabilitation - Sandusky Park	-	120,000	608,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	728,000	182,000	728,000	38,316
Stream Rehabilitation - Harriman Rd.	-	-	-	-	251,000	-	1,300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,551,000	387,750	1,551,000	81,632
Stream Rehabilitation - Wellington St. Phase 1	-	-	-	426,000	-	2,454,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,880,000	720,000	2,880,000	151,579
Stream Rehabilitation - Wellington St. Phase 2	-	-	-	-	-	-	2,558,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,558,000	852,667	2,558,000	142,111
Total trees to replace	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***240.0***	***2,400.0***	***240.0***	***6,000.0***	***240.0***
Urban Tree Replacement (only the VP in 2024)	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	438,000	4,380,000	438,000	10,950,000	438,000
Community gardens replacement																										-	-	-	-
Garden replacemnet															150,000										300,000	-	-	450,000	225,000
Total Rehab and Restore	478,000	1,316,000	1,086,000	904,000	729,000	2,932,000	4,336,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	628,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	478,000	778,000	**13,215,000**	**1,321,500**	**20,835,000**	**833,400**
Monitoring and Maintenance																													
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% to assess each year	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	-	-	-	-
Natural area assets assessments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Number of tree to be maintained	***26,435***	***26,495***	***26,555***	***26,615***	***26,675***	***26,735***	***26,795***	***26,855***	***26,915***	***26,975***	***27,035***	***27,095***	***27,155***	***27,215***	***27,275***	***27,335***	***27,395***	***27,455***	***27,515***	***27,575***	***27,635***	***27,695***	***27,755***	***27,815***	***27,875***	***267,050***	***26,705***	***678,875***	***27,155***
Urban Tree Maintenance, based on existing (no adjustment for additional trees)	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	203,495	2,034,950	203,495	5,087,375	203,495
Stream Monitoring																													
Red - 2019 Stream Management Master Plan recommended every 5 years, status quo assumes it is done every 10 years	10-year assessment being done as part of Master Plan, but no 5-year being done																									-	-	-	-
Yellow - 2019 Stream Management Master Plan recommended every 10 years	being done as part of Master Plan																									-	-	-	-
Green - 2019 Stream Management Master Plan recommended every 10 years, crossings only	being done as part of Master Plan																									-	-	-	-
Urban park, community garden, pet cemetery area to be maintained	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***1,254.1***	***125.4***	***3,135.2***	***125.4***
Existing maintenance cost	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	4,311,871	431,187	10,779,676	431,187
Total Monitor and Maintain	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	634,682	**6,346,821**	**634,682**	**15,867,051**	**634,682**
Plan and Design																													
Stream Management Master Plan	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	150,000	15,000	450,000	18,000
Urban Forest Study	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	15,000	1,500	30,000	1,200
Tree inventory update	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	36,200	3,620	108,600	4,344
Total Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	**201,200**	**20,120**	**588,600**	**23,544**

Table D-22 Detailed Cost Forecast for Scenario B: Status Quo with Moderate Rehabilitation, Monitoring and Maintenance

	Forecast Needs (2024 $)																								Forecast Needs (2024 $)		Forecast Needs (2024 $)	
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	300,000	30,000	750,000	30,000
Rehab and Restore	684,696	1,522,696	1,337,728	1,155,728	980,728	3,183,728	4,587,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	879,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	1,029,728	15,642,217	1,564,222	27,038,139	1,081,526
Monitor and Maintain	741,902	742,518	700,246	700,861	680,033	680,649	681,265	681,881	705,857	683,112	683,728	684,344	684,960	685,576	686,192	686,807	687,423	688,039	712,015	689,271	689,887	690,502	691,118	691,734	692,350	6,998,323	699,832	17,342,270	693,691
Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	201,200	20,120	588,600	23,544
OVERALL TOTAL	1,492,798	2,295,213	2,067,974	1,886,590	1,840,761	3,894,377	5,298,993	1,441,609	1,480,585	1,442,841	1,479,656	1,444,072	1,444,688	1,445,304	1,745,920	1,446,536	1,447,151	1,447,767	1,486,743	1,448,999	1,485,815	1,450,231	1,450,846	1,451,462	1,902,078	**23,141,740**	**2,314,174**	**45,719,009**	**1,828,760**
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049				
Construction and Securing (Growth)																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Additional trees planted each year	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***80.0***	***800***	***80***	***2,000***	***80***
Urban tree planting - new trees (does not include trees planted by developers)	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	300,000	30,000	750,000	30,000
Rehabilitation and Restoration																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% area to control each year	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***0.50%***	***21.4***	***2.1***	***53.6***	***2.1***
Invasive Species Control (does not include value of volunteer work)	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	128,664	1,286,636	128,664	3,216,591	128,664
% area to seed / plant each year	***0.05%***	***0.05%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***0.10%***	***3.9***	***0.4***	***10.3***	***0.4***
Targeted Seeding or Planting (does not include trees planted through external partnerships)	45,032	45,032	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	90,065	810,581	81,058	2,161,549	86,462
Stream Rehabilitation - Tyler St.	-	718,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	718,000	239,333	718,000	39,889
Stream Rehabilitation - Sandusky Park	-	120,000	608,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	728,000	182,000	728,000	38,316
Stream Rehabilitation - Harriman Rd.	-	-	-	-	251,000	-	1,300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,551,000	387,750	1,551,000	81,632
Stream Rehabilitation - Wellington St. Phase 1	-	-	-	426,000	-	2,454,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,880,000	720,000	2,880,000	151,579
Stream Rehabilitation - Wellington St. Phase 2	-	-	-	-	-	-	2,558,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,558,000	852,667	2,558,000	142,111
Total trees to replace	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***280.0***	***2,800.0***	***280.0***	***7,000.0***	***280.0***
Urban Tree Replacement (only the VP in 2024)	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	511,000	5,110,000	511,000	12,775,000	511,000
Community gardens replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garden replacemnet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	300,000	-	-	450,000	18,000
Total Rehab and Restore	684,696	1,522,696	1,337,728	1,155,728	980,728	3,183,728	4,587,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	879,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	729,728	1,029,728	**15,642,217**	**1,564,222**	**27,038,139**	**1,081,526**
Monitoring and Maintenance																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% to assess each year	***25%***	***25%***	***15%***	***15%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***600.4***	***60.0***	***1,243.7***	***49.7***
Natural area assets assessments	107,220	107,220	64,332	64,332	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	600,430	60,043	1,243,748	49,750
Number of tree to be maintained	***26,435***	***26,515***	***26,595***	***26,675***	***26,755***	***26,835***	***26,915***	***26,995***	***27,075***	***27,155***	***27,235***	***27,315***	***27,395***	***27,475***	***27,555***	***27,635***	***27,715***	***27,795***	***27,875***	***27,955***	***28,035***	***28,115***	***28,195***	***28,275***	***28,355***	***267,950***	***26,795***	***684,875***	***27,395***
Urban Tree Maintenance, based on existing (no adjustment for additional trees)	203,495	204,111	204,727	205,343	205,958	206,574	207,190	207,806	208,422	209,038	209,653	210,269	210,885	211,501	212,117	212,733	213,348	213,964	214,580	215,196	215,812	216,428	217,043	217,659	218,275	2,062,663	206,266	5,272,126	210,885
Stream Monitoring																													
Red - 2019 Stream Management Master Plan recommended every 5 years, status quo assumes it is done every 10 years	10-year being done as part of Master Plan								23,360										23,360							23,360	23,360	46,720	23,360
Yellow - 2019 Stream Management Master Plan recommended every 10 years	10-year being done as part of Master Plan																									-	-	-	-
Green - 2019 Stream Management Master Plan recommended every 10 years, crossings only	10-year being done as part of Master Plan																									-	-	-	-
Urban park, community garden, pet cemetery area to be maintained	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***1,254.1***	***125.4***	***3,135.2***	***125.4***
ıance cost	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	4,311,871	431,187	10,779,676	431,187
Total Monitor and Maintain	741,902	742,518	700,246	700,861	680,033	680,649	681,265	681,881	705,857	683,112	683,728	684,344	684,960	685,576	686,192	686,807	687,423	688,039	712,015	689,271	689,887	690,502	691,118	691,734	692,350	**6,998,323**	**699,832**	**17,342,270**	**693,691**
Plan and Design																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Stream Management Master Plan	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	150,000	15,000	450,000	18,000
Urban Forest Study	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	15,000	1,500	30,000	1,200
Tree inventory update	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	36,200	3,620	108,600	4,344
Total Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	**201,200**	**20,120**	**588,600**	**23,544**

Table D-33 Detailed Cost Forecast for Scenario C: Status Quo with High Rehabilitation, Monitoring and Maintenance

	Forecast Needs (2024 $)																									Forecast Needs (2024 $)		Forecast Needs (2024 $)	
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construct and Secure	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	600,000	60,000	1,500,000	60,000
Rehab and Restore	757,103	1,595,103	1,538,799	1,401,831	1,484,159	3,687,159	5,091,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,383,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,533,159	19,254,788	1,925,479	38,202,166	1,528,087
Monitor and Maintain	741,902	743,133	722,921	724,153	682,497	683,728	684,960	686,192	710,783	688,655	689,887	691,118	692,350	693,582	694,813	696,045	697,277	698,508	723,100	700,972	702,203	703,435	704,667	705,898	707,130	7,068,924	706,892	17,569,909	702,796
Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	201,200	20,120	588,600	23,544
OVERALL TOTAL	1,595,205	2,398,237	2,321,720	2,185,984	2,376,655	4,430,887	5,836,118	1,979,350	2,018,942	1,981,814	2,019,245	1,984,277	1,985,509	1,986,740	2,287,972	1,989,204	1,990,435	1,991,667	2,031,259	1,994,130	2,031,562	1,996,594	1,997,825	1,999,057	2,450,289	**27,124,912**	**2,712,491**	**57,860,675**	**2,314,427**

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Construction and Securing (Growth)																													
Additional trees planted each year	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***160.0***	***1,600***	***160***	***4,000***	***160***
Urban tree planting - new trees (does not include trees planted by developers)	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	600,000	60,000	1,500,000	60,000
Rehabilitation and Restoration																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% area to control each year	***0.5%***	***0.5%***	***1.0%***	***1.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***2.0%***	***64.3***	***6.4***	***193.0***	***7.7***
Invasive Species Control (does not include value of volunteer work)	128,664	128,664	257,327	257,327	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	514,654	3,859,909	385,991	11,579,726	463,189
% area to seed / plant each year	***0.10%***	***0.10%***	***0.15%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***0.20%***	***7.5***	***0.8***	***20.4***	***0.8***
Targeted Seeding or Planting (does not include trees planted through external partnerships)	90,065	90,065	135,097	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	180,129	1,576,129	157,613	4,278,065	171,123
Stream Rehabilitation - Tyler St.	-	718,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	718,000	239,333	718,000	39,889
Stream Rehabilitation - Sandusky Park	-	120,000	608,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	728,000	182,000	728,000	38,316
Stream Rehabilitation - Harriman Rd.	-	-	-	-	251,000	-	1,300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,551,000	387,750	1,551,000	81,632
Stream Rehabilitation - Wellington St. Phase 1	-	-	-	426,000	-	2,454,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,880,000	720,000	2,880,000	151,579
Stream Rehabilitation - Wellington St. Phase 2	-	-	-	-	-	-	2,558,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,558,000	852,667	2,558,000	142,111
Total trees to replace	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***295.0***	***2,950.0***	***295.0***	***7,375.0***	***295.0***
Urban Tree Replacement (only the VP in 2024)	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	538,375	5,383,750	538,375	13,459,375	538,375
Community gardens replacement																										-	-	-	-
Garden replacemnet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	300,000	-	-	450,000	18,000
Total Rehab and Restore	757,103	1,595,103	1,538,799	1,401,831	1,484,159	3,687,159	5,091,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,383,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,233,159	1,533,159	**19,254,788**	**1,925,479**	**38,202,166**	**1,528,087**
Monitoring and Maintenance																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Total land (open spaces, forests, wetlands)	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***	***428.9***				
% to assess each year	***25%***	***25%***	***20%***	***20%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***10%***	***643.3***	***64.3***	***1,286.6***	***51.5***
Natural area assets assessments	107,220	107,220	85,776	85,776	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	42,888	643,318	64,332	1,286,636	51,465
Number of tree to be maintained	***26,435***	***26,595***	***26,755***	***26,915***	***27,075***	***27,235***	***27,395***	***27,555***	***27,715***	***27,875***	***28,035***	***28,195***	***28,355***	***28,515***	***28,675***	***28,835***	***28,995***	***29,155***	***29,315***	***29,475***	***29,635***	***29,795***	***29,955***	***30,115***	***30,275***	***271,550***	***27,155***	***708,875***	***28,355***
Urban Tree Maintenance, based on existing cost/tree, increases with addition of trees	203,495	204,727	205,958	207,190	208,422	209,653	210,885	212,117	213,348	214,580	215,812	217,043	218,275	219,507	220,738	221,970	223,202	224,433	225,665	226,897	228,128	229,360	230,592	231,823	233,055	2,090,375	209,038	5,456,876	218,275
Stream Monitoring																													
Red - 2019 Stream Management Master Plan recommended every 5 years, status quo assumes it is done every 10 years	10-year being done as part of Master Plan								23,360										23,360							23,360	23,360	46,720	23,360
Yellow - 2019 Stream Management Master Plan recommended every 10 years	10-year being done as part of Master Plan																									-	-	-	-
Green - 2019 Stream Management Master Plan recommended every 10 years, crossings only	10-year being done as part of Master Plan																									-	-	-	-
Urban park, community garden, pet cemetery area to be maintained	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***125.4***	***1,254.1***	***125.4***	***3,135.2***	***125.4***
ıtenance cost	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	431,187	4,311,871	431,187	10,779,676	431,187
Total Monitor and Maintain	741,902	743,133	722,921	724,153	682,497	683,728	684,960	686,192	710,783	688,655	689,887	691,118	692,350	693,582	694,813	696,045	697,277	698,508	723,100	700,972	702,203	703,435	704,667	705,898	707,130	**7,068,924**	**706,892**	**17,569,909**	**702,796**
Plan and Design																										10-year TOTAL	10-year ANN AVG	25-year TOTAL	25-year ANN AVG
Stream Management Master Plan	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	-	-	-	-	-	-	-	-	-	150,000	150,000	15,000	450,000	18,000
Urban Forest Study	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	-	-	-	15,000	-	-	-	-	-	-	15,000	1,500	30,000	1,200
Tree inventory update	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	-	-	-	-	-	36,200	-	-	-	-	36,200	3,620	108,600	4,344
Total Plan and Design	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	-	-	-	15,000	-	36,200	-	-	-	150,000	**201,200**	**20,120**	**588,600**	**23,544**